

**The Waterbird Society
43rd Annual Meeting**

**6-9 November 2019
Princess Anne, Maryland**



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Committee on Local Arrangements:
Bill Bowerman, Jurgen Schwarz, Ellen Paul

Scientific Program Chair:
Dave Moore

Website: Amanda Moore

Social Media: #waterbirdsociety2019



For meeting announcements, reminders, sharing, etc.

Website: <https://waterbirds.org/>

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Welcome from the President of The Waterbird Society

I am excited to welcome all of you to Salisbury, Maryland for the 43rd Annual Meeting of the Waterbird Society. For over four decades, our society has held its annual meetings in a variety of locations and has consistently offered a bevy of scientific talks, symposia, workshops and other events. This year, however, truly marks a significant first for our society as we are meeting at the University of Maryland Eastern Shore (UMES), a Historically Black College or University (HBCU) and we are partnering with UMES to host a Diversity Day during our annual meeting. The Diversity Day, funded by the National Science Foundation, will take place Friday, November 8 and I strongly encourage all of you to participate. We have invited students from UMES and other HBCUs to attend. The day will be filled with speaker presentations, a Q&A panel, and demonstration papers. The Diversity Day will give us all a chance to hear from persons of color about their careers and experiences in the natural sciences field and provide HBCU students the opportunity to meet and converse with society members and many state and federal agencies, non-governmental organizations and private sector employers.

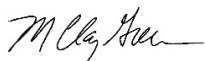
As always, we will have an excellent scientific program during our annual meeting. Society vice-President Dave Moore has put together another excellent program that includes a variety of symposia and workshops. We also have our very own Dr. Patty Szczys as our plenary speaker this year. We are excited to welcome back the Atlantic Marine Bird Cooperative which will hold a 1.5-day workshop with us again as they did in 2016.

I want to personally welcome all students to our society's annual meeting. Our society has always valued students and I believe we as fellow members make a sincere effort to welcome you to the meeting and encourage your active and enthusiastic participation in our society. Most of us that serve on the Executive Council began our involvement with the society as students. Likewise, welcome to all members who are attending their first Waterbird Society meeting. I hope you will find it as rich and rewarding as my first meeting many years ago. Our society cannot neither sustain itself nor grow without students and new member participation. We as Council are always looking for new people to actively participate in the society. I encourage everybody to attend our Business Meeting on Saturday, November 9 during lunchtime to learn more about the society and how you can get involved.

In closing, I want to thank all those who made this meeting possible. I thank the Society's officers, councilors, and committees for the many hours they volunteer to support our society and keep us progressing forward to promote waterbird research and conservation. I want to thank Bill Bowerman, Jurgen Schwarz, and Ellen Paul for their hard work in making this meeting possible. Bill in partnership with Jurgen promoted the idea of our society coming to UMES for its annual meeting and having a diversity event and Ellen, as she has in planning past meetings, truly took the "bull by the horns" and has tirelessly organized what will be a fantastic meeting.

I look forward to catching up with all of you in Maryland.

Yours sincerely,



Clay Green

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 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

President: Clay Green

Vice President: Dave Moore

Secretary: Patty Szczys

Treasurer: Christine Custer

Editor of Waterbirds: Andrew Kasner

Council members, 2017-2019

Dale Gawlik

Eric Mellink

Sara Schweitzer

Council members, 2018-2020

Dan Catlin

Sean Murphy

Kate Shlper

Council members 2019-2021

Danielle D'Auria

Miyuki Mashiko

K.S. Gopi Sundar

Welcome from the Chair of the Scientific Program Committee

I'd like to extend a warm welcome to all participants of the 43rd Annual Meeting of the Waterbird Society. I am very excited by this year's program, which kicks off with a plenary address by Dr. Patty Szczys (also one of our society's officers!): "Natural history and genetics: Informing tern conservation and undergraduate research". The program consists of 123 talks and 43 poster presentations (representing 452 authors), making it one of our best-attended conferences in recent years. This will be a truly international conference, featuring presenters from 15 countries.

Most importantly, for the success and vitality of our society and for continued research and conservation of the birds that we are all passionate about, more than a quarter of this year's presenters are students! Whether it is your first Waterbird Society meeting, and whatever your career stage, I invite and encourage you to become actively involved in our society.

The conference includes five symposia, covering a wide diversity of topics, which account for about half of all presentations:

- Pelicans of the world
- Great Blue Herons and Great Egrets: their biology, conservation and management
- Avian interactions with offshore energy development
- Black Rail ecology and conservation
- Ecology and management of gulls in urban landscapes

This year, the Waterbird Society is meeting jointly with the Atlantic Marine Bird Cooperative, which includes a workshop by the Seabird Colonies and Adjacent Waters Working Group to plan the proposed 2023 Atlantic and Gulf Coast coordinated colonial waterbird survey.

Talks by a number of invited speakers and special events will occur on Friday, November 8th to celebrate diversity and engage with young scientists at our host institution, the University of Maryland Eastern Shore. I encourage everybody to participate in these Diversity Day events.

This year's meeting is in a beautiful and historic location, and promises to be an interesting and memorable one.

I'm looking forward to seeing you all in Maryland!

Sincerely,

Dave Moore

Welcome from the Committee on Local Arrangements

We are pleased to welcome you to the University of Maryland Eastern Shore (UMES).

The UMES had its origin on September 13, 1886. Initiated under the auspices of the Delaware Conference of the Methodist Episcopal Church, the Delaware Conference Academy was established in Princess Anne on that date with nine students and one faculty member. The State of Maryland operated its land-grant program at the Maryland Agricultural College at College Park. African-Americans were not admitted as students. The University of Maryland sought to provide a Land-Grant program for African-Americans and assumed control of the Princess Anne Academy, renaming it the Eastern Shore Branch of the Maryland Agricultural College. The arrangement was effected in 1919. In 1926, the College passed into complete control and ownership of the State and the University of Maryland was designated as the administrative agency. In 1948, the Eastern Shore Branch of the university of Maryland, popularly known as Princess Anne College, became officially Maryland State College, a Division of the University of Maryland. On July 1, 1970, Maryland State College became the University of Maryland Eastern Shore.

The UMES is a Historically Black College or University (HBCU). The HBCUs were established before the Civil Rights Act of 1964 with the intention of primarily serving the African-American community. At that time, most predominantly white institutions of higher-learning prohibited African Americans from enrollment.

Today, this lovely campus hosts nearly 4,000 students and the Department of Natural Resources within the School of Agriculture and Natural Resources comprises five undergraduate academic areas: Biochemistry, Biology, Chemistry, Environmental Sciences and Physics, with four-year Bachelor of Science degrees granted in Biochemistry, Biology, Chemistry, and Environmental Sciences. Teacher Education degrees are also granted in cooperation with the Education Department. Undergraduate research opportunities are available at a variety of internship sites. Both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees are granted at the graduate level in USM's Marine, Estuarine and Environmental Sciences (MEES) programs and in the UMES Toxicology Program. In addition, DNS now offers an M.S. degree in Chemistry as well as a certified M.S. degree in Fisheries Economics and Resource Management. DNS also has a number of educational programs and facilities, including the CREST Center for the Integrated Study of Coastal Ecosystem Processes and Dynamics, the Living Marine Resource Cooperative and Science Center (LMRCSC) and the Paul S. Sarbanes Living Marine Research Center.

The HBCU status of UMES gave the Waterbird Society an exciting opportunity to pursue its goal of increasing diversity in the natural sciences via the diversity program that will be offered on Friday to students from UMES and four other HBCU institutions in the region. This effort was initiated at the 2016 meeting in New Bern, North Carolina and this diversity program is the first of what will be many projects to advance this goal.

On behalf of the Waterbird Society and the University of Maryland Eastern Shore, we thank you for your participation and encourage you to contact us if there is anything we can do to make this a terrific meeting for you.

**Slugging it: Help the Waterbird Society reduce carbon emissions
and lessen the meeting's contribution to climate change**

Fewer vehicles, more passengers! It **is** that simple. To reduce the carbon emissions from this meeting, we are asking every participant who has a car to ferry passengers from the hotel to the campus and back via a “slug line.”

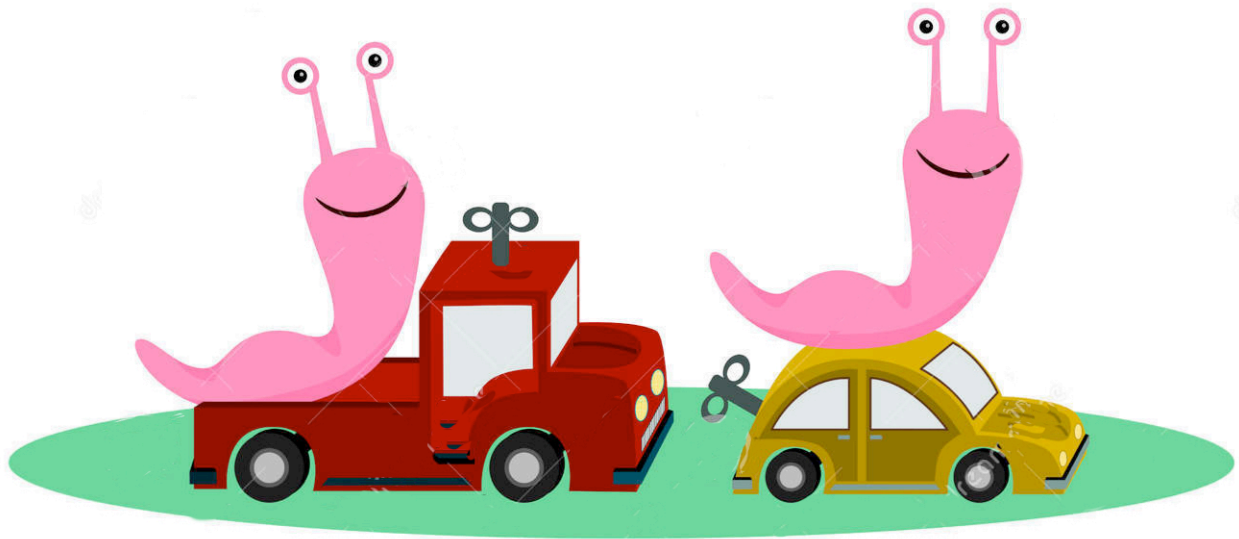
Drivers: When you finish your breakfast in the morning, go to your car, drive to the front door of the hotel, and pick up waiting passengers.

Passengers: When you finish your breakfast in the morning, go to the front door of the hotel and hop into the first car in line.

Returning to campus is essentially the same. We will identify a meet-up point in the building as we don't want anyone standing in the parking lot in the cold and dark. Look for the SLUG HERE signs.

Drivers and passengers will walk to the parking lot together.

We will have a few vans to sweep up any stragglers who have not found rides.



SLUG HERE!



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0.3g Geolocators

2.9g PinPoint GPS VHF Download

We'd love to hear about your project!

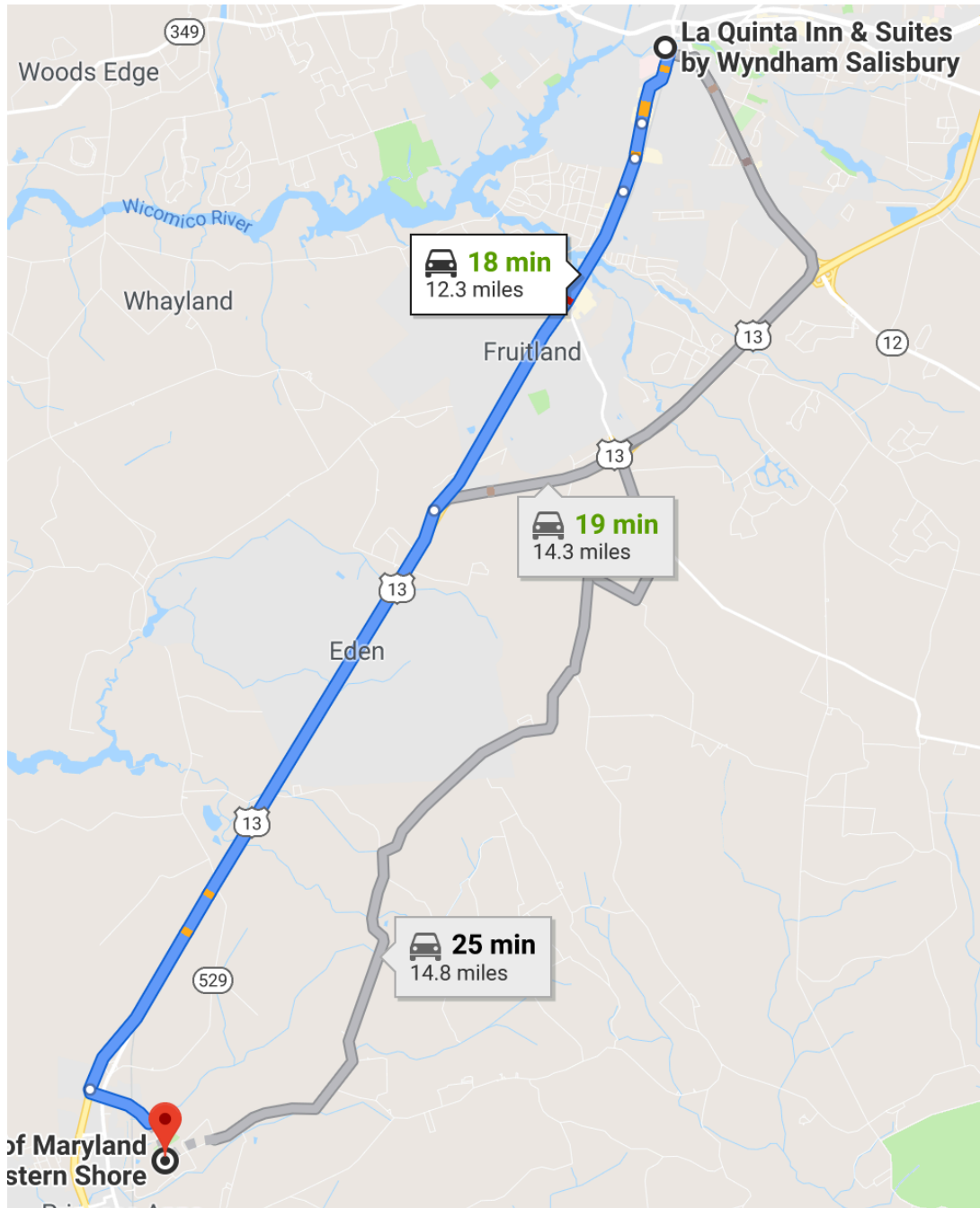
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Directions, hotel to UMES

*NOTE: This 12.6-mile drive takes about 25 min. Allowing time to park and walk to the Student Services Center, you should **leave the hotel no later than 7:15 a.m.** if you want to arrive in time for the plenaries, which start at 8 a.m. **Breakfast will be served at the hotel at 6:15 a.m.***



Leave the hotel and turn right/south onto South Salisbury Boulevard/US Business 13.

Continue 5.1 miles to US 13 South (a slight right turn).

Follow US 13 South 6.5 miles.

Turn left onto MD 822.

At the small traffic circle, continue on 822.

Continue to College Backbone Road, then turn right.

Park in the parking lot behind the lake (as indicated by the Waterbird Society parking sign).





Social Attraction Tools for your Conservation Projects

Visit our table at the Waterbirds Meeting or online at

<https://projectpuffin.audubon.org/decoys/mad-river-decoys-audubon!>

Mad River Decoy was established in 1990 by Jim and Nancy Henry in their barn nestled in the Green Mountains of central Vermont. Unlike large hunting decoy manufacturers, Mad River focused on conservation decoys and soon began supplying the Audubon Seabird Restoration Program (Project Puffin). Jim provided the master carving expertise and manufactured the polyethylene plastic decoys while Nancy specialized in painting the over 30 species they created. It was a labor of love, so when retirement came calling Jim and Nancy looked for suitable candidates to take over their business. Who better to take the reins but those who pioneered the social attraction technique for which their decoys were made? In December 2016, National Audubon Society's Seabird Restoration Program became the new owners of Mad River Decoy.



Daily Schedule

Wednesday 6 November

Activity	Time (hrs)	Location
WBS Council meeting	08:30 – 17:00	La Quinta Ballroom
WBS Committee meetings	08:30 – 17:00	La Quinta lobby, breakfast room, and other public spaces (check with your committee chair)
2023 Atlantic Colonial Waterbird Breeding Survey Planning Workshop	10:00 – 17:00	La Quinta Ballroom
Check-in and registration	13:00—17:00	La Quinta lobby
Icebreaker Reception	18:00 – 21:00	La Quinta Ballroom

Thursday 7 November

Welcome, announcements	08:00 – 8:05	Student Services Center Theater
Plenary	08:05 – 09:00	Student Services Center Theater
Paper sessions & symposia	09:00 – 10:00	Student Services Center Theater and Ballroom C/D
Coffee Break	10:00 – 10:20	Student Services Center Multipurpose Room
Paper sessions & symposia	10:20 – 12:20	Student Services Center Theater and Ballroom C/D
Lunch	12:20 - 13:30	Student Services Center Ballroom A/B
Mentor-student lunch	12:20 – 13:30	Student Services Center Ballroom A/B
Paper sessions & symposia	13:30 – 15:30	Student Services Center Theater and Ballroom C/D
Coffee break	15:30 – 15:50	Student Services Center Multipurpose Room
Paper sessions & symposia	15:50 – 17:30	Student Services Center Theater and Ballroom C/D
Atlantic Marine Bird Cooperative	09:00-17:30	Student Services Center 2144A/B
Poster session and reception	18:00 – 20:00	Henson Ballroom

(Remove posters at end of reception)

Friday 8 November

Waterbird Society meeting participants are welcome to attend the two Diversity Day panels and the lunch-time program.

Diversity Day morning panel	09:00 – 12:00	Student Services Center Theater
Diversity Day extended lunch	12:00 – 14:15	Student Services Center Ballroom
Diversity Day afternoon panel	14:15 - 16:30	Student Services Center Ballroom
Diversity Day Exhibits	10:00 – 17:00	Student Services Center Multi-purpose
Diversity Day Poster session/reception	18:00 – 20:00	Student Services Center Ballroom
Atlantic Marine Birds Cooperative	09:00 – 13:00	Student Services Center 2144A/B
Cellular Tracking Technologies	09:00 – 10:00	Student Services Center 2149A/B
Wildlife Acoustics hands-on workshop	10:00 – 11:00	Student Services Center 2149A/B
Lotek Drop-in Clinic	12:00 – 12:30	Student Services Center 2149A/B
Waterbird Society paper sessions	13:30 – 15:30	Student Services Center Theater and Rooms 2149 A/B
Waterbird Society coffee break	15:30 – 15:50	TBD
Waterbird Society papers & symposia	15:50 – 17:30	Student Services Center Theater and Rooms 2149 A/B

Saturday 9 November

Paper sessions & symposia	08:00 – 10:00	Student Services Center Theater and Ballroom C/D
Coffee break	10:00 – 10:20	Student Services Center Multipurpose Room
Paper sessions & symposia	10:20 – 12:20	Student Services Center Theater and Ballroom C/D
Lunch and Waterbird Society business meeting	12:20 - 13:30	Student Services Center Ballroom A/B
Paper sessions & symposia	13:30 – 17:30	Student Services Center Theater and Ballroom C/D
Silent Auction	12:00-16:00	Student Services Center, Ballroom A/B
Silent Auction, continued	18:30-20:00	La Quinta Ballroom
Banquet	18:30 – 20:30	La Quinta Ballroom

Social Events Schedule

Icebreaker

The icebreaker will be held at the La Quinta on Wednesday evening from 18:00 to 20:00.

Student-Mentor Lunch

This lunch will be held on Thursday, 7 November during the regular lunch break. An area of the lunch room will be set aside. For more information, contact Juliet Lamb [jslamb@g.clemson.edu]

Meals

Breakfasts will be provided at the La Quinta. Breakfast service will begin at 6:15 a.m.

Lunches will be held in the Student Services Center Ballroom A/B.

Dinners on Thursday and Friday are on-your-own; Saturday is on-you-own unless you purchased a banquet ticket.

Banquet

The banquet will be held at the La Quinta on Saturday evening from 18:00 – 21:00, including a cash bar, awards, and the silent auction.

Silent Auction

This is a reminder to bring your best artifacts for the Silent Auction to **help raise money for The Waterbird Society student travel funds!**

The silent auction will be held on Saturday, 9 November from noon to 4 p.m. in Ballroom C. It will re-open during the banquet and bidding will end immediately prior to the announcement of awards. The winners of each item will be announced after the completion of the awards and announcement and winners will be expected to pay for and retrieve their items at that time.

Remember - bid early and bid often.

Thanks for helping us with this worthy cause!!

Pool Party!

Immediately following the banquet. BYORD!



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Features

- Lightweight, compact and weather-proof for any environment
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- Change settings and schedule wirelessly via Bluetooth on your mobile device
- Automatically sends recorder status to the app via Bluetooth
- Uses your mobile device to set date, time, time zone and location
- Optional second microphone for stereo recordings
- Record up to 135 hours scheduled over months with 4 AA batteries or up to 500 hours with lithium-ion batteries
- Compatible with Kaleidoscope Pro software to help find species of interest

Dimensions

- Height: 4.9" / 123 mm
- Width: 6.6" / 168 mm
- Depth: 1.4" / 36 mm

Weight

- 0.64 lb / 290 grams including 4 AA batteries

The Song Meter Mini and Song Meter Mini Bat ultrasonic model will start shipping in early 2020.

Special Sessions

Planning for the proposed 2023 Atlantic and Gulf Coast coordinated colonial waterbird survey

Organizer: Ruth Boettcher

This workshop is opened to all Seabird Colonies and Adjacent Waters Working Group members and Atlantic and Gulf coast colonial waterbird biologists and managers committed to helping plan a 2023 large-scale coordinated breeding survey. The primary objectives of this one-day workshop include: establishing the geographic extent of the survey; gaining buy-in from states and provinces to participate in this effort; and organizing a planning team and structure that will ensure the development of a sound survey design. Come prepared to share your ideas and expertise as we tackle this exciting, but challenging undertaking that we all said needs to be done, but never quite got around to doing it. *Note: this workshop will be held at the La Quinta hotel.*

Atlantic Marine Bird Cooperative

Organizer: Caleb Spiegel



Since 2005, the Atlantic Marine Bird Cooperative (AMBC) has brought together partners to better understand and conserve Northwest Atlantic marine birds and their habitats, through cooperative science-driven actions.

Accomplishments include development of the NW Atlantic Seabird Catalog, the Business Plan for Addressing and Reducing Bycatch in Atlantic Fisheries, and a numerous tracking, surveying, and modelling projects that inform offshore energy development. The AMBC is also an official member organization of the World Seabird Union.

On **November 7 – 8, 2019**, the AMBC will hold a 1.5-day meeting. AMBC meetings are a place for discussing projects, sharing ideas, and fostering productive partnerships related to NW Atlantic marine birds. The 2019 meeting will highlight recent accomplishments, including actions undertaken by a number of active AMBC working groups, and offer a forum for continued collaboration. In addition, participants will have an opportunity to review and discuss current advances and future directions in how the group operates, and what it works on.

Wildlife Acoustics: Using Bioacoustics as a Valuable Waterbird Research Tool

Friday, November 8th, 10- 11 am
Student Services Center Room 2149 A/B

Unattended acoustic recorders provide a non-invasive and cost-effective technique to assess species presence within a region. This is especially true for waterbird research, where study sites may be difficult to access, and timing and conditions make traditional methods of monitoring challenging. Acoustic recordings can help determine population trends, find unknown colonies, and answer other research questions to support conservation efforts.?? This hands-on workshop will teach participants the features and configuration options of the Song Meter SM4 recorder. Time permitting, we will also discuss the free and paid versions of our Kaleidoscope software which allows for efficient analysis of acoustic data. Limited space (only 50 seats) available. Priority will be given to those who signed up online.

SCIENTIFIC PROGRAM

Locations

All plenaries, symposia, special sessions, and paper sessions will be held in the UMES Student Services Center. The meeting of the Atlantic Marine Bird Cooperative will be held in Rooms 2144A/B on the second floor. The poster session will be held in the Henson Center.

Instructions for talks

- Time slots are 20 minutes: plan for a 15-minute presentation + 5-minute discussion
- Software Requirements: PowerPoint presentations created in Office 2010 or later.
- You **MUST** upload your presentation to Dropbox no later than **48 hours** before your scheduled talk. Each of you will receive a DropBox share link to the folder for your session. If you do not have access to Dropbox at work, please sign up for a dropbox account at home or use the Dropbox account of a friend or colleague.
- Check your time assignment in the program. There will be a Dropbox folder for each session, clearly labeled with date, room and time slot (AM or PM). Be sure you are uploading your file to the correct folder.
- File labeling format: Day_Room_StartTime_PresenterSurname
 - e.g. Thu_Theatre_1100_Doe
 - e.g. Sat_2249_1530_Doe

Posters

The poster session will be held on Thursday 7 November from 16:00 – 18:00 hrs in the Henson Ballroom. Hors d'oeuvres will be served and there will be a cash bar.

You are encouraged to hang your poster any time after you arrive but no later than 15:30 on Thursday. Be sure to find the number tag that corresponds to your abstract number.

- Posters cannot exceed 40 inches width by 30 inches height (102 cm width by 76 cm height).
- One author must be present at their poster during the session.
- Find the slot with the tag number that matches the abstract number for your poster.
- The posters will be affixed to the walls with Command strips (which will be supplied).
- At the end of the poster session, the posters **MUST BE REMOVED**. The posters can then be put on display in the La Quinta ballroom on Friday, again with Command strips, and may remain on display until the start of the banquet on Saturday night.
- When removing posters affixed with Command strips, it is very easy to tear the paper. Therefore, we strongly recommend that you either laminate your poster or print two copies.

As a courtesy to all presenters, turn off cell phones while attending the symposia and sessions and during the poster sessions.

Plenary Speaker Biography and Abstract



Patricia Szczys, Ph.D.

Patty Szczys is Professor of Biology and Director of the University Honors Program at Eastern Connecticut State University. She earned a B.S. degree in Zoology at the University of North Dakota and a Ph.D. in Environmental Biology at the University of Massachusetts Boston. As a professor at Connecticut's only public liberal arts university, her career has focused on training undergraduates. Patty has students conducting studies in the field and in her population genetics lab with a focus on the conservation of terns across the world. Her research lab has exposed numerous students to important issues in tern evolution and conservation while they completed multi-year research projects and Honors Theses. She sees this investment payoff in some students producing publications and moving on to graduate programs in related fields, but also in developing a conservation ethic among young people no matter their career aspirations. Patty has been a member of the Waterbird Society since 1997. In 2007 she was an integral part of the first Waterbirds website upgrade and chaired the Communications and Outreach committee until 2016 when she was elected Secretary for the Society. By then, she was also involved in the second transformation of the website. She really enjoys interactions with students at Waterbirds meetings and regularly participates in the mentor lunches.

Plenary Abstract

Szczys, Patricia¹

¹Department of Biology, Eastern Connecticut State University, Willimantic, CT, USA
szczysp@easternct.edu

Natural history and genetics: Informing tern conservation and undergraduate research

Primarily undergraduate academic institutions (PUIs) and small colleges following the tradition of the liberal arts typically shift the focus of faculty away from extensive grant-seeking and high frequency, high-profile publication toward research-informed teaching and undergraduate-oriented research (UGR) programs. Expectations are that both in and out of the classroom, faculty employ high-impact, hands-on, and application-based methodologies from which

students develop the “soft-skills” of critical-thinking, problem-solving, and writing while maintaining the expectation of high-quality faculty scholarship. Research programs focused on colonial waterbirds and molecular analyses for population genetics present ideal model systems for faculty at PUIs and should be recognized as such by young scientists considering this career path. Further, strong partnerships between PUIs, state and federal agencies, and non-profit partners provide synergistic effects toward conservation and monitoring outcomes for waterbirds and meaningful undergraduate research experiences. Here I report the results of my two most recent research projects: (1) Metapopulation structure and historical population size in the Northwest Atlantic Roseate Tern (*Sterna dougallii*) population and (2) Patterns of diversity and structure at neutral and “candidate migratory package genes” in North American Common Terns (*Sterna hirundo*). The study of these species and others has engaged undergraduates to elucidate population size, connectivity, and to consider neutral versus adaptive variation, each with explicit intent to inform conservation priorities and management strategies. Using these projects as case studies, I demonstrate how one research program has taken practical approaches to deeply engage undergraduates in the classroom, in a molecular lab without graduate students and post-docs, and in intensive field experiences, all within the constraints of a significant teaching load. These approaches are adaptable to many species systems and to several areas of laboratory science and institutional focus so I outline strategies for adoption by others.

Symposia

Pelicans of the World

Organizers: D. Tommy King, Giorgos Catsadorakis, Juliet Lamb

This symposium, organized by the IUCN Pelican Specialist Group, will bring together experts from six continents on the world's eight species of pelicans. We will discuss the current status and trends of pelican populations, recent research into their basic biology and habitat use, and pressing conservation issues including habitat loss and modification, forage fish availability, hunting, contaminants, oil spills, and interactions with fisheries and aquaculture. The goals of the symposium are to publish proceedings providing a comprehensive synthesis of current knowledge, identify key priority areas for future study and monitoring, and improve collaborative relationships for studying and conserving pelicans around the world.

Great Blue Herons and Great Egrets: their biology, conservation and management...and is there a need for a Working Group?

Organizers: Chip Weseloh, Danielle D'Auria

The Great Blue Heron (*Ardea herodias*) and the Great Egret (*Ardea alba*) are the two largest and most wide-spread Ardeids in North America. They are also among the "least threatened" herons in North America, as identified by the IUCN. Hence, they are rarely the subject of intensive or well-funded study, though being ubiquitous on the landscape and easily identified, they lend themselves well to citizen science studies. Most regional populations of GBHEs appear to be stable while those of GREs appear to be increasing. However, both species do pose a management concern, especially at aqua-culture facilities. This symposium will foster discussion into their biology, conservation and management challenges and strategies. Four specific topics identified for discussion (and presentation) include: management issues at aqua-culture facilities, human/wildlife conflict at mainland rookeries, effective and ineffective field techniques, and the application of citizen science.

Avian Interactions with Offshore Energy Development

Organizers: Holly Goyert, Scott Johnston, Pam Loring, Caleb Spiegel, and Kate Williams

Energy development has a range of effects on waterbirds and other avian species that use the offshore environment. Understanding these effects and how to minimize associated risks will be an essential component of waterbird conservation in the coming decades, particularly as newer offshore energy sources, such as wind energy, continue to grow. This symposium will focus on assessing the current state of knowledge and identifying key gaps in our understanding of observed and predicted avian interactions with offshore energy development, including oil and gas extraction, wind energy, and hydrokinetics. We welcome talks on baseline distributions and abundance to inform project siting and impact assessments, as well as studies assessing interactions at existing facilities. The symposium will focus primarily on waters off of North America, but will also incorporate research conducted in other areas that could have relevance to North American waterbirds.

Black Rail ecology and conservation

Organizers: Whitney Wiest and Bryan Watts

The smallest rail in North America, the Black Rail (*Laterallus jamaicensis*), is found in salt, brackish, and freshwater marshes. This species is one of the most secretive of the secretive marshbirds and much of our knowledge of its life history and distribution has been gleaned from historical records over the last 200 years. This symposium aims to provide updates on recent research investigating the species' life history and habitat use, status and trends, and conservation strategies. This symposium is intended to build on the information that was presented at the 2016 Waterbirds symposium focused on the eastern black rail subspecies. The eastern subspecies was recently proposed for protection under the Endangered Species Act in October of 2018.

Ecology and management of gulls in urban landscapes

Organizers: Susan Elbin, John Anderson, and Lesley Thorne

This symposium focuses on the science and management of urban-nesting gulls. Although it may appear these city birds are everywhere and increasing, survey numbers often prove otherwise. Presenters will examine issues specific to the ecology of gulls in urban landscapes: foraging behavior, energetics, reproductive success, spatial ecology, microbiome characteristics, monitoring, and approaches to human-gull conflicts where they occur.



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GREAT WORK OF THE
WATERBIRDS SOCIETY

COME VISIT OUR BOOTH AND SEE THE
WORLD'S ONLY GPS/GSM/SATELLITE
HYBRID TELEMETRY UNIT!

Wednesday, 06 November			
Time	La Quinta Ballroom	La Quinta Lobby	La Quinta - common areas
8:30	Council Meeting	Registration Desk	Committee Meetings, etc.
17:00	Opening Reception La Quinta Ballroom		

[] = abstract number			
Thursday, 07 November - AM			
Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
8:00	Welcome, announcements		
8:05	Plenary speaker: Dr. Patricia Szczys Natural history and genetics: Informing tern conservation and undergraduate research		
9:00	General ecology & evolution <i>Chair: Bradley Wilkinson</i> [96] Kate Sheehan Quill Feather Mite Infection and Feather Distribution on Shorebirds	Black Rail Symposium <i>Chairs: Whitney Wiest & Bryan Watts</i> [38] Christine Hand Eastern Black Rails in managed tidal impoundments: challenges and opportunities	Atlantic Marine Bird Cooperative (AMBC) Meeting
9:20	[4] Jennifer Arnold Investigating variation in nocturnal sleep among incubating Common Terns	[50] Erik Johnson The Status of Black Rail in Coastal Louisiana	
9:40	[44] Danny Jackson A genus-wide genomic investigation of boobies	[35] Clay Green Species distribution models and habitat associations of the Black Rail in Texas	

[] = abstract number

Thursday, 07 November – AM continued			
Time	SSC Theater	SSC Ballroom C/D	
10:00	Break SSC Multipurpose room		
10:20	Breeding ecology 1 <i>Chair: Kate Shlepr</i> [14] Daniel Catlin Habitat selection and potential fitness consequences of two early-successional species with differing life-history strategies	Black Rail Symposium (cont'd) <i>Chairs: Whitney Wiest & Bryan Watts</i> [101] Bryan Stevens Predicting Black Rail Breeding Habitat: Spatial Models to Identify Anthropogenic Threats and Facilitate Conservation	AMBC Meeting
10:40	[84] Caroline Poli Unraveling the long-term demographic effects of early-life exposure to invasive prey	[9] David Brinker Black Rail distribution in Maryland	
11:00	[33] Natasha Gownaris Causes and Consequences of Skewed Sex Ratios in Magellanic Penguins	[117] Craig Watson The Atlantic Coast Joint Venture's Black Rail Initiative - Conservation Planning and Implementation	
11:20	 [104] Jeffery Sullivan Assessing Nest Attentiveness of Common Terns via Video Cameras and Temperature Loggers	Urban Gull Symposium <i>Chairs: Susan Elbin, John Anderson, Lesley Thorne</i> [26] Susan Elbin Urban Gulls: introduction to the symposium with examples from NY City	
11:40	[114] Brittany Velikaneye Microsatellites can exclude paternity in male-female pairs and assign maternity in female-female pairs of Roseate Terns	[56] Jeff Kolodzinski Jailbirds: The history and future of Herring Gulls on Rikers Island, NYC.	
12:00	[76] Ian Nisbet No evidence of reproductive senescence in North American Common Terns	36] Moriah Greenhaw Movement patterns and habitat use of urban-nesting Ring-billed Gulls during incubation.	
12:20	Lunch SSC Ballroom A/B		

[] = abstract number			
Thursday, 07 November - PM			
Time	SSC Theater	SSC Ballroom C/D	
13:30	Breeding ecology 2 <i>Chair: Alison Kocek</i> [66] Alan Maccarone Breeding Phenology and Reproductive Success by Little Blue Herons in an Urban Mixed-species Colony	Urban Gull Symposium (cont'd) <i>Chairs: Susan Elbin, John Anderson, Lesley Thorne</i> [57] Edward Kroc Differences in urban nesting behaviours and nest site selection of 7 common North American gulls	
13:50	[55] Alison Kocek Increasing Detection Rates through Passive Identification of Individual Birds Attending Nests	[2] John Anderson Locals and Summer People: Post-breeding Dispersal in Herring Gulls	
14:10	[7] Sarah Bolinger Modeling multiple sources of nest failure for Least Terns in Southern Louisiana	[98] Anouk Spelt Habitat use of urban-nesting lesser black-backed gulls during the breeding season	
14:30	[12] Paige Byerly Colony and nest site characteristics influence reproductive success in a threatened Caribbean seabird population	[82] Noah Perlut Dispersal and apparent survival by sub-adult Herring Gulls from urban and island colonies in the Gulf of Maine	
14:50	[85] Diann Prosser Estimating hatching and fledging success of Common Terns at an environmental restoration site	[60] Kimberly Lato A comparison of habitat use and foraging ecology between herring gulls and great black-backed gulls	
15:10	[97] Kate Shlepr Testing the effect of non-native fish on wading bird productivity in the Everglades	[108] Lesley Thorne Mercury concentrations reflect foraging behavior of herring gulls along an urban gradient	
15:30	Break Multipurpose Room		

[] = abstract number			
Thursday, 07 November – PM continued			
	SSC Theater	SSC Ballroom C/D	
15:50	Breeding ecology 3 <i>Chair: Gillian Holmes</i> [20] Alexandra Cook Proximity to nests of potential predators impacts nest site selection of imperiled tidal marsh sparrows	Foraging ecology <i>Chair: Marisa Martinez</i> [13] Aliya Caldwell Plastic Ingestion by Seabirds Nesting in the Gulf of Maine	
16:10	[99] Michelle Stantial Mesopredator Release by Removal of a Top Carnivore Affects Best Management Practices for an Endangered Shorebird	[52] Sarah Karpanty Assessing the effects of climate-driven shifts in prey on red knots using Virginia stopover habitat	
16:30	[19] Jonathan Cohen PiperEx: A Decision Support Tool for Exclosures for Piping Plovers	[21] Elizabeth Craig Evaluating seasonal, age-based, and interspecific variation in the diet and foraging behavior of Common and Roseate terns	
16:50	[42] Gillian Holmes Mining-induced Flooding and Use of Deterrents for Mitigating Impacts on Arctic-nesting Birds	[29] David Essian Species' traits influence population-level, but not nest-level responses to prey availability	
17:10	[30] Jacquelyn Evans Effects of highly variable foraging conditions on the physical condition and survival of small heron nestlings	[68] Marisa Martinez Time and tide wait for no bird: modeling resource selection by small herons in intertidal systems	
17:30	[92] Yvan Satgé Modelling the nesting habitat of the endangered Black-capped Petrel to inform conservation actions in the Caribbean		
18:00-20:00	POSTER SESSION HENSON BALLROOM		

[] = abstract number		
Friday, 08 November - AM		
Time	SSC Theater	SSC 2144 A/B
8:00 12:00	<p><i>Diversity Day Morning session (begins at 9 a.m.)</i></p> <p>Talks by five notable achievers in academia, federal agencies, and conservation organizations. They will relate how they became interested in nature, obtained academic degrees, internships, and other training opportunities, and found career opportunities and excelled in natural resource conservation and management and academic science. They will also address challenges faced as a person of color in white-dominated fields and how they are changing that culture in their own organizations and universities.</p> <p>The speakers are:</p> <p><i>Miguel Mora</i>, Ph.D. (Professor, Department of Wildlife and Fisheries Sciences and Intercollegiate Faculty of Toxicology, Texas A&M University)</p> <p><i>Teferi Tsegaye</i>, Ph.D. (National Program Leader, Natural Resources and Sustainable Agricultural Systems, USDA Agricultural Research Service)</p> <p><i>Dawn O'Neal</i>, Ph.D. (Director, NatureNet Science Fellows and Science Impact Project, Nature Conservancy)</p> <p><i>Keyana Ellis Reynolds</i>, Ph.D. USDA Forest Service Program Manager, Volunteers and Service Program</p> <p><i>Maya Solomon</i>, USDA Forest Service, Training Program Manager</p> <p>A panel-format Q&A, chaired by Moses Kairo, Ph.D. will follow these talks; students will have an opportunity to ask questions.</p> <p>(Waterbird Society meeting participants are welcome to attend)</p>	AMBC Meeting
09:00	Cellular Tracking Technologies Internet of Wildlife for Waterbird Research and Management (SSC 2149 A/B)	
10:00	Wildlife Acoustics Hands-on Workshop (SSC 2149 A/B) - Unattended acoustic recorders provide a non-invasive and cost-effective technique to assess species presence within a region. This is especially true for waterbird research, where study sites may be difficult to access, and timing and conditions make traditional methods of monitoring challenging. Acoustic recordings can help determine population trends, find unknown colonies, and answer other research questions to support conservation efforts. This hands-on workshop will teach participants the features and configuration options of the Song Meter SM4 recorder. Time permitting, we will also discuss the free and paid versions of our Kaleidoscope software which allows for efficient analysis of acoustic data. Priority for limited seats will go to those who signed up in advance.	
11:00	Lotek Drop-in Clinic (SSC 2149 A/B)	
12:00	Lunch, SSC Ballroom. Lunch for the Waterbird Society program ends at 13:30. Lunch for the diversity program extends to 14:30.	

[] = abstract number			
Friday, 08 November - PM			
Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
13:30	Pelicans of the World Symposium <i>Chairs: Tommy King, Giorgos Catsadorakis, Juliet Lamb</i> [47] Patrick Jodice An overview of research and conservation on Pelicans in the 21st century: data gaps and data strengths	Ongoing Diversity Day Lunch program	Heron & Egret Symposium <i>Chairs: Chip Weseloh & Danielle D'Auria</i> [111] Nellie Tsipoura Monitoring urban colonial waterbirds in the NY/NJ harbor
13:50	[112] Aimee Van Tatenhove Quantifying spatial and temporal population trends of North American pelicans		[45] Scott Jennings 30 Years of Ardeid monitoring in the San Francisco Bay Area
14:10	[53] Tommy King American White Pelican population trends		[69] Miyuki Mashiko Positive/negative aspects of Grey Herons and Great Egrets on conservation of mixed-species heron colonies in Japan
14:30	[75] John Neill Four decades of change for the American white pelican breeding colony on Gunnison Island, Utah	Diversity Day Afternoon Panel 14:30 – 16:30 Speakers are: Marisa Martinez (Florida Atlantic University), one of the two recipients of the Kushlan Research Award. She is working on how to predict wading bird foraging habitat and prey in dynamic intertidal systems in Florida.	[118] Chip Weseloh Age of first breeding, longevity and age structure of Great Egrets at a breeding colony in southern Ontario

[] = abstract number			
Friday, 08 November – PM (cont'd)			
Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
14:50	<p>Pelicans of the World Symposium (cont'd) <i>Chairs: Tommy King, Giorgos Catsadorakis, Juliet Lamb</i></p> <p>[94] Sara Schweitzer Abundance and distribution of the Brown Pelican in NC over 3 decades</p>	<p>Diversity Day Afternoon Panel (cont'd)</p> <p>Kiah Williams (Graduate Research Fellow, Tulane University) - As a PhD student, Kiah studies beach-nesting bird nest success, chick survival, and breeding sociality in coastal habitats, and how these patterns can be affected by beach restoration in anticipation of the ever-increasing frequency of severe weather events due to climate change.</p>	<p>Heron & Egret Symposium (cont'd) <i>Chairs: Chip Weseloh & Danielle D'Auria</i></p> <p>[22] Danielle D'Auria Seasonal home range and habitat use of Maine-nesting Great Blue Herons</p>
		<p>Shadaesha Green (Ph.D. student in the MEES graduate program at the University of Maryland Center for Environmental Science-Institute of Marine and Environmental Technology (UMCES-IMET). Her research is focused on crustacean physiology and endocrinology using the red deep-sea crab, <i>Chaceon quinquedens</i>, as her species of interest.</p>	
15:10	<p>[122] Carlos Zavalaga A revision of the conservation status of Peruvian pelicans in Perú: Population trends, changes in distribution and threats.</p>		<p>[46] Scott Jennings Migration and habitat use of Great Egrets in central California.</p>
15:30	Break - SSC Multi-purpose Room		

[] = abstract number			
Friday, 08 November – PM (cont'd)			
Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
15:50	Pelicans of the World Symposium (cont'd) <i>Chairs: Tommy King, Giorgos Catsadorakis, Juliet Lamb</i> Jaime Cursach Situation of the Peruvian pelican (<i>Pelecanus thagus</i>), with emphasis on its austral distribution	Diversity Day afternoon panel (cont'd) Panel discussion and Q&A	Heron & Egret Symposium (cont'd) <i>Chairs: Chip Weseloh & Danielle D'Auria</i> [10] John Brzorad Daily Flight Activity, Home Range and Utilization Distribution among Great Egrets
16:10	[15] Giorgos Catsadorakis Status of knowledge about the population trends and conservation developments for the Dalmatian pelican in the world	Diversity Day afternoon panel (cont'd)	[3] Carmen Johnson Great rest-pectations: Nocturnal roosting dynamics of Great Egrets along the North Carolina coast
16:30	[11] Sebastian Bugariu Population status of the Dalmatian Pelican and of the Great White Pelican in the Romanian Lower Danube basin and the Danube Delta Biosphere Reserve		[23] Danielle D'Auria & Chip Weseloh Wrap-up session for the Symposium
16:50	[51] Greg Johnston Australian pelicans: a waterbird on a desert continent		Winter distribution & conservation <i>Chair: Dave Moore</i> [24] Joan Walsh Conservation of Roseate Tern and Common Tern: Preliminary estimates of mortality and injury due to collisions with transmission lines in Brazil
17:10	[107] Scott Taylor Genetic distinctiveness of brown pelicans from the Galápagos Islands compared to continental North America		[6] Alicia Berlin Habitat Assessment for Wintering American Black Ducks in the Chesapeake Bay Refuge System.
17:30	[79] Ortaç Onmuş Genetic Diversity and population structure of Dalmatian Pelicans in Turkey		[54] Nicole Kleponis Red-throated Loon Winter Distribution in Delaware Bay

[] = abstract number			
Saturday, 09 November - AM			
Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
8:00	Pelicans of the World Symposium (cont'd) <i>Chairs: Tommy King, Giorgos Catsadorakis, Juliet Lamb</i> [8] Meyrick Bowker Breeding incidences of the Pink-backed Pelican in south eastern Africa: An update	Movement, migration & connectivity 1 <i>Chair: Marley Aikens</i> [43] Kelsi Hunt Movements and foraging of Common Terns nesting on the South Island of the Hampton Roads Bridge-Tunnel	Birds & Offshore Energy Symposium <i>Chairs: Holly Goyert, Scott Johnston, Pam Loring, Caleb Spiegel, Kate Williams</i> [119] Timothy White An overview of the Bureau of Ocean Energy Management's marine bird program: a national perspective
8:20	[18] Mark Clark Within-season variation in the shape and conductance of American white pelican eggs	[116] Linda Welch Using GPS loggers to track Arctic and Common terns in the Gulf of Maine	[63] Zachary Loman Web-based database for interagency sharing of colonial waterbird survey data
8:40	[31] Treena Ferguson Captive rearing and morphology of American White Pelican chicks	[27] Elisa Elizondo Clapper Rail breeding season movements in DE, USA	[109] Julia Tims Gaining an understanding of seabird communities offshore Guyana: results from 2 years of seasonal surveys
9:00	[58] Juliet Lamb Causes and consequences of individual variation in migratory patterns of Brown Pelicans: Insights from 10 years of tracking data	[25] Henrietta Bellman All our eggs in one basket: The importance of Mispillion Harbor, DE, for migratory birds	[88] Julia Robinson Willmott Inter-Annual Variations in Bird Distribution, Density and Flight Activity over 2 Years of NY Bight Survey Data
9:20	[81] Elisa Peresbarbosa Rojas Migration of American White Pelicans in Central Coast of Veracruz	[16] Melissa Chaplin Managing beaches for migrating and wintering shorebirds: A South Carolina case study	[106] Allison Sussman Aerial seabird surveys in the Northern Gulf of Mexico: A new design for better management
9:40	[113] Aimee Van Tatenhove A Pacific Flyway perspective on the conservation and management of the American White Pelican	[16] Melissa Chaplin Managing beaches for migrating and wintering shorebirds: A South Carolina case study	[72] Pamela Michael Black terns in the northern Gulf of Mexico: initial observations from the Gulf of Mexico Marine Assessment Program for Protected Species

[] = abstract number			
Saturday, 09 November – AM (cont'd)			
Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
10:00	Break - SSC Multi-purpose Room		
10:20	Pelicans of the World Symposium (cont'd) <i>Chairs: Tommy King, Giorgos Catsadorakis, Juliet Lamb</i> [17] Amos Chege Muthiuru The Role of the “Kenya Lake System” in the conservation of the Great White Pelican	Movement, migration & connectivity 2 <i>Chair: Anouk Spelt</i> [80] Kaitlyn Parkins Tracking Semipalmated Sandpiper migration from Jamaica Bay, NYC.	Birds & Offshore Energy Symposium (cont'd) <i>Chairs: Holly Goyert, Scott Johnston, Pam Loring, Caleb Spiegel, Kate Williams</i> [62] Jeffery Leirness Modeling at-sea distributions of marine birds on the U.S. Pacific outer continental shelf
10:40	[61] Paul Leberg Challenges faced by Brown Pelicans on a vanishing coast: loss and restoration in southeastern Louisiana	[32] Katharine Goodenough The true snowbirds of the Northeast: Black Skimmer migration along the Atlantic Flyway	[105] Allison Sussman A comparison of common methods to identify waterbird hotspots in the Great Lakes
11:00	[1] Olga Alexandrou Changes to Dalmatian pelican ecology brought by climate change: observations and findings from a 40-year study in Greece.	[40] Erin Heller Red knot diet reconstruction using next-generation sequencing of fecal samples	[48] Patrick Jodice Exposure of Brown Pelicans to PAHs in the northern Gulf of Mexico
11:20	[78] Guiming Wang Bayesian integrated population models for the effects of climatic change on the demography of migratory birds	[34] Carrie Gray Individual variation in movements associated with seasonal home range and migration behaviors among Red-throated Loons	[91] Yvan Satgé Using near real-time nighttime light imagery to locate existent seabird exposure to active oil and gas extraction.
11:40	[89] Graham Rosser A review of metazoan parasites of the American White Pelican	[49] Patrick Jodice First successful capture and satellite tagging of Black-capped Petrels at sea and subsequent movement patterns	[64] Pamela Loring Using results from avian tracking studies to inform assessments of offshore wind energy areas in the US Atlantic
12:00	[90] Graham Rosser Elucidation of the life cycles and diversity of trematode parasites of the American White Pelican impacting catfish aquaculture in MS, USA	[65] Jim Lyons Stopover and Migratory Connectivity of Red Knots at Cape Cod, Massachusetts: Analysis of Mark-recapture and Isotopes	[100] Iain Stenhouse Assessing spatial use by 3 diving bird species on the U.S. Atlantic Outer Continental Shelf: Potential exposure to offshore wind developments
12:20	Lunch - SSC Ballroom A/B		

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Saturday, 09 November - PM

Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
13:30	Pelicans of the World Symposium (cont'd) <i>Chairs: Tommy King, Giorgos Catsadorakis, Juliet Lamb</i> [120] Bradley Wilkinson Expansion of Brown Pelican diet associated with shrimp trawling effort in South Carolina	Population distribution and trends <i>Chair: Jeff Costa</i> [86] Sana Rehman Occupancy modelling of some common birds along a pollution gradient in river Yamuna, Delhi, India	Birds & Offshore Energy Symposium (cont'd) <i>Chairs: Holly Goyert, Scott Johnston, Pam Loring, Caleb Spiegel, Kate Williams</i> [102] Jennifer Stucker Avian use at the first freshwater offshore wind-energy project in North America
13:50	[39] Ohad Hatzofe Managing the conflict of Pelicans and inland fisheries in Israel	[110] Carol Lynn Trocki Coastal breeding bird monitoring in the Boston Harbor Islands National Recreation Area, MA, 2007-2019	[83] Kimberly Peters Avian Risk Reduction Technologies for Offshore Wind – Overview, Considerations, and a Path Forward
14:10	[103] Debbie Sullivan Pelicans and public engagement in the Gippsland Lakes, Australia	[70] James McCann Status, distribution, and population trends of colonial waterbirds in Maryland	[95] Martin Scott Digital video aerial surveys of red-throated loon: a European case study linked to offshore wind farms
14:30	[67] Aksheeta Mahapatra Changing Times and Changing Attitudes: Spot-billed Pelican conservation in Southern India	[41] Conor Higgins Status and distribution of American Oystercatcher in Maryland	[121] Kate Williams Regional Collaborations to Understand and Minimize Waterbird Impacts from Offshore Wind Energy Development
14:50	Tommy King, Juliet Lamb & Giorgos Catsadorakis Wrap-up session for the Symposium	[71] Alicia Berlin Reducing gillnet bycatch: sea duck underwater hearing thresholds and auditory deterrent devices	Kate Williams & Caleb Spiegel Wrap-up for symposium
15:10	Break - SSC Multi-purpose Room		
15:40	Population ecology & demography 1 <i>Chair: Samantha Robinson</i> [87] Samantha Robinson Piping Plover population change in a hurricane affected population and the relation to constructed nesting habitat	Population ecology & demography 2 <i>Chair: TBD</i> [59] Rachel Larson Evaluation of an innovative audio technique for monitoring wading bird colonies	

[] = abstract number

Saturday, 09 November – PM (cont'd)

Time	SSC Theater	SSC Ballroom C/D	SSC 2144 A/B
16:10	[5] Henrietta Bellman Piping plover population increase following habitat creation in DE, USA	[74] Amberly Neice Using environmental DNA to detect secretive marsh birds	
16:30	[115] Katie Walker Migratory and wintering survival of post-fledge piping plovers	[28] Hugh Ellis Basal metabolic rate of Arctic Terns: confirmation of a latitudinal gradient	
16:50	[93] Amy Schwarzer Life on the edge: density and demography of marsh wrens and seaside sparrows in FL	[77] Erica Nol How a persistent polar vortex impacts local population size in a sub-arctic breeding shorebird	
17:10		[71] Alicia Berlin Reducing gillnet bycatch: sea duck underwater hearing thresholds and auditory deterrent devices	
18:30	Closing Banquet La Quinta Ballroom		
20:30	POOL PARTY!		

ABSTRACTS FOR ORAL PRESENTATIONS

Abstracts are in alphabetical order; [] = abstract number.

Bolded names (and emails) are the presenter's.

** indicates consideration for Best Student Paper.*

[1] Alexandrou, Olga¹, Catsadorakis, Giorgos¹

¹ Society for the Protection of Prespa, Agios Germanos, Prespa, Greece; o.alexandrou@spp.gr

Changes to Dalmatian pelican ecology brought by climate change: observations and findings from a 40-year study in Prespa, northern Greece [*Pelicans of the World Symposium*]

The Dalmatian pelican is a short-distance migrant, nesting in Prespa (853m asl) and wintering in other low-lying (0-100 m asl) inland and coastal wetlands in the region. A number of changes were observed during the last 40 years in its population trends, ecological traits, phenology and behaviour, supposedly attributed to the differential effect of climate change on its breeding and wintering quarters. Its breeding population increased twelve-fold in 1980-2019 making Prespa the largest Dalmatian pelican colony on Earth. Conservation measures have contributed to the increase mainly by eliminating colony disturbance. This, however, might not be the sole cause of increase, but contribution of other interrelated factors, such as possible density-dependent effects, is not easily discernible due to unequal study efforts. Climate change is mainly manifested through increase of average winter temperature in the region the last 20 years. Lower basal metabolic rates may have led to lower mortality rates. Further, the advancement of laying dates by 35 days in 25 years was probably a result of higher prey availability in winter quarters. The degree to which high populations of Great cormorants may have also contributed to more efficient foraging by the pelicans through collaborative fishing remains unassessed. After 2014, increased frequencies of egg and chick abandonment, led to extremely low breeding success of early breeders while later breeders continued to be successful. This was attributed to a mismatch between over-advancement of laying dates and availability of prey as there were no fish available to pelicans at mid-winter in these mountain wetlands. Last, a behavioural change observed was that after a few years of failure as described above, pelicans gradually started commuting to more distant but lower lying wetlands to feed. This meant that a. they had to extend the length of attendance shift between the parents from 1-2 days to 3-4 days in order to accommodate the travel time needed and b. both parents started leaving chicks unattended at a much younger stage than that observed before.

[2] Anderson, John G.T.

College of the Atlantic Island Research Center, Bar Harbor, ME; janderson@coa.edu

Locals and Summer People: Post-breeding Dispersal in Herring Gulls [*Urban Gull Symposium*]

Between 2016 and 2019 my team and I deployed Ecotone Harrier GPS tags on nesting Herring Gulls (*Larus argentatus*) on Great Duck Island, Hancock Co. Maine, USA. Gulls were captured in mid to late incubation using walk-in traps, and nests were monitored subsequently for fledging or failure. Tagged birds exhibited highly individual flight patterns throughout the breeding season, utilizing very different habitats for foraging and loafing. The majority of our tagged birds returned for the breeding season following tagging, and as a result we were able to record dispersal patterns. Some birds remained within 50 km of the breeding colony for the entire winter season, while others traveled to Boston, Providence Rhode Island, New York City, Philadelphia, and the Chesapeake Bay – in some cases distances of over 1000 km from the colony. As with summer activities, birds that moved to urban areas appeared to be using very different habitats for foraging and loafing than birds who remained near the breeding site, though again individuals exhibited high degrees of variation, with some birds making use of urban land-fills while others appeared to be foraging in the inter-tidal. This suggests that members of the same population may face very different threats to survival over the course of a year, and this should be factored into any model of overall meta-population recruitment or decline.

[3] Andersson, Annika G.¹; Johnson, Carmen M.¹; Schweitzer, Sara H.¹

¹North Carolina Wildlife Resources Commission, Raleigh, NC, USA; carmen.johnson@ncwildlife.org

Great rest-pectations: Nocturnal roosting dynamics of Great Egrets (*Ardea alba*) along the North Carolina coast (2015-2018) [Heron & Egret Symposium]

Most research on and surveys of the Great Egret (*Ardea alba*) in North Carolina has focused on breeding populations, and roosting ecology has not been well studied. Recent telemetry research and resighting data of patagial-tagged egrets are elucidating the seasonal importance of roost sites. We surveyed 12 sites in Hyde and Carteret counties, North Carolina, USA from 2015-2018 to reveal habitat features selected by, and abundance trends of Great Egrets at evening roost sites, and composition of other species using these roosts. Roost habitats consisted of pine (*Pinus* spp.) and deciduous trees along a relatively shallow body of water (brackish canals, freshwater ponds and lakes), often in suburban or recreational areas where human activities and noise disturbance were common. Roosts located on private lands lacked conservation protection and may be at risk of being developed. Three roost sites were used consistently by Great Egrets throughout the year, while four sites hosted egrets short term or seasonally, 3-7 months/year, and two sites were used 1-2 months/year (the three remaining sites lack a full year's worth of data to analyze). Great Egret numbers ranged from 0 to 291 individuals/night, and sites that were used regularly tended to support a greater number of Great Egrets. Great Egrets roosted with other waterbird species during 93% of our surveys. Twelve species were recorded roosting with Great Egrets, four of which are of state-listed Special Concern: the Snowy Egret (*Egretta thula*), Little Blue Heron (*Egretta caerulea*), Tricolored Heron (*Egretta tricolor*), and Glossy Ibis (*Plegadis falcinellus*). Data collection will shed further light on the importance of these evening rest stations for waterbird communities in North Carolina. Results from this study will inform public land management decisions, landowner assistance programs, and local development planning programs. Full annual cycle management of migratory species is imperative to conservation, especially of state-listed Special Concern species.

[4] Arnold, Jennifer M.^{1,4}, Diehl, Jenna N.^{1,3}, Korpi, Zoe O.¹, Curtis, Paul D.², Case, Emily V.¹, Oswald, Stephen A.¹

¹Division of Science, Pennsylvania State University, Berks Campus, Reading, PA, USA; ²Department of Natural Resources, Cornell University, Ithaca, NY, USA; ³School of Biological Sciences, Monash University, Melbourne, VIC, Australia; jma25@psu.edu

Investigating variation in nocturnal sleep among incubating Common Terns

Very little is known about nocturnal sleep in terns even though sleep is necessary for physiological and cognitive function and sleep deprivation may impact fitness. Nocturnal sleep behavior and vigilance of incubating Common Terns (*Sterna hirundo*) were initially explored throughout the breeding season at two colonies: Gull Island (Ontario, Canada) for six years (2013-2018) and Little Island (New York, USA) for one year (2018). Behavioral posture and vigilance (eye[s] open) of visible study birds were recorded from time-lapse trail camera images taken at 1 min intervals. Terns utilized two sleeping postures, Back Sleep and Front Sleep, nearly identical to those used by gulls. Differences in the proportion of time spent sleeping between the two colonies were surprisingly large. Terns at Gull Island spent 75% less time in Back Sleep (deep-sleep posture, 7% of the night) than those at Little Island, and 64% of night with their eyes open (vs. <20% at Little Island). Predation risk is known to affect sleep and, during this study, terns at Gull Island experienced regular nocturnal predation by Black-crowned Night Herons (*Nycticorax nycticorax*) which may have increased their vigilance. However, differences in colony size, vegetation cover and presence of other nesting waterbirds may also have caused site-specific differences in sleep. To further distinguish between predation and these factors, we took advantage of a natural experiment in 2019 when predation pressures were reversed and night herons preyed on terns at Little Island only. We discuss the impact of ecological factors on tern sleep patterns and also use 2019 data to address within-pair and individual differences in sleep behavior. Together, these data increase our understanding of whether nocturnal sleep patterns may impact breeding success, colony attractiveness and appropriate management strategies.

[5] Bellman, Henrietta A.¹, Warshawsky, Stephanie¹, VonBoeckman, Evangelin¹, Larsen, Annabel², Vandeplas, Stormy², DeRose-Wilson, Audrey¹

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Piping plover population increase following habitat creation in Delaware, USA: benefits for the wider recovery unit

The Atlantic Coast Recovery Plan (USFWS, revised 2016) was established to ensure the long-term viability of the Atlantic Coast population of piping plovers (*Charadrius melodus*). This Plan defines three recovery units, with associated recovery goals. Delaware is part of the Southern recovery unit along with Maryland, Virginia, North Carolina and South Carolina. Although the southern recovery unit has shown an increase in pair numbers since 1986 (max of 386 in 2016), it has failed to reach the unit's recovery goal of 400 pairs. Numerous studies have described piping plover population growth following habitat creation through natural processes such as storms or hurricanes. Research has also shown that plovers will use human-created habitat such as engineered sandbars or beaches. In 2016 approximately 35 ha of wide, sandy beach was created during a restoration project at Prime Hook Wildlife Refuge (PHNWR) in Sussex County, Delaware. There are no records of piping plovers breeding on Delaware Bay beaches, and Delaware's small piping plover population ($\bar{x}=6$ pairs, 1989–2015) had nested exclusively on Atlantic Coast beaches (primarily at Cape Henlopen State Park). However, in 2016 one pair nested in the newly created habitat at PHNWR. Since then, the number of breeding pairs at PHNWR has increased to 14 pairs in 2019. In 2016, no chicks were produced but since then productivity has ranged from 1.08–2.25 fledglings/pair. The historic average productivity for piping plovers nesting on Delaware Atlantic Coast beaches was lower (1.37 fledglings/pair, 1989–2015). We have recorded color-banded plovers that were marked and previously nested in New Jersey breeding at PHNWR suggesting secondary dispersal and movement between states. These trends observed in Delaware demonstrate the potential benefit of habitat creation for breeding plovers at the regional and population level.

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Habitat Assessment for Wintering American Black Ducks in the Chesapeake Bay Refuge System

American black duck (*Anas rubripes*) utilize marshes throughout the Chesapeake Bay and are considered an indicator species of the ecosystem's health. Thus, conserving and increasing black duck habitats will subsequently benefit the general health of the Bay. We used a bioenergetics model to determine the viable habitat types for wintering black ducks (where benefits outweigh costs during foraging) and modeled the influences of two stressors (sea-level rise and land use change) on these viable habitats. Captive black ducks exhibited a Type II functional response curves (intake rate exponentially increases with increases in prey density up to an asymptote) for *R. maritima*, *Z. palustris*, *G. holbrooki*, and *M. bidentatus* and a Type I functional response curve (linear relationship between intake rate and prey density) for *S. validus*. The critical foraging densities concluded in this study were 749 g/m² for *R. maritima*, 435 g/m² for *Z. palustris*, 26 g/m² or 91 fish/m² for *G. holbrooki*, and 1.4 g/m² or 24 snails/m² for *M. bidentatus*. *S. validus* did not have a critical density as a result of having a linear relationship between intake rate and prey density. Quality habitat types for wintering black ducks when they arrive in the Fall were: 1. submerged aquatic vegetation (SAV), 2. high marsh; 3. low marsh, 4. mudflat, and 5. freshwater. Eastern shore refuges (Marshlands Refuge Complex) are at risk more from sea-level rise than development pressure, whereas, Western shore refuges (Virginia Rivers Refuge Complex) are at risk from both sea-level rise and development pressures. Ultimately the management and recovery of SAV in the Bay is potentially beneficial for wintering black ducks as long it does not become unavailable due to disturbance caused by close proximity to developed lands. Therefore, strategically placed SAV and living shoreline restoration efforts could provide more viable habitat for wintering black ducks.

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Modeling multiple sources of nest failure for Least Terns in Southern Louisiana

Beach restoration and renourishment projects in southern Louisiana create new sparsely vegetated beach, thought to be attractive nesting habitat for Least Terns (*Sterna antillarum*). Our analyses suggest that these restoration projects improve nest survivorship during storms due to the increase in elevation, but how they affect predation is

largely unknown. In addition, the nesting season brings large storm events that may mask the effects of predation and bias predation estimates. In 2019, we began a trial of nest cameras on beaches in southwest Louisiana to help us more accurately determine nest fates. We compared nest data from 2018 (no cameras) and 2019 (cameras present), as well as comparing both to synthetic nest data to determine biases across multiple model types. Continued monitoring by Audubon Louisiana and graduate students will provide insight into how these trends in predation, washout, and nest survival evolve in the years following restoration.

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Breeding incidences of the Pink-backed Pelican in south eastern Africa: An update
[Pelicans of the World Symposium]

In 2008 trends in the breeding incidences of the Pink-backed Pelican (*Pelecanus rufescens*) in the north eastern part of KwaZulu-Natal, South Africa, was published covering the period 1933 to 2005. Subsequent breeding events have been monitored, documented and analysed to update the breeding status of this species in the region. Observations were made mainly by aerial surveys and occasionally by land-based counts. Results indicate a decrease in the number of nests at the Nsumo Pan breeding site in the Mkhuze Game Reserve and the concurrent increase at the Nyamithi Pan in the Ndumo Game Reserve. The Nsumo Pan decrease may be the result of prolonged droughts and increased African elephant (*Loxodonta africana*) damage causing nesting tree loss and concomitant loss of suitable nesting sites. Ongoing monitoring is necessary to determine whether these trends will persist at these two sites.

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Black Rail distribution in Maryland *[Black Rail Symposium]*

In Maryland, Black Rail (*Laterallus jamaicensis*) has undergone a 90 percent decline and is now mostly absent from its historic range. Although multiple intensive surveys were completed since 1990 in tidal wetlands throughout the Chesapeake Bay and coastal bay regions, the potential use of relatively small, inland nontidal wetlands was not quantitatively investigated. During the summer of 2019 we conducted surveys for Black Rail at 103 wetland sites in the coastal bays, eastern Chesapeake Bay, and Piedmont regions of Maryland with the primary objective of determining their current distribution. We focused much of our sampling effort on non-traditional habitats to account for previous survey biases. In the Piedmont, we targeted small sedge-dominated wetlands with similar water depth and vegetation height as traditional Black Rail tidal marsh sites. Other non-traditional sites included restored wetlands, waterfowl management impoundments, areas dominated by *Phragmites* and areas that have received thin-layer deposition. We also surveyed traditional tidal marsh habitats where Black Rail had been previously documented. Each site was surveyed 3 times in May-June 2019 using Acoustic Recording Units (ARUs) from 60 minutes before sunset to 60 minutes after sunrise. Our survey protocol included the broadcast of Black Rail and Virginia Rail calls at 9 periods throughout each survey night to increase detection rates. A second objective of this project was to determine the efficacy of ARUs and playback for use in Black Rail occupancy surveys in mid-Atlantic wetlands. We found Black Rails in traditional tidal marsh habitats on the Eastern Shore as well as in a 0.8 acre nontidal Piedmont wetland. These survey data show the value of searching novel habitats and locations in occupancy studies, and the success of using ARUs for secretive and nocturnal bird surveys. It also demonstrates that Black Rails may occur more regularly in relatively small nontidal Piedmont wetlands than had recently been documented in Maryland.

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Daily Flight Activity, Home Range and Utilization Distribution among Great Egrets (*Ardea alba*) **[Heron & Egret Symposium]**

Habitat size quantification and movement distances were investigated among seventeen Great Egrets (*Ardea alba*). Each was outfitted with a 48g Bird Solar tags (e-obs) from 2013 to 2018 and followed using Movebank.org to document their daily movement distances, and their roost, colony and foraging locations. Using the T-LoCoH package in R home range size (Minimum Convex Polygon; MCP) and the Utilization Distribution (UD95) size were estimated. The year was divided into breeding, post-breeding and wintering phases and a total of 5693 bird-days (15.6 years) were collected for 13 males, 3 females, and one bird of unknown sex. The Total Daily Distance (TDD), or cumulative distance traveled each day and Maximum Daily Distance (MDD), or longest straight-line distance between the central place and the farthest point that day, varied over the annual cycle. Significant differences ($p < 0.0001$, $F = 166.7$) in TDD existed between the breeding ($19.0 \text{ km} \pm 0.28 \text{ SE}$), post-breeding ($11.4 \text{ km} \pm 0.32$) and winter ($12.9 \text{ km} \pm 0.28$) seasons as did differences ($p < 0.0001$, $F = 22.6$) in MDD: $5.4 \text{ km} \pm 0.21$; breeding, $6.7 \text{ km} \pm 0.24$; post-breeding, $4.1 \text{ km} \pm 0.21$). Despite annual differences in activity, there was no significant difference in the amount of area used on the ground/water (UD) at the 95th isopleth ($p = 0.23$, $F = 1.52$): $1.3 \text{ km}^2 \pm 0.99 \text{ SE}$; breeding, $1.2 \text{ km}^2 \pm 1.00$; post-breeding, and $1.8 \text{ km}^2 \pm 1.5$; winter). Home range (MCP) size did not differ significantly between the breeding and post-breeding seasons ($629.9 \text{ km}^2 \pm 1798.7$ vs. $325.1 \text{ km}^2 \pm 401.8$) but was considerably larger in winter ($3651.5 \text{ km}^2 \pm 7069.0$) ($p = 0.01$, $F = 5.0$). Conservation implications are discussed.

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Population status of the Dalmatian Pelican (*Pelecanus crispus*) and of the Great White Pelican (*Pelecanus onocrotalus*) in the Romanian Lower Danube basin and the Danube Delta Biosphere Reserve **[Pelicans of the World Symposium]**

The entire breeding population of the two pelican species occurring in Romania is concentrated in the Danube Delta Biosphere Reserve (DDBR) and along the Black Sea coastal lagoon and lakes. While Great White Pelicans breed exclusively in the Danube Delta in one colony (that is also the vast majority of the European breeding population of the species), Dalmatian Pelicans have been known to breed in the past 20 years in 3 well-known, traditional colonies, and have sporadically used another 2 sites located in the DDBR. Additionally, since 2012, the Dalmatian pelicans have started breeding in 2 new colonies that are presented. Most of the breeding colony sites in the DDBR are completely isolated and extremely difficult to access. Based on aerial and land surveys during the last 13 years as part of a long-term monitoring programme aiming at filling in knowledge gaps regarding the breeding status of the 2 species, the current status of their population is described and compared to historical data and other surveys. Based on our results, the Dalmatian Pelican population is currently considered stable/slightly increasing, while there is an indication of an increase in the Great White Pelican population. Population data resulted from the implementation of the South-Eastern European International Pelican Census is also presented, and the prospects for future conservation while working to minimize potential conflict with the fisheries sector are discussed.

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Colony and nest site characteristics influence reproductive success in a threatened Caribbean seabird population

Determining the primary factors limiting population recovery is a critical component of conservation planning for threatened and endangered species. The threatened metapopulation of Caribbean Roseate Terns (*Sterna dougallii*) is declining across its range, with potential causes attributed to human disturbance, adult mortality on South American wintering grounds, changes to prey availability, and low reproductive success. Roseate Terns in the region have low site fidelity and exhibit high variation across colony sizes and nest site characteristics, and a better understanding of how these characteristics influence reproductive success could aid in recovery planning.

We evaluated Roseate Tern reproductive success in 2017–18 in the U.S. and British Virgin Islands to identify potential limiting factors and to investigate the influence of colony and nest site covariates on nest survival. Monitoring was conducted via motion-triggered cameras, which enable 24-hour monitoring on remote nesting islands with minimal disturbance to breeding birds. We monitored $n=119$ nests in 6 colonies over the two breeding seasons. Nest survival was defined as a chick surviving to its 4th post-hatch day. Influences of covariates on daily nest survival and predation risk were evaluated through generalized linear mixed effects modeling with a logistic link function that allows for the incorporation of exposure days. Mayfield daily nest survival was 0.96 ± 0.03 with a period survival of 0.34 ± 4.63 for the 28 days from laying to fledging. Nest survival varied across colony sites, but not between years. Predation was the most common cause of nest failure, with 39% of nests failing due to predation. Primary predators were invasive brown rats (*Rattus rattus*), Great Egrets (*Ardea alba*), and hermit crabs (*Coenobita chypeatus*). Daily nest survival increased with colony size and decreased with height of vegetation around nest. Daily predation risk increased with distance to nearest neighbor and was higher for concealed nests than for exposed nests. Our results indicate that reproductive failure is likely inhibiting Roseate Tern population recovery in the Virgin Islands and that predator control and colony site enhancement should be priority conservation actions in the region.

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Plastic Ingestion by Seabirds Nesting in the Gulf of Maine

Plastic debris is a pervasive and critical environmental challenge that is described as a world-wide crisis for marine life. Seabirds are sensitive to pollutants and are of critical conservation concern. Because seabirds are excellent bioindicators of marine ecosystem health, information about their plastic ingestion can serve as an indicator of plastic exposure across multiple marine trophic levels. Our study describes the prevalence of plastic ingestion for four seabird species: Herring Gulls (*Larus argentatus*), Great Black-backed Gulls (*L. marinus*), Common Terns (*Sterna hirundo*), and Roseate Terns (*S. dougallii*) nesting in the Gulf of Maine. Samples were collected opportunistically, including pellets, regurgitant, discarded fish, and deceased seabirds. Plastics were primarily found in pellet samples, and common types included fragments and sheets. Herring Gulls displayed significantly higher plastic exposure than the other three species across all metrics analyzed ($p\text{-value} < 0.01$ in all cases), with no significant differences observed amongst the other three species.

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Habitat selection and potential fitness consequences of two early-successional species with differing life-history strategies

Habitat selection and its relationship to resources is a fundamental concept in ecology. While the connection between species and their habitats is broadly accepted, the connections between habitat and overall fitness often are less well understood. Despite the difficulties in understanding such intricate relationships, it is imperative that we understand habitat selection and its relationship with fitness. We compared habitat selection of piping plovers and least terns on the Missouri River (2012–2014) to examine the consequences of those choices on nest and chick survival. We developed an integrated habitat selection model that assessed selection across multiple scales (sandbar and nest scales) and directly modeled the effect of selection on nest and chick survival. We hypothesized that plovers and terns would select habitat that minimized the chance of flooding and predation of both eggs and adults, but that plovers would also select habitat that would provide foraging habitat for their chicks. In general, they

selected habitat in keeping with our hypotheses, relative to unused sites. Sandbar selection had either a negative or no appreciable effect on nest survival for both species across years. Nest site selection in 2012 had a positive impact on nest survival and chick survival for both terns and plovers, and this trended toward a negative effect by 2014. This result suggested that early selection decisions were adaptive, but that relatively high site fidelity and habitat degradation led to reduced benefit over time. Our results highlight the complex nature of selection and its relationship to fitness.

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Status of knowledge about the population trends and conservation developments for the Dalmatian pelican *Pelecanus crispus* in the world [Pelicans of the World Symposium]

This is an overview of the world status of the Dalmatian pelican (*Pelecanus crispus*). The most recent estimate of its world population is at 7,347- 8,993 pairs, roughly corresponding to c. 27,000 individuals, representing a more than double increase from previous estimate in the '90s. This led to a downscale of the species in the IUCN Red List global status from "Vulnerable" to "Near Threatened". The Dalmatian pelican populations of the world fall within three flyways: the Black Sea – Mediterranean flyway which includes the short-distance migrating populations of SE Europe; the W and C Asia flyway encompassing the purely long-distance migratory populations breeding mainly in Russia and Kazakhstan and overwintering mainly in Iran, Pakistan and India; and the East Asia flyway, which breed in Mongolia and overwinter in China. The Black Sea-Mediterranean flyway populations are monitored adequately and they increase due, amidst others, to conservation measures. To our knowledge the W and C Asia populations, which represent 50-80% of the global numbers, are not monitored sufficiently well but they also seem to increase, albeit with less certainty. The Mongolian populations have shrunk dangerously but causes of decrease which probably started in the '90s are not yet understood. Less knowledge of the W and C Asian flyway can just be an artefact of limited information flow due to language barriers between Russian and English literature. Lack of a coordination body which would collect and compile available info is however important. The migration routes in the C and W Asian flyway are not yet known and need to be studied with the use of transmitters. There is already evidence that the migration phenology has been affected by climate change in Iran as well as that there is a northerly expansion of the species in Siberia also attributed to climate change. Status of the species in Afghanistan and Iraq forms a black hole. Not clear answers exist on possible mixing of populations at the edges of geographical ranges of flyways. Also, mixing or non-mixing of populations in the wintering grounds remains uncertain.

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Managing beaches for migrating and wintering shorebirds: A South Carolina case study

Many species of shorebirds require healthy beach habitats with low disturbance to support all or part of their life cycle. Most of these species are in decline and some, such as the piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*), are listed as threatened under the Endangered Species Act. Shorebirds require certain physical and biological features associated with beach habitats that need to be taken into consideration throughout the entire year encompassing migratory and winter seasons in addition to the breeding season. These considerations need to be integrated into local beach management. Two management practices that can go a long way to minimize disturbance on developed beaches are not allowing dogs in important shorebird areas and posting roosting areas during the nonbreeding season. We outline specific examples from Hilton Head Island and Seabrook Island in South Carolina that have incorporated these practices into their local beach management. The evolution of these beach management practices has taken a combination of regulatory requirements, long term partnerships, monitoring, data sharing, and time. Shorebird survival impacts associated with disturbance (Gibson *et al.* 2018) and year-round recreational use of local beaches in South Carolina warrant year-round beach management. We highlight the lessons learned and evolution of these beach management practices in support of shorebird conservation and suggest that year-round management, not just breeding season management, is necessary on disturbed beaches where shorebirds are present year-round.

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The Role of the “Kenya Lake System” in the conservation of the Great White Pelican (*Pelecanus onocrotalus*)

[Pelicans of the World Symposium]

The Kenya Lake System was inscribed as a World Heritage Site by UNESCO on June 2011. The three lakes consist of Lake Bogoria, Lake Nakuru and Lake Elmenteita that are located within the East African Rift System along with Lake Naivasha. The lakes are recognized as Wetlands of International Importance as well as Important Bird Areas (IBA) by the Ramsar Convention and Birdlife International, respectively. These lakes are known for their high numbers of migratory and residential birds that are listed as vulnerable, endangered and species of least concern by the IUCN. These lakes, together with their riparian land, support over 500 million birds and over 70 species of mammals. The Great White Pelican (GWP) is known to feed in large numbers in Lake Nakuru and Lake Naivasha but breed in the only known breeding site in East Africa Rift Valley: Lake Elmenteita. The three lakes hold over ten thousand individuals annually on average. In 2009, over seventy thousand individuals were recorded in Lake Nakuru while Lake Naivasha had over 3,000 individuals in the same year (National Museums of Kenya). The population of these globally threatened birds fluctuates depending on food availability and water levels. Over eight thousand breeding pairs of Great White Pelican have been observed in Lake Elmenteita. Satellite tracking has shown overwintering of the GWP from the European region into the East African Lakes. Despite their capacity to support a huge diversity of flora, fauna and avian life, these lakes are faced by a number of challenges. No comprehensive strategy for conservation of the Great White Pelican has been developed as few studies have been conducted on this species. Siltation, pollution and uncontrolled developments at the sites have contributed to the destruction of the natural habitat. The high water levels experienced in 2013 submerged the breeding islands and changed the lakes' ecology. New research is required in order to develop with clear management strategies for conserving the species and enhancing the long-term management of these sites.

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Within-season variation in the shape and conductance of American white pelican eggs *[Pelicans of the World Symposium]*

I investigated the relationship between laying date and the characteristics associated with gas exchange in American white pelican (*Pelecanus erythrorhynchos*) eggs. Ninety-two eggs were collected (within 24 hours of laying) from 92 American white pelican nests located at Marsh Lake in Southwestern Minnesota, United States during the 2012 and 2015 breeding seasons. I measured size (mass, length and breadth), volume, surface area, conductance, shell thickness and porosity of the eggs in the lab. Size and volume of the eggs did not vary with laying date. However, surface area ($r^2 = 0.32$, $F_{1,62} = 28.9$, $p < 0.001$) and surface area:volume ($r^2 = 0.16$, $F_{1,62} = 11.8$, $p = 0.001$) increased with laying date. In addition, conductance (mg H₂O lost per day per torr) also increased with laying date ($r^2 = 0.15$, $F_{1,90} = 16.0$, $p < 0.001$). However, neither shell thickness nor porosity were related to laying date. The shape of American white pelican eggs changes across the season such that surface area relative to volume increases, and the increase in surface area to volume ratio facilitates greater conductance. This may be a mechanism by which offspring from eggs laid later in the season develop more quickly.

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PiperEx: A Decision Support Tool for Exclosures for Piping Plovers

Predator exclosures have been an important tool in the recovery of several threatened species, including beach-nesting birds. These wire cages can greatly increase the survival rate of nests. However, they are known to increase the risk of mortality for adult birds, as predators can use the exclosures to key in adults as they exit the structure. For Atlantic Coast Piping Plovers (*Charadrius melodus*), a federally-threatened species, it has long been known that

nests that are exclosed are abandoned at a higher rate than those that are not; in the last decade, evidence has mounted that such abandonment is a sign of mortality of one or both parents. Given the role exclosures have played in recovery of the Piping Plover, a new assessment was needed to determine the implications for exclosure use of the demographic tradeoff between nest protection and adult mortality. We developed a decision support tool called PiperEx, now freely available online, that combines 1) a statistical nest fate model that accepts nest monitoring data, 2) a population projection model that allows users to change some demographic parameters, and 3) decision support criteria including loss factors and a value of information statistic. The tool is designed to help individual site managers determine whether the use of exclosures is beneficial for population growth of Piping Plovers. In our initial assessment, we determined that site and year variation in nest predation is great enough to preclude the predictive ability of PiperEx when it is given only one year of nest monitoring data from a site. However, combining several years of data does adequately capture the tendency of a site and can provide reliable guidance. Moreover, the use of data from the first part of a breeding season can usually predict the best decision for the entire breeding season. Thus, PiperEx should aid in evidence-based decision making for this critical conservation measure.

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Proximity to nests of potential predators impacts nest site selection of imperiled tidal marsh sparrows

Nesting habitat selection of highly specialized species may be impacted by interspecies interactions within the landscape. When availability of high-quality habitat is limited, nest site selection and nest building characteristics may be influenced by interspecies competition. In tidal saltmarshes, the highest quality nesting habitat often is in the highest elevation portions of marsh, where tidal flooding is less frequent. We discovered a population of imperiled Saltmarsh Sparrows (*Ammodramus caudatus*) and Seaside Sparrows (*Ammodramus maritima*), both tidal marsh obligates, nesting within a colony of Herring Gulls (*Larus argentatus*) and Great Black-backed Gulls (*Larus marinus*) on a small island in New York. Gulls are potential predators of sparrow eggs, chicks, and adults and finding both predator and prey species nesting so close together was unexpected. We hypothesized that sparrows nested within the colony because it contained the highest quality high elevation habitat. Also, that sparrow nest site selection would reflect this risk of predation, by altered nest structure and/or nest sites selected with certain characteristics to avoid predation. Alternatively, sparrows may obtain an anti-predation benefit from nesting amongst these more aggressive colonial species. We modeled sparrow nest characteristics and vegetation structure at nest sites as a function of distance from the gull colony center, by comparing characteristics at nests and random points along a distance gradient. The probability of nest site selection by Saltmarsh Sparrows was significantly positively correlated with vegetation height near the center of the gull colony, but this relationship weakened for nests far from the colony. This relationship was evident but not conclusive for Seaside Sparrows. Nest height and percent woven canopy did not significantly change with respect to the center of the colony as could have been expected, if sparrows were attempting to hide their nests from nearby gulls. Therefore, it may be that sparrow nest height and architecture depends on flooding risk, and sparrows instead conceal their nests by placing them in areas with tall vegetation when in close proximity predators. Understanding interactions of tidal marsh sparrows with other saltmarsh species, specifically predators, can be useful when planning conservation efforts for a species of conservation concern.

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Evaluating seasonal, age-based, and interspecific variation in the diet and foraging behavior of Common and Roseate terns breeding on the Isles of Shoals, NH.

The Gulf of Maine is one of the fastest warming marine habitats on earth, causing shifts in the abundance and distribution of many marine species in the region. Breeding seabirds constantly sample the marine environment surrounding their colonies and therefore their foraging locations and diets can provide information about changes to the ecosystem. However, seabird diets can be difficult to monitor. In 2017 and 2018, we employed a fecal DNA method to monitor Common Tern (*Sterna hirundo*) and Roseate Tern (*S. dougallii*) diets at a mixed breeding colony in the Gulf of Maine. Adult Common Terns defecate upon intruders as a defense mechanism, allowing for the

collection of feces during the course of normal colony monitoring efforts. We also collected fecal samples from chicks of both species during banding activities. We then used metabarcoding to identify prey items from the DNA contained in the fecal samples. We used a hierarchical approach, employing universal eukaryotic primers to determine the breadth of the diet and fish-specific primers to identify fish prey items with higher resolution. We evaluated these results relative to breeding stage (incubating vs. chick-rearing), age class (hatch year vs. adult), species, and year, and compared our findings with chick-provisioning observations, stable isotope analysis of feather tissue, and GPS tracking data to provide an integrated understanding of resource use by terns in this system.

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Situation of the Peruvian pelican (*Pelecanus thagus*), with emphasis on its austral distribution [Pelicans of the World Symposium]

The Peruvian Pelican (*Pelecanus thagus*) is an endemic seabird of the Humboldt Current System in South America, inhabiting the Pacific coast from the south of Ecuador, Peru to the south of Chile. In Peru it is classified as an Endangered species, while globally it is considered Near Threatened. Although more than 50% of the habitat used by the Peruvian Pelican occurs on the coast of Chile, its population trends and conservation status remain unknown in this country. Since 2013, the Laboratory of Ecology of the University of Los Lagos studies the abundance and nesting of Peruvian Pelican in Chile. Developing field work, database analysis, perception of ornithologists, and niche modeling. The results obtained indicate that: (1) between the years 2010 and 2015 the abundance of Peruvian Pelican in Chile decreased significantly in the central zone of the country, (2) there is seasonality in its presence, with greater abundances during the winter season, (3) the perception of local ornithologists indicated a population increase towards the south of the country, (4) potential competitive interactions between the Peruvian Pelican and endemic seabirds of Patagonia (*Phalacrocorax atriceps*) were evident, (5) along the Chilean coast, 24 nesting sites of the Peruvian Pelican have been described, of which 29.1% are located inside of protected areas, (6) the mean daytime temperature range and marine primary productivity explain the current potential distribution and breeding of the Peruvian Pelican, (7) under the future climate change scenarios, the spatial distribution of the Peruvian Pelican is predicted to slightly change. While, the breeding distribution of the Peruvian Pelican can be benefited in the moderate scenario (2.6 rcp), but is predicted to decrease (near -20 %) in the severe scenario (8.5 rcp), (8) we predict that the coasts of southern Chile will constitute an important refuge for the conservation of the Peruvian Pelican under future climate change scenarios, and (9) in Chile, the Peruvian Pelican must be classified at least as a Near Threatened species.

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Seasonal home range and habitat use of Maine-nesting Great Blue Herons [Heron & Egret Symposium]

The Great Blue Heron (*Ardea herodias*, GBHE) is listed in Maine, USA as a state species of special concern due to a decline in nesting pairs along the coast. As part of a larger program to investigate the decline and whether it is also occurring statewide, we implemented a project that examines movement and habitat use among GBHEs. Advances in GPS technology and analytics provide detailed summaries of home range size, and the use of space and habitat. We tagged five adult GBHEs in June 2016, with Bird Solar Units (e-obs, Germany) that have since collected GPS data for up to three years. All tagged individuals nested in Maine in spring and summer, migrated south in the fall, and wintered in Florida, Cuba, The Bahamas, or Haiti. We used the T-LoCoH package in R to calculate utilization distributions and home range sizes across individuals and seasons to identify patterns and variation in habitat use. Utilization distributions using the 95% isopleth were 3.26 km² (n = 11, SD ± 2.67 km²) during nesting, 1.06 km² (n=11, SD±0.84 km²) during post-breeding, and 1.31 km² (n=9, SD±2.05 km², range: 0.025-6.32 km²) during winter. Minimum convex polygons were also calculated, and were much larger as expected: 74.03 km² (n=11, SD±40.12 km²) during nesting, 33.70 km² (n=11, SD±37.12 km², range: 0.025-6.32 km²) during post-breeding, and 25.30 km² (n=9, SD±18.18 km²) in winter. This analysis reveals a great amount of variability among individuals and across seasons and years. We will discuss patterns observed, potential reasons for

variability, and implications for habitat management. We will also compare these findings to similar data for non-migratory GBHEs in North Carolina, USA.

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Wrap-up session for the Symposium on Great Blue Herons and Great Egrets [[Heron & Egret Symposium](#)]

This will be a question and answer-type panel discussion based on the talks that were given by the authors. It will also be an opportunity to discuss the biology/conservation of other "Least Concern" Ardeids.

[24] de Lima Silva, Flávio José^{1,2}, Gavilan, Simone Almeida^{1,2,3}, de Farias, Daniel Solon Dias^{1,2}, Bomfim, Aline da Costa^{1,2}, Lima, Stella Almeida^{1,2}, da Silveira, Deborah Cristina Batista¹, Lima, Pedro Cerqueira⁴, Gomes, Camila Garcia⁵, de Sousa, Elivan Arantes⁵, Helen Hays⁶, **Walsh, Joan⁷**.

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Full Life Cycle Conservation of Roseate Tern and Common Tern: Preliminary estimates of mortality and injury due to collisions with electrical transmission lines in coastal Brazil

Roseate Tern (*Sterna dougalli*) is a US federally endangered, conservation-dependent seabird. Efforts to recover this species on the breeding grounds involve nest box construction, predator control, and vegetation control. Conservation efforts to reduce hunting pressure on the wintering grounds have met with some success, but there is an emerging threat to the sustained growth of this population - collisions with power transmission lines on the north coast of Brazil. We will report the preliminary results of a multi-year, government-mandated beach monitoring program in Galinhos, Brazil. This documents annual and seasonal injury and mortality, with more than 220 individual Roseate and Common Terns (*Sterna hirundo*) killed, with injuries consistent with colliding at night with low visibility power transmission lines. The number of terns killed may be much higher due a rapid scavenging rate of carcasses which often leaves only partial specimens for recovery. Band recoveries from the injured and dead terns allow linkages to breeding sites in North America, and to additional wintering sites in Brazil. This work reveals a new source of mortality for Roseate Tern and Common Tern, as well as other beach-roosting seabirds, on the wintering grounds. We propose several potential hypotheses for the recent increase in the number of birds recovered, including the development of a nearby land-based wind farms, as well as some potential solutions for reducing or eliminating this threat.

[25] DeRose-Wilson, Audrey L.¹, Clark, Jacquie A.², Clark, Nigel A.², Carter, David³, **Bellman, Henrietta A.¹**

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All our eggs in one basket: The importance of Mispillion Harbor, Delaware, for migratory birds

Thousands of migrating shorebirds stopover along the Atlantic Coast during the journey to and from breeding grounds in the Arctic and sub-arctic. Over the past two decades, extensive monitoring has confirmed the disproportionally high habitat value of Mispillion Harbor to migratory shorebirds using the Delaware Bay stopover. We chronicled the history of Mispillion Harbor's emergence as critical habitat, documented its vital importance to several shorebird species in the Western Hemisphere, and considered how habitat management of the site may

provide insights for management along the Delaware Bay coast. We summarized shorebird population data documenting the harbor's hemispheric habitat value in the context of shorebird and horseshoe crab population declines as well as coast wide habitat changes using mark-resight and GIS methods. Finally, we considered the long-term viability of the Mispillion site, the ongoing need for species monitoring to guide its sustainable management, the risks associated with shorebird overdependence on one site located in a coastal storm high hazard zone, and broader habitat development along the Delaware Bay coast. Protection of Mispillion Harbor is critical to several hemispheric populations of shorebirds. However, undertaking efforts to create additional high-quality sites is advised to mitigate the risks of dependence on a single site. The creation of additional high-quality sites may be a prerequisite to support future increases in shorebird populations should ongoing shorebird conservation efforts successfully result in population recovery. It may also be an indispensable tool for adaptation to habitat changes associated with sea level rise.

[26] Elbin, Susan B.¹, Parkins, Kaitlyn L.¹ and Tobón, Emilio¹

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Urban Gulls: Introduction to the symposium and a case study from New York City [*Urban Gull Symposium*]

This symposium focuses on the science and management of urban-dwelling gulls. Gulls are not new to the urban landscape. During the 20th century, gull populations in North America and in Europe experienced considerable changes in abundance, geographic range, and habitat use. Although it may appear these city birds are everywhere and increasing, survey numbers often prove otherwise. Presenters will examine issues specific to the ecology of gulls in urban landscapes: nesting, dispersal, foraging ecology. Methods for monitoring urban gulls, including roof-nesting colonies, approaches to human-gull conflicts, and the incidence of heavy metal contaminants will be discussed. In New York City, New York, NYC Audubon has been documenting Herring and Great Black-backed Gull (*L. marinus*) populations breeding on islands in the New York Harbor for the past 35 years. In this paper we focus on Herring Gulls because they occurred at significantly higher numbers than Great Black-backed Gulls (high count 2,516 pairs and 792 pairs, respectively). The number of Herring Gulls nesting pairs fluctuated over time. The high count was in 1990. Nesting declined through 2006, but experienced an uptick in 2007, with 2,486 breeding pairs. By 2016, the number of pairs nesting on the islands was 199. Although the species is declining in the region, Christmas Bird Count data did not corroborate a dramatic decline in Herring Gulls. We suggest gulls may be undercounted in our surveys because they are moving to rooftop and establishing colonies there.

[27] Elizondo, Elisa C.^{*1} and Shriver, W.G.¹

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Clapper Rail (*Rallus crepitans*) breeding season movements in Delaware, USA

The Clapper Rail (*Rallus crepitans*) is a secretive saltmarsh bird which occurs across the east coast of the United States. The logistical difficulties of saltmarsh research coupled with the secretive nature of rails has resulted in few data on their populations aside from auditory monitoring. Auditory surveys in the northeastern United States conducted by the Saltmarsh Habitat Avian Research Program indicate that Clapper Rail populations are declining, but managers have virtually no data on contemporary vital rates and habitat use. In an effort to study Clapper Rail home range sizes, adult breeding season survival, and productivity we deployed several tag types in Delaware, USA. We deployed 4 VHF tags in 2019, and in 2019, we deployed 5 Argos enabled GPS tags that remotely transmit GPS locations and 8 downloadable GPS tags across three sites along Delaware Bay. The preliminary 2019 Clapper Rail home ranges are on average 1.89 ha (n = 13, sd = 2.02) and we hope to continue receiving data transmissions from the Argos satellites into the migration and wintering periods. To date, the most productive Argos satellite tag has provided 655 locations across 3 months, but the transmission intervals can vary dramatically as the tags are solar powered. At the time this abstract was written, the Clapper Rails were undergoing molting prior to departing the state, and we will compare early to late season home range sizes and movements where possible. Moving forward, additional data from radiomarked rails will be collected to continue to gain better insight on Clapper Rail breeding season movements and survival as well as their migratory ecology.

[28] Ellis, Hugh I.¹, Gabrielsen, Geir Wing²

Basal metabolic rate of Arctic Terns: confirmation of a latitudinal gradient

We measured basal metabolic rate (BMR) in 18 Arctic Terns (*Sterna paradisaea*) with an average mass of 101.4 g in Ny-Ålesund, Svalbard (latitude 78.92 °N). BMR was 2.77 ± 0.33 (s.d.) mL O₂·g⁻¹·h⁻¹, with no differences based on sex ($P = 0.50$). In 1984, Ellis demonstrated a latitudinal gradient in BMR of Charadriiform seabirds. Using an allometric equation of Lasiewski and Dawson (1967) as a 100% baseline, high latitude seabirds had BMRs approaching two times baseline, i.e., 200% of that expected for their mass. In 1994, Klaassen measured BMR in Arctic Terns in the Netherlands (latitude 53.23 °N). He found BMR to be 2.19 mL O₂·g⁻¹·h⁻¹, which is 173.8% of baseline if their mass was the same as birds we measured in Svalbard. Ellis (1984) had predicted a BMR of 159.8% at that latitude. Our terns in Ny Ålesund were 219.5% of baseline, close to the 211.7% predicted by Ellis (1984) for such high latitudes. This confirms Ellis' interspecific latitudinal gradient for this group of seabirds and additionally suggests an intraspecific latitudinal BMR gradient for Arctic Terns. We recently (Ellis and Gabrielsen 2019) noted that most polar birds do not show a circadian rhythm in metabolic rate during the breeding season because they are active throughout the 24 h daylight period. However, when we regressed BMR against time of measurement, we found a small effect: $\text{BMR} = 3.75 - 0.057 \text{ time}$ ($R^2 = 0.228$, $P = 0.052$). This is not the same as discontinuous α (active) and ρ (resting) states, but is nonetheless interesting.

[29] Essian, David A.*¹ and Dale E. Gawlik^{1,2}

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Species' traits influence population-level, but not nest-level responses to prey availability

Wading birds are iconic wetland species that are used as indicators for wetland monitoring programs worldwide. One challenge of using wading birds as indicators is that they exhibit species-specific responses to environmental variation, and thus management actions that benefit one species may have a negative effect, or no effect, on another. For instance, the Snowy Egret (*Egretta thula*) has a shorter nesting period than the Great Egret (*Ardea alba*) and can therefore synchronize nesting with peak resource availability. In contrast, the Great Egret has a wider dietary niche and larger foraging range and can therefore exploit different types of prey farther from the nest. To assess differences in species responses to environmental drivers at Lake Okeechobee, FL, we examined the effects of water levels, prey availability, and habitat availability on nest abundance and nest survival of the Great Egret and Snowy Egret using data collected between 1977 and 2019. Based on their divergent foraging strategies described earlier, we predicted the Snowy Egret would be more influenced by prey, and the Great Egret would be more influenced by habitat availability. We found that Snowy Egret nest abundance increased with prey availability and Great Egret nest abundance increased with habitat availability. However, prey availability was the most important predictor of nest survival for both species. Our results corroborate previous studies in the Everglades that show the effect of environmental drivers on productivity vary by species. Specifically, species that synchronize nesting activity with food pulses are more strongly influenced by prey availability, at least at the population level. However, the importance of prey availability for nest survival of both species suggests that traits like wide dietary niche and large foraging range do not necessarily dampen the effect of prey availability on individual fitness. Since prey density and habitat availability are negatively correlated, hydrological scenarios that promote prey availability in some years and habitat availability in others will benefit both species over the long-term. This can be achieved by allowing water levels to fluctuate among years, which is a strategy conducive to dealing with inter-annual variation in rainfall that is common in subtropical wetlands.

[30] Evans, Jacquelyn D.*¹, Gawlik, Dale E.¹

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Effects of highly variable foraging conditions on the physical condition and survival of small heron nestlings in a managed, shallow lake system

Changes in water levels can significantly influence the timing and availability of resources to some consumers in wetland habitats. In subtropical Florida, water level reduction during the dry season concentrates aquatic fauna,

producing seasonal food pulses that are vital to wading bird reproduction. Conversely, a sudden rise in water levels during the dry season (a reversal) leads to the dispersal of prey. Wading birds respond to these changes in foraging conditions by altering nesting activity, foraging behavior, and parental care which in turn affect the fitness and survival of their nestlings. However, the effects of hydrological conditions on species-specific reproductive success of wading birds is poorly understood. During the breeding seasons of 2018 and 2019 we determined the provisioning rates, body condition, and survival of Snowy Egret (*Egretta thula*) and Tricolored Heron (*Egretta tricolor*) nestlings across a resource availability gradient on Lake Okeechobee, Florida. We sampled during three hydrologically distinct periods: 1) hydrologically average with a strong recession (“moderate-receding”; Mar – mid-May 2018), 2) hydrologically average with rising water (“moderate-rising”; mid-May – June 2018), and 3) hydrologically dryer-than average (“dry-receding”; Mar – May 2019). We found that the moderate-receding period was characterized by moderate prey densities and foraging habitat availability (FHA), the moderate-rising period by low prey densities and high FHA, and the dry-receding period by moderate prey densities and low FHA. A nestling body condition index (BCI) based on standardized morphometric measurements taken from 316 nestlings (where 0 represents a nestling that is the predicted mass for its body size) revealed that Snowy Egret nestlings had the lowest mean body condition during the moderate-rising period (- 4.71), while Tricolored Heron nestling mean BCI was lowest in the dry-receding period (-4.10). Both species experienced high BCIs (Snowy Egret: 9.84, Tricolored Heron: 4.57) and nestling survival during the moderate-receding period. These results confirm the influence that hydrological conditions have on wading bird nesting success, but further suggest that the reproductive success of closely related species are affected by different environmental variables. The results of this research will make it possible for resource managers to consider species-specific ecological demands in human-dominated, subtropical environments.

[31] Ferguson, Treena L.¹, D. Tommy King²

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Captive rearing and morphology of American White Pelican chicks [Pelicans of the World Symposium]

As American White Pelicans (*Pelecanus erythrorhynchos*) continue to lose habitat, in addition to having high mortality rate prior to fledging (King 2005, Knopf 1976), it is important to consider future management of this species by further detailing information about growth, caregiving and behavior. Since limited information exists on American White Pelicans from hatching to fledging, a captive trial (n = 16) examining energetics, nutrition, immunology, disease and overall growth was conducted from 29 May 2019 to 30 July 2012. Specific data such as morphometric development and behavior of chicks during hand rearing are important for creating a guideline to aid in captive rearing of future American White Pelicans. Observational notes made on behavior include things such as behavior before, during and after feeding. Morphological changes such as dropping of egg tooth, feather development and changes of eye colors were also noted. During the trial a few abnormalities were also observed, such as skin peeling around day 4-6 of the trial and splayed legs around day 10. We compiled these data into a growth timeline. Photographs of each pelican chick (n = 16) were taken of the body, head, shoulders and feather development every three days to enhance the written timeline. The combination of both written and photographic timelines will best serve as a guideline for captive rearing of American White Pelican chicks. Both timelines may also be useful for aging wild American White Pelican chicks in a field setting. Accumulating knowledge on American White Pelican growth will enhance conservation and management of the species.

[32] Goodenough, Katharine S.^{1,2}, Tara Schneider-Moran³, Rob Longiaru³

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The true snowbirds of the Northeast: Black Skimmer migration along the Atlantic Flyway

The Black Skimmer (*Rynchops niger*) is an iconic waterbird species that is distributed across the Americas. Along the Atlantic Coast of North America, the Black Skimmer breeding distribution ranges from Massachusetts south to Florida. Colonial waterbird surveys over the last 30 years suggest the Atlantic breeding populations are experiencing

declines in size attributed to both breeding and foraging habitat loss. In New York, a decline in the overall skimmer breeding population and number of colonies that was documented starting in the early 1990s has led to the existence of only two large breeding colonies on Long Island, at Rockaway and at Nickerson Beach that are separated by less than 20 miles. In 2018, we implemented a long-term movement and foraging ecology project to better understand Black Skimmer fine-scale and range-wide movements, foraging ecology, and the annual lifecycle of the New York breeding population. We deployed 25 GPS trackers on adults breeding at the Nickerson Beach colony. Of the 25 tracked skimmers, 16 skimmers returned to Nickerson Beach the following breeding season (2019) providing information on migration and over-wintering locations for tracked individuals. This is the first project to track the Black Skimmer using GPS technology and reveal wide-scale migration movements of the Black Skimmer along the Atlantic Coast. Fall migration was slower than spring migration occurring from August through early October. Skimmers began staging for spring migration starting in February and initiated migration in April arriving to New York the second week of May. Florida and Cuba have been identified as wintering locations for the New York skimmers. All tracked birds migrated to Florida and either spent the entire winter within Florida or departed for Cuba after spending 2-3 months in central and southern Florida (18%). Maximum migratory distance was 1,986km. An important finding of this research is the identification of stop-over locations along the Atlantic Flyway that appear to have great importance for migratory Black Skimmers. There is a critical need for collaboration and research that encompasses the entire range of the Black Skimmer so we can manage and protect areas important for migration along the Atlantic Flyway.

[33] Gownaris, Natasha J.¹, Boersma, P. Dee²

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Causes and Consequences of Skewed Sex Ratios in Magellanic Penguins

In many bird species, demographic rates are sex specific and adult sex ratios are male biased. Sex ratios are rarely tracked in seabirds because these species are difficult to sex visually. We used a detailed, long-term study of Magellanic penguins at Punta Tombo, Argentina to examine the causes and consequences of increasingly male-biased sex ratio at this declining colony. Using mark-recapture data for ~44,000 banded chicks, we found that the non-breeding-season survival of females was lower than that of males and that the magnitude of this bias was highest for juveniles (33% lower juvenile survival). Female-biased mortality of juveniles made the greatest contribution to the population decline and increasingly male-biased sex ratio at the colony from 1990-2009. We used nest check data from 2017 to examine whether female-biased mortality was related to sex-specific chick growth and fledging conditions. In 2017, hatching and fledging sex ratios were female-biased and two-female broods were significantly more common than two-male broods. Male chicks had faster maximum growth rates than female chicks and fledged at a larger size, but female chicks fledged in better body condition. To better understand the magnitude of the sex ratio bias and its impact on the population, we examined trends in the colony's operational sex ratio and how they related to male breeding behavior. We used data from annual colony-wide surveys to show that the sex ratio at the colony became increasingly male biased since 1983, with nearly three males for every female present in recent years. In years with more male-biased operational sex ratio, males are less likely to breed and more likely to engage in fights. We also showed that ignoring the increasingly male-biased sex ratio at this colony would result in overestimation of effective population size. Our study adds to growing evidence that knowledge of sex-specific demography and sex ratios are necessary for accurate assessment of seabird population trends.

[34] Gray, Carrie. E.¹, Brian. J. Olsen¹

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Individual variation in movements associated with seasonal home range and migration behaviors among Red-throated Loons tracked with satellite transmitters in eastern North America, 2012 -2016

Long-distance migrants may spend much of their annual cycle traveling thousands of kilometers between summer breeding and winter ranges. Stopovers play an important ecological role during the migration period, allowing animals to rest and renew energy stores, which is essential for large migrants with high fuel demands for flapping flight. Overall migration speed and progression is largely influenced by the frequency of stopover use and the duration of stay along the migratory route. The identification of important stopover locations and their timing of use,

along with the characterization of migration routes, is therefore a necessary task that provides a basis for prioritizing habitats and landscapes for species-specific conservation and management initiatives. We applied first-passage time (FPT) analysis within the vicinity of each location along the movement path of satellite-tagged Red-throated Loons (*Gavia stellata*) in order to identify seasonal ranges and migration routes of the species' mid-Atlantic wintering population. Partitioning methods based on residence time were then used to segment the migration path into homogenous bouts of activity to discriminate areas associated with stopover behavior from those correlated with faster, more directed movements. We also examined the number of revisits to locations to identify frequently visited sites within the winter range, which were assumed to be associated with highly profitable foraging locations. Our results indicated a high degree of variation in movement behavior among the individuals ($N = 40$) in our analysis. Monthly, annual, and seasonal (fall vs. spring migration) differences in movement behavior were also detected but contributed less overall variation compared to differences among individuals, even those that overlapped in space and time. Our study distinguishes key habitats for Red-throated Loons based on their intensity of use among the population and provides information on their timing of use. Furthermore, our findings provide insight into how individual variability and flexibility in migration strategy can be used to understand population-level patterns of seasonal movements.

[35] Green, M. Clay¹, Haverland, Amanda A.¹, and Floyd W. Weckerly¹.

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Species distribution models and habitat associations of the Black Rail in Texas [\[Black Rail Symposium\]](#)

The black rail (*Laterallus jamaicensis*) is a small and secretive marsh bird that inhabits coastal high marshes and freshwater wetlands throughout the Americas. In Texas, winter migrant and breeding populations of the eastern black rail (*L. j. jamaicensis*) are known to occur in disjunct wetlands along the Gulf Coast. During the four-year period 2015 to 2018, we studied the spatial ecology and habitat requirements of black rails in marshes of the Texas Gulf Coast. Through the application of occupancy models, radio telemetry, capture-recapture studies, and a geographic information system, we evaluated factors that influence the distribution of black rails in coastal Texas. Using occupancy data, we developed a species distribution model for the black rail in coastal Texas to identify important areas for the bird. We found positive associations between black rail occurrence and average annual precipitation as well as herbaceous vegetation density. High-marsh habitats with minimal tidal influence containing >50% herbaceous vegetative cover, especially gulf cordgrass (*Spartina spartinae*), had the highest predicted occupancy probabilities. Mapped predictions of black rail occupancy indicated only a small percentage of the study area (5.4%) had an occupancy rate >40%. Using radio telemetry, we tracked individual black rails during winter to estimate home range size and examine habitat associations. Home range size of wintering black rails in Texas was somewhat smaller than estimates of those during breeding in Florida, which represents the only other published home range study for the subspecies. Habitat trends within black rail home ranges were similar to occupancy model findings. Black rails selected high-marsh habitats with vegetation types that included large amounts of gulf cordgrass such as salty prairie and avoided the salt and brackish low tidal marsh. Understanding habitat use in relation to occupancy is critical for managing black rails in coastal areas, especially due to increasing threat of sea level rise and potential loss of habitat.

[36] Greenhaw, Moriah*¹, Jeffrey N. Costa², David J. Moore², James Quinn¹ and Olivia M.C. Trudeau^{2,3}

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Movement patterns and habitat use of urban-nesting Ring-billed Gulls during incubation [\[Urban Gull Symposium\]](#)

Over the past decade, there has been a marked increase in the number of Ring-billed Gulls (*Larus delawarensis*) nesting in urban areas in Ontario. In order to understand this distribution shift and the resulting potential for human-gull conflicts, we conducted a study on movement and habitat use by gulls at an urban colony site in Hamilton, Ontario. One randomly-selected adult at each study nest was captured midway through incubating a 3-egg clutch (7-14 May) and received a stainless steel and a field-readable plastic leg band, and a backpack harness and global positioning system (GPS) pinpoint tag (PTT) was fastened to each bird. (Lotek PinPoint GPS 240, n=10; Lotek PinPoint GPS VHF, n=7, Ornitela OrniTrack-10, n=14). A sample of blood was collected from each study bird for

molecular sexing (17 females, 14 males). GPS positions were collected at 10-minute intervals during daylight until civil twilight when intervals were increased to 60 minutes. Tracking data were logged during incubation for an average of 7 days (± 2 sd; range = 3-10 d). Movement data were filtered using an accelerometer function, or times between GPS fixes, to eliminate positions during flight of the subject bird. Land cover was classified using the Commission for Environment Cooperation (CEC) Land Cover GIS layer (spatial resolution = 30m) with landfill layers provided by the Ministry of Conservation and Parks (MECP). Study birds routinely ranged 20-30 km and up to 55 km from the colony during foraging trips. Movement and land use patterns varied greatly among individuals. Overall, birds used mainly habitats in Lake Ontario (median = 48%, range = 0.5-100%), and also exhibited moderate use of urban areas (median = 24%, range = 1-82%) and cropland (median = 13%, range = 0-87%). They rarely spent time in barren lands (median = 3%, range = 0-13%) or green spaces (median = 0.3%, range = 0-17%). Visits to landfill sites were infrequent during the incubation period ($n = 2$ visits). Changes in urban habitat use later in the breeding season and movement during staging and southward migration will also be discussed.

[38] Hand, Christine E.¹, Barrineau, Daniel A.¹, Dozier, Jamie², McAlister, Mark A.² and Woods, Joseph G.²

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Eastern Black Rails in managed tidal impoundments: challenges and opportunities *[Black Rail Symposium]*

Sea level rise is among the greatest threats to the persistence of Eastern Black Rails (*Laterallus jamaicensis jamaicensis*) along the Atlantic Coast of the USA. Managed tidal impoundments, which isolate marsh habitat from tidal influence, offer protection from daily water level fluctuations. We monitored water levels and Black Rail presence while working to understand the management potential of specific managed tidal impoundments at Bear Island Wildlife Management Area (BIWMA) and Tom Yawkey Wildlife Center (TYWC), which are owned and managed by the South Carolina Department of Natural Resources (SCDNR). SCDNR's ongoing research at BIWMA and TYWC is increasing our knowledge of Black Rail ecology, our ability to identify suitable impounded habitat, and is providing opportunities to improve management capabilities and practices in suitable impoundments. Incorporating management approaches to benefit Black Rails into existing management priorities and infrastructure presents new challenges as well as opportunities. A minority of managed tidal impoundments possess the topographical characteristics necessary to reliably provide high marsh habitat when multispecies management is the objective for the impoundment. Even when maintaining suitable conditions for breeding Black Rails is the primary objective, traditional water control structures may not allow for precise water depth management or for prompt drainage following severe rainfall events.

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Managing the conflict of Pelicans and inland fisheries in Israel *[Pelicans of the World Symposium]*

The entire western Palearctic Great White Pelicans (*Pelecanus onocrotalus*, GWP) population fly through Israel every fall on their migration to East Africa. Approximately, $\pm 50,000$ individuals arrive and stay from one night up to several weeks. This creates an inevitable conflict with the commercial inland fisheries. Most wetlands on the long route ($>1,200$ km) from the Bosphorus to Israel have dramatically been altered or drained in the last 60 years while the conflict has increased over those years. Nowadays, migrating GWP are almost totally depended on man-made water bodies and agricultural fish breeding stocks. The loss of wetlands on their route, especially in Turkey, may explain the early arrival of pelicans to Israel (a 6-week changeover in 40 years) due to the lack of stopover sites. This finding is intriguing since the GWP kept depart for migration from S.W. Europe at the same dates over this period. In order to understand and to better manage the increasing conflict, we trapped, measured and tagged 281 GWP. Trapping was only possible when foraging flocks arrived. Most trapped pelicans weigh on average ~ 1.5 kg below the average normal body mass, some even down to 60% of it. These results had supported the urge to ensure food availability for GWP, a practice that was first performed by fishermen in the Hula valley in the late 1980's and proved effective in reducing the conflict. This active management regime is imperative in order to enable GWP gaining their energetic requirements in order to continue the migration, to reduce their pressure on commercial fisheries and to keep them away from a military airbase. The fish stocking of over 120 tons, in an almost ad-lib regime, significantly reduced the numbers of wintering GWP (1980's vs. 2010's) and more than 99% of them

continue their migration, and has significantly reduced their pressure on fisheries and persecution of GWP decreased. Initially the fishermen had objected this practice but since 2014, the Fish Breeders Association and the Fisheries Department (Ministry of Agriculture) are collaborating in the effort to supply non-commercial fish every fall and to manage the conflict.

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Red knot diet reconstruction using next-generation sequencing of fecal samples collected in Virginia

Every year during spring migration, thousands of 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 suggest that knots in Virginia primarily consume bivalves (i.e., coquina clams, *Donax variabilis*; blue mussels, *Mytilus edulis*), no study, to our knowledge, 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 fecal matter likely varies based on foraging location within the past hour. To determine what prey knots are consuming and how this varies by foraging substrate (i.e., peat and sand), we collected 62 knot fecal samples in 2017 and 2018 and used DNA metabarcoding to analyze the feces for prey. To investigate the effects of confirmed prey types and various environmental factors on knot site use and abundance, we collected sediment core samples containing prey along both substrates and counted knots and associated factors across the islands (2007 – 2018). Fecal DNA metabarcoding analyses demonstrated that the knot diet varies by foraging substrate (Kruskal-Wallis, $p < 0.05$). They also confirmed that knots eat bivalves (Orders Veneroida and Mytiloida), crustaceans (Orders Amphipoda and Calanoida), and insect larvae (Order Diptera). A zero-inflated negative binomial model including confirmed prey abundances (blue mussel, coquina clam, crustacean, other prey), distance to closest presumed roost, Tierra de Fuego wintering knot counts, and tide best explained the variation in red knot presence and abundance at a given site (AICc wt=0.46). Our results suggest that knots eat a variety of prey items, though other factors, such as tide, roost location, and the number of birds using known wintering grounds, also affect site selection and abundance. Because the knot is federally-threatened, continued monitoring of knots and their prey is imperative to successful management practices in Virginia.

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Status and distribution of American Oystercatcher in Maryland

When the status of Maryland's breeding population of American Oystercatchers (*Haematopus palliatus*) was last assessed in 2003, the species was shown to be secure, having increased since the late-1980s. We reassessed the species' breeding status in 2018 by conducting surveys for nesting pairs and monitoring nest success throughout their breeding range in the state. While we found more pairs and nests in 2018 (109 nests) than in 2003 (85 nests), only 13 nests were successful which led to half the number of fledged chicks (17 in 2018 vs. 38 in 2003). There was nearly an even split in the number of nests and fledged chicks between the Atlantic coastal bays and Chesapeake Bay regions. However, in both regions, most fledged chicks (13 of 17) were confined to two large islands, Martin Island in the Chesapeake Bay and Assateague Island, a large barrier island in the coastal bays. Nests on smaller islands were most likely unsuccessful due to tidal inundation and predation, suggesting that these habitats may now be sinks. Habitat loss as a result of sea level rise and erosion is leading to the loss and degradation of small island nesting habitat. Many chicks appeared to be lost to predation before fledging. On Assateague Island, where there is a significant visitor presence, nesting oystercatchers may also be impacted by disturbance from pedestrians and off-road vehicles.

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Mining-induced Flooding and Use of Deterrents for Mitigating Impacts on Arctic-nesting Birds

In 2017, Agnico Eagle Mines Ltd. proposed the Whale Tail Project, approximately 130km North of Baker Lake, NU. The project includes the construction a dyke within Whale Tail Lake that will divert water from the proposed mining pit into the surrounding lakes and tributaries, resulting in flooding that will elevate the water levels by 4 m above current levels over two years, causing approximately 157 ha of tundra to become flooded during the time of birds' nest initiation. The Migratory Birds Convention Act (1994) prohibits the harm of migratory birds and the disturbance or destruction of nests and eggs. The research project intends to explore mitigation options for the proposed flooding during the construction of the Whale Tail Pit and to assess the degree of risk posed to migratory birds by mining-induced flooding during the nesting period. The study looks to determine the impact of mining-induced flooding on nest loss, success and dispersal of arctic-nesting birds, by outlining the timing, distribution and nest success of arctic-nesting birds relative to the timing and distribution of the flooding. The study also seeks to explore mitigation options for deterring arctic-nesting birds from nesting in potential flood zones by determining the degree to which bird behaviour changes with treatment intensity. Mitigation options seek to deter birds from nesting in high-risk areas so that the impacts from mining-induced flooding or other localized disturbances can be minimized. Through the experimentation of deterrent use, we can add to the understanding of mitigation and conservation of at-risk species.

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Movements and foraging of Common Terns (*Sterna hirundo*) nesting on the South Island of the Hampton Roads Bridge-Tunnel

We studied the movements and foraging of Common Terns (terns) nesting on the South Island of the Hampton Roads Bridge-Tunnel in Norfolk, VA. South Island is a man-made entrance and exit point for the east- and west-bound I-64 tunnel and home to the largest seabird nesting colony in Virginia. Road expansion threatens to displace these birds from the South Island, and results from this study should help determine potential locations for mitigation projects. From June 7–July 1, 2018 we captured, banded, and took measurements of incubating terns and deployed 1.6g Pathtrack nanoFix miniR GPS transmitters that collected positions every 5 minutes. After approximately 5 days, we recaptured individuals to retrieve transmitters. We inferred patterns in, and the ecological drivers of fine-scale movements of individual terns using hidden Markov models (HMM). Based on step length (speed, m/min) and bearing, we developed an HMM that allowed individuals to transition among the following unobservable behavioral states: 1) On colony; 2) Traveling to food resources; 3) Foraging; 4) Returning to the colony. We also examined the effect of environmental and individual covariates on movement and bearing. We deployed transmitters on 29 individuals. Of these, 18 individuals were recaptured and had enough positions collected, forming the basis for our analysis. On average, individuals carried transmitters for 6 days (range: 4–10 days). Common Terns spent over half of their time (58%) on colony followed by the Foraging (21%), Traveling (15%), and Returning states (5%), respectively. Individuals predominantly waited until sunrise to depart the colony and peak foraging generally occurred in the late afternoon until well after sunset. We found that individuals traveled relatively faster and more consistently when located further from the colony and slower and less consistently as they approached or had recently departed the colony. In addition, we found that individual foraging behaviors were variable and potentially influenced by current environmental conditions, but they also were related to the predisposition of individuals to visit certain areas. These results are being used by managers to select possible mitigation sites that account for the foraging needs of Common Terns in the lower James River.

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A genus-wide genomic investigation of boobies

The *Sula* genus of the Sulidae family consists of six seabird species, including the charismatic and well-known blue-footed booby (*Sula nebouxi*). These species vary in their distribution patterns, foraging habits, and morphologies, and much remains unknown regarding the evolutionary histories and morphological mechanisms that have resulted in these differences. Using whole genome sequence data of individuals from each species and from various populations within each species, we first update existing phylogenetic hypotheses. We then analyze patterns of gene flow, introgression, and differentiation between populations and species. Finally, we use gene ontologies to predict functional groups that may have been influential in the histories of these species, and we propose future works to supplement these predictions with experimental data.

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30 Years of Ardeid monitoring in the San Francisco Bay Area: populations trends, breeding status, and maintaining a large-scale citizen-science project over multiple decades [*Heron & Egret Symposium*]

The San Francisco Bay Area contains multiple wetland systems recognized for their value as wildlife habitat and for their importance in maintaining ecosystem services. These wetlands have been highly altered by the last 200 years of human activity and are now adjacent to extensive and growing human populations. Herons and egrets are important top predators in these wetlands and they serve as charismatic symbols of wetland conservation, making these species valuable indicators for monitoring. To better understand the response of heron and egret colonies to environmental changes and processes operating at multiple spatial and temporal scales, Audubon Canyon Ranch (ACR) has monitored population size and reproductive performance at all known heron and egret nesting sites in the region since 1991 ($n = 53\text{--}75$ sites year⁻¹). Data are collected with the assistance of trained volunteer observers ($n = 62\text{--}78$ observers year⁻¹), providing substantially more data than the organization's small staff of paid biologists could otherwise collect. Challenges with sustaining this mode of data collection over multiple decades include keeping volunteers engaged as expectations for the citizen science experience change, recruiting new volunteers, and maintaining the quality and consistency of data collected by a large volunteer corps spanning six counties. Breeding populations have been generally stable regionwide. However, the number of breeding pairs of Black-Crowned Night-herons (*Nycticorax nycticorax*) has declined in some subregions within the study area, particularly the central San Francisco Bay and the Napa-Sonoma Marshes. Furthermore, some subregions show much greater variability in number of breeding pairs than others. Productivity (number of chicks produced per nest) declined across the entire region for Great Egrets (*Ardea alba*) and Black-crowned Night-herons, declined gradually for Great Blue Herons (*Ardea herodias*), and was overall trendless but highly variable for Snowy Egrets (*Egretta thula*). Long-term demographic data from this project allow ACR to provide and evaluate management strategies for heron and egret populations and regional wetlands as restoration projects are undertaken, human needs and expectation of regional wetland change, and sea level rises.

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Migration and habitat use of Great Egrets in central California [*Heron & Egret Symposium*]

Great Egrets (*Ardea alba*, hereafter “egrets”) are migratory throughout much of their range, but movements in coastal California, where they are present year-round, are poorly documented. The San Francisco Bay Area is a complex and highly altered matrix of private and public lands in an urban setting. Egrets occur throughout this area, but the relative importance of different habitats to this species has yet to be quantified. We used GPS telemetry to quantify habitat use and movement of 10 egrets captured on Tomales Bay, CA, during spring and summer of 2017 and 2018. Approximately half of the tagged egrets departed the Bay Area following the breeding season; the remaining birds overwintered within 20 km of their trapping location. The Tulare Basin in the southern San Joaquin Valley (350–400 km from Tomales Bay) was the most frequent winter range for migrating birds. Egrets also showed

mixed behavior in local movements near Tomales Bay, with approximately half foraging only on the bay or the directly adjacent uplands (within 0.5 km), and the rest periodically travelling 10-20 km inland on trips lasting 1-5 d. These short movements inland were correlated with tidally-based patterns of availability of the extensive eelgrass (*Zostera* spp.) beds on Tomales Bay, an important regional foraging habitat. When tides excluded egrets from Tomales Bay eelgrass, they used a range of wetland and upland habitats in agricultural and other working lands. Our study is the first to quantify annual movements of egrets on the West Coast. We documented migration of a portion of this population, and we found an apparent lack of preference for habitats in protected natural areas over those in privately-owned working lands. Our results highlight the importance to these generalist predators of habitat heterogeneity provided by a matrix of protected and working lands.

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An overview of research and conservation on Pelicans in the 21st century: data gaps and data strengths
[Pelicans of the World Symposium]

The Pelicanidae is a unique family of birds and although represented by just 8 species, the distribution of the family is extensive. Breeding among all species ranges from ~ 59° N to 45° S, and spans 154° E to 124° W. With the exception of brown pelicans, all other species are freshwater dependent during the breeding season, although marine and estuarine systems can be occupied more frequently during nonbreeding. The extensive range of the family and breadth of habitats used exposes this suite of species to a wide array of environmental and anthropogenic threats across terrestrial, freshwater, estuarine, and marine systems. Currently, five species are considered to be of Least Concern, and three Near Threatened. While five species are considered to have an increasing or stable population, three are classified as declining or with an unknown trend. Here, we review research efforts and conservation needs for the family, with a focus on peer-reviewed and gray literature produced since ~ 2000, as well as solicitations from researchers and conservationists working on species within the family. The review is organized around focal topics covered in Nelson (2005) to readily allow for comparisons to our earlier state of knowledge and around topics summarized by conservation-oriented web outlets such as BirdLife International. Data gaps are highlighted by taxa and also by geography within taxa, to draw attention to potential spatial biases in our understanding of the ecology and conservation of the family. Although our review focuses on research and monitoring that is primarily aimed at informing conservation actions, we also consider important advances in basic research including physiology and biology.

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Exposure of Brown Pelicans to polycyclic aromatic hydrocarbons in the northern Gulf of Mexico
[Avian Interactions with Offshore Energy Symposium]

The Gulf of Mexico contains a high density of oil and gas infrastructure, with development highest in the central region, intermediate in the west, and least in the east. Given its distribution patterns, behavior, and known sensitivity to chemical and oil contaminants exposure, the Brown Pelican is potentially a good indicator of species-level impacts from interactions with oil and gas development. We assessed exposure of adult and chick Brown Pelicans to polycyclic aromatic hydrocarbons (PAHs) across a range of colonies in the northern Gulf. We measured PAHs in blood (adults n = 33) and feathers (adults n = 92 and chicks n = 35). For adults and chicks we assessed the relationship between PAHs and both body condition index (BCI) and colony location. For adults only we also assessed how sex, migration class, and home range size were related to PAH levels. Alkylated PAHs were detected in adult blood in 48% of individuals and parent PAHs in 30% of individuals. PAHs were more likely to occur in females compared to males while none of the other variables assessed were significant. Alkylated PAHs were detected in adult feathers in 46% of individuals and parent PAHs were detected in 26% of individuals. Presence of PAHs in feathers of adults was negatively related to BCI and positively related to migration distance. Alkylated

PAHs were detected in chick feathers in 34% of individuals and parent PAHs were detected in 9% of individuals. We found a moderate regional effect, with feathers from chicks in the western Gulf less likely to be contaminated by PAHs. We found that region was not a consistently strong predictor of the presence of PAHs in pelicans despite the geographic variation in oil and gas activity in the Gulf, while ecological factors including BCI, sex, and migration distance did affect the probability of exposure to PAHs. Our data suggest that assessing the exposure of pelicans to PAHs in the northern Gulf may need to consider factors beyond the proximity of colonies to oil and gas activity, and that individual variation in behavior and condition may also drive exposure.

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First successful capture and satellite tagging of Black-capped Petrels at sea and subsequent movement patterns

The Black-capped Petrel (*Pterodroma hasitata*) is a highly endangered seabird in the North Atlantic, is listed as globally Endangered by the International Union for the Conservation of Nature and is currently being reviewed for listing under the U.S. Endangered Species Act. There are an estimated 2,000 pairs of Petrels nesting at four documented sites on Hispaniola, although to date only ~ 80 nests have been located. Away from the nesting grounds, most of our current knowledge about habitat use at sea is based on an accumulation of at-sea observations during vessel-based surveys conducted over the past 3 decades. Here, we report on movement patterns and use areas at sea as determined from a recent effort to track birds with satellite tags. Unlike the two previous efforts to individually track petrels (2014 and 2018) which deployed tags at nest sites, this effort sought to capture birds at sea and subsequently track their movements. In May 2019, we captured 10 petrels (n = 3 females, n = 7 males) along the western edge of the Gulf Stream east of Cape Hatteras, North Carolina. We used a hand-held net launcher powered by compressed air to capture birds in flight over chum. Our capture rate was ~ 50% of attempts made. Six birds were classified as dark-morphs, and four birds were classified as white-morphs. Morphometrics differed somewhat between the two morphs with white-faced being larger. Mass averaged 398 grams, and wing length averaged 296 mm. Birds were equipped with 8 g solar-powered satellite tags set on a 6 hour on/28 hour off duty cycle. Subsequent tracks (May – July) showed that all individuals ranged from 28.4 – 41.2 degrees latitude, with no recorded trips to breeding areas/sites. While birds did use areas west of the Gulf Stream and over the shelf, we also recorded substantial levels of activity east of the Gulf Stream. Compared to birds tracked from breeding sites in 2014 and 2018, the current use areas appear similar to use areas during post-breeding periods, but dissimilar to use areas from 15 trips recorded during known breeding periods.

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The Status of Black Rail (*Laterallus jamaicensis*) in Coastal Louisiana [Black Rail Symposium]

The enigmatic Eastern Black Rail (*Laterallus j. jamaicensis*) remains poorly known, and even basic life history data like its distribution and habitat relationships remain poorly understood. Because of apparent rapid population declines in parts of its range, it is proposed for Endangered Species Act listing. Prior to May 2017, the Louisiana Ornithological Society had records of 13 well-documented Black Rail reports ever in Louisiana, although many additional unconfirmed reports suggested a more regular occurrence, which if true, had remained elusive to the research and conservation community. This project's goal was to document the status of Black Rails across Louisiana's coastal zone between May 2017 and April 2019 by focusing on potentially suitable habitat, as recently described in Texas. We did this by utilizing two survey methods: A) point counts (at 33 sites) and B) drag-line surveys (at 16 sites), the former during breeding season (April-July) and both during the non-breeding season (November-March). We tallied a total of 38 detections at 21 of 152 point count locations (among 11 of 33 sites) primarily during the breeding season, but also during the non-breeding season. Occupancy analyses considering a variety of habitat variables measured using SHARP protocols from 1,239 point count surveys indicated a strong positive relationship with *Spartina spartinae* cover. Predicted Black Rail occupancy exceeded 50% above 32% cover of *S. spartinae*. Among 61 drag-line surveys, we tallied 36 detections, including 28 Black Rail captures of 25

individuals across 7 of 16 survey locations. We deployed 0.9-g VHF radio transmitters on 16 birds, and among 13 with sufficient data (13 to 84 location estimates), we estimated the 95% minimum convex polygon home range size to be 0.71 ha (\pm 0.13 ha; range 0.22 – 1.59 ha). Our surveys efforts, funded by Louisiana Department of Wildlife and Fisheries and U.S. Fish and Wildlife Service, have demonstrated that the Black Rail is part of the core Louisiana avifauna, which has potential implications for coastal restoration, wetland mitigation, and land management activities in a landscape threatened by sea level rise, subsidence, and coastal wetland loss.

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Australian pelicans: a waterbird on a desert continent [*Pelicans of the World Symposium*]

Seventy percent of Australia receives <500mm rainfall annually and the only reliable surface water is in the Murray-Darling rivers system in the south-east of the continent. Paradoxically, Australia has its own species of water-dependent pelican. I will review the available published and unpublished data on the movements, breeding distribution and population trends of Australian pelicans to aid our understanding of their conservation status. Individuals can move across the species' entire geographic range within a few months, but tagging studies suggest most return to their natal breeding colony. Australian pelicans breed in the interior and on the coast. The largest breeding colonies (up to 50, 000 pairs) occur on normally dry inland lakes, whereas most coastal colonies are smaller (<1000 pairs). It is widely believed that pelicans from coastal colonies 'migrate' to breed on inland lakes following rare flooding rains. However, Australian pelicans breed at coastal and inland sites simultaneously and banding data show there is limited interchange between coastal and inland areas. These observations suggest that Australian pelicans do not move *en masse* from the coast to breed in central Australia, and that they are not panmictic, but are geographically structured. Long-term (>10 year) trends vary at specific sites, possibly reflecting movement of individuals in response to water/food availability, rather than population trends. However, pelicans have shown regional declines over south-eastern Australia, where water is being extracted unsustainably from the Murray-Darling System for human use. Predation and disturbance by introduced red foxes have had severe impacts on some breeding colonies. Historically the number of regular pelican breeding colonies has declined throughout Australia. Australian pelicans are adaptable and can establish new breeding colonies when suitable sites and sufficient water/food are available. But their long-term future will depend on how the social/economic and environmental needs for water are balanced in the world's driest inhabited continent, particularly in the context of our changing climate.

[52] Karpanty, Sarah M.¹, Heller, Erin L.¹, Ritter, Shannon J.¹, Catlin, Daniel H.¹, Fraser, James D.¹

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Assessing the effects of climate-driven shifts in prey on red knots using Virginia stopover habitat

Every year during spring migration, thousands of migratory red knots (*Calidris canutus rufa*; knot hereafter) use Virginia's barrier islands as stopover habitat to regain the fat required to continue flights to breeding grounds. Since the knot completes one of the longest migrations in the world and because it occupies a narrow foraging niche, it is an exemplar of the challenges faced by long-distance migrant shorebirds. These challenges may be exacerbated by climate change, as long-distance migrants may be unable to adapt quickly to changing prey ranges and abundances, resulting in spatial mismatches between predators and prey. More specifically, as climate change causes ocean temperatures near Virginia's barrier islands to rise, organisms that live within the intertidal zone, like blue mussels (*Mytilus edulis*; mussels hereafter), are retreating northward and possibly becoming less available to knots. Here, we investigated the variation in prey and knot abundances from 2007-2018 by counting knots and collecting core samples containing prey, including mussels, on Virginia's barrier islands to explore how changes in prey abundances may affect knots. Because bivalve shells contain isotopic clues about the environmental conditions present during shell formation, they record the oxygen isotopic signatures of the water they are in during different phases of development. Thus, we conducted oxygen (16O vs. 18O) stable isotope analyses on 21 mussels to address where larval mussels originate and how their range contraction may impact knots. During peak migration (May 14-28), we estimated that 3600-11900 knots used the islands. Prey distribution was not continuous, but where present, 150-56700 blue mussels were available/m² shoreline. Stable isotope analyses indicated that mussel umbos (first

portion of shell precipitated) contain more positive oxygen isotopic ratios than shell edges, suggesting that mussels originate from subtidal populations in cold saline water. Continued ocean temperature increases may further prey range changes, potentially making mussels less available to knots in the future. Since the knot is federally-threatened and uses Virginia's barrier islands during spring stopover, understanding factors influencing prey abundance is imperative to successful management practices in Virginia and the larger mid-Atlantic stopover.

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American White Pelican population trends [*Pelicans of the World Symposium*]

Trends in the abundance of American White Pelicans (*Pelecanus erythrorhynchos*) across North America have been periodically reported but not summarized. We compiled colony nest counts for all known colonies in 2013. Seventy-three of the 89 known colonies were surveyed. Six colonies that were surveyed recorded no active nests. Thirty-eight new colonies have been documented since the 2000 survey but 11 of these were not active in 2013. We analyzed trends in abundance at 14 colonies that were each surveyed in 1980, 2000, and 2013, to estimate population growth rates (λ). Pelican abundance increased at 9 of the 14 colonies, but mean λ across all colonies did not differ from replacement (0.993; 95% confidence interval [CI] 0.930 – 1.055) because of a population collapse at Lower Klamath Lake National Wildlife Refuge ($\lambda = 0.633$) likely due to prolonged drought. Excluding this location, mean λ was statistically positive (mean = 1.020; 95% CI 1.002 – 1.039). Our results suggest that over a span of 33 years, the abundance of American White Pelicans in the US is stable to increasing.

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Red-throated Loon (*Gavia stellata*) Winter Distribution in Delaware Bay

The Red-throated Loon, *Gavia stellata*, is listed in the North American Waterbird Conservation Plan as one of the highest conservation priorities among waterbirds in the U.S. Northeast and mid-Atlantic Region, covering Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Delaware, and Maryland. Studies have shown that the densest wintering populations of the Red-throated Loon in the east Atlantic are in Delaware Bay and off of North Carolina. However, where Red-throated Loons are found within Delaware Bay is not information found in the published literature. This study sought to determine Red-throated Loon distribution in Delaware Bay by performing vessel- and land-based surveys and noting habitat characteristics. I tested the hypothesis that habitat characteristics such as salinity, wind, wave conditions, and latitude (as a proxy for salinity) were associated with the number and distribution of Red-throated Loons in Delaware Bay. Point count surveys were conducted at thirteen locations along the Delaware side of Delaware Bay and three along the Atlantic Coast of Delaware. The number of Red-throated Loons and habitat/weather conditions were recorded. Transect surveys aboard a trawl boat detected no Red-throated Loons on the Delaware side of Delaware Bay from Augustine Beach to Broadkill Beach. A GLM with Poisson distribution assessed the relationship among the number of Red-throated Loons present and the habitat characteristics latitude, salinity, wind speed, and wave size. All habitat factors were significantly related to Red-throated Loon abundance. Red-throated Loon abundance was negatively related to large wave size and high latitude, and positively associated with higher temperatures and high salinity values. Red-throated Loons were found primarily off the Delaware coast and not inside Delaware Bay. These results are significant because they differ from a recent technical report regarding loon distribution in Delaware Bay.

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Increasing Detection Rates through Passive Identification of Individual Birds Attending Nests

Identification of individuals attending nests is often important in avian field work. For secretive species such as tidal marsh sparrows that cannot be easily identified by individual color bands in the field, capture of adults on nests is the primary method for identification. However, for a multi-year research project such as the Saltmarsh Habitat and Avian Research Program (SHARP), repeated recaptures of birds at the nest within and between seasons are required and have been found to lead to trap avoidance. Additionally, it is feared that this may also lead to occasional nest abandonment. To reduce both of these costs, we attached a Passive Integrated Transponder (PIT) tag to a band on Saltmarsh Sparrows and Seaside Sparrows in New York beginning in 2014. When a sparrow nest was found, we concealed an RFID reader antenna near the nest and if an attending adult had a PIT Tag band, the identity of that individual was successfully recorded every time. Use of PIT Tags reduced physical capture of adults at the nest by 79.2% in 2015, increased apparent detection of individuals by 50%, and five individuals were identified at the nest by use of RFID technology that were never physically captured that season. RFID technology has great potential to increase detection rates while reducing the cost of researcher induced nest abandonment for difficult to observe species.

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Jailbirds: The history and future of Herring Gulls on Rikers Island in New York City [*Urban Gull Symposium*]

Colonies of roof-nesting gulls have thrived in urban communities around the world. A handful of colonies of roof-nesting *Larus argentatus* (Herring Gulls) are established in New York City. One of these colonies is located on a large system of rooftops on Rikers Island, Bronx County, New York. Rikers Island is located less than 90 meters from LaGuardia Airport, one of the nation's busiest airports. Data from aircraft-wildlife strikes suggest that the nesting colony established itself sometime around 2000. In recent years, Herring Gulls have been the most frequently struck large-bodied bird at LaGuardia Airport. In an effort to reduce hazards to aircraft, the eggs of gulls nesting on Rikers Island have been addled since 2009. Despite management efforts, the number of nesting pairs continued to increase through 2014 when approximately 600 nesting pairs were documented. Since 2014, there have been annual decreases in colony size. The number of nesting pairs was less than 300 in 2019. Nest management efforts have reduced the number of Herring Gull strikes at LaGuardia Airport from 26 in 2006 to zero in 2018. Concurrent with nest management efforts, nesting adults have been banded to document the movements of the gulls nesting on the island. Recent sightings of banded gulls suggest that the Herring Gulls of Rikers Island may be moving to other nearby colonies. Understanding the movements of birds using the island are expected to further reduce wildlife hazards at LaGuardia Airport and better guide management decisions in the future.

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Differences in urban nesting behaviours and nest site selection of seven common North American species of gull [*Urban Gull Symposium*]

This talk will present details of how seven common species of North American gull select their nesting sites in the urban environment. The Glaucous-winged Gull of the Salish Sea and the Herring Gull of the Canadian Maritimes exhibit the most plasticity in nest site selection, from large colonies on flat industrial rooftops to isolated pairs on small, 1 sq. m landings atop stairwell or ventilation chutes. On the other hand, Ring-billed Gulls of the Great Lakes almost exclusively choose rooftop sites that can sustain large colonies. Preferences of the Western Gull of the Pacific coast lie somewhere in between. Mew Gulls nest alongside Herrings in urban Alaska, while Heermann's Gulls - incredibly - have established a small but thriving urban colony in central California among urban-nesting Westerns. Drawing on five years of survey work across Canada and the North American Pacific coast, I will compare nest densities among these species of urban-nesting gull and contrast with known nest density figures for conspecifics at traditional, non-urban colonies. Regarding urban nest site selection, I will describe differences and similarities in building height, urban density, and distance to water distributions among these species. As urban-nesting becomes more commonplace, a host of new human-wildlife conflicts can arise, as well as many exciting conservation

opportunities. These issues and ideas demand a deeper knowledge of how gulls use the urban environment for reproductive purposes, and this work represents another step toward satisfying this demand.

[58] Juliet Lamb^{1,2}, Yvan Satgé², Caroline Poli³, Christine Fiorello⁴, and Patrick Jodice⁵

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Causes and consequences of individual variation in migratory patterns of Brown Pelicans: Insights from ten years of tracking data
[Pelicans of the World Symposium]

Although Brown Pelicans are generally considered non-migratory, decades of band return data have shown that individual birds often undertake long-distance movements. However, given the difficulty of resighting a banded bird multiple times over its lifetime, the extent and nature of these movements have long remained obscure. The 2010 Deepwater Horizon oil spill highlighted the need to understand Brown Pelican movement patterns, including dispersal and migration, as a crucial step in accurately linking marine habitats affected by at-sea pollution to coastal habitats targeted for restoration. This presentation will focus on insights into migratory patterns of Brown Pelicans in the Gulf of Mexico, the southeastern United States, and California, gained from several large-scale telemetry studies undertaken over the past decade. We will summarize factors influencing migratory behavior and discuss how variation in migratory behavior contributes to distribution of risk factors, including contaminants exposure, across the regional populations and the species as a whole.

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Evaluation of an innovative audio technique for monitoring wading bird colonies in a highly modified wetland ecosystem

Wading birds (Ciconiiformes and Pelecaniformes) are monitored globally as indicators of wetland health and ecosystem changes because they are sensitive to hydrologic fluctuations and occupy a top trophic level position. In Florida, wading bird population abundances and productivity serve as indices of habitat quality and wetland restoration progress throughout the Greater Everglades ecosystem. My study aims to improve the efficiency of wading bird monitoring by testing the use of autonomous recording units (ARUs) as alternatives to traditional survey methods for estimating species composition and abundance in wading bird colonies. During the 2019 breeding season, I deployed ARUs in 3 colonies of Snowy Egrets (*Egretta thula*), Tricolored Herons (*E. tricolor*), and Great Egrets (*Ardea alba*) on Lake Okeechobee to detect the daily vocal activity rates (VAR) of nestlings. My preliminary analyses indicate that the average VAR differs between species and nestling age groups. The average VAR of Great Egret nestlings is 252 calls/minute while the average VAR of small herons (Snowy Egrets and Tricolored Herons) is 795 calls/minute. For nestlings aged 1-3 days, Great Egret VAR is 204 calls/min and small heron VAR is 390 calls/min. At 10-12 days, Great Egret VAR averages 300 calls/minute and the average VAR of small herons is 1200 calls/minute. The differences in VAR between species and nestling age groups indicate that VAR may facilitate automatic species recognition and age group classification of nestlings, providing an alternative to more expensive, time-intensive, and disruptive survey methods. The use of automatic recognition software for classifying bird species has increased in recent years, however, these methods have not been applied to nestlings or wading bird species. Because wading bird population sizes and reproductive success serve as metrics of Everglades restoration progress, improving methods of monitoring colonies will benefit the recovery of wading bird populations and the management of a highly modified wetland ecosystem.

[60] Lato, K.A.*¹, Veit, R.R.², Thorne, L.H.¹

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A comparison of habitat use and foraging ecology between herring gulls and great black-backed gulls [*Urban Gull Symposium*]

While many members of the *Larus* genus have adapted to urban environments, the degree to which urban environments are utilized for foraging may vary greatly between species. In order to understand how the use of urban areas drives movement and foraging behavior in gulls, we compared differences in the habitat use and foraging ecology herring gulls (*Larus argentatus*) and the lesser studied great black-backed gull (*Larus marinus*). While herring gulls are widely known to utilize urban environments (parking lots, dumpsters, and landfills, etc.) for foraging and breeding, great black-backed gulls may primarily use marine environments. We collected data from a mixed-species breeding colony on Young's Island, New York, during the incubation period in spring 2019. We deployed GPS tags on 6 great black-backed gulls and 3 herring gulls with minimum and maximum deployment duration of 5 and 12 days, respectively. We identified locations of foraging behavior as areas of restricted search (ARS) using the First Passage Time analysis (FPT). We found that the proportion of foraging points within urban environments was significantly lower for great black-backed gulls than for herring gulls (Kruskal-Wallis $p=0.01962$, $\chi^2=5.4454$). Site fidelity (defined as the number of foraging clusters revisited by an individual) was also significantly lower for great black-backed gulls than herring gulls (Kruskal-Wallis $p=0.3887$, $\chi^2=4.2667$). This contrast in site fidelity is likely the result of differences in the predictability and distribution of urban vs. marine prey items. Lastly, the average number of trips taken per day for great black-backed gulls was significantly less than herring gulls (Kruskal-Wallis $p=0.01962$, $\chi^2=5.5862$). Our results exemplify the variation in urban adaptability that exists within the *Larus* genus and how urban vs. non-urban habitat use may influence foraging behavior. Because habitat use is not a direct measure of prey consumption, ongoing work is using bulk stable isotope analyses for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ from tagged individuals to determine any significant differences in isotopic signatures between species. Together, these analyses will provide further insight in to how habitat use and the use of urban environments impacts behavior, diet, and trophic ecology.

[61] **Leberg, Paul L.**¹, Brock Geary¹, Jordan Karubian², Juita Martinez¹, Andrea Santariello¹, Scott Walter³, Mirka Zapletal¹

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Challenges faced by Brown Pelicans on a vanishing coast: loss and restoration in southeastern Louisiana [*Pelicans of the World Symposium*]

Recent estimates indicate that Louisiana accounts for approximately one-third of the eastern U.S. population of Brown Pelicans, but the number of breeding colonies in the Mississippi River Delta is in decline. Here we review a long-term data collection effort relevant to loss and restoration of nesting sites, as well as important questions that remain unresolved. Coastal island loss, driven by erosion and subsidence, is leading to loss of nesting habitat, with oil spills and storm events playing contributing roles. Vegetation type and cover can influence island resistance to these threats, and extensive restoration activities, in the form of breakwaters and dredge material placement, have been applied to several coastal islands. While these actions appear to have benefited nesting pelicans, most breeding is occurring on a small number of sites that are probably dependent on continued restoration. In spite of the success of translocations in the re-establishment of pelicans in Louisiana 6 decades ago, similar recent actions, as well as other techniques, have failed to establish new breeding populations on other islands. It is unclear whether birds born on islands that are subsequently lost relocate nearby or leave the delta. Furthermore, two goals of restoration, increased island size and elevation, are also associated with mammalian predator occupancy on barrier islands. It is unclear whether fire ants, another nest predator, may also benefit from increases in island elevation or changes in vegetative cover. As pelicans become dependent on just a few restored sites with little evidence of expansion to other islands, the location of remaining breeding sites relative to foraging resources also becomes an important consideration. Pelicans make foraging decisions based on the location of prey and prey habitat, but this process is not well understood, especially in relation to processes like marsh loss and creation, and the annual formation of a large hypoxic zone. Furthermore, planned restoration through major river diversions may influence fish distributions near remaining nesting sites, with unknown consequences for local foraging conditions and nesting success. Continued research and adaptive management have a major role to play in the long-term viability of pelican populations in the region.

[62] Leirness, Jeffery^{1,2}, Kinlan, Brian¹, Adams, Josh³, Ballance, Lisa⁴, Felis, Jonathan³, Joyce, Trevor⁴, Pereksta, David⁵, Coyne, Michael^{1,2}, Winship, Arliss^{1,2}

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Modeling at-sea distributions of marine birds on the U.S. Pacific outer continental Shelf

[Avian Interactions with Offshore Energy Symposium]

We report on the first phase of a multi-year effort to characterize the at-sea spatial distributions of marine birds on the US Pacific outer continental shelf (OCS). Results of this study will inform spatial planning and risk assessment for marine renewable energy in the region. We developed seasonal habitat-based spatial models of the at-sea distribution for 41 species of marine birds throughout the US Pacific OCS. A statistical modeling framework was used to estimate relationships between bird sighting data and a range of temporal and spatial environmental variables. The estimated relationships were then used to predict the long-term spatial distribution of each species throughout the study area in each season. Bird sighting data came from five scientific survey programs and consisted of at-sea counts of birds collected between 1996 and 2014 using fixed-wing aerial and boat-based transect survey methods. Environmental variables included temporal climate indices such as the Pacific Decadal Oscillation index, bathymetric variables such as depth and slope, and dynamic oceanographic and atmospheric variables such as chlorophyll concentration, surface current velocities, sea surface temperature, wind stress, and others. We present results for example species and discuss how the information can be interpreted to help guide marine spatial planning and minimize potential conflict between human activities such as renewable energy development and seabirds. A second phase of the project is currently underway that includes contributed data from additional survey programs in an effort to expand and improve the modeling and results presented here.

[63] Loman, Zachary G.¹, Cynthia S. Loftin²

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Web-based database for interagency sharing of colonial waterbird survey data *[Avian Interactions with Offshore Energy Symposium]*

Large interagency efforts to collect and share wildlife survey data are an important component of wildlife management at the continental scale. The Atlantic Flyway Waterbird Survey represents one such endeavor that produced large amounts of data on a suite of colonial waterbirds species collected by several state, federal and NGO partners. Rapid combining, vetting and redistribution of data among agencies and stakeholders from these types of efforts has traditionally presented a time-consuming challenge. We developed a web-based graphical user interface using an open-source platform within R to quickly deploy a tool for reviewing and visualizing data among stakeholders. The package, shinyR, requires little additional programming knowledge, and because it is R based allows developing web interfaces that seamlessly combine statistical analysis, geospatial information systems, HTML and JavaScript, and database management. Our tool, Colonial Waterbird Database Visualized, revitalizes an existing federal database that had fallen into abeyance, and that had no useable interface for stakeholders involved in collecting or using the data it contained. Through dynamic plotting, open source mapping tools, and searchable and sortable data tables, users can now review and explore data from any computer with a web connection. The rapid development of such tools vastly improves the ability to inform key partners across state and federal jurisdictions in near-real time of the data available for use in species population or trend estimates or for their other information needs.

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Using results from avian tracking studies to inform assessments of offshore wind energy areas in the US Atlantic

[Avian Interactions with Offshore Energy Symposium]

Since 2012, the USFWS Division of Migratory Birds and partners have conducted avian tracking studies with funding from the Bureau of Ocean Energy Management. This presentation highlights key results from some of these studies and applications to assessments of offshore wind energy areas in the US Atlantic. From 2013 to 2017, we used digital VHF transmitters and an array of 35 automated radio telemetry stations from Massachusetts to Virginia to track regional movements and flight altitudes of Common Terns (n=266), Roseate Terns (n=150), Piping Plovers (n=150), and Red Knots (n=388). Offshore movements of Common and Roseate Terns peaked during the post-breeding dispersal period in mid-July and August, and primarily occurred during daylight hours and fair weather conditions. Piping Plovers departing from their breeding grounds in MA and RI primarily used offshore routes to sites in the mid-Atlantic. Fall migratory departures of Piping Plovers peaked in early August, during evenings with favorable atmospheric conditions for crossing the mid-Atlantic Bight (i.e. winds blowing to the southwest, high visibility, little to no precipitation, and high atmospheric pressure). Fall migratory departures of Red Knots occurred during two distinct periods, the first from mid-August to mid-September and the second from early to mid-November. These flights were initiated within several hours of civil dusk and predicted to be highest in strong southerly winds. The presentation also includes results from pilot studies on Common Terns marked with newly available light-weight (2-g) satellite (Argos) and GPS transmitters aimed to collect more detailed information on movements and flight altitudes throughout a broader portion of the US Atlantic Outer Continental Shelf. Current efforts are underway to deploy digital VHF tracking stations on offshore wind turbines and buoys for fine-scale monitoring of offshore wind energy areas, and to develop guidance and best practices for regional, coordinated deployment of tracking equipment for offshore monitoring. New efforts for integrating data from avian tracking studies into a stochastic collision risk modeling approach for assessments of offshore lease areas in the U.S. Atlantic will be also be discussed.

[65] Lyons, J.E.¹, B.A. Harrington², S. Koch³, A. DeRose-Wilson⁴, A. Dey⁵, L. Niles⁶, F. Sanders⁷

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Stopover and Migratory Connectivity of Red Knots at Cape Cod, Massachusetts: Analysis of Mark-recapture and Isotopes

Red knots migrate from breeding areas in the central Canadian arctic to wintering areas in the SE USA, Caribbean basin, north coast of Brazil, and the Patagonia region of South America. Recovery of this threatened species will require estimates of population size, and a better understanding of migratory connectivity and stopover ecology. From 2009-2016, we studied stopover ecology and biogeography of knots at Cape Cod, Massachusetts in the northeastern United States. Our objectives were to 1) estimate passage population size and stopover duration using mark-recapture-resight methods, and 2) determine nonbreeding destinations of these birds using stable isotopes in feathers. We tested the hypothesis that the proportion of the Cape Cod stopover population that winters in the Patagonia region declined at our study area over time. We used the Jolly-Seber mark-recapture model and the isotope analysis to simultaneously estimate stopover population size and wintering locations. The average annual southbound passage population at the Cape Cod study area was nearly 5,000 birds; the population ranged from 3,100 to 7,800 during 2009-2016 but showed no clear trend during this period. Knots stayed in the study area approximately 50 days on average; birds that winter in Patagonia had shorter stopovers than birds that winter in the SE USA and Caribbean basin. Approximately 45% of the stopover population was from wintering areas in the Patagonia region, and this proportion was steady across the years of this study. Our results provide a better understanding of population structure and migratory connectivity for conservation planning.

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Breeding Phenology and Reproductive Success by Little Blue Herons (*Egretta caerulea*) in an Urban Mixed-species Colony

Little Blue Herons (*Egretta caerulea*) often join other egrets and herons in mixed-species breeding colonies. In June and July 2018, a random sample of 26 Little Blue Heron nests located in an urban colony were monitored during the breeding season. The goals of this study were to characterize nest-activity patterns by attending parents over the course of the breeding cycle and document reproductive success in an urban colony amid human disturbance. Scan samples with 5-min intervals were used to record activity during 50 h of observation on 24 random nests. An additional 77 h of focal samples at two different nests documented nesting phenology. Observations made at random times during morning, midday, and evening periods yielded 636 nest-hours across all stages. During incubation, parents mostly sat (63%) or stood (23%) near the nest and spent less time in nest maintenance (5 %) and self-maintenance (5 %). By midway through the breeding cycle, adults spent more time standing (70%) and less time sitting (11%) and in nest maintenance (1%). Toward the end of the breeding cycle, both parents were away from the nest 69% of the time. Of the 26 total nests monitored, 39 chicks fledged (1.4 ± 0.3 chicks/nest attempt). The 16 successful pairs (61 % of all nests) fledged a mean of 2.4 ± 0.2 chicks. Most unsuccessful nests were taken over by Cattle Egrets (*Bubulbus ibis*), or the chicks eaten by Black-crowned Night-herons (*Nycticorax nycticorax*). We describe sources of disturbance at this colony and its possible effect on breeding success.

[67] Mahapatra, A¹, Chalkapure, M. Sidramappa², Mohan, S.², Kumar, R. Suresh¹

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Changing Times and Changing Attitudes: Spot-billed Pelican *Pelecanus philippensis* conservation at the Kokkare-Bellur Community Reserve, Southern India [Pelicans of the World Symposium]

The Spot-billed Pelican (SbP) *Pelecanus philippensis* a Near-Threatened species was once widely distributed across South and Southeast Asia, is now restricted to few nesting sites in India, Sri Lanka, Cambodia and potentially Thailand. Kokkare-Bellur a small village is one among the 21 known SbP breeding sites in India, where pelicans and people are known to have coexisted since time immemorial. Recognizing the role of local people at Kokkare-Bellur in protecting pelicans, this site has been notified as a Community Reserve. However, over the years felling of nesting trees, intensive fishing and pollution in the surrounding waterbodies, and more recently pelican mortalities due to nematode infestation is thought to be the reason for decline in nesting population in this area. There has been no systematic attempt to understand this population, and the nesting numbers reported were speculative. Given this, a long-term study to understand the nesting ecology of SbP, their spatial-use and movements was initiated in 2018. Between October 2018 to April 2019, SbP were observed nesting on 21 trees of six species within the village and a total of 272 nests were recorded. Pelicans primarily nested on old and mature trees of *Tamarindus indica* (n = 8) having an average GBH of 247 ± 53 cm and had a total of 102 nests. Three trees of *Ficus benghalensis* (GBH = 369 ± 145) however appeared to be preferred for nesting having a total of 86 nests. Successful fledging was observed only in 65 of the 272 SbP nests (24%). The remaining 207 nests (76%) that failed, 75% were lost prior to hatching while 25% failed post hatching. The reason for this high level of nest failure is not known but is thought to be associated with nematode infestation. A total of 16 adult pelicans were found sick at the base of the nesting trees that subsequently died and was again suspected to be due to nematode infestation. The high nest failure along with adult mortality, and nest tree felling pose a serious challenge to both forest managers and local people in conserving pelicans at this site.

[68] Martinez, T. Marisa^{*1}, Kohler, Emilie R.¹, Gawlik, Dale E.¹, Calle, Leonardo² and Romañach, Stephanie S.³

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Time and tide wait for no bird: modeling resource selection by small herons in intertidal systems

Daily tide cycles place harsh restrictions on when and where wading birds can feed, particularly for shorter-legged herons, like the Little Blue Heron (*Egretta caerulea*) which requires shallow water depths to access prey. To investigate how small herons respond to the variable hydrology and landscape of intertidal systems, we developed a framework to model resource selection in Florida Bay and Lower Florida Keys. From 2016 to 2018 we collected regurgitated food contents from nestlings to examine prey selection, and quantified prey availability and foraging habitat attributes to evaluate habitat selection. Diet analysis revealed a broad dietary niche width frequently comprised

of gulf toadfish (*Opsanus beta*) and prawns (*Penaeus* spp.), though prey selectivity differed between sites and years. To link prey selection with landscape features, we next modeled prey-habitat associations and found gulf toadfish were associated with algae cover ($\beta=0.380$) and prawns were associated with seagrass density ($\beta=0.593$). Across the Lower Keys foraging landscape, prey abundance was weakly, negatively correlated ($p = 0.058$) with time-integrated habitat availability (i.e., shallow-water availability) and prey biomass was positively correlated ($p < 0.05$) with water depth. Finally, we performed a conditional logistic regression function on used and available foraging locations to model probability of habitat selection. We found support for SAV cover and water depth as the most important habitat attributes having the greatest effect sizes (-0.035 and 0.020 , respectively), but poorly explained habitat use patterns (95% confidence intervals overlapped zero). Time-integrated habitat availability and proximity to islands and deep water were less distinct attributes of foraging habitat. Surprisingly, we found no effect of prey abundance or prey biomass on habitat use patterns. Although prey were associated with deeper water and high SAV cover, herons were likely to use more accessible foraging sites with shallow water and less SAV cover. Prey availability is a composite of prey density and vulnerability of prey to capture, and is largely influenced by the interaction between hydrologic patterns and landscape structure. In tidally driven environments, prey accessibility may be the limiting component of prey availability and the stronger driver of resource selection by small herons.

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Increasing pioneers vs. decreasing followers: positive/negative aspects of Grey Herons and Great Egrets on management/conservation of mixed-species heron colonies in Japan [*Heron & Egret Symposium*]

Grey Herons and Great Egrets are the two larger Ardeidae that breed in annual colonies with the other four smaller herons and egrets in the eastern part of Japan. Grey Herons have rapidly increased and expanded their distribution in the last 20 years, and Great Egrets have increased slightly. Although the reasons of those population changes are not yet clear because there are no remarkable changes in habitat conditions, here we hypothesize that recent increases of the two larger species have affected, both positively and negatively, the dynamics of mixed-species colonies. The positive aspect is that the increase of the larger species promotes the establishment and persistence of colonies. Since Grey Herons, and Great Egrets more mildly, have solitary and early nesting habits, they had become pioneers for establishing new annual colonies in the last decades. The other four smaller species have more gregarious habits, and they may be cued by the presence of hetero-specifics when choosing colony sites to reduce decision-making costs. Considering such pioneer/follower relationship is also useful to manage human/bird conflicts; if the existence of a colony is welcomed/disagreed by human residents, first arrival of Grey Herons and Great Egrets should be preserved/disturbed so as to lead success/failure of the following colony formation. However, trends in population sizes of the smaller followers have not synchronized with the larger pioneers: Intermediate Egrets (“Near Threatened” in Japan) and Black-crowned Night Herons remained relatively constant, but Little Egrets and Cattle Egrets substantially decreased. The negative impact of Grey Herons and Great Egrets on the other species, i.e. reducing their reproductive success, has not been determined, selection of colony-site and its nesting vegetation led by larger pioneers might not sometimes suit the smaller followers. In fact, in some cases, followers did not join colonies started by the larger species on taller cedar trees, and established their own colony on bamboo thickets in the end. Further studies focusing on interspecific differences among co-colonizing species are required to establish better strategies for management and conservation of mixed-species colonies.

[70] McCann James M.², David F. Brinker¹, and Conor Higgins³

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Status, distribution, and population trends of colonial waterbirds in Maryland

Maryland population trends for 21 colonial nesting waterbird species over a 33-year period (1985-2018) are examined using regression analysis based on statewide surveys conducted every 1-5 years. The number of breeding pairs at each colony was determined using ground-based nest counts, aerial nest counts via fixed-wing aircraft, and offshore flight-line surveys of mixed heronries. For most of the state’s nine wader species, numbers varied widely

with no significant trends, populations remaining relatively small (35 to 1253 pairs), and mostly confined to islands in the lower Chesapeake Bay. Great Egret and Great Blue Heron are the exception with those populations increasing significantly. Great Blue Herons increased nearly four-fold from 1,274 pairs in 1985 to 8,085 pairs in 2013 when statewide surveys were last completed for this species. Black Skimmer, Common Tern, and Forster's Tern all experienced significant declines. The Common Tern decline was greater than any other waterbird species, from over 2,000 pairs in the mid-late 1980's to 193-317 pairs during 2014-18. Other tern species showed no significant trend but continue to occur as uncommon (Least Tern) to rare breeders (Royal Tern), and highly rare very irregular breeders (Gull-billed Tern, Sandwich Tern). Among gulls, Great Black-backed Gull showed a dramatic increase from 59 pairs in 1986 when they nested solely within Herring Gull colonies, to more than 110 nesting pairs in 2018 that included one exclusive Great Black-backed colony of 73 pairs. Herring Gull numbers declined approximately 85 percent from an average of 4,227 pairs in the mid-late 1980's. Laughing Gull continued to be a highly localized rare breeder with no significant trend. Double-crested Cormorant showed a strong positive trend from 55 pairs in 1990 when nesting was first documented in Maryland to 2,510 pairs in 2018. Brown Pelican numbers varied greatly but increased overall since their first Maryland nesting of 5 pairs in 1987 to 790 pairs in 2018. Island habitat loss due to sea level rise and land subsidence represents, by far, the greatest threat to Maryland's waterbirds. Great Horned Owl predation, along with expanding Great Black-backed Gull and Double-crested Cormorant populations pose localized management challenges.

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Reducing gillnet bycatch: Sea duck underwater hearing thresholds and auditory deterrent devices

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As diving foragers, sea ducks are vulnerable to underwater anthropogenic activities, including naval sonar activity and gillnet fisheries. Bycatch in gillnets is a principle driver of mortality for sea ducks, killing hundreds of thousands of seabirds annually. To avoid this, we proposed studying underwater hearing in affected species. Understanding hearing in diving birds can be directly applied to mitigation strategies for reducing gillnet bycatch through the use of acoustic deterrent devices. Additionally, knowledge of underwater acoustic sensitivity is important to current regulatory and management priorities in order to evaluate the impact of noise pollution. In order to determine underwater hearing sensitivities for sea ducks vulnerable to bycatch, we used psychoacoustic techniques to train captive ducks to respond to sound stimuli. We raised long-tailed duck (*Clangula hyemalis*), surf scoter (*Melanitta perspicillata*), and common eider (*Somateria mollissima*) ducklings at Patuxent Wildlife Research Center's breeding facility and trained ducklings to participate in underwater hearing tests in the center's dive tanks. Underwater threshold data obtained from two years of duckling cohorts suggest that these species share a common region of greatest sensitivity, from 1.0 to 3.0 kHz. An existing 3.0 kHz whale pinger may be successful in deterring the more acoustically sensitive species, though field testing and further product development is necessary. Additionally, based on the results of this study, sea duck underwater hearing sensitivities are within range of high intensity noise pollution generated from mid-frequency sonar, small vessel activity, and offshore drilling. The consequences of the overlap between sea duck sensitivity and multiple sources of underwater noise pollution are unknown, but could include disruption of normal biological behavior, masking, and physiological stress.

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Black terns in the northern Gulf of Mexico: initial observations from the Gulf of Mexico Marine Assessment Program for Protected Species [Avian Interactions with Offshore Energy Symposium]

The Gulf of Mexico (GoM) region is considered critically important to North America's migratory bird resources during some point of their annual life-cycle. Unfortunately, limited information is available regarding the species composition, distribution, and abundance of seabirds using the nearshore and offshore waters of the Gulf of Mexico even though the level of oil and gas (O&G) activity in this Region (in federal waters alone) exceeds all other BOEM Regions combined. Black terns (*Chlidonias niger*) are the only obligate marsh breeding terns native to the

New World. In combination with habitat loss in their breeding grounds in the Prairie Pothole Region, black terns are also susceptible to threats in the Gulf of Mexico (GoM) where they were lethally impacted by the Deepwater Horizon spill. We summarize preliminary findings on black tern distribution from the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS). From April 2017 – May 2019 we have conducted 233 days of vessel-based surveys on 13 NOAA cruises. Using standard, transect-based methodology we have amassed ~250 detections of ~ 2,000 individual black terns, making them the most numerous avian species observed during GoMMAPPS vessel surveys. Black terns were observed in spring, summer, and fall. Controlling for survey effort, apparent densities increased from spring through summer, peaking in fall. Across these seasons, high numbers were observed near the Mississippi River delta. Counts peaked during fall, and rare in the eastern GoM across seasons and occurrence was less common in the western GoM. We will describe the status of habitat models characterizing the association of black tern density with platforms and environmental features in space and time. The implications of high concentrations near the highly dynamic Mississippi Delta and exposure to areas with high O&G activity will also be explored and discussed. These data and results will be important to BOEM by informing National Environmental Policy Act analyses, Exploration Plans, Development Operations Coordination Document, oil spill risk assessment models, and to the USFWS for Section 7 consultations and planning of O&G activities in the Outer Continental Shelf to reduce or mitigate associated impacts.

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Using environmental DNA to detect secretive marsh birds

Recent degradation and loss of habitat has caused a decline in marsh bird populations. The Atlantic coast population of Eastern Black Rail (*Laterallus jamaicensis jamaicensis*) has shown alarming declines of more than 75% in parts of its range in the last 10-20 years. Consequently, the subspecies was recently federally listed as Threatened under the Endangered Species Act. Black Rails are difficult to detect due to their rarity, secretive nature, and use of visually concealing habitats. Auditory callback surveys, the most commonly used detection method, are time- and personnel-intensive, arguably distressful, and they do not detect unresponsive individuals. Using a molecular approach, detecting environmental DNA (eDNA) that has been shed from these birds in soil and water samples would provide an alternative, minimally-invasive test for the presence of these elusive marsh birds. To validate this method, we performed callback surveys for Black Rail at wetlands along the North Carolina coast, and collected soil and/or water samples at sites of positive detection. Positive detection samples were also collected from the vicinity of King Rail (*Rallus elegans*) nests found in the course of a study of the ecology and behavior of a breeding population at Mackay Island National Wildlife Refuge. Water samples were filtered to capture cell debris and any free DNA. DNA was extracted from samples using several commercially available kits to assess which provided optimal yield and quality. Extracted DNA was then analyzed for the presence of Black Rail or King Rail DNA using species-specific custom-designed primers and real time PCR. Using eDNA to detect secretive marsh birds would allow detections during the non-breeding season when rails are relatively silent. Improving detection will enhance our ability to monitor populations and inform management and conservation decisions. Moreover, eDNA methodology could be adapted for other water bird species and could be an important addition to the avian conservation tool box.

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Four decades of change for the American white pelican breeding colony on Gunnison Island, Utah [*Pelicans of the World Symposium*]

Gunnison Island in Great Salt Lake, Utah is home to one of the top five largest breeding colonies of American White Pelican (*Pelecanus erythrorhynchos*) within its North American range. Regional pelican populations appear to be doing well with the establishment and growth of nearby colonies leading to problems associated with the consumption of protected fish species by pelicans and the danger of potential bird-airplane collisions; however, recent drought and continued growth in water diversions within the Great Salt Lake basin threaten its pelican colony by turning Gunnison Island into a peninsula accessible by land-based disturbances. Beginning in 1972, three ground-based counts and subsequent aerial photographic surveys of the pelican population on the island now include 41 years of information recording a low of 5,210 breeding adults in 1973 and a peak of 20,270 in 1992. The latest

survey in 2019 resulted in the fewest breeding adults since 1981, potentially showing the impacts of documented land-based disturbance from remote camera traps. Based on May nest counts and late-July prefledgling counts, average productivity calculations from the last ten years estimate only 33% of the breeding pairs on Gunnison Island, brood and raise juveniles to prefledgling age. This rate is less than half the productivity of 69% based on data from an intensive ground survey from 1972-1974. While the reasons for the shifts in breeding numbers and productivity are complex, expansion and creation of impoundments for refuges and duck clubs since 1972, water flow to these wetlands and Great Salt Lake, and winter rotenone treatments in impoundments likely influence food availability during critical brooding periods of the American White Pelican. Research on diet analyses, West Nile Virus, heavy metals, and tracking efforts with the aid of leg bands, wing tags, and satellite telemetry may help explain recent population trends.

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No evidence for reproductive senescence in Common Terns

Late-life declines in reproductive performance have been reported in many bird species, but in a few species such declines could not be found despite intensive studies to advanced ages. We studied Common Terns (*Sterna hirundo*) at Bird Island, Massachusetts, USA, from 1986 to 2004. Our data set included 3,787 records of 2,064 individuals of known age (2–28 years old). We measured laying dates, clutch-sizes, egg masses and hatching success in almost all cases, and fledging success and productivity in 595 cases. We used Generalized Additive Mixed Models (GAMMs) in a Bayesian framework to analyze relationships between performance variables and age, laying date, body condition and other variables. All measures of breeding performance improved (earlier laying dates, higher values of all other parameters) monotonically with age up to at least age 23, without any signs of reversals among the oldest age-classes. Use of mixed models controlled for variations among individuals and years. Ages of mates were highly correlated, and mate age contributed to predictions of laying date. We found evidence for selective survival of early-laying birds, but not of birds with high productivity or other measures of individual quality. Our findings are similar to those reported for a population of Common Terns in Germany, and together suggest that this long-lived seabird may not experience reproductive senescence during its functional lifetime of ~25 years.

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How a persistent polar vortex impacts local population size in a sub-arctic breeding shorebird

Long-term studies of arctic-breeding shorebirds are rare, but valuable for understanding the effects of climate change on reproductive success and population trends. I studied demography of Semipalmated Plovers (*Charadrius semipalmatus*) over 27 years in the Churchill, Manitoba region. Several study areas in the Churchill region have been abandoned by breeding plovers and I used path-analysis to disentangle the potential reasons for these declines. Like many income breeders, dates of nest initiation are strongly determined by temperatures during June, their month of arrival on the breeding grounds. Annual variation in hatching success, chick survival and local breeding population size is relatively low. The strongest deviations in the size of local breeding populations, laying dates and chick survival are from low temperatures in June or July. A threshold of about 5°C during June results in population sizes less than 50% of the long-term average, and a threshold of 7°C during July results in very low chick survival. The path analysis results suggest that local population size is primarily determined by weather in June through its impacts on nest initiation dates. Lower temperatures result in later nesting dates and, as a result more individuals either avoid breeding by moving away and skipping a year, or die. Thus, depressed local breeding populations in recent years are likely due to the presence of a persistent polar vortex that concentrates in Western Hudson Bay during late May and early June. This weather pattern has been linked to warming water temperatures in the Gulf of Mexico.

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Bayesian integrated population models for the effects of climatic change on the demography of migratory birds [*Pelicans of the World Symposium*]

Migratory birds manifest unique life history strategies compared to non-migratory birds. Facultative migrants skip migrations depending on endogenous and exogenous conditions. Consequently, facultative migrants may exhibit demographic variation in their annual life-cycle stages. However, how facultative migrants change their demographic traits under different climates between wintering and nesting grounds still remains unclear. American white pelicans (*Pelecanus erythrorhynchos*) are facultative migrants during spring. We aimed to determine the effects of seasonal temperature and precipitation on the nest success and age-specific survival probabilities at Chase Lake, North Dakota. We analyzed banding and live encounter data and nest count data in Chase Lake from 1960 to 2014. We classified ages into hatch-year pelicans (0 to 1 year old), yearlings (1 to 2 years old), and adults (≥ 2 years old). We built Bayesian integrated population models by linking mark-resight-recovery models with state space models of nest counts. We found substantial variation in nest success of pelicans, intermediate variation in survival of hatch-year and yearling pelicans, and relatively stable survival of adult pelicans from 1960 to 2014. Increases in summer precipitation reduced survival of hatch-year pelicans. High water levels from heavy rains at Chase Lake may disturb pelican nest sites. The precipitation-induced disturbances could increase mortality of nestling pelicans before fledging. Cold temperatures in winter decreased survival of hatch-year and yearling pelicans. Hatch-year and yearling pelicans with small body size could be more susceptible to severe cold temperatures during winter than adult pelicans with large body size. Neither temperature nor precipitation influenced variability in adult survival or nest success probability of pelicans. However, survival of adult pelicans was inversely related to nest success probability. The inverse relationship of the demographic parameters may indicate the trade-offs of demographic traits between adult pelican survival and reproduction. We conclude that survival of hatch-year and yearling pelicans could be more susceptible to changes in climate than that of adults. Additionally, adult pelicans may exhibit trade-offs between survival and reproduction to optimize their life-time fitness.

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Genetic Diversity and population structure of Dalmatian Pelicans (*Pelecanus crispus*) in Turkey [*Pelicans of the World Symposium*]

Dalmatian Pelicans (DP) used to be an Endangered species in Europe and in Turkey, listed as VU in the IUCN RedList. The species used to be a widespread species throughout its range both across in Europe, and in Turkey, but underwent a large decline between 60s and 80s mainly due to drainage of wetlands, disturbance, predation, decreased fish stocks, and even pollution. Until the 1990's, approximately 473-763 pairs were breeding in Turkey at 20-25 sites and there remained only four active breeding colonies with an estimated breeding population of between 100-125 pairs only. Conservation studies and color ringing studies have initiated and the breeding population of the species has increased up to 490-550 breeding pairs today. Ringing recoveries have indicated a partial overlapping dispersal, pattern but no meta-population structure was confirmed, disallowing us the make accurate inference on the existing population structure. Besides, relatively large increase from a very small population leads significant doubts for the health statues and the continuity of the remaining population. Genetic diversity and population structure of Dalmatian Pelicans has been studied in its entire distributional range in Turkey during between 2014 and 2016. The species was sampled by using a non-invasive method (n=92). Genetic variation, polymorphism and possible gene flow were investigated by using microsatellite loci and Mitochondrial DNA analysis. Allele diversity, heterozygosity, Fixation index (F_{st}) values were investigated and calculated. Out of nine identified microsatellite loci in American White Pelican (*Pelecanus erythrorhynchos*), six of them successfully worked in DPs. Among the studied loci, Pel-221 was monomorphic, Pel-175 and Pel 188 had two alleles, Pel-207 and Pel-190 had three, Pel-265 had four alleles. We have found no significant differences in allele frequency in different breeding grounds and the expected heterozygosity (H_e) was found more than the observed (H_o) heterozygosity. Obtained evidences indicate strong deviations from "Hardy-Weinberg equilibrium" in most cases (except Pel 190 locus), which points out micro evolution. F_{st} values were very low and statistically were not different from zero, indicating that different

breeding populations were genetically identical. A gene flow was identified between different breeding sites which indicate a meta-population structure. Very poor genetic diversity indicates the founder effect and the development of a bottleneck population. Very poor genetic diversity may impose “significant threats/risks” for DP in TR against possible changes environmental factors and the species needs to be monitored in its entire breeding and wintering range.

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Tracking Semipalmated Sandpiper migration from Jamaica Bay, NYC

Jamaica Bay Wildlife Refuge, New York, NY, USA, is a 21,000-acre urban estuary along the Atlantic Flyway situated in the most densely populated city in the United States. Every spring and fall, large numbers of *Calidris pusilla* (Semipalmated Sandpipers) stop in Jamaica Bay to refuel during their long-distance migration to and from their wintering and breeding grounds. In order to understand how this urban stopover site fits into their annual migration and whether it is providing the necessary resources, we tracked long-distance movements using NanoTags, small radio transmitters (0.67 g) that emit signals stored on receivers in the Motus Wildlife Tracking System. We banded and tagged 38 birds (n = 19 in 2017; n = 10 in 2018; n = 9 in 2019) at two locations in Jamaica Bay during spring migration. 27 birds were detected continuing on their spring migration and 15 were detected during fall migration. While none were detected during the breeding season, one bird was detected in the fall flying from Massachusetts, USA to French Guiana, South America. The results indicate that Semipalmated Sandpipers stopping in Jamaica Bay in spring are able to successfully continue to their breeding grounds, and that the resources they find in Jamaica Bay need to be high quality. They also demonstrate that there is a large degree of variability in the migratory routes of individual birds in both spring and fall, and highlight the need for more information about breeding and wintering locations of the Eastern population of Semipalmated Sandpipers.

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Migration of American White Pelicans in Central Coast of Veracruz [*Pelicans of the World Symposium*]

The Central Coast of Veracruz witness one of the largest raptor migration in the world, as well as an important aquatic bird migration of American White Pelicans, Wood Storks, and Aninhhgas. Since 1994 the Veracruz River of Raptors watch site monitors the largest worlds known concentration of migratory raptors, registering also a huge amount of other aquatic and terrestrial birds, as well as dragonflies. Every year, the Pronatura team reports an average of 4.5 million migratory raptors, plus an average of 600,000 aquatic birds (Ruelas *et al.*, 2009). The monitoring protocol, adapted from the Hawk Association of North America, includes two count sites, one located in the Chichicaxtle Municipality of Puente Nacional and the other one located at Cardel, La Antigua Municipality in Veracruz, México. In this work, we report data for Migratory American White Pelicans or the two stations in central Veracruz collected from 1999 to 2018. This dataset representing 24 years of data constitutes a total effort of 4,320 days of monitoring in both stations (Pronatura Veracruz –River of Raptors Database). Every year, an average of 79,911 American White Pelican migrate through the coast of Veracruz (CCV). Population numbers change noticeably over the years, with a maximum of 139,885 individuals in 1998 and the lowest 22,141 in 2010. The Coastal Monitoring Site (Cardel = 47,699 / year) reports more birds than the station inner land at (Chichicaxtle = 30,748). We present the timing of migration, differences on migration regarding the time of the day, wind direction and wind velocity, as well as the variation of size of the flock. We comment on the habitat situation and main threats to migratory American White Pelicans during his migration flight in Central Coast of Veracruz.

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Dispersal and apparent survival by sub-adult Herring Gulls from urban and island colonies in the Gulf of Maine [*Urban Gull Symposium*]

Larus argentatus (Herring Gull) is a long-lived colonial-nesting seabird, where first breeding generally occurs between the third and fifth year. Little is known about the movements and habitat selection of this species during the pre-breeding sub-adult phase. We studied off-colony resight locations of color-banded sub-adult Herring Gulls hatched on three colonies across the Gulf of Maine, where this species is in population decline. Our northernmost site, the largely undisturbed Great Duck Island was 170 km NE of our roof-top nesting colony in Portland, which was 80 km N of the semi-disturbed colony on Appledore Island. In 2011-2019, we received resightings of 461 birds ranging from 34 to 2,572 days since banding (mean \pm SD = 555 \pm 492). The interaction between resight year and natal colony best explained variation in dispersal distance. Mean dispersal distance increased with latitude, where dispersal distances by Portland and Great Duck Island birds were 1.6 and 4.2 times, respectively, greater than Appledore Island hatched birds. Nonetheless, while dispersal distances varied, the three populations generally overlapped along the East Coast of the United States; 61% of all observations were concentrated between the Delaware Bay and the New Hampshire coast

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Avian Risk Reduction Technologies for Offshore Wind – Overview, Considerations, and a Path Forward [*Avian Interactions with Offshore Energy Symposium*]

Avian detection, deterrent and integrated detection-deterrent/detection-minimization technologies offer a promising avenue for reducing the potential biological impacts of offshore wind farms to birds. There are multiple systems in various stages of testing and implementation at operational wind facilities in North America and globally. Evaluation of these devices has primarily focused on examining their effectiveness in terms of direct (i.e., ability to detect, identify, and/or deter) and indirect (i.e., influence on observed fatality rates) capabilities, with varying results. Scientific support for the effectiveness of different systems has also differed substantially in terms of study robustness and level of third-party peer-review evaluation. While there is widespread recognition that the biological effectiveness of such devices needs to be established prior to commercial deployment, far less attention has been paid to the non-biological parameters that require evaluation. Many devices are offered for sale with little more than the vendor's assurance that they can be integrated into wind farm operations, and there is no guidance available regarding the operational implications or feasibility of using risk reduction technologies at individual wind farms. As an independent, third-party reviewer, DNV GL has assessed hundreds of operational wind facilities across the globe and has had the opportunity to interact extensively with wind energy developers and operators, regulatory agencies, and the avian conservation community. These interactions have resulted in a holistic approach that considers the effectiveness and integration of various project components from an ecological, engineering, and energy production standpoint, with the ultimate goal of identifying optimal solutions that will minimize impacts to birds while addressing climate change through the promotion of renewable energy. In this session, we will review the numerous aspects of risk reduction devices that regulatory agencies, wind energy developers and operators, and the avian conservation community should consider prior to promotion or installation. Aspects to be discussed will include evidence for direct and indirect effectiveness in reducing risk to shorebirds, seabirds, raptors and migratory songbirds, as well as operators' concerns such as supply and service chain, instrumentation standards, network and SCADA integration, and security.

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Unraveling the long-term demographic effects of early-life exposure to invasive prey

Conditions during early development may influence key biological and behavioral processes that affect individual organisms over long time periods and can feedback to influence population dynamics. Silver spoon effects occur when an individual reared in favorable conditions incurs benefits, with outcomes that may influence juvenile survival, adult morphology, and long-term fitness. For the critically endangered Snail Kite, recently-observed increases in survival, reproduction, and population size have been linked to invasion of wetlands in the southeastern US by an exotic snail. We sought to investigate mechanisms for potential silver spoon effects in Snail Kites and to understand the extent to which the snail invasion may affect survival and components of reproductive fitness on an individual level. We collected body measurements and conditions at the natal wetland for 4055 fledgling Snail Kites produced between 1996-2019. We monitored key breeding wetlands and recorded subsequent breeding attempts and breeding success for each individual. Birds that fledged from wetlands with invasive snails were heavier than birds that fledged from wetlands without invasive snails. Juvenile survival was notably higher for birds that were heavier at fledging, and the effect carried over into adult survival, indicating a silver spoon effect that diminished slightly with age. Our results highlight how early-life exposure to invasive prey can have long-term effects on an endangered bird, and point to individual condition at fledging as a key indicator for habitat quality.

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Estimating hatching and fledging success of Common Terns at an environmental restoration site

While environmental restoration projects are often lauded as providing habitat for wildlife, rarely is sufficient monitoring conducted to determine if these sites actually have the desired effect. One of the nation's largest environmental restoration projects is the Paul S. Sarbanes Ecosystem Restoration Project at Poplar Island, which uses clean dredged material from the approach channels to the Port of Baltimore to restore and supplement eroded remote island habitat in the Chesapeake Bay. The loss of this remote island habitat, once prevalent in this area, is believed to be a primary driving factor behind dramatic regional reductions in breeding waterbird populations. While the project is ongoing, Poplar Island has already successfully attracted over 30 species of waterbirds to breed at the site, including one of the only known Common Tern breeding colonies in the Maryland portion of the Chesapeake Bay. However, due to low breeding success of Common Terns on Poplar in the early 2000's, there have been concerns about the viability of this population. To address these concerns, we have studied hatching success and collected mark-recapture data to better understand fledging success of chicks hatched on the island.

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Occupancy modelling of some common birds along a pollution gradient in river Yamuna: Conservation monitoring in urban landscapes of Delhi, India

The challenges posed by increasing urbanization and pollution to riparian bird habitats in urban areas can be effectively dealt by incorporating ecological knowledge with habitat variables. In a study of bird occupancy of the river Yamuna passing through Delhi, North India, a total of 71 species were recorded from 176 sampling locations. The occupancy parameter (Ψ) was estimated for 22 common, resident species. The coefficients showing the relationship of species occupancy with habitat variables viz. physico-chemical characteristic of water (dissolved oxygen, pH, Total dissolved solutes), solid waste, % amount of vegetation and presence of humans in each sampling site were estimated for 16 species. The results suggest that Little Grebe (*Tachybaptus ruficollis*), The Great Cormorant (*Phalacrocorax carbo*), Pond Heron (*Ardeola grayii*), Grey Heron (*Ardea cinerea*), Grey Headed Swamphe (*Porphyrio poliocephalus*), Common Coot (*Fulica atra*), Common Moorhen (*Gallinula chloropus*) are negatively associated with the Total Dissolved Solids but positively related to occupancy of Blackwinged Stilt (*Himantopus himantopus*). The peculiar activity of these birds may be due to availability of easy food (prey) in such waters. However, further studies are required to identify birds in relation to the foraging energetics as well as availability of food in polluted areas. For River Yamuna, estimates of Ψ for various species can form a baseline to study the future trends.

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Piping Plover population change in a hurricane affected population and the relation to constructed nesting habitat

Understanding the effects of large-scale disturbances and anthropogenic changes on imperiled species can be important to improving management actions. In October 2012, Hurricane Sandy storm surges cleared vegetation throughout a barrier island, Fire Island, New York, creating Piping Plover (*Charadrius melodus*; plover) nesting habitat. Storm effects also prompted an island-wide stabilization project. Given that island stabilization may negatively affect new plover habitat, restoration areas were created to mitigate that loss. Since plovers in New York appear to be habitat limited, we expected to see positive population growth following habitat creation. We developed an integrated population model that incorporated breeding pair counts, nest success, and mark-recapture data to assess the effect of restoration areas on the constituent demographic processes (e.g., reproductive output, adult survival, site fidelity) that determined plover population growth during 2013–2018. We observed positive population growth in three of five years ($\bar{\lambda}=1.12$), and immigration ($r=0.93$) and reproductive output were correlated ($r=0.74$) with population growth. Chick survival was higher in restoration areas, although nest survival and site fidelity were lower at these sites. The combination of higher chick survival and lower nest survival in restoration areas resulted in reproductive output similar to the whole study area, and population growth for the restoration area was also similar to the rest of the study area ($\bar{\lambda}=1.09$). Restoration areas contributed 5–9% of the total natal recruits breeding in the population, and 6–10% of the adults remaining in the population, which was similar to what could be expected from based on proportional study area length (7%). In the short term, restoration areas seem to mimic natural plover habitat, but vegetation removal may be needed to maintain habitat suitability. Efforts to improve immigration, primarily by habitat creation or maintenance, is likely to have the greatest local effect on population growth. Management to improve reproductive output is also likely to have a positive local effect on population growth if there is suitable habitat to support recruits, and may have the greatest effect on regional populations with vacant habitat.

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Inter-Annual Variations in Bird Distribution, Density and Flight Activity over Two Years of New York Bight Survey Data [Avian Interactions with Offshore Energy Symposium]

Offshore wind energy is poised to become a major source of affordable, renewable power for New York State. New York is supporting the development of 9,000 megawatts of offshore wind energy by 2035, enough to power up to 6 million homes. Committed to responsible siting of offshore projects, New York State Energy Research Development Authority (NYSERDA) has identified data gaps for the Offshore Planning Area (OPA), including various ecological aspects of the New York Bight. To better understand the use of the OPA by birds, marine mammals and turtles, NYSERDA contracted Normandeau Associates Inc., teamed with APEM Ltd., to provide seasonal aerial digital surveys of the area over a 3-year period. These surveys provide snap shots of the use of the ocean space by birds as well as marine mammals, turtles, cartilaginous and bony fish, and fish shoals visible from surface, providing a wealth of new publicly available information on these animals. Two years of data collected on the use by birds of the New York offshore space have been analyzed and changes in inter-annual patterns of activity are evident. These include shifts in distributions and densities as well as species relative abundance, flight activity and flight heights, all of which provide insights into relative sensitivity to offshore wind among species. We explore how this new information could be used to inform decision making and risk assessments for offshore wind development, discuss the benefits of longer-term data sets, and describe how spatial patterns have changed over the course of two years of surveys.

[89] Rosser, T. Graham¹, King, D. Tommy², Woodyard, Ethan T.³, Baumgartner, Wes A.³, Griffin, Matt J.³

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A review of metazoan parasites of the American White Pelican *Pelecanus erythrorhynchos* [Pelicans of the World Symposium]

In North America the American White Pelican *Pelecanus erythrorhynchos* remains a fascination of ornithologists, but also parasitologists as they are host to a diverse population of metazoan parasitic organisms. For >120 years, researchers have endeavored to discover, characterize and understand the parasitic organisms living on and in *P. erythrorhynchos*. Today this list consists of c.80 reported species within the major groups of parasitic organisms: trematode and cestode flatworms, parasitic nematodes, acanthocephalans, parasitic arthropods, and a single parasitic protozoan. While this work is chiefly concerned with the systematics and ecology of the parasitic organisms themselves, some accounts exist reporting their pathogenicity in *P. erythrorhynchos*. However, the majority of these reports are based on opportunistic sampling and many of the host-pathogen interactions between *P. erythrorhynchos* and its parasites remain understudied. The migration of *P. erythrorhynchos* expands the geographic localities in which their parasites can be found, especially those with indirect life cycles and if suitable intermediate hosts are present. Along their migratory flyways, these birds acquire and disseminate parasitic stages as they forage for food. In the southeastern USA, pond-raised ictalurid catfish serve as hosts for several trematode parasites introduced by *P. erythrorhynchos*. Consequently, both pelicans and their parasites remain a source of economic hardship for catfish producers and an area of active research interest. Some of their trematodes and nematodes are of importance in human health, being potentially associated with cercarial dermatitis (swimmer's itch) and gastrointestinal anisakiasis, respectively. Aside from their direct impacts on their host, some of these parasites are candidates as bioindicators of a healthy ecosystem by their presence. This presentation will focus on highlighting current knowledge and future advancement of the study of metazoan parasites in *P. erythrorhynchos*.

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Elucidation of the life cycles and diversity of trematode parasites of the American White Pelican *Pelecanus erythrorhynchos* impacting catfish aquaculture in Mississippi USA [Pelicans of the World Symposium]

Pond-raised ictalurid catfish are the most extensively grown freshwater food fish in the United States and represent an important economic market in the southeastern USA. Piscivorous birds utilizing these ponds remain a challenge to catfish producers due to direct losses by predation and indirect losses due to fish-borne trematode parasites. The cyclical development of these parasites involves morphologically informative adult stages of trematodes in the avian definitive host, larval cercariae emerging from invertebrate molluscan hosts and metacercariae encysting in fish or amphibians. Management of trematode infections in pond-raised fish continues to present a challenge as their life cycles and the hosts involved remain understudied. As part of a larger survey of trematodes in piscivorous birds, American White Pelicans *Pelecanus erythrorhynchos* ($n = 12$) were lethally collected from the northeastern catfish farming region of Mississippi. Birds were necropsied and live trematodes were collected and archived for morphological identification and molecular characterization. Simultaneously, potential snail intermediate hosts, *Biomphalaria havanensis*, were collected from catfish production ponds and examined for trematode infections. Cercarial stages shed by infected snails were used in infection trials with fingerling channel catfish *Ictalurus punctatus*. Histopathological analysis of catfish tissues at defined timepoints was used to document pathological changes associated with the metacercarial development. Adult trematodes collected from *P. erythrorhynchos* were stained, morphologically identified, and representatives of each species were molecularly characterized by sequencing of key ribosomal DNA (internal transcribed spacer regions and 28S rRNA) and mitochondrial DNA

(cytochrome *c* oxidase subunit 1) gene targets. Similarly, rDNA and mtDNA from trematode larval stages were also sequenced and compared to the morphologically identified adults to identify putative life cycles. Through these efforts we have completed elucidated the life cycles of three diplostomid trematodes in the American White Pelican, establish two novel species and confirm the channel catfish as susceptible to infection with two of these species. These results highlight the importance of developing integrated pest management plans for targeted exclusion of the bird final host through harassment regimes and eradication of the snail hosts.

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Using near real-time nighttime light imagery to locate existent seabird exposure to active oil and gas extraction [Avian Interactions with Offshore Energy Symposium]

Assessing wildlife exposure to human activities demands access to information on animal distribution and/or habitat use, and on the distribution of threats. Recently, wildlife tracking studies have become ubiquitous and provide data on movements and connectivity at national and international scales, often with hourly to daily temporal resolution. Nevertheless, while trying to determine exposure to marine threats, seabird researchers are often impaired by the scarcity of datasets available on human activities in the marine environment. In the case of oil and gas (O&G) exploration and extraction, access to geographic information is often delayed or restricted due to security concerns at national levels, hindered by the lack of continuity and consistency in local databases, or regarded as commercial confidential information. When available, these databases often lack the temporal resolution that would allow for specific risk exposure. For example, in the U.S., the Bureau of Ocean Energy Management maintains a database of O&G structures in federal waters but is unable to provide such specific information as platform lighting and flaring; in Colombia, the National Hydrocarbon Agency provides up-to-date information on platform location but lacks information on activity; in Mexico or Venezuela, access to GIS datasets is not granted to outsiders. A way to circumvent these obstacles is to use near real-time nighttime light imagery to locate lighted platforms and flares. NOAA's Earth Observation Group (EOG) has launched an effort to classify artificial lighting observed by satellite. Through a multispectral analysis of day/night bands, the EOG Visible Infrared Imaging Radiometer Suite is able to distinguish artificial lights and classify them as boats, platforms, or flares. We present two case studies for which we used EOG's classification to locate active oil and gas platforms: risk modelling for Brown pelican (*Pelecanus occidentalis*) in the Gulf of Mexico, and a preliminary analysis of threat exposure of Black-capped petrel (*Pterodroma hasitata*) in the Caribbean Sea. EOG's dataset allowed us to determine which platforms in U.S. state and federal databases were active at the time of study; locate platforms in Mexico and Venezuela; and confirm the activity of platforms in Colombia.

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Modelling the nesting habitat of the endangered Black-capped Petrel to inform regional conservation actions in the Caribbean

The Black-capped Petrel (Diablotin, *Pterodroma hasitata*) has a fragmented and declining population estimated at ca. 1,000 breeding pairs. Black-capped Petrels nest underground in steep ravines with dense understory vegetation. Until 2017, the only confirmed breeding sites were located in the mountain ranges of Hispaniola, where habitat loss and degradation are continuing threats. Radar searches led to the discovery of a previously undetected nesting area in central Dominican Republic, and highlighted suspected nesting areas in Dominica. Other nesting populations may still remain undiscovered but, to locate them, laborious in situ nest searches must be conducted over expansive geographical areas. To focus nest-search efforts more efficiently, we modeled suitable nesting areas for Black-capped Petrel using openly available environmental datasets. We used a logistic regression model to compare the habitat characteristics of active Black-capped Petrel nests sites with those of potentially available (i.e., random)

sites. We then applied generalized linear models with binomial logistic structure to the environmental variables that showed a significant relationship with petrel nesting activity. Finally, we computed the habitat suitability model by weight-averaging the top-performing models on the basis of Akaike's Information Criterion. In a GIS framework, we created suitability maps for Hispaniola and for the whole Caribbean region. On Hispaniola, the model highlighted possible nesting areas for Black-capped Petrels in habitats not previously considered suitable: coastal foothills in northern Haiti and the southern Dominican Republic. In contrast, areas in the central Dominican Republic that were thought to be suitable for petrels were not highlighted by the model. Based on model results, we estimated the total the area of suitable nesting habitat for Black-capped Petrels on Hispaniola; we calculated that this area had greatly decreased between 2015 and 2018, primarily due to deforestation. Nevertheless, our model identified possible nesting habitat in mountains of southeastern Cuba, Jamaica, Dominica and Saint Vincent, in areas where threats of deforestation are less severe.

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Life on the edge: density and demography of marsh wrens and seaside sparrows in northeastern Florida

The Worthington's Marsh Wren (*Cistothorus palustris griseus*) and MacGillivray's Seaside Sparrow (*Ammospiza maritima macgillivrayi*) are saltmarsh specialists that have experienced severe range contractions and population declines in Florida over the past 50 years. We studied habitat selection and demographic rates during 2014–2017 in northeastern Florida saltmarshes dominated by smooth cordgrass (*Sporobolus alterniflorus*) and black needlerush (*Juncus roemarianus*) to better understand factors contributing to declines of both species. Nest survival for both species was low (wrens: 0.10, 95%CI: 0.04–0.18; sparrows: 0.03, 95%CI: 0.00–0.10), with high tides associated with the lowest survival rates for both species and habitat features at the nest site influencing survival for sparrows. Despite the influence of tides, we observed little evidence of direct nest loss via flooding and it appears high tides may in part influence predation. Marsh wren post-fledging survival was also low (0.10, 95%CI: 0.01–0.37) which when combined with nest survival estimates for the species suggests low overall productivity for the population. Nevertheless, the density and range of occupancy for both species were similar to those reported for the same population in 2000–2001, which indicates that either adult survival for these nonmigratory populations is high, or that immigration from outside the study area is substantial. Tall smooth cordgrass was particularly important to the birds: wren occupancy, abundance, nest-site selection, fledgling habitat selection, and post-fledging survival were all positively associated with tall spartina, as was sparrow abundance and nest-site selection. Our results suggest that protection and creation of saltmarsh with a high proportion of tall smooth cordgrass and of sufficient elevation to protect nests from high tide nests is warranted.

[94] Schweitzer, Sara H.¹, Addison, Lindsay M.², Johnson, Carmen M.³, Jennings, Nicholas M.⁴, Doane, Rebecca³, Hare, Lauren J.⁵, Kirse, Nathan P.⁵, and Lammers, Mark C.⁵

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Proliferation of pelicans: abundance and distribution of the Brown Pelican in North Carolina over three decades [Pelicans of the World Symposium]

Although the Brown Pelican (*Pelecanus occidentalis*) had not been an abundant species in North Carolina historically, reports mention relatively low numbers of nests (2-8) and juveniles (50-85) in the early 1960s at only a few sites. Beginning in the late 1970s and early 1980s, the species experienced a population increase and range expansion in the state. During the 1970s, James Parnell and his students at the University of North Carolina – Wilmington worked with the U.S. Army Corps of Engineers to manage and protect dredged-material islands for colonial-nesting birds. Previously, dredged material was placed on islands and beaches during all seasons without regard to habitat needs of colonial waterbirds. Coast-wide surveys of colonially-nesting waterbirds in North Carolina began in 1977, and to date, there have been 13 surveys conducted. Although data indicate an increase in numbers of nesting Brown Pelicans (5,455 nesting pairs recorded in 2017), data have not been analyzed quantitatively or spatially. We suspect pelicans increased as islands were managed for habitat characteristics and protected from

disturbance. We used analytical tools of ArcGIS to assess the change in abundance and distribution of the Brown Pelican over time in North Carolina and determined factors that assisted this increase in the population. We will use these results and identification of factors leading to the success of the Brown Pelican to plan future management of dredged-material islands in North Carolina, especially considering expected impacts of climate change and sea level rise. Our ability to manipulate dredged-material islands likely will provide important future habitat for Brown Pelicans as well as many other colonially-nesting waterbirds.

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Digital video aerial surveys of red-throated loon: a European case study linked to offshore wind farms *[Avian Interactions with Offshore Energy Symposium]*

The Outer Thames Estuary Special Protection Area (SPA) is a European protected site near London, England, designated in 2010 due to the importance of its wintering red-throated loon *Gavia stellata* population. In 2010 the site was estimated to hold 6,466 individuals on the basis of visual aerial surveys. Aerial surveys using digital imagery in January and February 2013 resulted in a revised peak population estimate of 14,161 individuals. A survey, completed in early 2018, used high resolution digital video imagery and resulted in a peak population estimate of 22,280 birds. Spatial analysis of the data also showed loon displacement due to shipping activity and offshore wind farms.

[96] Sheehan, Kate L.^{1,3}, Hunter, Alexandria², Bengston, Erik³, Thurston, Nickolas⁴, Spicer, Greg S.⁴, Hechinger, Ryan F.³

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Quill Feather Mite Infection and Feather Distribution on Shorebirds

Quill feather mites use the inner feather shaft of bird hosts as habitat. How these ectoparasites are distributed on the wings of their hosts can vary among and between host species. Here, we document the infection patterns of quill feather mites of Least Sandpipers (*Calidris minutilla*) and Western Willets (*Tringa semipalmata inornata*) from California. Two species of quill feather mites were documented on *C. minutilla*, *Eurysyringobia mauri* and *Sikyonemus minutillae*. Infections on *C. minutilla* tended to be more common in the primary flight feathers (54% prevalence) and primary coverts (28% prevalence) than the secondary flight feathers (11% prevalence); however, infection intensity was higher on primary (6.6) and secondary (2.6) flight feathers compared to coverts (0.67). Along a feather tract, infections were most common in proximity to the wrist. One species of mite was observed in feathers of *T. semipalmata*: *Syringobia chelopus*. Infection prevalence was highest in primary flight feathers (39%) and lowest in primary coverts (12%). Infections were again most likely to occur in feathers in close proximity to the wrist of willets. In addition to distribution patterns, we investigated the differences in morphology among feathers to test for preferred habitat characteristics for quill feather mites. In the sandpiper, infected feathers had a smaller diameter compared to uninfected flight feathers. Infection status of neighboring feathers of *C. minutilla* influenced likelihood of infection prevalence and the abundance of mites within a given feather quill. In the willet, infected quills had a larger internal diameter when compared to uninfected feathers. When a neighboring feather was infected on the same tract, infection likelihood was significantly greater; however, this trend disappeared when neighboring feathers of other tracts were also considered. With larger sample sizes and a broader survey of host taxa, we can better understand some of the ways that feather quill mites disperse on waterbirds. These trends could be useful in predicting feather infections of museum specimens that could be the subject of historical comparisons of host-parasite interactions.

[97] Shlepr, Kate R.^{*1}, Evans, Betsy A.¹ and Gawlik, Dale E.¹

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Testing the effect of non-native fish on wading bird productivity in the Everglades, USA: The Good, the Bad, or the Ugly?

Since the 1950s, an increasing number of non-native fish species have established in the Everglades, USA, partly as a byproduct of water management. Non-native fish have different habitat requirements and exhibit unique behaviors which alter fish community composition and placement across natural wetland and urban landscapes. These landscape changes may in turn affect the foraging behavior and diet of piscivores, e.g. wading birds. Furthermore, by chance, non-native fish species may provide superior or inferior quality nutrition to predators compared to native fish species. Our study assessed whether the prevalence of non-native fish in the diet of a threatened wading bird species, the Wood Stork (*Mycteria americana*), had a positive, negative, or neutral effect on nest-level reproductive success. We collected diet and productivity data at three natural wetland and three urban colonies in southeast Florida during breeding seasons, 2014-2018. We then created generalized linear mixed models (GLMM) and used Akaike information criterion model selection to test whether the amount of non-native fish in diet (per nest) explained nestling body condition (keel score) and productivity (fledglings per nest). On average, non-native fish constituted 19% of prey biomass (range: 2-58%; n=94) in stork diet samples from natural wetland colonies and 9% of prey biomass (range: 0-22%; n=120) in stork diet samples from urban colonies. GLMM models showed there was no effect of non-native prey on either reproductive success metric, suggesting that non-native fish are likely a neutral driver in Wood Stork population trends in the Everglades. These findings are consistent with results from a parallel study on small herons (Little Blue Heron *Egretta caerulea*; Tricolored Heron *E. tricolor*; Snowy Egret *E. thula*) nesting in colonies with storks in southeast Florida. Future research will test the hypothesis that prey quantity, not quality, drives nest-level wading bird productivity in the Everglades. This study fills an important knowledge gap in the management of non-native fish and their federally protected wading bird predators in the context of the Comprehensive Everglades Restoration Plan. More broadly, our findings inform decisions on invasive species control when the resources to conduct conservation actions are scarce.

[98] Spelt, Anouk*¹, Williamson, Cara¹, Shamoun-Baranes, Judy², Shepard, Emily L.C.³, Rock, Peter¹, Windsor, Shane P.¹

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Life in the city: Habitat use of urban-nesting lesser black-backed gulls during the breeding season [Urban Gull Symposium]

Increasing urbanisation negatively affects animal populations worldwide but could be advantageous for others. Many species are able to adapt to urban environments resulting in an increase in abundance of wildlife in cities such as foxes, badgers, leopards and bears. Gulls are an example of a bird species that has adapted effectively to urban environments. Urban-nesting populations of gulls have undergone rapid population increases worldwide which are possibly due to abundant food sources, predator-free nesting sites, warmer temperatures and lower costs of flight. This increase in gulls in cities has resulted in an increase in human-gull conflicts with problems ranging from aggression and noise to possible health hazards. In order to inform management and conservation decisions in relation to these growing populations, more information is needed about the behaviour of these birds in urban settings and how they utilise their environment. This study combined Global Positioning System (GPS) tracking data of 12 urban-nesting lesser black-backed gulls (*Larus fuscus*) with high-resolution habitat and behaviour data over three breeding seasons (2016–2018). Despite the proximity of marine areas (~10 km), the birds only made significant use of terrestrial environments, spending two-thirds of their time away from the nest in suburban and urban areas, and one-third in rural green areas. The gulls utilised suburban and urban areas more and changed their time-activity budgets as the breeding season progressed and their chicks grew. They also appeared to use diverse foraging strategies to suit different habitats. Overall, this study supports the view that gulls are generalist opportunistic foragers, taking advantage of a wide variety of food sources. The results indicate that the range of potential foraging areas available needs to be considered in management decisions and that urban bird populations may not use the resources they are expected to.

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Mesopredator Release by Removal of a Top Carnivore Affects Best Management Practices for an Endangered Shorebird

Management of predators to benefit endangered species can be complicated by interactions among predator species. Lethal removal of top predators may result in mesopredator release, leading to unchanged or even increased predation levels by intermediate predators after management. Moreover, lethal predator removal can be costly and controversial, and the effectiveness therefore needs to be better understood. We examined the interactions between two common nest predators of the federally-threatened piping plover (*Charadrius melodus*), red fox (*Vulpes vulpes*) and mink (*Neovison vison*), and the relationship between nest predation rates and red fox and mink presence on beaches in New Jersey, 2015-2017. The average probability of mink occupancy in a beach plot was higher when red foxes were absent (0.242 ± 0.052 SE) than when they were present (0.039 ± 0.026). Daily nest predation was similar at sites with (0.45 ± 0.11 SD) and without foxes (0.43 ± 0.10) for nests not protected by predator exclosures, but predation rates were higher for exclosed nests at sites without foxes (0.20 ± 0.08) than sites with foxes (0.06 ± 0.04). Furthermore, daily nest predation was similar for unexclosed nests at sites with mink (0.38 ± 0.13) and without mink (0.44 ± 0.14); however, nest predation rates for exclosed nests was 83.9 percent higher when mink were present than when mink were absent. These findings underscore a growing need to evaluate the effectiveness of predator management programs, and the potential interactions among predators, for species of concern.

[100] Stenhouse, Iain J.¹, Alicia M. Berlin², Andrew T. Gilbert¹, M. Wing Goodale¹, Carrie O. Gray³, William A. Montevecchi⁴, Lucas Savoy¹, Caleb S. Spiegel⁵

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Assessing spatial use by three diving bird species on the U.S. Atlantic Outer Continental Shelf: Potential exposure to offshore wind developments [*Avian Interactions with Offshore Energy Symposium*]

Extensive wind energy potential exists in offshore waters of the United States (U.S.). While few offshore turbines have been constructed in the U.S. to date, many large-scale developments are being planned, which have the potential to affect marine birds. This is particularly true off the Atlantic coast, where the first offshore wind facility became operational in 2016, and a number of developers hold additional leases and are actively planning construction. To determine spatial and temporal use and movement patterns, we tracked diving bird species, identified as vulnerable to offshore wind development – the Surf Scoter (*Melanitta perspicillata*), Red-throated Loon (*Gavia stellata*), and Northern Gannet (*Morus bassanus*). We captured 239 adults, primarily in bays and near-shore waters from New Jersey to North Carolina, between 2012 and 2015. Individuals were fitted with satellite transmitters and tracked. An additional 109 Surf Scoters, and 38 Northern Gannets tagged as part of other studies were integrated in our analyses. Tracking data were analyzed using dynamic Brownian bridge movement models to develop spatial utilization distributions for each species. In winter, and in general, all three species exhibited largely near-shore, coastal, or inshore distributions. Habitat use was concentrated in or around large bays, especially bay mouths. Northern Gannets covered a much larger area than the other focal species, ranging farther offshore and over greater latitudinal extents. Core use areas for all three species were associated with shallower, colder, and more productive waters, compared to other locations within each of their winter home ranges, supporting the idea that distributions were linked to forage resources. Results provide a better understanding of how diving birds use offshore areas of the Atlantic coast and beyond. Based on these results, we believe this tracking method, in combination with other research (offshore surveys, other tracking work), can be used to inform permitting, risk assessment, and pre- and post-construction impact assessments of offshore energy infrastructure.

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Predicting Black Rail Breeding Habitat: Spatial Models to Identify Anthropogenic Threats and Facilitate Conservation [*Black Rail Symposium*]

Spatial models are commonly used to differentiate optimal from sub-optimal habitat, and thus play a pivotal role in conservation for many avian species. Black rails (*Laterallus jamaicensis*) are a wetland-dependent bird of substantial conservation concern that were recently proposed for listing under the Endangered Species Act. Thus, we need to identify optimal breeding habitat, temporal patterns of persistence, and anthropogenic threats affecting black rails across their range. We developed the first statistical and spatial models to assess status and predict the location of optimal breeding habitat for black rails across their entire breeding range within the continental U.S. We used data from spatially-extensive call-broadcast surveys (n = 2,885 sites) conducted over a 13-year period to develop optimally-predictive, hierarchical Bayesian occupancy models to assess breeding distributions of black rails, including evidence for range contraction and effects of anthropogenic modification of wetlands and entire watersheds. We also translated optimal statistical models into fine-resolution (30-m pixels) spatial habitat models to predict habitat quality at wetlands located across the black rail breeding range. Our results document that human development of surrounding wetlands and human modification of flooding regimes has strong negative effects on breeding black rails, and also identify a temporal contraction of the breeding range for black rails across the U.S. from 1999-2012. Our spatial models predict fine-resolution breeding habitat quality across the entire range of black rails, and thus identify hotspots of high-quality habitat to facilitate strategic conservation of black rails across broad scales. This work provides a vital step towards understanding the role of anthropogenic disturbance in the range-wide decline of black rails, and also for conserving the most valuable remaining habitat for this species. Moreover, this work provides a modeling framework to update predictions over time or space as additional data are collected.

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Avian use at the first freshwater offshore wind-energy project in North America [*Avian Interactions and Offshore Energy Symposium*]

Evaluating the effects of energy production on wildlife is required for decision making and effects assessment. To date, land-based wind-energy facilities in the U.S. follow a prescribed set of pre- and post-construction wildlife assessments focused on risk and estimating mortality post-construction. Wind development in marine offshore areas followed a tiered pre-construction process focused on avoidance and minimization. Assessments of the offshore in freshwater are not included in either approach. Recently, Icebreaker Wind, the first freshwater offshore-wind project in North America was proposed for Lake Erie, near Cleveland, Ohio. This DOE supported demonstration project includes six turbines (20.7 megawatts). Our design and survey objectives were to develop a robust pre- and post-construction survey approach to characterize avian abundance and distribution within the project area, incorporating a gradient sampling design to assess wildlife distribution post-construction. The surveyed area encompassed 145 km² assessed with fixed aerial transects and opportunistic transects near shore every two weeks from October 2017 – May 2018. Data collection followed a distance sampling and double-observer approach to estimate observer bias. Analysis integrated a multiple-covariate distance sampling (MCDS) with mark-recapture distance sampling to develop density estimates, with confidence intervals from bootstrap resampling. Surveys documented 12,185 bird observations representing 17 species. Within the survey area, gulls constituted 71% of observations, followed by waterfowl and waterbirds; outside the survey area gulls (58%) were less abundant. Birds were observed flying (41%) or on the water surface (59%) swimming or standing. During periods of ice formation bird use shifted toward shore, and standing on ice increased. Bird density (9.37 birds/km²; 90% CI: 3.96 - 23.94) varied by season, ice cover, distance to shore, and water depth, with greatest densities observed in winter. Estimates of bird density at this location were lower than other Great Lakes relative abundance estimates, or Lake Erie surveys led by OH-DNR.

[103] Sullivan, Debbie¹, Mathews, Gary², Silcocks, Andrew¹, Johnston, Greg^{3,4,5}, Ward, John⁶

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Pelicans and public engagement in the Gippsland Lakes, Australia [*Pelicans of the World Symposium*]

Although they remain abundant, pelicans have declined across Australia. A breeding colony in the Gippsland Lakes is one of two remaining (out of ten historical) pelican colonies in the State of Victoria. The Gippsland Lakes are thought to be an important refuge for waterbirds in times of drought in south-eastern Australia. Since 2017 we have monitored pelican numbers, breeding success and movements in the Gippsland Lakes to understand the importance of this area to their conservation status. We have also engaged with the local community to gain information on the history of pelicans on the Lakes and increase public awareness of pelicans and the environment. Pelicans are important to local indigenous culture and are an icon for many local businesses. Pelicans have bred on the Lakes since at least 1993, and the colony has moved at least once in response to disturbance/predation by introduced red foxes. After high rainfall (773mm) in 2016, the region entered a drought with 463mm rainfall in 2017 and 420mm in 2018. Over this period the pelicans declined from 375 nesting attempts in 2017 (to 277 nesting attempts in 2018, with average breeding success of 0.48 fledglings/nest. A census of 92 sites throughout the Lakes by citizen scientists showed that pelicans have decreased from 1150 in 2017 to 600 in 2019. At least 3% of these pelicans have died due to botulism during 2018, presumably a result of low water levels. Social media has been used to encourage public awareness and reporting colour-banded pelicans. Banded young have dispersed up to 700km away from the Gippsland Lakes, whereas banded adults have stayed in the Lakes. Photographs collected during monitoring have demonstrated that the colour pattern on the pelicans' gular pouches varies between individuals and these individual patterns are consistent over time. Our results show that the number and breeding activity of pelicans in the Gippsland Lakes have declined during the recent drought. The Gippsland Lakes is an important breeding area for Australian pelicans but does not appear to be a drought refuge for pelicans (or other waterbirds) in times drought.

[104] Sullivan, Jeffery D.¹, Marban, Paul R.², Mullinax, Jennifer M.³, Brinker, David F.⁴, McGowan, Peter C.⁵, Callahan, Carl R.⁵, Prosser, Diann J.⁶

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Assessing Nest Attentiveness of Common Terns (*Sterna hirundo*) via Video Cameras and Temperature Loggers

While nest attentiveness plays a critical role in the reproductive success of avian species, little is known regarding the nest attentiveness patterns of many species during incubation. However, improvements in both video monitoring and temperature logging devices present an opportunity to improve our understanding of this aspect of avian behavior. To evaluate the ability of these technologies to document fine scale behaviors during incubation we monitored 13 nests across two Common Tern (*Sterna hirundo*) breeding colonies with a paired video camera - temperature logger approach, while monitoring 63 additional nests with temperature loggers alone. We examined data respective to four times of day: Morning (civil dawn-11:59), Peak (12:00-16:00), Cooling (16:01-civil dusk), and Night (civil dusk-civil dawn). Our results show that while successful nests had mostly short duration off bouts and maintained consistent nest attentiveness throughout the day, failed nests had dramatic reductions in nest attentiveness during the Cooling and Night periods ($p < 0.05$) with one colony experiencing repeated nocturnal abandonment due to predation pressure from a Great Horned Owl (*Bubo virginianus*). Incubation appeared to ameliorate ambient temperatures during Night, as nests were significantly warmer during Night when birds were on versus off the nest ($p < 0.05$). Meanwhile, though nests were cooler when birds were on the nest during Peak periods the off bouts during this period occurred at higher ambient temperatures, perhaps due to adults leaving the nest during the hottest periods to perform belly soaking. Unfortunately, temperature logger data alone had limited ability

to predict nest attentiveness status, with results highly dependent on time of day and bout duration. While our methods did not affect hatching success ($p > 0.05$) video-monitored nests did have significantly lower clutch sizes ($p < 0.05$). Despite the high-quality data recorded in this study, the logistical and potential biological complications reported suggest that careful planning is needed before these devices can be utilized.

[105] Sussman, Allison L.^{1,10,11}, Gardner, Beth², Adams, Evan M.^{2,3}, Salas, Leo⁴, Kenow, Kevin P.⁵, Luukkonen, David R.⁶, Monfils, Michael J.⁷, Mueller, William P.⁸, Williams, Kathryn A.³, Leduc-Lapierre, Michele⁹, and Zipkin, Elise F.^{10,11}

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A comparison of common methods to identify waterbird hotspots in the Great Lakes [*Avian Interactions with Offshore Energy Symposium*]

The Great Lakes are an important ecological, commercial, and recreational resource; therefore it is vital that we understand how our interactions in and around the Lakes will affect the environment. Because waterbirds are often used as indicators of ecosystem health, understanding their migration patterns and non-breeding habitat use in the Lakes is one way we can assess potential impacts of resource management and conservation decisions. However, our knowledge about waterbird patterns and distributions in the Great Lakes is limited. Hotspot analysis is often a first step in understanding these impacts by identifying areas of high biodiversity or conservation concern. Delineating and mapping hotspots is subjective and various approaches can lead to different conclusions with regard to the classification of particular areas as hotspots, complicating long-term conservation planning. We present a comparative analysis of common methods for identifying waterbird hotspots, with the goal of developing insights about the appropriate use of these methods. We selected four commonly used measures to identify persistent areas of high use: kernel density estimation, Getis-Ord Gi*, hotspot persistence, and hotspots conditional on presence, which represent the range of quantitative hotspot estimation approaches used in waterbird analyses. We applied each of the methods to aerial survey waterbird count data collected in the Great Lakes from 2012-2014. For each approach, we identified areas of high use for seven species/species groups and then compared the results across all methods and with mean effort-corrected counts. Our results indicate that formal hotspot analysis frameworks do not always lead to the same conclusions, each method has distinct advantages and disadvantages. Combining hotspot analysis methods using an integrative approach, either within a single analysis or post-hoc, could lead to greater consistency in the identification of waterbird hotspots. The most appropriate hotspot analysis method is dependent upon the objectives, study design, and available data. Considering the ecological question and scale of conservation or management activities prior to designing survey methodologies is necessary to minimize the influences of development on waterbird populations and determine potential impacts of resource management decisions within the Great Lakes.

[106] Sussman, Allison L.¹, Wilson, Randy², Davis, Kayla^{3,4}, Silverman, Emily⁵, Zipkin, Elise F.^{3,4}, and Lyons, Jim¹

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Aerial seabird surveys in the Northern Gulf of Mexico: A new design for better management [*Avian Interactions with Offshore Energy Symposium*]

The Gulf of Mexico is an important cultural and commercial resource for people; additionally, the Gulf is vital for many protected wildlife species including seabirds. Characterizing seabird species' composition, distribution, and abundance is essential for assessing the impacts of changing environmental conditions and for guiding management

practices and regulatory decisions. However, there is limited information available to quantify seabird species-use in the region. To bridge this gap, we are working to identify a statistically sound sampling framework for aerial seabird surveys in the near-shore environment as part of the Bureau of Ocean Energy Management's Marine Assessment Program for Protected Species (GoMMAPPS). We are conducting low-level (200-foot) aerial surveys from the USA-Mexico border near Brownsville, TX to Key West, FL including the Dry Tortugas during winter (2018, 2019, 2020) and summer (2018) seasons based on lessons learned from a pilot-effort off the Louisiana coast in July 2017. Using the U.S. EPA Environmental Monitoring & Assessment Program's 40-square kilometer hexagon sampling grid and a generalized random tessellation stratified sampling technique, we drew a random sample of 180 hexagons to survey. We then selected a random flight direction for each hexagon, which defined two additional, adjacent hexagons thereby increasing the spatial coverage and creating a three-hexagon sampling unit. Each sampling unit consists of three parallel ten mile transects spaced one mile apart, resulting in approximately 30 miles of transect per sampling unit. We are implementing a double observer protocol with three observers collecting data: the pilot-biologist, and two biologists who rotate their seat position daily (from back to front, as well as behind the pilot). Our survey design allows us to directly compare records of flock detection, count estimation, and species identification from two, independent observers. Understanding cumulative impacts on protected species in the Gulf from both natural and anthropogenic forces is required to inform regulatory needs, as well as providing important information needed for effective management and conservation of protected species in the Gulf of Mexico.

[107] Taylor, Scott A.^{1,2*}, Melissa Jenkins¹, Meera Manghani¹, Tim Birt¹, David J. Anderson³, Gustavo Jiménez-Uzcátegui⁴, Vicki Friesen¹

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Genetic distinctiveness of brown pelicans (*Pelecanus occidentalis*) from the Galápagos Islands compared to continental North America [*Pelicans of the World Symposium*]

We examined population differentiation across a substantial portion of the range of the brown pelican (*Pelecanus occidentalis*) to assess (1) the genetic distinctness of the Galápagos subspecies (*P. o. urinator*) and (2) genetic differentiation between subspecies that inhabit the coasts of North and Central America (*P. o. californicus* and *P. o. carolinensis*). Birds were sampled from coastal California, coastal Florida, and the Galápagos Islands. Using a 957 base pair (bp) fragment of the NADH dehydrogenase subunit 2 (ND2) gene, 661bp of the mitochondrial control region, and eleven microsatellite loci we characterize population genetic differentiation among 158 brown pelicans. The Galápagos subspecies is genetically distinct from the sampled continental subspecies, possessing a unique ND2 haplotype and unique mitochondrial control region haplotypes. Samples from the two continental subspecies all possessed the same ND2 haplotype and shared four mitochondrial control region haplotypes. Bayesian clustering in STRUCTURE placed the Galápagos subspecies in a distinct genetic group with high probability, but could not differentiate the continental subspecies from one another. Estimates of migration rates from BAYESASS indicated substantial migration between continental subspecies, but no migration between the Galápagos subspecies and either continental subspecies. There are clearly two Evolutionarily Significant Units within the range of the brown pelican, which warrants conservation attention. Further investigation should determine how the un-sampled subspecies (*P. o. murphyi* and *P. o. occidentalis*) fit into the broader picture.

[108] Thorne, Lesley H.¹; Matthew Fuirst¹; Richard Veit²; Zofia Baumann³

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Mercury concentrations reflect foraging behavior of herring gulls along an urban gradient [*Urban Gull Symposium*]

Mercury (Hg) is a highly toxic heavy metal which bioaccumulates in aquatic food webs, and is a potential indicator of foraging behavior in waterbirds such as gulls (*Larus spp.*). The bioaccumulative form of Hg, methylmercury

(MeHg), is present only in aquatic ecosystems and reaches elevated concentrations in seabird prey species. Conversely, land organisms accumulate only negligible amounts of Hg as there is no significant source of MeHg. Therefore, foraging on marine prey should result in higher Hg concentrations in waterbird blood. Gulls provide a particularly suitable study model for examining how Hg relates to foraging behavior since they are easily monitored, forage in both marine and terrestrial environments, and have a broad geographic distribution allowing for large spatial comparisons. While gulls show considerable individual variability in foraging behavior, the influence of movement and habitat use on Hg concentrations in gulls has received little attention. Gulls thrive in urban environments, and urbanization influences gull foraging behavior and the extent to which gulls rely on terrestrial human habitats versus offshore waters to forage. We hypothesize that these differences in foraging behavior influence gull diet and ultimately Hg uptake. To test this hypothesis, we combined GPS tracking studies of herring gulls (*Larus argentatus*) along an urban gradient with measurements of Hg concentrations in herring gull blood. We examined Hg concentrations in blood for 54 individual herring gulls that were tracked with GPS at study sites representing high, medium and low degrees of urbanization. Our results show a strong and significant positive relationship between Hg concentrations and the proportion of herring gull foraging locations occurring in offshore waters (linear regression, $R^2 = 0.51$, $p = 6.21 \times 10^{-10}$). Further, Hg concentrations differed significantly between herring gulls whose primary foraging habitat occurred in offshore, urban and marsh environments (Kruskal-Wallis test, $p = 2.42 \times 10^{-4}$). Our results suggest that Hg concentrations in blood can be used to infer the habitat use of herring gulls and possibly other animals that forage in both marine and terrestrial habitats, and highlight the importance of understanding movement ecology when using birds as indicators of Hg contamination.

[109] Tims, Julia¹, O'Shea, Brian²; McCrary, Jeffrey³; and Meshach Pierre.

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Gaining an understanding of seabird communities offshore Guyana: results from two years of seasonal surveys

[Avian Interactions with Offshore Energy Symposium]

Pelagic birds are of conservation concern worldwide, and the distribution and abundance of many species at sea is incompletely known. This is particularly true in the waters offshore of the Guianas, in northeastern South America, where routine marine bird survey work has only recently been initiated. Here, we present results of two years of seasonal bird surveys undertaken during the course of oil exploration and development in and around the Stabroek Block, a 26,800-sq-km oil lease area located approximately 200 km off the coast of Guyana. Ten surveys were conducted in the Stabroek Block and waters between the Guyana coast and the Stabroek Block over 77 days between fall 2017 and summer 2019, using standardized protocols for both mobile and stationary vessels. The surveys yielded 1,837 bird observations representing 69 species, twenty of which were pelagic species that do not occur on the adjacent mainland. For all survey events combined, the most commonly observed species far offshore were the Magnificent Frigatebird (*Fregata magnificens*), Masked Booby (*Sula dactylatra*), and Leach's Storm-petrel (*Oceanodroma leucorhoa*). Bird abundance was generally low, particularly far offshore, with a mean detection rate of 3.7 birds per hour of observation for all surveys combined. Nevertheless, the surveys revealed a dynamic pelagic avifauna comprising species with breeding ranges in both northern and southern hemispheres: species composition varied substantially and consistently across seasons, mostly due to the addition of migratory species in the fall and spring surveys. We observed numerous species of migratory shorebirds and landbirds from North America, confirming that at least some individuals of these species arrive in Guyana over water rather than by following the continental coastline. Our surveys provide the first documentation for Guyana of nine species - Manx Shearwater (*Puffinus puffinus*), Bulwer's Petrel (*Bulweria bulwerii*), Band-rumped Storm-Petrel (*Oceanodroma castro*), Red-billed Tropicbird (*Phaethon aethereus*), White-tailed Tropicbird (*Phaethon lepturus*), Great Black-backed Gull (*Larus marinus*), Bridled Tern (*Onychoprion anaethetus*), Arctic Tern (*Sterna paradisea*), and Long-tailed Jaeger (*Stercorarius longicaudus*) – demonstrating how little studied the area was prior to this study. This study highlights the importance of conducting robust, multi-year baseline surveys prior to offshore development to facilitate informed impact assessment, emergency response planning, and decisions regarding placement of offshore facilities.

[110] Trocki, Carol Lynn¹, Aaron Weed², Adam Kozlowski², Marc Albert³, Kristin Broms⁴, Brian Mitchell⁵

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Coastal breeding bird monitoring in the Boston Harbor Islands National Recreation Area, Massachusetts, 2007-2019

Boston Harbor Islands National Recreation Area (NRA), established in 1996, includes 34 islands and peninsulas situated within the greater Boston, MA shoreline. In 2002, the Boston Harbor Islands NRA was designated as a Massachusetts Important Bird Area. The Boston Harbor Islands provide habitat for a significant number of colonial-nesting waterbirds, including extensive colonies of *Larus argentatus* (Herring Gull), *Larus marinus* (Great Black-backed Gull), and *Phalacrocorax auritus* (Double-crested Cormorant), four mixed-species heronries, and *Sternula antillarum* (Least Tern) and *Sterna hirundo* (Common Tern), both listed as species of special concern in Massachusetts. In addition, the islands provide habitat for over 20 pairs of nesting *Haematopus palliatus* (American Oystercatcher) each year and support a population of over 300 nesting *Somateria mollissima* (Common Eider). Birds are an important component of park ecosystems and sensitive to changes within them. Since 2007, as part of the National Park Service's Inventory and Monitoring Program, volunteers have participated in an annual effort to monitor coastal breeding birds in the park under the guidance of a lead scientist. This presentation will offer a comparison of trends in nesting waterbird abundance over time, examine changes in colony location within the park, and provide a context for comparison to historic data and regional trends.

[111] Tsipoura, Nellie¹ and Susan B.Elbin².

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Monitoring urban colonial waterbirds in the NY/NJ harbor *[Heron & Egret Symposium]*

We have been using a citizen science approach since 2008 to investigate foraging and roosting habitat use by populations of herons and egrets that nest on islands in the NY/NJ Harbor. Collected data are diverse and complex, including basic site and habitat information, tide information, and behavioral observations of these birds at wetlands within the urban/suburban matrix of this metropolitan region. Analyses suggest habitat, and tide cycle are important factors in determining number of birds present and some sites consistently are used by large numbers of birds. The counts at foraging wetlands reflect numbers breeding in local colonies, although different species may be using sites and habitats differently. We have also been able to locate a several large late-summer and early fall roosts that appear to be used consistently year after year. Numbers of herons and egrets increase during the post-breeding season and decrease again in early fall as birds move out of the area. This project has provided some very useful information that can be used to address local management and conservation issues and can complement more intensive research in the region. While employing volunteer effort has allowed us to collect data from a multitude of sites, it is difficult to maintain consistent effort and there are high levels of attrition in citizen science participation without constant input from a project manager.

[112] Van Tatenhove, Aimee M.*¹, Moulton, Colleen², Norvell, Russ³, Rushing, Clark¹

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Quantifying spatial and temporal population trends of North American pelicans *[Pelicans of the World Symposium]*

American white pelicans (*Pelecanus erythrorhynchos*) and brown pelicans (*Pelecanus occidentalis*) are large North American migratory waterbirds. White pelicans are primarily inland birds, breeding across the United States and Canada, while brown pelicans are coastal, breeding along the eastern and western coasts of the United States and Mexico. Both species winter in the southern United States and Mexico, although the migratory connectivity of both white and brown pelicans is poorly understood. Across their large breeding ranges and throughout their annual migrations, pelicans encounter different environmental and anthropogenic conditions, which has likely produced the spatial and temporal variation in these species' population trajectories witnessed over the past century. In particular,

the ban on DDT and rapid anthropogenic changes to breeding, foraging, and wintering habitats have impacted pelican populations differently in different regions and time periods. Using 98-year band and wing tag resight and recovery datasets from the North American Bird Banding Laboratory (BBL), we used multi-state capture-recapture models to estimate migratory connectivity and spatial (eastern vs. western) and temporal (decadal) variation in pelican survivorship over the past century. This framework uses the band and wing tag resight data from both species, as well as resight effort data from other non-game species with regional overlap and similar life histories, to better estimate nuisance parameters (i.e., recovery and resight probabilities), which produces more precise estimates of species-specific migratory connectivity and survival probabilities. Results from this analysis provide important context for understanding past changes in pelican demography and abundance and for managing populations in the face of future threats across their annual cycle.

[113] Van Tatenhove, Aimee M.*¹, Norvell, Russell E.², Conner, Mary¹, Kijowski, Ashley², Brewerton, Adam², Neill, John², Moulton, Colleen³, and Green, Mike⁴.

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Conservation and management perspectives of American white pelicans within the Pacific Flyway [*Pelicans of the World Symposium*]

Navigating the management and conservation of American white pelicans (*Pelecanus erythrorhynchos*) within the Pacific Flyway is an exceptionally challenging task. There is a thin margin of human tolerance for this species, and they have long teetered between protection and persecution. Pelicans are avid piscivores that play an important role in managing fish populations, yet are frequently persecuted for their predation on game fish species. As such, American white pelicans are both a species of greatest conservation need in many western states and provinces and a target of lethal control in at least two of these. Entrenched management perceptions and unsteady pelican recovery from DDT-linked population depression have exacerbated these conflicts. Despite population recoveries since the ban of DDT, population status is judged against the eroding baseline of continued wetland loss that concentrates too few resources into too little space. As wetlands are continually fragmented and more intensively managed, conflicts between game species management and pelican conservation will continue to increase. To provide a stable future for the Pacific Flyway pelican population, a balance between conservation and control is needed, with emphasis on managing for human encroachment, increasingly intense management of other species, and water stress common within western North America.

[114] Velikaneye, Brittany*¹ and Szczys, Patricia¹

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Microsatellites can exclude paternity in male-female pairs and assign maternity in female-female pairs of Roseate Terns (*Sterna dougallii*)

Prior to the application of molecular genetic tools to mating system studies in birds, it was commonly assumed that almost all were both socially and sexually monogamous. However, the molecular data has often refuted this common belief (e.g. Black-headed Gulls; 20% Extra Pair Paternity) as only a small percentage of species are now considered strictly sexually monogamous (e.g. 0% Western Gull, Black-legged Kittiwake, Black and Common Terns). In this study, patterns of parentage were assessed in 26 family groups (n= 52 parents, 52 chicks) of Roseate Terns (*Sterna dougallii*) using seven polymorphic microsatellite loci. Blood samples were collected in 1998 and 1999 on Falkner Island, Connecticut and sexed for previous studies. Five family groups in this study were female-female pairs and the remaining 21 family groups were male-female social pair bonds. The software CERVUS was used to calculate the mean number of alleles per locus (7.42), allele frequencies (0.005 to 1.0), combined non-exclusion probability for the first parent (0.094) and second parent (0.018), and determined there was no deviation from Hardy-Weinberg equilibrium. For each chick raised by a male-female pair bond the probability of resemblance (the Ibarguchi method) was determined for its putative father. Rate of extra-pair paternity for the male-female pair bonds was 9.52% (2 of 21 broods and 4 of 42 chicks) which is consistent with other seabirds (e.g. 8% Whiskered Tern; 7.7% South Polar Skua; 8.3% Common Gull). Additionally, maternity tests were conducted for the female-female pairs and maternity was assigned for 40% (4 of 10) chicks. Previous attempts at measuring rates of extra pair

paternity in this subpopulation have been unsuccessful because of historical genetic bottlenecks and reduced genetic diversity exhibited by this population. This study was successful due to the use of newly developed and highly polymorphic microsatellite markers. While this study had significant power to make conclusions about parentage patterns, older primers still exhibited low genetic diversity making the development of new primers a necessity for future studies. This study demonstrates the power of new loci that could be applied a more extensive study to evaluate population-wide mating strategies for this endangered species.

[115] Walker, K.M.*¹, J.D. Fraser¹, D.H. Catlin¹, S.M. Karpanty¹, S.G. Robinson¹, and A. DeRose-Wilson^{1,2}

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Migratory and wintering survival of post-fledge piping plovers

Atlantic coast piping plover (*Charadrius melodus*) breeding ecology is well understood but understudied stages of the annual cycle may be limiting recovery. Current recovery plans include a goal for number of chicks fledged per pair, but studies have not considered survival of those fledged individuals. The post-fledge period may be especially demanding as individuals are no longer defended by their parents and may experience high risks of predation or of adverse weather on migration and on the wintering grounds. Fledgling survival through the first year translates to recruitment into the breeding population, thus, estimating fledgling survival during this time is important for assessing population growth and recovery. We studied piping plovers on Fire and Westhampton Islands, New York. During the breeding season, we searched for nests twice weekly and monitored nests every 2–3 days. Once eggs hatched, we marked all chicks with a unique alphanumerically coded green flag. We conducted resighting surveys twice per week within our study area in July and August from 2013–2017. From July through December each year, ancillary resights were used with our resights to estimate fledgling monthly apparent survival with a Cormack-Jolly-Seber model. We estimated that across all years, apparent survival was lowest in August (0.81–0.92) when most individuals were dispersing from their natal sites compared to other months (0.90–0.98). Monthly apparent survival showed similar trends across years, with post-fledge survival highest in 2015 and lowest in 2014. By assessing migratory and wintering survival, we can begin to piece together knowledge gaps within the piping plover annual cycle and consider mechanisms that may affect survival to inform recovery efforts.

[116] Welch, Linda¹, Elizabeth C. Craig², Don Lyons³, Pam Loring⁴

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Using GPS loggers to track Arctic and Common terns in the Gulf of Maine

The study of seabird movement is necessary to elucidate resource use, foraging behavior, and susceptibility to environmental change including climate change and wind energy development. GPS tracking allows for the collection of detailed movement data, and in recent years GPS tags have become commercially available that are light enough for deployment on small seabirds, such as terns, with the longevity to record throughout the full annual cycle. In June 2019 we deployed solar-powered GPS tags (PathTrack NanoFix GEO+RF; 2.6g; affixed using leg-loop harnesses) on adult Common Terns (*Sterna hirundo*; N= 22) and Arctic Terns (*S. paradisaea*; N= 8) breeding at three nesting colonies in the Gulf of Maine (Seal and Metinic Islands, ME, and Seavey Island, NH). Location data was downloaded remotely to base stations deployed at each colony. Tracking data from June to August 2019 were analyzed, yielding information on the distance, duration, and location of foraging movements for both species, as well as anomalous, long-distance trips from the breeding colonies. This allowed for the identification of foraging hotspots critical to each nesting colony. The tag attachment method deployed in this study was evaluated for future use in other co-occurring tern species, including the federally-endangered Roseate Tern (*S. dougallii*), for which detailed movement data are a major information need.

[117] Weldon, Aimee¹ and Craig Watson¹

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The Atlantic Coast Joint Venture's Black Rail Initiative - Conservation Planning and Implementation [Black Rail Symposium]

In 2018 the Eastern Black Rail was proposed for listing as Threatened under the Endangered Species Act. The Atlantic Coast Joint Venture (ACJV) Management Board and its conservation partners has adopted the Eastern Black Rail as one of its flagship species, and is focusing on conservation of this species in coastal marsh systems in the Atlantic Flyway. The ACJV has taken the lead on coordination, conservation planning, and implementation of projects to conserve and better understand the life cycle requirements of the Black Rail throughout its range on the Atlantic Coast. A major effort is to complete a Black Rail Conservation Plan in 2019. Black Rail experts, biologists, and land managers are developing a plan that will address the conservation status of the Eastern Black Rail, provide current and target population estimates and objectives for the species, identify major threats to the species and its habitat, and outline five major implementation strategies to begin the process of achieving short- and long-term population goals. Four major population centers have been identified and mapped, focusing on four states; New Jersey, North and South Carolina, and Florida. A short-term objective of stabilizing the population at >300 pairs for the four populations centers, and a long term objective to grow the population to >500 pairs in five populations has been established. The five strategies to achieve these goals are : 1) create new Black Rail habitat, 2) promote improved impoundment management, 3) develop and promote Black Rail fire-friendly best management practices, 4) develop and promote Black Rail friendly agricultural practices, and 5) develop a landowner assurances program. Several management projects are underway as pilot projects for an Adaptive Management project to inform several of these strategies, and an irrigation planning tool developed for the Black Rail in California is currently being adapted to inform management scenarios on the Atlantic Coast. Cross-collaboration with a wide variety of partners will be necessary to maintain and recover the Eastern Black Rail in the Atlantic Flyway and across the species' larger geographic range.

[118] Weseloh, D.V. Chip¹, David J. Moore², Jeffrey N. Costa² and Tina Knezevic¹

¹Canadian Wildlife Service, Toronto, ON, Canada; ²Canadian Wildlife Service, Burlington, ON, Canada; chip.weseloh@canada.ca

Age of first breeding, longevity and age structure of Great Egrets at a breeding colony in southern Ontario [Heron & Egret Symposium]

We have been marking flightless Great Egrets (*Ardea alba*) with field-readable plastic leg bands or patagial tags at a breeding colony (Nottawasaga Island southern Georgian Bay, Lake Huron, near Collingwood, Ontario) annually since 2001. Over 2,200 nestlings have been banded, resulting in over 2002 encounters (live re-sightings, dead recoveries) of 606 (27.5%) marked egrets. The objective of this paper is to present an analysis of the age of first breeding, longevity and age structure of egrets at this colony. We banded flightless young at the colony in June-July and made annual trips (3-10 per year; May- July) to re-sight previously marked adults. Marked egrets were rarely observed at the breeding colony before they were two years old (0.5% of resights). Estimated recapture probability increased with age: $7.1 \pm 14.5\%$ (se) for 1 y.o. birds, $57.4 \pm 12.5\%$ for 2 y.o. and $69.9 \pm 6.7\%$ for adults (2+ y.o.). The most common age for the first re-sighting of a banded egret at this site was 2 years (35.6%; the youngest breeders); 51.4% of egrets were 3-5 y. o. when first re-sighted (mean = 3.5 ± 0.1 y.o.). Survival was estimated to be $31.1 \pm 2.3\%$ during the first year (0-1 y.o.), $76.3 \pm 4.2\%$ during the second year (1-2 y.o.) and $78.4 \pm 1.9\%$ for adults (2+ y.o.). Longevity (age at last re-sighting) ranged from 1 (0.5%) to 13 (1.3%) years; 66.9% were between the ages of 2-6 years when last re-sighted on the colony. Natal philopatry appears to be high: 96.4% of marked adults breeding at this site had hatched there. This long-term study provides the first robust estimates of vital rates for Great Egrets.

[119] White, Timothy P.

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An overview of the Bureau of Ocean Energy Management's marine bird program: a national perspective

[Avian Interactions with Offshore Energy Symposium]

The Environmental Studies Program (ESP) is the Bureau of Ocean Energy Management's applied science research program. Annually, the ESP with a network of dedicated partners produces a broad spectrum of new studies involving waterbird ecology that are indispensable in BOEM's decisions regarding energy development and minerals extraction on the Outer Continental Shelf. Section 20 of the Outer Continental Shelf Lands Act mandated the ESP and established three general goals for the program: 1) baseline studies 2) impact studies 3) monitoring. The ESP continues rigorous pursuit of these goals through a diverse suite of scientific studies of marine bird ecology, which include long-term at-sea monitoring programs, advanced modeling techniques and use of innovative technology to detect potential impacts. ESP archives all of its studies online and available to download via the Environmental Studies Program Information System (ESPIS). In this presentation, I will provide an introduction to BOEM's marine bird program with examples of past and current studies across BOEM's planning regions.

[120] Wilkinson, Bradley P.*¹ and Patrick G.R. Jodice²

¹Department of Forestry and Environmental Conservation, South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University, Clemson, SA, USA; ²USGS South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University, Clemson, SC, USA; bpwilki@g.clemson.edu

Expansion of Brown Pelican diet associated with shrimp trawling effort in South Carolina
[Pelicans of the World Symposium]

Optimal foraging theory posits that an organism should maximize energetic gain while minimizing energetic expenditure. In anthropogenically-influenced systems, species able to acquire resources from human activities with limited expenditure of energy may profit via a realized food subsidy. We examined how the diet of brown pelicans breeding near an urban center was influenced by shrimp trawling effort over the course of two years. In the first year, colder wintertime conditions precipitated a decrease in summer trawl effort by reducing shrimp recruitment, leading to a pelican diet dominated by Atlantic menhaden. The following year, warmer wintertime conditions allowed for increased shrimp recruitment and concomitant trawl activity. Though menhaden remained important forage, the dietary breadth of pelicans was expanded by inclusion of benthopelagic fish species likely acquired as trawling discards. We show that pelican diets reflect variations in shrimp trawling activity mediated by the environmental conditions of the preceding winter. Pelicans in this system may therefore profit energetically by exploiting an easily obtained food subsidy when conditions allow, assuming that proximate composition and energy density of natural versus anthropogenically-mediated prey are equivalent or balance out via differences in capture effort.

[121] Williams, Kate¹, Kate McClellan Press², Julia Gulka¹, Gregory Lampman²

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Regional Collaborations to Understand and Minimize Waterbird Impacts from Offshore Wind Energy Development *[Avian Interactions with Offshore Energy Symposium]*

Offshore wind energy development, though well-established in Europe, is a new industry in the United States. Many lessons can be learned from the European experience with offshore wind, including the types and severity of impacts to waterbirds that have been observed to date. However, the ecological and regulatory context for American offshore wind development is unique in some ways, and new approaches and frameworks are required to ensure that offshore wind energy is developed in the U.S. in an environmentally responsible way. In 2018, New York State led the formation of a regional, science-based collaboration to develop guidance and fill data gaps around the potential risks and impacts of offshore wind energy development to wildlife. The Environmental Technical Working Group (ETWG)'s structure takes a new approach to informing and prioritizing topics for further research and conservation guidance, including work at differing geographic scales and levels of implementation detail. New York has made a long-term commitment of technical expertise and administrative support for this effort. Within this novel structural framework, impacts to waterbirds are being addressed in the arenas of stakeholder engagement and collaboration, scientific research on impacts, and environmental permitting. Current efforts include: (1) development of Best Management Practices (BMPs) for understanding and minimizing impacts to birds and bats from offshore wind

energy construction and operations, (2) development of a scientific research framework to understand the long-term impacts of offshore wind development on birds and bats and identify priorities for funding and future research, (3) development of detailed guidance and decision support tools for studies using miniature digitally-coded VHF transmitters (nanotags) at offshore wind facilities, (4) new research into ecological community dynamics to better understand the drivers of seabird distribution and abundance patterns, and (5) “State of the Science” workshops that bring together scientific experts in the field to assess the state of knowledge about offshore wind and wildlife science, identify key data gaps, and promote regional collaboration. The planned 2020 workshop will focus on the development of a research agenda for understanding cumulative impacts to wildlife as the offshore wind industry progresses in the United States.

[122] Zavalaga, Carlos¹, Sebastián Lozano¹, Cinthia Irigoin¹

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A revision of the current conservation status of Peruvian pelicans in Perú: Population trends, changes in distribution and threats [*Pelicans of the World Symposium*]

Peruvian pelicans (*Pelecanus thagus*) breed on the guano islands and protected headlands of the Peruvian coast. Together with the Guanay cormorant (*Phalacrocorax bougainvillii*) and the Peruvian booby (*Sula variegata*), the Peruvian pelican has been traditionally considered as an important guano producer. Because of their economic value, Peruvian pelican numbers have been monitored uninterruptedly over a century by different governmental agencies, allowing a unique scenario to evaluate population trends and distribution. Peruvian pelican numbers in Perú have decreased dramatically since mid-1950s. Major causes of population decline of Peruvian pelicans seems to be related to competition for food with commercial fisheries and strong El Niño events in the last decades based on historical records of pelican population trends, fishing landing and occurrence of anomalous oceanographic conditions. Nevertheless, new threats (invasive mammals, human disturbance, changes in oceanographic conditions and pollution) may also have contributed to current low numbers, reproductive failure and restricted breeding range in Peru. Eradication of cats and rodent in their main colonies and reinforced vigilance of colonies during the pelican breeding seasons as initial protection measurements would revert pelican population trends. Consistent monitoring of their breeding performance, demography and at-sea behavior would also help to understand major causes of current population decline.

POSTER ABSTRACTS

Abstracts are in alphabetical order; [] = abstract number.

Bolded names (and emails) are the presenter's.

* indicates consideration for Best Student Paper.

[124] Aikens, Marley*¹, Erica Nol¹ and Glen Brown²

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Interactions between breeding and migration behaviour in a subarctic breeding shorebird

Arctic breeding shorebirds spend a significant portion of their lifecycle on migration, yet our understanding of ultimate and proximate drivers of migration behavior remains limited. For small-bodied (< 60g) species, this is largely due to weight limitations imposed by currently available tracking devices. Here, we used small (< 0.8g) VHF transmitters and the Motus Wildlife Tracking Network to monitor individual Semipalmated Plovers (*Charadrius semipalmatus*) across two key periods, breeding and fall migration, with the aims of identifying migration routes and understanding migratory patterns in the context of preceding parental investment. We hypothesized that time and energy invested in breeding carries over to influence migration behaviour (departure timing, migration route, location and duration of stops *en route*). We predicted that individuals with lower reproductive investment (i.e. females and failed breeders) would depart breeding areas earlier, show more variable migration routes and stop more frequently and/or for longer durations than individuals with higher reproductive investment (i.e. males and successful breeders), as the latter individuals have less time and energy available for migration. Preliminary analyses found three distinct migration routes of individuals departing from breeding sites near Churchill, Manitoba. Contrary to our prediction, however, choice of route and stopover characteristics were not related to breeding outcome or sex. Breeding outcome had no influence on departure timing, suggesting that failed breeders remain in breeding areas for potential re-nesting opportunities. Females departed breeding areas an average of 9 days before males. This study identifies high variation in migration strategies within a single breeding population and validates the use of automated radio-telemetry in a subarctic shorebird system.

[125] Angeli, Nicole¹, Anthony, Ryan², Griffin, Rusty³, Beisler, Whitney⁴, Snyder, Caitlin⁵, Wilson, Jennifer⁶, and **Woodrow, Jarrett⁷**

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Using National Wetland Inventory data to support land management planning for the eastern black rail, *Laterallus jamaicensis jamaicensis* [Black Rail Symposium]

The eastern black rail is one of the most secretive marsh birds in North America, inhabiting dense herbaceous vegetation and typically only detected through auditory means. Daily movement patterns are difficult to assess without telemetry information. The subspecies is wetland dependent, using wetland habitats that range in wetness from seasonally dry to standing water typically no deeper than 3 cm. They also use the wetland-upland transition zone and contiguous non-wetland habitats of similar vegetative structure to forage and to escape flooding events. Management of both wetlands and contiguous uplands are therefore very important for conservation of the subspecies. In order to provide guidance for land managers, we assessed point location observations of eastern black rails against existing National Wetland Inventory maps to determine their association with different wetland types and to determine contiguous upland buffer distances around occupied wetlands within the current range of the subspecies. This information will be useful to resource managers, who will need to identify the wetland types and associated upland buffers used by the subspecies in their region in order to better support conservation of this subspecies.

[126] Bonnett, Sarah M.F.*¹ and Nol Erica.²

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Does food availability change at different elevations on the tundra?

Many birds on the Arctic tundra time their breeding with increases in arthropod abundance so that there is food readily available for growing chicks. My study addresses the question of what effect elevation and habitat have on arthropod abundance on the Arctic tundra, and in turn, how does arthropod abundance relate to nest placement and nesting success of arctic-breeding shorebirds? During snowmelt 71 pitfall traps were placed evenly throughout 8 6-ha study plots approximately 120km north of Baker Lake Nunavut and emptied weekly to monitor insect abundance throughout the breeding season. At the end of the season habitat surveys were conducted at each trap, random points, and at shorebird nests. Elevation of plots ranged from 116-168m. I will provide preliminary data on elevation effects on arthropod communities and the relationship between elevation and shorebird nest placement.

[127] Brown, Andrew D.*

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An investigation into factors influencing the distribution and range expansion of the Piping Plover (*Charadrius melodus*) in the Great Lakes region

After officially being considered extirpated from the Canadian Great Lakes in 1986, Piping Plovers (*Charadrius melodus circumcinctus*) were not found nesting in Ontario until 2007. In subsequent years, the Ontario breeding Piping Plover population gradually increased, with nesting locations expanding eastward along Lake Huron and Lake Ontario. It is likely that the first Ontario recruits came from Lake Michigan, however it has not yet been determined if this is the case and if there is a predictable pattern of dispersal as the population increases. My research intends to summarize information on Great Lakes Piping Plovers related to where they are coming from, what age they are, and where they are nesting, and to assess how chick weight during banding (~1 week after hatch) relates to return rates of new recruits in the following spring. To achieve this, I will analyze historical nesting and banding data on Ontario's Great Lakes Piping Plover population as well as data from Michigan-hatched Piping Plovers that nested in Ontario.

[128] Buck, Evan¹, Collier, Tom², Sullivan, Jeffery D.³, Dale, Katherine E.⁴, Callahan, Carl R.⁵, McGowan, Peter C.⁵, Prosser, Diann J.⁶

¹Department of Forestry, Wildlife and Fisheries, University of Tennessee, Knoxville, Tennessee USA; ²UASBio llc, Marriottsville, Maryland USA; ³Natural Systems Analysts, Winter Park, Florida USA; ⁴Department of Ecology and Evolutionary Biology, University of California Santa Cruz, Santa Cruz, California USA; ⁵Chesapeake Bay Field Office, U.S. Fish and Wildlife Service, Annapolis, Maryland, USA; ⁶Patuxent Wildlife Research Center, U.S. Geological Survey, Laurel, Maryland, USA; ebuck4@vols.utk.edu

Using thermal infrared cameras to detect avian chicks at various distances and vegetative coverages

Population monitoring of nesting waterbirds typically involves frequent entries into the colony, but thermal infrared cameras mounted on small unmanned aircraft systems may provide a cost-effective way to remotely survey birds and their nests more effectively and with less disturbance than traditional methods. Unfortunately, such an approach can have high initial costs, which has likely created a dearth of research into the functionality of a paired thermal infrared and small unmanned aerial systems approach. Here, we evaluate the ability of two thermal infrared camera systems suitable for mounting on a small unmanned aerial system to detect an avian chick under varying vegetative cover and distances. Seven "bio-boxes" were created to simulate a range of natural vegetation types and densities for the common tern (*Sterna hirundo*), a species of interest in the Chesapeake Bay. A juvenile chicken (*Gallus gallus*, a surrogate for a tern) was placed in each box, and cameras were tested at five elevations ≤ 12 m. The chick was visible from at least one threshold value after digital processing in 19 and 31 out of 35 processed FLIR and ICI images, respectively. Percentage of the chick detected across thresholds after digital processing was generally

highest at lower threshold values and elevations and increased as elevation and threshold increased. However, the relative importance of each variable changed dramatically across bio-boxes and camera types. Visibility generally decreased with increasing elevation, and while no quantitative comparisons were made between boxes, detectability appears greatest for both ICI and FLIR when little or no vegetation is present. Interestingly, no single threshold value was best for all bio-boxes. Notable differences were observed between cameras including visual resolution of detected temperature differentials and image processing speed. Results of this controlled study show promise for the use of thermal infrared systems mounted on small unmanned aircraft systems mounted for detecting small cryptic species in vegetation. Next steps are to combine thermal infrared and visual sensors with a small unmanned aircraft systems in a field application.

[129] Bugariu, Sebastian¹, Fântână, Ciprian¹, Domşa, Cristian¹, Todorov, Emil¹

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Current status of the breeding Dalmatian Pelican (*Pelecanus crispus*) population in Romania - results from aerial and land surveys [*Pelicans of the World Symposium*]

The results of Dalmatian Pelican colony counts performed in the Danube Delta Biosphere Reserve and vicinity are summarized. Since 2007, the census of the breeding population has been implemented yearly except for 2010. For the otherwise inaccessible sites located in the Danube Delta, flights using ultralight planes have been performed in order to survey colonies; the breeding sites in the lagoon situated south of the Danube Delta have been also evaluated during land surveys in several years. Additional recent colonies, apart from the traditional well-known colony sites, are described. Counts based on detailed aerial photography have been performed in order to evaluate the status of each colony and of the whole breeding population.

[130] Costa, Jeffrey N.¹, David J. Moore¹, Moriah Greenhaw², James Quinn² and Olivia M.C. Trudeau^{1,3}

¹Canadian Wildlife Service, Environment and Climate Change Canada, Burlington, ON, Canada; ²Dept. of Biological Sciences, McMaster University, Hamilton, ON, Canada; ³School of Environment, Resources & Sustainability, University of Waterloo, Waterloo, ON, Canada; Jeffrey.costa@canada.ca

GPS pinpoint tags have transitory effects on Ring-billed Gull nest attendance during incubation [*Urban Gull Symposium*]

The miniaturization of technology has led to breakthroughs in life cycle analysis of avifauna, but little is known about the effects of the attachment of tracking devices on behavior, reproduction or survival. As part of a larger study on movement and habitat use by urban-nesting Ring-billed Gulls (*Larus delawarensis*), we assessed the effects of global positioning system (GPS) pinpoint tags (PTTs) on adults tagged in Hamilton, Ontario. After the peak of clutch completion, we randomly assigned 3-egg nests to either “tagged” or control groups. During mid-incubation, a single adult at each study nest was captured and fitted with stainless-steel and field-readable plastic leg bands. Birds at tagged nests also received a PTT (Lotek PinPoint GPS 240, n=10; Lotek PinPoint GPS VHF, n=7, Ornitela OrniTrack-10, n=14), attached using a backpack harness, and weighing 10.0-10.5 g including harness material (1.8-2.2% of body mass). A drop of blood was collected from each study bird in order to perform molecular sexing (tagged: 17 females, 14 males; control: 14 females, 14 males). Nest attendance was collected for both pair members at each nest using cameras (photos at 5 sec intervals, mean duration = 2.5±0.1 [se] h, range = 1 – 5.2 h) during two time periods: (i) within 9 h of capture and (ii) an average of 6.3±0.3 days later (range = 3-9 d post-capture). There was no effect of PTT type or gender of captured bird (tagged or control) on the proportion of time spent incubating. We found evidence of a short-term effect of PTT attachment on incubation effort. On the day of capture, tagged birds spent less time incubating (32.5±7.7%), with compensatory behavior by their mates, than controls receiving bands only (48.4±6.4%). However, a week after PPT attachment, incubation effort was similar between tagged (56.1±7.2%) and control (56.5±7.6%) birds. We recommend allowing gulls to acclimate to tags for a few days before movement data are collected. Hatching success did not differ between tagged and control nests. In May 2020, we will return to this colony to re-sight tagged birds and record the timing and size of clutches, to assess for longer-term effects of PTT attachment on local survival and reproduction.

[132] Custer, Christine M.¹, Thomas W. Custer¹, Paul M. Dummer¹

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Using tree swallows to assess remedy effectiveness at Great Lakes Areas of Concern (AOCs), 2010-2017

Tree swallows (*Tachycineta bicolor*) are being sampled across the Great Lakes basin as part of the Great Lakes Restoration Initiative (GLRI) to provide a system-wide assessment of current exposure to organic contaminants. At selected sites, dredging of contaminated sediment has been done. Tree swallows, because their diet is mainly the aerial stage of benthic aquatic insects, offer a unique opportunity to assess the effectiveness of sediment removal on contaminant uptake in biota. Data were collected before and after sediment removal. When swallows migrate away from nesting areas, as they do at the end of each breeding season, they depurate accumulated contaminants. Thus, when they return, they start with virtually a ‘clean slate’. Therefore, changes in bioavailability of contaminants can be assessed by analysis of eggs and nestlings. Three metrics, contaminant concentrations in eggs, concentrations in nestling carcasses, and the rate of contaminant accumulation per day in the nestling can be computed. Data from Areas of Concern (AOC) such as Lincoln Park, Milwaukee Estuary AOC, and Waukegan Harbor AOC where tree swallows were monitored for 3 years pre-dredge and for several years post-dredge will be presented. In both locations, because of the level of contamination and size of the area, a large percentage of the contaminated sediment was targeted for removal. The results from this type of dredging will be compared to other AOCs where targeted sediment removal was the remedy of choice. The amount of time post-dredge that a site needs to be monitored will be discussed as will the potential to reduce Beneficial Use Impairments.

[133] Dolinski, Lauren^{*1}, D’Auria, Danielle E.², and Erik J. Blomberg³

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Landscape factors affecting foraging flight altitudes of Great Blue Herons in Maine; relevance to wind energy development [*Heron & Egret Symposium*]

In an attempt to increase alternative energy sources, there has been greater development of wind farms across the United States. This expanded development may pose a potential threat to birds that are flying overhead (EIA 2017, Leung and Yang 2011). More information is needed on the factors that affect a bird’s behavior while flying and if the current policies and dimensions of wind turbines interfere with flight altitudes. We used data from GPS-marked Great Blue Herons (*Ardea herodias*) in Maine to classify their flight altitudes relative to wind turbine height, and conducted a GIS analysis to assess different landscape factors that affect flight altitude. We found an altitude range of 1 m to 924 m, compared to a range of wind turbine heights in Maine from 24 m to 156 m, with 43% of observed flight altitudes falling within that range. We found elevation, speed, proximity to open water and wetlands, and the proportion of surrounding urban development and forest cover to have a positive effect on flight altitude. Slope had a negative effect on heron flight altitudes. Our results can help to better understand how the flying behavior of birds is affected by the surrounding landscape, and therefore how that behavior may be affected by human developments, such as constructed wind turbines.

[134] Dubrow, Nathan A.*

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The Dive: Age and Other Factors in Feeding Success in Northern Gannets

I observed the feeding habits of Northern Gannets (*Morus bassanus*) during the summer of 2019, while stationed on Mount Desert Rock, Hancock County, Maine, USA, to determine the influence of age class on dive success. Gannets do not breed in the Gulf of Maine, but they frequent the waters surrounding Mount Desert Rock and are easily seen from the lighthouse tower. I classified birds as either 1st cycle, 2nd cycle, subadult and adult based on plumage and observed feeding in the area daily, sampling every hour on the half hour from 0630 hrs to 1730 hrs. I hypothesized that more experience would result in a higher rate of success, however I also examined a number of other environmental factors to determine whether their role also affected foraging success. During the ten-minute observation period, gannets in the area were visually tracked and their post-dive success was recorded based on either a visible prey item or the motion of swallowing one which was captured. Environmental data, including the

tide, visibility, light conditions, wind direction and Beaufort scale reading were collected during each observation period in the hopes of determining what conditions drew feeding birds to the area and might affect dive rates and overall success. Insight into the use of the midwater region by gannets and other foraging species is of particular importance given changes in oceanographic conditions and proposed increases in industrial wind development.

[135] Ferguson, Lisa¹, Collins, Samantha¹, Morey, Brittany¹, Anholt, Allison¹, Yepsen, Metthea², Tedesco, Lenore¹

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Establishing higher ground for nesting birds in coastal marshes of New Jersey through dredged material placement

Nesting options for avian species in coastal New Jersey have been limited by dense development and recreational use of barrier island beaches and salt marshes, and are being further constrained by rising sea levels and flood frequency. Projects tailoring sediment management practices to benefit coastal habitat, including the modification or addition of bird nesting areas during routine dredging of navigable channels and inlets, are being explored for augmenting nesting options. Elevation is a key design consideration to meet project objectives related to habitat suitability for target species, but the sustainability of elevation and changes in habitat features over time are relatively unknown. Beneficial use of sandy dredged material was used to create nesting habitat on a tidal salt marsh for Black Skimmer (*Rynchops niger*) and tern species in 2014. A target elevation above 3.6' NAVD88 was established for the site based on predictions of local tide levels to contend with flooding from spring tides. We explored changes in elevation on the created habitat over a five-year period and the relationship of elevation with nesting composition, density, and success. American Oystercatcher (*Haematopus palliatus*) and Least Tern (*Sterna antillarum*) were the first species to nest on the habitat in 2015. Black Skimmer and Common Tern (*Sterna hirundo*) nests covered the available high ground by 2017 and the colony increased proportionally in size after site renourishment in 2018. Nest success was highly variable among species and years but we did not document nest loss attributed to flooding for nests above spring high tide. Sensitive avian species nesting in coastal New Jersey often nest on areas in tidal marsh enhanced with dredged material if the site meets elevation requirements necessary to contend with spring tidal levels and provides suitable nesting substrate and vegetation communities. Continued management of enhanced sites will be necessary to ensure conditions for successful nesting (e.g., predator and vegetation management) for target species. Additional studies involving long-term monitoring of these areas are needed to fully understand rates of elevation loss and avian responses to habitat changes to provide recommendations for future restoration plans that target large-scale conservation goals.

[136] Finch, Rachael*¹, Mostello, Carolyn S.², Murphy, Nate¹ and Szczys, Patricia¹

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Effects of subcutaneous PIT-tags on Roseate Terns (*Sterna dougallii*) breeding at Bird Island, MA, USA

Roseate Terns (*Sterna dougallii*) are an endangered coastal seabird intensively studied in the northeast Atlantic for more than 30 years. Many roseates in the population are banded; however, observations suggest that these bands cause mortality by increasing terns' visibility and desirability to hunters in the South American wintering area and vulnerability to entanglement. This pilot study aimed to test short-term effects of PIT-tags on Roseate Terns; the ultimate goal is to investigate annual survivorship of conventionally banded and PIT-tagged terns. Twenty-five study nests were chosen by visibility from a blind, lay date, and nest age. Nests were matched for lay date and age and divided into PIT-tag, standard no tag, and quick-release no tag groups. Standard control birds were held on an average of 16.4 minutes to match PIT-tag birds. Quick-release controls were trapped and minimally handled at the nest, averaging a hold time of 2.3 minutes. PIT-tagged birds were banded, given a subcutaneous PIT-tag alongside the keel, and held on average for 16.3 minutes. All birds were marked with dye to facilitate resighting. Following release, we observed each nest from a blind to document return time. If birds returned on the day of trapping, continuous behavioral observations were recorded for 10 min on that day and subsequent days. For birds that did not return on the initial trapping day, nests were checked on subsequent days for parental attendance and 10-min continuous observations were conducted when study birds were detected. We observed nine PIT-tag, nine control, and seven quick release birds. Six of nine for each of the standard control and PIT-tag groups and two out of

seven quick-release birds did not return on the day of trapping. Only one (standard control) abandoned the nest entirely. There were no differences among groups for hatching success (0.60-0.67), fledging success (0.6-0.86), or productivity (1.0). Similarly, we did not find a difference in behaviors among groups. Results suggest that PIT-tags pose no greater risk to individuals at the colony than do typical trapping and banding operations, and handling time itself may be the most influential driver of post-processing behavior, including nest abandonment.

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Habitat Selection in Common Eider (*Somateria mollissima*) in Relation to Tide on Great Duck Island, ME

Common Eider (*Somateria mollissima*) are large sea ducks which forage and loaf in a variety of habitats, including tidepools and intertidal ledges. Observations of eider in coastal Maine suggest that following hatch female eiders concentrate with “creches” of chicks in particular areas along the shoreline of in-shore islands. Eider were observed on Great Duck Island, Maine, USA (lat. 44° 8' N, long. 68° 10' W) from late June to early August 2019 during the rearing portion of the breeding season. The entire shoreline of Great Duck Island was surveyed for eiders approximately every 10 days following the first observation of hatchlings. Eider creches concentrated in and around a series of tide pools and ledges at the southern end of the island. Behavioral observations were conducted from the lighthouse tower in order to minimize disturbance to the birds. For each eider raft, the behavior, particular habitat, and number of females and chicks were recorded. I also noted tidal level, air temperature and cloud cover. Tidal range during observations was approximately 3m, so extensive areas of intertidal habitat might be exposed or covered during a single tidal cycle. I hypothesized that tide would affect eider behavior, but not locational preference. I predicted that eider would prefer areas with rockweed (*Ascophyllum nodosum*) regardless of tidal level, but would exhibit different foraging behavior while feeding on invertebrates within the rockweed. The great majority of eider foraging was in areas with dense rockweed formations. This is of particular importance given the increased pressure on the intertidal from rockweed harvesting. Predictive models of areas of greatest importance to eider loafing and foraging could minimize conflicts between harvesters and conservationists.

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Clapper Rail (*Rallus crepitans*) response to audio playback based on telemetry monitoring and auditory observation

The Clapper Rail (*Rallus crepitans*) is a declining saltmarsh specialist bird species which occurs on the eastern coast of North America. It is an inherently secretive species, and thus difficult to monitor. Much of the data regarding their populations is based on auditory surveys, as their territorial vocalizations can be heard from quite a distance. Previous research suggests that the use of playback may improve the detectability of Clapper Rail during auditory surveys. Using radio-marked birds, we conducted a pilot study to evaluate the impact of playback on the vocalization rate and short-term movements of Clapper Rail in Delaware, USA. Upon locating a VHF tagged bird, we played two territorial calls with a passive period after each call and recorded the responses of each individual rail. Responses were monitored by an observer monitoring the bird's location and recording any vocalizations. We monitored 18 total audio playback occasions across 8 individual birds, with 1 to 4 playback sessions for each individual. The average amount of time it took for the birds to vocalize after the playback, if the bird vocalized at all during the session, was 2.33 minutes (sd=1.15, n=3). The average amount of time for the birds to move following playback was 2.06 minutes (sd=1.79, n=18), with 67% of the movement responses occurring within the first minute following the initial playback. The monitoring of Clapper Rail responses to playback with radio transmitters demonstrates that while a movement response to playback is common, vocal responses are less common than expected. These preliminary results suggest that auditory playback may not contribute much to detectability and call for further research into methods for improving detectability of this secretive species.

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Analyses of diet breadth and specialization of a breeding shorebird using DNA metabarcoding

Arctic breeding shorebirds rely heavily on consistent food availability. Therefore, understanding diet choices of shorebirds is important for predicting the impact of a changing climate. While the feeding habits of Semipalmated Plover (*Charadrius semipalmatus*) are well studied, gaps in knowledge still exist. DNA metabarcoding provides a new, non-invasive look at the diet breadth and specialization of Semipalmated Plover. Here, we plan to use DNA metabarcoding to analyse the diet of male and female breeding Semipalmated Plover in a subarctic habitat (Churchill, MN). Additionally, we will analyse the diet breadth and specialization of non-breeding Semipalmated Plover in their wintering habitat in South Carolina. We aim to identify differences in diet between male, female, inland, coastal, breeding, and nonbreeding birds. We hypothesize that there will be a difference in the diet of male and female breeding birds, inland and coastal breeding birds, and breeding and non-breeding birds. We predict that breeding females will consume larger, more nutritious prey while breeding males will have a more general diet, reflecting their respective energy requirements during laying and incubation. Additionally, we predict that inland birds will have wider diet breadth than coastal birds due to higher density of flying insects, and wintering birds will have a more general diet than breeding birds due to less energy intensive activity. This study will provide an updated and in-depth analysis of the diet breadth and specialization of Semipalmated Plover in breeding and wintering populations while highlighting differences in the diet of male and female breeding birds.

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Reddish Egret Conservation in the Americas: Strategies for sustaining populations across the species' range

Despite its relatively large geographic range within southern North America, Central America and the northern coastlines of South America, the Reddish Egret has a disjunct distribution occupying narrow strips of coastal habitat across its range with a relatively small and declining global population. Across the International Reddish Egret Working Group and its many partners and stakeholders, there is broad agreement that the Reddish Egret is a species of conservation concern and in need of our immediate attention especially in the face of changing climates and specifically global sea level rise. Using the Open Standards Approach for Conservation Measures, the working group building off the initial Conservation Action Plan (Wilson et al. 2014) and work conducted since the initial plan present a revised range-wide conceptual conservation model for this species that highlights and ranks the greatest threats to maintaining population stability and expanding the population, explores the underlying causes of those threats and identifies 7 overarching strategies for Reddish Egret conservation. These 7 strategies include a) long-term monitoring of breeding, non-breeding and migratory populations, b) elevating the protected status of the species, c) direct and indirect management of breeding and foraging habitats and mitigating threats to the populations and d) promoting the effective conservation of the species through outreach and education. The Conservation Action Plan will provide the guiding document to achieve the working group's vision that the distribution, diversity and abundance of populations and habitats of breeding, migratory and nonbreeding Reddish Egrets are sustained or restored in appropriate current, transitional and future habitats of the Americas.

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Breeding phenology and chick development of Eastern Black Rails in the Southeastern USA [Black Rail Symposium]

Although Eastern Black Rails (*Laterallus jamaicensis jamaicensis*) are receiving increased attention as the subspecies is undergoing consideration for listing under the Endangered Species Act, many aspects of their ecology remain poorly understood. Due to their rarity and secretive habits, studying the species is

particularly challenging. Very little information about the growth and development of Black Rail chicks is available, and this information is necessary for appropriately timing management activities. Using motion-activated camera traps during the 2017, 2018 and 2019 breeding seasons, we captured images of over 20 Eastern Black Rail broods in South Carolina. With these data, we are developing aging criteria and documenting the breeding phenology of Eastern Black Rails in the Southeastern USA.

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Machine Learning for Automated Detection and Classification of Seabirds, Waterfowl, and Other Marine Wildlife from Digital Aerial Imagery [*Avian Interactions with Offshore Energy Symposium*]

The Bureau of Ocean Energy Management (BOEM), in partnership with the U.S. Fish and Wildlife Service Division of Migratory Bird Management (USFWS-DMBM) and the U.S. Geological Survey, has prioritized the use of Outer Continental Shelf (OCS) Program funds to advance the development of a digital aerial imagery and annotation database and machine learning algorithms to automate the detection, enumeration, and classification of seabirds, waterfowl, and other marine wildlife. High resolution digital imagery, collected during aerial surveys of the Atlantic OCS and the Great Lakes, will provide data for algorithm and annotation tool development. Annotated image datasets are being developed to train algorithms; species are manually identified to the lowest taxonomic level possible from representative imagery that captures the variability in appearance, maximizing classification accuracy. Annotation also includes information on age, gender, and activity (when resolvable) to support advanced analysis in the future. The project seeks to improve the efficiency, standardization, and accuracy of airborne wildlife population surveys and aid in informing harvest and other regulatory decisions, environmental assessments, and impact analyses of potential wildlife exposure to offshore energy development projects.

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Ecological Insights for Freshwater Birds from Endoparasite Community Analysis

Birds are often considered some of the top organisms in freshwater food webs, but their specific ecological niches have remained relatively unstudied. Upper-level predators are often more susceptible to mortality from parasitism than direct predation. However, little is known about the parasite communities that inhabit these upper-level freshwater birds. To address this knowledge gap, we examined endoparasite communities in ten waterbird species: common loon (*Gavia immer*, n=14); American coot (*Fulica americana*, n=5); common moorhen (*Gallinula chloropus*, n=5); limpkin (*Aramus guarauna*, n=2); belted kingfisher (*Megasceryle alcyon*, n=6); red-breasted merganser (*Mergus serrator*, n=3); anhinga (*Anhinga anhinga*, n=3); pied-billed grebe (*Podilymbus podiceps*, n=2); least grebe (*Tachybaptus dominicus*, n=2); horned grebe (*Podiceps auritus*, n=2). Specimens were collected from local wildlife centers who froze them immediately post-mortem. These specimens were thawed overnight, and individual organ systems were examined visually for endoparasites. To date, we have recovered a total of 13,739 parasites, including 7,647 digenea, 5,296 cestodes, 286 acanthocephalans, and 510 nematodes. New host records of trematodes, nematodes, cestodes, and acanthocephalans are reported for least grebes and horned grebes in Florida. Understanding the parasite communities in these bird species allows for further analysis of the long-term diet preferences of these species in the South Florida area as well as possible migratory behavior of these bird taxa.

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Colony site selection of Great Cormorant in northern Japan

Environmental preference of species and/or intra-interspecific interaction influence breeding site selection. Great Cormorant (*Phalacrocorax carbo*) can breed physiologically all year round. In Tohoku region, northern Japan, breeding period are restricted during spring to summer. Whereas, cormorants in Kanto region, central Japan, have a twice breeding season in a year from early winter to autumn. The difference of breeding timing could be defined snow duration and cold climate period, and these factors may also affect colony site selection of cormorant. In addition, our previous studies suggest that cormorants gain benefit from the mixed-species colony that forms with Grey Heron (*Ardea cinerea*). Thus, cormorants could be attracted to a colony by herons as they select a colony site. In this study, we focused on environmental condition (cold climate: especially freezing of lakes and marshes) and interspecific interaction (between Grey Heron) to reveal factors affecting colony site selection. We examined the timing of thaw of each lake and marsh in western Aomori prefecture, Tohoku region. At the same time, we examined where cormorants and/or herons formed colonies. To reveal the effect of herons on colony site selection of cormorants, we investigated the pioneer of mixed-species colonies consisting of cormorants and herons in Tohoku region. We compared the proportion of mixed-species colonies in Kanto region (cormorant population is already high) and in Tohoku region (cormorant population is currently increasing). Great Cormorant selected the colony sites around the lakes and marshes that thawed early. In this condition, cormorants preferred a site where Grey heron formed colonies. All mixed-species colonies in Tohoku, pioneer was Grey heron. The proportion of mixed-species colonies was greater in Tohoku region than in Kanto region. Our results suggest that freezing of the lakes provide limitation for constructing colonies of Great Cormorant. Under the restriction, Great Cormorant may take advantage of Grey Heron as “an indicator of a more suitable colony site for breeding” at the area where cormorant’s population have been increased.

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How to Pick up Chicks: Researcher Impact on Juvenile Herring Gulls

Herring Gull (*Larus argentatus*) chicks are often handled for banding, determination of growth rate, and general morphometrics. For the past 21 years, researchers on Great Duck Island, Hancock County, Maine, U.S.A. have handled chicks almost daily from 20-40 predetermined nests to determine fledging success. Upon capture, gull chicks often regurgitate recently consumed meals. Although regurgitate may on occasion be reingested, the food is frequently ignored and wasted. If chicks repeatedly lose meals due to the stress from being handled then their potential weight gain and nutritional input could be less than that of a chick in an environment without daily interference. Past studies with other species have shown that researchers can have significant impacts on health of study subjects due to the stress caused by handling and observation. To see if researchers affected weight gain and growth rates of gull chicks in study plots on Great Duck Island, I established two plots, one, a disturbance plot containing 30 nests which was visited daily, weather permitting, and the other a non-disturbance plot containing 20 nests, that was visited only every three days. For each nest, clutch size, hatching success, survivorship, and chick weight were recorded. Chicks were banded with a metal federal band. Plots were monitored from June 14 to July 15 2019, which was the peak growth period in the colony. Preliminary analysis of results suggests little difference in growth and survival between the two plots, however additional variables must be considered before any final conclusion can be reached.

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Can egg variability be used as a monitoring tool to distinguish between breeding female King Rails?

Avian eggs are naturally variable in appearance, and those of waterbirds frequently exhibit within-population variability in coloration, patterning, dimensions and/or shape. Many of these quantifiable characteristics can vary simultaneously among females, leading to the possibility of eggs having a maternally unique signature. Eggs with distinctive characteristics could thus be used to identify breeding females in monitored breeding populations. For species of conservation concern, this could provide managers a minimally-invasive tool with which to identify

multiple-brooding, within-year renests, and inter-year return rates of individual breeding females. We are investigating aspects of variability and maternal distinctiveness of the eggs of King Rails *Rallus elegans*. As a first step in this study, we investigated the degree of inter-clutch variation in egg dimensions. Females in this population vary substantially in weight, and their clutch sizes range between 4 and 13 eggs. Parental investment theory predicts that egg sizes should also vary among females. Territorial breeding pairs at Mackay Island National Wildlife Refuge in North Carolina were located using callback in suitable freshwater marsh habitat. Nests were found via systematic searching while wading through emergent vegetation. Using calipers, we measured the length and width of each egg in clutches found during the 2011-2019 breeding seasons. Standardized photos were taken of each completed clutch. Ultimately, we will determine how the inclusion of egg dimensions in conjunction with intra- and inter-clutch variation in shape, color and patterning affects the efficacy of assigning maternity.

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Effects of vegetation on Leach's Storm-Petrels' (*Oceanodroma leucorhoa*) nest site preference on Great Duck Island, Maine

Leach's Storm-Petrels (*Oceanodroma leucorhoa*) are the most widespread *procellariiform* breeding in the Northern Hemisphere, and are one of the smallest seabirds. They nest in burrows on offshore islands that are free of predatory mammals. Great Duck Island (GDI), a 89 hectare (220-acre) island located off the coast of Maine, has one of the largest breeding colonies of petrels in the North Eastern United States. Population estimates vary widely, ranging from 5,000 to 20,000 pairs. Censuses are difficult because of the heterogeneous habitat and clustering of burrows. A better understanding of distribution and nest site preferences in relation to surrounding vegetation is necessary for more precise estimates. This study sought to answer how vegetation and other factors impacted Leach's storm-petrel nest site preference. Burrows were located and mapped along five transects averaging 410m in length that crossed the island east-west, as well as in a 100m×140m plot in southern end of the island and two 20m×20m plot in northern end. These transects and plots spanned various habitats including lowbush blueberry (*Vaccinium angustifolium*) fields, spruce (*Picea* spp.) forests, areas dominated by ferns snags and blowdowns, and a 40-year-old timber harvest area filled in with ferns, mountain ash (*Sorbus americana*) and white birch (*Betula papyrifera*). Information on surrounding vegetation, canopy cover, downed woody debris volume, and petrel occupancy were noted. These data inform macro-habitat characteristics of current nesting areas as well as providing insight into potential future habitat availability given the changing landscape of the region, which includes significant reduction in the spruce forest cover on the island.

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Nest Success and Factors Influencing Brown Pelican (*Pelecanus occidentalis*) Breeding Ecology in Coastal Louisiana [Pelicans of the World Symposium]

As a result of anthropogenic and environmental influences, Louisiana is experiencing some of country's fastest rates of land loss. In order to mitigate for future losses various coastal restoration projects have been implemented. Barrier islands are the first line of protection for the coastline, taking on erosional impacts from wave action and storm surges. These islands also provide crucial nesting habitat for various seabird species including brown pelicans (*Pelecanus occidentalis*). By the early 1960s brown pelicans were considered extirpated from coastal Louisiana as a result of widespread pesticide use. Following reintroduction in 1968 the local population has vastly increased although numbers remain in flux. Several factors, including natural disasters, predator presence and reduction of suitable nesting vegetation, have been found to impact the reproductive success of brown pelicans across multiple years. We used motion activated cameras to monitor nests through the breeding season at five barrier island colonies across Terrebonne and Barataria Bay, Louisiana. For an average of three months chicks were monitored until nest site usage was no longer required. Daily nest success was quantified in terms of the number of fledglings per nest, factors contributing to nest failure, and daily survival rates. We modeled the effects of environmental and ecological factors on nest success and daily survival rates across five islands to evaluate influences of island characteristics on reproductive success. Restored islands and nests on live wood vegetation had higher nest success, although results

from the model were mixed. Measuring the reproductive success of these colonies will provide valuable insights into factors affecting variation in nest success and habitat use across the coastline to better inform future restoration projects and practices.

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Application of saltwater solution to effectively control vegetation growth and cover in a tern colony during the nesting season

Vegetation that emerges during the nesting season in early successional and restored habitats is a common challenge for habitat management of Black Skimmers (*Rynchops niger*), tern and shorebird species that typically prefer open, sandy substrate with sparse vegetation. High, dense vegetation can restrict the ability of the birds to detect predators, making the site less desirable and potentially less successful. Protocols to reduce disturbance during incubation and chick-rearing coincide with peak vegetation growth, limiting options for control of emergent vegetation during the nesting season. The goal of this study was to determine a method to safely and effectively reduce vegetation growth and control ground cover in a tern colony without causing additional disturbance during nesting. Prior to nest initiation, six transects spaced 10m apart were established perpendicular to the waterline on a constructed nesting habitat in the salt marsh. Along each transect, 1m² plots were fixed every 5m and randomly selected as treatment (10% salt spray; n=23) or control (no salt spray; n=25). Treatment plots were sprayed 12 times (7.6 ± 2.5 d apart, April-July 2019) with a backpack sprayer during the duration of direct nest checks. Vegetation metrics (Braun-Blanquet cover class, species, and live stem lengths of dominant species) were measured in each plot before and after treatment period. Following the treatment period, the percent change in species richness was significantly higher ($165.5 \pm 30.2\%$) for control plots compared to treatment plots ($3.1 \pm 10.1\%$; $p < 0.01$). Cover class was also impacted by treatment, with live vegetation covering the majority of area in 84.0% of control plots and 8.7% of sprayed plots following the treatment period. Spraying reduced or eliminated weedy, invasive species, while rhizomatous species (e.g. *Distichlis spicata*, *Ammophila breviligulata*) tended to be reduced but not eliminated. Results suggest that within a nesting season, a saltwater solution can be applied to reduce ground cover and eliminate or reduce growth of many emergent species without causing additional disturbance to nesting birds. Combined with other vegetation management approaches, this targeted management approach may help to maintain favorable conditions for nesting birds when alternate open habitat is not available.

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Predicted relative abundance of King Rail (*Rallus elegans*) in coastal marsh of the Gulf Coast Joint Venture

North American bird habitat Joint Ventures are regional partnerships composed of individuals, corporations, conservation organizations, and local, state, provincial, and federal agencies concerned with conservation of migratory birds and their habitat in a particular physiographic region. Originally identified due to its importance to migrating and wintering waterfowl and breeding Mottled Duck, the Gulf Coast Joint Venture (GCJV) region is also important to many other species of landbirds, shorebirds, and non-waterfowl waterbirds. King Rail (*Rallus elegans*) is a priority species for conservation planning and delivery in the GCJV, and the region is believed to be a stronghold for the rail (Pickens and Meanley 2018). To assist with conservation planning and delivery, GCJV staff modeled King Rail predicted relative abundance, using remotely sensed variables, based on a modified methodology utilized by Pickens (2012). 2010 Landsat Thematic Mapper 5 satellite imagery was analyzed and three parameters were used to model predicted relative abundance: (1) mean open water at a 180 meter (m) scale, (2) mean normalized vegetation difference index (NVDI) at a 180 m scale during spring 2010, and, (3) the Coefficient of Variation for the spring modified normalized difference water index (MNDWI) at a 1000 m scale. The scales selected are relevant to localized movements associated with actual nest sites and the approximate home range of the species. Model outputs are intended to guide conservation of existing, high quality King Rail habitat, as well as to identify potential areas for habitat enhancement, restoration and creation. GCJV staff are currently analyzing additional years of satellite imagery to determine how modeled King Rail predicted relative abundance changes over time, and if model outputs can be used to monitor increases or decreases in available King Rail habitat.

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The loafing pelican: testing assumptions about loafing location [*Pelicans of the World Symposium*]

Loafing behavior of Brown Pelicans is not well understood and it is not known if the amount of pelicans loafing on a breeding island consists largely of pelicans breeding on that island. This study analyzed satellite tracked location data of island loafing Brown Pelicans in the Gulf of Mexico during the breeding season of 2012. The proportion of island loafing pelicans loafing on their nesting island was determined to be 81.4%. The proportion of island loafing pelicans that were not loafing on their nest island was 18.6%. Our model of best fit included date, nesting island, nesting stage, and sex as significant predictors of island loafing location. Date had a negative effect on nest island loafing. Female pelicans were more likely to loaf on their nesting island. Pelicans with chicks were more likely to loaf on their nesting island. Pelicans nesting on Bird II, Felicity, Queen Bess, Brandy, and Shallow Bayou were more likely to loaf on their nesting island while pelicans nesting on Gaillard and Raccoon were less likely to loaf on their nesting island.

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Updates on pelican research and conservation in the Caribbean [*Pelicans of the World Symposium*]

A hotspot for avian biodiversity, the Caribbean hosts several species of waterbirds that use the region as residents or migrants. Among them, the Caribbean Brown pelican (*Pelecanus occidentalis occidentalis*), a resident subspecies endemic to the region, is distributed from the Bahamas to northern South America. The subspecies is recovering from population declines due to reproductive failures induced by pesticides; considered of least concern in some countries (e.g. Puerto Rico), it is still listed as threatened in others (e.g. French Antilles). Caribbean Brown pelicans face numerous conservation issues (such as human disturbance, habitat modification and destruction, human competition for prey, or exposure to contaminants) but it remains relatively understudied in the region despite being geographically and numerically ubiquitous. Another pelican species utilizing the Caribbean, the American white pelican (*Pelecanus erythrorhynchos*) is generally only present during migration, in the extreme west of the basin; nevertheless, recent surveys in northwest Cuba showed that a small population remains resident during the breeding months. As a way to foster collaboration across and beyond the Caribbean, we present updates on status, research projects and conservation issues on Brown pelicans and American white pelicans in Cuba, Puerto Rico, Guadeloupe, and Venezuela.

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Migration route, stopover sites and wintering area of the Little Ringed Plover breeding in central Japan

Decreasing of waders has been reported in worldwide, particularly, that tendency of migrant birds has been concerned. To maintain and recover populations of migratory waders, we must identify the important stopover sites and habitat use along migration routes. However, we have little such information for waders that depend on inland freshwater areas compared with those that depend on coastal areas. Recent technological developments in tracking devices now allow us to define habitat use at a fine scale. In this study, we used GPS loggers to track both spring and autumn migration along the East Asia–Australian flyway of the Little Ringed Plover (*Charadrius dubius*) as birds moved to and from their breeding grounds, gravel riverbeds in Japan. We captured 19 birds and attached GPS loggers to them in 2017 and six birds were recaptured in next breeding season. Our tracked birds overwintered in the Philippines and made stopovers mainly in Taiwan and the Philippines. The most important habitat during the non-

breeding season was rice paddy fields. Our findings imply that changes in agriculture management policy in the countries along the migration route could critically affect the migration of waders that depend on rice paddy fields. To maintain populations of migrant inland waders that use the East Asia–Australian flyway, it is necessary not only to sustain the breeding habitat but also the rice paddy fields used during the non-breeding season.

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Leach's Storm-Petrels in the Gulf of Maine: Current population estimates indicate an increase at major colonies

Leach's Storm-Petrel (*Oceanodroma leucorhoa*) colonies in Atlantic Canada have experienced significant declines in the past 20 years, yet no population surveys have been conducted on the Atlantic coast of the United States since the mid-1990s. More than 99% of the U.S. population in the Northwest Atlantic breeds in Maine, and was estimated at 10,366 pairs when last surveyed (1994-1996). At that time, burrows were found on 36 islands. Only seven of these had more than 100 pairs, with 76% of the population breeding at just two sites - Great Duck Island and Little Duck Island. Both of these colony islands, as well as four mid-sized colonies – Matinicus Rock, Old Man Island, Jordan's Delight, and Eastern Egg Rock - were surveyed again in 2018-2019. Results suggest that the number of active burrows on Little Duck Island and Great Duck Island have increased significantly (more than doubled) since the mid 1990's. The number of active burrows estimated at Matinicus Rock, Eastern Egg Rock, and Old Man Island have remained similar or increased, while the population at Jordan's Delight appears to have declined significantly as a result of mammalian predation. Our preliminary results suggest that the declining trends seen in Atlantic Canada's Leach's Storm-Petrel population may not be mirrored in colonies at the southern edge of their range in the Gulf of Maine.

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Black Rail Status Survey for Coastal and Interior Florida [Black Rail Symposium]

The Eastern Black Rail (*Laterallus jamaicensis jamaicensis*) has declined at a rapid rate across parts of its range over the past several decades. Surveys conducted in Maryland showed an approximately 85% reduction in occurrence between 1992 and 2007. Anecdotal reports suggest that this pattern is also occurring throughout the Atlantic states including Florida. The subspecies has been recommended for federal listing. In Florida, breeding rails have been confirmed historically at several salt marsh and interior freshwater locations, but surveys have not been performed in >20 years. During the 2016-2017 breeding seasons (April-June) we surveyed 438 points three times each across five historically occupied properties and 22 new properties with potential black rail habitat to determine the persistence and distribution of black rails across Florida. We detected rails at twenty-one of the 438 points. Detections occurred on four of the five historically occupied properties, though often at different locations within those properties than previously reported. Black rails occupied ten of the 22 newly surveyed properties. Rails were incidentally detected at an additional five properties that were not surveyed using our standardized protocols. Unfortunately, the small number of detections precluded a formal occupancy analysis and we did not detect rails in many patches of apparently suitable habitat, so we cannot determine whether sites were occupied with undetected birds or if sites were simply unoccupied. Despite apparent low densities, rails occurred broadly throughout the state. Future surveys should include a greater number of surveys per point or should use alternate approaches such as the use of autonomous recording units (ARUs) to maximize detections.

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Using GPS tags to investigate the foraging behavior of Atlantic Puffins nesting in the Gulf of Maine

Little is known about the foraging locations and habitats of Atlantic Puffins (*Fratercula arctica*) that breed in the Gulf of Maine USA. To investigate foraging behavior, we attached Pathtrack nanoFix-GEO archival GPS tags to chick-rearing Atlantic Puffins at Matinicus Rock, Maine during the 2019 breeding season. Tags weighed <2.5 g and were attached to the bird's back feathers with Tesa tape. Tags were deployed for 4-7 days before recapture and recovery of the tag was attempted. We also monitored chick growth and conducted observations of chick provisioning behavior at both study and control burrows before, during, and after tag deployment to assess tags effects. We deployed tags on 12 puffins; 7 tags were recovered, and 5 of those contained data. Responses of puffins to being tagged were variable, but all tagged individuals exhibited a delay of at least 2-4 days before resuming chick provisioning, with corresponding slower chick growth rates at study burrows during tag deployment compared to controls. The relative stress of capture and handling versus carrying a tag were unclear, but normal chick provisioning behavior resumed after tags were removed or fell off, and all chicks of tagged puffins fledged. Movements of tagged puffins indicate that foraging occurred primarily to the southeast and at distances of up to 36 km from the colony. Initial results from this pilot study are promising and provide data that can inform ocean management decisions in the Gulf of Maine.

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Parasite Habitat Scaling Trends

Parasites can infect many organs of their avian hosts. Their infection loads are ultimately limited by the way that they use spatial and energetic resources within and among host organ systems. Allometric scaling of tissues is suggested to scale isometrically with body size. Here, we investigate the allometric relationships between body size (whole body mass) and the weight of organs documented as infection sites of helminth parasites in coastal and pelagic bird species in California and Alaska. We confirm previously reported isometric scaling of organ systems and discuss taxon-specific adjustments that reinforce or disrupt these trends. Finally, we discuss the predicted use and scaling of parasite loads within each selected organ systems.

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Diet of maturing Brown Pelican (*Pelecanus occidentalis carolinensis*) chicks in Coastal Alabama [Pelicans of the World Symposium]

The quantity and quality of prey can strongly affect the reproductive success of breeding seabirds. Understanding the marine habitat needs of breeding seabirds, including prey availability and foraging locations, can inform and improve management and restoration; however, these parameters are challenging to measure in dynamic marine systems. Brown Pelicans, a species of high conservation concern, breed throughout the northern Gulf of Mexico but data are lacking on many aspects of their reproductive ecology including diet. To better understand the spatial distribution and abundance of marine prey resources that support the reproductive output of nesting Brown Pelicans in Mobile Bay, we described the taxonomic and proximate composition of meals from Brown Pelican chicks, compared taxonomic composition of meals to the species composition of prey available within Mobile Bay, and used otoliths from Gulf Menhaden (*Brevoortia patronus*) in chick meals to better understand the life history of this important prey species. We found that throughout the study a majority (86%) of Brown Pelican chick meals contained a single species of fish. Meals had a higher average energetic content and biomass in 2017, despite a lower diversity of species. Of the 57 available fish species found within Mobile Bay, only 10 fish species were found in chick diets. In 2017, Brown Pelicans selected for Gulf Menhaden and Bay Anchovies; however, there was a greater diversity of fish species in meals in July 2017 when other species populations in Mobile Bay peaked. Gulf Menhaden accounted for a majority of the fish found in chick meals (2017: 93%, 2018: 66%). Of Gulf Menhaden

found in meals, we found that 90% were juveniles (age 0-1). We found that Gulf Menhaden preyed upon spent on average approximately 60% of their lifespans in freshwater and only 6% in marine systems. Also, most core and edge otolith signatures were freshwater, showing the importance of freshwater nursery and foraging areas. Since Brown Pelicans are apex predators that respond to processes occurring throughout marine food webs, an improved understanding of the fish species that support Brown Pelican chicks in the Gulf of Mexico could aid management and restoration of other species.

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Reproductive success and nest proximity between American Oystercatcher and Piping Plover breeding on New York City Beaches

The American Oystercatcher (*Haematopus palliatus*) and Piping Plover (*Charadrius melodus*) share breeding habitat on the beaches of New York City, NY, USA. American Oystercatchers are the first to arrive and establish nesting territories, and Piping Plovers arrive later, often nesting in close proximity to oystercatchers. From 2015 to 2018, American Oystercatcher and Piping Plover nests were monitored in two locations in Queens, New York (Breezy Point and Rockaway Beach) by New York City Audubon, the National Park Service, and the New York City Department of Parks & Recreation Wildlife Unit. During that time, there have been anecdotal accounts of both positive and negative interactions between American Oystercatchers and Piping Plovers. It appears the territorial nature of the American Oystercatcher benefits both species in terms of predator detection and deterrence. Alternatively, there are accounts of American Oystercatchers acting aggressively towards Piping Plovers and their chicks, possibly leading to an increase in chick mortality. By looking at reproductive success and nest distance, both inter- and intraspecific, we test the hypothesis that Piping Plovers experience increased reproductive success when nesting in close proximity to nesting oystercatchers.

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Energy expenditure of Black-legged Kittiwakes (*Rissa tridactyla*) using the doubly-labelled water technique paired with triaxial Daily Diaries and GPS logging

Middleton Island, in the Gulf of Alaska, is a long-term monitoring station for breeding Black-legged Kittiwakes (*Rissa tridactyla*). To improve understand of their energetic expenditure throughout their reproductive period, we attached GPS-accelerometers and tri-axial Daily diaries to kittiwakes, coupled with doubly-labelled water (DLW) to obtain CO₂ production. The daily behavior of Black-legged Kittiwakes was studied throughout pre-laying, incubating and chick-rearing phases. DLW was used to assess field metabolic rate (FMR) and compare energy expenditure in the three reproductive phases, as well as specific daily activities such as walking, flying and resting. A total of 40 birds were injected with DLW and an additional 40 birds were used as controls. GPS-accelerometers and daily diaries were attached to kittiwakes from both groups (n=10 pre-laying, n=10 incubating and n=20 in chick-rearing) and recaptured 2 days later. We expect to see an increase in energetic needs as the birds invest in reproduction, with the chick-rearing phase being the most energetically demanding and pre-laying being the least energetically demanding since foraging behavior increases with the chick's needs. Furthermore, we expect flying to be more demanding than walking and sitting. Distinct differences in the foraging behavior and location have been observed among stages. All birds in pre-laying tended to forage at the same foraging site whereas individual birds in incubation and chick-rearing foraged at multiple sites. Unusually high temperatures, low reproductive success and a shift in behavior suggest that these results might be due to a change in resource availability. We expect to show that GPS-accelerometry can accurately track energy expenditure of wild kittiwakes in response to changing food availability.

[161] Turney, John W.*¹, Samantha J. Jarret¹, Jack D. Williams¹, Samantha S. Cleveland¹, Alan D. Maccarone² and John N. Brzozad³

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Foraging behaviors of small egrets in South Carolina

There has been some concern about population decline among the smaller egrets (Snowy Egret, Little Blue Heron, Tricolor Heron; *Egretta thula*, *Egretta caerulea*, and *Egretta tricolor*, respectively) in the Southeastern United States. Here we investigate the role foraging behavior may play in the energetic balance among these species. Foraging behavior was recorded with an automated computer-based timer in May 2019 during a two-week period for a total of 8.5 hours at the Tom Yawkey Wildlife Refuge, Georgetown, SC. Steps, strikes, capture success and total turns per minute were recorded. Snowy Egrets stepped (44.1 steps/min + 33.1 SD) significantly more than both Tricolor (30.0 steps/min + 12.2) and Little Blue Herons (21.0 + 5.44). Similarly Snowy Egrets turned (7.7/min + 3.9) significantly more than both Little Blue Herons (3.14 + 1.28) and Tricolor Herons (2.8 + 2.6), who appeared to ambulate in the straightest lines. Capture success (prey/strike) differed significantly among the three species and was greatest among Little Blue Herons (0.67 + 0.15), intermediate among Tricolor Herons (0.34 + 0.21), and lowest among Snowy Egrets (0.21 + 0.15).

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Effects of beach restoration on Wilson's Plover nest survival in coastal Louisiana

Following the completion of beach renourishment projects across coastal Louisiana from 2014 to 2016, concerns have been raised about the effects these projects could have on nest survival of beach-nesting birds. We have been intensively monitoring and protecting breeding Wilson's Plovers (*Charadrius wilsonia*) in southeast and southwest Louisiana to study the effects of restoration on an understudied species of conservation concern. We compared daily nest survival estimates of breeding Wilson's Plovers from 2016 to 2018 between three restored and six unrestored sites. Nest survival in southeast Louisiana was greater than in southwest Louisiana, except in unrestored sites in 2017. In restored sites, survival increased each year from 2016 to 2018 in both regions. In unrestored sites nest survival was higher in 2018 than 2016, but in 2017, severe storms caused nest washouts and greatly reduced nest survival. We conclude that the increased elevation from restoration has a small effect in years without storms, but a dramatic positive effect on nest survival in years when storms are severe, which may be more frequent in a changing climate.

[163] Wilson, Jennifer¹, Heath, Susan², and Smith, Joseph³

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Migratory connectivity and breeding site fidelity of Eastern Willets on the Texas Gulf Coast

In the United States, the Eastern Willet (*Tringa semipalmata semipalmata*) uses coastal habitats reduced by anthropogenic activities and vulnerable to tidal flooding and sea level rise. However, it is a low conservation priority due to: 1) lack of trend data; 2) the conflation of Eastern and Western Willets; and 3) little information on migratory patterns. Previous research has identified overwintering sites for Atlantic breeding Eastern Willets. However, overwintering sites for Gulf Coast breeding Eastern Willets are unknown. During the 2015-2019 nesting seasons, we located 41 Eastern Willet nests at San Bernard National Wildlife Refuge in coastal Texas. We trapped 30 Eastern Willets on the nest and fitted each with color bands (later leg flags) for unique identification. We applied geolocators mounted on leg flags to 24 of these individuals. We retrieved geolocators from 10 of the returning birds. We report the timing and duration of spring and fall migration for Eastern Willets at this study site, the annual return rate of color-banded birds, and describe the spatial distribution of located nests within and between years. Results to date indicate no range overlap between wintering Gulf Coast and Atlantic Coast Eastern Willets.

This difference in migratory connectivity will be helpful for assessments of regional population trends for Eastern Willets.

[164] Zambrano, Ricardo¹ and Warraich, T. Natasha²

It's no day at the beach: Changing nesting habitats for least terns in Florida.

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Least terns, a State Threatened species in Florida, have nested on flat tar-and-gravel roofs in Florida and other regions of the United States since the early 1950s. Habitat disturbance and loss has been implicated as the primary reason for this shift from the ground to roofs. It is estimated that currently about half of the nesting population of least terns in Florida are on gravel roofs. However, gravel roofs are being phased out in favor of newer materials which are not suitable for nesting. Simultaneously, the least tern's traditional nesting habitats continue to face pressure from human development and recreation. Possibly as a result, least terns have started nesting in non-traditional ground habitats, which are far removed from the Florida coastline or are exploiting artificial habitats such as abandoned bridges, gravel roads, and construction zones. Least terns have successfully nested and fledged young in all these new habitats. The least tern's penchant for utilizing non-traditional habitats may help with the recovery of the species in Florida. Nesting platforms, rafts, artificially created islands and spoil mounds are increasingly being used by wildlife managers to provide alternate habitat for least terns in protected areas. These artificial habitats are also being utilized by other species of seabirds and shorebirds.

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Diet and growth of Peruvian Pelican chicks at Punta San Juan, Perú [Pelicans of the World Symposium]

Peruvian pelican numbers in Perú have decreased dramatically since mid-1950s. Major causes of population decline of Peruvian pelicans seems to be related to competition for food with commercial fisheries and strong El Niño events in the last decades based on historical records of pelican population trends, fishing landing and occurrence of anomalous oceanographic conditions. Nowadays, limited information on their feeding habitats and breeding biology preclude managers to identify main problems and therefore, take effective conservation actions. In this study, we determined meal composition and growth of free-living Peruvian pelican chicks (*Pelecanus thagus*) at Punta San Juan, Perú between January and April 1995, a period of high availability of food. Spontaneous regurgitations of large chicks were collected immediately after capture and handling. The diet comprised six species of pelagic fish, with Peruvian anchovies (*Engraulis ringens*) being the most important prey in the samples (N = 61) both by occurrence (87%) and by mass (70%). Anchovies eaten by pelicans consisted mainly of adults (range = 10.5 - 16.5 cm). The distribution of anchovy size matched closely with that from fishery catches (range = 10 - 17 cm). Body mass growth was fitted by a Gompertz equation with the following parameters: $k = 0.063 \text{ days}^{-1}$, $A = 7025 \text{ g}$. Body mass increased from 90 g at hatching to a maximum average of 7300 g at 54 days of age, with an average daily increase of 133 g day^{-1} . Culmen development was linear, increasing from 2.21 cm at hatching to 34.2 cm at fledging. The growth constant of Peruvian pelicans was approximately 70% higher than that predicted by its body mass. The high marine productivity of the Humboldt Current may be one of the main factors by which Peruvian pelicans exhibit a faster mass gain relative to size than other altricial seabirds.

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A Comparison of Direct & Indirect Survey Methods for Estimating Colonially Nesting Waterbird Populations

Population estimates derived from monitoring efforts can be sensitive to the survey method selected, potentially leading to biased estimates and low precision relative to true population size. While small unmanned aerial systems present a unique opportunity to survey waterbird populations while limiting in-colony survey disturbance, relatively little is known about how this method compares with more traditional approaches. In this study we compared population estimates of an egret colony in the Chesapeake Bay derived from small unmanned aircraft system photo counts to those from traditional flush counts, flight-line surveys, and nest counts along with the time required to derive an estimate via each approach. Preliminary data indicate that flush counts and small unmanned aircraft system counts produced lower estimates but required dramatically less time than nest counts and flight-line surveys. These data suggest that while small unmanned aircraft systems could be a useful method for monitoring waterbird populations, detectability differences between methods across time of day and habitat must be considered before comparing results across methods or using these data to make management decisions.

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Poster abstracts

Hlavacek, Enrika¹, Lucas Spellman², Simon Wagner², Jennifer Dieck¹, Timothy White³, Mark Koneff⁴, Brian Lubinski⁵, Luke Fara¹, Larry Robinson¹, Travis Harrison¹, Stella Yu⁶, and Tsung-Wei Ke⁶

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Machine Learning for Automated Detection and Classification of Seabirds, Waterfowl, and Other Marine Wildlife from Digital Aerial Imagery

The Bureau of Ocean Energy Management (BOEM), in partnership with the U.S. Fish and Wildlife Service Division of Migratory Bird Management (USFWS-DMBM) and the U.S. Geological Survey, has prioritized the use of Outer Continental Shelf (OCS) Program funds to advance the development of a digital aerial imagery and annotation database and machine learning algorithms to automate the detection, enumeration, and classification of seabirds, waterfowl, and other marine wildlife. High resolution digital imagery, collected during aerial surveys of the Atlantic OCS and the Great Lakes, will provide data for algorithm and annotation tool development. Annotated image datasets are being developed to train algorithms; species are manually identified to the lowest taxonomic level possible from representative imagery that captures the variability in appearance, maximizing classification accuracy. Annotation also includes information on age, gender, and activity (when resolvable) to support advanced analysis in the future. The project seeks to improve the efficiency, standardization, and accuracy of airborne wildlife population surveys and aid in informing harvest and other regulatory decisions, environmental assessments, and impact analyses of potential wildlife exposure to offshore energy development projects.

Merriman, Joel

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Bird-Smart Wind Energy

In 2010, American Bird Conservancy (ABC) initiated the Bird-Smart Wind Energy Program to advance the sustainable development of wind energy while minimizing risk to affected bird life. ABC supports the effort to combat climate change through responsible renewable energy development, but has concerns regarding the impacts of offshore wind turbines on seabirds. We are working with partners to implement our Bird Smart Wind Energy Policy, which promotes: a comprehensive assessment of likely impacts to birds prior to committing to a wind energy

project; proper siting of turbines away from high-bird-collision-risk areas; transparent post-construction monitoring; effective minimization measures in construction and operation; effective mitigation to compensate for bird mortality; and a plan for facility decommissioning. For more information on ABC's Bird-Smart Wind Energy Campaign, please visit abcbirds.org/program/wind-energy-and-birds/.

Powers, Kevin D.¹, David N. Wiley¹, Linda J. Welch², Zachary H. Olson³, and Les S. Kaufman⁴

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Annual Variation in Spatial Use of the Gulf of Maine by Great Shearwaters

The Gulf of Maine is a primary wintering area for non-breeding great shearwaters from June to November (Powers and Brown 1987, Powers et al. 2017). Shearwaters are the most frequently by-caught species in the US Northeast and mid-Atlantic regions (Hatch 2018) and an area constituting only 1% of the Gulf of Maine (east of Cape Cod) now represents 50% of the observed shearwater takes, primarily from gillnets (Hatch et al. 2016). Therefore, an understanding of the spatio-temporal patterns of great shearwaters is of ecological and conservation importance. To investigate great shearwater spatial use in the Gulf of Maine we used data from satellite tags placed on 47 birds between 2013 – 2017. We explored spatial differences in core and home ranges and estimated how much range overlap occurred from year to year. We examined behavioral traits within these ranges, such as revisitation and duration of stay in the foraging area, and activity patterns on a daily basis. Shearwaters used the entire Gulf of Maine as their home range each year, but spend 65% of their time foraging within only 24% of that area (*i.e.*, core range).

McGregor, Ross M., S. King, C. R. Donovan, B. Caneco, and A. Webb (Presenter: **Martin Scott**)

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A Stochastic Collision Risk Model for Seabirds in Flight

Existing Collision risk models are unable to incorporate variation or uncertainty into calculations of collision frequency. HiDef, under contract to Marine Scotland, created a new collision risk model app that incorporates variability in input parameters. It is available as an online tool (<https://www2.gov.scot/Topics/marine/marineenergy/mre/current/StochasticCRM>)

Andy Webb¹, Ansgar Diederichs², Monika Dorsch², Felix Weiß², Georg Nehls² (Presenter: **Martin Scott**)

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High definition digital video aerial surveys- an advanced method

High definition digital video aerial surveys before, during, and after construction produce reliable and replicable data which can be reviewed by independent experts to support environmental impact assessments and post construction monitoring programs. They can also be used for conservation surveys of seabirds and marine mammals. We review these surveys here.

Spiegel, Caleb S., and Debra Reynolds

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The Atlantic Marine Bird Cooperative: Facilitating over 10 years of collaborations to better understand and conserve marine birds in the Northwest Atlantic

Worldwide, seabirds face greater threats from human-related activities than most other bird taxa, with many species experiencing substantial declines during recent decades. In the northwest Atlantic ocean, primary threats include competition for food resources with fisheries, bycatch in fishing gear, displacement and mortality associated with offshore energy development, pollution, and degradation of nesting habitat. The magnitude of these issues requires collaboration among many stakeholders. Since its formation in 2005, the Atlantic Marine Bird Cooperative (AMBC) has brought together a diverse international partnership of agencies, NGOs, and academic institutions to identify, prioritize, and better understand the most pressing conservation needs for marine birds in the Northwest Atlantic, and develop actions to address them. We review the achievements of the AMBC, and highlight innovative ways the group has developed productive partnerships, shared ideas and information, and utilized working groups to develop action-oriented projects and associated funding.

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Seabird Ecological Assessment Network: Building collaboration, community and credibility through citizen scientists

The Seabird Ecological Assessment Network (SEANET) is a citizen science program that brings together researchers and members of the public in a long-term, collaborative effort to collect data on seabird mortality along beaches up and down the eastern seaboard. SEANET was started by researchers at Tufts Center for Conservation Medicine in 2002. Since that time, SEANET expanded to beaches from Maine to Florida. Dependent largely on volunteers, the participation in SEANET has waxed and waned. However, through hosting of regional SENAET workshops to promote collaboration and a sense of community, potential volunteers (i.e. citizen scientists) are introduced SEANET survey protocols. These regional workshops are crucial to establishing new SEANET survey routes and expanding the overall participation in SEANET. In addition, the need to store and manage SEANET data (ca 15,000 survey records) is a constant requirement to the success of the SEANET. Originally, SEANET data was hosted online via a university server, but was closed down in 2017 because of internal university IT security concerns. Currently, SEANET survey data are stored and managed on Anecdota.org, a free citizen science platform anyone can use to collect observations of our changing world, to further the collaboration, community and credibility of a largely citizen scientist-based seabird monitoring program. Overall, SEANET has been leveraged for science education, social engagement around science and the subject of, and raising awareness about seabirds in the ocean environment.

Stenhouse, Iain, J. and Andrew T. Gilbert

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SeaScribe – A Mobile Avian Survey Data Collection Software Application

Offshore surveys for marine wildlife (seabirds, marine mammals, sea turtles, etc.) are necessary to collect baseline and project-specific data prior to, during, and after offshore development. There have been a couple of computer

programs designed to collect offshore survey data in the field, but these are now antiquated and sometimes difficult to use with little or no ability to be run using current handheld devices. However, tablet computers and smart phones are now ubiquitous, usually have onboard GPS, Wi-Fi, or cellular connectivity, are relatively low cost, and are easy to weather-proof. With funding from the Bureau of Ocean Energy Management (BOEM), we created SeaScribe, a modern survey data collection application specifically for handheld devices. We designed SeaScribe to have better, built in, on-the-fly data checking, improved data standardization across surveys, improved data entry, and reduced time to quality-controlled data. The application was designed to collect core offshore survey data but also gives users the flexibility to add data fields as necessary to satisfy specific survey or research needs. In order to achieve a modern application for this environment, we built SeaScribe from the ground up to best utilize the most current hardware and software. SeaScribe can be used in both Android and Apple operating systems, and BOEM has made the application freely available (iTunes App Store and Google Play) for use on all offshore marine wildlife surveys. You can learn more and download the current User's Manual at www.briloon.org/seascribe.

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Predicting offshore distribution of seabirds in Baffin Bay and Davis Strait to inform risks from human activities.

Millions of seabirds use Canadian Arctic waters in the summer and autumn and for some communities, the harvest of seabirds and their eggs is an important food source. However, warming temperatures and changing sea ice are leading to increased human activity; putting seabirds at increasing risk to anthropogenic threats like pollution, oiling and bycatch in fisheries. Understanding where seabirds are found in high numbers helps us to identify areas where they are most vulnerable to anthropogenic pressures. Focusing on four common species – Black-legged Kittiwake, Dovekie, Northern Fulmar and Thick-billed Murre—we identified areas where seabirds are at most risk to human activities in the arctic waters of Lancaster Sound, Baffin Bay and Davis Strait. We developed density surface models from at-sea seabird survey data (2007 – 2018) to produce predictive density maps in summer (June – August) and autumn (September – November) and incorporated species-specific sensitivity to threats to produce vulnerability maps. Using vessel traffic as an index of risk, we overlaid the vulnerability maps with maps of vessel traffic density (from 2013-2016) to identify areas where seabirds are at risk from various types of anthropogenic threats. We found that seabirds are at highest risk to oiling and disturbance from cargo and tanker ships in Lancaster Sound, around Bylot Island and off Qikiqtarjuaq in summer, and off Frobisher Bay towards Cumberland Sound in autumn. Seabirds are most at risk to bycatch in fisheries offshore in Davis Strait in summer, and further south towards the Labrador Sea in autumn. The Arctic is changing. With those changes comes increased pressures on wildlife and new opportunity for development. Understanding where seabirds are currently at risk to human pressures will help with conservation planning and management decisions.

LOCAL RESTAURANTS

Dining options in Salisbury (near the La Quinta) include:

Edge Bar (La Quinta lobby) - variety of apps, salads, sandwiches, and entrees.

MoJo's (0.1 miles) - festive eatery providing eclectic comfort fare & a rotating beer list with wide screen TVs & music

Market St. Inn (0.3 miles) - waterfront choice serving upscale American fare with local seafood & paired wines, with live music

The Brick Room (0.2 miles) - artisan meat and cheese boards, grilled paninis, lump blue crab fondue, fresh salads and wine pairings

Acorn Market (0.4 miles) - relaxed restaurant serving soup, sandwiches & salads in a vintage, brick-walled setting

Maya Bella's Café and Pizzeria (0.3 miles) – pizza, sandwiches

Riverwalk Café (0.5 miles) – paninis, quesadillas, wraps, smoothies, fancy coffee drinks, baked goods

Brew River Restaurant and Bar (0.5 miles) - A seafood-heavy American menu & craft brews are served at this riverfront eatery & nightclub

Dining options in Princess Anne

The Washington Inn and Tavern - 11784 Somerset Ave. Historic homey atmosphere with ancient timbers and log burning fires in cooler months, a firm favorite with locals and visitors alike. Real food at tasty prices using fresh ingredients and featuring traditional favorites, Eastern Shore specials and friendly service.

Beach to Bay Seafood - 12138 Carol Lane.

Peacocks Restaurant - 30361 Mount Vernon Rd. Americana Grill and Bar, here to serve a modern twist on a traditional favorite. Bigger than bun burgers, rustic, classic, sturdy and hefty - man plates, if you will. All family-oriented with quality taste in every bite.

M St Grille - 12302 Somerset Avenue. A sports themed restaurant with Happy Hour 4-7 Daily! Daily Food and drink specials! Book your events and birthday parties with us!

Notes