

# 2022 Pacific Seabird Group

## 49<sup>th</sup> Annual Meeting

22 - 25 February 2022



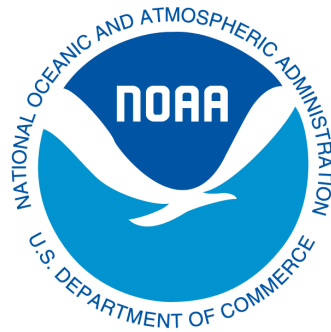
# Pacific Seabird Group 2022

SEABIRDS UNITE

## SPONSORS

We acknowledge the generous support of the following sponsors:

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## DONORS

We thank the following individuals for their financial contributions.

<i>PSG HELPS</i>		<i>Student Travel Fund</i>
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<i>Craig S. Harrison Conservation Fund</i>		<i>PSG General Support Fund</i>	<i>Former Chairs Fund</i>
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## LOCAL COMMITTEE WELCOME

The PSG 2022 “Local” Organizing Committee would like to welcome you to the 49<sup>th</sup> Annual Meeting of the Pacific Seabird Group. Building on the success of our 2021 meeting, it is once again an honor to bring you a completely virtual event. The decision to hold this meeting virtually was hard and not taken lightly. The San Diego Local Organizing Committee did a considerable amount of work to make an in-person meeting happen, and we hope that we can enjoy the warm hospitality of San Diego during some February or March in the future.

This meeting will feature some of the most popular elements of our last virtual meeting, including virtual field trips, interactive social events, an incredible scientific program, and a fully virtual silent auction, while providing a high level of engagement for participants. And with a virtual format this meeting also allows us to significantly decrease our carbon footprint compared to our traditional in-person meetings.

We are excited about the incredible Scientific Program that our Incoming PSG Chair Rachel Sprague and her team have created. The Scientific Program features Plenary Speakers, Special Paper Sessions, and a Symposium. In addition, the Equity, Inclusion, and Diversity Committee of PSG is hosting a workshop on Inclusive Communication and Leadership led by Gwen Navarrete Klapperich, of Klapperich International Training Associates. This workshop builds upon the very successful "Implicit Bias, Privilege, and DEI" workshop from our last meeting.

This year our “Scenes from the Field” virtual field trips will visit several far-flung locations, from the Canadian Arctic to the Antarctic Peninsula. We’ll also take you behind the scenes to showcase important seabird rescue and rehabilitation work. This year we are making our “Scenes from the Field” more accessible by offering Spanish and Japanese translation of many of our field trips, in addition to live Q&A with the hosts. And the best part is that each of the trips will be recorded and available online, so you can attend them all!

Once again, seabird ecologist and natural science illustrator Olivia Townsend has created incredible artwork for the meeting, with the theme “Seabirds Unite.” To order merchandise featuring Olivia’s logo, please visit the official PSG Redbubble Store.

Finally, our Silent AUKtion to benefit students is up and running. Please visit the site and bid early and often! The auction ends Friday, February 25, at 3pm Pacific Time, so get those bids in now!

Once again, welcome to the 49<sup>th</sup> Annual Meeting of the Pacific Seabird Group. We look forward to sharing this time with you.

# Marc

Marc Romano, Local Committee Chair,  
[locochair@pacificseabirdgroup.org](mailto:locochair@pacificseabirdgroup.org)

## GREETINGS FROM THE PROGRAM CHAIR

Welcome to the 49th annual meeting of the Pacific Seabird Group, and our second virtual meeting. At a time when we're still all farther apart than most of us would like, our theme this year is Seabirds Unite: History, Oceans, People, Ecosystems. We started with a longer version of the theme that included those words, but then realized it fit into a graphical representation that allowed the "Seabirds Unite" phrase to be completed with each of the concepts. It took longer still for someone to point out that the four ending words are also an acronym for HOPE. Of course, many of us have been struggling with stress through the pandemic, as well as many things (like climate change and invasive species) that began well before the pandemic started. On the other hand, there is significant hope, not the least in seeing how our members are turning information into action, using knowledge for advocacy, and making new and creative connections to communities and new audiences.

We have tried to reflect the reality of challenges we face, balanced by hope and innovation, in our scientific program this year. Our plenary speakers are examples of this ... **Dr. Emily Choy** not only conducts award-winning research on impacts of climate change on Arctic species, but you can also find her doing Facebook live sessions with kids from halfway down a cliff in a murre colony in belaying gear. Then we have my friend **Caren Loebel-Fried**, an artist and author who hasn't just asked questions and looked at photos of seabirds to inspire her art, but has flown and hiked into remote field sites to visit and participate in conservation work for breeding colonies of seabirds from Midway Atoll to the petrel colony where I work on Lāna'i. Her plenary will focus on how she uses her own experiences to create stories and artwork to bring the amazing feelings of being in seabird colonies to kids and communities. Her stories don't shy away from the reality of conservation challenges and extinction, but tells the stories in a way that leaves folks with hope and motivation to act. Finally, **Dr. Dan Roby**, this year's Lifetime Achievement Award winner exemplifies this idea, and is sure to inspire in his plenary, entitled "(Mis)adventures of a wayward physiological ecologist: from respirometry to restoration."

You will find more than 100 oral and poster presentations in the scientific program. In addition to the standard session topics, you can find several engaging special session topics, symposia, workshops, and discussion panels contributed by the PSG membership for this year's meeting. An invited session on Wednesday afternoon before the EID workshop will feature indigenous speakers from Hawai'i and Mexico speaking about **including traditional knowledge in seabird ecology and conservation**. Two sessions on Thursday will focus on the information seabirds can provide regarding broader ocean conditions and fisheries management: **"Use of seabird data in ecosystem-based fishery management,"** and **"Seabirds as Indicators,"** highlighting examples of the direct connections between seabirds and specific ocean processes to which they are responding. On Friday, a panel of experts will continue the **offshore wind discussion** and the potential formalization of a group within PSG to manage discussions and feedback on offshore wind energy policy. Finally, later Friday afternoon, several PSG volunteers have organized a **PSG Committee "Open House"** for membership to learn more about the different committees that help to keep PSG

running and opportunities to become engaged, as well as a discussion about the future of ***Pacific Seabirds***. And also Friday afternoon, you can join a virtual informal discussion to share observations from field sites and notes of interest between members – a great way to connect and try to replace those great conversations that usually happen in the lobby of the conference center or afterward at dinner!

Planning this year’s scientific program has been inspiring and hopeful, seeing engagement from students, the driven EID committee, the growing support for scientists through PSG HELPS, and scientists throughout the society getting creative in their approach to science, and their approach to communicating and engaging beyond the scientific community. Many thanks to all the volunteers, sponsors, and contributors who have made this meeting happen. We all hope you enjoy PSG’s 49th annual meeting, and will keep fingers crossed that we can once again engage in person at our 50th meeting next year!

A handwritten signature in black ink, appearing to read 'Rachel Sprague', written in a cursive style.

Rachel Sprague, Scientific Program Chair

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# Pacific Seabird Group

## **PACIFIC SEABIRD GROUP EXECUTIVE COUNCIL FOR 2021–2022**

### **Officers**

Chair Roberta Swift

Chair-elect Rachel Sprague

Past Chair Rob Suryan

Vice-chair for Conservation Peter Hodum

Treasurer Kirsten Bixler

Secretary Sadie Wright

### **Representatives**

Alaska and Russia Marc Romano

Washington and Oregon Laura Koehn

Northern California Katie Stoner

Southern California, Latin America, & Hawai'i Cristián Suazo

Non-Pacific USA José R. Ramírez-Garofalo

Canada Kerry Woo

Asia and Oceania Chung-hang Hung

Europe and Africa Nina O'Hanlon

Student Representative Kristin Brunk

## **Local Organizing Committee for the 2022 Annual Meeting**

Marc Romano - Local Committee Chair

Justine Miller, Luana Events - Conference Planner

Jennifer Barrett, Connect Consulting

Wieteke Holthijzen, Anna Vallery - Communications Committee Coordinators

Rachel Sprague - Chair of the Scientific Program

Roberta Swift - PSG Chair

Kirsten Bixler - Treasurer

Kristin Brunk - Student Representative

Local Committee Members: Amie Aquiar, Zoe Burr, Quinn Carvey, Adrian Gall, Derek Harvey, Annette Henry, Kate Iaquinto, Erin Lefkowitz, Justine Miller, Ryan Mong, Hannah Moon, Kim Nelson, Nina O'Hanlon, Samantha Richman, Hans Sin, Katie Stoner, Cheryl Strong, Jennifer Urmston

## **PACIFIC SEABIRD GROUP'S DIVERSITY STATEMENT**

The Pacific Seabird Group is an all-inclusive international society of professional seabird researchers and managers dedicated to the study and conservation of seabirds and their environment. PSG is committed to making diversity a core and abiding strength among our membership and all of our activities including programs, events, publishing, and professional development. Achieving diversity requires an enduring commitment to inclusion that must find full expression in the culture, values, norms and behaviors of the PSG. We support diversity in all of its forms, encompassing but not limited to age, disability status, economic circumstance, ethnicity, gender, race, religion and sexual orientation.

## **ACKNOWLEDGEMENTS**

We would like to thank the following people and organizations for all their hard work to make this meeting possible.

**Conference Planning:** Justine Miller, Luana Events

**Virtual Conference Planning and Implementation:** Jennifer Barrett, Connect Consulting

**Scientific Program:** Rachel Sprague, Shilo Felton, Erika Dittmar

**Local Chair:** Marc Romano

**Student Events:** Kristin Brunk, Kate Iaquinto

**Early Career Scientist Panelists:** Amelia DuVall And the ECS panelists will be: Jim Howard, Christy Wails, Sam Monier, Emma Kelsey, and Kate Iaquinto

**Fundraising:** Kim Nelson, Quinn Carvey

**Meeting Website and Registration:** Adrian Gall, Erin Lefkowitz

**Merchandise Website:** Roberta Swift

**Silent AUktion:** Jennifer Urmston, Kristin Brunk and all the generous donors who contributed

**Social Media:** Anna Vallery, Wieteke Holthuisen

**Field Trip Organizing:** Ryan Mong

**Field Trip Videos and Hosts:** Gemma Clucas, Alyssa Eby, Rae Okawa, Carlos B. Zavalaga, Debbie Dettman, Linda Elliot, Robyn Higgins, Alexis Portillo, Pua Heimul, 大槻都子 (Kuniko Otsuki), 木幡愛梨 (Airi Kowata), Shokun Yamashita, Yoko Teshima, Yutaka Nakamura, Yutaka Nakamura, Rosana Paredes, Stephen J. Insley, Marianne Aplin, Nora Rojak.

## ACKNOWLEDGEMENTS CONTINUED

**Field Trip Subtitles and Transcripts:** 木幡愛梨 (Airi Kowata), 大槻都子 (Kuniko Otsuki), Adrian Gall, Peter Hodum

**Communications:** Wieteke Holthijzen, Anna Vallery

**Social Events:** Kate Iaquinto

**Program Production:** Ryan Mong, Nina O'Hanlon

**Diversity, Equity, Inclusion Event:** Katie Stoner, Anna Vallery, Derek Harvey, Kristina McComber

**Special Session Hosts and Discussion Organizers:** Derek Harvey, Amelia DuVall, Cristián G. Suazo, Tom Good, Stephani Zador, Enriqueta Velarde, Bill Sydeman, David Ainley, George Divoky, Lindsay Adrean, David Duffy, Anna Vallery, Wieteke Holthijzen, Theo Squires, Kristen Brunk, Dan Roby

**Volunteer Organizer:** Justine Miller

**Moderators:** Cassidy Ruge, Jackie Lindsey, Juliet Lamb, Katie Stone, Kristina McComber, Amelia DuVall, Annette Henry, Jennifer Learned, Martyna Syposz, Nina Karnovsky, Airi Kowata, Caitlin Marsteller, David Craig, Rob Suryan, Lila Bowen, Ruth Joy, Anna Vallery, Marc Romano, Rachel Sprague, Kate Iaquinto, Roberta Swift

**Student Presentation Judges:** We are grateful to the 33 volunteer judges who have reviewed the scientific presentations of students at the annual meeting: Alma Barajas, Stephanie Borrelle, Colby Brady, Lara Brenner, Kristin Brunk, Douglas Causey, David Craig, Erika Dittmar, Sarah Durham, Amelia DuVall, Alyssa Eby, Shilo Felton, Megan Friesen, Jefferson Hinke, Robert Kaler, Nina Karnovsky, Emma Kelsey, Jennifer Learned, Jackie Lindsey, Caitlin Marsteller, Pamela Mora Solano, Michael Polito, Martin Raphael, Marc Romano, Cassidy Ruge, Stephanie Schneider, Lauren Scopel, Alice Skehel, Theodore Squires, Rob Suryan, Roberta Swift, Anna Vallery, and Yutaka Watanuki.

*We would like to acknowledge that many members of this organization work with seabirds on traditional lands of numerous Tribes. We honor with gratitude the land itself and these native people, past and present.*

**About the Front Cover:** Our PSG 2022 Annual Meeting artwork was once again designed by seabird ecologist and natural science illustrator [Olivia Townsend](#). Olivia designed the PSG 2020 & PSG 2021 Annual Meeting logos!

## CONFERENCE MEETINGS

All interested members are welcome to attend any of these meetings. In particular, please come to Wednesday's Conservation Committee meeting and Thursday's PSG Members' meeting, where you can learn about PSG's activities during the year and make comments or raise issues that concern you.

*Monday, February 21*

**9:00-15:00 Executive Committee Meeting**

**16:00-18:00 Northeast Asia Seabird Conservation Committee**

*Tuesday, February 22*

**9:00 - 12:00 Workshop: Turning Sound into Discovery: Using Bioacoustics to Understand your Seabird**

**9:00 - 12:00 Marbled Murrelet Technical Committee**

**9:00 - 12:00 Aleutian Tern Technical Committee**

**16:00-15:00 Seabird Monitoring Committee**

**14:00-16:00 American Bird Conservancy Gillnet Bycatch Meeting**

**15:00 - 17:00 Scripps's and Guadalupe Murrelets Technical Committee**

**15:00 - 16:00 North Pacific Albatross Working Group**

**13:00 - 15:00 Tufted Puffin Technical Committee**

**14:00-16:00 Kittlitz's Murrelet Technical Committee**

*Wednesday, February 23*

**12:00-13:00 Conservation Committee**

*Thursday, February 24*

**11:00-12:00 PSG Members' Meeting**

*Friday, February 25*

**12:00-13:00 Past Chairs Luncheon**

## SCHEDULE-AT-A-GLANCE

<b>Wednesday 23 February 2022</b>			
<i>Most up-to-date agenda available on WHOVA</i>			
830-900	<b>Scenes from the Field: South Georgia and Antarctic Peninsula (Track 1)</b>		
900-910	<b>Welcome and Opening Remarks (Track 3)</b>		
910-945	<b>PLENARY 1: Dr. Emily Choy, Early Achievement in Research and Science Communication (EARS) (Track 3)</b> ARCTIC SEABIRDS AS SENTINELS OF ENVIRONMENTAL CHANGE AND ANTHROPOGENIC STRESSORS IN MARINE ECOSYSTEMS		
945-1000	<b>BREAK</b>		
	<b>Track 1</b>	<b>Track 2</b>	<b>Track 3</b>
1000-1030	<b>Conservation Biology</b>	<b>Breeding Phenology and Ecological Change</b>	<b>Non-breeding Biology</b> (starts 1015)
1030-1100			
1100-1115	<b>BREAK</b>		
1115-1200	<b>Conservation Biology</b>	<b>Climate Change</b>	
1200-1300	<b>LUNCH</b>		<b>Conservation &amp; EID Committee Meeting</b>
1300-1330	<b>Conservation Biology</b>	<b>Physiology</b>	
1330-1400			<b>Indigenous Knowledge</b>
1400-1445			
1445-1500	<b>BREAK</b>		
1500-1700	<b>WORKSHOP - Inclusive Communication and Leadership: Continuing the Equity, Inclusion, and Diversity Conversation (Track 3)</b>		
1700-1730	<b>Student Mentoring Reception</b>	<b>Scenes from the Field: Coats Island, Nunavut, Canada</b>	
1740-1800		<b>Virtual Field Trip: Hawaii Wildlife Center</b>	<b>Scenes from the Field: Peruvian Diving Petrels of La Vieja and San Gallán Islands, Peru</b>
1800-1900	<b>Discussion: Graduate School? Your questions answered!</b>	<b>Happy Hour (General)</b>	
1900-2030	<b>SPECIAL DOCUMENTARY SCREENING - <i>Enigma: The Chinese Crested Tern</i></b>		

## SCHEDULE-AT-A-GLANCE

<b>Thursday 24 February 2022</b>			
<i>Most up-to-date agenda available on WHOVA</i>			
	Track 1	Track 2	Track 3
800-830	<b>Virtual Field Trip: Degreased to Released - An Inside Look to Caring for Oiled Wildlife</b>		
830-900	<b>Virtual Field Trip: San Diego Zoo's African Penguins</b>		
900-915	<b>Welcome and Announcements (Track 3)</b>		
915-945	<b>Population Biology</b>	<b>Symposium: Using Seabird Data in Fisheries Management</b>	
945-1045			<b>Contaminants and Marine Debris</b>
1045-1100			
1100-1200	<b>PSG Members Meeting (Track 3)</b>		
1200-1300	<b>LUNCH/ Networking Time</b>		
1300-1345	<b>PLENARY 2: Caren Loebel-Fried (Track 3)</b> HOW I USE STORIES AND ART TO BRING COMMUNITIES AND KIDS TO SCIENCE AND CONSERVATION		
1345-1400	<b>BREAK</b>		
1400-1545	<b>Breeding Biology</b>	<b>Special Session: Seabirds as Indicators</b>	<b>Tracking and Distribution</b>
1545-1600	<b>BREAK - Poster Pre-Perusal Period</b>		<b>BREAK - Poster Pre-Perusal Period</b>
1600-1700	<b>LIVE Poster Session on WHOVA (Artifact Center)</b>		
1700-1730		<b>Scenes from the Field: Ka'ena Point, O'ahu</b>	<b>Field Fails (Track 3)</b>
1730-1800		<b>Scenes from the Field: Birojima and the Izu Islands, Japan</b>	
1800-1900	<b>SEABIRD TRIVIA!</b>	<b>Happy Hour (General)</b>	

## SCHEDULE-AT-A-GLANCE

<b>Friday 25 February 2022</b>			
<i>Most up-to-date agenda available on WHOVA</i>			
	Track 1	Track 2	Track 3
830-900		<b>Scenes from the Field: Cape Parry, N.W.T. Canada</b>	
900-1000	<b>PLENARY 3, Lifetime Achievement Award, Dr. Daniel Roby (Track 3)</b> (MIS)ADVENTURES OF A WAYWARD PHYSIOLOGICAL ECOLOGIST: FROM RESPIROMETRY TO RESTORATION		
1000-1015	<b>BREAK</b>		
1015-1145	<b>Foraging</b>	<b>Tools and Techniques</b>	<b>Management and Policy</b>
1145-1200	<b>BREAK</b>		
1200-1300	<b>PAST CHAIRS LUNCH</b>	<b>Lunch/Networking</b>	
1300-1330	<b>Behavior (starts 1315)</b>	<b>Offshore Wind Panel (to 1430)</b>	<b>EARLY CAREER SCIENTIST PANEL</b>
1330-1400			
1400-1415	<b>BREAK</b>		<b>BREAK</b>
1415-1545	<b>Around the Pacific Observations Roundtable</b>		<b>Workshop: PSG Committee Open House and <i>Pacific Seabirds</i> Discussion</b>
1545-1600	<b>BREAK</b>		
1600-1630	<b>Scenes from the Field: Alaska Maritime NWR</b>		
1630-1730	<b>CLOSING CEREMONY (Track 3)</b>		
1730-1830	<b>* Closing HAPPY HOUR: See you in 2023 in San Diego!*</b>		



## DETAILED SCHEDULE

*Note: **bold** indicates presenting author, \* indicates student presenter*

<b>PSG 2022 Detailed Daily Schedule</b>			
<b>Wednesday 23 February 2022</b>			
<i>Most up-to-date agenda available on WHOVA</i>			
830	<b>Scenes from the Field: South Georgia and Antarctic Peninsula (Track 1)</b>		
900	<b>Welcome and Opening Remarks (Track 3)</b>		
910	<b>PLENARY 1: Early Achievement in Research and Science Communication (EARS), Dr. Emily Choy (Track 3)</b> ARCTIC SEABIRDS AS SENTINELS OF ENVIRONMENTAL CHANGE AND ANTHROPOGENIC STRESSORS IN MARINE ECOSYSTEMS		
945	<b>Coffee Break</b>		
	<b>Track 1</b>	<b>Track 2</b>	<b>Track 3</b>
	<b>Conservation Biology</b>	<b>Breeding Phenology and Ecological Change</b>	<b>Non-Breeding Biology</b>
1000	DOCUMENTATION AND RELATIVE COLLISION RISK FOR HAWAIIAN SEABIRDS AND WATERBIRDS AT POWERLINES AND COMMUNICATION TOWERS <b>Marc Travers</b> , Scott Driskill, Molly Bache, Caitlin Scott, Andre Raine	BREEDING SUCCESS, PHENOLOGY, CHICK GROWTH, AND PROVISIONING OF THE BLACK STORM-PETREL (OCEANODROMA MELANIA) UNDER VARIABLE OCEAN CONDITIONS <b>Yuliana Bedolla Guzman</b>	
1015	WHEN, HOW AND WHY SEABIRDS ARE AFFECTED BY LIGHT POLLUTION? <b>Martyna Syposz</b> , Oliver Padget, Natasha Gillies, Annette L. Fayet, Joe Wynn, Benjamin M. Van Doren, Jay Willis, Matt J. Wood, Aaron Alejo, Tim Guilford	DIFFERENT RESPONSE TO WEATHER CONDITIONS IN BREEDING PHENOLOGY AND SUCCESS OF TWO PYGOSCELIS PENGUINS IN THE ANTARCTIC PENINS <b>Min-Su Jeong</b> , Hankyu Kim, Jeong-Hoon Kim, Jin-Woo Jung, Youmin Kim, Hae-Min Seo, Hwayeon Kang, Junsoo Kim, Hosung Chung	NON-BREEDING NICHE OVERLAP OF THREE NORTH ATLANTIC ALCID SPECIES <b>Emily Runnells*</b> , Gail Davoren
1030	LIGHT POLLUTION ON STREAKED SHEARWATER (CALONECTRIS LEUCOMELAS): QUANTITATIVE COUNTS OF GROUNDED FLEDGLINGS AND THEIR PHYSICAL CHARACTERISTICS <b>Kyosuke Iwayama*</b>	LONG-TERM IMPACTS OF THE 2014-2016 NORTH PACIFIC MARINE HEATWAVE ON SEABIRDS IN COOK INLET, ALASKA <b>Sarah Schoen</b> , Mayumi Arimitsu, John Piatt, Caitlin Marsteller, Sam Stark, Naomi Bargmann	THE HIDDEN MOVEMENTS OF NON-BREEDERS AT COLONIES: AN EXAMPLE FROM BROWN SKUAS (STERCORARIUS ANTARCTICUS) ON AMSTERDAM ISLAND <b>Juliet Lamb</b> , Jérémy Tornos, Amandine Gamble, and Thierry Boulinier

1045	IMPACT OF THE NATIONAL FISH AND WILDLIFE FOUNDATION'S SEABIRD CONSERVATION PROGRAM <b>Scott Hall</b> , Kelly Zilliacus, Don Croll, Bernie Tershy, Annamarie Lopata	SIZE AND BREEDING PHENOLOGY OF THE WORLD'S LARGEST COLONY OF SOUTH AMERICAN TERNS <b>Carlos Zavalaga</b> , Sebastián Lozano-Sanllehi	PREDICTING CLIMATE CHANGE IMPACTS ON THE NON-BREEDING DISTRIBUTION OF THICK-BILLED MURRES (URIA LOMVIA) <b>Allison Patterson</b> , Grant Gilchrist, Anthony Gaston, Kyle Elliott
1100		<b>BREAK</b>	
	<b>Track 1</b>	<b>Track 2</b>	<b>Track 3</b>
	<b>Conservation Biology</b>	<b>Climate Change</b>	
1115	CONSERVING AN ENDANGERED ICONIC SEABIRD: STATUS AND TRENDS OF THE TUFTED PUFFIN (FRATERCULA CIRRHATA) IN THE SALISH SEA <b>Peter Hodum</b> , Scott Pearson	COMMON MURRE (URIA AALGE) DIE-OFF IN THE KODIAK ARCHIPELAGO, ALASKA, APRIL 2015 TO APRIL 2016 <b>Robin Corcoran</b>	
1130	MICE TO EAT YOU: UNCOVERING THE DIET OF INVASIVE HOUSE MICE <b>Wieteke Holthuijzen*</b> , Elizabeth Flint, Jonathan Plissner, Kaylee Rosenberger, Daniel Simberloff, Coral Wolf, Holly Jones	COLONY FAILURE OR COLONY COLLAPSE? ABSENCE SUGGESTS FUNCTIONAL LOSS OF CRESTED AUKLETS (AETHIA CRISTATELLA) AT BIG KONIUJI I., ALASKA <b>Hector Douglas</b> , Brie Drummond, Alexander Kitaysky, Evgenia Kitaiskaia, Suzanne Budge	
1145	RAPID AND SPONTANEOUS SEABIRD COLONIZATION INCREASES SOIL NUTRIENT AVAILABILITY ON THE ISLAND OF MAUI <b>Cecelia Frisinger</b> , Jennifer Learned, Martin Frye, Skye Anderson, Mariah Rivera, Jay Penniman	PRIORITIZATION OF RESTORATION NEEDS FOR SEABIRDS IN THE US TROPICAL PACIFIC <b>Lindsay Young</b> , Eric VanderWerf	
1200-1300	<b>LUNCH</b>		<b>Conservation and EID Committee Meeting</b>
	<b>Track 1</b>	<b>Track 2</b>	<b>Track 3</b>
	<b>Conservation Biology</b>	<b>Physiology</b>	
1300	THE IMPACT OF FERAL HONEY BEES (APIS MELLIFERA) ON ENDANGERED SEABIRDS IN THE HAWAIIAN ISLANDS <b>Andre Raine</b> , Scott Driskill, Jennifer Rothe, Kyle Pias, Alex Dutcher	COSTS OF REPRODUCTION MEDIATED BY OXIDATIVE STRESS IN A SEABIRD – AN EXPERIMENTAL STUDY <b>Chinatsu Nakajima*</b> , Jacopo G. Cecere, Kyle Elliott, Marie Claire Gatt, Scott Hatch, Yasuaki Niizuma, Don-Jean Léandri-Breton, Joan Ferrer Obiol, Diego Rubolini, Shannon Whelan, Akiko Shoji	

1315	ABUNDANCE IN 3D: ASSESSING COLLISION VULNERABILITY OF SEABIRDS AND FLOATING OFFSHORE WIND IN THE CALIFORNIA CURRENT <b>Stephanie Schneider</b> , Sophie Bernstein, Glenn Ford, Janet Casey, Jarrod Santora, Scott Terrill, Sharon Kramer, David Ainley	GEOGRAPHICAL BODY SIZE VARIATION IN THE RED-BILLED TROPICBIRD (PHAETHON AETHEREUS) AT THE MEXICAN PACIFIC <b>Alberto Piña Ortiz*</b> , José Alfredo Castillo-Guerrero, Luis Manuel Enríquez-Paredes, Guillermo Fernández, Salvador Hernández-Vázquez, Petra Quillfeldt	
1330	BIOSECURITY ACTION ON NATIVIDAD ISLAND, MEXICO. A SINGLE RAT THREAT A KEY BIODIVERSITY ISLAND <b>Maria Felix Lizarraga</b> , Yuliana Bedolla Guzman, Mariam Latofski Robles, Alejandra Fabila Blanco, Maria del Mar Garciadiego San Juan, Alicia Aztorga Ornelas, Evaristo Rojas Mayoral, Federico Méndez Sánchez	IN-AIR HEARING SENSITIVITY OF AN ENDANGERED ALCID SEABIRD, THE MARBLED MURRELET (BRACHYRAMPHUS MARMORATUS) <b>Adam Smith</b> , Michelle Kissling, Steve Lewis, Alyssa Capuano, Aran Mooney	<b>Indigenous Peoples and Local Communities: <i>Flying from Traditional Knowledge to Their Inclusion in Seabird Ecology and Conservation</i></b>
			HAWAIIAN CULTURAL SIGNIFICANCE OF NATIVE SEABIRDS <b>Sam ‘Ohu Gon III</b>
1345	INTRODUCED AND NATIVE VERTEBRATES IN PINK-FOOTED SHEARWATER (ARDENNA CREATOPUS) BREEDING COLONIES IN CHILE <b>Ryan Carle</b> , Abram Fleishman, Tiare Varela, Pablo Manriquez Angulo, Ryan Carle, Peter Hodum, Valentina Colodro, Verónica López, Héctor Gutiérrez-Guzmán	FLAPPING FLIGHT ANALYSIS OF STREAKED SHEARWATERS (CALONECTRIS LEUCOMELAS) USING A HIGH-TIME RESOLUTION ACCELERATION / GPS RECORDER <b>Kazuki Harada*</b> , Leo Uesaka, Masaru Naruoka, Katsufumi Sato, Kentaro Sakamoto	CHARTING A PATH TO RECOVERY THROUGH PEOPLE AND PLACE <b>Maka‘ala Ka‘aumoana</b>
1400	NEW FINDINGS ON TOWNSEND'S SHEARWATER (PUFFINUS AURICULARIS) BREEDING POPULATION AND THE IMPLICATIONS FOR ITS CONSERVATION <b>Fernando Solís</b> , Antonio Ortiz Alcaraz, Yuliana Bedolla Guzman, Alejandra Fabila Blanco, Ana Cárdenas Tapia, Alicia Aztorga Ornelas, Javier Góngora Salinas, Braulio Rojas-Mayoral		SEABIRD RELATED CULTURE AND KNOWLEDGE OF THE COMCAAC, PEOPLE OF THE SEA <b>Enriqueta Velarde</b> , Thor Morales, Cathy Moser Marlett
1415	TRANSLOCATION OF BLACK-FOOTED ALBATROSSES (PHOEBASTRIA NIGRIPES) FROM MIDWAY ATOLL, USA TO CREATE A BREEDING COLONY ON GUADALUPE ISLAND, MEXICO <b>Eric VanderWerf</b> , Federico Méndez Sánchez, Julio Hernández Montoya, Robby Kohley, Ariana Duarte Canizales, Lindsay Young, Leilani		THE COMCAAC PEOPLE AND BIRDS: A STORY OF RELATIONSHIPS BETWEEN TRADITIONAL KNOWLEDGE, WESTERN SCIENCE, AND CONSERVATION <b>Jaime Martinez</b> , Lorayne Meltzer, Lauren Dolinski, Leonel Hofer, Elida Barnett

	Fowlke, Marisol Torres Aguilar, Eduardo Ponce Guevara, Humberto Berlanga García		
1430	EXTINCTION OF THE SPECTACLED CORMORANT (URILE PERSPICILLATUS): A MEDIA AND LITERATURE OVERVIEW <b>Theodore Squires*</b>		Discussion
1445	<b>Coffee Break</b>		
1500- 1700	<b>WORKSHOP - Inclusive Communication and Leadership: Continuing the Equity, Inclusion, and Diversity Conversation</b>		
1700	<b>STUDENT MENTORING RECEPTION</b>	<b>Scenes from the Field: Coats Island, Nunavut, Canada</b>	
1730		<b>Virtual Field Trip: Hawaii Wildlife Center</b>	<b>Scenes from the Field: Peruvian Diving Petrels of La Vieja and San Gallán Islands, Peru</b>
1800- 1900	<b>Discussion: Graduate School? Your questions answered!</b>	<b>Happy Hour (General)</b>	
1900- 2030	<b>SPECIAL DOCUMENTARY SCREENING - <i>Enigma: The Chinese Crested Tern</i></b> <i>(Also available for asynchronous viewing for 24 hours from 7pm Wednesday 2/23 to 7pm Thursday 2/24)</i>		

# PSG 2022 Detailed Daily Schedule

Thursday 24 February 2022

*Most up-to-date agenda available on WHOVA*

0800	<b>Virtual Field Trip: Degreased to Released - An Inside Look to Caring for Oiled Wildlife</b>		
830	<b>Virtual Field Trip: San Diego Zoo's African Penguins</b>		
900	<b>Welcome and Opening Remarks (Track 3)</b>		
	<b>Track 1</b>	<b>Track 2</b>	<b>Track 3</b>
	<b>Population Biology</b>	<b>Symposium: Using Seabird Data in Ecosystem-based Fisheries Management</b>	
915	SYNCHRONY IN SEABIRD SURVIVAL: DRIVERS AT MULTIPLE SPATIAL SCALES <b>Sarah Converse</b> , Nathan Hostetter, Staci Amburgey, Abby Bratt, Amelia DuVall, Brielle Thompson, Lisanne Petracca, Hannah Sipe, Mark Sorel, Amanda Warlick, Martina Kadin	BUILDING CAIRNS' BRIDGE: SEABIRD DATA USE IN U.S. FISHERIES MANAGEMENT <b>Thomas Good</b> , William Sydeman, Stephani Zador	
930	EVALUATING SURVEY METHODS FOR ESTIMATING ABUNDANCE OF FRATERCULA PUFFINS IN THE KODIAK ARCHIPELAGO <b>Katie Stoner*</b> , Robin Corcoran, Megan Boldenow, Don Lyons	GULF OF CALIFORNIA FORAGE-FISH FISHERY: SEABIRD DIET DATA AND FISHERY INDEPENDENT ESTIMATES AS POSSIBLE MANAGEMENT TOOLS <b>Enriqueta Velarde</b> , Exequiel Ezcurra, Daniel W. Anderson, Osvaldo Gutierrez-Benitez	<b>Contaminants and Marine Debris</b>
945	A GLOBAL PHYLOGENY OF PIED AND BLACK OYSTERCATCHERS (HAEMATOPUS LONGISTOSTRIS AND HAEMATOPUS BACHMANI) <b>Tereza Senfeld*</b> , Martin Collinson	HOW SEABIRD DATA INFORM FISHERIES QUOTAS IN ALASKA <b>Stephani Zador</b>	GUANAY CORMORANT PELLETS (PHALACROCORAX BOUGAINVILLII) AS AN INDICATOR OF MARINE PLASTIC POLLUTION ALONG THE PERUVIAN COAST <b>Isabella Diaz</b> , Carlos Zavalaga, Bethany L. Clark
1000	EFFECTS OF OCEANOGRAPHIC VARIABILITY ON DEMOGRAPHY OF CASSIN'S AUKLET (PTYCHORAMPHUS ALEUTICUS) IN THE CALIFORNIA CHANNEL ISLANDS <b>Amelia DuVall</b> , Josh Adams, David Mazurkiewicz, Sarah Converse	CAN PUFFIN DIET BE USED TO PREDICT POLLOCK BIOMASS? <b>William Sydeman</b> , Sarah Ann Thompson, John Piatt, Stephani Zador, Martin Dorn	OCCURRENCE OF PLASTIC IN PELLETS OF NEOTROPIC CORMORANTS (PHALACROCORAX BRASILIANUS) IN LIMA, PERU, BEFORE AND DURING THE COVID-19 PANDEMIC ANTHROPAUSE <b>Catalina Porras*</b> , Carlos Zavalaga

1015	POPULATION ESTIMATE FOR RAKO OR BULLER'S SHEARWATER (AR DENNA BULLERI), AN ENDEMIC MARINE INDICATOR <b>Megan Friesen</b> , Craig Simpkins, James Ross, Sandra Anderson, Stefanie Ismar-Rebitz, Alan Tennyson, Graeme Taylor, Karen Baird, Chris Gaskin	SEABIRD-BASED INDICATORS IN CENTRAL CALIFORNIA CURRENT FORAGE FISH MANAGEMENT <b>Julie Thayer</b> , John Field, Ryan Carle, Pete Warzybok, Willim Sydeman	PREVALENCE OF PLASTIC DEBRIS IN NESTS OF TWO CORMORANT SPECIES IN PERU <b>Carolina Meza*</b> , Carlos Zavalaga
1030	COMMON MURRE (URIA AALGE CALIFORNICA) RECOLONIZATION OF ITS SOUTHERNMOST BREEDING COLONY Phil Capitolo, <b>Daniel Barton</b> , Josh Adams, Michael Parker, David Mazurkiewicz, Gerard McChesney, Harry Carter	HOW SEABIRD DIET DATA CAN BE USED TO INFORM FISHERIES MANAGEMENT: LESSONS FROM THE GULF OF MAINE <b>Lauren Scopel</b> , Antony Diamond, Stephen Kress, Paula Shannon	EFFECTS OF DILUTED BITUMEN ON FLIGHT AND DIVING BEHAVIOURS OF CHICK-REARING RHINOCEROS AUKLETS (CERORHINCA MONOCERATA) <b>Catherine Lee-Zuck*</b> , Tony Williams, John Elliott, Kyle Elliott
1045	Discussion	Discussion	<b>BREAK</b>
1100			<b>PSG Members Meeting (Track 3)</b>
1200-1300	<b>LUNCH/Networking Time</b>		
1300	<b>PLENARY 2: Caren Loebel-Fried (Track 3) HOW I USE STORIES AND ART TO BRING COMMUNITIES AND KIDS TO SCIENCE AND CONSERVATION</b>		
1345	<b>Coffee Break</b>		
	<b>Track 1</b>	<b>Track 2</b>	<b>Track 3</b>
1400	<b>Breeding Biology</b> PREDATOR DISTURBANCES CONTRIBUTE TO COMMON MURRE (URIA AALGE) BREEDING FAILURES IN KACHEMAK BAY, ALASKA, FOLLOWING THE HEATWAVE <b>Caitlin Marsteller</b> , Mayumi Arimitsu, Sarah Schoen, John Piatt, Sam Stark	<b>Special Session: Seabirds as Indicators</b> INTRODUCTION <b>David Ainley</b>	<b>Tracking and Distribution</b> 17-YEARS OF OPPORTUNISTIC SIGHTINGS OF SEABIRDS DURING SMALL-BOAT SURVEYS FOR CETACEANS AROUND THE MAIN HAWAIIAN ISLANDS <b>Jordan Lerma*</b> , Peter Pyle, Daniel Webster, Robin Baird

1415	SMALL INTER-ANNUAL VARIATION IN BODY CONDITION OF CHICK-REARING RHINOCEROS AUKLETS (CERORHINCA MONOCERATA): A TEST OF ADAPTIVE BODY MASS HYPOTHESIS <b>Jumpei Okado*</b> , Yutaka Watanuki	“INDICATING” THE COLLAPSE OF AN ECOSYSTEM: A HALF-CENTURY OF MONITORING AN ICE-OBLIGATE SEABIRD’S PATH TO EXTINCTION <b>George Divoky</b> , Pierre-Loup Jan, Christophe Barbraud	TRACKING SEABIRDS TO IDENTIFY HIGH STAKES AREAS IN THE NATURAL PARK OF THE CORAL SEA <b>Andreas Ravache</b>
1430	<i>Break/Discussion</i>	EGG ORDER AND OCEANOGRAPHIC FACTORS DRIVE EGG SIZE DIFFERENCES IN SCRIPPS’S MURRELETS (SYNTHLIBORAMPHUS SCRIPPSI) <b>Marcela Todd Zaragoza</b> , Amelia DuVall, Jim Howard, David Mazurkiewicz, Sarah Converse	WHERE ARE THEY LANDING? MAPPING SEABIRD FALLOUT FROM ARTIFICIAL LIGHTING IN AUCKLAND, NEW ZEALAND <b>Ariel-Micaiah Heswall*</b> ,
1445	CHICK PROVISIONING RATES AND NESTING SUCCESS OF THE MARBLED MURRELET (BRACHYRAMPHUS MARMORATUS) <b>Jon Dachenhaus</b> , Jim Rivers, Kim Nelson, Dan Roby, Matt Betts, Ethan Woodis, Jennifer Bailey Guerrero, Jonathon Valente, Lindsay Adrean	RESURGENCE OF THE ANTHROPOCENE IN THE ROSS SEA, ANTARCTICA <b>David Ainley</b> , Virginia Morandini, Leo Salas, Nadav Nur, Rose Foster, Roxanne Beltran, Jay Rotella, Michelle La Rue, Claire Parkinson, Kevin Arrigo	SEABIRD COMMUNITY COMPOSITION: SEASONALITY IN THE NORTHERN GULF OF MEXICO <b>Pamela E Michael</b> , Kathy M. Hixson, Jeffery Gleason, J. Chris Haney, Yvan Satgé, Patrick G. R. Jodice
1500	AN ASSESSMENT OF FACTORS THAT INFLUENCE NEST SUCCESS OF THE MARBLED MURRELET (BRACHYRAMPHUS MARMORATUS) <b>Ethan Woodis</b> , Jonathon Valente, Kim Nelson, Dan Roby, Matt Betts, Jon Dachenhaus, Jennifer Bailey Guerrero, Jim Rivers	BILL-LOADS OF RHINOCEROS AUKLETS (CERORHINCA MONOCERATA) INDICATE LONG-TERM CHANGE OF THE SUMMER FORAGE FISH COMMUNITY IN THE NORTHERN JAPAN SEA <b>Yutaka Watanuki</b> , Mariko Yamamoto, Jumpei Okado, Motohiro Ito, William Sydeman	CHANGES IN POSITIVE ASSOCIATIONS AMONG VERTEBRATE PREDATORS AT SOUTH GEORGIA AND IN THE CALIFORNIA CURRENT <b>Samantha Monier*</b> , Richard Veit, Lisa Manne, Jarrod Santora
1515	HABITAT ASSOCIATIONS OF NESTING ALBATROSS AT MIDWAY ATOLL AND IMPLICATIONS FOR RESTORATION AND MANAGEMENT STRATEGIES Jonathan Plissner, <b>Sarah Youngren</b> , Daniel Rapp, Joseph Latsha, Kelly Goodale	SPATIAL AND TEMPORAL VARIATION IN NEARSHORE MARINE BIRD COMMUNITIES IN A WARMING GULF OF ALASKA <b>Brian Robinson</b> , Heather Coletti, Brenda Ballachey, James Bodkin, George Esslinger, Daniel Esler	MARINE HABITAT USE PATTERNS OF THE ENDANGERED MARBLED MURRELET (BRACHYRAMPHUS MARMORATUS) IN THE CENTRAL-SOUTHERN PUGET SOUND <b>Bryce Poplawsky*</b> , Peter Hodum
1530	MACHINE LEARNING AS A TOOL FOR MONITORING SEABIRD NESTING COLONIES <b>Rose Wilkin*</b> , Macus Ong, Laurentiu Cojocaru, Jillian Anderson, Jenna Cragg, Gregory McClelland, Ruth Joy	PHENOLOGICAL AND DEMOGRAPHIC RESPONSES OF ALCIDS TO CLIMATE CHANGE IN THE GULF OF MAINE <b>Heather Major</b> , Sarah Durham, Antony Diamond	

1545	<b>BREAK - Poster Pre-Perusal Period</b>	SEABIRDS ARE INDICATORS AND PREDICTORS OF THE ENVIRONMENT <b>Enriqueta Velarde</b> , Daniel W. Anderson, Exequiel Ezcurra, Gabriela De la Cruz-Pino	<b>BREAK - Poster Pre-Perusal Period</b>
1600-1700	<b>LIVE Poster Session on WHOVA (Artifact Center)</b>		
1700		<b>Scenes from the Field: Ka'ena Point, O'ahu</b>	<b>Field Fails (Track 3)</b>
1730		<b>Scenes from the Field: Birojima and the Izu Islands, Japan</b>	
1800-1900	<b>SEABIRD TRIVIA!</b>	<b>Happy Hour (General)</b>	



# PSG 2022 Detailed Daily Schedule

Friday 25 February 2022

*Most up-to-date agenda available on WHOVA*

830		<b>Scenes from the Field: Cape Parry, N.W.T. Canada</b>	
900	<b>PLENARY 3: Lifetime Achievement Award, Dr. Daniel Roby (Track 3) (MIS) ADVENTURES OF A WAYWARD PHYSIOLOGICAL ECOLOGIST: FROM RESPIROMETRY TO RESTORATION</b>		
1000	<b>BREAK</b>		
	<b>Track 1</b>	<b>Track 2</b>	<b>Track 3</b>
	<b>Foraging</b>	<b>Tools and Techniques</b>	<b>Management and Policy</b>
1015	FORAGING NICHE DIFFERENTIATION OF CHICK-REARING SYMPATRIC SEABIRDS IN THE GULF OF THE ST-LAWRENCE <b>Christina Petalas*</b> , Kyle Elliott, Raphael Lavoie	CORMORANTS, OCEANOGRAPHY, AND COLLABORATIONS: USING BIOLOGGING TO MEASURE TEMPERATURE AND SALINITY FROM FORAGING SEABIRDS <b>Rachael Orben</b> , Adam Peck-Richardson, Alexa Piggott, Dylan Winters, Sabir Bin Muzaffar, Alastair Baylis, Dorukhan Ardağ, Greg Wilson, James Lerczak	A GLOBAL DATABASE OF ACTIVE SEABIRD RESTORATION PROJECTS <b>Dena Spatz</b>
1030	SHARING SPACES: PERUVIAN BOOBIES (SULA VARIEGATA) SHOW CONSISTENT INTRASPECIFIC NICHE OVERLAP ACROSS VARYING OCEAN CONDITIONS <b>Sara Wang*</b> , Michael Polito, Carlos Zavalaga	EYE IN THE SKY: USING DRONES AND AI TO INVESTIGATE MULTI-SPECIES FORAGING ASSOCIATIONS <b>Wednesday Davis*</b> , Rochelle Constantine, Gaia Dell'Ariccia	BEST MANAGEMENT PRACTICES TO PROTECT ENDANGERED AND NATIVE BIRDS AT SOLAR INSTALLATIONS IN HAWAI'I <b>Jay Penniman</b> , David Duffy, Jennifer Learned
1045	FEATHER AMINO ACID ISOTOPES IDENTIFY CONTRASTING SEASONAL TROPHIC NICHES IN PENGUINS WITH DIFFERING MIGRATION STRATEGIES <b>Michael Polito</b> , Katelyn Lamb, Jefferson Hinke	USING ORNITHOLOGICAL RADAR TO DETERMINE POPULATION TRENDS OF HAWAIIAN PETRELS (PTERODROMA SANDWICHENSIS) AND NEWELL'S SHEARWATERS (PUFFINUS NEWELLI) ON THE ISLAND OF MAUI <b>Skye Anderson</b> , Jennifer Learned, Cheryl King, Stephen Rossiter, Martin Frye, Cecelia Frisinger, Jay Penniman	CONTINUITY OF NORTH PACIFIC FISHERIES OBSERVER SEABIRD/FISHERY INTERACTION TRAINING DURING THE COVID-19 PANDEMIC <b>Jackie Lindsey</b> , Charlie Wright, Adriana Meyers, Shannon Fitzgerald

1100	ECOLOGICAL RESPONSES TO THE ENVIRONMENTAL CHANGE IN RHINOCEROS AUKLETS (CERORHINCA MONOCERATA) BREEDING ON ISLANDS IN THE TSUGARU STRAIT, JAPAN <b>Hikari Ozawa*</b> , Motohiro Ito	ESTIMATING THE DETECTABILITY OF BREEDING BEHAVIORS AT KNOWN MARBLED MURRELET (BRACHYRAMPHUS MARMORATUS) NEST SITES <b>Jonathon Valente</b> , Kim Nelson, Jon Dachenhaus, Ethan Woodis, Jennifer Bailey Guerrero, Dan Roby, Matt Betts, Jim Rivers	CULTURALLY IMPORTANT SEABIRDS DISTRIBUTE BEYOND THE SHIPPING AVOIDANCE AREA AROUND ST. LAWRENCE IS., NORTHERN BERING SEA <b>Jean-Baptiste Thiebot</b> , Alexis Will, Alexander Kitaysky, Akinori Takahashi
1115	INDIVIDUAL-LEVEL VARIATION IN THE FORAGING FLEXIBILITY OF A PURSUIT-DIVING SEABIRD, THE COMMON MURRE (URIA AALGE) <b>Sarah Hecocks*</b> , Scott Shaffer	PARTNERING FOR TERN CONSERVATION: DEVELOPING A STATEWIDE ALEUTIAN TERN (ONYCHOPRION ALEUTICUS) COLONY CENSUS PROTOCOL <b>Robert Kaler</b> , Heather Renner, Megan Boldenow, Robin Corcoran, Michael Goldstein, Susan Oehlers, Erin Cooper, Don Lyons, Jenell Larson Tempel, Martin Renner, Patty Szczys, Trent McDonald, Nathaniel Catterson	SEABIRDS ARE NOT CANARIES BUT THE OCEAN HAS BECOME A COAL MINE <b>George Divoky</b>
1130	SPATIAL AND TROPHIC ECOLOGY OF TWO SEABIRD SISTER-SPECIES ISOLATED THROUGH PHENOLOGICAL DIVERGENCE <b>Fernando Medrano*</b> , Julio Hernández Montoya, Sarah Saldanha, Ariana Duarte Canizales, Sofia Dieguez, Yuliana Bedolla Guzman, Jacob González-Solís	ON THE IMPORTANCE OF CONSIDERING UNCERTAINTY IN LANDSCAPE-SCALE WILDLIFE HABITAT ASSESSMENTS <b>Adam Duarte</b> , Zhiqiang Yang, Martin Raphael	COMBATTING CAT DEPREDATION IN HAWAII THROUGH COMMUNICATION <b>Helen Raine</b> , Hob Osterlund
1145	<b>BREAK</b>		
1200-1300	<b>PAST CHAIRS LUNCH</b>	<b>Lunch/Networking</b>	<b>EARLY CAREER SCIENTIST PANEL (Track 3)</b>
	<b>Track 1</b>	<b>Track 2</b>	
1300		<b>Offshore Wind Panel &amp; Discussion</b>	
	<b>Behavior</b>		
1315	PERSONALITY IN RAZORBILLS INFLUENCES THEIR BEHAVIOR <b>Matthew Legard*</b> , Gail Davoren, Emily Runnells		
1330	UNDERSTANDING VARIANCE IN MARSH PREDATOR DISTURBANCE PATTERNS IN PACIFIC ESTUARIES <b>Maddie Paris*</b> , Leo Gaskins		
1345	DIVING PERFORMANCE VARIES WITH AGE AND SEX IN A PLUNGE-DIVING SEABIRD <b>Jennifer McKee</b> , David Anderson		
1400	<b>BREAK</b>		<b>BREAK</b>

1415	<b>Around the Pacific Observations Roundtable</b>		<b>Workshop: PSG Committee Open House and <i>Pacific Seabirds</i> Discussion</b>
1430			
1545	<b>Coffee Break</b>		
1600	<b>Scenes from the Field: Scenes from the Field: Alaska Maritime NWR</b>		
1615			
1630-1730	<b>CLOSING CEREMONY</b>		
1730-1830	<b>* Closing HAPPY HOUR: See you in 2023 in San Diego!*</b>		

## POSTERS

*Note: **bold** indicates presenting author, \* indicates student presenter*

Poster #	Poster Title	Topic
1	LIPID NORMALIZATION OF STABLE ISOTOPE VALUES IN BLOOD PLASMA ACROSS MULTIPLE SEABIRD SPECIES <b>Angela Stahl</b> , Michael Polito, Andrea Raya Rey, Sabrina Harris, Natalia Rosciano	Tools and Techniques
2	2021: SEABIRD CONSERVATION ACTIONS DURING A YEAR OF CONTINUAL CHALLENGES <b>Annette Henry</b> , Lee Benaka, Colby Brady, Shannon Fitzgerald, Thomas Good, Jason Jannot, Trevor Joyce, Mi Ae Kim	Conservation Biology
3	CREATING A CULTURE OF COEXISTENCE AT A STRATEGICALLY MANAGED SOUTH MAUI WEDGE-TAILED SHEARWATER COLONY <b>Cheryl King</b> , Mike Ing, Jennifer Learned, Martin Frye, Cecelia Frisinger, Skye Anderson, Mariah Rivera, Jay Penniman	Breeding Biology
4	THE INFLUENCE OF INDIVIDUAL WESTERN GULL (LARUS OCCIDENTALIS) BOLDNESS ON NEST SITE QUALITY AND REPRODUCTIVE SUCCESS AT THE FARALLON ISLANDS <b>Danielle Devincenzi*</b> , Samantha Patrick, Pete Warzybok, Scott Shaffer	Behavior
5	A REVIEW OF SEABIRD VESSEL STRIKES IN ALASKA GROUND FISH FISHERIES 2010-2020 <b>Elizabeth Labunski</b> , Shannon Fitzgerald, Andrew Kingham	Fisheries
6	DOCUMENTING THE IMPORTANCE OF WATERBIRDS IN THE INDIGENOUS TERRITORY OF THE COMCAAC; INFIERNILLO CANAL, SONORA, MEXICO <b>Francisco Jaime Martínez Reyes</b> , Lorayne Meltzer, Lauren Dolinski, Paulina Camarena, Elida Barnett	Conservation Biology
7	THE STATUS ON CRAVERI'S MURRELET IN THE MIDRIFF ISLAND REGION IN THE GULF OF CALIFORNIA, MEXICO <b>Francisco Jaime Martínez Reyes</b> , Paulina Camarena, Noah Oas, Lorayne Meltzer, Lauren Dolinski, Abram Fleishman	Breeding Biology
8	SCENT FEATHERS: A SHARED DERIVED TRAIT IN THE GENUS AETHIA? <b>Hector Douglas</b>	Breeding Biology
9	USING GAME CAMERAS TO MONITOR DISTURBANCE EVENTS AT PROTECTED SEABIRD COLONIES <b>Helen St. John*</b>	Tools and Techniques
10	OFFAL DISCARDS ARE PROBABLY ONE OF THE CAUSES OF ALBATROSS CONGREGATIONS IN OFFSHORE WATERS OF SOUTHERN PERÚ <b>Javier Quiñones</b> , Carlos Zavalaga	Behavior
11	UNDERSTANDING THE ROLE OF COLOR IN NORTH PACIFIC SEABIRDS <b>Katelynn Gulley*</b> , Megan Friesen	Behavior
12	YEAR-ROUND FORAGING PATTERNS IN ADULT WESTERN GULLS (LARUS OCCIDENTALIS) FROM SOUTHEAST FARALLON ISLAND <b>Katherine Douglas*</b> , Scott Shaffer, Pete Warzybok, Mike Johns	Tracking and Distribution
13	WHAT'S ON THE MENU? USING VIDEO LOGGERS TO ESTABLISH A PREY IMAGE LIBRARY FOR ADÉLIE PENGUINS AT CAPE CROZIER, ANTARCTICA <b>Kenlynn Volz*</b> , Suzanne Winquist, Katie Stoner, Megan Elrod, Annie Schmidt, Jean-Baptiste Thiebot, Virginia Morandini, Grant Ballard, Arvind Varsani, Katie Dugger, Rachael Orben	Foraging Ecology
14	DIET ASSESSMENT AND VULNERABILITY OF A PLANKTIVOROUS SEABIRD TO CHANGE IN A SOUTHERN OCEAN WARMING HOTSPOT <b>Madhuli Karmalkar</b> , Lauren Roman, Farzana Kastury, Fernando Arce Gonzalez, Kerrie Swadling	Climate Change
15	ESTIMATING THE NUMBER OF BREEDING PAIRS OF WEDGE-TAILED SHEARWATERS (ARDEENNA PACIFICA) ON MAUI BASED ON OCCUPANCY RATES <b>Mariah Rivera</b> , Jennifer Learned	Population Biology

16	DOCUMENTATION OF A SIGNIFICANT BREWSTER'S BROWN BOOBY COLONY IN THE MAIN HAWAIIAN ISLANDS <b>Martin Frye</b> , Eric VanderWerf, Jennifer Learned, Zeke Smith, Fern Duvall, Sasha Smith, Karla Trigueros, Cecelia Frisinger, Skye Anderson, Cheryl King, Mariah Rivera, Zach Pezzillo, Jay Penniman	Population Biology
17	PLASTIC INGESTION IN WEDGE-TAILED SHEARWATERS: AN ANALYSIS OF BLOOD CHEMISTRY, GENE EXPRESSION AND BODY CONDITION <b>Nicole Mejia*</b> , Jennifer Learned, Flavia Termignoni Garcia, Scott Edwards, Jay Penniman	Contaminants and Marine Debris
18	POPULATION STRUCTURE AND CONSERVATION IMPLICATIONS OF A POORLY KNOWN SEABIRD, THE SOUTH AMERICAN TERN (STERNA HIRUNDINACEA) <b>Roxiris A. Azuaje Rodríguez*</b> , Sofia Marques Silva, Caio J. Carlos	Conservation Biology
19	IDENTIFYING FORAGING HOTSPOTS AND ENERGY BUDGETS OF COMMON MURRES AND BLACK-LEGGED KITTIWAKES IN COOK INLET, ALASKA <b>Sam Stark</b> , Sarah Schoen, Caitlin Marsteller, Mayumi Arimitsu, John Piatt	Tracking and Distribution
20	A QUANTITATIVE REVIEW OF SEABIRD COLONY ATTENDANCE <b>Sarah Guitart</b> , Joseph Mooney, Rachael Orben	Other
21	TUFTED PUFFIN OREGON COAST WIDE COLONY SURVEY 2021 <b>Shawn Stephensen</b> , Alyssa Nelson	Population Biology
22	EFFECTS OF RESEARCHER DISTURBANCE LEVELS ON 5 DAY OLD BLACK-LEGGED KITTIWAKE CHICKS <b>Stephanie Lin*</b> , Eadaoin Kelly, Sierra Pete, Scott Hatch, Morgan Benowitz-Fredericks	Physiology
23	PRELIMINARY RESULTS FROM AN ASSESSMENT OF ATLANTIC PUFFIN (FRATERCULA ARCTICA) DIET USING FECAL DNA METABARCODING <b>William Kennerley*</b>	Foraging Ecology

## PSG 2022 SPECIAL ACHIEVEMENT AWARD RECIPIENT

### Shannon Fitzgerald



Shannon Fitzgerald is the leader of the NOAA Fisheries Alaska Fisheries Science Center's Coordinated Seabird Studies Group. Shannon grew up in central western Minnesota in a conservation minded family. He received a B.S in Wildlife Management from the University of Minnesota where he worked on a study of the Ecology of the West Indian Manatee in Florida. After a season completing prescribed burns on native prairie he began employment with NOAA in 1982 as a tuna/porpoise observer and then went on to study interspecific competition between snowshoe and Arctic hares, completing fieldwork for a M.Sc. in Wildlife Ecology from the University of Wisconsin. He completed fishery observer and research cruises in the Antarctic, the Eastern Tropical Pacific, the North Pacific Transition Zone, and the Bering Sea. While seabirds were not the focus of these cruises, their constant presence and rich ecology were astonishing. Returning to NOAA as part of the High Seas Driftnet Program, a group awarded the Dept. of Commerce Silver Medal, he worked with the USFWS and together they helped bring about important changes to the North Pacific Groundfish Observer Program, implementing seabird monitoring responsibilities and quality seabird training for observers. After 10 years he

took on a new position created to focus on seabird/fishery interaction issues. Shannon has built strong collaborations within NOAA Fisheries and with many partners with a goal of improved monitoring, reporting, and mitigation of seabird bycatch. He has led research to improve seabird monitoring through expanded observer or electronic monitoring programs, including machine learning to improve seabird species ID for electronic monitoring systems. Collaborations with Washington Sea Grant and others led to the fishing industry implementing streamer lines in 2002 and reducing seabird bycatch per unit effort by 77–90% in longline fisheries, preventing the death of thousands of seabirds annually. Shannon has also supported maximizing the scientific value of bycaught birds by implementing the NOAA Pacific Seabird Necropsy Program. In collaboration with Oikonos and US observer programs throughout the North Pacific fisheries, over 3,700 necropsies have been completed since 2007, providing important information on the impact of fisheries on seabirds and helping to gain a better understanding of seabird ecology. Shannon has also been a member of NOAA's National Seabird Program since its inception in 2001 and supports international efforts on seabird conservation through organizations such as the Agreement on the Conservation of Albatrosses and Petrels. He has helped with the PSG small grants committee and has consistently provided mentorship and guidance for younger scientists working on seabird-fisheries issues. Shannon has co-authored over 25 peer-reviewed journal articles and technical reports and regularly presents to the scientific community and supports Fisheries Management Council processes. Shannon's efforts have demonstrated that fishery-specific solutions, strong industry support, constant vigilance in analysis and reporting observer data, and ongoing outreach to fleets are essential for successful seabird conservation and reduction of bycatch.

In recognition of his dedication to develop innovative methods and collaborations to monitor and mitigate seabird bycatch, the Pacific Seabird Group honors Shannon Fitzgerald with a Special Achievement Award.

## PSG 2022 LIFETIME ACHIEVEMENT AWARD RECIPIENT

### Dr. Daniel Roby



Dan Roby recently retired as Unit Leader–Wildlife for the US Geological Survey-Oregon Cooperative Fish and Wildlife Research Unit and Professor of Wildlife Ecology in the Department of Fisheries, Wildlife, and Conservation Sciences at Oregon State University. He received graduate degrees from the University of Alaska Fairbanks (M.Sc. in Wildlife Management) and the University of Pennsylvania (Ph.D. in Biology). In addition to his faculty position at Oregon State University, Dan has held faculty positions at Southern Illinois University – Carbondale (1988-1992) and the University of Alaska Fairbanks (1992-1995).

Although his M.Sc. thesis concerned caribou and the Trans-Alaska Pipeline on Alaska’s North slope, his primary area of research interest is the physiological ecology, foraging ecology, and conservation biology of birds, with an emphasis on seabirds. Dan has conducted field research on the ecology of seabirds in Alaska, Hawaii, Greenland, Newfoundland, South Georgia, China, and Antarctica, as well as throughout the Pacific Northwest region of the U.S. Over the last 25 years, he has been involved in research on the impact of avian predation on recovery of ESA-listed salmonids in the Columbia River Basin and non-lethal methods to mitigate those impacts. He has also studied the long-term effects of the Exxon Valdez oil spill on seabirds in Alaska, most recently focusing on restoration of seabirds that have failed to recover from the spill over the subsequent 30 years. Dan is also serving as a technical advisor for restoration efforts for the critically endangered Chinese crested tern in China, a seabird species so rare it was thought to be extinct for 63 years, and research efforts to better understand the factors limiting recovery of the endangered marbled murrelet in Oregon. He served as Chair of the Pacific Seabird Group in 2005 and was elected a Fellow of the American Ornithologists’ Union in 2008. In 2017, Dan received the Ralph W. Schreiber Conservation Award from the American Ornithological Society. He has authored or co-authored over 100 peer-reviewed publications. During his career, Dan served as major advisor and mentor for 40 graduate students, which he rates as his most significant professional accomplishment.

In recognition of his distinguished contributions to the study and conservation of seabirds, student mentoring, and our organization, the Pacific Seabird Group honors Dr. Daniel D. Roby with a Lifetime Achievement Award.

### ***AWARD CEREMONY & PLENARY***

**Friday, February 25  
09:00–10:00**

**(MIS)ADVENTURES OF A WAYWARD PHYSIOLOGICAL ECOLOGIST: FROM  
RESPIROMETRY TO RESTORATION**

## PLENARY SPEAKER - EARLY ADVANCEMENTS IN RESEARCH AND SCIENCE COMMUNICATION

### Dr. Emily Choy

Postdoctoral Fellow  
McGill University  
Environmental and Climate Change Canada

**Wednesday, February 23**  
**09:15-09:45**



Dr. Emily Choy is a postdoctoral fellow in the Department of Natural Resource Sciences at McGill University and Environment and Climate Change Canada. Her research is supported by an NSERC and an L'Oreal-UNESCO for Women in Science Research Excellence Fellowships. Dr. Choy is studying the physiological response of thick-billed murres to climate change on Coats Island, Nunavut. She completed her PhD in Biological Sciences at the University of Manitoba on beluga whales as sentinels of environmental change in the Beaufort Sea ecosystem in partnership with Inuvialuit communities. Dr. Choy was a scientist on the Victoria Strait expedition and a recipient of the Erebus Medal. She is an Explorer-in-Residence for the Royal Canadian Geographical Society, a Scientific Advisor for The Weston Family Foundation, and a council member for the Association of Field Ornithologists.

### ARCTIC SEABIRDS AS SENTINELS OF ENVIRONMENTAL CHANGE AND ANTHROPOGENIC STRESSORS IN MARINE ECOSYSTEMS

Arctic ecosystems are undergoing rapid change, and seabirds are considered sentinels of ecosystem health and marine contaminants. Over the past 30 years, thick-billed murres (*Uria lomvia*) in northern Hudson Bay, Nunavut, have experienced a long-term shift in diet, from 50% Arctic cod to 50% capelin, with the warming of Hudson Bay. To examine the impacts of climate-induced prey shifts on the energetics of seabirds, heart rate was examined as a proxy for O<sub>2</sub> consumption in murres from Hudson Bay and black-legged kittiwakes (*Rissa tridactyla*) at Middleton Island, Alaska. We also examined the direct effects of Arctic warming on murres. In response to increasing temperatures, murres exhibited limited heat tolerance and low ability to dissipate heat, with one of the lowest evaporative cooling efficiencies recorded in birds. Finally, we investigated relationships between perfluoroalkyl acids (PFAAs) and thyroid hormones (THs)[total thyroxine (TT4), free T4 (FT4), total triiodothyronine (TT3) and free T3 (FT3)] in blood plasma collected from murres. While FT3 increased with PFDA, PFDoA, PFTeDA,  $\Sigma$ PFCA7, and  $\Sigma$ PFAAs in murres, TT3 decreased with PFOS, PFDoA, and PFTeDA in males, but not females, suggesting thyroid disruption. TT3 increased with body mass, whereas several PFAAs were negatively correlated with body mass. Negative associations between PFDoA, PFTeDA, and  $\Sigma$ PFAAs and hatch dates may be the result of a disruption in incubation behaviour. As an Arctic seabird experiencing effects of climate change, the interaction of PFAAs on thyroid activity may cause additional stress to murres.



## PLENARY SPEAKER

### Caren Loebel-Fried

Artist - Illustrator - Author  
Volcano, Hawai‘i

Thursday, February 24  
13:00 - 13:45



Caren Loebel-Fried is an award-winning author and artist from Volcano, Hawai‘i. Birds, conservation, and the natural world are the foundations for her work. Caren has created eight storybooks to date, including *A Perfect Day for an Albatross* (Cornell Lab Publishing Group,) *Manu, the Boy Who Loved Birds* (University of Hawai‘i Press,) and the forthcoming, *Finding Home, a Petrel’s Journey*. Her books have been recognized by the American Folklore Society, Moonbeam Children’s Book Awards, and the Hawai‘i Book Publishers Association, and she works with educators to create content for schools and at-home learning based on her books. Caren has produced educational art for many organizations and agencies including the U.S. Fish & Wildlife Service, Midway Atoll National Wildlife Refuge, Kīlauea Point Natural History Association, Conservation Council for Hawai‘i, and Friends of Hanauma Bay. Caren’s love of seabirds is fueled by fieldwork on Midway Atoll with the albatross census team, and research of the ‘Ua‘u, Hawaiian petrel, and other seabirds on their breeding grounds throughout the Hawaiian Islands. With art and stories, Caren aims to bring science to communities and people of all ages, in the hope that having connections to the natural world will awaken a desire to help care for it.

### HOW I USE STORIES AND ART TO BRING COMMUNITIES AND KIDS TO SCIENCE AND CONSERVATION

Public education about cryptic animals like seabirds is essential for their conservation. But how can we get people to care about animals that are rarely seen because they are active at night and nest in remote locations, often at high elevations and in harsh terrain? Through my experience working with biologists, educators, and the public, I have found that art and stories can make seabird data relatable to people of all ages. Fieldwork gives me a sensory experience of the sights, sounds, and smells of seabird nesting colonies, and helps my art and stories come alive. And gearing stories toward youngsters and families helps to raise the next generation of scientists and people who care about wildlife and preserving wild places. In this presentation, I will talk about my wildlife art and books about albatross on Midway Atoll, the extinct Hawaiian ‘Ō‘ō bird, and current research of the ‘ua‘u, the Hawaiian petrel. I will share discoveries I have made about how to persuade people to fall in love with seabirds and other wildlife.

## SPECIAL EVENTS

### SPECIAL PAPER SESSIONS AND SYMPOSIA

#### **Indigenous peoples and local communities: flying from traditional knowledge to their inclusion in seabird ecology and conservation**

*Wednesday, February 23rd, 13:30-14:45*

Conveners: Derek Harvey, Amelia DuVall, & Cristián G. Suazo

Current knowledge is experiencing a growing and frequent interaction of communities with people who are more involved with the once-isolated western science. Today, we can find a diverse and interactive seascape, including the revival of ecological and traditional knowledge from communities. In turn, people's wisdoms and generational knowledge can help inform decisions to keep or change our experiences and habits with marine biodiversity, such as seabirds. However, linkages between biodiversity and cultural diversity (biocultural diversity) are being eroded with detrimental effects on unique sources of knowledge. Intangible cultural-spiritual links through people's experiences involve us with seabirds, thus facilitating a unique platform to learn from each other. This special paper session "Indigenous peoples and local communities: flying from traditional knowledge to their inclusion in seabird ecology and conservation," is an opportunity to hear experiences, learn through a different way of knowledge, and recognize seabirds' impact on our interactions with conservation and management of the marine realm.

#### **Use of Seabird Data in Ecosystem-based Fisheries Management**

*Thursday, February 24th, 09:15-11:00*

Conveners: Tom Good, Stephani Zador, Enriqueta Velarde, and Bill Sydeman

In a remarkably thoughtful but relatively obscure paper, Cairns (1992) posited that including seabird data could strengthen fisheries stock assessment models by calibrating estimates of stock size and providing indices of recruitment and natural mortality. To date, however, active fishery management has made limited use of seabird-derived data. Given the sophistication of stock assessment and harvest models now in use, the development of ecosystem-based fisheries management approaches, and the longevity of many seabird datasets, we believe opportunities exist to expand the use of seabird data for tactical fisheries management. This symposium will address the potential use of seabird data in various "on-ramps" for fisheries management. One focus will be on information obtained during studies of seabird food habits, as many seabirds provide their chicks with fish species or age-classes that are important to fisheries managers. Food habits data, such as percent diet composition, may be used as recruitment indices, and morphometric information, such as prey length or mass, may be used to understand cohort strength and natural mortality. Regional examples will address various fisheries on demersal and small pelagic fish. The goals of the symposium are to: summarize current and past use of seabird data in stock assessments, identify "on-ramps" for seabird data to inform tactical fisheries management, and strategize ways to further incorporate seabird data in global ecosystem-based fisheries management efforts.

#### **Seabirds as Indicators**

*Thursday, February 24th, 14:00-16:00*

Conveners: David Ainley and George Divoky

The Merriam-Webster and Dictionary.com definition of "indicator" --- an organism or ecological community so strictly associated with particular environmental conditions that its presence denotes the existence of these conditions, and vice versa. Along those lines, countless seabird papers and proposals begin with text stating

that a particular seabird study was worth conducting and your attention, or the proposal is worth funding, because everyone knows that seabirds are good indicators, or even sentinel species. It's in part "group think," accepted with little question. Some agencies, such as the Commission for the Conservation of Antarctic Living Marine Resources, for example, have elevated certain marine bird and mammal species, by their powers of indication, on paper, to be critical in providing insight into resource management, i.e. the CCAMLR Ecosystem Monitoring Program. On the other hand, a number of authors have questioned whether or not seabirds are all that useful as indicators, and for instance, CCAMLR has never incorporated its indicator species into fishery policy. This is not unusual. In this PSG session, we wish to explore situations in which seabirds have provided more than just whether "the system is or is not doing well" because seabirds are behaving or breeding accordingly. In this introduction to the session, we will provide noteworthy, true examples of seabirds responding to specific processes and being indicators of temporal variation in the quality of their supporting food webs.

## **INCLUSIVE COMMUNICATION AND LEADERSHIP: CONTINUING THE EQUITY, INCLUSION, AND DIVERSITY CONVERSATION**

*Wednesday, February 23, 15:00-17:00 Pacific Time*

The Equity, Inclusion, and Diversity (EID) committee is pleased to invite meeting attendees to this virtual event where participants will learn steps to handle implicit bias from different points of view, discuss ways to communicate different values and perspectives, and learn ways to be an inclusive colleague and leader. This workshop will include interactive elements such as polls, breakout rooms, whiteboard activities, and visualization exercises.

The event will be led by Gwen Navarrete Klapperich, Chief Learning Consultant of Klapperich International Training Associates (KITA). Gwen holds over 20 years of experience in training & development, customer service supervision, employee management, and quality assurance initiatives. She has worked in various industries such as retail, call centers, healthcare, government, hospitality, nonprofits, and continuing education. Gwen earned her Certified Professional in Talent Development (CPTD) from the Association for Talent Development, and she holds a M.Ed. specializing in Training and Performance Improvement from Capella University and a B.S. in Hotel Administration specializing in HR, Training & Development, and Multicultural Communication from Cornell University.

\*Please note that portions of the workshop that include member sharing and sensitive discussion will not be recorded or shared. Lecture portions of the event may be recorded.

## **PANEL DISCUSSIONS, ROUND TABLES, AND WORKSHOPS**

### **Turning Sound into Discovery: Using Bioacoustics to Understand Your Seabirds**

*Tuesday, February 22nd, 9:00-10:00*

Convener: Wildlife Acoustics

Sound collection and analysis is increasingly becoming a valuable tool for biologists and environmental managers. Seabird research can especially benefit from adding acoustics monitoring as a tool— unattended acoustic recorders provide a non-invasive and cost-effective way to assess species presence within a study site that may be difficult to access, where timing and conditions make traditional methods of monitoring challenging. This workshop will teach seabird researchers about bioacoustics- what it is and how it can be used to answer the questions you are asking. We will review the features and configuration options of the Song Meter SM4 and Song Meter Mini to help you identify the best tool to collect your seabird vocalizations. Time

permitting, we will also discuss the free and paid versions of our Kaleidoscope software which allows for efficient analysis of acoustic data. Biologists all over the world have made the Song Meter platform the standard for bioacoustics recording with over 100,000 recorders deployed in 90 countries. Come join us!

### **Offshore Wind Discussion**

*Friday, February 25th, 13:00-14:30*

Convener: Lindsay Adrean

This discussion is a continuation of the conversation that started at PSG 2021. An overview of the status of offshore wind development along the west coast will be provided, along with updates on recent and ongoing research. We will then open the floor to discuss how PSG members would like to follow this topic and if there is a need for a technical committee.

### **Around the Pacific Observations Roundtable**

*Friday, February 25th, 14:15-15:45*

Convener: David Duffy

Share your observations from the 2021 seabird year around the Pacific on climate conditions and anomalies, red tides, die-offs and breeding failures, or even if the year appeared normal (or the "new normal") where you work in the Pacific.

### **PSG Committee Open House and *Pacific Seabirds* Discussion**

*Friday, February 25th, 14:15-15:45*

Conveners: Anna Vallery, Wieteke Holthuijzen, Theo Squires

This workshop will include an open house of PSG committees to increase accessibility to and participation in Pacific Seabird Group Committees by members of the organization. Committee chairs will give short overviews of their committees, followed by a panel-style Q&A session immediately after these short presentations, as well as a poll to put folks in contact with committee coordinators more efficiently.

- Executive Committee
- Awards Committee
- Communications Committee
- Corresponding Members Committee
- Elections Committee
- Equity, Inclusion, and Diversity Committee
- Local Committee
- Membership Committee
- PSG HELPS

The second half of this workshop will be dedicated to a review of *Pacific Seabirds*, a call for associate editors, and a brain-storming session from members regarding what they would like to see from the publication. This will include a poll opportunity to hear opinions from all attendees of the workshop to better understand how PSG members use *Pacific Seabirds*, and help inform updates or changes to the publication.

## STUDENT AND EARLY CAREER SCIENTIST EVENTS

### **Mentoring Session**

*Wednesday, February 23rd, 17:00-18:00*

We're excited to host the Mentoring Session once again at PSG 2022. The event will be an informal virtual evening gathering and an opportunity for students and early career scientists to connect with a mentor who has an established career in seabird research or conservation. We have matched a small group of 2-4 students to each mentor prior to the event, based on common research or career interests.

### **Graduate School? Your Questions Answered!**

*Wednesday, February 23rd, 18:00-19:00*

This informal happy hour session will cover all things grad school! We will have several current and former graduate students in attendance to help answer questions and share their experiences about finding and applying for graduate programs, tips for being a successful graduate student, maintaining work-life balance, and anything else related to graduate school! This event is aimed at both prospective and current grad students and will hopefully provide some support and community for those looking for grad programs as well as those currently in grad programs! Bring a drink and come hang out!

### **Early Career Scientist (ECS) Panel**

*Friday, February 25th, 12:00-13:15*

If you are an early-career scientist or want to help facilitate the professional advancement of early-career scientists, this event is for you! Our definition of ECS mirrors that of other professional societies: a current student (associates, bachelors, masters, or PhD) or scientist who has received their highest degree within the last 5 years. This virtual panel is an informational, structured event where panelists will give a brief background of their own research and career path, and then answer questions about career development submitted by YOU!

Our panel this year consists of people with an intentional diversity of backgrounds and research interests, who are either transitioning out of being an ECS or are experienced in and regularly interested in hiring ECS. Our panelists this year are:

**Dr. Christy Wails** – Postdoctoral Associate, Department of Fish and Wildlife Conservation, Virginia Tech

**Emma Kelsey** – Wildlife Biologist, Western Ecological Research Center, US Geological Survey

**Jim Howard** – Lead Seabird Biologist, California Institute of Environmental Studies

**Kate Iaquinto** – Deputy Project Leader, Oregon Coast National Wildlife Refuge Complex, US Fish and Wildlife Service

**Samantha Monier** – PhD Candidate at CUNY Graduate Center and the College of Staten Island

Questions for the panelists can be submitted anonymously prior to the event by e-mailing Kristin Brunk ([student\\_rep@pacificseabirdgroup.org](mailto:student_rep@pacificseabirdgroup.org)), but there will be opportunities for attendees to ask questions via the chatbox during the event, as well. Students and all other ECS are invited to attend!

## **SPECIAL DOCUMENTARY SCREENING OF *ENIGMA: THE CHINESE CRESTED TERN***

*Wednesday, February 23rd, 19:00-20:30*

Host: Dan Roby

Chinese Crested Tern is rarely seen after being named in 1861. Is it only a myth, or still existing on earth? A dramatic mistake in 2000 let photographer Liang Chieh-Te rediscover Chinese Crested Tern in Matsu. Since then, people from all over the world have made an effort to conserve them. Liang Chieh-Te follows the bird of myth to record the story that interweaves the bird of myth, people who are passionate about the bird, and nature.

## **SILENT AUKTION**

*Happening right now online! Ends Friday, February 25, at 3:00 pm PST!*

For the past decade, the silent auction has been held at each annual meeting to raise funds for Student Travel Awards. This has historically been a really successful event and has assisted more than 100 students in attending and presenting their work at the annual meeting! The Silent AUktion proceeds will be used a little differently this year: our goal is to raise at least \$3,000, and money raised at this year's auction will go directly towards supporting student research by funding additional Student Research Grants!

## **SOCIAL EVENTS**

**Welcome Happy Hour**, *Wednesday February 23,, 18:00–19:00*

Catch up with friends and colleagues from near and far at the first of several virtual Happy Hours through the WHOVA app!

**Poster Session**, *Thursday February 24,, 16:00–17:00*

Grab a drink (from your kitchen!) and join our Poster authors to talk about their work! Virtual posters will be available throughout the conference, and you can leave your questions for the authors in the chat box anytime!

**Build Your Own Happy Hour**, *Thursday February 24, 18:00–19:00*

**Seabird Field Fails Happy Hour**, *Thursday February 24, 17:00–18:00*

Do you have a terrible, funny experience in the field, lab, or office when you thought everything was going right but then...it didn't!? Or NOTHING went as planned? If so, we want to hear all about it! Grab your favorite beverage and listen or share your story to this fun live storytelling session! Stories will be allowed a 3-5 min slot depending on the number of people signed up to share. To share a story, be sure to select the session in WHOVA and sign up to give a few details about your Field Fail here:

[https://docs.google.com/forms/d/e/1FAIpQLSeI5COYVyOngkUZn1bG2UZcEYzE\\_kHDFB2\\_AOogtjNBtI84IQ/vi/ewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSeI5COYVyOngkUZn1bG2UZcEYzE_kHDFB2_AOogtjNBtI84IQ/vi/ewform?usp=sf_link)

**Seabird Trivia**, *Thursday February 24, 18:00–19:00*

Come test your seabird knowledge in a fun-filled evening of Seabird Trivia hosted by John Scaramucci! John will be creating some questions to fool even the biggest bird nerd. Hope you can make it and show off your skills! The winner will be awarded nothing, but earns the privilege of being crowned the WINNER of PSG Trivia!

**Closing Happy Hour**, *Friday February 25, 17:30-18:30*

## MEETING LOGISTICS

### REGISTRATION

The 2022 Annual Meeting of the Pacific Seabird Group will take place on Whova. To access the web app go to [https://whova.com/portal/webapp/amops\\_202202/](https://whova.com/portal/webapp/amops_202202/)

If you need more guidance on how to use Whova to attend the event, please see the [Whova User Guides](#)

If you have any trouble with Whova or need assistance with uploading presentations and posters, please contact Jennifer Barrett at [mail@jenbarrett.net](mailto:mail@jenbarrett.net) or [jen@connect.consulting](mailto:jen@connect.consulting)

For any issues regarding the scientific program, please contact Rachel Sprague at [programchair@pacificseabirdgroup.org](mailto:programchair@pacificseabirdgroup.org)

### TWITTER

We encourage anyone with a Twitter handle to share updates from the meeting using the hashtag **#PSG2022**. You can also follow and mention @PacificSeabirds. Presenters, if you would like to encourage mentions of your work, please include your Twitter handle on your opening (and closing) slides. Conversely, if you prefer that your presentation not be tweeted, please say so at the beginning of your talk. PSG's own designated Tweeters will be tweeting live from the conference!

### SUSTAINABILITY AT PSG2022

PSG members have expressed, loud and clear, the desire to make annual meetings more sustainable and less consumptive. Having a virtual meeting this year has again substantially reduced the meeting's carbon emissions. One study has reported that "videoconferencing takes at most 7% of the energy/carbon of an in-person meeting".<sup>1</sup>

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<sup>1</sup> Ong D, Moors T, Sivaraman V (2014) Comparison of the energy, carbon and time costs of videoconferencing and in-person meetings. *Comput Commun* 50:86–94

## FIELD TRIPS

This year we're excited again to have **Scenes from the Field** – virtual field trips on location around the world! We'll travel to seabird colonies and birding hotspots on both sides of the Pacific through nine different tours that will include footage from the field and a live Q&A with the hosts. See below to learn about the trips we have planned!

Transcripts in Japanese and Spanish will be available for many of the Field Trips! They can be found in WHOVA at the event page.

フィールドトリップの和訳をご用意いたしました！これらは、イベントページのWHOVAでご覧いただけます。

¡Las transcripciones en español estarán disponibles para muchas de las excursiones! Se pueden encontrar en WHOVA en la página del evento.

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### A sailing ship expedition to South Georgia and the Antarctic Peninsula - Gemma Clucas

*Wednesday, February 23rd, 0830-0900*

Join Gemma and a team of scientists as they brave the Southern Ocean to sail to beautiful South Georgia and the Antarctic Peninsula. Get up close and personal with penguins, discover the petrels, prions, and albatrosses that accompany them across the waves, and find out what it's like to cross Drake's Passage in a sailboat. Gemma and her collaborators will take you through the genomics, drones, and remote cameras that they're using to monitor seabird populations in this remote corner of the globe.





## **The Life of Murres - Coats Island, Nunavut- Alyssa Eby**

*Wednesday, February 23rd, 1700-1730*

Have you ever wondered what it is like to be surrounded by 30,000 breeding pairs of calling thick-billed murres? Join us as we transport you to an Environment and Climate Change Canada long-term seabird monitoring site located in Inuit Nunangat! The tour will highlight the history of the island and field site, local wildlife, and current research, giving you a glimpse into Arctic fieldwork and all things murre!



Douglas Noblet

## **Native Seabird Rehabilitation: Behind the Scenes at Hawai'i Wildlife Center - Linda Elliot**

*Wednesday, February 23rd, 1740-1800*

The Hawai'i Wildlife Center is a purpose-built native wildlife hospital and rehabilitation center for all species of native birds and the Hawaiian hoary bat. Patients arrive from throughout the state for treatment and care. This virtual field trip will feature a behind-the-scenes look into the wildlife hospital and focus on the specific issues and special considerations involved in rehabilitating seabirds.



## **Peruvian Diving Petrels of La Vieja and San Gallán Islands, Peru.**

*Wednesday, February 23rd, 1740-1800*

Peruvian diving-petrels are small seabirds endemic to the Humboldt Current. In Peru, almost the whole population is found on two islands within the Paracas National Reserve: La Vieja and San Gallán. Introduced house mice on La Vieja are threatening the diving-petrels. We are undertaking surveys on this island to assess diving-petrel numbers, breeding success, and mice density to determine the effects of invasive species in native seabirds on Peruvian guano islands. We work in collaboration with local and international institutions to elaborate management plans for mice eradication.



## **San Diego Zoo Behind the Scenes Field Trip - Robyn Higgins**

*Thursday, February 24th, 0830-0900*

Join staff from the San Diego Zoo for an inside peek of the Dan and Vi McKinney Penguin habitat, featuring their colony of endangered African penguins! Meet members of the colony up close with one of the penguin specialists who oversees their care. Learn all about the threats the species faces, the San Diego Zoo's successful husbandry and breeding program, as well as the ways in which the San Diego Zoo Wildlife Alliance collaborates with global partners, such as the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB), in order to protect this important species in the wild.



## **Greased to Degreased: An Inside Look to Caring for Oiled Wildlife**

*Thursday, February 24th 0830-900*

Have you ever wondered about the journey that an oiled bird takes once it is captured? Getting oiled is never a good thing for wildlife, but when it does happen, the lucky ones are the ones that get captured quickly and are cared for by experts in this field. Join us on this virtual field trip as we take you along a bird's journey from when it gets captured to when it is released, and all the steps in between. You will come away from this virtual trip having a better understanding for this process and the effort that it takes to care for oiled animals. You might want to bring a box of Kleenex, though, as it might get a bit emotional. Please join us!



## **Ka'ena Point, O'ahu, Hawaii Field Trip - Pua Heimul**

*Thursday, February 24th, 1700-1730*

The Ka'ena Point Natural Area Reserve, established in 1983, is found on the Western-most point on the island of O'ahu. It is one of the last restored dune ecosystems in the main Hawaiian Islands. It's rarity makes it an important natural and cultural resource, and an exciting place to explore. This video will highlight the main features of the Natural Area Reserve while leading you through the different habitat zones; tidal, coastal sand dunes, coastal scrubland, and rocky lowlands. We will discuss the species and management practices that occur in each zone



## **The Japanese murrelets of Birojima Island, Japan - Kuniko Otsuki and Airi Kowata**

*Thursday, February 24th, 1730-1800*

On this short field trip, we will lucky be able to see the world largest breeding colony of the Japanese Murrelet (*Synthliboramphus wumizusume*), Birojima/Biro Island. Because of the scale of the population of this species, several scientists from several countries, including PSG members, visit this colony.

In the additional slideshow movie, compiled from 100's of photos, you can see the historical places related to murrelets previously known only to the local elderly population. You can also see a breeding colony that was officially confirmed in 2019. After seeing this movie, we hope you agree with us that all knowledge of the area held by the local population should be recorded as prosperity.

## **Save the Japanese Murrelets of Izu Islands, Japan**

*Thursday, February 24th, 1730-1800*

Join the Wild Bird Society of Japan in this introduction of some of the Izu Islands, located south of Tokyo, Japan. They are home to many seabirds and other unique birds. One of Izu Islands is Miyakejima/ Miyake Island, which is the popular bird watching location. Also, there are some breeding colonies of the Japanese murrelet (*Synthliboramphus wumizusume*) that we are working to protect. The Japanese murrelet has been designated as an endangered species and they breed mostly at uninhabited islands . We were able to capture the images of Japanese murrelets at night using trail cameras set up at our survey sites. Please take a look at the beautiful Izu Islands, the sea, and the birds



## **Cape Parry Marine Bird Sanctuary (MBS): A Thick-billed murre Study - Rosana Paredes**

*Friday, February 26th, 0830-0900*

Come join us to discover the Cape Parry Marine Bird Sanctuary, home to the only Thick-billed murre (*Uria lomvia*) colony in the western Canadian Arctic. The Cape Parry MBS is located within the Inuvialuit Settlement Region (ISR) in the eastern Beaufort Sea and is part of the Anguniaqvia niqiqyuam Marine Protected Area (ANMPA), Canada's second Arctic designated MPA.

Although murrens have been studied since the 1950's across their circumpolar arctic distribution, Cape Parry murrens have remained largely unknown. We hope to fill knowledge gaps on the foraging and spatial ecology of this species to help with the conservation and management of this population as well as that of the ANMPA.

It took us 3+ years of serious organization including permitting to get the Cape Parry murre project off the ground and COVID did not help! Thanks to the support of the federal, territorial and Inuvialuit agencies, particularly Paulatuk Hunters and Trappers and of course all the funders, we can finally share this amazing place and some preliminary results with you. What will you see? Murrens of course but also other seabirds, polar bears and more!



**Alaska Maritime NWR Field Trip - Marc Romano and Marianne Aplin**

*Friday, February 25th, 1600-1630*

In the summer of 2019, photographer Ian Shive joined the research biologists and ship's crew of Alaska Maritime National Wildlife Refuge aboard the R/V Tiglax. In addition to a Discovery Channel hour-long show, he created a short film about the Aleutian Islands Unit of the Alaska Maritime National Wildlife Refuge. Join us for a view of the vast, enigmatic, and remote Aleutian Islands unit of the refuge.





## INFORMATION FOR PRESENTERS, SESSION CHAIRS, AND JUDGES

### ORAL PRESENTATIONS:

**For all oral presentations, if there are slides that you do not want shared online,** please include a "no tweet" sign, such as shown below, on each slide that you do not want shared to clearly indicate that you do not want a picture of your slide posted online by anyone in the audience. This helps people moving between sessions to know your preference because they may miss an announcement at the beginning of the talk.



### Session Hosts

Thank you for your willingness to help manage the scientific program. You have a critical job in keeping presenters within the time allotted to their talk. As a reminder, each oral presentation is scheduled for 15 minutes—12 minutes for the presentation and the remaining 3 minutes for questions. Please prepare to enter your assigned Zoom stream at least 10-minutes prior to your session start time (note that there may be a few occasions where the zoom room will not open until closer to the session start time if there aren't breaks between two sessions using the same Zoom stream). As speakers arrive to the session, be sure to remind them that they will be given 5- and 2-minute warnings near the end of their talk. At the scheduled start time for the Session, please welcome attendees and presenters and announce the Session's title (e.g., Conservation Biology, Discussion Session: Offshore Wind, etc.). At the 7-minute mark, please display a 5-min warning card as a notice to the speaker that it's time to wrap up. At the 10-minute mark, it's time to communicate a more forceful warning by waving the 2-minute warning card. If the presentation goes over 12-minutes or there isn't enough time remaining to answer all questions, please remind attendees that they may post their additional questions in the Session listing on Whova. At the 15-minute mark, thank the speaker, and begin your introduction of the next speaker. In the event of a last-minute cancellation, do not move the other talks up a slot and finish early. Instead, leave the canceled speaker's slot as time for discussion so that those in other sessions that have planned on attending specific talks later in the session do not get thrown off. If you have any questions, please ask Rachel Sprague, Scientific Program Chair.

### Student Presentation Award Judges

Thank you, judges, for volunteering to give valuable feedback to students as they develop their scientific communication skills. At the beginning of the conference, judges will meet to be assigned student talks and posters to evaluate. Judges will submit their scores electronically. Please submit scores as soon as possible after you score a talk or poster. Awards for the best oral and poster presentations will be presented at our closing ceremony, 16:30 to 17:30, Friday 25th February.

## SEARCH FOR A PRESENTER

### How to search for a presenter in a PDF

1. Press CTRL+F (Windows) or CMD+F (Mac).
2. In the text box, enter the name of the person you are looking for and press Enter
3. Press the Next or Previous buttons to navigate between the results.

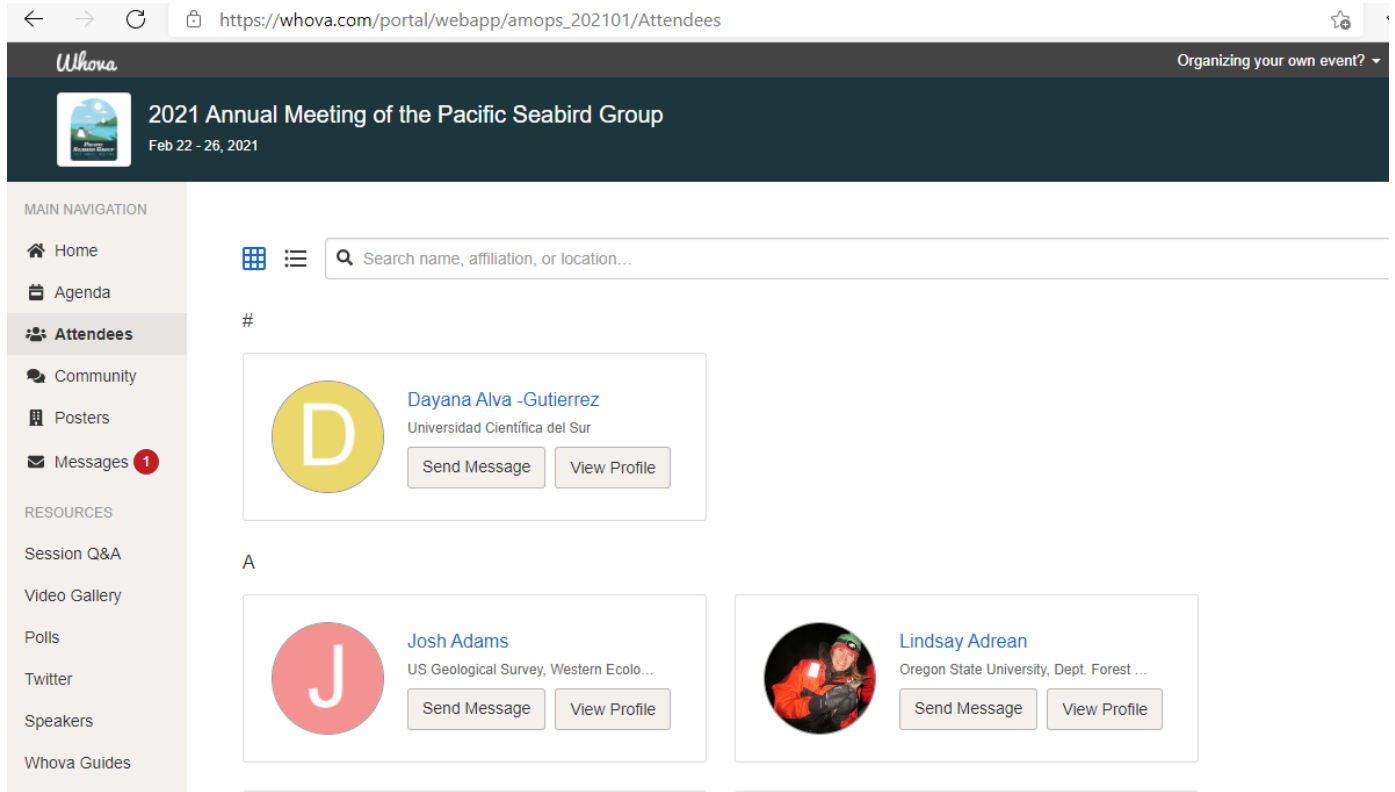
You can also search for a specific phrase or species.

The screenshot shows a PDF viewer interface with a search window open. The search term 'Montevecchi' is entered, and the results are displayed in a table. The table has columns for time slots and presentation topics. The search results are highlighted in the table below.

Time	Track 1	Track 2
1045	ASHY STORM PETREL EXPAND THEIR BREEDING HABITAT IN THE MEXICAN ISLANDS Maria Felix Lizarraga, Yuliana Bedolla Guzmán, Alejandra Fabila Blanco, C. Alicia Azorga Ornelas	
1100	Coffee Break	
	Track 1	Track 2
	Conservation Biology	Tracking and Distribution
1115	A SPATIAL ANALYSIS OF WEDGE-TAILED SHEARWATER (ARDENNA PACIFICA) FALLOUT ON SOUTHEAST OAHU, HAWAII Jennifer Urmston, Susan Carstenn, Keith Swindle, K David Hyrenbach	INDIVIDUAL CONSISTENCY IN SPACE-USE AND TIMINGS DURING THE NON-BREEDING PERIOD OF A TROPICAL SEABIRD, THE ROUND ISLAND PETREL Kirsty Franklin*, Ken Norris, Jennifer Gill, Norman Ratcliffe, Simon Butler, Nik Cole, Carl Jones, Kevin Ruhomaun, Vikash Tatayah, Malcolm Nicoll
1130	REDUCING ANTHROPOGENIC SUBSIDIES CURBS DENSITY OF AN IMPORTANT MARBLED MURRELET NEST PREDATOR IN A PROTECTED AREA Kristin Brunk*, Elena West, M Zach Peery, Anna Pidgeon	SEASONAL LIFE-STAGE AND MARINE HEATWAVE AFFECT MOVEMENT PATTERNS AND HABITAT-USE OF COMMON MURRES Stephanie Loredo*, Rachael Orben, Robert Suryan, Donald Lyons, Josh Adams, Shawn Stephensen, Jeannette Zamon
1145	ASSOCIATIONS AMONG MASS MORTALITY EVENTS, SEABIRD DEMOGRAPHY, AND OCEAN CLIMATE TRENDS IN CENTRAL CALIFORNIA Kirsten Lindquist, Pete Warzybok, Meredith Elliott, Julie Howar, Jan Roletto, Nadav Nur, Taylor Nairn, Jaime Jahncke	IMPROVING UNDERSTANDING OF TROPHIC LINKS AND INDIVIDUAL-LEVEL MOVEMENT AND HABITAT USE OF NON-BREEDING NORTHERN GANNETS Julia Gulka, Evan Adams, Alicia Berlin, Kevin Friedland, Andrew Gilbert, Chandra Goetsch, William <b>Montevecchi</b> , Matthew Perry, Iain Stenhouse, Kate Williams
1200-1300	LUNCH	
		Conservation Meeting

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2. On the left hand side panel press the Attendees panel
3. In the text box, enter the name of the person you are looking for and press Enter



## ABSTRACTS

### RESURGENCE OF THE ANTHROPOCENE IN THE ROSS SEA, ANTARCTICA

D Ainley<sup>1</sup>, V Morandini<sup>2</sup>, L Salas<sup>3</sup>, N Nur<sup>3</sup>, J Rotella<sup>4</sup>, F Shanhun<sup>5</sup>, M LaRue<sup>6</sup>, R Foster<sup>6</sup>, C Parkinson<sup>7</sup>, K Arrigo<sup>8</sup>, G van Dijken<sup>8</sup>, R Beltran<sup>9</sup>, S Kim<sup>10</sup>, C Brooks<sup>11</sup>, J Kooyman<sup>12</sup>, P Ponganis<sup>12</sup> and D Anderson<sup>13</sup>

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<sup>13</sup>Manaaki Whenua – Landcare Research, Lincoln 7640 NZ

The Ross Sea is considered to be the ocean area least affected by human activities, but its ecosystem is showing signs of change. It experienced appreciable exploitation of whales and seals as well as intense local pollution during the 20<sup>th</sup> century, impacts since greatly reduced. Protected otherwise under the Antarctic Treaty, now much of it is within a marine protected area (MPA). Nevertheless, three species of upper-trophic level “indicator species,” Adélie and emperor penguins and Weddell seal, have increased dramatically over the past 20 years. Therefore, ecosystem structure and function must also be changing. We review decadal data sets of populations, climate and sea ice, as well as fishing pressure of a competitor, the Antarctic toothfish, with fishing recently restricted to MPA boundaries. Modeling results for the most complete time series, Adélie Penguins at two colonies and Weddell Seals at another, indicate that a few climate variables as well as extraction of toothfish may well be explaining apparent population changes. Some effects were expected, e.g. large scale sea ice extent (negative, as noted in an earlier data set), but reasons for correlation among the others is uncertain. All four mesopredators prey heavily on the Antarctic silverfish; toothfish removal may be altering intraguild predation dynamics, leading to trophic competitive release. While climate change may be having an impact, it appears that fishery goals, to reduce spawning biomass by 50% within 35 years (now >25%), should be re-evaluated in accord with ecosystem-based management under the Convention for the Conservation of Antarctic Living Marine Resources and its MPA.

## USING ORNITHOLOGICAL RADAR TO DETERMINE POPULATION TRENDS OF HAWAIIAN PETRELS AND NEWELL'S SHEARWATERS ON THE ISLAND OF MAUI

Skye Anderson<sup>1</sup>, Cheryl King<sup>1</sup>, Stephen Rossiter<sup>2</sup>, Jennifer Learned<sup>1</sup>, Martin Frye<sup>1</sup>, Cecelia Frisinger<sup>1</sup>, Jay Penniman<sup>1</sup>

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([skye3@hawaii.edu](mailto:skye3@hawaii.edu))

<sup>2</sup>Rossiter Ecological Consulting, 74 West Golden Lake Road, Circle Pines, MN, 55014

Hawaiian Petrels (*Pterodroma sandwichensis*, 'ua'u) and Newell's Shearwaters (*Puffinus newelli*, 'a'o) are endangered seabirds endemic to the Hawaiian Islands. Due to the nocturnal nature and remote breeding grounds of these species, radar surveys have proved to be an effective method of monitoring their populations. The objectives of this study are; 1. replicate a passage rate radar study conducted on Maui in 2001 to determine how the populations of 'ua'u and 'a'o have changed over 20 years, and; 2. establish a consistent and accurate method to track population trends and distribution patterns over time. We studied nightly movement rates of 'ua'u and 'a'o at 16 sites on Maui in 2021 using an ornithological radar closely matching that used in 2001. Our results found that passage rates among sites were highly variable (1-488 targets/hr); however, all sites had similar or higher rates than 2001. Overall, the island-wide mean passage rate increased from 49 targets/hr in 2001 to 78 in 2021. We also found that passage rates are highest on the east side of the island which is consistent with the 2001 results. While we know that the bulk of the 'ua'u population nests on Haleakalā, little is known about 'a'o distribution. This study will help define target areas on Maui so we can focus our search for breeding areas and conservation efforts for these two species. Further, this ongoing annual survey will allow us to compare 'ua'u and 'a'o passage rates on Maui to those on Kaua'i, increasing our knowledge of these species distributions across the Hawaiian Islands.

## POPULATION STRUCTURE AND CONSERVATION IMPLICATONS OF A POORLY KNOWN SEABIRD, THE SOUTH AMERICAN TERN (*STERNA HIRUNDINACEA*).

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<sup>2</sup>Centro de Investigação em Biodiversidade e Recursos Genéticos / InBIO Laboratório Associado, Vairão, Portugal

The South America Tern (*Sterna hirundinacea*) is a migratory seabird restricted to South American Atlantic and Pacific coasts. It is considered Vulnerable to extinction at a regional scale. The species' breeding seasons vary in distinct latitudes; furthermore, coastal populations are separated by oceanographic and ecological barriers that may be causing population isolation and differentiation and restricting the distribution of each putatively independent lineage. To evaluated morphological diversity among

specimens across the species distributional range. We collected 7 morphometric measurements from 118 specimens from museums. We performed a Pearson's correlation and a Shapiro-Wilk normality test for each character, then a Wilcoxon-Mann-Whitney test, a Kruskal-Wallis, and a Pairwise Wilcoxon Rank Sum test to determine differences between sexes and populations. We will also use mitochondrial DNA to assess population genetic diversity and structure among populations occurring in separate areas. Total DNA will be extracted from 59 blood and tissue samples and fragments of one mitochondrial DNA gene (Cytb) will be sequenced. We will estimate summary statistics, genetic distances within and among populations, construct a haplotype network, and calculate genetic differentiation indices (Fst). We found differences between sex and among populations from the Atlantic, Pacific, and Malvinas/Falkland Islands for the bill height, wing length, tail fork depth, and tail length. We expected the genetic datasets to support similar patterns of differentiation among the populations. If population structure or speciation events were confirmed, each lineage would need a reassessment of its taxonomic and conservation status.

### **BREEDING SUCCESS, PHENOLOGY, CHICK GROWTH, AND PROVISIONING OF THE BLACK STORM-PETREL UNDER VARIABLE OCEAN CONDITIONS**

Yuliana Bedolla-Guzmán<sup>1,2</sup>, Juan F. Masello<sup>2</sup>, Alfonso Aguirre-Muñoz<sup>1</sup>, Fernando Álvarez-Santana<sup>1</sup>, and Petra Quillfeldt<sup>2</sup>

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<sup>2</sup>Department of Animal Ecology and Systematics, Justus Liebig University Giessen, 35392 Giessen, Germany

Procellariiformes species may buffer environmental variability during the breeding period by changing their diet composition, phenology, or feeding strategies to enhance chick survival. Comprehending how flexibly species respond to variations in ocean climate conditions is primordial to evaluate their tolerance to changing oceans and implement effective conservation measures. We examined inter-annual differences in the breeding success, breeding phenology, chick growth, and provisioning rates of the black storm-petrel (*Hydrobates melania*) at San Benito Oeste Island, Mexico, during six breeding seasons (2012-2017) with highly variable conditions. Our findings suggest that adults maintained a constant high breeding success over time but differed in the timing of hatching and fledging. Also, the provisioning and growth of chicks varied over the years. These results suggest that black storm-petrels can buffer chick mortality under less favorable conditions, through regulation of foraging performance, albeit at the expense of nestling quality.

### **COMMON MURRE (URIA AALGE CALIFORNICA) RECOLONIZATION OF ITS SOUTHERNMOST BREEDING COLONY**

Phil Capitolo<sup>1</sup>, Daniel Barton<sup>2</sup>, Josh Adams<sup>3</sup>, Michael Parker<sup>4</sup>, David Mazurkiewicz<sup>5</sup>, Gerard McChesney<sup>6</sup>, Harry Carter<sup>7,†</sup>

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<sup>3</sup>U.S. Geological Survey, Western Ecological Research Center, Santa Cruz, CA 94555 USA

<sup>4</sup>California Institute of Environmental Studies, Davis, CA 95617 USA

<sup>5</sup>Channel Islands National Park, 1901 Spinnaker Drive, Ventura CA 93001 USA

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<sup>7</sup>Carter Biological Consulting, 1015 Hampshire Road, Victoria, British Columbia V8S 4S8 Canada; †Deceased

The Common Murre (*Uria aalge californica*) recently recolonized its southernmost known breeding colony along the Pacific coast of North America, Prince Island, an islet just off the north shore of San Miguel Island in the California Channel Islands, where the last prior record of breeding was from 1912.

Recolonization was confirmed through observations of four murre chicks during boat-based surveys in July 2011, but attendance patterns indicate breeding may have occurred earlier. During April-June 2007, up to 70 murrees were observed on the water or flying near the island, and 10-15 murrees were observed on land on 1 May. Annual aerial photographic counts of murrees attending Prince Island increased from 65 birds in 2008 (none in 2007) to 874 in 2021, with 16 and 29 chicks counted from July photographs in 2015 and 2021, respectively. Records of private egg collectors during 1885-1912 reference a population size of about 100 pairs. The mean annual growth rate from 2008 to 2021 was about 20%, with higher growth rates in some later years, likely as more locally produced murrees reached breeding age, but also likely reflecting continued or episodic immigration. The nearest potential source colony of immigrants to Prince Island is nearly 300 km to the north, but the recolonization mirrors several simultaneous murre colony formations in central and northern California, where substantial murre population recovery has occurred in recent decades with increased protections.

## **INTRODUCED AND NATIVE VERTEBRATES IN PINK-FOOTED SHEARWATER (*ARDENA CREATOPUS*) BREEDING COLONIES IN CHILE**

Ryan D. Carle<sup>1</sup>, Abram B. Fleishman<sup>2</sup>, Tiare Varela<sup>1</sup>, Pablo Manríquez Angulo<sup>1</sup>, Guillermo De Rodt<sup>1</sup>, Peter Hodum<sup>1,3</sup>, Valentina Colodro<sup>1</sup>, Verónica López<sup>1</sup>, Héctor Gutiérrez-Guzmán<sup>1</sup>

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<sup>2</sup>Conservation Metrics, Inc., 145 McAllister Way, Santa Cruz, California, United States of America

<sup>3</sup>University of Puget Sound, 1500 N. Warner St., Tacoma, Washington, United States of America

Although introduced mammals are the greatest threat to seabirds globally, data on introduced species is lacking for many seabird breeding islands. To inform conservation planning, we used trail cameras to document the presence, relative abundance, and seasonal and diel attendance of introduced and native vertebrates within pink-footed shearwater (*Ardenna creatopus*) breeding colonies on Isla Mocha (five colonies, 2015-2020) and Isla Robinson Crusoe (Juan Fernández Archipelago), Chile (one colony, 2019-2020). The most commonly detected species were pink-footed shearwaters and introduced rats

(*Rattus* spp.) on Isla Mocha, and European rabbits (*Oryctolagus cuniculus*) and pink-footed shearwaters on Isla Robinson Crusoe. Introduced mammals observed, in order of greatest catch-per-unit-effort, were rats, cats (*Felis catus*), dogs (*Canis lupus familiaris*), and European hares (*Lepus europaeus*) on Isla Mocha and European rabbits, cats, cattle (*Bos taurus*), rats, dogs, mice (*Mus musculus*), and southern coati (*Nasua nasua*) on Isla Robinson Crusoe. Noteworthy results for pink-footed shearwater conservation were the presence of cats during all monitoring months in colonies on both islands, that catch-per-unit-effort of rabbits was greater than shearwaters on Isla Robinson Crusoe, and that rats were the most observed vertebrates after shearwaters on Isla Mocha. The regular presence and temporal overlap with shearwaters of multiple introduced mammal species within shearwater colonies indicated a serious conservation threat for pink-footed shearwaters and other native species. Finally, our study provides a widely applicable model for analysis of multi-year trail camera data collected with unstandardized settings.

### **SYNCHRONY IN SEABIRD SURVIVAL: DRIVERS AT MULTIPLE SPATIAL SCALES**

Sarah J Converse<sup>1</sup>, Nathan J Hostetter<sup>2</sup>, Staci M Amburgey<sup>3</sup>, Abby E Bratt<sup>4</sup>, Amelia J DuVall<sup>3</sup>, Brielle K Thompson<sup>4</sup>, Lisanne S Petracca<sup>3</sup>, Hannah A Sipe<sup>5</sup>, Mark H Sorel<sup>3</sup>, Amanda J Warlick<sup>3</sup>, and Martina Kadin<sup>3</sup>

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<sup>2</sup>US Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit, Department of Applied Ecology North Carolina State University, Raleigh, North Carolina 27607, USA

<sup>3</sup>Washington Cooperative Fish and Wildlife Research Unit, School of Aquatic and Fishery Sciences, University of Washington, Seattle, Washington 98195, USA

<sup>4</sup>Washington Cooperative Fish and Wildlife Research Unit, Quantitative Ecology and Resource management Program, University of Washington, Seattle, Washington 98195, USA

<sup>5</sup>Washington Cooperative Fish and Wildlife Research Unit, School of Environmental and Forest Sciences, University of Washington, Seattle, Washington 98195, USA

The dynamics of spatially structured populations are controlled by forces acting at both subpopulation and population scales. The relative strength of these forces has important implications for extinction risk, vulnerability to global climate change, and the provisioning of ecosystem services. We investigated synchrony in the survival of common murres (*Uria aalge*) at 10 islands in the Baltic Sea during 1997–2015 using a multievent mark-recapture/resight model. Our model incorporated multiple observation types, uncertainty in murre age, and an efficient approach to modeling inter-island movement. We also developed a hierarchical structure that included local (i.e., subpopulation or island scale) and global (i.e., population scale) random effects to describe spatiotemporal variability in survival by age group. We evaluated the degree to which we could explain island- or population-scale variability using a series of covariates at each of these scales. Finally, we calculated the intraclass correlation coefficient as a measure of island-scale versus population-scale control of survival dynamics. Results indicate that murre survival is controlled more at the population rather than at the island scale, suggesting that there may be substantial vulnerability to changing marine conditions in the Baltic. However, our ability to explain island- or population-scale variation using available covariates was limited. Understanding the scale of forces driving



murre populations has the potential to inform management, including the viability of implementing island-scale conservation efforts to blunt potential effects resulting from changes occurring throughout the Baltic.

## **COMMON MURRE (*URIA AALGE*) DIE-OFF IN THE KODIAK ARCHIPELAGO, ALASKA, APRIL 2015 TO APRIL 2016**

Robin M. Corcoran<sup>1</sup>

<sup>1</sup>Kodiak National Wildlife Refuge, 1390 Buskin River Road, Kodiak, AK 99615; email: [robin\\_corcoran@fws.gov](mailto:robin_corcoran@fws.gov)

A mass die-off of Common Murres (*Uria aalge*) occurred from spring 2015 to spring 2016 in the northern Gulf of Alaska. Seabird die-offs have been recorded previously in the region, but this event was unique in its long duration and wide spatial extent. In response to the die-off, Kodiak National Wildlife Refuge (NWR) biologists conducted systematic beach surveys along the road system adjacent to the city of Kodiak and compiled reports from citizens in remote locations throughout the Kodiak Archipelago to document the number of dead birds observed on beaches. Analysis of beached bird records indicated that at least 1,994 dead Common Murres were observed in the Kodiak Archipelago from 4 April 2015 to 26 April 2016. Extrapolating the density estimate based on carcasses counted on systematic surveys on the Kodiak road system (55 murres/km, SE = 12) to all beaches in the Kodiak road system study region in the same biophysical habitat class based on Alaska ShoreZone coastal mapping yielded an estimate of 6,305 dead Common Murres (95% CI = 3,522-9,088). The die-off event was preceded by a large-scale inshore movement by marine bird species typically seen offshore (Common Murres and shearwater species), as documented by Kodiak NWR survey data and by local observers throughout the archipelago. Survey data indicate the population estimate for Common Murres in the northeastern region of the archipelago increased from 711 in June 2012 to 31,543 in June 2015 (4,335% increase), and from 5,063 in August 2012 to 64,039 in August 2015 (1,165% increase).

## **CHICK PROVISIONING RATES AND NESTING SUCCESS OF THE MARBLED MURRELET (*BRACHYRAMPHUS MARMORATUS*)**

Jon Dachenhaus<sup>1</sup>, Kim Nelson<sup>2</sup>, Daniel Roby<sup>2</sup>, Matthew Betts<sup>3</sup>, Ethan Woodis<sup>1</sup>, Jennifer Bailey Guerrero<sup>1</sup>, Jonathon Valente<sup>1,4</sup>, Lindsay Adrean<sup>5</sup> and James Rivers<sup>1</sup>

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<sup>4</sup>Smithsonian Conservation Biology Institute, Migratory Bird Center, National Zoological Park, Washington, D.C., USA, 20013

<sup>5</sup>American Bird Conservancy, 4249 Loudoun Ave., The Plains, Virginia, USA

Understanding factors that limit reproductive success is essential for recovering listed species. For the Marbled Murrelet, these factors are not adequately understood due to the substantial challenges involved with locating and monitoring active nests. Studies that provide information on nesting behavior, including chick provisioning rates, are needed to understand potential constraints on offspring production. During the summers of 2018–2019, we located 12 active murrelet nests in the central Oregon Coast Range and used video cameras to provide continuous recordings of nests. We obtained comprehensive footage at 6 nests during the chick-rearing period and documented >415 chick-feeding events. Of these nests, 4 were successful, 1 was depredated, and 1 failed due to suspected chick starvation; age at fledging ranged from 33 days to 45 days. Observed number of feedings per day varied between 0 and 6, and average daily feedings per nest ranged from  $1.3 \pm 1.1$  feedings/day in the nest that failed to apparent chick starvation and  $3.2 \pm 1.7$  feedings/day in a nest that fledged in 33 days. Daily feeding rates at successful nests peaks approximately three-quarters of the way through the chick-rearing period. This suggests that nests with greater provisioning rates may be more likely to succeed, and provisioning rates during later chick development, when chick energy requirements are greatest, may enhance the likelihood of fledging. Through comprehensive nest monitoring, our study demonstrates how variation in provisioning behavior is linked to reproductive success, with clear implications for murrelet conservation efforts given the climate-driven changes that are expected in coastal regions in the coming decades.

## **EYE IN THE SKY: USING DRONES AND AI TO INVESTIGATE MULTI-SPECIES FORAGING ASSOCIATIONS**

Wednesday Davis<sup>1</sup>; Gaia Dell’Ariccia, <sup>2</sup>; Rochelle Constantine, <sup>1,3</sup>

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Multi-species foraging associations (MSFA's) are characterised by the joining of two or more species to feed on ephemeral prey patches. Seabirds often forage in MSFA's, using local enhancement and foraging behaviours of sub-surface predators to detect and feed on similar prey. Innovative techniques, such as drone use, offer promising opportunities to survey MSFA dynamics, with high-resolution imagery providing a range of potential metrics, including fine-scale behaviours. Between September 2019 and August 2021, 45 MSFA surveys were undertaken in the Hauraki Gulf, New Zealand, with 4k drone footage captured on 19 surveys using a Mavic-2 Pro drone. We present an approach where artificial intelligence (AI) can tag and map targets of interest from drone imagery. Semi-automated and automated detection provides a faster approach to manually surveying large, complex aggregations of highly mobile predators. AI detection tasks were divided into the detection of objects and the classification of the detected object

into species and behaviours. AI was used to automatically detect the following species: Common dolphins (*Delphinus delphis*), Bryde's whales (*Balaenoptera edeni brydei*), Australasian gannets (*Morus serrator*), white-fronted terns (*Sterna striata*), and fluttering (*Puffinus gavia*), sooty (*Ardenna grisea*), flesh-footed (*A. carneipes*) and Buller's (*A. bulleri*) shearwaters. Experimental results showed that both seabirds and cetaceans can be accurately detected from drone footage collected during MSFA surveys. AI tools allow us to audit the fine-scale foraging behaviours of predators from drone footage, increasing our understanding of interactions within and between these communities aggregating around ephemeral prey sources.

## **THE INFLUENCE OF INDIVIDUAL WESTERN GULL (*LARUS OCCIDENTALIS*) BOLDNESS ON NEST SITE QUALITY AND REPRODUCTIVE SUCCESS AT THE FARALLON ISLANDS NATIONAL WILDLIFE REFUGE**

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Boldness, or an individual's propensity to take risks, is a measurable personality trait that has been characterized for several avian species. Animal personality studies that focus on the boldness trait suggest that bolder individuals may benefit by outcompeting conspecifics for greater access to resources, but conversely may be exposed to increased risks of predation. Personality studies are therefore important for understanding individual to group level processes and it is conceivable that personality plays a role in affecting factors like mate choice, territorial defense, and nest quality (i.e. density, protection). We used a novel object test to measure the boldness of 43 individual western gulls (*Larus occidentalis*) with known breeding histories at multiple sub-colonies across Southeast Farallon Island in central California. A total of 70 tests were conducted in which gulls displayed individual variation in behavior. Subsets of individuals were retested twice, three times, and four times to ensure repeatability of behavior. Our results could expand the current knowledge about mechanisms that influence nesting density, habitat choice, and how these factors contribute to changes in population size of nesting gulls on the island.

## **GUANAY CORMORANT PELLETS (*PHALACROCORAX BOUGAINVILLII*) AS AN INDICATOR OF MARINE PLASTIC POLLUTION ALONG THE PERUVIAN COAST**

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Plastic presence in the world's oceans has increased dramatically over the past few years, becoming a threat to marine wildlife especially top predators such as seabirds. Therefore, it is crucial to monitor plastic levels in the marine environment to understand its impacts, not only on threatened species but also on other species. Our study evaluates plastic ingestion in guanay cormorants (*Phalacrocorax bougainvillii*) through pellet analysis at ten colonies along the Peruvian coast between 2018 and 2019. A total of 2,286 pellets were collected and analyzed, of which plastic debris was present in 162 (10.8%) pellets (N = 1497) consisting of mainly user plastics and varying in size from mega (>20 mm) to micro (1-5 mm) plastics (nano plastics were not assessed). Micro and meso plastic (5-20 mm) were most abundant with 67% and 23% by number, respectively. The commonest plastic color found was white (27% by number). There was a significant difference in the percentage by the occurrence of plastic across regions, with the highest occurrence of plastic found in Lima region. We also found a significant relationship between the percentage occurrence of plastic debris in pellets and the presence of river mouths closer to the colonies. Plastic ingestion by guanay cormorants reveals that plastic has already been transferred into the Peruvian Marine Food Web. This study is the first of its kind in the Peruvian marine environment and the results set a baseline for future studies of plastic pollution in the Peruvian sea.

## **SEABIRDS ARE NOT CANARIES BUT THE OCEAN HAS BECOME A COAL MINE**

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It is the rare seabird research publication or proposal that does not mention how seabirds, as upper trophic level predators, are indicators, bellwethers or sentinels of ecosystem change. This framing helps to demonstrate the broader applicability of the work, even if it was undertaken primarily to examine the researcher's most recent interest in some aspect of seabird biology. In some cases, the "canary in the coal mine" analogy is invoked, typically to indicate a change that is a threat and not simply a response to cyclical changes in the marine environment. While the condition of canaries in coal mines would cause an immediate response, to avoid major consequences to the humans who placed them there, similar actions in response to failing seabird populations are rare, occurring primarily when a seabird species or population is threatened or endangered. Because much of the funding for seabird research is conducted to enable resource exploitation, including commercial fishing and fossil fuel extraction, marine ornithologists are faced with the dilemma of knowing their work is facilitating system perturbations likely to negatively affect seabirds. The canary in the coal mine analogy may help the general public better understand why seabird studies are important. But in a growth economy, resource exploitation has always taken precedence over the status of seabirds and marine ecosystem health. While seabird populations will continue to be monitored during the coming decades of sanctioned commercial exploitation and other anthropogenic impacts on the world's oceans, it is unrealistic to think the increasing industrialization of oceans will be curtailed by evidence of how seabird populations are being affected.

## **"INDICATING" THE COLLAPSE OF AN ECOSYSTEM: A HALF-CENTURY OF MONITORING AN ICE-OBLIGATE SEABIRD'S PATH TO EXTINCTION**

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Seabirds, as highly visible upper trophic predators, are useful indicators of temporal changes in marine ecosystems, especially those lacking regular oceanographic sampling or commercial fisheries. While seabirds can be important indicators of ecosystem change in the Arctic, recent major reductions in the ice-associated cryopelagic ecosystem have been well documented by satellite; monitoring of the decline of ice-obligate Arctic seabirds did not so much “indicate” loss of habitat as demonstrate the importance of the habitat to those species. Insight into the processes by which sea ice loss led to reduction of the ice-obligate Mandt’s Black Guillemot (*Cepphus grylle mandtii*) are known thanks to a five-decade study on Cooper Island in northern Alaska. Detailed monitoring of demographics, feeding ecology and movements have demonstrated the importance of seasonal, annual and decadal variation in sea ice extent to the colony’s growth and decline. Polar cod (*Boreogadus saida*), the primary forage fish associated with sea ice, is the preferred prey and ice loss and resulting increases in SST reduced its availability, decreasing the breeding success and immigration that allowed the colony to increase in the 20<sup>th</sup> Century, while increasing adult overwinter mortality and parental foraging effort during breeding during this century. The long-term decline of the colony that began in 1990 is expected to continue, resulting in the quasi-extinction of the colony within decades. However, increased availability of alternate subarctic prey could occur with the borealization of the Arctic Ocean. Should that happen, continued monitoring of the colony would provide an important indicator of a shift in the Western Arctic’s marine ecosystem.

## SCENT FEATHERS: A SHARED DERIVED TRAIT IN THE GENUS AETHIA?

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In the Genus *Aethia*, two species with striking plumage ornaments, the crested auklet (*Aethia cristatella*) and the whiskered auklet (*A. pygmea*), emit conspicuous aldehydic scents, but the least auklet (*A. pusilla*) and the parakeet auklet (*A. psittacula*) do not. I hypothesized that crested and whiskered auklets would manifest evidence of shared derived traits associated with odorant production. I performed microdissections, chemical analysis, and histological assays to test for the presence of aldehyde-secreting cells and structures in the birds’ integument. All four species of auklets were included, but the results were negative for least and parakeet auklets. I did isolate a specialized odorant-secreting structure in whiskered auklets. Gas chromatography/mass spectrometry revealed odorant constituents of the whiskered auklet in its wick feathers, analogous to what I previously found in crested auklets. The two species share one molecule, a 10-carbon aldehyde, as a minor odorant constituent and possibly a common antecedent, but in other respects have diverged in their odorant chemistry.

The crested auklet emits aldehydes with even numbers of carbon atoms, while aldehydes with odd numbers of carbon atoms are more important in the whiskered auklet's odorant. In previous work, mono-unsaturated aldehydes prominent in the crested auklet's scent could barely be detected at trace levels in whiskered auklet plumage. In this study I isolated one such compound from a whiskered auklet wick feather. These limited data suggest that that like character displacement in bird song, notation of the crested auklet's perfume may have been suppressed in the whiskered auklet's floral odor bouquet.

## **COLONY FAILURE OR COLONY COLLAPSE? ABSENCE SUGGESTS FUNCTIONAL LOSS OF CRESTED AUKLETS AT BIG KONIUJI I., ALASKA**

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The colony of crested auklets (*Aethia cristatella*) at Big Koniuji Island (BK), AK (Lat. 55° 03' 58.1" N, Long. 159° 31' 45.5" W) was reputed to be one of the largest breeding concentrations of crested auklets in existence in the early 20<sup>th</sup> Century. However, a precipitous population decline followed the initiation of fox farming in 1916. Foxes were removed by the mid-1980's, but by 2002 the colony had not increased substantially in number of birds or area occupied, despite available nesting habitat. Data in 2002 did not indicate food limitations: baseline corticosterone concentrations and indices of diet inferred from fatty acid profiles were comparable between BK and other colonies. Predation, may have inhibited population growth, but we did not find direct evidence. Arctic ground squirrels (*Spermophilus parryii*), known to predate chicks and eggs, occupied the colony. However, ground squirrel scat collected at the colony in 2002 did not have a marine-derived stable isotope signature. By 2012 it appeared that the BK population had increased, based on delineation of colony boundaries, yet in 2021 there were no signs of activity at the colony in mid-July, when crested auklets are usually tending chicks. It appeared that some crested auklets attempted to attend the colony in 2021, based on remains of a few predated carcasses, but the colony appeared abandoned. We discuss the potential factors that may have contributed to the apparent functional loss of this colony, the only breeding colony of crested auklets east of the Aleutian Islands.

## **YEAR-ROUND FORAGING PATTERNS IN ADULT WESTERN GULLS (LARUS OCCIDENTALIS) FROM SOUTHEAST FARALLON ISLAND**

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Despite their prominent populations, habitat usage of the Family *Laridae* is largely undocumented during the non-breeding season. Given their ecological role as generalist foragers, tracking year-round movement patterns of western gulls (*Larus occidentalis*) can contribute significantly to understanding marine and terrestrial resource usage along Pacific coastlines. During May to June 2021, 17 western gulls were equipped with GPS trackers to determine year-long habitat usage during the breeding and non-breeding periods, and frequency of visitation to Southeast Farallon Island (SEFI) during the non-breeding season. Results showed that during the breeding season gulls (May – Aug, n = 13) made 335 trips to the island, travelled a maximum distance of 76.3 km, and frequented off-island and coastal areas. During the start of non-breeding season gulls (Aug – Nov, n = 11) made 59 return trips, travelled a maximum distance of 1072.2 km, and were commonly tracked in urban environments. These initial results indicate that during the breeding season western gulls utilize short-range pelagic foraging trips, with SEFI as the “home base” point of return. During the non-breeding season gulls expanded their foraging range, while the amount of return trips to SEFI decreased as birds centralized onto urban resources of the mainland, a trend that will likely continue to decline in the winter months. These preliminary findings support the concept that gulls do not utilize SEFI as a central place from which to forage during their non-breeding period, thus providing support for the proposed eradication of house mice (*Mus musculus*) set for SEFI’s winter season.

## **ON THE IMPORTANCE OF CONSIDERING UNCERTAINTY IN LANDSCAPE-SCALE WILDLIFE HABITAT ASSESSMENTS**

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Given habitat has a major role in regulating the distribution and abundance of species, landscape-scale habitat assessments are fundamental to informing species conservation and management. Myriad approaches can be taken to quantify wildlife habitat, and each approach comes with its own set of assumptions, benefits, and limitations. Yet, in practice such habitat assessments typically rely on a single approach and rarely formally consider the uncertainty in the remotely sensed habitat layers that are often used to develop species distribution models for such assessments. Herein, we demonstrate the utility in using a multistep approach to quantify and interpret 25 years of spatiotemporal variation in Marbled Murrelet (*Brachyramphus marmoratus*) nesting habitat across the species’ range in the Pacific Northwest, U.S.A. Furthermore, we consider models that relate species occurrence to remotely sensed variables at multiple scales and implement an ensemble modeling approach to combine habitat models and incorporate model uncertainty. Our study demonstrates a workflow that can be used to minimize propagation of error when quantifying wildlife habitat using remotely sensed habitat products and

incorporate competing hypotheses on how species use habitats across landscapes. Overall, this approach provides a more robust and transparent landscape-scale habitat assessment process to inform conservation and management decisions.

## **EFFECTS OF OCEANOGRAPHIC VARIABILITY ON DEMOGRAPHY OF CASSIN'S AUKLET IN THE CALIFORNIA CHANNEL ISLANDS**

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An obligate zooplanktivore, the Cassin's Auklet (*Ptychoramphus aleuticus*) is sensitive to changes in the marine environment, such as sea surface temperature, chlorophyll concentration, and upwelling dynamics, which can affect foraging conditions and in turn affect auklet productivity and survival. In the northern California Channel Islands, USA, Cassin's Auklets nest at two colonies ~90km apart with contrasting oceanographic influences: Prince Island, near San Miguel Island, and Scorpion Rock, near Santa Cruz Island. Birds in the two colonies use separate core foraging areas. Monitoring data collected since the mid-1980s – including band resighting data, nest box occupancy data, and reproductive output data – provide a unique opportunity to better understand the scales at which marine conditions influence Cassin's Auklet demography. We developed a multistate robust design mark-recapture model in a Bayesian framework to evaluate apparent survival over a 21-year period (2000-2020). We examined interannual demographic trends and an intra-class correlation coefficient, which serves as an index of synchrony in survival across the two colonies. Our results underscore the utility of tracking auklet responses to marine climate change and anthropogenically changing seascapes off southern California, for better understanding the ecology of this species and for supporting its conservation.

## **BIOSECURITY ACTION ON NATIVIDAD ISLAND, MEXICO. A SINGLE RAT THREAT A KEY BIODIVERSITY ISLAND**

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The Mexican islands are an outstanding example of ecosystem conservation and restoration. Due to the successful eradication programs of invasive species, active restoration actions, environmental education,



and biosecurity activities. Natividad Island holds great biodiversity and is the most important breeding site for the endemic, Black-vented Shearwater (*Puffinus opisthomelas*). There, cats were eradicated in 2000. Then, donkeys, rabbits, horses, dogs, and feral goats were eradicated between 2002 and 2007. After eradications, an active seabird restoration program was implemented from 2013 to 2019, included environmental education and a biosecurity program to protect the island. On June 14, 2019, a rapid response protocol was activated because the local community warned of possible rats on Natividad, while biologists of Grupo de Ecología y Conservación de Islas were on the island. On June 24, 2019, the rat (*Rattus rattus*) was confirmed in a camera trap. Eight types of traps, ten types of bait, camera traps, and a K9 unit were employed to catch the rat. An effort of 5.640 trap/night and 1.230 camera trap/night were accumulated over three months. A rat was caught on August 11, 2019, but trapping continue until November 19, 2019, when the absence was confirmed with a certainty of 97%. Also, a biosecurity protocol was developed and presented to the community of the island and government agencies. This event demonstrates the importance of including a biosecurity program in an integral long-term conservation project.

## **POPULATION ESTIMATE FOR RAKO OR BULLER'S SHEARWATER (*AR DENNA BULLERI*), AN ENDEMIC MARINE INDICATOR**

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Establishing population estimates are the key first step in assessing conservation status and trends. Rako, or Buller's Shearwater (*Ardenna bulleri*) breeds only on the Poor Knights Islands, NZ, but forages throughout the Pacific Ocean during the non-breeding season. The Poor Knights Islands are free of invasive threats. Due to their protection on their only known breeding islands, Buller's shearwater are an ideal indicator of ocean conditions in the broader Pacific. Although the species is commonly seen at-sea, historical land-based surveys have produced estimates varying from ~2.5 million birds (from the 1980's) to ~100,000 pairs. Despite their endemic status, our research provides the first thorough population estimate for the species. Based on burrow counts and state of occupancy models we estimated active burrows of Buller's shearwaters to be 78,645 (95% confidence interval 67,176–89,178), generally relating to the breeding population. This estimate is lower than previous assessments and provides a critical, repeatable baseline for better understanding Buller's shearwater breeding populations.

## **RAPID AND SPONTANEOUS SEABIRD COLONIZATION INCREASES SOIL NUTRIENT AVAILABILITY ON THE ISLAND OF MAUI**

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As sea-level rise continues to threaten seabird breeding habitat in the low-lying atolls and islands of the Papahānaumokuākea Marine National Monument, the race to restore viable nesting habitat and recruit more seabirds in the main Hawaiian Islands becomes urgent. Yet, due to allochthonous nutrient deposition, the re-introduction of seabirds has the potential to transform the ecological structure of the areas where new breeding colonies are established. The recent and spontaneous formation of a Red-footed Booby (*Sula sula*) colony on the island of Maui offered a highly unique opportunity to conduct a baseline study on the impacts of colonization. To determine the effects of the colony on soil nutrient availability, we deployed Plant Root Simulator (PRS<sup>®</sup>) probes in three experimental zones: grassland (birds absent), canopy outside of the colony (birds absent), canopy within the colony (birds present). We found that, despite the recent formation of the colony, bird presence was already significantly impacting total nitrogen (633 mg/m<sup>2</sup>/21 days,  $p < 0.001$ ) and phosphorus (583 mg/m<sup>2</sup>/21 days,  $p < 0.001$ ) levels within the soil. Furthermore, a positive correlation exists between nutrient availability and the proximity to the colony (total N:  $r^2 = 0.661$ ,  $p = 0.03$ ; P:  $r^2 = 0.433$ ,  $p = 0.05$ ), indicating that the seabird-derived nutrients are beginning to disperse across the terrestrial landscape. The results of this study come at an opportune time, as the colony site is slated for restoration within the State Wildlife Sanctuary program. Our findings support that seabirds contribute key nutrients vital to the establishment of native plant communities. Therefore, attracting seabirds to restoration areas should be a continued consideration.

## **DOCUMENTATION OF A SIGNIFICANT BREWSTER'S BROWN BOOBY COLONY IN THE MAIN HAWAIIAN ISLANDS**

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Historical records show occasional and increasing observations of Brewster's Brown Booby (*Sula leucogaster brewsteri*, 'Ā) in the Hawaiian Archipelago from the latter 20th Century to the time of this writing, but very few records from the main islands. We present observations and photographs from a new Brewster's Brown Booby colony on Moku Mana, an islet in East Maui. The more commonly recorded

Brown Booby subspecies in the Hawaiian Archipelago, *S. l. plotus*, has occasionally nested on Moku Mana, though in low numbers. Since 2019, both subspecies have been frequently observed. In 2021, we counted, mapped, and opportunistically monitored visible nests between May and August. There were at least 12 *S. l. brewsteri* and 6 *S. l. plotus* nests on Moku Mana. We noted various reproductive stages, and all observed nests were attended by pairs sorted by subspecies; there were no observed pairs of mixed subspecies. This is the first significant Brewster's Brown Booby colony documented in the Hawaiian Archipelago, and it represents solidification of evidence for range expansion in the Central Pacific.

## **HAWAIIAN CULTURAL SIGNIFICANCE OF NATIVE SEABIRDS**

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Both resident and seasonal migratory seabirds in Hawai'i play important roles in Hawaiian culture. Exploring the cultural significance of Hawaiian species involves investigating 1) their role as *kinolau* (physical manifestations) of Hawaiian deities, 2) their uses in Hawaiian material culture, and 3) their place in the intellectual, ethical, and spiritual knowledge base. This presentation briefly reviews these aspects, providing examples that involve Hawaiian seabirds, demonstrating their cultural significance, and their importance to Native Hawaiians of past, present and future. Understanding cultural significance is foundational to biocultural approaches in seabird conservation and helps ensure support and involvement of indigenous and local communities in conservation management.

## **BUILDING CAIRNS' BRIDGE: SEABIRD DATA USE IN U.S. FISHERIES MANAGEMENT**

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Seabirds are known to be sentinels of the marine environment, as their distribution and abundance, diet, reproduction, and mortality can indicate the status and health of the marine ecosystems of which they are a part. A recognition of seabird-prey linkages in particular led David Cairns, 30 years ago, to call for using seabird diet data explicitly to inform fisheries stock assessments. To assess progress on incorporating seabird data into fisheries management in general ("Cairns' bridge"), we reviewed U.S. fisheries stock assessments, management plans, and regional Integrated Ecosystem Assessments. Of the ways where seabird data plug in to the fisheries management process ("on-ramps"), incorporating seabird data into stock assessments was rare, and using seabird indicators to exemplify ecosystem changes and adjust harvest levels was documented for a few fish stocks. Largely, seabird data has provided contextual

ecosystem information for ecosystem status reports. In the California Current, multiple time series of seabird diet and reproduction highlight trophic and environmental linkages and are promising candidates for informing fisheries management. We will present candidate time series, outline potential analyses, and discuss where they might be incorporated into fisheries management--as covariates or inputs in stock assessments, health indicators for “stoplight” management recommendations, inputs to risk tables for harvest modification, etc. Increasing the use of seabird data in fisheries management overall will increase the profile of seabirds as an important ecosystem component, build a bridge between seabird biologists and fisheries managers, and signal progress toward effective ecosystem-based fishery management.

## **A QUANTITATIVE REVIEW OF SEABIRD COLONY ATTENDANCE**

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Seabird population estimates rely on colony attendance, but attendance itself is not well documented for many species. We performed a quantitative literature review of seabird colony attendance to provide a unifying research framework, identify knowledge gaps, and provide guidance for future studies. Methodology followed the PRISMA Statement and publications were found through Web of Science, SORA, and Google Scholar. We examined the taxonomic coverage, breeding strategies, latitudinal distribution, and conservation status of species present in colony attendance literature from 1965-2021. We then identified factors influencing colony attendance and quantified explanatory power. Within the literature (n=231), only 27.4% of seabird species (n=96) were present. Common murre (*Uria aalge*) and black-legged kittiwakes (*Rissa tridactyla*) were the most studied species and Alcidae the most studied family. The literature displayed a bias towards diurnal (n=169) and surface-nesting (n=141) populations, as well as high latitude (n=78) and species categorized as Least Concern (n=68). Few papers (n=42) examined driving factors of colony attendance and fewer (n=20) provided adequate statistics for comparative analysis. Weather was commonly tested but offered less explanatory power than ocean conditions. We highlight that despite advances in digital monitoring equipment many seabirds are underrepresented in the colony attendance literature and few studies quantitatively assess drivers of colony attendance. This can be problematic for enumeration of populations that rely on single counts (e.g., satellite imagery) or burrow nesting species where populations are estimated from metrics of abundance (e.g., acoustic activity).

## **UNDERSTANDING THE ROLE OF COLOR IN NORTH PACIFIC SEABIRDS**

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Carotenoid-based pigments (e.g. red, orange) may be an indicator of seabird health and fitness due to their dietary origin. The expression of these pigments has also been correlated with the ability to genetically and parentally provide for their offspring. Previous research has also observed that some seabirds have an innate attraction to these pigments during development and foraging. The present study aims to understand the role color plays in the indication of health and in breeding behaviours of north Pacific alcids. We are observing the behavioural responses to carotenoid-based pigments in a captive seabird population. This is done with choice tests using colored stimuli in the enclosure of our study population. Behavioural responses will be recorded in an ethogram and analyzed for patterns. Another goal of the present study is to correlate health and carotenoid-based pigment expression. This portion of the study will look at spectrograms and body condition measurements collected from recently deceased alcids (if available). This research aims to Hopefully, these experiments will provide insight into the behavioral response and variation of carotenoid expression in north Pacific alcids.

### **IMPACT OF THE NATIONAL FISH AND WILDLIFE FOUNDATION'S SEABIRD CONSERVATION PROGRAM**

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Between 2011 and 2020, the National Fish and Wildlife Foundation (NFWF) awarded 181 grants to 53 organizations to protect 12 focal Pacific seabird species. We used a purpose-built seabird meta-population viability analysis model (seabird mPVA) to evaluate the predicted impact of funded projects. Our model compared extinction risk probabilities under a baseline (no NFWF investments) scenario and a scenario with the predicted project impacts. NFWF-funded seabird projects reduced the predicted probability of extinction for 7 of 10 focal species that could be modeled. The reduction in extinction risk ranged from 1% to 90%, with an average of 30%. These same projects also increased predicted population abundance projections for 9 of 10 focal species over baseline estimates. In addition, NFWF-funded projects also provided benefit to at least 75 additional seabird species including predicted extinction reductions for 5 of 16 IUCN threatened species. Predicted extinction reductions for the five IUCN threatened seabird species varied from 3 to 24%, with an average extinction risk reduction of 13%.

### **FLAPPING FLIGHT ANALYSIS OF STREAKED SHEARWATERS USING A HIGH-TIME RESOLUTION ACCELERATION / GPS RECORDER**

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Much research has been done on birds flapping in wind tunnels, but few researches have been done in the field. Therefore, we analyzed the precise flapping behavior of streaked shearwaters (*Calonectris leucomelas*) in the field using high-time resolution acceleration / GPS recorder. The study was conducted on Funakoshi Ohshima Island in Iwate Prefecture, Japan. The seabird colony on the island is located 47 meters above sea level. Five birds in 2018 and one in 2019 were fitted with a NINJA-SCAN recorder that recorded 3-axis acceleration at 100 Hz, GPS location at 5 Hz. The flapping motion was analyzed using the acceleration record of the longitudinal axis and dorso-ventral axis. A flight trajectory was generated from GPS location record and the flight pattern was investigated in combination with the acceleration record. The flight pattern at sea consisted of flapping and gliding. In contrast, as birds approached the island and ascended towards the colony, they changed to a continuous flapping flight. According to the acceleration record analysis, we found that two positive peaks occurred in the longitudinal acceleration in one stroke cycle, indicating two propulsion movements within a single flapping motion. One propulsion corresponded to the time when the dorso-ventral acceleration was also positive, and the other corresponded to the time when the dorso-ventral acceleration was negative. These results suggest that the timing of gaining propulsion force does not always coincide with the timing of gaining lift.

## **INDIVIDUAL-LEVEL VARIATION IN THE FORAGING FLEXIBILITY OF A PURSUIT-DIVING SEABIRD, THE COMMON MURRE**

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The role of individual variation within populations is becoming increasingly recognized as central to a population's ability to adapt to environmental change. While it is common for populations within heterogeneous marine environments to contain varying levels of specialists and generalists, the environmental drivers and mechanisms by which individuals within heavily generalized populations exhibit specialization are still poorly understood. Combining GPS and time-depth loggers with prey delivery imagery, we examined the fine-scale foraging flexibility of pursuit-diving common murre (*Uria aalge*) during the chick-rearing periods of 2019–2021 on Southeast Farallon Island. We estimated the degree of consistency in individual foraging routes, locations, environmental covariates, and prey types across trips, both within and between individuals. Murre tracked over multiple foraging trips and years exhibited high individual-level variation in spatial overlap, foraging trip and dive characteristics within and between years. Importantly, behavioral repeatability was higher for individuals when interannual environmental conditions were similar (2020 and 2021), than when they strongly differed (2019 and 2021). These results

suggest that murrens are predictable in their utilization of the marine environment when conditions allow, but are able to exhibit flexible foraging strategies in response to prey and productivity fluctuations. While increased foraging effort may incur greater energetic costs with subsequent demographic consequences, flexible behavior is likely to be advantageous as the climate continues to change.

## **2021: SEABIRD CONSERVATION ACTIONS DURING A YEAR OF CONTINUAL CHALLENGES**

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Amidst COVID's ability to disrupt many aspects of seabird bycatch monitoring and mitigation, research, and management, NOAA Fisheries' National Seabird Program (NSP) remained highly productive. The year, 2021, called for creativity in adapting to our new COVID-induced work reality, and the NSP team members continued their conservation efforts. Highlights for 2021 included (a) Jason Jannot shared the story of fishermen joining forces with scientists and regulators to protect the Short-tailed Albatross on a Conservation Café podcast to honor World Albatross Day; (b) Colby Brady and Sarah Ellgen collaborated with the Western Pacific Fishery Management Council and Hawai'i Longline Association to design and conduct field trials with tori lines to tackle Black-footed Albatross fishery interactions; (c) Jeannette Zamon and Jeff Shenot hosted a workshop at the 3<sup>rd</sup> World Seabird Conference to address Seabird Collisions at Night Caused by Lights on an international level; (d) Tom Good, Keeley Kent, and Colby Brady gave presentations about U.S. bycatch mitigation strategies at an international webinar series hosted by New Zealand to improve cooperation with Asia Pacific Economic Cooperation member economies and raise awareness of bycatch mitigation strategies on an international level; (e) Shannon Fitzgerald led an effort to develop a strategic plan for AFSC seabird activities and worked with U.S. Fish and Wildlife Service on behalf of NOAA Fisheries to address issues of incidental take in U.S. fisheries under proposed changes to the Migratory Bird Treaty Act. Moreover, the collection of essential seabird bycatch data was continued due to NOAA's observer program, observer trainers, at-sea observers, and host fishing vessels.

## **WHERE ARE THEY LANDING? MAPPING SEABIRD FALLOUT FROM ARTIFICIAL LIGHTING IN AUCKLAND, NEW ZEALAND**

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Urbanization is creating a plethora of harmful impacts on wildlife. One of them being Artificial lighting at night (ALAN). ALAN is a growing concern for seabirds as they become disoriented and grounded by the lights. The Hauraki Gulf, a seabird hotspot, is located near New Zealand's largest urban city, Auckland. Auckland is a "flyway zone" for seabirds. Many of them become grounded by the lights across Auckland. This project aims to identify the locations and hotspots of the seabird groundings in Auckland. Using the Wildlife Medical Rehabilitation Database we mapped out the seabird fallout in Auckland between 2018-2021. We also mapped the seabird fallout against the predicted night sky brightness. We found that the central business district and industrial areas had some of the greatest number of seabird groundings in the Auckland region. This correlates to the predicted amount of night sky brightness. The greater the light pollution, the greater the chance of a seabird becoming grounded. Also, different seabird species display differences in the number of groundings. The Cook's petrel had the greatest number of fall-out compared to the other seabird species. This is potentially due to the Auckland isthmus being a "flyway zone" for them as the fledglings migrate over Auckland to the Tasman Sea. Furthermore, different species could have differences in their visual ecology which may influence light attraction. Greater awareness of seabird groundings from light attraction in Auckland is needed. This will help generate a larger database of the location of seabird groundings across Auckland.

## **CONSERVING AN ENDANGERED ICONIC SEABIRD: STATUS AND TRENDS OF THE TUFTED PUFFIN (*FRATERCULA CIRRHATA*) IN THE SALISH SEA**

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Tufted Puffin (*Fratercula cirrhata*) populations have declined significantly throughout the California Current System during the past century, with populations in California and Oregon estimated to have declined by more than 90% and in Washington by nearly 90%. In Washington, where the species was listed as Endangered in 2015, the population was estimated at approximately 25,000 birds in the early 1900s and at 2950 birds between 2007-2010. The number of active colonies in Washington waters declined from 43 in the early 1900s to 35 between 1978-1984 and, most recently, to 19 between 2007-2014. Within the Salish Sea, of 14 colonies documented historically, only two remain active, Protection and Smith islands, both of which are protected as part of the U.S. National Wildlife Refuge system. Current



conservation actions include a range-wide assessment of abundance and trends, the development of standardized survey methods, and terrestrial breeding habitat restoration. Given the lack of historical data on the diet of Tufted Puffins in the Salish Sea, we are using photographic ID techniques to determine diet composition and prey characteristics. A potential restoration action is to use social attraction techniques to reestablish breeding populations on historically occupied islands. Given that causes of puffin declines in the Salish Sea remain poorly understood, developing a better understanding of drivers of the decline and their relative importance is essential to help inform ongoing conservation planning for the species in this region.

## **MICE TO EAT YOU: UNCOVERING THE DIET OF INVASIVE HOUSE MICE**

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Midway Atoll National Wildlife Refuge (MANWR) is the world's largest albatross colony and provides globally significant breeding grounds for over 20 avian species totaling more than 3 million birds. Since 2015, invasive house mice (*Mus musculus*) have attacked and depredated hundreds of nesting adult albatross. Mouse eradication on MANWR is planned for the summer of 2022, but the broader ecosystem-level effects of this invasive species are largely unknown. Here, we investigate mouse diet in order to infer ecological impacts of mice and predict potential ecosystem response to mouse eradication. We combined next-generation sequencing and stable isotope analysis to construct house mouse diet composition. We collected (paired) fecal and hair samples from 318 mice across MANWR's Sand Island from April 2018 to May 2019. Mice were trapped approximately every 8 weeks among four distinct habitat types, so as to provide insight into temporal and spatial shifts. Preliminary results from NGS indicate that mice consume a wide array of arthropods and plants, with 13 different native and non-native plants and 29 non-native arthropods detected in 5% or more of the mouse fecal samples. More importantly, Laysan Albatross (*Phoebastria immutabilis*) DNA was detected in over 90% of the mouse fecal samples. Stable isotope analysis reveals that mice have very high trophic positions, greater than that of Laysan Albatross by more than 3%. Mice may preferentially consume seabird sources (likely through scavenging or preying on scavengers) for a substantial part of their diet; in turn, mouse diet could have implications for eradication operations in regard to bait palatability and availability of alternate food sources.

## **LIGHT POLLUTION ON STREAKED SHEARWATER: QUANTITATIVE COUNTS OF GROUNDED FLEDGLINGS AND THEIR PHYSICAL CHARACTERISTICS**

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In recent years, artificial light has been increasing in the natural environment due to urban development and human population increase. Although the fledglings of Streaked Shearwaters (*Calonectris leucomelas*) are often attracted by artificial lights and grounded around harbor and village areas close to the breeding colony, factors affecting the light-induced groundings remain unclear. In this study, we conducted quantitative counts of grounded birds attracted by artificial lights and their body measurement at Toshima Island, Japan, during October to November, 2020 and 2021. We counted the numbers of fledglings grounded in village and harbor areas at night. The external measurement including wing area were conducted on the grounded fledglings as with adults and fledglings at their colony. Sexing was conducted by the molecular analysis. During our survey, 199 grounded fledglings were captured in the village and harbor areas. Slightly higher numbers of grounded fledglings were found in harbor area with metal halide lamps than around LED street lamps at the village area (2020, harbor : n=47, village : n=30, 2021, harbor : n=67, village : n=53). The sex ratio was 56% for males and 44% for females (in 2020). The wing loading was significantly lower in the grounded fledglings than fledglings and adults in their colony. Our results suggest that the light types and morphological features of fledglings might have some effect on the process of the light-induced groundings.

## **DIFFERENT RESPONSE TO WEATHER CONDITIONS IN BREEDING PHENOLOGY AND SUCCESS OF TWO *PYGOSCELIS* PENGUINS IN THE ANTARCTIC PENINSULA**

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The Antarctic Peninsula is experiencing the most rapid climate change within the Antarctic region. Investigation of the effect of annual climate conditions on demographic parameters of seabirds can provide an opportunity to assess the adaptive capacity of species and understand population response to changing climate. We used 8-year data (2012/13-2019/20) of air temperature, precipitation, prey availability (the mean concentration of chlorophyll) on adjacent sea surface, and the breeding parameters of Gentoo (*Pygoscelis papua*) and Chinstrap penguins (*P. antarcticus*) in King George Islands, Antarctic Peninsula to study the effect of environmental factors on their breeding phenology and success. We identified relationships among environmental covariates and breeding parameters with non-metric multidimensional scaling, then tested for the strength of relationships between breeding parameters and environmental conditions with linear regressions. We found that mean hatching dates of both species were earlier in years with the warm and dry early breeding season (October-November). The breeding success of Gentoo penguins was higher in warm and dry years. In general, the breeding success of Gentoo penguins were lower when they hatched later in the season. On the other hand, no environmental variable was related to the breeding success of Chinstrap penguins. Also, there was no evidence of the effect of the prey availability on breeding phenology and breeding success in both species, potentially due to the poor spatio-temporal resolution of satellite images. The increase in breeding success of Gentoo penguin in warm years suggest that they may be more adaptable than Chinstrap penguins in the rapidly warming Antarctic Peninsula.

## **CHARTING A PATH TO RECOVERY THROUGH PEOPLE AND PLACE**

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Kaua'i is a unique place in many regards - never having been conquered by Kamehameha in his bid to unite the Hawaiian Islands, people hold fast to their culture and connections to place. In 1995, the Kaua'i Electric Company proposed construction of power lines in Kalihiwai. Local environmentalists were very concerned about the impacts they might have on migrating seabirds. Denise Antolini, then with Earthjustice, was asked to help. Thus began a several-decades-long effort to better understand the native seabirds, their habitat and the dangers they faced. Effective advocacy requires a comprehensive approach. So a team formed, including fact finders in science and law, and community members who are linked to the issue. In this case, Hui Ho'omalua i ka 'Aina, stewards of the land, was asked to participate as practitioners and cultural advisors. Representing fishers, hunters, farmers, weavers and kupua of moku Halele'a, the Hui worked closely with scientists and lawyers to provide cultural context for the birds. To this day the work continues.

## **PARTNERING FOR TERN CONSERVATION: DEVELOPING A STATEWIDE ALEUTIAN TERN COLONY CENSUS PROTOCOL**

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The Aleutian Tern is one of Alaska's most imperiled seabirds, having undergone population declines of more than 80% at known colonies in recent decades. Owing to concern, the Pacific Seabird Group's Aleutian Tern Technical Committee (ATTC) was formed in 2016 with the goals of developing a diverse and collaborative partnership to develop and implement a list of action items and prioritized projects that would most benefit Aleutian Tern conservation efforts in Alaska. In 2021, the ATTC tested a colony survey and monitoring framework in the Alaska Peninsula Bristol Bay region using a three phase, grid-cell based approach. Cells overlaid on potential habitat were first surveyed by aircraft for the presence of colonies, and second for abundance and species composition if colonies were observed (Phase I). Intensive aerial surveys were conducted at a portion of the cells initially surveyed to assess detectability (Phase II). Aerial surveys were conducted in June 2021 in the Bristol Bay region of Alaska. A total of 49 tern colonies were detected, including 10 colonies with Aleutian Terns. Intensive aerial surveys were conducted at 51 cells; no additional colonies were detected. For direct ground-counts (Phase III), only two colonies were easily accessible from aircraft landing locations. Future protocol refinement will include additional methodology to address aerial survey detection rate, ability to identify terns to species from aerial photographs, and the logistics of accessing and surveying colonies with drones and/or helicopters. Our goal is to further refine the technique in 2022 and implement the statewide protocol in 2023.

## **DIET ASSESSMENT AND VULNERABILITY OF A PLANKTIVOROUS SEABIRD TO CHANGE IN A SOUTHERN OCEAN WARMING HOTSPOT**

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Shifts in zooplankton communities due to rising ocean temperatures are known to affect marine food webs, with recent attention to the serious consequences of marine heatwaves on planktivorous seabirds

in the Northern Hemisphere. However, little is known about the vulnerability of planktivorous seabirds in the Southern Hemisphere, including rapidly warming seas such as the south-east Australian warming hotspot. Furthermore, there is a lack of available data on the prey of planktivorous seabirds in this region, which can affect our understanding of the vulnerability of these species to change in prey species composition and their exposure to nutrients and minerals within their foraging areas. We investigated the diet composition and concentration of trace elements in the prey species and feathers of white-faced storm-petrels (*Pelagodroma marina*) in the Bass Strait. The diet composition was reflective of a generalist feeder, with crustaceans and fish representing the majority of prey. Coastal krill (*Nyctiphanes australis*) was the most abundant prey type. Trace element concentrations in prey items revealed that, in the breeding season, birds are exposed to similar nutrients irrespective of diet composition. We posit that despite being a generalist forager, white-faced storm-petrels in the Bass Strait substantially rely on relatively few prey types, which may increase their vulnerability to events that lead to reductions in abundance of preferred prey species. As coastal krill is highly sensitive to sea surface temperatures, the predicted increase in ocean temperatures and marine heat waves might alter the timing and abundance of krill swarms. We conclude that white-faced storm-petrel populations, may be vulnerable to rising temperatures in the Bass Strait.

#### **PRELIMINARY RESULTS FROM AN ASSESSMENT OF ATLANTIC PUFFIN (*FRATERCULA ARCTICA*) DIET USING FECAL DNA METABARCODING**

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Numerous methods currently exist for assessing seabird diet. During the chick-provisioning period, Atlantic puffins ("puffins") carry prey items in their bills back to the colony for their chicks, allowing colony-based, observational studies to occur. Presently, it is often assumed that chick diet is a fair proxy for adult diet. However, few studies have examined this assumption and adult diet as a whole remains understudied. Adult diet during the incubation period is particularly poorly known, as prey is consumed at sea and puffins need not restrict their foraging trips as closely to the colony during this time. We investigated the diet of adult puffins in the Gulf of Maine by collecting fecal samples from individuals of known breeding status; sample collection began during the incubation period and continued until chicks fledged. Chick fecal samples were obtained opportunistically during weekly productivity checks. We used MiFish primers to amplify 12S rRNA sequences that could be sequenced to identify the fish prey taxa present in each fecal sample. Prey taxa frequency of occurrence is examined by breeding stage (incubation vs. chick-rearing), bird age (chick vs. adult), and time of year. To the authors' knowledge, this is the first application of molecular techniques to examine the diet of incubating puffins. These preliminary results are encouraging and promise to better our understanding of puffin diet composition throughout the entire breeding period.

## **CREATING A CULTURE OF COEXISTENCE AT A STRATEGICALLY MANAGED SOUTH MAUI WEDGE-TAILED SHEARWATER COLONY**

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Coastal seabird colonies in the Main Hawaiian Islands have drastically decreased since historical times. Regardless, conservation efforts have proved successful in reviving embattled colonies in suboptimal habitats amidst urbanized areas. Kāma'ole III in Kīhei, Maui is an example of such a nesting habitat for the indigenous wedge-tailed shearwater (*Ardenna pacifica*, 'ua'u kani). Maui Nui Seabird Recovery Project has been managing this colony in partnership with State of Hawai'i and County of Maui organizations to mitigate threats to 'ua'u kani survival: human disturbance, introduced mammalian predators, invasive vegetation, and light pollution. Chick and adult banding efforts began in 2004 and 2008 respectively. From 2008-2021, 50.6% of the 2,387 adults banded were recaptures. The total chicks banded/year ranged widely from 37 to 105 until 2017 when only 3 live chicks were found. In response, predator control and daily colony patrols were initiated in mid-2018. In 2019, a high proportion of recaptured adults (65.7%) and predated adult birds (n= 34) were counted, suggesting predators were still having an impact. Invasive grass/plant removal started in 2019 to eliminate vegetative cover for predators. Reflecting trapping and habitat restoration progress, in 2021 the highest number of chicks were banded (n= 144) and only 2 adult carcasses were found. Burrow counts have more than doubled from 376 in 2018 to 820 in 2021, with inland expansion to available habitat, so carrying capacity has not been reached. Ecologically-driven colony management strategies urging community coexistence are needed for these encouraging trends to continue.

## **A REVIEW OF SEABIRD VESSEL STRIKES IN ALASKA GROUND FISH FISHERIES 2010-2020**

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NOAA Fisheries reports the estimated seabird bycatch associated with Alaskan commercial fisheries annually. Estimates are provided beginning in 1993 when fishery observer duties were expanded to capture a wide suite of seabird/fishery interaction information. The USFWS and NOAA Fisheries coordinated closely to implement these expanded observer data collection protocols and continue to

collaborate on fishery interaction information. Initially, due to ad hoc reports about “bird storms”, where many seabirds collide with a vessel under inclement conditions, part of observer activities were to record vessel strike information. While these data were initially only recorded on paper forms, since 2010 they were captured electronically in a relational database. While the issue of seabird vessel strikes is an unattested source of seabird mortality in the Alaska Groundfish Fisheries, reports of strikes and bird storms have been low and did not trigger a full analysis or changes to protocols. However, given recent actions, including (a) a vessel collision event in 2019 resulting in mortality of 22 threatened spectacled eiders (*Somateria fisheri*), (b) changes to the Migratory Bird Treaty Act to address incidental take, and (c) reduction of sea ice in the northern Bering sea allowing greater fishery effort, the seabird vessel collision component of the North Pacific Observer Database is being examined. We report, for 2010 to present, number of incidents, species involved, numbers of birds, vessel types, locations, conditions at time of incident (environmental, vessel activity, vessel lighting), overall observer deployments, and provide an index regarding incidents and mortalities over time.

## **THE HIDDEN MOVEMENTS OF NON-BREEDERS AT COLONIES: AN EXAMPLE FROM BROWN SKUAS ON AMSTERDAM ISLAND**

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Studies of wildlife movement often focus on breeders, whose territorial attachments facilitate capture and observation. However, this excludes the movements of individuals not actively breeding due to age, nest failure, territorial exclusion, and other factors. Non-breeding floaters may play important roles in spatially-structured processes such as disease transfer; thus, excluding them from movement studies could bias results or miss important spatial dynamics. We captured brown skuas (*Stercorarius antarcticus*) attending either loafing areas (“clubs”) or nests at Amsterdam Island, a multi-species seabird colony in the southern Indian Ocean. We tested captured skuas for avian cholera, fitted them with GPS transmitters, and used movement patterns of known breeders to determine breeding status of individuals captured at clubs and compare movements between breeders and non-breeders. Non-breeders ranged more widely, spent more time active, showed greater intra- and inter-individual variation in space use, and overlapped more with other breeding seabirds and mammals than breeders. We found that capturing skuas at clubs better represented population-level movements than capturing at nests, while avoiding disturbance in sensitive nesting areas. We detected avian cholera infections in both breeders and non-breeders; however, only non-breeders utilized areas of known outbreaks as well as breeding habitat of the endangered Amsterdam albatross (*Diomedea amsterdamensis*), making them more likely to spread the pathogen among species of concern. Given the planned eradication of introduced rodents on Amsterdam Island, monitoring skua movements could help detect effects of eradication on interspecific interactions and pathogen circulation.

## **EFFECTS OF DILUTED BITUMEN ON FLIGHT AND DIVING BEHAVIOURS OF CHICK-REARING RHINOCEROS AUKLETS (*CERORHINCA MONOCERATA*)**

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Diluted bitumen (dilbit) is an unconventional crude oil that is transported overseas by tanker. However, there is a lack of research on the risks that this novel contaminant may pose to the many marine birds that use this habitat. While large-scale conventional oil spills are well-known to be deadly to seabirds, it is less well understood how small amounts of oil can hinder their health and behaviour. We captured chick-rearing Rhinoceros Auklets (*Cerorhinca monocerata*) on Middleton Island, Alaska. Birds were given sublethal dosages of diluted bitumen either internally (4 mL/kg) or externally (on upper wing coverts and breast contour feathers, total body surface area <5%). We then deployed small loggers that recorded GPS every 10 minutes, depth at 1 Hz, and acceleration in three axes at 50 Hz for 2 days after dosing. After device retrieval, burrow status was monitored for chick survival. 29 of 58 devices were retrieved across two summers of field work. We examined overall dynamic body acceleration and wing-beat frequency for bouts of flying and diving to see if exposure to dilbit affected activity-specific performance during foraging trips. Preliminary analysis indicates that birds exposed to even small amounts of diluted bitumen face challenges that can impact their ability to successfully fledge chicks.

## **PERSONALITY IN RAZORBILLS INFLUENCES THEIR BEHAVIOUR**

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Animal personality, exhibited as consistent between-individual differences that persist through time and across contexts, can result in divergent behaviour and influence reproductive success. We aimed to identify personality in razorbills (*Alca torda*) and its impacts on behaviour and fitness. During 2021, we conducted three boldness tests on chick-rearing adults (n=30) in coastal Newfoundland, Canada, to quantify the frequency of traits along the shy-bold continuum. These tests involved quantifying responses to extraction from the breeding crevice, a period of restraint, and handling by observers. Razorbills exhibited a wide range of responses along the shy-bold continuum and individuals were consistent across all three tests, providing preliminary evidence for personality in this species. Personality tests will be repeated on individuals in subsequent years to test behavioural consistency over time. We used a Principal Component Analysis to combine all test scores into a boldness index for each individual. Successful



breeders had a significantly higher mean boldness index than failed breeders (Pairwise Wilcoxon Test,  $p=0.028$ ). Currently, we are relating the boldness index to dietary metrics (carbon/nitrogen stable isotope ratios) and foraging/movement patterns during breeding (GPS tags) and non-breeding (GLS tags) seasons in a multi-year context. Based on previous studies, we predict that bold individuals will disperse farther from the colony and exhibit more specialist foraging behaviour relative to shy individuals. This study represents a first step in quantifying personality in this species and its influence on fitness, which will provide insight into the ability of razorbills to cope with future environmental change.

## **17-YEARS OF OPPORTUNISTIC SIGHTINGS OF SEABIRDS DURING SMALL-BOAT SURVEYS FOR CETACEANS AROUND THE MAIN HAWAIIAN ISLANDS**

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Seabirds are often used as indicators of the health of marine ecosystems but not much is known about their at-sea distribution in relation to environmental variables around the Main Hawaiian Islands. From April 2002 to November 2019, seabirds were recorded during cetacean surveys around the main Hawaiian Islands covering 116,674 km over 1,034 vessel days, with more than half of the effort off Hawai'i Island. A total of 86,200 birds of 59 species were systematically counted with GPS waypoints recorded for rare or unusual sightings ( $n=1959$ ) and photos taken when possible. For species that are difficult to identify in the field (e.g., *Pterodroma* spp.), photos were examined to confirm species identification. Frequently encountered and common species like Wedge-tailed Shearwaters (*Puffinus pacificus*) were tallied using event counters and totaled at the end of each day. A model was developed to examine relationships between seabird sightings and a variety of temporal (e.g., seasonality), static (e.g., distance from shore, depth), and dynamic environmental variables (e.g., chlorophyll-a, SSH). Seabirds were associated with cetaceans in almost 16% of encounters ( $n=130$ ) with the most associations with pantropical spotted dolphins (*Stenella attenuata*) ( $n=50$ ) and rough-tooth dolphins (*Steno bredanensis*) ( $n=45$ ). Our survey effort has resulted in some of the only at-sea sightings of species like Bonin Petrel (*Pterodroma hypoleuca*), Tahiti Petrel (*Pseudobulweria rostrata*), and Bridled Tern (*Onychoprion anaethetus*) in the Main Hawaiian Islands. Here we present an overview of our results and distribution maps per species as they relate to survey effort and discuss future effort to quantify sighting data.

## **CONTINUITY OF NORTH PACIFIC FISHERIES OBSERVER SEABIRD/FISHERY INTERACTION TRAINING DURING THE COVID-19 PANDEMIC**

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To meet Alaska commercial fishing observer coverage requirements, the North Pacific Observer Program (NPOP) provides ca 40,000 observer coverage days annually. In March 2020, NOAA Fisheries responded to the Covid-19 pandemic by cancelling research and charter cruises, directing employees to work from home, canceling field work, and restricting office/lab access to only the most critical mission needs while adopting strict on-site safety protocols. The NPOP met challenges to observer training by changing the traditional classroom setting to a hybrid online video-based training with limited in-person interactions as needed. These actions affected training for observer's seabird responsibilities, which include reporting fishery interaction with species of conservation concern including Short-tailed Albatross (*Phoebastria albatrus*). The University of Washington's Coastal Observation and Seabird Survey Team (COASST) provides the seabird training segment under contract to NOAA Fisheries. We report here how COASST and NOAA Fisheries adjusted to provide continuity in training. In the virtual training space, COASST added live quiz tools to encourage participation and supplemented the training with new types of images and activities for seabird identification practice. Lab-time was divided with the NPOP trainers, who continued to provide hands-on learning opportunities in the days (or weeks) following virtual training. Revisions in year two of hybrid training included virtual activities to bridge the gap between training and hands-on practice. Total observer coverage rates were only minimally affected and observers collected data in support of the annual estimates and other important seabird/fishery interaction information.

## **EFFECTS OF RESEARCHER DISTURBANCE LEVELS ON 5 DAY OLD BLACK-LEGGED KITTIWAKE CHICKS**

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The ability to closely monitor and manipulate marked populations of seabirds is invaluable for ecological research and conservation efforts. A reconfigured radar tower on Middleton Island, Alaska provides accessible semi-artificial nesting sites for black-legged kittiwakes (*Rissa tridactyla*). It has hosted many studies about physiological responses to environmental challenges in free-living seabirds. However, long-term researcher disturbance may affect seabird physiology, such that disturbed and undisturbed birds may not be directly comparable. Such differences may be evident in chicks, which are easier to access than adults. We tested effects of researcher disturbance on kittiwake chicks by categorizing disturbance levels as high, medium, and low based on researcher activities at 3 locations. A subset of the high disturbance birds were supplementally fed (whole fish ad libitum 3x/day). A (N=77) and B (N=77) chicks were measured and bled in <3min when the A chick was 5 days old. Red blood cells were used for genetic sexing. Whole-blood glucose and ketones were measured with handheld meters; glucose was also measured in plasma in the lab. Despite being validated in adult kittiwakes, glucose values from handheld meters did not show good concordance with lab-measured glucose ( $R^2=0.08$ ). We found that disturbance levels did not significantly affect measures of chick physiology (body condition or metabolites). The lack of effects of disturbance levels on very young chicks suggests either that kittiwakes are robust to disturbance

or that effects are not apparent until later when chicks demands are higher or chick physiology may be more responsive to challenges.

## **PHENOLOGICAL AND DEMOGRAPHIC RESPONSES OF ALCIDS TO CLIMATE CHANGE IN THE GULF OF MAINE**

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The Gulf of Maine is warming faster than most of the world's ocean and is also the southern-most limit for nesting, cold-adapted Atlantic Puffin (*Fratercula arctica*), Razorbill (*Alca torda*), and Common Murre (*Uria aalge*). Beginning in 1995, the Atlantic Laboratory for Avian Research has collected annual data on phenology, productivity, diet, and fledgling body condition for seabirds nesting at Machias Seal Island. Here, we aimed to quantify changes in these measures and assess whether they are related to environmental conditions. Variation in all measures was found among our three focal species, with some showing changes between 1995 and 2021 and others not. Interestingly, puffins, Razorbills, and murre were often found to be responding differently to changes in environmental conditions. Specifically, we found that environmental conditions were important predictors for measures of breeding performance, but importance of environmental conditions differ both between the species and among the metrics tested. Continued research is needed to understand the reasons for differences between the species and the impacts of continued warming.

## **PREDATOR DISTURBANCES CONTRIBUTE TO COMMON MURRE BREEDING FAILURES IN KACHEMAK BAY, ALASKA, FOLLOWING THE HEATWAVE**

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Avian predation can influence seabird breeding success, especially when predation increases during times of low prey availability. Following the 2014-2016 marine heatwave, which greatly reduced forage fish availability and quality, Common Murres (*Uria aalge*) on Gull Island in Kachemak Bay, Alaska experienced multi-year reproductive failures (2016-2018) followed by low productivity (2019; 0.26 chicks/egg), compared to historical rates (1995-1999; 0.54 ±0.15 chicks/egg). To evaluate the potential impacts of predator disturbance on murre breeding success following the heatwave, we used time lapse cameras on

Gull Island to quantify the frequency and duration of disturbances and rates of egg predation throughout the breeding season from 2016-2020. In all years, Bald Eagles (*Haliaeetus leucocephalus*) were the most common cause of disturbance and Glaucous-winged (*Larus glaucescens*) and Herring Gulls (*Larus argentatus*) were the primary egg predators. Disturbances in 2016 and 2018, years of reproductive failure, were more frequent, longer in duration, extended later in the breeding season, and had the greatest rate of egg predation, compared to other years. Similar results were seen in 2020. In contrast, disturbance events in 2017, a reproductive failure, and 2019, when chicks fledged, were less frequent, shorter, and declined in frequency earlier in the season. While murrelets failed on plots in 2017, chicks were seen off plot, indicating greater success than 2016 or 2018. These results suggest that predator disturbance is impacting breeding success on Gull Island, which could be exacerbated by lasting heatwave effects on the timing and availability of prey for both murrelets and their predators.

## **THE STATUS ON CRAVERI'S MURRELET IN THE MIDRIFF ISLAND REGION IN THE GULF OF CALIFORNIA, MEXICO**

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The Craveri's Murrelet (*Synthliboramphus craveri*) is an endangered seabird in the Alcidae family, and the only member to breed in the Gulf of California, specifically in the Midriff Island Region. Despite their endangered status under Mexico's *Norma 059* and their listing as vulnerable on the IUCN Red List, this species is the least studied of the family. The lack of data makes it difficult to determine the timing of the breeding season and therefore to survey nesting activity efficiently. More complete information about the species' nesting phenology and geography is needed in order to fill in knowledge gaps about nesting ecology, inform population estimates, and increase effectiveness of conservation efforts. First documented in 2009, the colony on Alcatraz Island has been monitored every year since 2017. Surveys documented 12 nests during the first four years. In 2021, 11 of 18 known nests appeared to be occupied from Jan-April. Nests were checked weekly to study phenology. Over the season eight were successful and three failed. Based on the number of eggshells found, 12 chicks were believed to have hatched. The remaining nests were recorded in previous seasons but were not active in 2021. In February 2021, nest searches were conducted on San Esteban and Dátil Islands, in addition to one nocturnal spotlight survey around San Esteban. Three nests were found on San Esteban Island, and one on Dátil Island. Total of 43 breeding pairs were estimated on San Esteban Island after the nocturnal survey, indicating a need for further nest searches.

Further study of the current status of this little-known species will facilitate better informed conservation decisions.

## **DOCUMENTING THE IMPORTANCE OF WATERBIRDS IN THE INDIGENOUS TERRITORY OF THE COMCAAC; INFIERNILLO CANAL, SONORA, MEXICO**

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The Infiernillo Canal is a shallow, naturally formed channel between Tiburon Island and the Sonoran coast within the territory of the indigenous Comcaac people of northwest Mexico. It is characterized by the presence of the largest and southernmost concentration of annual sea grass beds in the eastern Pacific, as well as mangrove estuaries located at the northern limit of this vegetation type, and habitat for 81 endemic and/or threatened species. In 2009, the Infiernillo Canal was declared a Ramsar Site (UN wetland of international importance), an important designation and tool for biocultural conservation. The Ramsar Convention requires that the Ramsar Site Information Sheet (RIS) filed with the application be updated and submitted for reaffirmation. During the winter and spring of 2020-2021, we documented the waterbird diversity of the Canal. In collaboration with Comcaac community members, we monitored waterbird diversity in nine estuaries within the Canal and surveyed the full 29,700-hectare surface area of the canal. We recorded a total of 54 species of waterbirds, of which four are considered as Near Threatened (IUCN). In addition, six species are considered as Threatened, and two as In Danger of Extinction under the Mexican *Norma Oficial SEMARNAT-059-2010*. Additionally, we documented new breeding sites for the endangered Snowy Plover, quantifying the high importance of protecting these sites. Our results satisfy the necessary biological criteria for the Ramsar site renewal. We aim to highlight both the importance of the Canal for waterbirds as well as the value of involvement of local indigenous communities in the monitoring and protection of these habitats and species.

## **THE COMCAAC PEOPLE AND BIRDS: A STORY OF RELATIONSHIPS BETWEEN TRADITIONAL KNOWLEDGE, WESTERN SCIENCE AND CONSERVATION**

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The Comcaac people have inhabited the coastal region of the Sonoran Desert in Mexico for thousands of years. Their traditional and ecological understanding of the region is very comprehensive. Despite outside pressures, this knowledge, and its use in modern day conservation, continues to be preserved by the Comcaac, with support from the Prescott College Kino Bay Center (the Center) and other conservation organizations. The Center works in collaboration with a Comcaac youth community group called “Grupo Coijaac” whose members are trained in bird monitoring and talk with their elders to compile traditional knowledge about the bird species observed. The Canal del Infiernillo, located 100% within Comcaac territory, is a Ramsar Site (2009) comprised of ten estuaries that supports critical habitat for nesting, migratory and resident waterbirds, including Brants (*Branta bernicla*), Redheads (*Aythya Americana*) and several species of shorebirds. During the 2020-2021 season, the Center and Grupo Coijaac performed avian surveys in the Canal del Infiernillo in order to update the Canal's Ramsar Site status. The process also

included community dialog about the biocultural importance of birds and estuaries. Through these methods, the community gained access to both traditional and contemporary sources of information pertaining to avian ecology. This integrated approach sets deeper and stronger roots toward future conservation of this important site. The Comcaac knowledge about the local sites that birds use to rest, feed, and reproduce was instrumental in conducting this study and illustrates the importance and effectiveness of combining indigenous traditional knowledge with scientific knowledge in acts of conservation.

## **DIVING PERFORMANCE VARIES WITH AGE AND SEX IN A PLUNGE-DIVING SEABIRD**

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Declining physiological function could affect many aspects of late-life performance, but detecting physiological senescence in functional traits remains a challenge in wild organisms. For a marine predator that plunge-dives from the air on concentrations of ephemeral prey, the physiologically-demanding dive cycle could challenge elderly members of the population more than other ages. We evaluated how aspects of diving performance varied with age in Nazca boobies (*Sula granti*), a tropical, pelagic seabird. Male and female adults were tagged with tri-axial accelerometers during the incubation period of two breeding seasons in 2015 and 2016. We tested the ability of age and body size to explain variation in five diving traits (e.g., dive depth and wingbeat frequency when taking off from the surface of the water after a dive) using linear mixed models. We analyzed data from males and females separately because of known sex-specific patterns of breeding performance and flight performance in Nazca boobies. Notably, only diving traits of females varied with age, dependent on the number of dives undertaken by a bird in the 10 minutes preceding a dive. Young and old females performed shallower dives compared to prime-age birds, and spent less time resting on the water as fatigue (e.g., from an increased number of dives) accumulated. Young females also flapped slower than middle-aged and old birds during the take-off, suggesting physiological immaturity for young breeders in these demanding aspects of plunge-diving. This study expands our understanding of aging in Nazca boobies, complementing observed sex-specific reproductive senescence in this species.

## **SPATIAL AND TROPHIC ECOLOGY OF TWO SEABIRD SISTER-SPECIES ISOLATED THROUGH PHENOLOGICAL DIVERGENCE**

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Phenological divergence between sympatric populations, known as allochrony, is increasingly recognized as an important evolutionary process that may lead to speciation. One taxa in which this type of speciation has occurred are the Northern storm-petrels (*Hydrobatidae spp.*). In this study, we evaluated the drivers of phenological divergence in two allochronic sister species of storm-petrels breeding in Guadalupe Island, the Townsend and Ainley's storm-petrel. We described the phenology of both species in detail, analyzed their spatial and trophic ecology, and studied the environmental variation that eventually drove the divergent phenology. We monitored nests, tracked birds with GPS, and conducted DNA barcoding analyses for both species. We found that the timing of breeding of both populations barely overlap, with few Townsend storm-petrel's fledglings still present at the colony at very start of the Ainley's storm-petrels incubation period. Both populations mainly visited two areas, one at the South-East of Guadalupe Island, near the Cedro Island, which was used when birds conducted short trips, and another area between San Diego and San Francisco, used when birds conducted long trips (up to 1,080 kilometers). The diet differed between the birds visiting both areas, but was mainly composed of fish, squids and copepods. In our next steps, we will compare the niche overlap between both populations, and will analyze geolocation and activity data for both species.

#### **PLASTIC INGESTION IN WEDGE-TAILED SHEARWATERS: AN ANALYSIS OF BLOOD CHEMISTRY, GENE EXPRESSION AND BODY CONDITION**

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Plastic pollution is a global threat and affects almost every marine ecosystem. Seabirds, typically top predators in marine food chains, have been greatly affected by ocean plastic pollution, with 59% of species found to have ingested plastic. Little is known about the sublethal effects - when organisms or populations survive exposure to a toxicant - of plastic on seabirds that otherwise appear healthy. More research is needed for a complete understanding of the relationship between ingestion and sublethal effects. Through analyses of blood chemistry, gene expression, morphometrics and stomach contents, we aim to document the effects of plastic ingestion on Wedge-tailed shearwaters (*Ardenna pacifica*, WTSH) in Maui, Hawai'i. We performed *in situ* sampling of 29 adult WTSH in June, 2021. Plastics, which included microplastics and fishing line, were found in 42.8% of the stomach contents of the sampled birds. The only blood chemistry analyte that was significantly different in birds with ingested plastic was anion gap indicating more alkaline blood. For future direction, we will use bioinformatic tools to align the RNA sequences to the Cory's Shearwater reference genome and closest relative to the Wedge-tailed Shearwater in order to perform differential gene expression analyses from blood. This study provides baseline data for WTSH blood chemistry, and to guide future studies into the impacts of plastics on this population.

## PREVALENCE OF PLASTIC DEBRIS IN NESTS OF TWO CORMORANT SPECIES IN PERU

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The Guanay cormorant (*Phalacrocorax bougainvillii*) and the Red-legged cormorant (*Phalacrocorax gaimardii*) breed along the Peruvian coast in waters strongly influenced by the productive Humboldt Current. Guanay cormorants are colonial, dichromatic and nest in flat areas, whereas Red-legged cormorants are solitary, colorful and nest in vertical cliffs. Both species incorporate a large amount of material (feathers, algae, guano, bones, debris, etc.) to build their nests, making them suitable indicators of ocean plastic pollution around their colonies. To test inter-specific differences in nest plastic occurrence, we counted nests (with and without plastic debris) either by direct inspection (Guanay cormorant) or by observations at distance (Red-legged cormorant) at 10 locations off the coast of Peru between March 2018 and September 2019. The occurrence of debris in Red-legged cormorant nests (55%, N = 96) was much higher than that of Guanay cormorants (8.5%, N = 3,497). The density of debris at sea, as determined from boat transects, was also higher around Red-legged cormorants. Debris in Guanay and Red-legged cormorant nests consisted mainly of user plastic of different colors (black, green, white, and translucent). There were geographical differences in nest plastic occurrence. The results of this research will allow the identification of hotspot areas of plastic marine pollution in Peru.

## SEABIRD COMMUNITY COMPOSITION: SEASONALITY IN THE NORTHERN GULF OF MEXICO

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Community composition is often characterized by averaging observations across the study area, making it relatively easy to view data on a single image. However, excluding temporal inference can lead to misinterpretations of data that may have relevant management implications. The northern Gulf of Mexico (nGoM) supports a diverse assemblage of seabird species, some breeding locally and others making long migrations from colonies in the southern Gulf of Mexico, the Caribbean, across the North American continent, or the eastern north Atlantic. We compared the composition of seabird communities using observation data averaged across space (spatial communities) with data aggregated by date and space (spatiotemporal communities). Three spatial and four spatiotemporal communities were identified. Both approaches identified a shelf-associated community dominated by Sooty tern (*Onychoprion fuscatus*) and



a pelagic community with no single dominant species. The last spatial community was nearshore, dominated by Black terns (*Chlidonias niger*). The remaining spatiotemporal communities were nearshore, with one dominated by fall observations and Black tern, migrating from northern breeding grounds. The other community was split between fall and spring, with possibly locally breeding Laughing gull (*Leucophaeus atricilla*) and north Atlantic coast breeding Northern gannet (*Morus bassanus*), making roughly 50% of the individuals observed. The spatiotemporal clustering approach revealed important temporal patterns in the nearshore environment blurred by spatial only approaches. Identifying temporal patterns in seabird communities is an important part of understanding the processes influencing community composition.

## **CHANGES IN POSITIVE ASSOCIATIONS AMONG VERTEBRATE PREDATORS AT SOUTH GEORGIA AND IN THE CALIFORNIA CURRENT**

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We studied positive associations among seabirds and marine mammals at South Georgia during the Austral winters of 1985, 1991 and 1993 and found statistically significant differences. We collected data on at-sea abundance and distribution, providing a critical reference for sub-Antarctic conservation in anticipation of future environmental changes. We found significant changes in the abundance of 29% of species surveyed and a consequent change in species diversity. We postulate that the resulting altered community composition may have previously unanticipated population effects on the component species, due to changes in positive interactions among species which use each other as cues to the presence of prey. We found a near threefold reduction in spatial overlap among vertebrate predators in the warmest compared to the coolest year. Of immediate concern is that anthropogenic changes may be altering the quantity and quality of these associations, with fitness consequences for the species involved. In this way, environmental changes may disproportionately impact predator abundances and such changes are likely already underway as ocean temperatures have likely risen substantially since our last survey. Our results will be compared to repeats of the transects conducted during the Austral winters of 2022 and 2023. We are also investigating changing species interactions (as well the causes and consequences of such changes) in the California Current, using data from the late spring seasons of 1996-2018.

## **COSTS OF REPRODUCTION MEDIATED BY OXIDATIVE STRESS IN A SEABIRD – AN EXPERIMENTAL STUDY**

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Life-history theory predicts that long-lived iteroparous individuals must balance the cost of current reproduction with their own conditions against future opportunities to breed. Therefore, carry-over effects that occur when events in one season affect the performance of the subsequent season may be particularly relevant in these species. Nevertheless, how carry-over effects influence future breeding success and behavioral changes is poorly understood. Here, we examine physiological effects induced by a bidirectional manipulation of the breeding efforts in Black-Legged Kittiwakes (*Rissa tridactyla*), which may affect costs of reproduction mediated by oxidative stress. Breeding pairs were assigned to three experimental groups: 1) supplementary fed (unlimited food provisioning to both adults and chicks; n = 57 pairs), 2) handicapped (by clipping primary and tail feathers; n = 33 pairs), 3) control (n = 51 pairs). The manipulations have started upon laying of the first egg, meaning the carry-over effects from incubation period could be applied to subsequent chick-rearing period and later. Although the average numbers of eggs laid and hatched in the three groups combined were similar ( $1.7 \pm 0.5$  eggs and  $1.0 \pm 0.9$  chicks per pair respectively; average  $\pm$  SD), the average number of fledged chicks among the three groups were: 1)  $0.6 \pm 0.7$ , 2)  $0.1 \pm 0.3$ , 3)  $0.4 \pm 0.5$  chicks per pair, and thus the values have matched with the amount of breeding costs as expected. We present results of oxidative status of adults and chicks from three groups and discuss how different breeding costs affect parents' behavior as well as physiological conditions in chicks.

## **SMALL INTER-ANNUAL VARIATION IN BODY CONDITION OF CHICK-REARING RHINOCEROS AUKLETS: A TEST OF ADAPTIVE BODY MASS HYPOTHESIS**

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The provisioning rates of seabirds vary largely in response to inter-annual changes in prey availability. The variation of the body condition (body mass) in chick-rearing adults, however, is less variable. Some seabirds during the chick-rearing period (i.e. carrying meal-loads) decrease body mass to reduce the flight cost: Adaptive body mass hypothesis. Alcids bring meal-loads by continuous flapping flight so spend greater energy than swimmers (penguins) and gliders (procellariiformes). If the hypothesis is supported, chick-rearing alcids may be especially sensitive to maintaining adaptive body mass. Using 27-year monitoring data of Rhinoceros Auklets breeding on Teuri Island, northern Japan, we calculated the coefficient of variation (CV) of the chick growth rate as an index of provisioning rate and that of adult body mass. Then we compared these CVs with those reported in other 9 seabird species (including 4 alcids, 3 procellariiformes, 1 penguin, and 1 gull species). We found that CV for chick growth rate in Rhinoceros Auklets (36.4) are larger than others (8.1-21.9) but that for adult body mass is smaller (1.4-1.5) than others (2.3-7.5). Among alcids, Rhinoceros Auklets carry the heaviest meal-load, despite a medium-sized species. Therefore, chick-rearing Rhinoceros Auklets may have little room for increasing energy expenditure for extra flight cost and so be sensitive to maintaining their body mass. This study suggests that Rhinoceros Auklets have adaptive body mass.

#### **CORMORANTS, OCEANOGRAPHY, AND COLLABORATIONS: USING BIOLOGGING TO MEASURE TEMPERATURE AND SALINITY FROM FORAGING SEABIRDS**

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Biologging has matured as a method to understand the movements and behaviors of seabirds at sea. However, using biologging to characterize environmental conditions encountered by foraging seabirds is still not commonly applied. Biologging tags are constrained in size and shape to limit impacts on study animals. Yet, limited flexibility in tag programming and sensor development also present challenges in measuring oceanographic parameters. Here we present and compare data from two tags carrying fast response temperature sensors to measure ocean temperature profiles along the dives of foraging seabirds: GPS/GSM with a gold external temperature sensor (Ornitela, 26.9g) and GPS/base station tags with a smaller external temperature sensor enclosed in a 3-D printed cage (TechnoSmart, 29g). Tags were deployed on Socotra Cormorants (*Phalacrocorax nigrogularis*) and Rockhopper penguins (*Eudyptes chrysocome*) in December 2021. Preliminary analysis of paired CTD-tag casts indicates both temperature

sensors have less than a 2 second response time, approaching the sub-second response time of oceanographic CTDs. We also present initial paired data from a RBR Concerto CTD and a biologging tag with integrated inductive conductivity and temperature sensors (Ornitela, 36g). Dive-linked GPS allows for georeferencing of CTD profiles and facilitates the characterization of dynamic near-shore habitats. As part of the Cormorant Oceanography Project, we are developing a global collaborative network of researchers to demonstrate the potential for using cormorants as oceanographic sampling platforms while developing a better understanding of foraging ecology, movements, and migrations necessary for informed marine conservation efforts.

## **ECOLOGICAL RESPONSES TO THE ENVIRONMENTAL CHANGE IN RHINOCEROS AUKLETS BREEDING ON ISLANDS IN THE TSUGARU STRAIT, JAPAN**

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Large-scale changes in the marine environment cause to changes in the fish resources on which seabirds feed. In this study, we obtained data of foraging locations by GPS trucking and at sea survey, bill-loads and chick measurement from breeding Rhinoceros auklets (*Cererhinca monocerata*) in 3 adjacent colonies, Tai Island and Benten Island, Matsumae-kojima Island, located in the Tsugaru Strait, Japan, in 2019 and 2021. Around the Tsugaru Strait, the Tsushima Warm Current (Sea of Japan), the Tsugaru Warm Current (Tsugaru Strait) and the seasonal front area of the Oyashio Cold Current (Pacific Ocean) are closely located. In 2019, the auklets mainly foraged along the coast of Hokkaido, around 8°C in SST, and might mainly forage on Japanese sardine (*Sardinops melanostictus*), however, in 2021, the most of auklets on foraged on the Pacific side of the coast of the Tsugaru Strait, around 12 and 17 °C in SST, and the majority of bill-loads were Japanese anchovies (*Engraulis japonicus*) in all colonies. Accordingly, chick growth was especially higher in 2021 in all colonies than in other years when the anchovies were not available. In recent years, after 2014, it is known that abundance of anchovy has been crashed in the waters around Japan due to the cold regime shift. The mechanisms of the sudden increase of anchovy availability around the Tsugaru Strait is still unclear, our study suggested that Rhinoceros auklets breeding around the Tsugaru Strait respond behaviorally to the sudden occurrence of anchovy and improve their breeding success.

## **UNDERSTANDING VARIANCE IN MARSH PREDATOR DISTURBANCE PATTERNS IN PACIFIC ESTUARIES**

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Understanding how marsh predators and humans interact in protected spaces is important to informing meaningful conservation and management efforts. Disturbance time is a tool to examine impact and

interactions within habitats. In this study, we will examine the variance in disturbance interval between marsh macrofauna, and the drivers of those patterns. We collected data from marsh bank trail cameras over a 52 day period in the Elkhorn Slough National Estuarine Research Reserve, located in Monterey Bay, California. Within the ten most abundant animals, there is a range of over five hours in average disturbance time; the animals with the highest disturbance intervals are white pelicans (*Pelecanus erythrorhynchos*), whimbrels (*Numenius phaeopus*), and humans, respectively. Our findings will contribute to a greater understanding of predator dynamics and spatial partitioning in pacific marshes. Understanding anthropogenic impacts on estuarine reserves is of great importance, as managers must balance human recreational use and protecting the ecosystems for these valuable bird species and endangered mammals.

## **PREDICTING CLIMATE CHANGE IMPACTS ON THE NON-BREEDING DISTRIBUTION OF THICK-BILLED MURRES**

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Climate change is altering the marine environment at a global scale, with some of the most dramatic changes occurring in Arctic regions. These changes may affect the distribution and migration patterns of marine species throughout the annual cycle. Species distribution models (SDM) have provided detailed understanding of the responses of terrestrial species to climate changes, often based on observational data; biologging offers the opportunity to extend those models to migratory marine species that occur in marine environments where direct observation is difficult. We used a SDM to predict potential future changes in the non-breeding distribution of thick-billed murres (*Uria lomvia*) from a colony in Hudson Bay, Canada, from 2021 to 2100 using CMIP6 climate scenarios. Under the highest emissions scenario (SSP5-8.5), all models predicted suitable habitat would become available year-round within Hudson Bay during the next century, in some cases as early as 2035. Depending on how quickly murres adapt to this habitat change, this could lead some portion of this migratory population to become year-round residents within Hudson Bay. There was a consensus among models that the winter range within the North Atlantic could shift north, such that there would be little to no suitable habitat south of 55°N by 2090. This shift would have significant implications for the murre harvest in Newfoundland and Labrador, particularly if murres from other colonies show a similar response to climate change.

## **BEST MANAGEMENT PRACTICES TO PROTECT ENDANGERED AND NATIVE BIRDS AT SOLAR INSTALLATIONS IN HAWAI‘I**

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Solar Energy facilities in Hawai'i are a growing major source of low carbon emission energy generation as the state strives to reduce emissions of greenhouse gasses to prevent the worst predictions of global climate change. It is incumbent upon developers of these facilities to consider wildlife impacts and take measures to mitigate for them. While the technology is relatively new there are evolving best management practices that should be undertaken. We identify five endangered waterbird species, three listed seabird species, and one raptor of conservation concern, that have been or may be at risk from solar energy generation facilities in Hawai'i. In addition, there are migratory species: fifteen waterbirds and seventeen shorebirds that may be vulnerable. We review relevant literature for impacts and consequences of wildlife interactions with solar energy facilities and recommend best management practices to minimize wildlife impacts. Design considerations for minimizing wildlife impacts are identified, and must be implemented and followed by monitoring to identify and quantify downed wildlife incidents and further development of effective mitigation strategies.

## **FORAGING NICHE DIFFERENTIATION OF CHICK-REARING SYMPATRIC SEABIRDS IN THE GULF OF THE ST-LAWRENCE IN TIME, SPACE, AND DIET**

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Ecological theory predicts that completely competitive species sharing identical overlapping niches cannot coexist in the same habitat at the same time. To persist, these species must sufficiently partition their limiting resources, a phenomenon known as niche differentiation. Seabirds provide a unique opportunity to understand such patterns of niche segregation among coexisting species because they form highly competitive multi-species colonies of breeding aggregations with seemingly overlapping diets and foraging areas. This competition may be strongest and peak during the breeding season when there are increased demands for food and individuals need to supplement themselves and their young while also being constrained to forage within a closer range around the colony. Advancements in biologgers show the tactics in which breeding seabirds employ to segregate components of their foraging strategies by foraging at different times, areas, and depths. In the Gulf of St-Lawrence in the Mingan Archipelago, we investigate whether and how niche differentiation occurs in four sympatrically breeding chick-rearing seabirds using GPS-tracking: the Atlantic puffin (*Fratercula arctica*), razorbill (*Alca torda*), common murre (*Uria aalge*), and black-legged kittiwake (*Rissa tridactyla*). Results indicate that intense overlap arises during the most competitive stage of the breeding cycle and subtle niche partitioning is occurring not only in the area that they are foraging but also within the depths they dive within the water column and timing

of their foraging events. These subtle foraging habitat specializations may be alleviating high interspecific competition allowing for their coexistence, providing insight on multispecies colonial living.

## **GEOGRAPHICAL BODY SIZE VARIATION IN THE RED-BILLED TROPICBIRD (*PHAETHON AETHEREUS*) AT THE MEXICAN PACIFIC**

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Physical traits have been assessed in wildlife, showing in some cases a substantial variation across geographical gradients. Body size variation across multiple animal taxa has been suggested to follow Bergmann's rule at the interspecific level or James's rule for intraspecific pattern. We measured body mass and size traits of Red-billed tropicbirds (*Phaethon aethereus*) at six different breeding colonies in the Mexican Pacific, and tested the James's rule by examining the relationships between the body traits and environmental variables (air temperature, sea surface temperature and chlorophyll-a) that characterize each breeding area. Furthermore, as males are apparently larger than females, sexual size dimorphism (SSD) may influence the pattern of inter-colony variation in body size so that issue was analyzed as well. We noted a geographic variation in the body size of the species increasing from the south to north, and this was related to environmental conditions. Overall, Red-billed tropicbird's body traits did not support our prediction of SSD in the species, since only two colonies showed SSD (males > females). The latitudinal cline in the species could be influenced by a set of both abiotic (air temperature, sea surface temperature and primary productivity) and biotic (foraging behaviour, food availability) factors which has led to a phenotypic plasticity according to local environmental conditions. Furthermore, the SSD detected in colonies with larger body size and favourable oceanographic conditions suggests that latitudinal variation among populations is an important correlate or mediator of SSD.

## **HABITAT ASSOCIATIONS OF NESTING ALBATROSS AT MIDWAY ATOLL AND IMPLICATIONS FOR RESTORATION AND MANAGEMENT STRATEGIES.**

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Habitat restoration efforts, including control of invasive plants and outplantings of native species, have been ongoing at Midway Atoll since the late-1990s, primarily with a goal of enhancing nesting habitat for albatrosses and other seabirds. Laysan and, to a lesser extent, black-footed albatrosses nest in all habitat types at Midway; but habitat associations with reproductive success have not been determined. During the 2019-2020 and 2020-2021 breeding seasons, we monitored nests of both species within four habitat types across the atoll: open habitat dominated by non-native grasses and forbs, non-native ironwood forest, coastal shrubland, and restoration areas dominated by native bunchgrass or small shrubs (*Chenopodium oahuense*). In 2019-2020 we only monitored nests post-hatching and found highest fledging success for both species in ironwood forests (Black-footed: 85% in ironwoods compared to 66% across all habitats; Laysan: 75% in ironwoods compared to 53% across all habitats). During 2020-2021, however, fledging rates were relatively low in forests (Black-footed: 44% in ironwoods compared to 59% across all habitats; Laysan: 40% in ironwoods compared to 56% across all habitats). During both years, Laysan albatross reproductive success was lowest (<35% fledging and overall nest success) in restoration areas with dense bunchgrass. Nest densities of both species were highest in open, non-native habitats and lowest in coastal shrub for Laysan albatross and in ironwoods for black-footed albatross. Habitat associations with nest densities and success provide important guidance for future habitat management planning at Midway and other sites with existing colonies or plans for re-establishing seabird nesting populations.

## **FEATHER AMINO ACID ISOTOPES IDENTIFY CONTRASTING SEASONAL TROPHIC NICHE IN PENGUINS WITH DIFFERING MIGRATION STRATEGIES**

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Seabirds are common model organisms in basic and applied research on climate change, marine pollution, and fisheries management. However, most studies of seabird foraging ecology have focused on the breeding season and little is known about these species' diets during the winter. Stable isotopes analysis can be used to infer seabird diets when they are away from their colonies, but often cannot distinguish the influence of a consumer's diet (i.e. what it eats) from geographic or temporal differences in baseline isotopic values (i.e. where and when it is eating). To address these challenges, we used compound-specific stable isotope analysis of amino acids in feathers to compare the breeding (i.e. chick rearing) and non-breeding (i.e. winter) trophic niches of Adélie (*Pygoscelis adeliae*) and Chinstrap (*P. antarctica*)



penguins from the South Shetland Islands, Antarctica while explicitly accounting for varying isotopic values at the base of the food web. We found that these species had similar trophic positions (~3.3) reflective of krill consumption during the chick rearing period similar to past studies using more traditional methods. However, trophic position was higher in Chinstrap penguins wintering in ice free areas (3.9), relative to Adélie penguins wintering in ice covered areas (3.1). Moreover, trophic position differed between Chinstrap penguins migrating eastward into the Scotia Sea (3.6) or westward to the Pacific sector of the Southern Ocean (4.0). These results suggest that estimates of Adélie and Chinstrap penguin diets and Antarctic krill (*Euphausia superba*) consumption from the breeding season may not be necessarily reflective of the trophic niches of these species year-round.

### **MARINE HABITAT USE PATTERNS OF THE ENDANGERED MARBLED MURRELET (*BRACHYRAMPHUS MARMORATUS*) IN THE CENTRAL-SOUTHERN PUGET SOUND**

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Seabirds face many threats including human disturbances, pollution, and climate change. Marbled Murrelets (*Brachyramphus marmoratus*) are particularly vulnerable to these impacts, as both terrestrial and marine environments are crucial for their survival. Listed as Endangered in Washington state and Threatened by the US Fish and Wildlife Service south of the US-Canada border, Marbled Murrelets are well-studied; however, relatively little is known about their marine habitat use patterns in the southern Puget Sound. We conducted shore and boat-based observations of Marbled Murrelets at three study sites near Tacoma (Browns Point Lighthouse, Gig Harbor Lighthouse, and Point Fosdick) from April through August 2021 to determine if persistent marine hotspots exist for marbled murrelets at these locations and characterize habitat use patterns. At the Browns Point Lighthouse site, we also measured boat traffic and conducted behavioral observations of murrelets to assess whether boat traffic caused disturbances. All three sites were used consistently for foraging by Marbled Murrelets throughout the breeding season, with birds observed through the end of July. Additionally, we mapped the distribution of foraging activity locations around Browns Point, with foraging occurring almost exclusively along the inshore area to the northwest of the lighthouse. Boat traffic did not appear to influence foraging behavior. Our results indicate that there are multiple stable foraging hotspots for Marbled Murrelets in southern Puget Sound. Additionally, the consistent presence of Marbled Murrelets at these sites throughout the breeding season suggests that there is a previously undescribed population of these endangered seabirds in southern Puget Sound.

### **OCCURRENCE OF PLASTIC IN PELLETS OF NEOTROPIC CORMORANTS IN LIMA, PERU, BEFORE AND DURING THE COVID-19 PANDEMIC ANTHROPAUSE**

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Anthropause, a recess in human activities because of lockdowns during the recent COVID-19 pandemic provides a unique chance to test any effects of human disturbance on seabirds. Lockdowns in Peru prevented people from visiting coastal areas and disposing of garbage to the ocean that may have temporarily decreased plastic pollution. We tested this idea in inshore-feeding Neotropic cormorants (*Phalacrocorax brasilianus*) along a 12.7 km highway (Costa Verde) in a coastal strip of the city of Lima, Peru (~ 20 million people). Fresh pellets were collected in the median of the highway before (11 months) and during the pandemic lockdowns (8 months). The % of occurrence of plastic and other debris in the pellets was measured. There was a significant decrease in plastic occurrence in pellets during anthropause (% Oc = 2.47, n = 647 pellets) in comparison to pre-pandemic conditions (% Oc = 7.25, n = 800 pellets; Chi-square = 15.852, df = 1, p-value < 0.0001). The commonest debris item in the pellets was user plastic and threadlike of different colors. This study demonstrates that millions of people visiting the Costa Verde annually substantially increase plastic marine pollution. Imported garbage from nearby river mouths and coastal dumps may also be involved in plastic pollution in the Costa Verde.

## **OFFAL DISCARDS AND PROBABLY ONE OF THE CAUSES OF ALBATROSS CONGREGATIONS IN OFFSHORE WATERS OF SOUTHERN PERU**

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We perform two fishing trips in oceanic areas in southern Peru, between May and July 2021, specifically in the Hague triangle, between 17°30'S and 19°S and from 130 to 160 nautical miles offshore, The trips were made in artisanal longline vessels targeting blue shark (*Prionace glauca*) and shortfin Mako shark (*Isurus oxyrinchus*), during the fishing activities we realized that when the fishermen discarded the sharks offal, a particular behavior of the pelagic birds was noticed, first when discarding the intestines, the White-chinned Petrels (*Procellaria aequinoctialis*), later when they made loud screams, the Black-browed albatross (*Thalassarche melanophris*) approached but in a shy manner. However, when the shark liver was discarded, the approach of the birds was much more intense and fights were generated between and among the two mentioned species, later arrived the Buller albatrosses (*Thalassarche bulleri*), generating strong fights with the Black-browed albatrosses. The shark liver discards also generated the presence of Chatham albatrosses (*Thalassarche eremita*) who generally beat their other opponents to get the food. This type of offal discards can contribute strongly to the presence of these albatrosses species in oceanic waters of southern Perú.

## **COMBATting CAT DEPREDATION IN HAWAII THROUGH COMMUNICATION**

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In 2021, the Kaua'i Wildlife Coalition launched the Wildlife Friendly Business initiative. The project targets business owners and asks them to agree to simple conditions including refraining from feeding feral cats and adhering to wildlife-friendly lighting guidelines. The aim is to make the feeding of feral cats outdoors in Kaua'i socially unacceptable, as a first step to reducing feral cats on the landscape and saving hundreds of threatened and endangered waterbirds and seabirds annually from cat depredation. In this lightning talk, we will briefly explore the deepening problem that outdoor cats pose to highly endangered Hawaiian waterbirds and explore how the WFB project is one of the solutions we are using to mitigate for it.

## **THE IMPACT OF FERAL HONEY BEES (*APIS MELLIFERA*) ON ENDANGERED SEABIRDS IN THE HAWAIIAN ISLANDS**

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The 'A'o (Newell's Shearwater *Puffinus newellii*) and 'Ua'u (Hawaiian Petrel *Pterodroma sandwichensis*) are both endangered seabirds endemic to the Hawaiian Archipelago. For the last decade, multiple colonies on Kaua'i have been the focus of intensive management (particularly predator control) and monitoring programs. Management has been effective at increasing reproductive success rates at all colonies, and the number of introduced predators (such as cats *Felis catus* and black rats *Rattus rattus*) recorded within colonies has decreased significantly. However, over the last few years a new threat has emerged - feral honey bees *Apis mellifera* - which were introduced to the Hawaiian Islands. Since the first instance of a swarm of honey bees taking over a Hawaiian Petrel burrow on Kaua'i in 2013, the frequency of these events on the island appears to be increasing. Honey bees have been recorded swarming into burrows during the day and building their hives inside the burrow tunnels and chambers. These incidents result in the complete failure of the breeding season for the pair and, in multiple cases, fatalities of chicks or adults from bee stings. The issue is not confined to Kaua'i – additional cases have been reported from Hawaiian Petrel colonies on Lana'i. We present data on all recorded incidents of feral honey bee invasions of active seabird burrows during seabird monitoring work undertaken between 2012 and 2021 on Kaua'i. We also consider if there are certain burrow structures more susceptible to bee invasion. Novel methods used on Kaua'i to tackle this issue are discussed.

## **TRACKING SEABIRDS TO IDENTIFY HIGH STAKES AREAS IN THE NATURAL PARK OF THE CORAL SEA**

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In the South-West tropical Pacific, New Caledonia is a prime breeding area for seabirds, with more than 25 species breeding annually. Yet, little is known about their biology and foraging ecology within the Coral Sea and the exclusive economic zone. Here, we studied the at-sea movements of 5 seabird species from 10 different colonies, tracked over 6 different years using GPS devices, to characterize their foraging behaviour and at-sea habitat. Seabird foraging behaviour was assessed relative to stable and dynamic environmental variables. This allowed to highlight the oceanographic features determining seabird main foraging areas. Machine learning approach helped predicting and testing the consistency of these areas across years. Identifying stable foraging areas will help stakeholders to better safeguard important marine areas for seabirds. Furthermore, as seabirds feed in association with a wide range of marine species, their main foraging areas can be used as a proxy of areas of high abundance and diversity of marine organisms. New Caledonia recently created the Natural Park of the Coral Sea, the fourth largest marine protected area in the world, covering 1.3 million square kilometres, and this multi-colony, multi-species study aims at identifying high-stakes areas and relevant protection and management measures within this large oceanic region.

## **ESTIMATING THE NUMBER OF BREEDING PAIRS OF WEDGE-TAILED SHEARWATERS (*ARDENNA PACIFICA*) ON MAUI BASED ON OCCUPANCY RATES**

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The wedge-tailed shearwater (*Ardenna pacifica*, 'ua'u kani) is a seabird indigenous in the Hawaiian Islands and is widely distributed throughout tropical waters. However, this species is subject to various human-caused threats on the islands they populate. Historically, the populations of wedge-tailed shearwaters in Hawai'i have experienced vast fluctuations in size due to these threats. The Maui Nui Seabird Recovery Project counts 'ua'u kani burrows every two years at three colonies on Maui (Hawea, Kāma'ole III and Ho'okipa). All three colonies undergo varying degrees of management including habitat

restoration and predator control; thus, the colonies are growing at different rates. Tracking the number of burrows allows for comparisons among colonies but is not a direct estimate of the number of breeding pairs. To determine population size, we tested a method for estimating occupancy rates at each colony. Occupancy surveys were conducted during the 2021 nesting season, when adults were incubating eggs. The results indicate that the colonies have different average occupancy (Hawea=68%, Kāma'ole III=76%, and Ho'okipa=55%). Based on these occupancy rates and burrow counts conducted in December 2021, we can estimate the number of breeding pairs of 'ua'u kani on the island of Maui. An average 'ua'u kani occupancy rate could be used to estimate breeding pairs in Maui Nui (Maui, Molokai, and Lāna'i), if this methodology was replicated on the offshore islets and the other islands.

## **SPATIAL AND TEMPORAL VARIATION IN NEARSHORE MARINE BIRD COMMUNITIES IN A WARMING GULF OF ALASKA**

Brian Robinson<sup>1</sup>, Heather Coletti<sup>2</sup>, Brenda Ballachey<sup>1</sup>, James Bodkin<sup>1</sup>, George Esslinger<sup>1</sup>, and Daniel Esler<sup>1</sup>.

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Upper trophic-level species, such as marine birds, are useful indicators of ecosystem structure and function. In particular, marine bird community composition may reflect variability in oceanic conditions as a result of large-scale disturbances such as the Pacific marine heatwave, or smaller-scale regional differences related to habitat and prey availability. We evaluated spatiotemporal variation in nearshore marine bird communities in the northern Gulf of Alaska from 2006-2021. Specifically, we tested for differences in community composition between regions (Kenai Fjords versus Katmai National Park), seasons (summer versus winter), and before and after the onset of the Pacific marine heatwave. We also examined temporal trends in foraging guilds and species of interest. Nearshore marine bird community structure differed by both region and season. Katmai supported a high density and diversity of wintering waterfowl, whereas Kenai Fjords supported high densities of summer breeding birds. We also detected a shift in summer nearshore marine bird community structure related to the Pacific marine heatwave, with a greater proportion of pelagic diving species present after the heatwave, which we hypothesize is due to reproductive failures causing birds to depart breeding colonies and occupy nearshore habitats. Our findings underscore the importance of both large and small-scale mechanisms in shaping nearshore marine bird communities.

## **NON-BREEDING NICHE OVERLAP OF THREE NORTH ATLANTIC ALCID SPECIES**

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Although our understanding of the foraging ecology of adult seabirds has been greatly enhanced by the development of biochemical analyses as well as the miniaturization of tracking devices, there remains

limited information on important foraging areas and diet during the non-breeding season. Even less is known about the spatial and dietary overlap of seabird species during the non-breeding season, which could lead to interspecific competition during low productivity winter conditions. We aimed to quantify spatial and isotopic niche overlap among Common Murres (*Uria aalge*), Razorbills (*Alca torda*), and Atlantic Puffins (*Fratercula arctica*) outside the breeding season by combining data from geolocators and stable isotope analysis ( $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ ) of body, secondary, and head feathers collected from ~20 birds per species during July 2017-2020 in coastal Newfoundland. As feathers are inert once grown, feather stable isotope ratios of carbon and nitrogen are a record of both the foraging location and diet during moult. Seasonal utilization distributions of each alcid species indicate generally low spatial overlap during most months in the non-breeding period, with exceptions due to puffin individual variability. Stable isotope analysis revealed larger niche breadth for puffins than other species, matching their greater spatial variation. Razorbill and murre isotopic niches were more contracted and showed relatively high overlap during flight feather molt. Elucidating the diet and foraging areas for these three alcid species along with potential interspecific interactions during a formerly understudied phase of the annual cycle is important to predict seabird responses to varying environmental conditions.

### **ABUNDANCE IN 3D: ASSESSING COLLISION VULNERABILITY OF SEABIRDS AND FLOATING OFFSHORE WIND IN THE CALIFORNIA CURRENT**

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The California Current System (CCS) is the most intensely surveyed marine region in the world, with decades of vessel and aerial surveys targeting seabirds since the late 1970s. These surveys have been essential for developing two-dimensional (2D) patterns of occurrence for single and multiple species. Such analyses provide useful insight on the location of 2D seabird abundance and diversity 'hotspots' in the CCS. However, current proposals to construct floating offshore wind facilities (FOSW) necessitate more explicit consideration of vertical (3D) use of space to better assess collision vulnerability. Seabird flight heights often vary as a function of wind speed and, for dynamically soaring seabirds, flight heights may increase rapidly with increasing wind speed. These dynamic soarers dominate the outer continental shelf of the CCS, particularly during fall and winter months. Here, we present a 3D view of seabird abundance in the CCS as a function of location, season, and wind speed. Additional covariates used to help predict abundance included bathymetry, distance to shelf break, distance to nearest breeding colony, cumulative and biologically effective upwelling transport index, and others. This 3D framework demonstrates how, in areas of the CCS with a rich wind resource capable of supporting FOSW, the avifauna composition near the

sea surface is quite distinct from the composition at the height of rotor swept zones. Improving understanding of these differences in vertical distribution and abundance of seabirds with different flight styles is essential for understanding seabird vulnerability to collision with FOSW projects.

## **LONG-TERM IMPACTS OF THE 2014-2016 NORTH PACIFIC MARINE HEATWAVE ON SEABIRDS IN COOK INLET, ALASKA**

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An extreme marine heatwave in the northeast Pacific Ocean during 2014-2016 resulted in large-scale ecological impacts, including a massive die-off and widespread breeding failures of Common Murres (*Uria aalge*) in 2015-2016. The cause of mortality was starvation, concurrent with a large-scale collapse of forage fish. We began monitoring murres and Black-legged Kittiwakes (*Rissa tridactyla*) in 2016 at Chisik and Gull islands in Cook Inlet, Alaska to document their recovery from the heatwave, and we compared findings with studies pre-heatwave (1995-1999). We surveyed populations using colony-wide censuses and population plots, and estimated productivity of murres and kittiwakes on plots from 2016-2021. Population estimates were lower post heatwave for both species. At Chisik, there were more than 65% fewer murres and more than 80% fewer kittiwakes. At Gull, murres were 57% fewer on censuses and 28% fewer on population plots; kittiwakes were no different on censuses and 32% fewer on population plots. In stark contrast to pre-heatwave productivity (>0.50 chicks fledged/eggs), murres failed to fledge chicks at either colony from 2016-2018. From 2019-2021, murres had one more year of failure and 2 years of low productivity at both colonies. Kittiwakes failed (<0.09 chicks/nests) at Chisik in all years. At Gull, kittiwakes had high productivity in 2017 and 2019 (>0.60), but failed in 2016, 2018, 2020 and 2021. The multi-year population declines and breeding failures we observed indicate ongoing population-level effects of the marine heatwave on both murres and kittiwakes and suggest a chronic scarcity of adequate forage. Populations are unlikely to fully recover for decades or longer if adverse breeding conditions continue.

## **HOW SEABIRD DIET DATA CAN BE USED TO INFORM FISHERIES MANAGEMENT: LESSONS FROM THE GULF OF MAINE**

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Commercial fisheries have traditionally been managed as single-species harvest operations, but managers are increasingly calling for ecosystem-based fishery management (EBFM). EBFM seeks to manage fisheries by incorporating environmental variability and the needs of other fish predators. Many fisheries suffer from data gaps, particularly regarding the youngest age classes of harvested fish, which makes EBFM difficult to implement. Where seabirds act as predators of juvenile stages of harvested fish species, they may be able to predict future cohort sizes, overcoming some of these knowledge gaps, but relatively few studies have attempted to link seabird and fishery data. We used data from four seabird species at nine seabird colonies in the Gulf of Maine, near the Atlantic Canada-USA border, to investigate the relationship between seabird diets and the Atlantic herring (*Clupea harengus*) stock. We used an exploratory regression approach to identify pairs of seabird and fishery data that could provide predictive relationships regarding the size and quality of the herring stock. We found that 1) seabirds are best divided into three geographical subregions within the Gulf of Maine; 2) juvenile herring show spatial movements at much smaller scales than are currently incorporated into fisheries assessments; and 3) “unusual” fish datasets not currently used in stock assessment showed strong trends with seabird data. Canadian fisheries managers were not receptive to incorporating seabird data into their management strategy evaluation process, prompting reconsideration of how to better engage with potentially insular fisheries management operations.

## **A GLOBAL PHYLOGENY OF PIED AND BLACK OYSTERCATCHERS**

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Oystercatchers (order Charadriiformes, family Haematopodidae) are a genus of globally distributed shorebirds with eleven currently recognised extant species. Phylogenetic reconstruction and species delimitation of this group has been a longstanding challenge due to their morphological similarity and inconsistent sampling. The purpose of this study was a complete reconstruction of the evolutionary history of taxa inclusive of all recognised oystercatcher species. Nuclear and mitochondrial DNA were isolated from feathers and toepads of specimens and sequenced for phylogenetic reconstruction. Based on a combined alignment of mitochondrial and nuclear markers, a robust time-calibrated phylogeny was constructed, resulting in an improved understanding of the evolutionary history of the genus. It was found that oystercatchers separated into two ancient clades approximately 24.13 mya (CI: 19.86-28.24 mya) representing the New and Old Worlds. Within the New World, the endemic Galapagos Oystercatcher (*Haematopus galapagensis*), previously treated as a subspecies of the American Oystercatcher (*Haematopus palliatus*) likely represents a valid new species. Likewise, in the Old World clade, the Pacific Oystercatcher (*Haematopus osculans*), previously a subspecies of the widespread Eurasian Oystercatcher



(*Haematopus ostralegus*), should be treated as a separate species. We subsequently recommend several changes to be made to oystercatcher taxonomy.

## **IN-AIR HEARING SENSITIVITY OF AN ENDANGERED ALCID SEABIRD, THE MARBLED MURRELET (*BRACHYRAMPHUS MARMORATUS*)**

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Anthropogenic noise is pervasive and impacts wildlife across marine and terrestrial environments. Amphibious animals such as seabirds face a unique combination of sound exposure in both media. Potential noise impacts are of increased concern for species already under threat. Marbled murrelets (*Brachyramphus marmoratus*) spend most of their life in the coastal marine environment in areas that overlap with human encroachment. Yet, there are no basic data on the hearing of the species, limiting any predictions of the frequencies or sound levels which would actually induce acoustic impacts. We measured the auditory sensitivity of 10 wild marbled murrelets in a capture-and-release setting. Individuals were caught from Auke Bay, Alaska using the spotlighting method at night before being temporarily anesthetized for electrophysiological auditory measurements. Auditory responses were detected across a 0.5 to 6 kHz frequency range, similar to other birds. The mean auditory threshold was lowest at 2 kHz (33 dB), while hearing was generally sensitive across a range extending from 1 to 3.5 kHz. In-air sensitivities were also used to provide an initial prediction of underwater hearing sensitivity; suggesting hearing comparable to some pinnipeds. Frequencies of marbled murrelet hearing overlap with many anthropogenic noise sources, indicating that the species is susceptible to disturbance from a range of noise types. Additionally, auditory sensitivities of the marbled murrelet were similar to two other Alcid species for which comparable data has been collected. A comparison to other birds suggests that Alcid in-air hearing appears more sensitive than that of other diving birds described to date.

## **NEW FINDINGS ON TOWNSEND'S SHEARWATER BREEDING POPULATION AND THE IMPLICATIONS FOR ITS CONSERVATION**

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Townsend's Shearwater (*Puffinus auricularis*) is a species endemic to the Revillagigedo Archipelago, Mexico, in the Tropical Eastern Pacific. It is one of the most endangered seabird species in North America

listed as critically endangered with a breeding population lower than 100 breeding pairs. The population decrease is attributed to volcanic eruptions and the introduction of alien invasive species. This work summarizes the findings of six years (2015-2021) of a monitoring program to locate the latest nesting colonies and determine their status. We collected new information about the breeding population through auditory surveys, automatic recorders, detection dogs, trail cameras, and burrow checks. In 2017, we began active restoration using social attraction techniques (artificial burrows and sound systems). Up to now, around 3,316 ha of breeding habitat have been surveyed on Socorro and Clarión islands. More than 40 recording sites with the presence of calls and 20 active burrows have been found on Socorro. Also, five active burrows have been found on Clarión, representing the first nesting records for the island after 29 years. Burrow monitoring has shown that there is a low reproduction success despite 100% of breeding pairs attendance every year, probably as a result of native predators. In 2019, the first pair of shearwaters nested in an artificial burrow, and until now, two chicks have fledged successfully. Non-native mammal eradications have considerably improved the habitat on Socorro and allowed the recolonization of Clarión. Nevertheless, the results suggest that despite mammal eradications, new active restoration techniques would be needed to enhance Townsend's Shearwater population recovery.

## **A GLOBAL DATABASE OF ACTIVE SEABIRD RESTORATION PROJECTS**

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Seabirds are globally threatened yet management actions can result in positive seabird outcomes, such as through the removal of invasive species from breeding islands. Social attraction and translocation are active restoration techniques that can further recover seabird populations, particularly where threat removal alone does not result in recovery. However, there is a lack of common knowledge of how to select and apply active restoration methods with the greatest chances of success. We created the Seabird Restoration Database, a data center of active seabird restoration methods and outcomes, to assist in knowledge transfer among practitioners seeking to use restoration tools to recover seabird populations. The Database builds on a previous seabird restoration review by Jones and Kress (2012), and contains records of planned, ongoing, and complete restoration projects, including those deemed as failed. We reviewed ~1,400 resources and contacted >600 experts to gather published and unpublished information on restoration events and outcomes. The research will result in a dataset of active seabird restoration projects from around the world – where they are happening, the species targeted, the methods applied, and the restoration outcomes. As of November 2021, the database contained >800 records of active

restoration methods applied in >40 countries and targeting >130 seabird species; this data is viewable online at seabirddatabase.org. The Seabird Restoration Database and subsequent analyses will inform restoration best-practices and will serve as a foundation from which other applied questions about seabird restoration, and wildlife reintroductions in general, can be formed to and improve conservation outcomes.

## **EXTINCTION OF THE SPECTACLED CORMORANT (*URILE PERSPICILLATUS*): A MEDIA AND LITERATURE OVERVIEW**

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In 1741, after reaching Alaska from eastern Russia and exploring the Aleutian Islands, naturalist Wilhelm Steller became shipwrecked along with the crew of Vitus Bering. During his struggle to fend off starvation in the unmapped Commander Islands, Steller discovered what would eventually be confirmed as the largest cormorant species on earth. Peter Simon Pallas recognized the bird described in Steller's journal as a new species, coining it *Phalacrocorax perspicillatus* in 1811. Within 40 years of its listing in scientific literature, Leonhard Stejneger declared the cormorant extinct after finding only bones and conferring with native Aleutians regarding its decline. During the 110 year period that the Spectacled Cormorant was concurrently extant with humans, only 7 skins were preserved and almost nothing was recorded about the bird's behavior. Today the Spectacled Cormorant has largely faded from memory and there are only a handful of scientific reports discussing the species. In this presentation, the location and status of the extant specimens are reviewed and confirmed. In consultation with museums worldwide, new photographs of the specimens are made publicly available for posterity. Additionally, an effort is made to locate and review all existent media and literature regarding the species to create a more comprehensive assessment of the bird's life history.

## **LIPID NORMALIZATION OF STABLE ISOTOPE VALUES IN BLOOD PLASMA ACROSS MULTIPLE SEABIRD SPECIES**

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The stable carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) isotope values in seabirds are determined by isotopic abundances in their food, with specific tissues reflecting their dietary sources at the time of synthesis. This feature allows researchers to use stable isotope analysis to gain insights on seabird diets, foraging ecology, movements, and migration patterns. However, within seabird tissues, lipids are relatively more depleted in  $^{13}\text{C}$  than protein because lipid biosynthesis preferentially incorporates  $^{12}\text{C}$ . Therefore, differences in tissue lipid content among individuals have the potential to bias  $\delta^{13}\text{C}$  values and confound ecological interpretations of resource use. Lipids can be removed from lipid-rich tissues using chemical extraction; however, this approach can also affect  $\delta^{15}\text{N}$  values. We examined the effect of lipid content on the stable isotope values of blood plasma across three penguin species in the genus *Pygoscelis*, the imperial cormorant (*Leucocarbo atriceps*), and Kelp Gull (*Larus dominicanus*) by comparing  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values before and after chemical lipid extraction using a 2:1 chloroform:methanol solution. Lipid-extracted  $\delta^{13}\text{C}$  values were significantly lower than non-extracted  $\delta^{13}\text{C}$  values, and lipid-extracted  $\delta^{15}\text{N}$  values were significantly higher than non-extracted  $\delta^{15}\text{N}$  values in all five species. A linear equation using the C:N ratio and  $\delta^{13}\text{C}$  values from the non-extracted blood plasma samples across all five species calculated 98% of individual blood plasma samples lipid-extracted  $\delta^{13}\text{C}$  values within  $\pm 0.3\text{‰}$ . Therefore, we suggest that algebraic normalization represents a suitable solution to account for lipid-induced biases when using seabird blood plasma in stable isotope studies.

## **IDENTIFYING FORAGING HOTSPOTS AND ENERGY BUDGETS OF COMMON MURRES AND BLACK-LEGGED KITTIWAKES IN COOK INLET, ALASKA**

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During a recent extended marine heatwave, large-scale changes in marine food webs led to widespread seabird die-offs and breeding failures in the Gulf of Alaska. Impacts from the heatwave on seabirds were particularly severe in Cook Inlet, where populations coexist with ongoing oil and gas production, planned lease areas, and large-vessel traffic. Given these factors, it has been a long-term priority of the Bureau of Ocean Energy Management to monitor the status and trends of seabirds, develop some understanding of why populations fluctuate, and identify important foraging areas for marine birds in this region. Since the early 1990s, USGS biologists have periodically monitored attendance and breeding success of Common Murres (*Uria aalge*) and Black-legged Kittiwakes (*Rissa tridactyla*) at two colonies in lower Cook Inlet. Marine waters around each colony were simultaneously surveyed to document the spatial distribution of seabirds and to measure the abundance and distribution of forage fish underwater. To complement these ongoing efforts, we are deploying Ecotone GPS tags on murres and kittiwakes to track their movements to and from foraging hotspots around colonies. These tags will also collect dive locations (wet/dry sensor) and dive depth for murres. This will allow us to connect foraging location and daily energy budgets acquired from these tags with the three-dimensional prey landscape developed from concurrent hydroacoustic-trawl surveys. Tagging data will be used to better understand foraging habitat use in lower

Cook Inlet, identify prey targeted at these sites, evaluate the persistence of foraging hotspots over time, and assess the susceptibility of murres and kittiwakes to the impacts described above.

## **TUFTED PUFFIN OREGON COAST WIDE COLONY SURVEY 2021**

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The Tufted Puffin (*Fratercula cirrhata*) is a medium-large pelagic seabird and member of the Auk family. The distribution of the Tufted Puffin is widespread in the North Pacific Ocean and populations have generally declined throughout the southern portion of their range from British Columbia to northern California. The U.S. Fish and Wildlife Service (USFWS) conducted a burrow-nesting seabird survey of the Oregon coast in 2008 and documented an order of magnitude decline in the puffin population since the previous survey in 1988. During summer 2021, USFWS conducted an Oregon coast wide survey of the Tufted Puffin during the chick rearing period from July 14 – August 25 to assess and document the current breeding population. A total of 62 historical colonies were surveyed, 16 active colonies were documented, and no new colonies were detected. The current Tufted Puffin estimated breeding population of Oregon is 519 individuals. The breeding population remains low but stable compared to previous coastwide surveys.

## **USING GAME CAMERAS TO MONITOR DISTURBANCE EVENTS AT PROTECTED SEABIRD COLONIES**

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Second Chance is a dynamic sandbar in the Rookery Bay NERR of southwest Florida that is a nesting site for protected Least Tern (*Sternula antillarum*), Black Skimmer (*Rynchops niger*), and Wilson's Plover (*Charadrius wilsonia*) shorebird species and is therefore certified as a Critical Wildlife Area (CWA) by the Florida Fish and Wildlife Conservation Commission (FWC). While regular monitoring occurs, we do not know what happens on the island when we are absent. The main objective of this study was to determine if game cameras could provide data for wildlife managers on disturbances to the Second Chance nesting sites. We used Spartan GoCam cellular game cameras to wirelessly monitor nesting colonies. To our knowledge, this is the first use of Spartan game cameras on an entire colony. This summer, we found that disturbances occurred most often in mornings and on weekends, and that fishermen had the greatest impact on the colonies.

## **EVALUATING SURVEY METHODS FOR ESTIMATING ABUNDANCE OF *FRATERCULA* PUFFINS IN THE KODIAK ARCHIPELAGO**

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There is currently no range-wide standardized methodology for monitoring populations of tufted and horned puffins (*Fratercula cirrhata*, *F. corniculata*); a patchwork of approaches is used across regions. The recent tufted puffin species status assessment and listing determination by the U.S. Fish and Wildlife Service suggested possible declines at some breeding colonies and an uncertain trend across the Gulf of Alaska (GOA) Large Marine Ecosystem. Comparatively little information is available on the status of the horned puffin, but long-term datasets from discrete subregions of the GOA hint that the horned puffin should also be considered a species of conservation concern. Because the GOA supports large proportions of the world populations of tufted and horned puffins (approximately 35% and 80%, respectively), accurate population estimates are needed within this region to support range-wide trend evaluation and predictions of species persistence and resiliency. We estimated abundance for *Fratercula* puffins breeding in Kodiak Archipelago from long-term data collected using two survey methods: boat-based surveys of adults attending colonies and at-sea nearshore and offshore line transect surveys. We present preliminary results comparing estimates of puffin abundance and evaluating trends derived from different survey methodologies. By comparing abundance assessments obtained via at-sea transect surveys and designated colony surveys, we enhance the potential to work collaboratively across regions, despite varying survey methods, to produce comprehensive, accurate range-wide population estimates.

## **CAN PUFFIN DIET BE USED TO PREDICT POLLOCK BIOMASS?**

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Understanding variation in juvenile groundfish recruitment is needed for predicting fisheries stocks, but is often poorly known. In the Western Gulf of Alaska (WGoA) and Eastern Bering Sea (EBS), puffins (mostly *Fratercula cirrhata*), regularly prey upon and thereby “sample” age-0 groundfish, including walleye pollock (*Gadus chalcogramma*), the target of a \$1B annual fishery. We test the hypothesis that puffin diet (% age-0 pollock) varies data with pollock stock assessment data and provides early-warning signals of

variation in age-0 abundance and “potential recruitment”. We conducted cross-correlation and regression analyses of puffin-based age-0 pollock indices and spawning stock biomass for the GoA and EBS walleye pollock stocks. For the WGoA, SSB leads the abundance of age-0 fish in the puffin diet, indicating that puffins sample the downstream production of the GoA spawning stock. By contrast, the use of age-0 fish by puffins leads SSB for the EBS stock by 1–3 years, indicating that the puffin diet proxies incoming year class strength and potential recruitment for this stock. Puffins thereby indicate connectivity between the WgoA and EBS pollock stocks. Integration of non-traditional data sources, such as seabird dietary data with stock assessment data, appears useful to fill information gaps important to fisheries in the North Pacific.

## **WHEN, HOW AND WHY SEABIRDS ARE AFFECTED BY LIGHT POLLUTION?**

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An extraordinary array of physiological and behavioural changes due to light pollution has been documented in a variety of organisms, and the scope is constantly being updated. Young fledglings of shearwaters and petrels are known for their attraction towards light. Annually, rescue campaigns organise searches for grounded seabirds in order to release them back to sea - typically by the hundreds. It is still unknown, however, why seabirds are coming to lit-up areas. Furthermore, while most of the studies are focused on understanding the effect of light on young shearwaters, there is very little literature concerning adults. During my research I explored orientation of both, adult and fledgling Manx shearwaters (*Puffinus puffinus*), specifically focusing on the impact of light on their navigational abilities. My research shows differences in behaviour of young and adult seabirds toward light pollution and investigates factors that affect the maiden flight of seabirds. I discuss the implications of my findings for general seabird navigation, and what information we still need in order to understand the effects of light on their behaviour and to improve their conservation.

## **SEABIRD-BASED INDICATORS IN CENTRAL CALIFORNIA CURRENT FORAGE FISH MANAGEMENT**

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Forage fishes are critically important in marine ecosystems, yet few examples of applied ecosystem-based management exist. We will elaborate on two examples of seabird-based indicators in forage fish management in the California Current system. The first uses data on mass mortality events of Pacific herring (*Clupea pallasii*) predators to provide information about the health of this predator community, contributing to a stoplight indicator that can be used to adjust herring fishing quotas (Thayer et al. 2020 Marine Policy). This indicator has been integrated into the State of California herring fisheries management plan. The second example uses long time series of predator-based sampling, common in seabird monitoring programs, to fill gaps in Northern anchovy (*Engraulis mordax*) length frequencies where traditional sampling does not exist (Thayer et al. 2021 Fisheries Research). Additionally, where traditional sampling does exist, predator-based sampling which targets patchily-distributed forage species can provide a different perspective than standardized ship-based sampling, revealing biases of each and the advantages of synthesis for a more holistic depiction of forage species characteristics and dynamics. This has not yet been implemented in management, although anchovy management is currently under review at the federal level.

## **CULTURALLY IMPORTANT SEABIRDS DISTRIBUTE BEYOND THE SHIPPING AVOIDANCE AREA AROUND ST. LAWRENCE IS., NORTHERN BERING SEA**

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One direct consequence of Arctic warming is the expansion of ice-free navigable portions of the Arctic Ocean. In this context, vessel traffic is starting to intensify in the Arctic, posing increased levels of threats to the marine environment and to the people who rely on its biological resources for food and cultural continuity. In the Bering Strait region, the convergence of expanding maritime commerce, active indigenous cultures, and biological richness requires particular care in spatial planning to promote maritime safety, cultural protection, and environmental conservation. In this study, we use GPS tracking data collected across three years on four seabird species breeding at St Lawrence Island in the northern Bering Sea (common murre *Uria aalge*, thick-billed murre *U. lomvia*, crested auklet *Aethia cristatella*, black-legged kittiwake *Rissa tridactyla*), to examine the spatial relevance of an Area To Be Avoided (ATBA) designated around St Lawrence Island, with respect to these species' habitat use. Among these four species, murre are a key resource to the islanders for subsistence harvesting of the eggs and adults. GPS



data from a total of 47 at-sea foraging trips show that foraging ranges of both murrelets and crested auklet extended beyond the current boundaries of the St Lawrence Island ATBA. Habitat modelling further shows that the birds' suitable habitats were associated with seasonal surface chlorophyll blooms, and largely extended beyond the ATBA. Thus, we suggest that ATBA boundaries should be revised and based on habitat spatial use data, to adequately preserve marine living resources from growing threats related to shipping traffic.

### **EGG ORDER AND OCEANOGRAPHIC FACTORS DRIVE EGG SIZE DIFFERENCES IN SCRIPPS'S MURRELETS (SYNTHLIBORAMPHUS SCRIPPSI)**

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Egg size is an important life history parameter affecting chick growth and survival. While oceanic conditions affect multiple life history parameters in seabirds, the relationship between marine conditions and egg size has been rarely studied. We investigated the effects of marine conditions and egg order on the size of Scripps's Murrelet (*Synthliboramphus scrippsi*) eggs at Santa Barbara Island, California, USA, from 2009-2017. We evaluated indices characterizing marine productivity at the large scale (Pacific Decadal Oscillation [PDO], Oceanic Niño Index [ONI], and North Pacific Gyre Oscillation [NPGO]), the regional scale (larval anchovy catch-per-unit-effort [ANCHL] and Biologically Effective Upwelling Transport Index [BEUTI]), and the local scale (sea surface temperature [SST]). We also included egg order in candidate models. We fit linear mixed models with random effects of monitoring plot and used Akaike's Information Criterion for model selection. We detected relationships between egg size and PDO, ONI, NPGO, BEUTI, and SST. However, all of these indices had effects opposite to that predicted, with lower ocean productivity associated with larger eggs. Only the positive relationship we detected between ANCHL and egg size supported our prediction that larger eggs result from greater ocean productivity. The strongest relationship we detected was between egg order and egg size, with second eggs being larger than the first eggs. Our results indicate a complex relationship between marine productivity and egg size. Fluctuating oceanographic conditions have the potential to change multiple seabird life history parameters, and egg size may be another parameter through which oceanic conditions influence seabird populations.

## **DOCUMENTATION AND RELATIVE COLLISION RISK FOR HAWAIIAN SEABIRDS AND WATERBIRDS AT POWERLINES AND COMMUNICATION TOWERS**

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On Kaua'i, powerline collisions have been documented to be a major conservation issue for two endangered seabird species - - the 'A'o (Newell's Shearwater) and 'U'au (Hawaiian Petrel). However, to date little has been known about the collision risk for other seabird species and native Hawaiian birds in general. In addition to collisions involving endangered seabirds, we document powerline collisions for 'A (Red-footed Boobies), koa'e kea (White-tailed Tropicbirds), and 'Ua'u kani (Wedge-tailed Shearwaters) along with other native Hawaiian birds, including the NĒnĒ (Hawaiian Goose), Koloa maoli (Hawaiian Duck), 'Alae 'ula (Hawaiian Moorhen), and 'Alae kea (Hawaiian Coot). We report species-specific collision risk factors that vary with the location of the powerlines relative to topography and habitat as well as species-specific morphology and behavior. We also document collisions and mortality from communication towers. Lastly, we consider the relative collision risk by species at the landscape and island scale. While the vast majority of collisions and collision risk involve the two endangered seabirds, proximity to coast increases risk for Wedge-tailed Shearwaters while proximity to wetland habitat increases risk to waterbirds. This information is critical to helping prioritize areas for powerline minimization actions such as changes in line configurations or diverter attachments to reduce collisions.

## **ESTIMATING THE DETECTABILITY OF BREEDING BEHAVIORS AT KNOWN MARBLED MURRELET (*BRACHYRAMPHUS MARMORATUS*) NEST SITES**

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The Pacific Seabird Group's (PSG) protocol is used to survey for Marbled Murrelets in forest stands and document sub-canopy flights or circling (hereafter, occupied behaviors) thought to be indicative of breeding. However, discerning whether occupied behaviors indicate true local breeding requires

understanding how observations of such behaviors vary with proximity to active nests. We designed a study in the Oregon Coast Range to compare the probability of observing occupied behaviors at variable distances from known nests with the probability of observing these behaviors at random sites. From 2018-2021 we identified 11 murrelet nests and combined them with control sites randomly placed in stands previously identified as either occupied (n = 20) or unoccupied (n = 12) by the PSG protocol. Observers naïve to site status (nest or control) conducted surveys at multiple distances (0-200 m) from each site and we used generalized linear mixed models to quantify detection rates. The false positive rate was zero, as occupied behaviors were never detected during 151 surveys of unoccupied sites. In contrast, false negative rates were high; the probability of failing to observe occupied behaviors on a single survey was 0.55 (95% CI = 0.30, 0.78) within 5 m of an active nest, and increased to 0.91 (0.75, 0.98) at locations 200 m from the nest. Nonetheless, detection rates were consistently greater near nesting sites than at random control sites in occupied stands. Our findings suggest that while occupied behaviors can indicate nesting activity, they are difficult to detect even close to a nest. Thus, identifying nesting stands will likely require many more surveys per stand than currently required by the PSG protocol.

## **TRANSLOCATION OF BLACK-FOOTED ALBATROSSES FROM MIDWAY ATOLL, USA TO CREATE A BREEDING COLONY ON GUADALUPE ISLAND, MEXICO**

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The Black-footed Albatross (*Phoebastria nigripes*) has a total breeding population of about 57,500 pairs, 95% of which nest on low atolls in the Northwestern Hawaiian Islands. Inundation of breeding colonies from sea level rise and storm surge associated with climate change is its most serious long-term threat. Protection of suitable nesting habitat and creation of new colonies on higher islands are among the highest priority conservation actions. In collaboration with many partner agencies in the USA and Mexico, under the Canada/USA/Mexico Trilateral Island Initiative, in 2021 we translocated Black-footed Albatross eggs and chicks from Midway Atoll to Guadalupe Island, Mexico to create a new breeding colony. Guadalupe is a large, high island that is protected as a Biosphere Reserve and already supports a thriving colony of Laysan Albatrosses. We moved 21 eggs in January and placed them in Laysan Albatross foster nests. We moved 12 chicks in February that we raised by hand. Eighteen of the 21 eggs hatched, and all 18 of those chicks fledged. Nine of the 12 translocated chicks fledged, for a total of 27 chicks fledged from Guadalupe. In 2022, we plan to translocate 36 more eggs to Guadalupe, but not chicks. Black-footed

Albatrosses already forage in the cold waters of the California Current around Guadalupe, which are less likely to be affected by climate change than most other regions of the Pacific. Creation of a breeding colony in the eastern Pacific would increase the breeding range of the species and enhance its resiliency to climate change.

## **SEABIRD RELATED CULTURE AND KNOWLEDGE OF THE COMCAAC, PEOPLE OF THE SEA.**

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The Comcaac ethnic group (aka Seri) has lived along the coast of the Sonoran desert (Gulf of California) for over 2000 years. Theirs is the only hunter/gatherer/fishers culture in present Mexico. Their traditional knowledge of the marine environment and its ecology is vast and accurate. This knowledge has been eroded in the last decades due to aculturation. Information was gathered through field work based on interviews with elders and bird experts, recording of songs and stories, and literature searches. Of the 28 seabird species reported for their territory, the Comcaac recognize 20 species belonging to 3 orders, 11 families, and 16 genera. Of the 20 recognized seabird species, the names assigned to 12 of them fall at the species level and 8 at the generic level. Most seabird species are mentioned in the oral tradition (uses, songs, stories). We report on dozens of beliefs, fables, songs, toponyms, terms that indicate ecological relations, and uses. There are 25 terms for bird anatomical parts. The importance of birds in the culture of the Comcaac is not merely based in a utilitarian interest. While in the past the Comcaac used several bird species as food and for their parts (feathers, skin, etc.) at present such practices have all but disappeared. While seabirds are barely used at present, they continue to be an important part of the culture and tradition of the Comcaac people. Cultural information reveals a wide knowledge about habitat, behavior, food and migration of birds. The traditional information of seabird ecology is deep and respectful, and provides important information for conservation and a better knowledge of the regional avifauna. It is part of the cultural heritage of the Comcaac, and all humanity.

## **SEABIRDS ARE INDICATORS AND PREDICTORS OF THE ENVIRONMENT**

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Many seabirds feed on forage fish which, in turn, feed on phyto- and/or zooplankton. Phytoplankton productivity depends on oceanographic conditions such as temperature, nutrient availability, solar radiation, and other parameters. Based on correlation analyses, it has generally been concluded that seabirds are indicators of ocean conditions, but there is a general lack of proof of this relationship, resulting in a need to review the whole pathway between nutrient availability, primary productivity, forage fish and, finally, seabirds and their responses to the conditions of this whole pathway. In an attempt to cover this pathway with the available information we present two examples of two seabird species that respond in distinct ways to similar oceanographic conditions. Using the examples of Heermann's Gull and Elegant Tern, nesting in Isla Rasa, Gulf of California, we show two distinct responses to oceanographic positive temperature anomalies that have increased in frequency and characteristics in the last two decades, and we describe their likely pathways. Elegant Terns are more likely to abandon their nesting site in search of better food conditions for breeding. Heermann's Gulls, exhibit higher nesting site tenacity, and are more likely to stay at their traditional nesting site and seem to vary their breeding effort according to food availability. However, individual differences in life history strategies in this species allows for adaptive variability and the possibility of a certain proportion of individuals leaving offsprings even under low food availability conditions. Therefore, individual life history strategies and their proportion in the population, may also provide indication of environmental conditions.

#### **GULF OF CALIFORNIA FORAGE-FISH FISHERY: SEABIRD DIET DATA AND FISHERY INDEPENDENT ESTIMATES AS POSSIBLE MANAGEMENT TOOLS**

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With few exceptions, fisheries management has been carried out with limited use of information derived from seabird studies. The use of such approaches would allow for a more accurate ecosystem-based fisheries management. The use of long term seabird datasets of various types (breeding success, diet composition, etc.) provide the opportunity for a more wholistic view of fish populations, their distribution and fish community composition. These data would allow for a long-term focus of fisheries management. Seabird diet studies may provide information about their prey such as morphometric information (prey length and mass), prey body condition, etc. Based on studies of diet composition of the Heermann's Gull and Elegant Terns we have been able to provide a prediction of the total catch and catch per unit effort of the industrial small pelagic fishery of the Gulf of California, based in the state of Sonora. Historical collapses of the fishery have been identified as related to forcing due to overdimension of the fleet. Several independent estimates of sustainable catch have provided similar results to those obtained based on seabird diet studies. Seabird data should ideally be incorporated in ecosystem-based fisheries management.

## **WHAT'S ON THE MENU? USING VIDEO LOGGERS TO ESTABLISH A PREY IMAGE LIBRARY FOR ADÉLIE PENGUINS AT CAPE CROZIER, ANTARCTICA**

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Adélie penguins (*Pygoscelis adeliae*) are considered an indicator species for Southern Ocean ecosystem health. Breeding colonies such as the large Cape Crozier colony on Ross Island, Antarctica are dependent on reliable summer prey resources. Annual variation in oceanographic conditions in the Antarctic can result in shifts in the abundance and distribution of prey species from year to year. To understand the diversity of prey types that make up the current diet of Adélie penguins at Cape Crozier, we deployed animal-borne video loggers on 27 penguins with chicks, producing ~50 hours of foraging videos. We manually reviewed videos to identify individual prey capture events and prey types when possible. Prey type determination from video snapshots is challenging and requires individual observers to develop strong identification skills. To expedite the training process, standardize identification of prey, and document the observed diet of Cape Crozier Adélie penguins, we established a prey type image library. Preliminary results show that the diet of Adélie penguins consists primarily of krill, fish, and squid. We also identified amphipods, pteropods, and jellies as occasional prey, indicating a greater prey item diversity than previously understood. This prey image library will serve as a reference tool for the analysis of additional Adélie penguin foraging videos to be collected at Cape Crozier during the 2021/2022 Antarctic summer. As a living document we will continue to collect, organize and catalog images of prey capture events and the breadth of prey types utilized by Adélie penguins in the Ross Sea. This library can serve as a potential reference tool for other researchers working with prey imagery in this region.

## **SHARING SPACES: PERUVIAN BOOBIES (*SULA VARIEGATA*) SHOW CONSISTENT INTRASPECIFIC NICHE OVERLAP ACROSS VARYING OCEAN CONDITIONS**

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Breeding Peruvian boobies (*Sula variegata*) are central-place foragers, which places constraints on their foraging and has the potential to lead to intraspecific competition when resources are scarce. In addition, inter-annual shifts in oceanic productivity due to El Niño/La Niña may affect prey availability and foraging costs, and subsequently may influence competition and niche partitioning. We examined spatial and trophic foraging niche partitioning between sexes in Peruvian boobies at Isla Guañape Norte, Peru using GPS tracking and blood stable isotope analysis in two years (2016 and 2019) that differed in ENSO conditions. Foraging areas and isotopic niches were broadly similar between sexes within each year, but differed between years. Both sexes foraged closer to shore in 2019 (weak La Niña) compared to 2016 (neutral ENSO conditions). In addition, both sexes had lower  $\delta^{15}\text{N}$  values in 2019 relative to 2016. These results suggest little to no intraspecific foraging niche partitioning in Peruvian boobies, which could indicate that resources were not limiting in these years. However, there may be partitioning along dimensions that were not examined here, such as dive depth or temporal variation. The differences in spatial and isotopic foraging niches between years may be related to ENSO conditions. Shifts in foraging areas could be related to changes in upwelling and/or local prey availability, and higher  $\delta^{15}\text{N}$  could indicate feeding at higher trophic levels and/or a baseline shift in the food web. Understanding how Peruvian boobies respond to changing oceanographic conditions will aid in their future management and conservation.

## **BILL-LOADS OF RHINOCEROS AUKLETS INDICATE LONG-TERM CHANGE OF THE SUMMER FORAGE FISH COMMUNITY IN THE NORTHERN JAPAN SEA**

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Samples of bill-loads of puffins are believed to indicate spatial and temporal variations of the local forage fish stock. We sampled 3,067 bill-loads of Rhinoceros Auklet *Cerorhinca monocerata* (RHAU) breeding at Teuri Island in northern Japan Sea between 1984 and 2020. They brought sardine/sand lance/Pacific saury in 1984-1987, anchovy/0-year greenling in 1992-1997, anchovy in 1998-2013, 0-year greenling/squid/0-year sand lance in 2014-2018, and 0-year and >1-year sand lance in 2019-2020. The between-year variation of the mass proportion of each prey species was explained by its stock size for sardine and anchovy but not for 0-year greenling. The increase of stock size of sardine and anchovy in cool phase (before 1988) and warm phase (1989-2013), respectively, induces the expansion of distribution of

these species from their main spawning regions and so these fish species were highly available to RHAU breeding at Teuri Island. In 2014 – 2017, the stock size of anchovy was decreased but that of sardine was still small and both of these were not available at all, so 0-year greenling might be only available major forage fish. Bill-loads of RHAU possibly reflect the long-term change of the local forage fish community (i.e. proportional abundance) that may be associated with decadal climate change.

## **MACHINE LEARNING AS A TOOL FOR MONITORING SEABIRD NESTING COLONIES**

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Double-crested Cormorants (*Nannopterum auritus*) and Pelagic Cormorants (*Urile pelagicus*) nest in the Strait of Georgia on offshore islands as well as bridges in Metro Vancouver. We monitored cormorant colonies at three locations over the 2021 nesting season: the Gabriola Island sea cliffs, Mitlenatch Island and the Second Narrows Bridge. All three sites were photographed in series throughout the season, and counts of nests, adult cormorants, juveniles, and eggs (where possible) were taken from the photos. To make counting and image processing more efficient, we are developing and training two machine learning models to detect cormorants and nests in photos of the Gabriola sea cliffs and the Second Narrows Bridge respectively. Researchers used a semi-automated annotation pipeline to annotate photos and program the algorithm to train itself using these annotations. With training, the mean average precision of the Second Narrows Bridge model improved over the course of three months from 45% to 71%, with room for further improvement. This technology was applied to the dozens of panoramic photos and thousands of close-up photos we collected of cormorants to reduce the image processing burden. With this level of precision, machine learning models could be more broadly applied to monitoring seabird colonies, particularly with panoramic or long-distance photos that can be collected with noninvasive and inexpensive methods.

## **AN ASSESSMENT OF FACTORS THAT INFLUENCE NEST SUCCESS OF THE MARBLED MURRELET (*BRACHYRAMPHUS MARMORATUS*)**

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Understanding the factors that influence nest survival in the Marbled Murrelet (*Brachyramphus marmoratus*), an endangered seabird that nests in older inland forests, is essential to its recovery. Challenges associated with finding nests of this cryptic species, however, have made identifying such population drivers difficult. To learn more about murrelet nesting propensity, nest site selection and nest survival, we tracked 239 murrelets using VHF-telemetry tags during the 2017-2019 and 2021 breeding seasons. In total, thirty-three individuals (13.8%) attempted to nest across years and nesting propensity aligned with annual ocean conditions; 0% of birds attempted to nest in 2017 – the year with the poorest ocean conditions as calculated by a suite of localized oceanographic data sets - whereas 39% of tagged birds attempted to nest in 2021 when ocean conditions were relatively improved. Chicks successfully fledged from 10 nests (33%), although ocean conditions were not a strong predictor of nest success. Using generalized linear models, we found no strong effects of local- (e.g., nest cover, tree size) or landscape-scale (e.g., distance to forest edge, habitat within 2 km) on the probability of daily nest survival. We did, however, find strong evidence that nest initiation date has an effect on daily nest survival; the odds of daily nest survival were reduced by approximately 50% (95% CI = 40.5% and 73.2%) for every 19-day delay in initiation date. Whether this reduction in daily survival within the breeding season can be explained by changes in nest predators, prey resources or shifts in ocean conditions is unclear and should be the focus of future research.

## **PRIORITIZATION OF RESTORATION NEEDS FOR SEABIRDS IN THE US TROPICAL PACIFIC**

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The U.S. Tropical Pacific (USTP) is a globally important area for seabirds with tens of millions of individuals of at least 32 seabird species breeding in five geographic regions: the Main Hawaiian Islands, the Northwestern Hawaiian Islands, the Mariana Islands, American Samoa, and the Pacific Remote Islands Marine National Monument. The low-lying islands and atolls within this region are among the most vulnerable in the world to sea level rise. This project assessed the risk of impacts from climate change and invasive species and prioritized active restoration actions for seabirds nesting in the USTP. Social attraction and translocation are active restoration techniques that can be applied to recover and relocate seabird populations to suitable breeding areas and are increasingly being used to mitigate the impacts of sea level rise and invasive predators. To prioritize species at highest risk in the USTP that would benefit most from active restoration, we scored each species for each of 11 criteria that reflected their extinction risk and vulnerability to climate change, and then summed the scores of all criteria to obtain an overall score. We then used the overall score to rank species in terms of overall conservation need. The top five species at

risk (in order) were Polynesian Storm Petrel, Phoenix Petrel, Newell's Shearwater, Hawaiian Petrel, and Black-footed Albatross. While restoration activities are underway in the USTP for three of the five species, the top two (Polynesian Storm-petrel and Phoenix Petrel) occur primarily outside the USTP, but actions within the USTP are needed to complement existing conservation measures underway elsewhere in the Pacific and should be prioritized for future management actions.

## **HOW SEABIRD DATA INFORMS FISHERIES QUOTAS IN ALASKA**

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Scientists have been providing contextual ecosystem information to federal fisheries managers in Alaska to support the quota-setting process for over 25 years. This information is supplemental to the stock assessment process and largely consists of ecosystem indicators that track physical and biological changes in the ecosystem. Seabird information is used in several ways by the North Pacific Fisheries Management Council when they set groundfish harvest quotas each year. Some long-term monitoring datasets (diet, breeding success) are regularly included in ecosystem status reports as indicators of different parts of the ecosystem. Additional indicators are curated each year to allow early communication to managers of warning signs covering a variety of trophic levels. In this presentation I will focus on the risk tables that have been included with stock assessments since 2018. These risk tables identify and rank assessment model, population dynamics, and ecosystem concerns, including information from seabirds. These concerns can then be used to adjust harvest recommendations if warranted. I share lessons learned in the process of informing fisheries management with seabird information and how these lessons might be applied in other systems.

## **SIZE AND BREEDING PHENOLOGY OF THE WORLD'S LARGEST COLONY OF SOUTH AMERICAN TERNS**

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South American terns (*Sterna hirundinacea*) breed in the Pacific and the Atlantic coasts from southern Ecuador to northern Brazil, respectively, and the Malvinas-Falkland Islands. Several colonies have been identified in the Atlantic (Brazil-Argentina, Malvinas-Falklands), but in the Pacific (Chile, Peru and Ecuador), very few have been reported. In Peru, only one breeding colony on Isla Santa Rosa has been described since the beginning of 1900s. This colony is no longer active, but another one on Isla La Vieja, located < 20 km from Isla Santa Rosa, has remained active at least since 1990s. We counted the number of active nests of South American terns in 2012 and 2021 in the colony of Isla La Vieja, Peru. We used transect surveys (25-m grid) in the 15-16 Ha colony and spatial analyst in GIS to determine nest density,

hot spot maps and number of nests. Every 25-m, we counted the number of active nests and their contents within a circle of 4-m radius. The breeding population decreased from 22,800 nests in 2012 to 14,300 nests in 2021. These numbers also reveals that this is the world's largest colony of the species. The onset of egg-laying was the first week of May in both years. Observed fishermen disturbance and house mice presence in the colony may prevent tern settlement and decrease breeding success.