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DEVELOPMENT OF A BAYESIAN ANALYTICAL FRAMEWORK TO ASSESS FACTORS THAT INFLUENCE THE ABUNDANCE OF MURRELETS IN GLACIER BAY NATIONAL PARK, ALASKA

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From 2009 to 2021, Kittlitz’s and marbled murrelets have been monitored in Glacier Bay National Park using a designed-based approach that incorporates distance sampling from vessel-based line-transect surveys to estimate on-water abundance and spatial distribution during July. Key elements of the monitoring program include a serially alternating panel design, spatially balanced sampling stratified by expected Kittlitz’s murrelet density, and analytic and field methods that account for incomplete detection. Here, we develop a contemporary modeling framework with the goal of accounting for multiple sources of uncertainty associated with estimating murrelet relative abundance and distribution. Specifically, we built a Bayesian N-mixture model to estimate the distribution and relative density of Kittlitz’s and marbled murrelets and account for uncertainty when incorporating observations with uncertain species identification and covariate effects. Preliminary estimates for Kittlitz’s murrelets suggest - high inter-annual variation and declines in recent years, while marbled murrelets are stable. Our study provides insight into spatio-temporal patterns in murrelet abundance in Glacier Bay and is flexible enough to incorporate extensions to address species misidentification, demography, and movement with ultimate goal of providing a more integrated ecological understanding of the factors that influence murrelet abundance in Glacier Bay.
STATE OF THE ARCTIC TERRESTRIAL BIODIVERSITY REPORT – BIRD FINDINGS AND COLLABORATIVE IMPLEMENTATION OF RECOMMENDATIONS

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The 2021 State of the Arctic Terrestrial Biodiversity Report (START) is a product of the Circumpolar Biodiversity Monitoring Program (CBMP) of the Arctic Council’s Conservation of Arctic Flora and Fauna (CAFF) Working Group. The overall goal of the START is to assess the status and trends of terrestrial Focal Ecosystem Components—including vegetation, arthropods, birds and mammals—across the Arctic, and identify drivers of change and gaps in monitoring coverage. This report represents an important step in ongoing efforts to advance circumpolar terrestrial biodiversity monitoring and to understand the impact of changes on Arctic terrestrial ecosystems. This presentation will provide an overview of the START report and details of the findings in the Birds chapter, and will present how we can work together to implement the monitoring recommendations for effective pan-Arctic collaboration.
IMPLEMENTING THE USFWS 2021 BIRDS OF CONSERVATION CONCERN LIST IN ALASKA

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The USFWS recently released the 2021 Birds of Conservation Concern (BCC 2021), which provides a long overdue update to the previous list developed in 2008. This national list identifies species, beyond those already designated as federally threatened or endangered, that represent our highest conservation priorities. The list is based on an assessment of several factors, including population abundance and trends, threats on breeding and nonbreeding grounds, and size of breeding and nonbreeding ranges. We developed an Alaska-specific version of the list for collaboration and conservation across the state and beyond, based on the comprehensive suite of species included in the national list. The presentation will showcase the list and highlight species of conservation concern for multiple organizations within the state.
POPULATION GENETIC STRUCTURE OF RED-FACED CORMORANTS IN THE ALEUTIAN AND PRIBILOF ISLANDS

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Rapid and severe regional declines of Red-faced Cormorants (Phalacrocorax urile), particularly in the Western Aleutian Islands and the Pribilof Islands, have prompted its designation as a Priority Species by USFWS Region 7. Although Red-faced Cormorants have a widespread distribution and are sometimes locally abundant, little is known about the population dynamics of this species, and whether they have an ecological or genetic metapopulation structure. They are assumed to have a low dispersal rate, which can significantly structure geographically separated populations. Peripheral populations are more likely to be genetically distinct from populations nearer to the center of a species distribution due to the limited dispersal options for birds on the periphery. We used 1893 double-digest restriction-associated DNA sequences (ddRADseq) to investigate population genetic structure of Red-faced Cormorants in western Aleutian Islands and St. Paul Island (Pribilof Island chain) and found significant differentiation between these populations. The results of this study will help determine if separate populations of these species are distinct to the point that they need to be managed as discrete conservation units, in order to best preserve genetic diversity at the species level. This information can impact the conservation and management implications of the Red-faced Cormorant in the U.S. Fish and Wildlife Alaska Maritime Refuge.
American Kestrel populations have declined across much of North America in the past 50 years. Little is known about kestrels at the extreme northern extent of their range. Understanding the biology of peripheral populations can provide valuable insights to help conserve declining species. Therefore, we placed nest boxes between 66° and 68° North Latitude along the Dalton Highway Corridor and monitored their use by kestrels from 2002-2021. We found that kestrels occupied 17.4%-82.4% of the boxes that were available to them during our study, but there was no apparent trend in occupancy over time. The average dates for initial egg-laying (nest initiation) were variable, ranging from 8-25 May. Clutch size for kestrels ranged from 1-7 (mode = 5), which is comparable to populations at lower latitudes. We used stochastic gradient boosting to model factors that influence kestrel occupancy and nesting success. Top predictors of occupancy were: presence or absence of other species, latitude, longitude, elevation and minimum temperatures in May. Top predictors of nesting success were: latitude, maximum snow depth in May, orientation of the nest box, individual high precipitation events in April, total precipitation in May and the number of days below freezing during the nesting season.
KITTLITZ’S MURRELET SPACE USE IN COLUMBIA BAY, PRINCE WILLIAM SOUND, ALASKA

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The Kittlitz’s murrelet is a small seabird that nests in remote, alpine habitats, often associated with glaciers. They are found throughout Prince William Sound, but one area of particular interest is Columbia Bay where, due rapid glacial retreat, new shorelines are exposed providing ideal camping and hiking conditions for recreationalists. The potential for increased human disturbance in Kittlitz’s murrelet nesting habitat led to the need to better understand Kittlitz’s murrelet space use throughout the nesting season. During May of 2021, we marked 17 adult Kittlitz’s murrelets with satellite transmitters (Pinpoint Argos 75) in Columbia Bay. Our objectives were to: 1) identify nesting habitat characteristics, 2) determine feeding and roosting habitat, and 3) assess overlap of Kittlitz’s murrelet space use and human activity. Of 13 transmitters that collected substantial location data, 5 demonstrated nesting behavior. Apparent nest initiation dates ranged from 28 May to 19 June and nests were active for 10–24 days (\(\bar{x} = 21d\)). Nest sites were in steep terrain at elevations of 800–1400m; nesting birds showed strong fidelity to foraging locations that were 11–30km from the nest. The 4 transmitters operational during late July showed a migration along the west coast of Alaska to the Seward Peninsula and the north slope.
HOW CONTINUOUS VEGETATION MAPS CAN HELP US STUDY THE DISTRIBUTION & HABITAT OF BIRDS

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Avian habitat association studies typically use categorical vegetation or land cover maps to link habitat for birds to particular vegetation types. However, categorical maps subsume potentially important variation into discrete units, represent all transitions in community composition as abrupt breaks, and involve human interpretational bias not necessarily important to avian species. To address these issues, we developed continuous foliar cover maps to quantify the distribution and abundance of 15 dominant or widespread plant species or species aggregates in boreal and Arctic Alaska and adjacent Yukon. In this presentation, we explore the advantages of continuous vegetation maps from the perspectives of ecological theory and information loss. We compare the performance of the continuous foliar cover maps to two representative categorical vegetation maps to show that ecologically specific continuous representations of vegetation better quantify observed vegetation patterns than do traditional categorical maps. Finally, we present case studies to illustrate how continuous foliar cover maps can be used to answer questions related to distribution, abundance, habitat use, and food availability for wildlife species. We hope to encourage more scientists to consider using continuous foliar cover maps in order to gain a greater understanding of bird species and the habitat and food resources they need to thrive.
ABUNDANCE OF BLACK OYSTERCATCHERS AND PIGEON GUILLEMOTS FOLLOWING INTRODUCED FOX REMOVAL IN THE SHUMAGIN ISLANDS, ALASKA

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The introduction of mammalian predators to islands can devastate native bird populations. Foxes were introduced to hundreds of Alaskan islands in the late 1800’s and early 1900’s for fur farming. While foxes on many islands died out or were removed by trappers when the fur market crashed, they persisted on some islands and caused major declines in populations of some seabird species. Beginning in 1949, the U.S. Fish and Wildlife Service has been removing introduced foxes from Refuge islands to facilitate recovery of island ecosystems. We examined the responses of black oystercatchers and pigeon guillemots to removal of introduced arctic foxes from two islands in the Shumagin Islands in 1994-1995. We counted numbers of birds before and after fox eradication, and also compared surveys conducted on three nearby control islands without foxes. Populations of both oystercatchers and guillemots increased following predator removal, and most recent surveys in 2021 suggest that numbers are still increasing on the two islands 26 years later. This contrasts with stable or slightly decreasing trends in oystercatcher and guillemot numbers on nearby control islands, suggesting there may be some movement between islands following the removal of predation pressure.
IT'S FOR THE BIRDS: BRINGING BIOSECURITY TO YOUR ALASKA FIELDWORK

Lauren M. Flynn

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Pandemic life has made us all experts in biosecurity for public health, but can you name any biosecurity practices that help protect the species you study? Throughout the 2021 field season, the Alaska Maritime National Wildlife Refuge staff employed a core practice of “clean, inspect, seal” to protect the millions of seabirds that nest on Refuge islands from nonnative species. For example, we stopped bringing cardboard to field sites and started scrubbing boot soles before every island visit. Was the extra work worth it and should you follow suit? Join me to learn more about the Refuge’s new “cleaning culture” and how these protocols can be adapted to your work-to the benefit of Alaska’s birds.
ALASKA-BREEDING WHIMBRELS: ANNUAL MOVEMENTS, NOTABLE EXEMPLARS, AND IMPLICATIONS FOR CONSERVATION.

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Whimbrels (\textit{Numenius phaeopus}) are Holarctic breeders, including throughout much of Alaska (so-called \textit{N. p. rufiventris}). We used satellite telemetry to track the movements of Whimbrels breeding at two sites in northcentral Alaska, allowing us to better identify possible population threats throughout their annual cycle. These Whimbrels migrated entirely within the Pacific Americas Flyway, with individuals distributed among all countries on the eastern Pacific coast (110º of latitude from Alaska to southern Chile) over the course of annual movements. Our study revealed that these birds exhibited a diversity and flexibility in migratory timing, use of habitats (including human-altered), and distribution throughout their annual cycle. Such diverse patterns in movement and residency differ from those of other Whimbrel populations in both the New and Old worlds and create specific challenges (e.g., many jurisdictions as stewards, limited interannual site fidelity during migration) but also potential benefits (e.g., seeming absence of bottlenecks, habitat flexibility) in this population’s conservation.
SURVIVORSHIP OF A LONG-DISTANCE ARCTIC BREEDING SHOREBIRD: WORKING TO IMPROVE ADULT SURVIVAL ESTIMATES OF *ARCTICOLA* DUNLIN

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The subspecies *arcticola* dunlin (*Calidris alpina arcticola*) is a shorebird which breeds in Arctic-Alaska and migrates along the East Asian-Australasian Flyway (EAAF). Unlike other dunlin subspecies, and, sympatric Arctic-breeding shorebird species, *arcticola* dunlin have been experiencing population declines for inconclusive reasons. We used a Cormack-Jolly-Seber survival model to estimate annual adult survival rates of this subspecies using 16 years of capture, recapture, and resight data collected in Utqiagvik, Alaska. We examined effects of several breeding-site variables (predator counts, invertebrate abundance, climactic data) and individual variables (sex and morphological-measurements) on adult survival. Previous research indicated breeding-site conditions minimally impacted adult survival, and regardless of comparable detection rates, this subspecies survival rate remained lower than other subspecies. We found survival estimates differed between sexes, and that rates were higher than previously published estimates of apparent survival, with female average apparent survival at 0.61 (range 0.40–0.92) and male average apparent survival at 0.66 (range 0.47–0.94). Weak relationships were detected between breeding site variables and apparent annual adult survival. Our findings suggest adult survival may be more affected by conditions experienced during the non-breeding life stages than during the breeding phase. Our results are similar to survival studies on other migratory shorebirds that use the EAAF, which are known to exhibit low adult survival in addition to declining populations. Future work will include using a Barker modeling approach to estimate “true” adult survival of this subspecies by using both breeding-site capture and recapture/resight data with supplemental non-breeding site resight data.

*Student
PREDATION IMPACTS OF COMMON MERGANSER ON CHINOOK SALMON

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Piscivorous ducks such as the Common Merganser (\textit{Mergus merganser}) can be important predators of juvenile salmonids. Mergansers are regularly observed feeding near known Chinook salmon rearing areas in the Yukon River Basin. Merganser predation in these areas may be a contributing factor to ongoing Chinook salmon population declines. To assess potential predation impacts of mergansers on salmon populations, we 1) inferred presence of Chinook salmon in merganser diets using species-specific genetic assays on merganser scat samples (n=96) collected from the Chena and Salcha rivers 2) conducted piscivorous bird surveys along approximately 90 km of each river. The minimum post-breeding Common Merganser density was 0.78 birds / river km on the Chena River and 1.68 birds / river km on the Salcha river. We will present results of the genetic diet analysis and a synopsis of merganser behavioral observations. Finally, we will describe a forthcoming bioenergetics assessment of whether mergansers consume enough salmon parr to represent a meaningful source of mortality to Chinook salmon populations.
USING HIGH FREQUENCY GPS TRANSMITTERS TO INFER NESTING AND BREEDING BEHAVIOR OF DUNLIN

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Traditional techniques for monitoring shorebird nests require regular disturbance at nests and likely biases nest survival estimates, an important demographic metric used in assessing population status. Until recently, tracking devices were too large for shorebirds and could not collect accurate and frequent location fixes. In summer 2021 we placed high frequency GPS tags on Dunlin at Utqiaġvik, Alaska and tracked adults from pre- to post-breeding. Based on a limited number of nests with both GPS and human visit data, we determined criteria to assess nest fate solely from the GPS tracks without ever seeing the nest. This allowed us to determine the first true nest survival estimates without human disturbance. Equally important, we gained insights into other nesting behaviors that were not previously possible. Using the tracking data we could see pre-breeding movements, how many birds attempted nesting, the direction and distance of incubation break movements, seasonal adult survival, and habitat use throughout the entire breeding season. Reported decreases in nest survival of Arctic shorebirds may be linked to invasive research methods, so it is important to quantify the effect we may have on nest survival and account for it.

*Student
PACIFIC BIRDS HABITAT JOINT VENTURE - 30 YEARS OF PARTNERSHIP
DRIVEN CONSERVATION

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Pacific Birds Habitat Joint Venture (Pacific Birds) is a cooperative regional partnership with a mission of creating the ideal environment for bird habitat conservation. Given the urgent need to conserve declining bird populations, Pacific Birds is committed to working with partners to develop collaborative strategies to advance bird habitat conservation. Three conservation priorities identified by the Pacific Birds International Management Board guide the focus of our work. These include Hawai’i Wetlands, Coastal Wetlands, and Oak and Prairie. These habitats are inextricably linked to human communities. Many are connected by bird migrations. All need the best available science, expert knowledge, and collective collaboration to meet current and future needs. The Pacific Birds Coastal Wetlands Committee is working to refine a collective vision and plan for coastal wetland habitats spanning from northwest California to Alaska. This presentation will share where Pacific Birds is headed, how that relates to Alaska’s birds and habitats, and how you can contribute.
A GOLDEN EAGLE NESTING HABITAT MODEL IN ALASKA

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Recently, there has been interest in understanding Golden Eagle (Aquila chrysaetos) populations as threats to the species increase. The Alaskan population of Golden Eagles has been estimated at 1,000–4,000 individuals, yet recent information suggests there may be more Golden Eagles living in the state than previously thought. Nesting surveys have been the primary tool for understanding the distribution and density of breeding Golden Eagles in Alaska. The goal of this work was to develop a landscape-level planning tool for Golden Eagle conservation by gathering information on current and historical Golden Eagle nesting structures and developing a predictive spatial model for Golden Eagle nesting occurrence in Alaska. We acquired nest location data from multiple government and private organizations, with most nest data located in the Alaska Range, Wrangell Mountains, Seward Peninsula, Dalton Highway corridor of the Brooks Range, Ahkul Mountains, and northern Brooks Range. Based on this collection, we modeled the probability distribution for Golden Eagle nest occurrence in east-central Alaska. The predictive map we produced can be used to determine regions with a high probability of Golden Eagle nest occurrence. This will be useful to identifying high conservation priority locations and assisting with management decisions.
Bar-tailed Godwits *Limosa lapponica baueri* breed in Alaska and spend the nonbreeding season primarily at sites in eastern Australia and New Zealand. Long-term declines in the number of godwits spurred recent surveys at nonbreeding sites that yielded a revised population estimate of ~126,000 birds. To aid in the interpretation of the long-term declines and revised population estimate, we conducted aerial surveys for Bar-tailed Godwits in 2018 and 2019 at pre-migratory staging sites in western Alaska. We used digital photography to count godwits during our surveys and enumerated nearly 97% of our survey total in digital images. Unlike previous surveys in 1997, we documented very few Bar-tailed Godwits at estuaries on the Alaska Peninsula, results that also align with other aerial surveys from this region from 2003–2016. The occurrence of godwits at coastal sites along the Kuskokwim River Delta remained high and underscores the continued importance of this region to pre-migratory Bar-tailed Godwits. We counted nearly 93,000 godwits (~92% of survey total) along ~60 km of coast in this small region in 2019, a value constituting nearly three-quarters of the subspecies’ total population.
ALEUTIAN TERN ONYCHOPRION ALEUTICUS ABUNDANCE ESTIMATES AT FOUR GLOBALLY SIGNIFICANT COLONIES

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Aleutian tern Onychoprion aleuticus numbers have been in steep decline at known Alaskan breeding colonies in recent decades. Available data suggest that the majority of the species may currently breed in Russia. Efforts to document global abundance and trends have been hampered by remoteness of colonies, lack of a formal monitoring program, and the absence of reproducible population estimates with quantifiable errors, especially for large colonies. We surveyed four historically large colonies in Russia (2018) and Alaska (2019), which together may comprise 30-50% of the global breeding population. At each colony we obtained high resolution aerial photographs using a small Unmanned Aircraft System (sUAS). The large size of the colonies and the minimal altitude required to identify terns made it impractical to collect imagery of the entire colony. Instead, we employed a sampling approach, with sample locations selected based on spatially balanced acceptance sampling. Statistically sampled, low altitude sUAS images provided a fast, reproducible, and rigorous count of abundance for geographically large colonies. Concurrence among observers in photo counts indicated high precision in counts of attending birds and unattended nests, although species attribution in mixed tern colonies remains a source of significant uncertainty. Our results indicate that the four colonies surveyed here together supported <2,500 pairs of Aleutian terns in the survey years. None of the colonies approached their peak size reported previously, likely due to recent predation, long-term decline, cold early season weather, or other factors. If these reduced colony sizes are representative of the current conditions, the implications for the global population would be dire.
COUNTING BIRDS ALL NIGHT LONG AND NEVER GET TIRED

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The recording of nocturnal flight calls (NFC) has been an active field of research along the East Coast and in Europe for decades, yet little has been done in Alaska. Here, I report on my experience recording NFCs in the September-October of 2021. I made continuous nightly recordings using a microphone mounted in a parabolic reflector in Homer. After noise reduction and amplification, spectrograms were manually scanned for NFCs. Compared to daylight activity levels of local birds, the nights were quiet. At night, I detected up to 30 events per hour. Few of these could be confidently assigned to species. Attempts were made to confirm known, and identify unknown NFCs using deep-learning models BirdNET, BirdNET-lite, and BirdVOX. Recognized species included Golden-crowned Sparrow, Fox Sparrow, Golden-crowned Kinglet, and Varied Thrush, but also less expected species like Great-blue Heron. Automated detection was less accurate than hoped, showing little overlap with manual detection without further treatment. In either case, most NFC were left unidentified. Correcting misidentifications, learning more about local NFCs, and retraining the neural networks will get us closer to the ultimate goal of a fully automated system. Automated monitoring of NFC has tremendous potential for cost-effective monitoring of migration patterns, phenology, species composition, and trends.
COMPARATIVELY FEW SPECTACLED EIDERS ENCOUNTERED DURING THE MARCH 2020 WINTER AERIAL SURVEY

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To determine winter population size and late winter distribution, we conducted an aerial survey of the Bering Sea wintering area of Spectacled Eiders (Somateria fischeri). On 03–04 March 2020, survey observers documented 76,952 Spectacled Eiders in 105 flocks. The total count of eiders in 2020 was 78% less than the most recent count from March 2010 (~369,000). The 2020 survey encountered more flocks (mean number of flocks encountered in the previous 8 surveys = 55, range = 19–115) that included fewer individuals (78% of flocks included < 1,000 eiders in 2020) than the 2010 survey. In contrast, previous winter surveys often encountered flock sizes > 10,000. Spectacled Eider flocks were located farther northeast than previously documented, closer to the southeast coast of St. Lawrence Island. The potential causes of the lower count in 2020 compared to 2010 include incomplete census due to unobserved flocks within the survey area and additional flocks outside of the survey area, and population decline; however, we cannot disentangle the relative contributions of these factors. Because the 2020 count may be incomplete, it should be treated as a minimum count and interpreted with caution.
SPATIAL AND TEMPORAL VARIATION IN NEARSHORE MARINE BIRD COMMUNITIES IN THE NORTHERN GULF OF ALASKA

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High-level trophic species, such as marine birds, can be 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 region (Kenai Fjords versus Katmai National Park) and season. We also examined temporal trends in foraging guilds. Overall bird abundance was similar between summer and winter within regions, but community composition differed between seasons. Summer bird communities were supported by large numbers of piscivorous and planktivorous colony nesters, whereas winter bird communities were dominated by benthic foragers. We found variation in trends of some species at the regional scale, suggesting that drivers to abundance may not be coherent across the Gulf of Alaska. However, for other species the lack of variation in trends across regions may indicate Gulf-wide drivers to abundance. Taken holistically, contrasting trends in a variety of species can inform as to the underlying factors driving individual species’ abundance and distribution.
LIFE-HISTORY ATTRIBUTES OF ARCTIC-BREEDING BIRDS DRIVE UNEVEN RESPONSES TO ENVIRONMENTAL VARIABILITY ACROSS DIFFERENT PHASES OF THE REPRODUCTIVE CYCLE

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For Arctic-breeding birds, traits like diet, egg nutrient allocation, clutch size, and patterns of chick growth are predicted to be under increasing selection pressure due to climate change. We compared the reproductive responses of black brant, lesser snow geese, semipalmated sandpipers, and Lapland longspurs to environmental variability at an Arctic site in Alaska from 2011–2018. Semipalmated sandpipers advanced their site arrival and bred in higher numbers in response to early snow melt and warm temperatures, while brant and snow geese advanced their nest initiation dates and increased their clutch sizes. During chick rearing, longspur chicks were relatively resilient to environmental variation whereas warmer temperatures increased the growth rates of sandpiper chicks but reduced growth rates of snow goose goslings. These responses generally aligned with traits along the capital-income spectrum of nutrient allocation and altricial-precocial modes of chick growth. Under a warming climate, the ability to mobilize endogenous reserves likely provides geese with relative flexibility to adjust the timing of breeding and the size of clutches. Warmer temperatures, however, may negatively affect the quality of herbaceous foods and slow gosling growth. Thus, as the Arctic warms, species may possess traits that are beneficial during one phase of the reproductive cycle and others that may be detrimental at another phase, underscoring the need to consider multiple reproductive phases when assessing the effects of environmental variability on Arctic-breeding birds.
WARMING ARCTIC SUMMERS UNLIKELY TO INCREASE PRODUCTIVITY OF SHOREBIRDS THROUGH RENESTING

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Climate change in the Arctic is leading to earlier summers, creating a phenological mismatch between the hatching of insectivorous birds and the availability of their invertebrate prey. While phenological mismatch would presumably lower the survival of chicks, climate change is also leading to longer, warmer summers that may increase the annual productivity of birds by allowing adults to lay nests over a longer period of time, replace more nests that fail, and provide physiological relief to chicks. However, there is little information on how these competing ecological processes will ultimately impact the demography of bird populations. In 2008 and 2009, we investigated the survival of chicks from initial and experimentally-induced replacement nests of arcticola Dunlin (Calidris alpina) breeding near Utqiaġvik, Alaska. We monitored survival of 66 broods from 41 initial and 25 replacement nests. Based on the average hatch date of each group, chick survival (up to age 15 days) from replacement nests ($\hat{S}_r = 0.10$; 95% CI = 0.02–0.22) was substantially lower than initial nests ($\hat{S}_i = 0.67$; 95% CI = 0.48–0.81). Daily survival rates were greater for older chicks, chicks from earlier-laid clutches, and during periods of greater invertebrate availability. As temperature was less important to daily survival rates of shorebird chicks than invertebrate availability, our results indicate that any physiological relief experienced by chicks will likely be overshadowed by the need for adequate food.
PARASITES AND PLASTICS IN SEABIRDS FROM A DIE-OFF EVENT

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Seabirds often function as definitive hosts of trophically-transmitted parasites, and consequently, their parasite communities reflect their foraging ecology. During the breeding season, seabird foraging distances are understood to be less than those travelled during the non-breeding season. Thus, the parasite communities of different seasons can tell us about the local and regional prey communities in which they forage. Similarly, sick or injured birds are more likely to forage closer to their colonies than healthy birds with more abundant energy resources – so in this way, we can compare local and regional prey communities within a season. Here, we assess the parasite infracommunities of seabirds that were part of a die-off event on Middleton Island, Alaska in summer 2021 (infected with Avian Botulism) and compare them to those of birds collected in summer 2016 under non-diseased conditions. We use general linear models to compare parasite richness, alpha diversity, and energetic allocation to parasite maintenance and discriminant analysis to learn whether the parasite communities can help predict whether a seabird is diseased or not. In addition to parasite assessments, we also detected microplastic pollution in the diseased birds from 2021 (80% contained plastic) and the collected birds from 2016 (69% of GI tract contents contained plastic). We further explore the potential interactions of plastics within the gut of the host, how they might contribute to the diseased state of die-off birds, and how they might be interacting with the parasites that also reside in the gut.
EFFECTS OF ENVIRONMENTAL VARIATION ON NEST SURVIVAL OF EMPEROR GEESE ON THE YUKON-KUSKOKWIM DELTA, ALASKA

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Waterfowl productivity is often influenced by environmental conditions on the breeding grounds. For example, factors such as local abundance of predators, spring phenology, and weather conditions during the nesting season often affect productivity in arctic nesting goose populations. Nest success is an important component of productivity in geese; however, the effects of breeding ground conditions on nest survival are not well understood for some species, including the emperor goose (*Anser canagicus*), a species of conservation concern that is endemic to the Bering Sea region. Here, we used hierarchical nest survival models and 24 years (1994–2017) of nest monitoring data from the Manokinak River in western Alaska to estimate annual nest survival probabilities for emperor geese, and examined how indices of spring phenology, predator abundance, and individual level covariates (e.g., nest initiation date, clutch size, nest age) influence daily survival probabilities of nests. Results from our study will help to further understand emperor goose nesting ecology and elucidate potential effects of climate change on productivity of emperor geese.

*Student
HARMFUL ALGAL BLOOMS AND ALASKA SEABIRDS: SAXITOXIN ASSOCIATED WITH RECENT DIE-OFF EVENTS

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Harmful algal blooms (HABs) produce biotoxins that can injure or kill fish, wildlife, and humans. These blooms occur naturally but have intensified worldwide due to recent climatic changes, including ocean warming, and are of particular concern in northern regions. In Alaska, seabird mortality events have occurred annually since 2015 alongside anomalously high seawater temperatures. Although starvation related to prey availability has been linked to many bird deaths, HAB toxins have also been identified as possible contributing factors. Here, we present results from two geographically and temporally distinct events: a multispecies die-off in the Bering and Chukchi seas in 2017 and a localized die-off among nesting Arctic Terns (Sterna paradisaea) in southeast Alaska in 2019. To investigate possible causes of bird mortalities, we tested seabird tissues for HAB toxins. Concentrations of saxitoxin (STX) in tissues collected from Northern Fulmars (Fulmarus glacialis) in the Bering and Chukchi seas and Arctic Terns in Southeast Alaska were of similar magnitude (maximum of 63.3 and 39.4 µg/100g, respectively) to those reported from other STX-induced die-offs, suggesting that HABs may have played a role in these events. Additionally, elevated STX concentrations from forage fish at Arctic Tern nests provided evidence of direct exposure to STX via their prey. These findings suggest that HABs present a hazard to northern seabirds and should be addressed in future assessments of population health.
EVIDENCE OF LARGE-SCALE RECENT PATTERNS OF DYNAMIC CHANGE IN BERINGIAN FOOD-WEBS USING SEABIRDS AS INDICATORS

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The Arctic regions are experiencing rapid change in marine and terrestrial environments from many sources, primarily caused by climate change and anthropogenic impacts of increased development and pollution. In this study, we are analyzing the constituent stable isotopes (e.g. C, N, S) of muscle and feather samples collected from 16 avian species collected in the far Western Aleutian Islands (e.g. Near, Rat, and Delarof Islands) since 2009, and northern Bering Sea (St. Matthew and Hall Islands) in 2018 & 2019. Initial results indicate that for offshore piscivorous and planktivorous species (e.g., Tufted Puffin Fratercula cirrhatus), Black-legged Kittiwake Rissa tridactyla, Common Murre Uria alga, Crested Auklet Aethia cristatella, Least Auklet Aethia pusilla, Northern Fulmar Fulmarus glacialis, Thick-billed Murre Uria lomvia—diets of male and females diverged significantly through time. The greatest divergence was seen in Tufted Puffins and Northern Fulmars. Species typically foraging in nearshore waters, by comparison, showed the least change in gender-based patterns of diet (e.g., Pelagic Cormorant Phalacrocorax pelagicus and Horned Puffin Fratercula corniculata). We discuss possible factors associated with these changes and the significance of seabirds as sensitive indicators of ecosystem change in the Bering Sea region.

*Student
PACIFIC SHOREBIRD CONSERVATION INITIATIVE

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Effective actions to conserve shorebirds and their habitats require coordinated flyway-scale conservation initiatives. We developed the Pacific Shorebird Conservation Initiative to assemble and synthesize current knowledge to create a comprehensive international approach for addressing the most pressing conservation needs of shorebirds along the Pacific coast of the Americas. On-the-ground conservation projects, development of tools and resources, working groups and partnership coordination is how we collectively deliver conservation solutions. This lightening talk will highlight the partnership’s strategies and effective actions and opportunities to restore shorebird populations across the Pacific Americas Flyway.
PLANNING THE WESTERN MOTUS NETWORK TO INCLUDE SOUTHEAST ALASKA

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The Motus Wildlife Tracking System is an international collaborative research network of automated radio-telemetry receiving stations that allows researchers to track the movements of radio-tagged individuals over large spatial and temporal scales. Motus has been successfully used to fill gaps in knowledge about the full annual cycle of migratory species by identifying important stopover sites and migratory routes, and addressing questions about seasonal movements and post-fledging dispersal. Despite the successes of Motus research throughout the existing network, there are significant gaps across the western portions of North America, especially in Alaska. This presentation describes the efforts of the Pacific Northwest Motus Coordination Group to develop a strategic Motus network that will provide movement and migration information critical to the conservation of migratory species that breed in Alaska.
ALEUTIAN TERN COLONY CENSUS: BRISTOL BAY PILOT STUDY RESULTS

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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. In advance of a statewide census effort, we 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 one). Intensive aerial surveys were conducted at a portion of the cells initially surveyed to assess detectability (phase two). Aerial surveys were conducted from 9-28 June 2021, from Goodnews Bay to Cold Bay. 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 3), 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.
**BREEDING ECOLOGY OF CAVITY-NESTING DUCKS IN CENTRAL ALASKA**

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This project continues a 25-year extant investigation of the ecology and life history of the Common Goldeneye (*Bucephala clangula*) and other cavity-nesting ducks amid the Chena River system of central Alaska. We monitored 148 nest boxes from April-July 2021. Common Goldeneye, Bufflehead (*Bucephala albeola*), and Common Merganser (*Mergus merganser*) combined for 114 nests (77% nest box use). We also found 12 nests of Boreal Owls (*Aegolius funereus*). For 69 successful nests of Common Goldeneye, mean clutch size was 8.6 and we detected 25 (36%) parasitized nests (ie.>9 eggs/nest), with 76% being intraspecific. We found 25 nests with mixed clutches of common goldeneye (\(n = 18\)) bufflehead (\(n = 6\)) eggs, and Common Merganser (\(n = 1\)) where mean clutch size across all shared nests was 11.2 (± 2.09 SE). These results are merely exploratory as the lead author is currently developing research hypotheses and analytical paths using this long-term dataset as part of his MSc. degree program.

*Student
SEEBIRD: A COMMUNITY SCIENCE PROJECT ENGAGING LOCAL HIGH SCHOOL STUDENTS IN SEABIRD ECOLOGY

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The SeeBird program is a community science project in coastal Seward, Alaska engaging high school students in a project with hands-on data collection on seabird communities and their habitats. This environmental science program was initiated as a pilot project in 2018, as a way to enhance marine bird survey data collection and science education in our community. During the school year, weekly surveys are conducted along a 2km transect of the local waterfront. For the survey, students collect environmental data including weather and sea conditions as well as water property data. As students walk the transect they record observations of every seabird within 100m of the shoreline, noting behavior, recording the location, as well as documenting age and sex if known. In addition to conducting surveys, students are challenged to create their own research questions and hypotheses, analyze data, and communicate the results to the community through a presentation. To date, three cohorts of students and community members have participated, over 50 surveys have been conducted and almost 1000 observations of marine animals recorded. SeeBird surveys have provided fine scale phenology and abundance data, which complement monthly data from the Alaska SeaLife Center’s Resurrection Bay surveys.
COMMON GOLDENYE INDIVIDUAL RESPONSE TO CLIMATIC VARIATION: DOES PERSONALITY PLAY A ROLE IN REPRODUCTIVE ECOLOGY?

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Nesting common goldeneye have been monitored on the Chena River since 1997, when an extensive nest box program was initiated. Throughout the breeding season, each nest box is visited multiple times to capture nesting hens, candle and measure eggs, and webtag ducklings. During the project history, climatic conditions have continuously changed, with “early” and “late” springs. The purpose of my work is to examine how changing climatic variables may be impacting goldeneye populations due to individual females’ personalities. Personalities are observed in wildlife as within-individual consistencies in behavior, or, consistent between-individual differences in behavior within a population. Understanding personality is important in understanding how climatic changes impact populations, as I hope to determine if changes in observed reproductive metrics are due to plasticity in females’ reproductive behaviors between years in response to environmental conditions (showing no effect of personalities), or if climatic conditions impact the makeup of populations by selecting for females that utilize the same behavioral and reproductive strategies inter-annually, despite climate (showing effects of personalities). Thereby, individual females’ personalities can have impacts on a population-level and on species’ responses to climate change. Data are currently being analyzed, so I anticipate preliminary results to present in November.

*Student
IZEMBEK: A UNIQUE WATERFOWL HOTSPOT

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Izembek National Wildlife Refuge is world-renowned as critical habitat for birds, particularly for Steller’s eiders that molt in Izembek lagoon in the fall and the entire Pacific black brant population, which uses the refuge for staging, and increasingly, wintering habitat. However, less well-known is the fact that Izembek also hosts a unique population of tundra swans that make up the only known essentially non-migratory population in North America. While nearby populations migrate to the lower 48 for the winter, swans that breed on and around Izembek NWR remain on the lower Alaska Peninsula, taking advantage of geothermal springs that keep small lagoons from freezing over during the winter. Izembek NWR has conducted aerial surveys of the tundra swan population since the 1970’s, as well as performed banding and neck collaring efforts. While the nearby migratory populations appear to be stable, the non-migratory Izembek population appears to be in a long-term decline, despite a hunting closure for the past several decades. In this talk, I hope to highlight Izembek NWR, these interesting birds, and explore some ideas on why they might exhibit these population dynamics.
IMPACTS OF CLOSTRIDIUM BOLTULINUM ON INTESTINAL PARASITE COMMUNITIES OF BLACK-LEGGED KITTIWAKES

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Trophically-transmitted parasites typically exert sublethal effects within their definitive hosts, often establishing long-lived populations that persist without causing major damage to the organs they infect. Consequently, final hosts like seabirds, can accumulate high diversities of parasites that reflect the intermediate hosts species that they consume. This can be helpful in evaluating the degree to which the prey bases in marine systems are changing – as human-induced shifts in the structure of food webs appears to be one of many factors that is driving declines in seabird populations. Additionally, disease outbreaks in seabird colonies is of concern. The causative agents of seabird die-offs vary from system to system (and regionally); however, once a bird becomes moribund, the likelihood that parasitic infections can further deteriorate their health increases. What is more, as seabirds succumb to pathogenic infections, their foraging behaviors are likely to change and the types of parasites that they acquire can also differ. Here, we compare the parasite communities of Black-legged Kittiwakes: some expected to have typical parasites diversity (species richness and Shannon-Weiner) from presumably healthy individuals; and others that we expected to have lower parasite diversity as their foraging changed due to an infection of Avian Botulism. The birds from this second group were part of a multi-species die-off event in the summer of 2021 on Middleton Island, Alaska. Further, we identify parasitic infections that could have contributed to the die-off as damaged tissues from the bacterial infection and its toxins were more susceptible to secondary infection.

*Student
SIGN OF LARGE-SCALE RECENT PATTERNS OF DYNAMIC CHANGE IN BERINGIAN FOOD-WEBS USING SEABIRDS AS INDICATORS

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The Bering Sea region are experiencing rapid change in marine and terrestrial environments from many sources, primarily caused by climate change and anthropogenic impacts of increased development and pollution. Several endemic species, such as Red-faced Cormorants (Phalacrocorax urile) are currently undergoing dramatic population declines, likely related to climate-related change in food availability and trophic structure of the local marine environment. In this study, we analyze the constituent stable isotopes (eg. C, N, S) of muscle and feather samples collected from 16 avian species collected in the far Western Aleutian Islands (eg., Near, Rat, and Delarof Islands) since 2000, and northern Bering Sea (St. Matthew and Hall Islands) in 2018 & 2019. Our preliminary results indicate that the spatial and temporal dynamics of marine bird ecosystems are far greater in the last decade (2009 – present) than has been evident over recent decades. In particular, we show that the ecological patterns observed within such widespread arctic species as puffins Fratercula spp., Northern Fulmars Fulmarus glacialis, and Black-legged Kittiwakes Rissa tridactyla indicate diets are strongly perturbed on small geographic and temporal scales of $10^1$ km and decades. We hypothesize that these fine-scale changes are related to mid-scale oceanographic and trophic-level changes (eg., the “Warm Blob” in 2013, possibly later in 2019), in addition to larger-scale perturbations possibly related to a cascade of climate-related factors.

*Student
PARASITES OF BLACK-LEGGED KITTIWAKES FROM A MULTI-SPECIES DIE-OFF EVENT

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Seabird die-off events are reported at higher frequencies today than any time in history. The agents that precipitate these mortalities can include infectious pathogens and toxic compounds that are a result of biological activity (biotoxins) and/or pollutants. As infected individuals weaken with disease, their behaviors can change (feeding strategies reflective of reduced energy availability), and symbionts like trophically-transmitted parasites that have negative yet benign impacts on host health can become pathogenic. During summer 2021, a multi-species seabird die-off event occurred on Middleton Island, Alaska and the majority of birds impacted were Black-legged Kittiwakes, *Rissa tridactyla*. The suspected agent of disease is Avian Botulism (Type C). The physiological impacts of this disease can involve numerous organ systems, and here, we assess the impacts of infection on the kidneys, trachea, and gall bladder – comparing the endoparasite infection rates of these organs to birds collected under ‘healthy’ conditions from the Aleutian Islands. In collected birds (taken in 2016), 23% of *R. tridactyla* had kidney infections with reniculid trematodes and we expected to find differences in infection rates for those parasites in diseased birds; however infection rates were much lower in the 2021 die-off kittiwakes. Diseased birds also exhibited enlarged and highly productive gall bladders, and we found trematodes (collected bird prevalence was 0%) infecting them. Understanding the ways that secondary infections of trophically-transmitted parasites or their transition from benign to pathogenic as a consequence of underlying disease can be important in recognizing and potentially treating wildlife at the onset of die-off events.

*Student
EFFECTS OF EGG HARVEST ON EGG LAYING BY GLAUCOUS-WINGED GULLS ON THE COPPER RIVER DELTA

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Across many parts of Alaska, the subsistence harvest of wild bird eggs is a traditional activity. On the Copper River Delta we examined the impact of egg collection on Glaucous-winged Gull (Larus glaucescens) nesting by comparing egg laying patterns across two experimental plots. In one plot, we manually removed eggs from incomplete clutches (one- or two-egg clutches) and in the other we created disturbance by walking through the plot. We found that Glaucous-winged Gulls in this study did not appear to increase the number of eggs laid to compensate for eggs experimentally removed from their nests. Following nest manipulation only 10% of gull pairs completed a full clutch (3 eggs). We recommend that because state-managed subsistence harvest pressure on the Copper River Delta gull colonies is a relatively new phenomena (since 2014), continued research and monitoring is warranted to determine the long- and short-term impacts of egg collection.
ALASKA SEABIRD MORTALITY EVENT INFORMATION EXCHANGE

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Seabird die-offs are not uncommon in Alaska, but they have increased in frequency, duration, and intensity since 2015. Documenting the size and scope and investigating the cause of these anomalous mortality events is a priority, as seabirds can be indicators of ecosystem status and change, and coastal communities in these regions rely on the marine ecosystem for their nutritional, cultural, and economic well-being. The U.S. Fish and Wildlife Service is the federal agency responsible for the conservation and management of migratory birds, for which the U.S. Geological Survey provides research support. In response to seabird mortality events, these agencies endeavor to coordinate with federal, state, and tribal governments, community members, and academia to collate observations, collect seabird carcasses for examination, and report on collective findings. Coordination with existing regional communication networks, as well as coastal communities, provides crucial information otherwise unavailable. The workshop objectives are to: (1) share ongoing and future efforts to respond to Alaska seabird mortality events, (2) discuss necessary steps towards documenting the size and scope of events and determining cause(s) of mortality, and (3) evaluate how best to disseminate results in a timely and effective manner.
Coastal communities in Alaska are witnessing a changing marine environment, including rising ocean temperatures, shifting fisheries, and increases in disease and toxic algal blooms. Since 2014 seabird mass mortality events have occurred at least annually in the North Pacific, affecting a breadth of species and large marine ecosystems. COASST, BeringWatch, the Alaska Migratory Bird Co-Management Council and the US Fish and Wildlife Service and the National Park Service have teamed up to work with coastal communities to track seabird die-offs in Alaska. Die-off Alert (DOA) is a way for community members throughout coastal Alaska to gather, record, share and learn information about seabird die-offs as they happen. This 1-hour training equips attendees and their communities to survey beaches and report carcasses, including photographs and locations that are essential information for tracking the geographic and temporal extent of a mortality event. All information is returned to the affected communities and reported to management agencies.