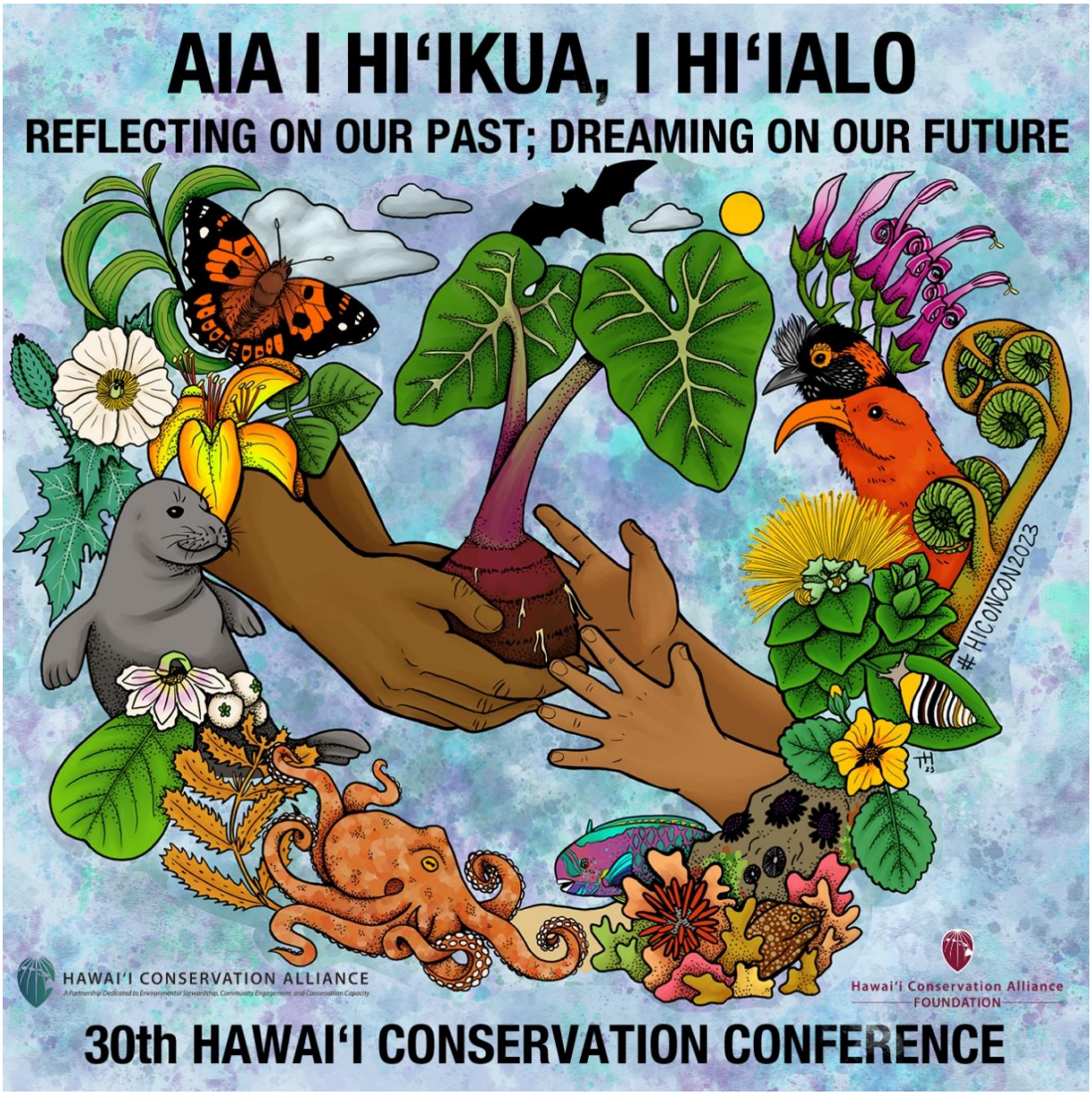

30th Annual Hawai‘i Conservation Conference Abstract Book

June 27th – June 29th, 2023

Community Engagement in Coral Reef Management: How Citizen Science can Influence Marine Ecosystem Policy, Management, and Conservation in Hawai‘i

Leland Williams

Hawaii Pacific University, Honolulu, Hawaii. Unity College, Unity, Maine

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Over a 3-year time period (2019-2021) an observational study was conducted assessing reef health improvement at multiple location on O‘ahu. One such location, Hanauma Bay, saw an increase of about 64% in water quality and visibility after state mandated COVID-19 restrictions stopped tourism to the Islands. Additionally, ongoing research at both Pūpūkea and Waikiki Marine Conservation Districts also showed water quality improvements as well as decreases in alien and invasive marine species. Paralleled with this observational study was the comparison of current coastal and marine ecosystem management practices and how community science and community-based marine conservation organizations influence these practices. Currently in Hawai‘i, there are two pieces of legislation that mandate the inclusion of community-based management and the inclusion of native Hawaiian voices. Hawai‘i’s Holomua Marine 30x30 initiative and Hawai‘i Ocean Resources Plan must allow Hawai‘i’s communities to have active roles in the decisions being made in their natural spaces. Other management practices such as marine conservation districts and marine protected areas have implemented community-based strategies as well. As the State of Hawai‘i reacts and assembles solutions to the main threats towards marine ecosystems, tools can be made for community scientists as a means to effectively include themselves in what has historically been a top-down approach to environmental management. As such, a public Mobile App framework was created to be used as a potential tool to serve as a statewide “collector” app in responding to coral bleaching, disease, crown of thorns seastar outbreaks, and other marine impacts.

Presentation Keywords

Marine , Conservation , Management , Community , Technology

7

The Efficacy of the Semiochemical Repellent Verbenone to Protect Healthy and Ceratocystis-infected ʻŌhiʻa from Attack by Ambrosia Beetles

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The *Ceratocystis* fungal disease complex, Rapid ʻŌhia Death (ROD), has killed over one million ʻōhiʻa (*Metrosideros polymorpha*), the keystone tree species of Hawaiʻi. The disease can be spread by invasive ambrosia beetles (Coleoptera: Curculionidae) through fungal inoculum found on their bodies and also in the frass they produce. Thus, there is a critical need to manage beetle attack on ʻōhiʻa trees to curtail the subsequent infection and spread of ROD. In this experiment at Waiākea Forest Reserve, we tested the efficacy of semiochemical repellent, verbenone, in commercial SPLAT Verb formulation, in protecting healthy and ROD-infected ʻōhiʻa from ambrosia beetle infestation. Beetle attack was monitored bi-weekly over 16-weeks, using sticky traps on ethanol-baited trees with low (72g) or high (108g) dose verbenone treatment. ROD-positive trees were then felled and beetles were reared in the lab from bolts to determine the effectiveness of the repellents on beetle assemblage post-treatment. Finally, we used gas-chromatography mass-spectrometry (GC-MS) to measure the abundance of verbenone released over time. We found that the low dose of verbenone repellent is the most effective and economical application for deterring ROD-associated ambrosia beetle attack on both healthy and ROD-infected ʻōhiʻa. However, the GC-MS analysis revealed a large decrease of verbenone abundance by week 8 of the experiment and may require re-application for preventing specifically *Xyleborinus saxesenii* attack on ROD-infected ʻōhiʻa. Our study demonstrates that verbenone can effectively prevent beetle attack on ʻōhia, thereby reducing the spread of ROD, and supports the registration of the product for use in Hawaiʻi.

Presentation Keywords

rapid ohia death, repellent, beetles, invasive species, management

Agenda & Additional Required Information for Forums, Workshops, and Trainings

8

Propagation and reintroduction of critically endangered *Cyanea kuhihewa* in Limahuli Valley

Uma Nagendra[1], Hayley Walcher[2], Rhian Campbell[2], Merlin Edmonds[1], Nina Ronsted[2], Ken Wood[2], Mike DeMotta[2]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Cyanea kuhihewa (L.) is a Hawaiian tree lobelia previously only known from Limahuli Valley on the north coast of Kauai island. The species was presumed to be extinct until December 2017, when a small population was found on private property in a valley nearby Limahuli. Since these few remaining plants were very likely the last remaining population of *C. kuhihewa* on Earth, action was immediately taken to enact a conservation plan.

For the past five years, The National Tropical Botanical Garden, in collaboration with the Plant Extinction Prevention Program, Lyon Arboretum, and others, have been using a combination of approaches to ensure the preservation of this critically endangered plant. Experienced field botanists monitor, collect seeds, and mitigate threats in the wild population. Dedicated horticulturalists pioneer propagation techniques and strategies to grow healthy seedlings from both tissue culture and wild-sourced seed. The final reintroduction process included site selection, planting strategies, and threat mitigation in the re-introduction area.

This presentation will discuss the triumphs, challenges, and new information learned throughout the reintroduction process. This work has resulted in the mapping of a new population of 12 wild plants, numerous seeds preserved in seed bank storage, and valuable new nursery propagation techniques specific to cloud forest *Cyanea* species. In the past three years, 37 new *Cyanea kuhihewa* seedlings have been re-introduced in their historical range, with dozens more in propagation.

Presentation Keywords

endangered plant, reintroduction, plant propagation, horticulture, monitoring

9

The State of Avian Malaria in Hawai'i: A Cross-Island Comparison

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Avian malaria is a primary cause of native Hawaiian honeycreeper declines and extinctions. Without control or elimination of the malaria's vector, the southern house mosquito, several endangered honeycreepers will become extinct within the next 1-10 years, and remaining species will continue to decline. Avian malaria mitigation efforts are complicated by the fact that climate change is expanding the range of mosquitoes and malaria into previously unaffected habitats through changes in temperature and rainfall patterns. Landscape-level mosquito control, captive care, and translocation of birds to refugia with lower disease prevalence provide hope for these critically endangered birds. Up-to-date data on the prevalence of avian malaria across the state is essential to make informed decisions about implementation of mosquito control and feasibility of translocation efforts. To this end, Kauai Forest Bird Recovery Project, Maui Forest Bird Recovery Project, and Hawai'i Island Division of Forestry and Wildlife collaborated to obtain a snapshot of avian malaria in key high elevation forest habitats in Hawai'i in 2022 by concurrently sampling birds and mosquitoes on each respective island. We compare the seasonal distribution and abundance of mosquitoes as well prevalence of avian malaria in bird populations on Kauai, Maui, and Hawai'i Islands, and present the implications of these trends for future conservation actions to prevent native Hawaiian forest bird extinctions.

Presentation Keywords

disease ecology, avian malaria, mosquitoes, endangered species, Hawaiian honeycreepers

10

Forest Bird Populations at The Big Island National Wildlife Refuge Complex, Hawai‘i

Steven Kendall[1], Rachel Rounds[2], Richard Camp[3], Ayesha Genz[4], Eldridge Naboa[5]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Surveys were conducted at The Big Island National Wildlife Refuge Complex (BINWRC) to monitor forest bird populations. We analyzed survey data from 1987 to 2019 at the Hakalau Forest Unit (HFU) and 1995 to 2019 at the Kona Forest Unit (KFU). We looked at three strata at HFU: open-forest, closed-forest and afforested-pasture, and two strata at KFU: upper and lower. In all years, I‘iwi (*Vestiaria coccinea*), ‘Apapane (*Himatione sanguinea*) and Hawai‘i ‘Amakihi (*Hemignathus virens*) were the most abundant species at HFU. The three endangered species, Hawai‘i ‘Ā‘kepa (*Loxops coccineus*), ‘Alawī (*Oreomystis mana*) and ‘Akiapōlā‘au (*Hemignathus munroi*), had much lower densities. The most abundant species at KFU was ‘Apapane. At HFU most species trended upward in afforested-pasture stratum, stable in the open-forest stratum, and downward in the closed-forest stratum. However, when we looked at the most recent decade at HFU, more species were showing downward trends in all three strata. At KFU results were mixed, with more species trending downward in the upper stratum and upward in the lower stratum. Both units in the BINWRC are important for conservation of forest birds and our results show that HFU supports the majority of the population of three endangered forest bird species found on Hawai‘i Island. Our analysis also shows the importance of continuous monitoring and timely analysis to track forest bird populations. Knowing current population densities, abundances, and trends allows managers to evaluate and adapt management actions to support forest bird conservation at the BINWRC.

Presentation Keywords

endemic forest birds, population abundance and trends, listed species, forest bird surveys, Big Island National Wildlife Refuge Complex

11

Management Actions for Conserving Forest Bird Populations at the Big Island National Wildlife Refuge Complex, Hawai‘i

Steven Kendall[1], Rachel Rounds[2], Richard Camp[3], Ayesha Genz[4], Donna Ball[1], Thomas Cady[1], Eldridge Naboa[5]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The Big Island National Wildlife Refuge Complex (Refuge Complex) was established for the conservation of endangered forest birds and their habitats. Surveys of forest bird populations have been conducted annually at the Refuge Complex; at Hakalau Forest Unit (HFU) since 1987 and periodically at the Kona Forest Unit (KFU) since 1995. Data from these surveys were used to estimate forest bird population status and trends through 2019. We found a continuation of several trends observed in previous analyses at HFU, with most species’ trends upward. However, several species showed downward trends in closed-forest habitats and in the most recent decade. Results were mixed at KFU. This data analysis has allowed managers to evaluate if management actions to mitigate threats have been effective for conserving forest birds. Threats to forest birds at the Refuge Complex, including habitat loss, avian disease, feral ungulates, and non-native predators, appear to be having a negative impact. Management actions at HFU have included eradicating feral cattle and pigs, controlling invasive plants, and planting native trees and shrubs. Similar management is planned for KFU but has yet to be implemented. Our analysis indicated forest restoration has been effective, but the effectiveness of the other management actions were less clear. Continuing and enhancing management actions such as restoring forests, removing invasive species, limiting the prevalence of avian disease, controlling predators, and collaborating with adjacent landowners, could help mitigate the impacts and allow the Refuge Complex to remain a key site for forest bird conservation in Hawai‘i.

Presentation Keywords

endemic forest bird conservation, threats to forest bird populations, management actions, Big Island National Wildlife Refuge Complex

12

Auwahi Wind HCP: Notes from the field

Jessie Wagner, Nuuanu Santos, George Akau

Auwahi Wind, Kula, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

The Auwahi Wind Habitat Conservation Plan was implemented in 2012 to create positive benefits to species impacted by the project. After 10 years of wind farm operations positive impacts to species are being observed. The protection and creation of bat habitat and management of seabird habitat are some examples of efforts taken by the project.

Presentation Keywords

bat, seabird, habitat conservation plan, renewable energy, wind

14

A multi-prong study of coral reef ecosystems in West Hawai‘i

Amy Olsen[1], Shawn Larson[1], Jacqueline Padilla-Gamiño[2], Terrie Klinger[2], Jeff Christiansen[1], William Walsh[3], Chris Teague[3], Brian Tissot[4], Zachary Randell[1], Jenna Rolf[2]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Marine heatwaves are prolonged events of anomalously warm water that affect marine habitats and their associated biota. Evidence shows that anthropogenic climate change is increasing the frequency and duration of marine heatwaves, and thermal stress has been documented to cause coral bleaching and mortality. In three studies, we describe a unique underwater video survey method, and use the data to report fish community and coral species response to consecutive marine heatwaves (2014-2015) in three areas in West Hawai‘i. Fish were counted and identified to species or genus, and two coral species (Porites compressa and Porites lobata) were classified alive or dead using CoralNet. Our studies show that all fish assemblages changed significantly in each area after the marine heatwaves. Following the marine heatwaves, fish abundance increased in two areas with fewer fishing regulations. In the most protected area, fish abundance remained high and diversity indices were significantly higher post-marine heatwaves. Porites lobata was observed to be the most prevalent species, with decreases in live coral cover post marine heatwaves at all sites. Porites compressa was only present at three sites, with declines in coral cover post marine heatwaves. The increase in duration and intensity of marine heatwaves, associated with climate change and continuous warming of oceans, punctuates the need for continued monitoring to understand how Hawaiian coral reefs respond to increasing heat stress.

Presentation Keywords

Fish community, Coral, Marine heatwave, Diver Operated Video (DOV)

15

The spatial and temporal distribution of *Staphylococcus aureus* along a tropical Hawaiian watershed

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Staphylococcus aureus is the leading source of community-acquired skin infections in the U.S., with Hawai‘i historically leading the country in these infections due to recreational water exposure. Unfortunately, knowledge is limited on tracking potential sources and abiotic influences of *S. aureus* in Hawaiian waters. This study statistically models the abundance and distribution of *S. aureus* and associated virulence genes through culture and culture-independent techniques with high spatial resolution across an O‘ahu watershed that receives a gradient of human influence. On average, *S. aureus* concentrations were significantly greater by two orders of magnitude when measured by quantitative PCR of the *femA* gene, than culture-based methods with CHROMagar. However, both methods revealed similar spatial distributions. In the dry season, concentrations of cultured *S. aureus* were consistent across sites; whereas abundances of *femA*, and staphylococci antibiotic resistance and virulence genes *mecA*, and *etB* increased downstream likely due to increased human activity, lower streamflow, and higher residence times at wider estuarian sites. During the wet season when streamflow was higher, *S. aureus* concentrations increased along the watershed peaking at estuarine sites due to increased rainfall and runoff from potential terrestrial sources. Interestingly, *mecA* and *etB* genes were highest at upstream sites with no public access, suggesting a potential zoonotic source for virulent *S. aureus* strains. Models developed in this study will help predict *S. aureus* concentrations along watersheds, enabling land stewards to more effectively apply interventions to mitigate risk and maintain public health in recreational waters.

Presentation Keywords

Watershed microbiome, Pathogens, Ahupua‘a, Water quality, Biogeography

17

The Hawai‘i Cesspool Hazard Assessment & Prioritization Tool

Christopher Shuler[1,2], Michael Mezzacapo[3], Melanie Lander[2]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Hawai'i’s 88,000 cesspools are a substandard sewage disposal method and are widely recognized to harm human health and the environment, particularly sensitive coastal ecosystems. To address pollution concerns, the Hawai'i State Legislature mandated replacement of all cesspools by 2050. A major step in achieving this goal is categorizing cesspools based on potential or realized harm to humans and the environment. This presentation will showcase the development and key features of The Hawai'i Cesspool Prioritization Tool (HCPT), a web-based framework designed for this purpose and funded by Hawai'i Department of Health. The tool incorporates a comprehensive list of datasets that meet the concerns of state government, cultural values, and environmental sensitivities including fifteen risk-factors that control or relate to how cesspool impacts are distributed across communities and the environment. A Weighted Risk Scoring Model is used to calculate a prioritization score for every cesspool in Hawai‘i, and results are validated through comparison with statewide limu-based assessment of nearshore wastewater impacts. The HCPT was designed to be a management and public outreach tool, and to be as objective as possible to eliminate human bias from prioritization decisions. The tool places all of Hawai'i's cesspools into one of three prioritization categories with 13,885 in Priority 1, and 13,482 and 54,058 cesspools in Priority 2 and Priority 3, respectively. These prioritizations are currently being used as a basis for state cesspool-conversion financing programs and are cited in multiple state bills aimed at moving the needle on cesspool conversion progress.

Presentation Keywords

cesspools , water quality, policy, nutrients, health

18

Discussing the Potential and Implementation of a Hawai‘i Visitor Impact Fee

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

As an archipelago, Hawai‘i is uniquely vulnerable to the increasing impacts of anthropogenic stressors including the climate emergency, biodiversity crisis, and our local need for added conservation capacity. Across the field, sustained financing for conservation is limited, with our conservation funding gap estimated at $360 million each year. Hawai‘i Green Fee is an innovative initiative to finance conservation, sustainability, and climate solutions across the State using a visitor impact fee. At $50 per visitor, we would generate over $400 million a year for Hawai‘i and generate crucial support to restore, protect, enhance, sustain, and regenerate our environment across ecosystems and sectors. After the 2023 legislative session and five years of advocating for statewide policy, we will discuss next steps for the initiative, including the program’s potential for scaling community-based solutions, a proposed implementation strategy, and ways to ensure visitor and resident support for the program.

Presentation Keywords

Conservation, Financing, Innovation, Visitor Impact Fee, Hawai'i Green Fee

19

Coral Taxonomy and Local Stressors Drive Bleaching Prevalence Across the Hawaiian Archipelago in 2019

Morgan Winston[1,2], Thomas Oliver[2], Courtney Couch[1,2], Mary Donovan[3], Gregory Asner[3], Eric Conklin[4], Kimberly Fuller[5], Bryant Grady[3], Brittany Huntington[1,2], Kazuki Kageyama[5], Tye Kindinger[2], Kelly Kozar[6], Lindsey Kramer[7], Tatiana Martinez[8], Amanda McCutcheon[6], Sheila McKenna[6], Ku'ulei Rodgers[9], Cameron Kaʻilikea Shayler[10], Bernardo Vargas-Angel[1,2], Brian Zgliczynski[11]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The Hawaiian Archipelago experienced a moderate bleaching event in 2019 — the third major bleaching event over a 6-year period to impact the islands. In response, the Hawaiʻi Coral Bleaching Collaborative (HCBC) conducted 2,177 coral bleaching surveys on snorkel and open-circuit SCUBA across the Hawaiian Archipelago. HCBC was established to coordinate state-wide bleaching monitoring efforts amongst academic, non-governmental, and governmental organizations to facilitate data sharing and provide management recommendations. In 2019, HCBC goals were to: 1) assess spatial and temporal thermal stress patterns; 2) examine taxa-level bleaching susceptibility patterns; 3) quantify spatial variation in bleaching extent; 4) compare 2019 patterns to prior events; 5) identify bleaching predictors in 2019; and 6) explore site-specific management strategies to mitigate future bleaching. Acute thermal stress and bleaching in 2019 were less severe compared to the last major marine heatwave events in 2014/2015. Bleaching was highly site- and taxon-specific, driven by the susceptibility of coral assemblages whose structure was shaped by previous bleaching and mortality. Acute stressors (e.g. surface light and temperature) were equally important as previous environmental conditions in accounting for 2019 bleaching variability. We found little evidence for acclimation by reefs to thermal stress. Moreover, our findings illustrate how detrimental effects of local anthropogenic stressors, such as tourism and urban run-off, may be exacerbated under high thermal stress.

Given the forecasted increase in severity and frequency of bleaching, future mitigation of local and global stressors is a high priority for the future of corals in Hawai‘i.

Presentation Keywords

coral reefs, coral bleaching, thermal stress, coral taxonomy

20

Marketing for Environment: Using Influencer Marketing to Locate and Engage the Stakeholders of a Marine Resource Manager

Kapono Gaughen

University of Hawaii at Manoa Department of Natural Resources and Environmental Management, Honolulu, Hawaii

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

While the value of including stakeholders in the design and implementation of conservation practices has become increasingly recognized as crucial, the practices used to find and engage individuals using a particular place for a specific purpose lag behind the approaches used by the private sector for marketing. For a location like Hawai‘i, with native biodiversity and biocultural projects ranging on scales from large swaths of the ocean to isolated ridgelines, effective conservation solutions may entirely hinge on the ability to engage highly-specific stakeholder groups. Influencer Marketing, underpinned by connecting with communities of select demographics via the creators of the online content such communities have self-organized around, appears particularly applicable to conservation initiatives; however, it is largely unknown if environmental managers can co-opt the utility Influencer Marketing for locating and engaging their stakeholders. This project tested if Influencer Marketing could be used to identify and engage one of The State of Hawai‘i’s Division of Aquatic Resources (DAR) core stakeholder groups, those who fish in Hawai‘i. Stakeholders were assumed to be concentrated in the following of “Topical Influencers,” those producing content on places and activities defining an environmental manager’s stakeholders. Topical Influencers were sponsored to include multiple rounds of outreach material in their regular postings; each round attempted to elicit the participation of DAR’s stakeholders in a specific DAR project. The outcomes of this engagement will be compared to the results of DAR’s past outreach attempts and methodology, the completed analysis of which will be finished by 04/15/23.

Presentation Keywords

Stakeholder Engagement, Social Media, Aquatic Resource Management, Private Sector Marketing, Public Sector Community Outreach

21

Kiwikiu Conservation Translocation and How Disease Thwarted Everything

Laura Berthold[1,2], Hanna Mounce[1,2], Christopher Warren[3], Hillary Foster[1,2], Lainie Berry[4]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

In 2006, U.S. Fish & Wildlife Service recommended establishing a second population of kiwikiu (*Pseudonestor xanthophrys*), a Hawaiian honeycreeper endemic to Maui, Hawai‘i, to protect from potential loss or extinction. At that time, there were > 500 kiwikiu all located on windward East Maui; however the 2017 population estimate of ~157 indicated that recovery efforts were even more critical. In 2019, we attempted to reintroduce kiwikiu to the south slope of East Maui in Nakula Natural Area Reserve. After decades of preparation, including fencing, ungulate removal, outplanting, avian disease surveys, building infrastructure, controlling predators, and reducing mosquito densities, the area was presumed ready. Fourteen kiwikiu were transferred to the site: seven wild and seven from a conservation breeding facility. After only a month, all but three birds were confirmed to have died from avian malaria, a non-native disease spread by invasive mosquitoes that had expanded into higher elevations. The translocation highlighted the variance in mosquito movements and how quickly disease can flood a habitat. This awakened the possibility that kiwikiu may have few years left before extinction, persisting within a very narrow band of elevation on the north slope of Haleakalā. Their recovery is now dependent on landscape-level disease control, a tool under consideration by management agencies. We will continue to monitor the wild population, encourage habitat restoration, establish a population in captive care, and evaluate the possibility of a translocation to Hawai‘i island, while working towards and implementing urgently needed disease control.

Presentation Keywords

translocation, avian disease, birds, recovery action

22.

Successfully Preserving and Restoring Hawai'i's Endemic and Rare Coral Species

Honor Weber

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

High endemism is a defining feature of Hawaiian ecosystems, and coral reefs are no exception, with endemic corals comprising ~25% of all Hawaiian coral species. Geographically isolated from other coral populations means genetic replacement pools for Hawaiian corals are almost nonexistent. This isolation, coupled with risks from anthropogenic impacts (e.g. climate change, coastal development, pollution, anchor damage, etc.) means these populations of endemic and rare Hawaiian corals are vulnerable . In response, the State of Hawai‘i’s Division of Aquatic Resources (DAR) started a rare and endemic Hawaiian coral “ark” at its land-based Hawai‘i Coral Restoration Nursery (HCRN) on the island of O‘ahu. The Rare Coral Ark holds living representatives of rare, endemic, and uncommon Hawaiian coral species for preservation, and reintroduction. Holding these corals ex-situ in the HCRN’s land-based nursery tanks allows specialized staff to care for the corals in a controlled environment with ideal conditions to ensure optimum coral health. Functioning like a living seed bank, the Rare Coral Ark has contributed to the enhancement of diminished or locally extinct populations. In 2019, the Ark was used in the successful reintroduction of Knobby Finger Coral (Porites duerdeni) to Kāne‘ohe Bay. As the Coral Ark continues to evolve and grow, so does the potential for active restoration of rare and endemic species in order to preserve and enhance the biodiversity of Hawaiian reefs.

Presentation Keywords

Coral, Conservation, Restoration, Reef, Endemic

23

Nature-based Interventions to Reverse Coral Reef Loss and Protect Hawaiian Shorelines

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Climate change is causing increased frequency and severity of storms that damage coastal communities. Such impacts are exacerbated by the loss of coral reefs, which dissipate wave energy and storm surge, and are often replaced by shoreline hardening to protect vital infrastructure. Coastal hardening is contentious and needs periodic renewal as protection is broken down by continued erosion. Here, we present a novel nature-based approach to reducing damaging wave energy by combining the immediate efficacy of engineered breakwaters with the regenerative capacity of coral reefs. The Rapid Resilient Reefs for coastal Defense (R3D) project brings together scientists and engineers with a desire to work with local knowledge holders to protect Pacific Island communities. We take a three-pronged approach to coastal protection. First engineers and oceanographers design an array of perforated in-water structures that mimic the wave dissipating properties of a natural reef crest. The second group integrates habitat complexity and new technology to promote coral larval settlement and growth, encourage fish recruitment, and inhibit competitive algae. The third research team focuses on covering these man-made structures with diverse and resilient corals that will grow and withstand future ocean conditions. This prototype hybrid engineered-natural reef will set the stage for working together with local communities and Indigenous knowledge holders to incorporate traditional practices that further enhance nearshore productivity and food security and ensure the long-term success of this project. This presentation will discuss the overall goals and progress during the first year of this 5-year project.

Presentation Keywords

climate resilience, coastal protection, coral restoration, hybrid reef

024.

The Status and Trends of Forest Birds on Molokaʻi, Hawaiʻi

Lauren Smith[1], Seth Judge[1], Lainie Berry[2], Ayesha Genz[3], Richard Camp[4], Hanna Mounce[5], Laura Berthold[5]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The composition of Hawaiʻi's avifauna has changed drastically since human colonization. Each main island has suffered numerous extinctions of endemic forest birds and non-native bird populations are increasing. Managers use point-transect distance sampling to track population densities and trends of native and non-native forest birds. The island of Molokaʻi was first surveyed in 1979, and a 3,527 ha core area has been re-surveyed every 6-11 years. In 2021, surveys were conducted on 11 transects within reserves managed by The Nature Conservancy and State of Hawaiʻi. Only two of 11 species detected were native – ʻApapane (Himatione sanguinea) and Hawaiʻi ʻAmakihi (Chlorodrepanis virens). Non-native species accounted for 67.3% of the 1,791 total detections, with sufficient detections to calculate abundance of three: Japanese Bush Warbler (Horornis diphone), Red-billed Leiothrix (Leiothrix lutea), and Warbling White-eye (Zosterops japonicus). Since 1979, abundance of Japanese Bush Warbler and Red-billed Leiothrix increased by 99% and 87%, respectively. Due to high variance, trends were non-significant for Warbling White-eye, which decreased by 35%, and ʻApapane, which increased by 33% with 574 detections. Continuing to persist in alarmingly low numbers is the disease-vulnerable Hawaiʻi ʻAmakihi, only detected 11 times. We failed to detect the federally threatened ʻIʻiwi (Drepanis coccinea), which has become exceedingly rare or extirpated from Molokaʻi as it was last observed there in 2010. The island-endemic thrush, Olomaʻo (Myadestes lanaiensis) has not been detected since 1980—its existence remains in question due to its cryptic behavior and the extreme topography of Molokaʻi which prevents traditional survey methods.

Presentation Keywords

native forest birds, forest bird survey, Molokaʻi, population trends, introduced birds

026.

Uncertainties in modelling Hawai'i's climate future and what it means for endangered forest birds

Erica Gallerani

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Globally, birds function as valuable indicators for the effects of climate change on biodiversity as they are well-studied and ubiquitous. Amongst bird species some of the most vulnerable to changes in climate are those on tropical islands with limited range mobility. However, many island nations reside in areas of low global climate model agreement or high uncertainty. Additionally, these island ecosystems are affected by several physical processes which lead to local variability in conditions not captured at global scales. Hawai'i honeycreepers, a group of birds endemic to the Hawaiian Islands, are particularly vulnerable to small scale changes in climate that aid the spread of avian malaria. To ensure the future survival of these species, it is essential to understand how the climate will change in the Hawaiian Islands at biologically relevant scales, despite high levels of uncertainty in future predictions. By reviewing recent scientific literature, I have synthesized those major sources of uncertainty which fall into two major categories: 1) downscaling global climate models (GCMs) to small, topographically complex islands and 2) systematic biases in the representation of the tropical Pacific climate. Preliminary results from this review have found that properly capturing changing El Nino- Southern Oscillation (ENSO) regimes will have a large effect on predicting the future for Hawai'i's forest birds, something not fully resolved by current GCMs. Additionally, dynamical downscaling versus statistical downscaling has proven more realistic for predicting future precipitation patterns for small island communities, something essential for understanding climate at biologically relevant scales.

Presentation Keywords

Climate change, ENSO, Climate modelling, Honeycreepers

027.

Impact of an Educational Presentation to Aquarium Visitors about the Coral Reefs of Hawai‘i on Predictors of Behavior Change

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[2]Hawai‘i Institute of Marine Biology (HIMB), Kane‘ohe, HI

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Coral reefs in Hawai‘i are crucial to the marine ecosystem, offering habitat for a diverse array of marine life, including many endemic species, and hold significant ecological, economic, and cultural importance. However, they face numerous threats, including degradation due to reef tourism. A recent study found that high live coral cover in Hawai‘i draws in visitors, which in turn contributes to the degradation of the reefs. Harmful behaviors such as touching, breaking, and stepping or sitting on corals are common on Hawai‘i's reefs. Providing education to the public, including reef tourists, about responsible behavior around corals may be helpful. This current study explored the impact of an educational presentation for visitors at the Waikīkī Aquarium, aimed at promoting sustainable behavior to preserve the reefs. Results from the pre and post-survey of 90 visitors indicate that even a short presentation can significantly affect predictors of behavior change such as intentions for more sustainable behavior ($p<.001$). While further research is necessary to determine the long-term impact, the findings suggest that short, directed educational presentations can be an effective and resource-friendly way to reach and educate visitors about coral reef health and other preservation concerns.

Presentation Keywords

marine tourism, coral reefs, behavior change, education

28

Approaches to Monitoring Ungulate Abundance and Population Dynamics in Hawai‘i

Steven Hess

USDA-APHIS-WS National Wildlife Research Center, Hilo, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

There is a recently renewed interest in monitoring the abundance of ungulates in Hawai‘i. Aerial surveys have been used to monitor population level abundance of large animals since the mid-20th century. There is a large body of scientific literature that demonstrates the approach underestimates abundance, and many methods have been developed to correct these abundance estimates. Corrections may add additional costs to the aerial survey approach and may not be necessary depending on monitoring goals. If goals are to determine change in abundance over time, index surveys coupled with removal data may be sufficient, where an index is defined as any measurable corelate of abundance. Rates of population growth can also be estimated from removal data, which may be particularly useful for areas of Hawai‘i where large numbers of ungulates are planned to be removed. If goals are to determine bag limits for hunting, a population dynamics approach by monitoring vital rates (e.g., pregnancy, perinatal survival, recruitment, age, and sex ratio) may be more appropriate. Regardless, analyses are warranted to determine the statistical power to detect the level of change of interest to mangers. I will review advantages and disadvantages of techniques used for monitoring abundance by aerial surveys, techniques for monitoring vital rates, and provide examples for improving the cost effectiveness of ungulate monitoring.

Presentation Keywords

Ungulates, Monitoring, Aerial surveys, Population dynamics, Abundance

29

E Lele! Hawaiian seabird card game for education and fun

Scott Crawford

Maui Nui Seabird Recovery Project, Makawao, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

E Lele! is a card game, based on a play style similar to Go Fish, with a custom deck of 19 species of Hawaiian seabirds and 7 seabird habitats. Sets consist of a mating seabird pair and a suitable habitat (e.g. offshore islet, sea cliff, dunes, coastal grasslands, etc), representing a thriving seabird colony. The deck also features environmental threats (e.g. predators, plastic, light pollution) and corresponding protections (e.g. predator traps, beach cleanup, dark skies) that add another layer of strategy and education.

All of the birds, habitats, threats and protections are based on actual ecological relationships, as provided by Maui Nui Seabird Recovery Project.

Games are a powerful tool for education, and can engage players in learning and caring about important areas of conservation. E Lele! (“Go Fly!”) game is designed to be easy to learn and play, but offers a depth of strategy to be engaging and fun, while educating about Hawaiian seabird names, ecology and conservation. The entire card deck is also designed with ʻolelo Hawaiʻi as the primary language, to teach Hawaiian names for the birds and terms for the habitats, threats and protections.

This workshop will include an overview of the game rules, and an opportunity for all participants to actually play a full prototype of the game. Participants will also be invited to provide feedback on its development.

Presentation Keywords

Seabirds, Seabird Recovery, Education, Games, ʻOlelo Hawaii

Agenda & Additional Required Information for Forums, Workshops, and Trainings

The workshop agenda will consist of an introduction and overview to the rules of the game, followed by an opportunity for the attendees to play the game. Tables will be broken out in groups between 3-7 people, with a card deck and a set of rules. Scott and others who have experience playing the game will move among the tables to observe the games and answer any

questions that come up during play, and also to take feedback from the participants. At the end, a brief survey will be offered for participants to give their feedback and suggestions for the game.

The goals of the workshop will be 1) to expose the participants to the game with the hopes that they will be able to find ways to incorporate it into their work in various settings; 2) to play test the game and gain feedback from the participants in order to help fine tune the rules and instructions; and 3) network and make connections that may help to find ways for the game to be distributed and find relevant audiences.

The target audience is anyone interested in Hawaii Seabird conservation, or conservation overall, and especially educators who may have an opportunity to utilize the game in their settings; and conservation educators who have an interest in games as an educational tool.

030.

Lessons from the Loʻi: Hoʻokuaʻāina and Biocultural Restoration

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Many ʻāina-based organizations (ʻāina: land and nearshore sea) have formed in Hawaiʻi since the 1970s to care for our biocultural landscapes, but these organizations sometimes struggle to receive adequate funding, volunteers, and research to scale their efforts. Hoʻokuaʻāina is an ʻāina-based organization that cultivates community through kalo farming and educational programs at their site in Kailua, Oʻahu. The primary objective of this research project was to understand and communicate the social value of Hoʻokuaʻāina. I partnered with Hoʻokuaʻāina to conduct and transcribe 40 interviews (30-90 minutes each) from 2020-2022 about peoples' experiences with and perspectives on Hoʻokuaʻāina. I chose 12 interviews that exhibited a diversity of perspectives and converted each of those interview transcripts into a short essay. I edited the essays with the interviewees and Hoʻokuaʻāina's executive directors, which included adding, trimming, reordering, and rephrasing content. This process produced a collection of 12 essays (1200-1500 words each). I found that Hoʻokuaʻāina provides a healthy educational environment that creates the potential for personal growth if people will commit themselves to the people and place for a day, a season, or multiple years. The short essays allowed community members to share their perspectives in a concise and interesting way, and the essay collection demonstrates the value of Hoʻokuaʻāina from a diversity of perspectives, which will hopefully increase support for Hoʻokuaʻāina and other ʻāina-based organizations. This project may inspire future efforts to communicate the value of community biocultural efforts in Hawaiʻi and beyond using similar methods of interview-to-essay conversion.

Presentation Keywords

biocultural, education, interviews, community, agriculture

31

I Ka Wa Ma Mua, I Ka Wa Ma Hope: A Water Planning Framework Built on Cultural Foundations

Kaleo Manuel, Katie Roth

Commission on Water Resource Management, Honolulu, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Water is the lifeblood of Hawai‘i. As the State approaches the limits of its water resources impacted by the climate crisis, effective and proactive plans and strategies are needed. The Commission on Water Resource Management (Commission) is mandated to protect and manage the use of Hawaii's water resources for the benefit of its people. The Commission is looking to traditional knowledge systems and cultural place-based practices of Native Hawaiians to reframe the way it plans for our water resources.

As Ke Kahuwai Pono – the trustee who oversees the balanced sharing of water – the Commission recognizes the role of planning in the protection of water resources by outlining a comprehensive water resource planning program called the Hawaii Water Plan. The Hawaii Water Plan is made of up of five separate plans, which are meant to bridge land and water use development.

These five plans are guided by a framework document to ensure the are integrated. Commission staff is currently updating this document to encourage a more holistic approach to water planning by building on the unique cultural foundation and values of Native Hawaiians; stewardship of water as a public trust, a living part of the ecosystem that must thrive so that we may live - Ola i ka wai.

Presentation Keywords

Water, Sustainability, Wai, Kilo, Kanawai

032.

Avian Malaria Monitoring in The Nature Conservancy's Waikamoi Preserve, Maui, HI

Hillary Foster[1], Sonia Vallocchia[1], Laura Berthold[1], Kerri Fay[2], Lainie Berry[3], Hanna Mounce[1]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Hawaiian honeycreepers have experienced rapid declines in the last two decades due to *Plasmodium relictum,* a parasite transmitted by the non-native southern house mosquito (*Culex quinquefasciatus*) that causes avian malaria. Most native Hawaiian forest birds persist at higher elevations where transmission rates of avian malaria are low enough for the birds to survive. The impacts of climate change are predicted to expand the distribution and abundance of *C.quinquefasciatus* and the prevalence of avian malaria into critical high-elevation forest bird habitat. In 2021, we set out to understand the current disease threat within the western section of The Nature Conservancy's Waikamoi Preserve. We performed seasonal systematic disease monitoring at two sites located at upper and lower elevational limits of endangered forest bird ranges. We set traps at each site to collect mosquito samples for relative abundance estimates. Blood samples from all bird species captured were collected to test for the prevalence of avian malaria within the areas. Mosquito trapping efforts did not result in the capture of *C.quinquefasciatus* during 826 trap nights, whereas blood sampling determined presence of avian malaria in both native and non-native bird species. Birds that tested positive may have contracted the disease at lower elevations and returned to higher elevations becoming carriers of the disease. However, it is also possible that birds were exposed to the parasite locally. This study as well as others will aid in the design and implementation of a landscape-level mosquito control technique using *Wolbachia* incompatibility to suppress mosquito breeding activity.

Presentation Keywords

hawaiian honeycreepers, avian malaria, conservation

33

Exploring predator-prey dynamics to support fisheries management on Hawai‘i’s coral reefs

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Track

IV. Advancement in Conservation Research and Management

Abstract

The continued global decline of coral reef environments poses complex challenges for managers and coastal communities which depend on the resources provided by these ecosystems. As critical ecological processes continue to be altered by climate change, there is an urgent need to increase our understanding of coral reef fisheries and their management. Indigenous resource managers employ tools for managing conditions to optimize trophic interactions to ultimately increase the productivity of nearshore reefs through the strategic fishing of certain trophic levels. Yet, these practices have been poorly described in contemporary conservation literature. Here, we develop a two-species dynamical systems model of predator-prey interactions in which the predator is partially coupled to the prey. By extending a classic two-species model, we explore the intricate ecological relationships in coral reef systems and simulate response to harvest effort across trophic levels to better understand predator-prey dynamics on reef environments and how Indigenous management strategies may leverage these trophic interactions to enhance abundance. We find that predator-prey systems exhibit a diverse range of dynamics depending on the interaction strength between two species, including predator dominated and prey dominated systems. Additionally, in systems with high interaction strength between the two species, we find scenarios where resource fish abundance can be increased above natural levels through optimized distribution of fishing effort amongst trophic levels. These results highlight the underlying characteristics that shape important trophic processes in coral reef communities and emphasize the relevance of Indigenous knowledge in conventional fisheries management strategies in Hawai‘i.

Presentation Keywords

coral reefs, fisheries management, predator-prey systems, historical ecology, modeling

34

Monitoring *Culex quinquefasciatus* in Kīpahulu Valley, Haleakalā National Park to Support Future Landscape-scale Mosquito Control

Lauren Smith[1], Dennis LaPointe[1], Katherine McClure[1], Mona Renee Bellinger[1], Richard Camp[1], Seth Judge[2], Ryan Monello[2], Corinna Pinzari[3], Stephanie Mladinich[4]

[1]U.S. Geological Survey, Pacific Island Ecosystems Research Center, Hawaii National Park, HI. [2]National Park Service, Pacific Island Inventory and Monitoring Network, Hawaii National Park, HI. [3]Hawai‘i Cooperative Studies Unit, University of Hawai‘i at Hilo, Hilo, HI. [4]University of Hawai'i at Hilo, Hilo, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Avian malaria (*Plasmodium relictum*) and its vector the invasive Southern House Mosquito (*Culex quinquefasciatus)*, are significant contributors to the continued decline and extinction of endemic Hawaiian forest birds. Both parasite and vector are temperature-dependent, and as mean temperatures rise, disease-free, high-elevation refugia disappear. The Incompatible Insect Technique (IIT) shows promise for suppressing *C. quinquefasciatus* populations, and Kīpahulu Valley, Haleakalā National Park, Maui, is a priority site for IIT release. To determine baseline parameters for mosquito populations in Kīpahulu, we established two study areas (Delta (975m), Palikea (1,280m)) and began monitoring in August 2022. We tested trapping efficacy for multiple trap types and lures. To date, after a 1,115 trap-night effort, Biogents Pro traps have seen the greatest efficacy, catching a total of 0.45 *Culex*/trap-night. Gravid traps and Biogents Sentinel traps caught 0.29 and 0.25 *Culex*/trap-night, respectively. At Delta, we captured 355 female *C. quinquefasciatus*, but at Palikea, only 10. No males have been captured at either site, despite the use of acoustic lures. By conducting dip surveys of streams and pig wallows, we found *C. quinquefasciatus* larvae continuously present at Delta from August-February. In contrast, we only found non-vector *Aedes japonicus* larvae in similar habitat at Palikea. To improve detection of cryptic larval mosquitoes we are developing an eDNA targeted assay and field collection protocol. Results from our study will inform future IIT control efforts with critical ecological parameters to guide releases of incompatible males, as well as criteria for monitoring the effects of IIT on wild *C. quinquefasciatus* populations.

Presentation Keywords

Incompatible Insect Technique, Culex quinquefasciatus, invasive species, mosquito suppression, avian malaria

035.

Body Language: Do Introduced Rats Have Sublethal Effects on Hawaiian Forest Birds?

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Invasive rats (*Rattus spp.*) have negatively affected Hawaiian forest bird populations, contributing to widespread declines and extinctions. Rats impact birds by spreading disease, depredating eggs, chicks, and adults, and competing for food. Often rat invasions result in lower nest success, productivity, or survival, yet physiological and sublethal impacts are less well known. Our objective was to determine if rodent control can influence physiological effects of island forest birds. To test this objective, we measured the age, fat, weight, and overall body condition of four focal Hawaiian forest bird species residing in Kauaʻi's Alakaʻi Wilderness Preserve in relation to rat abundance. Birds captured within areas with active rodent control for the past 4-7 years were compared to birds captured in areas with no rodent control. We modeled the effects of rat control on avian body condition using linear mixed models. A second year of data is currently being collected and results from both years will be reported. Preliminary results from 2022 suggested no significant effect of rodent control on body condition of the four focal species. If data continues to indicate a lack of relationship between body condition and rodent control, other management issues such as introduced disease, habitat loss, or impacts from other predators may be better at explaining possible differences in body condition of birds. This information will be important in prioritizing management actions to protect Hawaiʻi's ecologically and culturally important avian populations and contribute to a deeper understanding of rat impacts on forest bird health.

Presentation Keywords

management, predator control, birds, body condition, rats

37

Moving beyond the malaria line: Other factors beyond temperature shape patterns of avian malaria prevalence across the Hawaiian landscape

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Track

IV. Advancement in Conservation Research and Management

Abstract

The distribution and intensity of avian malaria is increasing across the Hawaiian Islands, driven by climate change, threatening multiple native Hawaiian honeycreepers with extinction. As predicted, warming temperatures over the last several decades has facilitated the expansion of malaria into high elevation forests, but simple changes in temperature does not explain all distribution changes. Using machine learning algorithms and remote sensed data of climate and terrain, we analyzed an unprecedented sample of forest birds from across the Hawaiian Islands to identify patterns and predictors of avian malaria prevalence across these native bird communities. We found that, beyond the expected strong relationship between temperature and avian malaria prevalence, multiple other factors strongly and consistently help explain spatial patterns of disease prevalence across the landscape. In particular, the interaction between temperature and precipitation produced surprising results that helped explain anomalous patterns of changing malaria prevalence across forest bird communities. By moving beyond the overly simplistic bathtub model of temperature-driven disease encroachment into remaining forest bird refuges, a much more detailed and nuanced landscape-level understanding of disease prevalence highlights challenges and opportunities for disease management in an era of rapid climate shifts.

Presentation Keywords

Hawaiian forest birds, Avian malaria, Climate change, Adaptive management, Preventing extinction

38

Updates on Surveying and Monitoring ʻŌhiʻa Health Across Hawaiʻi

Brian Tucker

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Reflecting on our past, it was less than a decade ago that Rapid ʻŌhiʻa Death (ROD) was first being noticed as a serious problem in East Hawaiʻi. Through the establishment and dedicated efforts of the multi-agency, multi-discipline ROD Working Group, we have come a long way in our understandings. A key decision early on was to systematically survey and monitor Hawaiʻi forests. This remains a high priority, and methods have been consistently followed and continually improved upon. From helicopter surveys since 2016 to developing remote sensing techniques, we strive to maintain a current aerial view of the problem to rapidly respond to new outbreaks and changing forests. This presentation will focus on the latest developments and partnerships for statewide ROD surveys and monitoring, the latest tools and technology for sharing the data, and how it helps inform research and management. The presentation will include results from the past year's various surveys, how they relate to years of compiled data, how we have developed and published ArcGIS StoryMaps and Dashboards to support key ROD messaging, and also highlight projects within the ROD Working Group that reflect the benefits of this data driven approach. As we focus on the present, we dream of a future that includes healthy native forests.

Presentation Keywords

Rapid ʻŌhiʻa Death, survey, monitoring, ArcGIS, data management

39

A Prioritized Plan for Coastal Wetland Restoration on Molokaʻi, Hawaiʻi

Judith Drexler[1], Helen Raine[2], Sally House[1], James Jacobi[3], Pūlama Lima[4], William "Butch" Haase[5], Arleone Dibben-Young[6], Nancy McPherson[7], Bret Wolfe[8]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Coastal wetlands in Hawai'i provide important habitat for endangered waterbirds and invertebrates and serve as a source for socio-cultural resources. Most coastal wetlands are degraded due to development, sedimentation, and invasive vegetation. Restoration is needed to improve habitat, ecosystem services, and socio-cultural resources. We used (1) a rapid field assessment of hydrology, vegetation, and soils, (2) a habitat analysis for endangered waterbirds, (3) spatial data on site characteristics, (4) recent sea-level rise projections for 2050 and 2100 and wetland migration potential, and (5) indigenous community preferences to conduct a GIS site suitability analysis of twelve coastal wetlands on Molokaʻi. The field assessment revealed that groundwater is a ubiquitous water source for coastal wetlands. One wetland, currently used as a loʻipūnāwai (spring pond for growing taro), was the site of such high groundwater discharge that it contained a freshwater herbaceous peatland (coastal fen) directly adjacent to the coastline. Thirty-nine plant species were found at the sites; 26 of these were wetland species, 11 of which were native. Wetland soil texture ranged from loamy sands to silty clays and mean % organic carbon content across the sites was 10.93% ± 12.24%. Three sites along the southern coast ranked highest in the suitability analysis: Kaupapaloʻi o Kaʻamola, Kakahaiʻa National Wildlife Refuge, and Ohiʻapilo Pond Bird Sanctuary. The site prioritization serves as an actionable blueprint for wetland restoration and provides an alternative approach for restoration decision-making without the need for comparison to pristine coastal wetlands, which no longer exist in Hawaiʻi.

Presentation Keywords

groundwater-dependent ecosystem, wetland restoration, coastal resilience, sea-level rise, traditional ecological knowledge

40

Oh hi! We've been in a jar for 30-years: Viability of endangered ʻōhai seeds after three-decades of ambient conditions

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Track

IV. Advancement in Conservation Research and Management

Abstract

When a jar of 30-year-old endangered species' seeds were discovered in ambient herbarium climate conditions we were naturally curious about their current state of viability. The jar contained 12,000 seeds from 9 accessions of ʻōhai, *Sesbania tomentosa*, collected from 1990 – 1992 from across the Hawaiian Islands. ʻŌhai is a federally listed endangered species in the Fabaceae (legume) family. Although it is unknown if these ʻōhai seeds were ever dried, they were stored at ambient conditions of 55% relative humidity (RH) at 20°C. International gene bank standards suggest drying seeds in equilibrium with 15% RH and stored at -18°C. To investigate seed viability, we mechanically scarified and then sowed 15 seeds from each accession at daily alternating regimes of 12 hours light and 12 hours dark at corresponding temperatures of 25/15°C. Germination was observed after 7 days and ended after 25 days. Mean final germination was 88.9% (0.08 sd) and ranged from 73-100%. In seeds with a water-impermeable seed coat (i.e. physical dormancy), such as ʻōhai, seeds can desorb but not adsorb water. Therefore, if the seeds were initially dried, although exposed to high RH for up to 30 years, seed equilibrium RH may have remained low, which may in part explain the observed high germinability. This study holds significance for managers who are working to conserve this endangered Hawaiian species and gives hope that even suboptimal conditions may still yield highly viable seeds several decades into the future.

Presentation Keywords

seed banking, ex situ plant conservation, ʻŌhai, Sesbania tomentosa, Physical dormancy

41

Decreased tourism during the COVID-19 pandemic positively affects reef fish in a high use marine protected area

Kevin Weng[1], Alan Friedlander[2], Laura Gajdzik[3], Whitney Goodell[2], Russell Sparks[4]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Humans alter ecosystems through both consumptive and non-consumptive effects. Consumptive effects occur through hunting, fishing and collecting, while non-consumptive effects occur due to the responses of wildlife to human presence. While marine conservation efforts have focused on reducing consumptive effects, managing human presence is also necessary to maintain and restore healthy ecosystems. Area closures and the tourism freeze related to the COVID-19 pandemic provided a unique natural experiment to measure the effects of decreased tourism on fish behavior in a high use no-take marine protected area (MPA) in Hawai`i. We found that when tourism shut down due to COVID restrictions in 2020, fish biomass increased and predatory species increased usage of shallow habitats, where tourists typically concentrate. When tourism resumed, fish biomass and habitat use returned to pre-pandemic levels. These displacement effects change fish community composition and biomass, which could affect key processes such as spawning, foraging and resting, and have knock-on effects that compromise ecosystem function and resilience. Managing non-consumptive uses, especially in heavily-visited MPAs, should be considered for sustainability of these ecosystems.

Presentation Keywords

COVID-19, fishes, marine protected area, tourism management, human-wildlife interactions

42

Diving in Deep: Deep Learning for the Identification of Yellow Tang (*Zebrasoma flavescens*) Grazing Behavior in Hawai'i

Trevor Nishida, John Burns, Drew Gray

University of Hawai'i at Hilo, Hilo, Hawai'i

Track

IV. Advancement in Conservation Research and Management

Abstract

Advancements in underwater camera technologies have allowed various sectors to expand the breadth and depth of their studies into underwater environments. The use of these cameras, however, results in copious amounts of video data being collected. For researchers to extract information of interest from these data, they must be processed manually, costing valuable resources spent in time and labor. The use of artificial intelligence to automate video data processing provides a solution to this portion of the problem which can be cost effective and save substantial amounts of time. My project explores the possibility of using machine learning algorithms to track grazing behavior of a common Hawaiian reef fish, the yellow tang (*Zebrasoma flavescens*). Footage of yellow tang feeding behavior was collected from an underwater camera located in Kona, Hawai'i, U.S.A. This footage was split into still images which were annotated by a human. A machine learning model was trained on an 87:9:5 ratio split of training:validation:test datasets from a total of 3600 annotated still frames. The model was able to successfully detect feeding behaviors on videos it had not seen during training (Recall: 96.92%, Precision: 80.81%). These results demonstrate that it is possible to apply machine learning to detect behaviors in aquatic organisms. Further analysis of the behavioral data extracted from videos can be used as a tool to quantify health in underwater environments, providing policymakers with the information required to make informed decisions for the preservation of these environments.

Presentation Keywords

machine learning, artificial intelligence, yellow tang

043.

Pipe Dreams: Addressing the Wastewater Workforce Shortage In Hawaiʻi to Improve the Health of Nearshore Ecosystems

Graeme Lander, Stuart Coleman

Wastewater Alternatives and Innovations, Honolulu, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

This presentation focuses on the urgent need to invest in wastewater workforce development in Hawaiʻi to address untreated wastewater and its impact on the environment and public health. The state legislature has mandated the conversion of 83,000 cesspools by 2050 meeting this goal requires significant investment and an increase in the wastewater workforce. The presentation highlights the environmental pressures and consequences of untreated wastewater on reefs and other sensitive ecosystems; drawing on outcomes from studies focusing on limu health and impacts of nearshore wastewater plumes, it will explore the potential for degradation of groundwater resources, contamination of coastal waters, and the spread of diseases that threaten Hawaiʻi's unique ecosystems, cultural resources, and communities. The lack of a trained and knowledgeable workforce supporting conversion efforts will make it difficult to implement effective solutions and achieve the necessary scale of change. The presentation introduces the Workforce-4-Water program as an important first step in overcoming this problem on Maui and Hawaiʻi Island. The risks of inaction are clear and the repercussions are significant. Therefore, it is imperative to raise public awareness, develop a trained workforce, and implement effective solutions to protect Hawaiʻi's environment and communities for generations. The presentation concludes by emphasizing the urgent need for investment in wastewater workforce development to address the pressing issue of untreated wastewater and its impact on the environment and public health in Hawaiʻi.

Presentation Keywords

Workforce Development, Cesspools, Environmental Impact, Public Health Impact, Community Impact

44

An Underground View of Hawaiian Forests: Assessing Biodiversity in Lava Tube Cave Roots

Amir Van Gieson, Megan Porter, Mireille Steck, Rebecca Chong

University of Hawai‘i at Mānoa, Honolulu, Hawai‘i

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The lava tube caves of Hawai‘i are home to diverse communities of endemic cave-adapted arthropods that rely on “root galleries” formed from surface plants as they penetrate into caves. Although plant roots are the main source of nutrients in these underground ecosystems, little is known about their species identities or diversity. In this study, we use a genetic approach to characterize biodiversity and intraspecific genetic diversity in cave root samples from three volcanoes across the island of Hawai‘i. Using three genetic markers, one nuclear and two plastid, we identify 84% of our root samples (41 of 49) as the endemic ‘Ōhi‘a lehua (Family Myrtaceae: *Metrosideros polymorpha*), a declining evergreen, while the remaining samples include several non-native species. We find that root biodiversity varies between volcanoes and that Hualālai, the oldest of the three sampled volcanoes, possesses the lowest proportion of ‘Ōhi‘a roots. Further, phylogenetic analyses incorporating other Pacific *Metrosideros* sequences suggest that ‘Ōhi‘a forming root galleries may be genetically distinct within Hawaiian ‘Ōhi‘a. While ‘Ōhi‘a are one of the first known plants to colonize fresh lava flows, pioneering the formation of Hawaiian forests, these results confirm that ‘Ōhi‘a is also an essential resource for maintaining underground biodiversity and highlight the implications of its ongoing decline.

Presentation Keywords

Caves, Metrosideros polymorpha, Island biogeography, Biodiversity, Genetic variation

45

Post Release Monitoring of *Mompha trithalama* Along an Elevational Gradient

Ellyn Bitume, Rosalie Nelson, Stuart Mize, Tracy Johnson

USDA Forest Service, Hilo, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Miconia crenata (formerly *Clidemia hirta*) is a highly invasive tropical shrub that disrupts native ecoystems in Hawaii by outcompeting other plant species. While biological control efforts have been attempted with the release of several agents, including the moths *Carposina bullata* and *Mompha trithalama*, success has been limited, and little is known about factors affecting establishment and impact. To quantify *M. trithalama* impact on seed count and viability, we collected ripe fruit and counted the number of seeds and tested germination rates of fruit infested or not infested with *M. trithalama*. Fruit attacked by *M. trithalama* produced significantly fewer seeds than clean fruit and germinated at significantly lower rates. In 2021, we began surveys to quantify the presence of *M. trithalama* along an elevational gradient. We collected fruit at sites along the elevational gradient and recorded the number of fruit infested with *M. trithalama*. These surveys were repeated at intervals of 2-4 months for two years to capture seasonal differences. Elevation had a significant effect on biocontrol, with less infestation of fruit by *M. trithalama* at the highest elevations. There also was a significant interaction between elevation and collection date, suggesting seasonal shifts in abundance of *M. trithalama* at higher elevations. *Carposina bullata* was thought not to have established after its release in 1995, however we recovered a total of 229 *C. bullata* larvae from our fruit collections from multiple locations on Hawaii Island. These results demonstrate the importance of long-term post-release monitoring and climate matching for effective biological control.

Presentation Keywords

biocontrol, invasive plants, invasive species, climate matching

46

Hawai‘i Forest Monitoring Efforts and Mortality Patterns Associated with Rapid ‘Ōhi‘a Death

Nai'a Odachi[1], Ryan Perroy[1], Brian Tucker[2], Dustin Swan[3], Patricia Perez[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Widespread mortality of the keystone ‘ōhi‘a tree (*Metrosideros polymorpha*) across Hawai‘i has been attributed to the fungal pathogen *Ceratocystis lukuohia*. ‘Ōhi‘a crowns infected by this vascular disease follow predictable patterns of color changes, ultimately resulting in complete defoliation and death within a few months. To monitor the progression of forest mortality, we began collecting repeat visible wavelength imagery over specific areas via small unmanned aerial systems (sUAS) and helicopter flights in 2016, and currently monitor more than a dozen sites statewide. Additional aerial and satellite imagery, obtained with assistance from federal partners and funding from the National Geospatial Agency and National Reconnaissance Office, were used to extend the time series and establish baseline forest conditions for each site. We identified all living, potentially infected, and dead ‘ōhi‘a trees using a symptomatic leaf color classification system to follow progressions over time. Spatiotemporal ‘ōhi‘a mortality patterns generally show rapid increases during initial infection years, followed by slower but persistent mortality rates, with maximum cumulative mortality reaching 35% on Hawai‘i Island. We have also used the satellite imagery to greatly expand monitoring and track ‘ōhi‘a mortality over 753,219 acres in East Hawai‘i from 2013 to 2021. We compared these results with biannual helicopter-based digital mobile sketch mapping (DMSM) surveys from 2016 to 2021. These datasets complement one another and broadly reaffirm observed mortality patterns. We are in the initial stages of creating an automated suspect identification system which will identify outbreak areas and potentially infected trees from satellite imagery.

Presentation Keywords

Rapid 'Ōhi'a Death, Remote Sensing, 'Ōhi'a, Aerial Imagery, Satellite Imagery

047.

Special Ecological Areas: A Classic Prioritization System for Restoring Native Ecosystems at Hawai'i Volcanoes National Park Since 1984

Stacey Torigoe[1], Jonathan Maka'ike[1], Dwayne Montoya-Aiona[1], Daniel Duda[2]

[1]Hawai'i Volcanoes National Park, Hawai'i National Park, HI. [2]Pacific Cooperative Studies Unit, University of Hawai'i, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

When it became apparent in the early 1980s that invasive plants like kahili ginger and faya tree were not eradicable from Hawai'i Volcanoes National Park, managers created the Special Ecological Areas (SEA) system to prioritize areas for ecological restoration with limited resources (Loh et al. 2014). These areas were selected based on specific criteria including feasibility of management, representativeness, relevance to community members, visitors and researchers, and biodiversity.

Today, many of the underlying strategies, as well as strengths and weaknesses of the SEA approach, remain the same nearly 40 years later. Over the years, new SEAs have been added to represent new lands and ecosystems, while some areas have been lost entirely. The flexibility and overall ability to manage habitats long-term under constant invasional pressure makes the SEA approach a classic and effective way to maintain representative areas of native Hawaiian ecosystems. Initial labor inputs are high in the knockdown phase, but maintaining these areas is significantly easier in following years.

As we look to the future, new tools and techniques such as Field Maps GPS forms, aerial precision spray and incision point application of new herbicides may help regain ground in areas that have been invaded since work interruptions caused by a catastrophic eruption in 2018 and subsequent global pandemic. However, this classic prioritization system still has relevancy for land managers of natural areas across Hawaii who are tasked with controlling invasive species to protect native ecosystems with inadequate resources.

Presentation Keywords

invasive plants, invasive species management, scaling up, land management, restoration

48

Teens Creating Conservation Innovations: Students Share Their Hawai‘i Youth Sustainability Challenge Projects

Elia Herman[1], Lindsay Todd[1], Natalie McKinney[2]

[1]Kupu, Honolulu, HI. [2]Kōkua Hawai‘i Foundation, Hale‘iwa, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

The Hawai‘i Youth Sustainability Challenge (HYSC), a program of Kupu and Kōkua Hawai‘i Foundation, helps students develop innovative solutions to conservation challenges in their schools and communities. Students address challenges they have personally identified or tackle “community partner challenges” (i.e. top problems confronted by organizations across the state that would benefit from creative solutions developed by students). The 2022-2023 cohort comprises 17 teams, three of which are addressing community partner challenges and four of which are legacy projects from previous years. These teams consist of 26 student leads in grades 9-12 at 14 schools across two islands: O‘ahu and Moloka‘i. Student projects include: investigating renewable energy sources, innovating new technologies, reducing waste, addressing food insecurity, conserving native forests, combating coastal erosion, protecting native species, and more. HYSC awards teams up to $1,000 to conduct projects through Spring 2023 with the support of coaches and mentors. New to the program this year was HYSC’s training day “*Lā Ho‘ohui ‘Ike*: A Day of Gathering Knowledge” where the cohort came together to elevate each other’s projects through shared learning and participate in training, skills building, and mentorship to ensure successful project implementation and personal toolkit building to help them in their work now and in the future. During this forum, six exemplary project teams will present their work and engage in meaningful exchange with the audience as young people building a more sustainable Hawai‘i. The forum also provides an opportunity for intergenerational learning and will help aspiring students build their networks.

Presentation Keywords

Youth, Innovation, Challenges, Solutions, Sustainability

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda (2 hours):

- Overview of Hawai‘i Youth Sustainability Challenge (including new program pieces) by Kupu and Kōkua Hawai‘i Foundation staff, including 1 min video (5 min)

- Student Presentations and Project Demonstrations (as applicable) (6 presentations x 8 min = 48 min)
- Facilitated Q & A after each presentation (6 presentations x 2 min = 12 min)
- Small Group Breakout Table Discussions (rotating) (6 rounds x 7 min = 42 min)
- Crowdsourcing for future project ideas/community partner challenges and Closing (13 min)

List of Speakers:

- Elia Herman, Senior Program Manager, Kupu
- Lindsay Todd, Program Manager, Kupu
- Natalie McKinney, Chief Program Officer, Kōkua Hawai‘i Foundation
- 6 student project teams (presenting teams will be selected in May/June 2023 at the completion of the program and upon submission of their final reports)

Innovative Audience Engagement Techniques:

The audience will get the chance to engage with the presenting students throughout the forum via the short, facilitated Q&A sections after each student presentation to offer feedback on the students' projects and pose any immediate questions they might have. This will allow the students to directly address questions and engage with the audience on the topics of their projects. To ensure continual audience engagement throughout the presentation portion of the forum, polls posing questions to the audience will be launched at the start of the forum and during transitional periods between presentations using platforms easily accessible via the audience's personal devices (e.g. Mentimeter). These polls will function to give our student presenters context for who makes up their audience by asking for audience demographic information as well as frame the context of the forum for the audience by having them answer questions related to student involvement in conservation and sustainability topics. Following the presentation portion of the forum, we will have small group "breakout" table discussions in which each student project team will have their own table for audience members to engage with them directly in brainstorming, connection building, general discussion, etc. We will conduct these small group sessions in rounds to ensure the audience has the opportunity to speak with each student group individually if so desired. Finally, we will bring the audience and our student presenters back together for a closing in which the audience will have the chance to provide ideas for future student projects and/or propose community partner challenges for the next HYSC program term.

Goals and Target Audience:

The goal of the forum is to provide a space to inspire the audience (by giving them the chance to hear about the students' passion and innovative work) and empower the students (by giving them the opportunity to share their work in a formal setting in front of respected professionals). Furthermore, the goal is for both professionals and students to exchange ideas to help improve each other's work and for the students to make connections they can draw on in the future. The target audience includes resource managers and practitioners, as well as formal and non-formal educators.

049.

Merging ecology and genetics to understand the cryptogenic invader *Chondria tumulosa* in Papahānaumokuākea

Taylor Williams[1], Heather Spalding[2], Kristina Hill-Spanik[2], Randall Kosaki[3], Brian Hauk[3], Solenn Stoeckel[4], Stacy Krueger-Hadfield[1]

[1]University of Alabama at Birmingham, Birmingham, Alabama. [2]College of Charleston, Charleston, South Carolina. [3]Papahānaumokuākea Marine National Monument, NOAA, Honolulu, Hawai'i. [4]INRAE, Université de Rennes, Le Rheu, France

Track

IV. Advancement in Conservation Research and Management

Abstract

Chondria tumulosa is a cryptogenic red alga that was found acting invasively at Manawai (Pearl and Hermes Atoll) and Kuaihelani (Midway Atoll), Papahānaumokuākea Marine National Monument. *Chondria* was first documented in low abundance at Manawai in 2015, but by 2019 formed large mats that smothered native corals and algae, reducing the diversity and abundance of reef organisms on the scale of thousands of m^2. We hypothesized that the high biomass of *Chondria* was driven by asexual reproduction, largely through vegetative fragmentation. Most thalli were vegetative at the time of sampling at Manawai in 2019. All reproductive (~20%) and genotyped thalli (N=41) were tetrasporophytes. We observed in situ thallus fragmentation that was supported by the presence of 17 repeated multilocus genotypes and by negative F_{IS} values (indicating heterozygote excess) with large variance over loci, as expected due to asexual reproduction. Our genetic data hint at rapid expansion, thallus fragmentation, and tetrasporophytic dominance, which are consistent with other red macroalgal invaders studied to date. In additional sampling from Manawai in 2021 and at Kuaihelani in 2022, reproductive gametophytes were found in low abundance (<1%), suggesting on-going demographic events that require further investigation. *Chondria* has the potential for rapid spread throughout the PMNM and beyond. However, these data also point to the importance of phycological expertise to accurately identify not only species but stages within complex life cycles. These data are integral to management decisions and to progress our understanding of the evolution and maintenance of biodiversity.

Presentation Keywords

Invasive species, Macroalgae, Reproductive systems, Population genetics

50

USFS Hawai‘i Forest Inventory Remeasurement: Initial change results

Olaf Kuegler[1], Julian Dendy[2], Ashley Lehman[3], Jonathan Marshall[4], Suzanne Owen[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

The USDA Forest Service Forest Inventory and Analysis (FIA) Program recently finished the first remeasurement of Hawai‘i’s forest. Forest inventories are assessed every 10 years and provide long-term monitoring data on both public and private lands. The forestland area FIA estimates in Hawai‘i drastically increased from 1,471 thousand acres in 2010 to 1,808 thousand acres in 2019. Most of this change was due to forestland incorrectly classified due to poor imagery as non-forest previously (263,000 acres), followed by an increase in access granted by local landowners (77,000 acres) in 2019. Field crews were also granted access to both Moloka‘i and Kaho‘olawe in 2019, which were not measured previously. Actual on-the-ground net changes included only 25,000 acres.

Aboveground live tree biomass based on plots that were previously and currently recorded as forestland increased by 11 million tons (SE=3.4). Despite the introduction of Rapid ‘Ōhi‘a Death to Hawai‘i, ‘Ōhi‘a lehua (*Metrosideros polymorpha*) population was relatively stable: biomass increased by 1.8 million tons (SE=1.2); the number of ‘Ōhi‘a lehua trees decreased by 12.3 million (SE=10.3) from 338.5 (SE=36.0) to 326.2 (SE=35.8) million. Unfortunately, the biomass of invasive species, strawberry guava (*Psidium cattleianum*) increased by 34% compared to 2010 (2.5 million tons, SE=0.4).

Long-term forest monitoring by FIA, using nationally standardized plot design and methods, is vital to understand how Hawaiian forests change over time and for managing and conserving natural resources. However, FIA data users should be aware of the forestland differences between these two inventories.

Presentation Keywords

Forest Inventory, ‘Ōhi‘a lehua, strawberry guava, Change analysis

51

Maternity Roost Use and Fidelity of ʻŌpeʻapeʻa, the Hawaiian hoary bat (*Lasiurus semotus*), on Hawaiʻi Island

Kristina Montoya-Aiona[1], P. Marcos Gorresen[2], Karen N. Courtot[1]

[1]U.S. Geological Survey, Pacific Island Ecosystems Research Center, Hawaiʻi National Park, HI.
[2]Hawaiʻi Cooperative Studies Unit, University of Hawaiʻi at Hilo, Hilo, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The Hawaiian hoary bat (*Lasiurus semotus*) or ʻōpeʻapeʻa, is a federally and state listed endangered species, and is the only extant, native terrestrial mammal in the Hawaiian archipelago. It is a solitary and foliage-roosting species that generally roosts alone or in mother-pup family groups. We examined ʻōpeʻapeʻa roost use and fidelity at maternity roosts from May 2018 through August 2021. Bats were captured, radio-tagged, and tracked to roosting locations on Hawaiʻi Island. During the course of tracking and revisiting known roost trees and surrounding areas, additional roost trees were identified with unknown, not previously captured bats, wherein three were classified as maternity roost trees where an adult female was sighted roosting with pups and displaying maternal behavior. A total of nine maternity roost trees were identified in six tree species, including native and non-native species. Notably, we located roost "hot-spots" in large and densely foliated trees that were consistently used by both multiple maternity groups and single bats in different parts of the same tree and over several reproductive seasons. Because some individuals were not marked and identified among years, it is unclear if these "hot-spots" were due to natal philopatry or were simply used by otherwise unrelated bats. This study broadens our understanding of the habitat requirements and maternity roost ecology of ʻōpeʻapeʻa and provides the first accounts for the species of multiple maternity roosts in proximity to each other and in use concurrently.

Presentation Keywords

ʻŌpeʻapeʻa, bat, habitat selection, roost fidelity, ecology

52

Comprehensive Arthropod Surveys Reveal Hidden Diversity in Fragmented Native Habitat

Karl Magnacca

Center for Conservation Research and Training, Honolulu, HI. Native Ecosystems Protection & Management Program, DLNR, Honolulu, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

part of the Betsy and Wayne Gagne Memorial Invertebrate Conservation Symposium I

A comprehensive survey of terrestrial invertebrates, focused on insects, was conducted at the Pacific Missile Range Facility (PMRF) installations at Barking Sands and Kōkeʻe, using a wide variety of collecting methods to obtain the most complete picture possible of the arthropod diversity, including passive and baited traps, hand collecting, and targeted searches of specific habitats. Barking Sands was dominated by alien species, but still had considerable diversity of native shoreline flies and true bugs. The Kōkeʻe montane mesic forest sites consisted of small fragments of high-quality native forest in a matrix of invasive weeds, but nevertheless were extremely diverse, with over 700 total species found. Over 1/3 of the nearly 450 endemic species are undescribed, highlighting the need for greater taxonomic effort. A number of rare endemics were found, including the flightless stag beetle *Apterocyclus honoluluensis*, several species of click beetles and false click beetles, the coastal fly *Bryania bipunctata*, and the listed endangered pomace fly *Drosophila musaphilia*. This was the first attempt at a fully comprehensive insect survey in a native forest site, and the data on abundance and taxa collected by different methods will help inform future surveys targeted towards rare taxa.

Presentation Keywords

insects, survey, Kauai, endangered species

54

Hawai‘i-Japan invasive mongoose countermeasures research partnership in action

Robert Sugihara[1], Takamichi Jogahara[2], Sawako Horai[3]

[1]USDA National Wildlife Research Center, Hilo, Hawaii. [2]Okinawa University, Naha, Okinawa, Japan. [3]National Institute for Minamata Disease, Kumamoto, Japan

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

The small Indian mongoose (Urva auropunctata [syn. Herpestes auropunctatus]) is a common alien mammalian predator negatively impacting the biodiversity of fragile native species in both the Hawaiian Islands and globally, including the southern Japanese archipelago. Introduced as a biocontrol species to reduce rat damage in sugarcane fields in Hawai‘i (1883) and to control poisonous snakes in Okinawa (1910) and Amami-Oshima, Kagoshima, Japan (1979), mongooses pose a serious threat to native ground-nesting birds, are carriers of diseases, and a serious biosecurity risk of accidental introductions in mongoose-free areas of both countries.

Since 2006, U.S. Department of Agriculture’s National Wildlife Research Center, Hawai‘i Field Station researchers have collaborated with Japanese governmental agencies, NGOs, academic institutions and other practitioners involved in better understanding the ecological dynamics and impacts of invasive mongooses at two geographically diverse regions. Such cooperative exchanges of innovative research findings and control implementation ideas have resulted in mutual benefits towards the development of control strategies for this serious predator applicable for both Hawai‘i and Japan and other regions worldwide.

We discuss some case studies of this successful research partnership, including preliminary experimental trials conducted in Hawai‘i and Japan validating the efficacy of a novel toxic bait and delivery system for mongooses. Another collaboration evaluates mongoose as a bio-indicator species for assessing environmental heavy metal contamination. Analyses of mongoose tissue samples from various sites in Hawai‘i and Japan suggest a strong relationship between chemical residues and environmental health and agricultural and industrial land use patterns.

Presentation Keywords

Invasive mongooses, Research partnership, Chemicals, Environmental health, Control method

55

A Panicle of Persistent Partners; 20 years of Plant Extinction Prevention Efforts on O‘ahu

Susan Ching[1,2], Kobey Togikawa[2]

[1]Department of Land and Natural Resources, Division of Forestry and Wildlife, Pearl City, Hawaii. [2]Plant Extinction Prevention Program, Pearl City, Hawaii

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

O‘ahu is home to its own unique and diverse flora with over 100 species that meet the Plant Extinction Prevention Program’s (PEPP) criteria of fewer than 50 wild individuals or are in danger of becoming a PEPP species. The O‘ahu PEPP/Division of Forestry and Wildlife (DOFAW) rare plant team has been hard at work on these species over the last 20 years. A consequence of working in remote habitats with small, isolated, populations and in areas that other conservation organizations may not focus means the work is slow going, arduous, and challenging. But there are numerous success stories. Highlighting some of our partnerships include: A tale of two Hāhā with Kualoa Ranch and Mānoa Cliffs Restoration; Slow and Steady Progress with Board of Water Supply; Seed investments with Kamehameha Schools; and Continuing Questions through Research Collaborations. Successes have ranged from preventing extinction through ex situ collections, incorporating PEPP species into restoration sites, and promoting new research on rare taxa. Stories of success would not be possible without our partners, landowners and dedicated conservationists, who work closely with the PEPP/DOFAW team to accomplish our goals. With these partners, we look forward to the future of not only preventing extinction but have shared dreams of seeing PEPP species thrive and multiply; species by species, site by site, seed by seed.

Presentation Keywords

Endangered, Plant, Conservation, Partners, Management

056.

Taxonomic Identification of Native and Nonnative Sponges in Hawai‘i

Rachel Nunley, Jan Vicente, Emily Rutkowski, Rob Toonen

Hawai'i Institute of Marine Biology, Kāne‘ohe Bay, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Sponges are a diverse group of organisms that are widely understudied, but critically important species in marine environments. Sponges provide filtration in many marine ecosystems and form the base of the food web for nutrients that support coral reef biodiversity. Stony sponges of the order Tetractinellida have long been culturally important but are not well studied in Hawai‘i. For example, their extremely tough tissues allowed Native Hawaiians to use these stony sponges as sandpaper. Likewise, the bioactive chemicals produced by these sponges were also used in traditional medicine, such as crushed ‘ana sponges being given with water to treat ‘ea (thrush). This study seeks to identify native and nonnative Tetractinellid sponges around O‘ahu. Through a combination of genetics and morphological taxonomy, we can record and identify at least 4 new species. Taxonomic identification of these culturally important sponges will better help understand their diversity and distribution throughout the Hawaiian Islands and allow resource managers to protect them in the future.

Presentation Keywords

sponges, taxonomy, genetics, tropical pacific

57

Identify Plants Like A Pro: Evaluating and Ranking Plant ID Apps for Conservation and Management

Kevin Faccenda[1], Molly Murphy[2], Charles Chimera[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Accurate and timely identification of unfamiliar plant species plays an integral part in early detection of spreading or newly emerging invasive weeds. The ability to identify or recognize native plant taxa can also facilitate conservation of native plants and ecosystems by fostering a sense of stewardship over and recognition of Hawai'i's unique and threatened flora. Previously the purview of trained botanists, plant identification is being democratized with the proliferation of computer vision based plant identification apps, and the ubiquity of smartphone technology. The observations and input of the general public and citizen scientists using these apps have also produced large amounts of data and have expanded the potential reach of early detection and conservation programs, but their utility is dependent on the accuracy and reliability of their identifications. To evaluate their accuracy, we tested several of the most popular plant ID apps using expert-identified images of cultivated, invasive, and native plants. We also compared the apps' performance on common vs rare plants in each category. We quantified each app's accuracy of identification to species, genus and family, as well as accuracy of alternative identifications, and ranked them by overall performance. Identification accuracy ranged from 0-100% depending on the app and type of plant. Based on our results, we recommend iNaturalist for both professionals and the public, discuss limitations of this technology, and provide a framework for future evaluation and utilization of larger data sets for conservation and invasive species management.

Presentation Keywords

plant ID, invasive plants, native plants, iNaturalist

58

Predator Impacts on Hawaiian Stilt (*Himantopus mexicanus knudseni*) Nesting Success: Which Species Pose the Highest Risk?

Lauren Katayama, Kristen Harmon, Jessica Idle, Melissa Price

University of Hawai‘i at Mānoa, Honolulu, Hawaii

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Predation and abandonment are common causes of nest failure for ground-nesting birds, but managing these threats for endangered species remains challenging due to variations in predator impacts, particularly between native and invasive predators. The Hawaiian Stilt (Ae‘o, *Himantopus mexicanus knudseni*) is an endangered waterbird whose eggs and chicks are vulnerable to a variety of native and invasive predator types including mammals, birds, reptiles, amphibians, and invertebrates. This study aimed to identify differential impacts among all potential predators of Ae‘o eggs. Motion-activated cameras were deployed at the nest to identify potential predators as well as nest fate. The presence of invasive mammals, including mongoose, cats, and rats was significantly associated with nest predation ($p= 0.03$, $z= 2.074$). Importantly, although invasive amphibians and birds were also detected by nest cameras, as well as native avian predators including Pueo (Hawaiian Short-eared Owls) and ‘Auku‘u (Black-crowned Night Herons), our results suggest the majority of nest predation events were associated with invasive mammals. There was no relationship between predator type and nest abandonment, but the ability to detect relationships may have been limited by the small number of abandoned nests during the study period. Despite intensive efforts toward mongoose and cat removal at sites, mammals were still significantly associated with nest predation events, highlighting the importance of approaches that result in the complete absence of invasive mammals, such as mammal exclusion fencing. Our study is consistent with other evidence, highlighting the benefits of invasive mammal eradication in tropical island systems.

Presentation Keywords

Hawaiian Stilt, Predators, Wetland, Nonnative , Invasive

059.

Ecological Niche Modeling of Hawaiian Dryland Ferns: Conservation Implications in the Face of Competition and Land Use Change

Krystalyn Edwards-Calma[1], Laura Jimenez[2], Carrie Tribble[3], Rosana Zenil-Ferguson[4], Miles Thomas[5]

[1]University of Hawai‘i at Mānoa, Honolulu, Hawai‘i. [2]Universidad de Chile, Santiago, Chile. [3]University of Hawai’i at Mānoa, Honolulu, Hawai‘i. [4]University of Kentucky, Lexington, Kentucky. [5]Bernice Pauahi Bishop Museum, Honolulu, Hawai‘i

Track

IV. Advancement in Conservation Research and Management

Abstract

Competition from non-native species and habitat loss are common threats to Hawaiian biodiversity. These forces may act synergistically to increase competition for decreasing habitat availability. While many ferns prefer moist environments, some ferns are adapted to drylands. In Hawai‘i, these include native ferns, such as endemics *Doryopteris decipiens*, *D. decora*, and *D. angelica* and indigenous *Pellaea ternifolia*. However, non-native but closely-related ferns *Cheilanthes viridis*, *Pityrogramma calomelanos*, and *Pityrogramma austroamericana* typically also occur in drylands and may compete with the native species for habitat. The extent to which these ferns share similar fundamental niches (the set of environmental conditions in which they can survive) is unknown, as are the potential compounding effects of land-use change. We took an ecological niche modeling approach that uses fine-resolution climatic variables and occurrence data from herbarium specimens to estimate the modern distributions of these native and non-native ferns. We quantified the degree to which non-native ferns occupy similar regions of niche space, and project remaining available habitat given land use change Hawai‘i. We found significant overlap in estimated niches, with a few exceptions. Our results suggest that non-native ferns are likely not competing for the exact same environmental conditions as the natives *P. ternifolia*, *D. decipiens*, and *D. decora*. However, non-natives likely share environmental preferences with *D. angelica*, an endangered species, suggesting that future research and conservation efforts should examine the potential impact of non-native ferns on *D. angelica*’s few remaining populations.

Presentation Keywords

Hawaiian ferns, Pteridaceae, ecological niche modeling, climatic niche, land use

061.

Manu o Kū of Diamond Head: Breeding Behavior of an Indigenous Seabird on the Kapiʻolani Community College Campus

Lee Perez[1], Nicole Buyukacar[2], Kelly Furuya[1], Emma Ho[1], Taylor Kim[1], james lee[1]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The Manu o Kū or white tern (Gygis alba) is an indigenous seabird, named the official bird of the City and County of Honolulu. The species is listed as threatened by the State of Hawaiʻi and protected under the Migratory Bird Treaty Act. In Spring 2014, Kapiʻolani Community College (KapCC) students initiated a Manu o Kū monitoring program on the campus, which is now an ongoing undergraduate research project. During the semester, surveys for nests were conducted between 9:45 a.m. and 12:00 a.m. twice a week. Once a nest was located, students observed nesting behaviours from an unobtrusive location at a minimum distance of 10 m. Nesting locations were recorded and mapped using GPS. To communicate with the college's Auxiliary Services, a protocol was established to notify staff of the birds' presence. Data from the KCC campus is now shared with the larger White Tern Hui project. During the 2012-2023 academic year, six undergraduate students participated in the research, most of whom are working towards undergraduate degrees in biology or natural resources. Here the undergraduate researchers report on the most recent breeding season and the cumulative analysis of our multi-year monitoring of the KapCC campus population. We also report on a series of unusual mortality events that occurred during Fall 2019, indicating possible barn owl predation. The project continues to serve as an avenue for building capacity among local students for avian monitoring and survey techniques.

Presentation Keywords

Manu o Kū , white tern, avian, ecology, zoology

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Ecosystem effects of loko iʻa restoration in Kāneʻohe Bay, Oʻahu, Hawaiʻi

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Track

IV. Advancement in Conservation Research and Management

Abstract

Hawaiʻi currently imports about half of all consumed seafood (around 15 million lbs per year), while local aquaculture supplies only 20,000 lbs per year. However, there is a recent push for restoration of loko iʻa (Indigenous aquaculture systems) which could significantly increase the amount of local seafood available. The objective of this study was to evaluate how loko iʻa restoration affects fish populations and fisheries harvest in Kāneʻohe Bay, Oʻahu. To do so, we constructed a food web model representing nutrients, phytoplankton, fish (focusing on ʻamaʻama), and fisheries in three distinct habitats within Kāneʻohe Bay: loko iʻa, inshore estuary and offshore estuary. We explored the interactive effects of loko iʻa area, fishing effort, and fish dispersal rates on fish density and fisheries harvest. We found increasing loko iʻa size not only increased loko iʻa fish density and fisheries harvest but had the potential to supplement estuary fish populations and fisheries harvest under certain scenarios. We also identified a tradeoff where at high fish dispersal rates, larger loko iʻa provided maximal benefits to the estuary fish population and harvest, while at low fish dispersal rates, smaller loko iʻa were more beneficial to estuary fish populations and harvest. As expected, loko iʻa created a surplus of fish within the pond. Our results support the idea that loko iʻa restoration could positively impact conservation efforts by simultaneously increasing local fish availability, both inside the loko iʻa and through supplementing estuary fish stocks.

Presentation Keywords

loko iʻa, aquaculture, fisheries, restoration, modeling

063.

Coastal Ecosystem Accounting for Hawai‘i

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

This project applies natural capital accounting to systematically assess coastal ecosystems' contribution to the Hawaiian economy and engage with decision makers to catalyze transformative change in conservation and economic policy. Less than 5% of Hawaiian coastal waters are under some form of management, and most of the coastline is impacted by climate change, land use, and resource harvest levels that threaten coastal functioning. Hawai‘i's reliance on coasts for wellbeing and revenue, sustainability-driven policy environment, and blend of worldviews make the state a uniquely powerful place to demonstrate and refine the science of coastal natural capital accounting and to engage with decision-makers. Moreover, the state‘s pathway using accounts to inform coastal policy can serve as an example for Pacific island neighbors.

An ecosystem account begins with synthesizing information about the extent, condition, and use of the natural environment of the landscape and seascape, focusing on locally relevant biophysical metrics of natural capital assets and ecosystem services. The process is designed to provide an evidence base for understanding and mapping natural capital, evaluating its status and trends, and exploring its relationship with priority economic sectors, livelihoods, and users.

Building the accounts involves compiling time series data for land and coastal habitats. Second, we synthesize existing data for relevant conditions such as fish biomass, coral cover, and water quality. Third, we quantify use with a focus on fisheries, recreation, tourism, and shoreline protection. Outputs, including ecosystem extent, condition, and use accounts, are targeted to community, state, and federal partners.

Presentation Keywords

natural capital accounting, ecosystem accounting, coastal habitat, ecosystem services, valuation

64

Digital Reefs: Coral Reefs at Your Fingertips

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

A diverse consortium of partners, led by Woods Hole Oceanographic Institution, in close collaboration with The Nature Conservancy, is building the world's first coral reef digital twin – a four-dimensional digital replica of the dynamic coral reef environment, at spatial and temporal scales designed to meet management needs. "Digital Reefs" will empower stakeholders with universal access to near-real time data and what-if scenarios via intuitive, interactive visualizations delivered to desktops, laptops, and, eventually, even mobile phones. Leveraging 21st century Digital Twin technology, high performance computing, and cloud system services not available 5 years ago, Digital Reefs provides meter-scale visualizations of reef bathymetry, of past, present, and future ocean current and temperature conditions, down to 150 m depth. Users will be empowered with tools that enable simulations of larval connectivity, sewage and plastics dispersal, and feasibility testing of various management options. For example, coral restoration practitioners will be able to virtually plant corals on select restoration plots and determine where currents will carry their offspring. Reef managers charged with bolstering adaptation to climate change will be able to implement conservation and restoration strategies informed by future projections of reef conditions and locally relevant thermal threshold data generated by users. Ultimately, a global-scale, interconnected network of digital reefs has the potential to transform the management, conservation, restoration, and sustainable use of coral ecosystems for the 21st century blue economy.

Presentation Keywords

coral, reef, management, resilience, action

066.

Advancements in Trapping: Timms Performance at Haleakalā National Park

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Invasive mammalian predators such as rats, mongooses, and feral cats are a threat to native species in Hawai‘i. For that reason, predator control has been a major component of endangered and threatened bird management at Haleakalā National Park (HALE) for 30 years. HALE has used adaptive management principles to test and integrate new trapping tools as they become available. One such product is the Timms trap from Xcluder® (based in New Zealand). The trap is housed in a light weight, durable plastic box that is easily set using a nylon string. Testing the performance and efficacy on target species (mongooses and feral cats) is ongoing. Moreover, HALE is monitoring for interactions between the traps and protected species such as the endangered Hawaiian Petrel (‘ua‘u) and threatened Hawaiian Goose (nēnē) to determine if the trap can be safely deployed in their designated habitat. Timms traps were always paired with a game camera when testing (for both set and un-set units). Most traps were not set (but baited) when collecting data on non-target species. Staff are also testing different baits for longevity and to determine what would be most attractive to target species while not attracting native birds. Preliminary results show minimal interaction by birds while also having the potential to target mongooses and feral cats. If the Timms trap continues to show positive performance, incorporating them into the predator control program at HALE would be beneficial for the continued protection of native Hawaiian species from invasive predators.

Presentation Keywords

Timms, Trapping, Invasive Species, Haleakala

67

Strong Evidence for Resistance to Rapid ʻŌhiʻa Death in *Metrosideros polymorpha*

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Track

IV. Advancement in Conservation Research and Management

Abstract

The ʻŌhiʻa Disease Resistance Program (ʻŌDRP) was established in 2017 to develop scientific and community-based strategies to optimize the discovery, propagation, and screening of ʻōhiʻa (*Metrosideros polymorpha*) for resistance to rapid ʻōhiʻa death, while building a framework for restoration. The program uses a targeted and broad-net strategy to select ʻōhiʻa germplasm for propagation and resistance screening. In the targeted strategy, survivor trees in forest stands with high rates of rapid ʻōhiʻa death-induced mortality are selected for subsequent propagation and screening. In the broad-net approach, ʻōhiʻa seed accessions from across the state are selected from the Laukahi Seed Banking Partnership to represent a wide diversity of ʻōhiʻa genetics and provenance. Propagative material (seeds or cuttings) is raised in ʻŌDRP greenhouses on Hawaiʻi Island and later screened for resistance to the rapid ʻōhiʻa death fungal pathogen, *Ceratocystis lukuohia*, in artificial inoculation trials. The first disease resistance trial began in October 2021 and screened rooted cuttings from 56 survivor trees from the heavily impacted sites of Puʻu Kaliʻu, Keaukaha Military Reservation and Waiākea Forest Reserve on Hawaiʻi Island. Susceptibility and disease resistance levels were assessed based on foliar wilt severity over eight months after inoculation. Results indicated a wide spectrum of plant responses ranging from complete foliar wilt and death to resistance, with plants displaying little or no wilt. A second trial began in January 2023, with results expected in July. These trials represent the progress of many partners to develop C. lukuohia-resistant ʻōhiʻa for stewardship and restoration of disease-impacted forests.

Presentation Keywords

rapid ʻōhiʻa death, disease resistance, conservation, forests

68

Perpetuating the Rare and Endangered Plants of Hā‘ena, Kaua‘i, through Conservation Partnerships

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

The ahupua‘a of Hā‘ena, on the north shore of Kaua‘i, consists of two valleys, Limahuli and Mānoa. Both are privately owned and contain designated critical habitat for plants and lowland wet forest ecosystem. Biodiversity is high in the lowland wet forests of Hā‘ena, over 43% of the total native flora of Kaua‘i can be found in these two valleys, including 90 single island endemic and 19 threatened and endangered (T&E) plant species. Invasive weeds and feral ungulates threaten each species and the entire ecosystem. Both valleys consist of upper and lower valleys separated by waterfalls, with upper sites only accessible by helicopter. Recovery efforts in such remote and rugged terrain are challenging. However, through collaborative partnerships between private landowners, non-profit organizations, state, and federal entities, rare plant recovery has been ongoing in Limahuli for over 25 years, and seven years in Mānoa. Recovery efforts include ungulate exclusion fencing, weeding, rare plant surveys, propagule collection, and reintroduction. These efforts have led to documentation of new populations, survival of wild individuals, and the successful reintroduction of hundreds of seedlings. This presentation will highlight our results to date, with focus on a few key species including, *Schiedea kauaiensis* (Endangered (E), < 50 wild individuals), *Cyanea rivularis* (E., 3 wild ind.), *Melicope degeneri* (E., ca. 86 wild ind.), *Kadua fluviatilis* (E., < 170 wild ind.), *Lysimachia ovoidea* (< 10 wild ind.) and *Geniostoma lydgatei* (E., ca. 231 wild ind.).

Presentation Keywords

conservation partnerships, endangered species, biodiversity, lowland wet forest, plants

069.

Evaluating the Potential for Marine Debris Removal at a Finescale Convergence Phenomenon Around Makai Pier, Windward O'ahu

Brittney Lockett, David Field

Hawai'i Pacific University, Honolulu, Hawai'i

Track

IV. Advancement in Conservation Research and Management

Abstract

The issue of marine debris accumulation in the marine environment is becoming of greater concern as interactions between marine life and floating debris increase, prompting the scientific community to consider new methods for efficient and cost-effective removal. There have been many removal efforts in large-scale debris accumulation areas such as the Great Pacific Garbage Patch (GPGP), where microplastic concentrations up to 12 pieces/m² have been reported. Convergence zones on smaller scales may also be effective removal sites, where microplastics have been documented in densities of up to 70 pieces/m² with the potential to threaten local and endemic species. The Hawaiian Archipelago in particular receives a notable amount of marine debris on its windward shores, and in order to mitigate the threat of debris aggregation, we must understand how local environmental factors influence the presence and abundance of surface debris. To determine debris concentrations and ultimately the effectiveness of a local nearshore site for removal, we collected microplastic samples from the surface waters of a finescale convergence phenomenon around Makai Pier, windward O'ahu under various environmental conditions using both neuston tows and small sieves. We report estimates of microplastic concentrations on different days and under different environmental conditions with densities being as high as 1,150 pieces/m² - two orders of magnitude greater than some of the highest densities recorded in the GPGP. In total, up to sixty thousand pieces of microplastics may accumulate and ultimately be removed from a convergence feature here under particular environmental conditions.

Presentation Keywords

Microplastics, Convergence, Marine Debris, Removal Efforts, Accumulation

70

Phylogenetic Insights Into the Evolution of Hawai‘i's Endemic Amastrid Land Snails

Chandra Earl

Bernice Pauahi Bishop Museum, Honolulu, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

The Hawaiian Islands offer an opportunity to study evolutionary relationships due to the their unique biogeographical and environmental history. This study focuses on the land snail family Amastridae, which is the only extant family of floristic or faunistic species that is wholly endemic to the Hawaiian Islands. 95% of amastrid diversity has disappeared since 1935 due to impacts such as climate change, habitat loss and introduction of invasive species. Despite this, there is a paucity of knowledge regarding these snails due to their rarity and general disinterest and ignorance in terrestrial mollusks. Therefore, study aims were two-fold: First, to test the hypothesis that variation in amastrid shell size and shape is driven by rainfall, given that larger snails with wider apertures are usually found in moist habitats and second, to better understand the general evolutionary history of amastrids and these traits through exploratory analyses. The three traits (size, shape and rainfall) were collected from museum specimens and four phylogenetic comparative tests were conducted using a maximum-likelihood phylogeny. Results show that 1) the Brownian motion model was the most suitable model for describing the evolutionary patterns of all three traits. 2) Only rainfall preference evolutionary rate differed between the two subfamilies, but there was 3) no significant evolutionary correlation between rainfall and either size or shape, disproving the original hypothesis. Finally, 4) ancestral area reconstruction revealed evidence consistent with the progression rule, which suggests that ancestral species colonize older islands and more recent lineages are found on younger islands.

Presentation Keywords

Land Snails, Evolution, Phylogenetic Comparative Analysis, Traits

071.

Developing a State-Wide Monitoring Program for Novel Strains of the Myrtle Rust Fungus (*Austropuccinia psidii*)

Marc Hughes[1], Jorge Ibarra Caballero[2], Jane Stewart[2]

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Track

IV. Advancement in Conservation Research and Management

Abstract

The myrtle rust fungus, *Austropuccinia psidii*, was first detected on Oʻahu in 2005 on ʻōhiʻa (*Metrosideros polymorpha*) plants and shortly thereafter was found on all islands across the state. Currently, the "pandemic biotype", which is extensively distributed across the world, is the only biotype that exists in Hawaiʻi. Although ʻōhiʻa is considered moderately resistant to the disease, the Hawaiian endemic and endangered *Eugenia kooalauensis* and non-native invasive rose apple (*Syzygium jambos*) populations have nearly been extirpated by myrtle rust. Studies acknowledging the potential of novel, non-pandemic, biotypes more aggressive to ʻōhiʻa entering Hawai'i prompted the banning of all myrtaceous plants into the state. To determine if new myrtle rust biotypes have or are entering Hawaiʻi, we have developed the Myrtle Rust Monitoring Network. This pilot program harnesses a network of collaborators and botanical gardens that will raise local sentinel plants susceptible to myrtle rust and monitor for leaf symptoms and utilize a newly developed Loop Mediated Isothermal Amplification (LAMP) assay to assess biotype diversity present or recently invaded into Hawaiʻi. Leaves colonized by *A. psidii* are sent for analysis and the LAMP assay is used to determine if infections are caused by *A. psidii* that belongs to the pandemic or to a different biotype. Identified strains not belonging to pandemic biotype will be genetically characterized using additional markers for verification. This project exemplifies the biosecurity potential of synergizing a collaborative network of citizen scientists, sentinel plantings and newly developed, easy to use genetic tools for environmental monitoring.

Presentation Keywords

Myrtle rust, Forest Disease, Invasive Species

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Ceratocystis lukuohia Inoculum in Ohia Forest Soils and its Relationship to Ungulate Activity: Implications for Management

Richard Flint Hughes[1], Gabriela Benito[2], Kyson Dunn[1], Joseph Rocco[2], Marc Hughes[1]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Today, the health of our ʻŌhiʻa forests face a major threat in the form of Rapid ʻŌhiʻa Death (ROD), a lethal disease caused by the recently introduced fungal pathogen, *Ceratocystis lukuohia*, which threatens ʻŌhiʻa forests statewide. Since its discovery as ROD's causal agent in 2014, *C. lukuohia* has hastened stand level mortality across more than 20% of Hawai'i Island's ʻŌhiʻa-dominated forests. However, feasible management actions may exist to protect ʻŌhiʻa-dominated forests from *C. lukuohia* infection and eventual widespread mortality. *C. lukuohia* is a characterized as a wound pathogen, and fresh wounds are required to allow the pathogen's infection of trees. Further, feral ungulates have been implicated in the spread of *C. lukuohia* inoculum and wounding of ʻŌhiʻa trees that allow the fungal pathogen to enter and kill individual trees and entire stands. In forests where feral ungulates are excluded *C. lukuohia*-induced mortality is suppressed compared to adjacent areas of ungulate activity. Here we present research revealing mechanisms underlying documented patterns of differential ʻŌhiʻa stand mortality regarding feral ungulate presence. Evaluating forest soils for presence and abundance of *C. lukuohia* inoculum, we found significantly lower amounts of inoculum in soils (e.g., 0 to 4% of samples) where feral ungulates were excluded compared to adjacent forests where ungulates were present and active (e.g., 40 to 86% of samples). Our results provide insight and strong evidence supporting the need to eliminate exposure of such forests to feral ungulate damage to suppress the spread and impact of Rapid ʻŌhiʻa Death.

Presentation Keywords

ʻŌhiʻa, Ceratocystis, feral pigs, tree mortality , fungal pathogen

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Fostering Biocultural Conservation Through ʻŌlelo and ʻIke Hawaiʻi

Kekaianiani Irwin, Pōmaikaʻi Iaea, Kealohapauʻole Ahuna, ʻIkaʻaka Nāhuewai, Kalaniali‘i Stoleson

Ka Haka ʻUla o Keʻelikōlani College of Hawaiian Language, Hale Kuamoʻo Hawaiian Language Center, Hilo, Hawaiʻi

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

Hoʻoulu Maluō is a new collaborative project of the Hale Kuamoʻo Hawaiian Language Center and the Hawaiʻi Conservation Alliance Foundation that aims to *waele i ke ala* (clear new pathways) for Hawaiian medium middle and high school students. The project responds to a critical need for capacity building efforts fostering community and culturally-based conservation, in particular for Hawaiian language speaking future leaders. Drawing inspiration from information shared at the 2022 Hawaiʻi Conservation Conference, the project developed six curriculum units for Hawaiian immersion students in grades 6-12 featuring: *konohiki* traditions; developing *kilo* muscles for deepened relationships to *ʻāina* and *kai*, the Limu Hui as an entry point to *limu* conservation; soil science as a pathway to *ʻāina momona*; endemic land snail and culture conservation; and place-based perspectives from Nāpuʻu on everchanging *ʻāina*. Highlights include subject matter expert support and review paired with original research utilizing relevant primary sources from historical Hawaiian language print and oral language archives.

Produced to support Hawaiian Immersion classrooms, we believe these curriculum units will will also shed light on the subtle avenues in which Western science and Indigenous knowledge intersect. The content itself is grounded in the Hawaiian language and culture, and thus, the overall approach is rooted firmly in a Hawaiian thought process. These curricula may help provide relevant insights to strengthen the relationship conservation professionals have with their work and the *ʻāina*. The presentation will be primarily through *ʻōlelo Hawaiʻi* with English language support in the slides, reflections, and follow-up Q&A.

Presentation Keywords

ʻōlelo Hawaiʻi, ʻike kupuna, indigenous conservation, Hawaiian immersion, ʻāina momona

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda (1 hour Workshop) | Innovative Audience Engagement Strategy:

1 - Finding biocultural conservation and Hawaiian language connections through an innovative *ahupua‘a*-based audience reflection and discussion.

2 - Elucidating the integrated transdisciplinary curriculum development methodology of the Ho‘oulu Maluō project.

3 - Sharing curriculum units developed for the project:

- *I Ō ka ‘Āina i ke Konohiki* – Kealohapau‘ole Ahuna
- *No‘eau Kilo Kau a Kau* – Kekaianiani Irwin
- *E Māhuahua a‘e ka ‘Āina i ka Lepo Momona* – Pōmaika‘i Iaea
- *Kāhuli i ke Ao* – ‘Ika‘aka Nāhuewai
- *‘O Nāpuu, He ‘Āina Aloha* – Kalaniali‘i Stoleson

4 - Discussion / Q&A.

Target Audience: Educators and students in Hawaiian medium and/or Hawaiian language educational settings, grades 6-12. Anyone interested in *‘ōlelo Hawai‘i* and *‘ike Hawai‘i* insights into conservation in Hawai‘i.

Goals:

1 - *Ho‘oulu i ka hoi e pili ana i nā ‘oihana ho‘omaluō ma ka na‘au o nā ‘ōmuamua ‘ōlelo Hawai‘i o kēia mua aku* – Foster interest in conservation careers for Hawaiian language speaking future leaders.

2 - *Ho‘olako i nā ha‘awina a me nā kumuwaiwai e ‘āwili ‘ia ai ka ‘ike ku‘una Hawai‘i a me ka ‘ike akeakamai ho‘omaluō o ke au nei* – Provide curricula and resources integrating traditional Hawaiian knowledge and contemporary conservation science knowledge.

3 - *Hāpai a ho‘olaha i kekahi mau momi ‘ike o ka ‘Aha Ho‘omaluō o Hawai‘i i nā kula kaiapuni Hawai‘i* – Uplift and disseminate to *kaiapuni* schools selected knowledge from the Hawai‘i Conservation Conference.

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Lessons Learned Establishing the Maui County ROD Resistance Project

Marian Chau[1,2], Nick Dudley[3], Tamara Sherrill[4], Cathy Davenport[4], Marc Hughes[5]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Reflecting on the past several years Hawai‘i has been affected by Rapid ‘Ōhi‘a Death, two things stand out: the accumulated scientific knowledge on which to base conservation actions, and the high degree of collaboration to effectively and rapidly address this threat. The conservation community dreams of a future with ROD-free, thriving native forests. In 2020, through collaboration of public, private, and non-profit partners, we established the Maui County ROD Resistance Project. Our goal is to develop ‘ōhi‘a seed orchards that provide ROD-resistant ‘ōhi‘a trees for future restoration. Methods include strategic seed collection, propagation, and testing according to published ‘Ōhi‘a Disease Resistance Program (‘ŌDRP) protocols. In the first two years, we collected seeds from 218 trees across 3 islands, 14 seed zones, and all 7 ‘ōhi‘a taxa from Maui Nui. Challenges with land access and pandemic restrictions limited our ability to engage the public in volunteerism. Thus, these collections were made possible through cultivated relationships with 26+ partner organizations, trainings attended by 125+ participants, and 350+ volunteer field hours from the conservation community. After year 1, seeds from 27 trees were selected and sent to ‘ŌDRP in Hilo, where they are being grown to the size needed for resistance testing. Due to variable and lower than expected germination, we adapted our strategy to include viability estimates, germinating seeds from 70+ trees so far, to better inform selection for resistance testing. The valuable lessons learned will inform our efforts as we continue expanding the project to advance research in ROD resistance.

Presentation Keywords

ROD, ‘ōhi‘a, disease resistance, seed banking, forestry

077.

Documenting Use of Riparian Habitat by Larval Invasive Mosquitoes in Hakalau Forest National Wildlife Refuge

Mei Iwamoto[1], Matthew Mueller[1], Dennis LaPointe[2], Katherine McClure[2], Richard Camp[2], Lucas Fortini[2]

[1]Hawai‘i Cooperative Studies Unit, Hilo, HI. [2]U.S. Geological Survey, Pacific Island Ecosystems Research Center, Hawai‘i National Park, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

One major factor leading to the decline of Hawaiian honeycreepers is avian malaria, transmitted by the invasive mosquito *Culex quinquefasciatus*. Honeycreeper populations have declined significantly on Kaua‘i and Maui, but they remain relatively stable at Hakalau Forest National Wildlife Refuge on Hawai‘i Island. Limited availability of suitable larval habitat may be one reason *C. quinquefasciatus* are seldom detected at Hakalau and why avian malaria remains at low prevalence in the avian communities there. Changing patterns in precipitation and stream hydrology, however, could increase riparian larval habitat and provide a stepping-stone invasion route into higher elevation forests like Hakalau. We established seven sites on an elevation gradient (1110-1750 m) along two streams in Hakalau and one stream in the adjacent Laupāhoehoe Forest Reserve and conducted regular surveys for available larval habitat and larval presence. We also established climate stations and stream gages at our sites to collect key environmental data. Available larval habitat (the mean number of pools/ten-meter section) at the mid-elevation Hakalau site decreased from 12.9 pools in March 2022 to 7.63 in June 2022 and increased back to 13.1 in July 2022. Despite the persistence of available habitat and presence of *Aedes japonicus*, we found no *C. quinquefasciatus* larvae at Hakalau. Both species were consistently found at all three Laupāhoehoe elevation sites. Our survey and environmental data will be used to assess current and future risk of *C. quinquefasciatus* invasion at Hakalau and provide a decision threshold for Incompatible Insect Technique (IIT) control.

Presentation Keywords

Mosquitoes, Riparian habitat, Avian malaria, Climate change, Forest birds

79

The trail less traveled: Envisioning a new approach to identifying key food resources for threatened Hawaiian arboreal snails

Wallace Meyer[1], Kenneth Hayes[2], Norine Yeung[3], Andre Cavalcanti[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Our understanding of Hawaiian arboreal snails' diets remains rudimentary, hindering the development of effective conservation strategies. To identify important food resources, we tested the hypothesis that epiphytic microbial assemblages differ on plant species preferred and avoided by snails at Mt. Kaala Natural Area Reserve, where snail plant preferences are known from previous studies. Comparing microbial assemblages on plants snails both prefer and avoid was identified as a potentially key step to moving research away from characterizing which microbes snails encounter to testing if microbial assemblages are driving snail plant preferences. We found that fungal and bacterial assemblages differed between plant species preferred and avoided by snails indicating that Hawaiian arboreal snails may be selecting plants based on their epiphytic microbial assemblages. Previous microbes thought to be important, Cladosporium spp., propagated in captive rearing facilities, and Botryosphaeria spp., preferred fungi in a feeding experiment, were both rare and had similar abundances on preferred and avoided plant species in Mt. Kaala. Our approach, conducting preference studies before isolating microbes is key to identifying arboreal snail food resources and improves our ability to identify microbes that form the foundation of Hawaiian arboreal snails' diet. If we can identify important food resources, it greatly expands our ability to: (1) assess and monitor habitat quality, (2) make informed restoration recommendations, and (3) improve rearing efforts for highly endangered captive reared populations.

Presentation Keywords

snail, food resources, epiphytic, plant, trophic

80

ʻĀina hoʻomalu ululāʻau: 120 years of Forestry in Hawaiʻi

David Smith[1], Jennifer Grimm[1], Heather McMillen[1], Robert Hauff[1], Pua Heimuli[2], Joshua Atwood[1], Sherry Hazelhurst[3], Jodi Chew[4]

[1]DLNR Forestry & Wildlife, Honolulu, HI. [2]UH PCSU, DLNR Forestry & Wildlife, Honolulu, HI. [3]USDA Forest Service, Vallejo, CA. [4]USDA Forest Service, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

In 1903 the Territorial Legislature created the first Forest Reserve in Hawaiʻi, marking the beginning of what would later become the Division of Forestry and Wildlife. At this bidecacentennial anniversary, we reflect on the evolution of forestry over 120 years and ask for collaborative input on envisioning the future of Hawaiʻi's forests.

Presentations will summarize the history of the Division of Forestry and Wildlife as well as achievements, lessons learned, and potential future directions for our Forest Reserve System, Kaulunani Urban and Community Forestry Program, Forest Health program, and more.

The interactive portion of the forum will be primarily comprised of roundtable groups providing discussion and input on topics related to the presentations. Tables will be facilitated by DLNR and USFS partners. Discussions will be focused on topics related to the presentations and will ask a) what has worked well in the past, b) what hasn't worked well and needs to change, c) what we can do differently together over the next five years, and d) the long-term goals and milestones of this work. Tables will report back to the larger group, and outputs will be provided to USFS for their programmatic review process.

The forum will provide opportunities for crowd-sourced, collaborative input using audience polling software, as well as traditional note-taking. Participants will also be invited to add future milestones to a forestry timeline that includes historical events from 1903-2023 and provides blank space for participants to create a hypothetical future from 2023-2143.

Presentation Keywords

forest, forestry, management, future, past

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Moderator welcome and forum overview (5 min)

Presentations (1 hr; each presentation is 10 min, with 3 min for questions and 2 min for transition between speakers. We will identify a crowd-sourced question, poll, or word cloud to be completed live by the audience during the five minutes for questions and transitions.

- Bidecacentennial Reflections on the Evolution of Forestry and Wildlife – David Smith, Administrator
- Hawai‘i’s Forest Reserve System, Past and Future Possibilities- Jennifer Grimm, Forestry Program Manager
- 30 Years of Kaulunani Urban and Community Forestry- Heather McMillen, Kaulunani Program Coordinator
- The Future of Forests- Rob Hauff, Forest Health Program Manager

Roundtable Discussions, Timeline, & Sharing (50 min)

- Moderator: Brief overview of topic categories, instructions for breakout discussions (5 min)
- Roundtable discussions and timeline creation (25 min). Breakout tables include:
    - Forests in our future: Envisioning our Forest Reserve System over the next 120 years
    - Building a sustainable forest products industry in Hawai‘i
    - Engaging communities in planning, management, and incorporation of traditional ecological knowledge
    - New and growing threats in our forests (e.g., what current problems will worsen in the coming decades, and what new threats might we face?)
    - New tools for forest management (e.g., what emerging technologies do we need to support, and what theoretical tools do we need to turn into reality?)
- Timeline creation: At any time during the roundtable discussions and report out, participants can add future milestones to a paper timeline placed on the wall. The timeline will include past events (1903-2023) and a large blank area for participants to add events for 2023-2143.
- Report out (20 min). Each table facilitator will share a main idea from their group’s conversation. (one per table). Invite participants to share any other points they felt were important or that build on the main ideas.
- Participants may continue to write on the timeline during the reporting period.

Closeout (Moderator, 3-5 min)

81

Nearshore water quality monitoring in Hawai‘i: regulations, methods, current landscape, and designing ecologically-relevant protocols for broad application

Christina Comfort[1], Kim Falinski[2], Erica Perez[3]

[1]WAI: Wastewater Alternatives & Innovations, Honolulu, HI. [2]The Nature Conservancy, Honolulu, HI. [3]Coral Reef Alliance, San Francisco, CA

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Coastal ecosystems are affected by the health of the adjacent watershed, including the results of poor land management such as erosion, stormwater runoff, and wastewater contamination. Poor water quality increases the risk of coral bleaching, changes community structure for limu, and alters fish habitat. However, water quality monitoring is regularly conducted to protect human health at places where use is highest, and therefore agency-level monitoring focuses on fecal indicator bacteria, which may not be the best indicator for ecosystem health. Considering the biological and cultural importance of nearshore ecosystems in Hawai‘i, there is an urgent need to expand water quality monitoring throughout the state to be relevant to ecological thresholds in addition to human health concerns.

This workshop will open with a brief introduction about the water quality monitoring environment in Hawai'i and then focus on roundtable discussions in the World Cafe format. Participants will engage in small group discussions around targeted questions to identify various methods, challenges and innovations in ecologically-relevant water quality monitoring, with the goal of mapping out three types of regular ecosystem monitoring programs for recommendation to State agencies.

Presentation Keywords

Monitoring, Nearshore ecosystems, Water quality, Regulations, Land-based pollution

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda:

This workshop will open with a brief introduction about the water quality monitoring environment in Hawai'i and then focus on roundtable discussions in the World Cafe format. Participants will engage in small group discussions around targeted questions to identify various

methods, challenges and innovations in ecologically-relevant water quality monitoring, with the goal of mapping out three types of regular ecosystem monitoring programs for recommendation to State agencies.

084.

Cruising at the Beach: Grounding Climate Impacts with Everyday Activities to Engage Youth

Kanesa Duncan Seraphin[1], Ana Espanola[2], Alisha Summers[2], Ruby Pap[3], Kai Whitfield-Seebeck[4], Cindy Knapman[5], Thor Seraphin[6], Emily Sesno[7], Judith Lemus[8]

[1]Hawai‘i Sea Grant, Kapa‘a, HI. [2]County of Kaua‘i, Līhu‘e, HI. [3]University of Hawai‘i Sea Grant, Līhu‘e, HI. [4]Kaua‘i Community College, Līhu‘e, HI. [5]University of Hawai‘i Sea Grant, Honolulu, HI. [6]University of Hawai‘i Sea Grant, Kapa‘a, HI. [7]United States Geological Survey, Honolulu, HI. [8]University of Hawai‘i at Mānoa, Honolulu, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

More than 27% of Kaua‘i’s 73,500 population is under 25 years of age. These youth will inherit the impacts of Climate Change, including growing storminess, extreme heat, sea level rise, and other associated hazards. It is the County of Kaua‘i’s kuleana—our responsibility and privilege—to incorporate youth perspectives in our Climate Adaptation and Action Plan (CAAP). The Youth Climate Summit was developed to foster a comfortable space for youth (ages 11-25) to give input, share experiences, identify vulnerable locations, and provide suggestions that support and improve Kauai‘i’s CAAP. The summit hosted a youth panel, community resource tables, and interactive activity stations—where youth were encouraged to share their knowledge and opinions. The county incorporated both youth groups and organizations in planning the summit. To connect with daily life, stations were organized by every-day activities (e.g., fishing, playing sports, walking, skating, biking). For example, at the “Cruising at the Beach” station, photos, maps, Voice of the Sea TV episodes, magazines, and books helped youth visualize the impact of climate change in their moku (district). Interactive elements included the Hawai‘i Sea Level Rise (SLR) Viewer and a hands-on experiment on the effects of hardening shoreline from the Sea Earth Atmosphere (SEA) curriculum. Youth comments from the summit, including concerns and recommendations, were analyzed and are being incorporated into the CAAP. In this presentation, we will share resources; discuss student responses and questions; and explore strategies used to engage youth participants, and lessons learned on how to engage youth.

Presentation Keywords

youth, climate, summit, video, curriculum

085.

Entanglement Scar Analysis of Humpback Whales, *Megaptera novaeangliae*, in Hawaiian Waters (2013 – 2021): A Comparison of Surface and Underwater-Obtained Imagery

Edward Lyman[1], Rachel Finn[1], Ted Cheeseman[2,3], Jason Moore[1,4]

[1]NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary, Kihei, Hawai‘i. [2]Happywhale, Portland, Oregon. [3]Southern Cross University, Lismore, Australia. [4]Cardinal Point Captains, San Diego, California

Track

IV. Advancement in Conservation Research and Management

Abstract

Entanglement is a significant anthropogenic source of injury and mortality for large whales worldwide. However, quantifying the incidence and impact through reporting alone underestimates the threat. Scar analysis, the systematic evaluation of scarring consistent with prior non-lethal entanglement, provides additional information on the entanglement threat. While most efforts focus on surface-obtained imagery of the caudal peduncle region to assess entanglement, expanding assessment to other body regions using underwater imagery may provide a more comprehensive analysis. Underwater analyses can pose additional challenges depending on conditions, optics, logistics and platform limitations. We conducted scar analyses for North Pacific humpback whales (*Megaptera novaeangliae*) on their wintering grounds of Hawai‘i and compared results from surface and underwater imagery of uniquely identified animals. Images were obtained as a permitted activity by the Hawaiian Islands Humpback Whale National Marine Sanctuary in Maui Nui waters between December and May, from 2013 through 2021. Surface images were obtained using DSLR cameras, while handheld or boat-mounted DSLRs and/or pole-mounted GoPros were used for underwater images. Results showed conditional scar rates (removing ambiguous cases) of randomly selected individuals similarly evaluated and compared were 18.5% for surface and 9.9% for underwater, indicating a lower scar rate using underwater imagery. The results illustrate that while underwater imagery may be more comprehensive in its coverage, challenges in obtaining and evaluating underwater images compared to the surface-obtained images may under-estimate the scar rate. By analyzing both surface and underwater imagery, a more comprehensive picture of the large whale entanglement threat can be obtained.

Presentation Keywords

Humpback whales, Entanglement, Conservation, Scar analysis, Marine mammals

86

A decade of seabird monitoring highlights the effectiveness of management actions in Upper Limahuli Preserve for 'a'o and 'ua'u

Andre Raine, Scott Driskill, Jennifer Rothe

Archipelago Research & Conservation, Hanapepe, HI

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Upper Limahuli Preserve contains the largest monitored population in the World of the endangered 'a'o (Newell's Shearwater *Puffinus newelli*), as well as a significant population of the endangered 'ua'u (Hawaiian Petrel *Pterodroma sandwichensis*). Seabird monitoring has been carried out at the site since 2011 in tandem with predator control activities (for introduced predators including cats and rats) by the National Tropical Botanical Gardens. Monitoring at the site incorporates multiple techniques including acoustic sensors, auditory surveys, burrow checks and cameras. By the end of 2022, a total of 316 seabird burrows were being monitored, of which 195 were confirmed to be 'a'o and 52 'ua'u. We utilize the results of these monitoring techniques to highlight the effectiveness of ongoing management actions. Reproductive success at burrows has increased significantly, with a 61.7% increase for 'a'o and 65.7% increase for 'ua'u. Acoustic sensors have also highlighted this positive trend with a 74.0% increase in call rates for 'a'o and 335.8% increase for 'ua'u. Conversely predation rates at burrows for mammalian predators has declined during this period including a 95.2% decrease in rat depredations and an 89.0% decrease in cat depredations. Utilizing data collected during this study, we present models that show long term population trends for endangered seabirds at the site with and without predator control. We also discuss current challenges to management, including increasing barn owl *Tyto alba* depredations and recent burrow take overs by feral honey bees Apis mellifera, as well as enhanced management actions planned for the future.

Presentation Keywords

'a'o, 'ua'u, seabird, conservation, monitoring

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Variability in Collisions Between Vessels and Humpback Whales (*Megaptera novaeangliae*) in Hawaiian Waters (1979 – 2022)

Edward Lyman[1], Marc Lammers[1], Adam Pack[2], Amanda Bradford[3], Diana Kramer[4], Jens Currie[5], Stephanie Stack[5], Jeannine Rossa[6], Rachel Finn[1]

[1]Hawaiian Islands Humpback Whale National Marine Sanctuary, Kihei, Hawai‘i. [2]University of Hawai‘i at Hilo, Hilo, Hawai‘i. [3]Pacific Islands Fisheries Science Center, NOAA Fisheries, Honolulu, Hawai‘i. [4]NOAA Fisheries Protected Resources - Pacific Islands Regional Office, Honolulu, Hawai‘i. [5]Pacific Whale Foundation, Maalaea, Hawai‘i. [6]Research Corporation of the University of Hawai‘i, University of Hawai‘i at Mānoa, Honolulu, Hawai‘i

Track

IV. Advancement in Conservation Research and Management

Abstract

Injury and mortality from collisions with vessels is considered a major anthropogenic threat to whales worldwide. We examined 44 years (1979-2022) of confirmed reports involving collisions between vessels and humpback whales (*Megaptera novaeangliae*) on their breeding/calving grounds around Hawai‘i. In total, 145 whales were confirmed impacted by collisions: 101 were observed, 38 had injuries consistent with a recent collision, and six were dependent calves. The majority of observed reports involved tour vessels (69.1%, n=74), though many vessel types were involved. Most vessels were under 20 meters (95.0%, n=95). Most vessels reported making contact at 15 knots or less (81.1%, n=73), a recommended transit speed during whale season. A majority of vessels reported contact while transiting (81.5%, n=75), though 18.5% (n=17) occurred around whale watching. Calves represented 48.4% (n=59) of known-aged reports, suggesting greater susceptibility. Leeward Maui had the highest incidence of known collisions (65.7%, n= 71). Comparison of reports shows an increase in incidences over time to an average of 6.4 reported collisions/year over the last decade. Several factors affecting risk and reporting may explain variability in collision rates and impacts. For example, an increasing number of animals, environmental fluctuations affecting whale presence on breeding grounds, pandemic-related reductions in vessel traffic, and greater awareness from increased outreach and engagement. Accounting for these factors will better inform ongoing efforts to assess and mitigate the impacts of vessel collisions on humpback whales in Hawai‘i.

Presentation Keywords

Conservation, Humpback whale, Kohola, Ship-strikes, Collisions

89

Abiotic Factors Affecting ʻŌpaeʻula Abundance Within the Makalawena Loko Waiʻōpae Complex

Kekuʻiapōiula Keliipuleole[1], Natalie Kurashima[2], Rosie Alegado[1]

[1]University of Hawaiʻi at Mānoa, Honolulu, Hawaiʻi. [2]Kamehameha Schools, Kailua-Kona, Hawaiʻi

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

In Hawaiʻi, loko waiʻōpae (anchialine pools) habitats are tidally-influenced, land-locked aquatic habitats with subterranean connections to the sea. These environments are home to unique assemblages of organisms, such as the endemic shrimp ʻōpaeʻula (Halocaridina rubra), and are culturally important ecosystems. The stability of anchialine environments are threatened by sea level rise, groundwater contamination, runoff pollution, and disturbances by invasive species. However, how these threats and abiotic factors impact ʻōpaeʻula abundance is unknown. This project engaged resource managers to characterize the Makalawena loko waiʻōpae (MLW) complex and investigate extrinsic drivers of ʻōpaeʻula abundance. The Kona landscape is marked by different lava flows, which has facilitated distinct organic and inorganic succession. We hypothesized that lava flows in Makalawena act as hydrological barriers to isolate loko waiʻōpae from one another. We assigned ponds to regions based on lava flow topology: northern ponds dominated by ʻaʻā-lava rock (North), central ponds amongst pāhoehoe-lava rock (Mid), and ponds surrounded by sandy, mixed-rock composition in the south (South). All but two ponds in the Mid region have predator fish. Results from water quality and ʻōpaeʻula abundance surveys indicated that the MLW complex partitions into two types of water chemistry. North loko waiʻōpae are characterized by higher salinity and lower nutrients, whereas Mid and South loko waiʻōpae have lower salinity and higher nutrients. Understanding the effects of these abiotic factors on 'ōpae'ula abundance is critical to the management of the anchialine pools now and into the future as sea level rise and land-based pollution influence Hawaiʻi's coastal zones.

Presentation Keywords

ʻōpaeʻula, anchialine pools, loko waiʻōpae, Halocaridina rubra, brackish water ecosystems

90

Can Felling and Tarping Reduce *Ceratocystis* Viability?

Helen Sofaer[1], Robert Peck[2], Ellen Dunkle[2], Daniel Duda[3], Stacey Torigoe[4]

[1]U.S. Geological Survey, Pacific Island Ecosystems Research Center, Hawaii National Park, HI. [2]University of Hawai‘i at Hilo, Hawai‘i Cooperative Studies Unit, Hilo, HI. [3]Research Corporation of the University of Hawai‘i, Pacific Cooperative Studies Unit, Honolulu, HI. [4]National Park Service, Hawai‘i Volcanoes National Park, Hawaii National Park, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Few management tools are available to slow the intraisland spread of the *Ceratocystis* fungi that cause Rapid ‘Ōhi‘a Death (ROD). One mechanism by which *Ceratocystis* may spread is through the activity of wood-boring ambrosia beetles, whose tunneling into infected trees can push wood particles (frass) containing viable *Ceratocystis* propagules outside the tree. Ambrosia beetles can also carry viable fungal spores on their bodies. Felling infected trees could reduce the spread of ROD because exposed frass would be confined to the ground level and would be less likely to be carried as far in the wind. Tarping piles of wood from felled trees could further reduce *Ceratocystis* spread by protecting infected wood from beetle attacks and by changing the temperature and humidity so that wood dries out more quickly and the fungus inside becomes inviable. We conducted a small experiment in Hawai‘i Volcanoes National Park to test whether tarping led to quicker reductions in *Ceratocystis* viability compared to untarped piles and standing trees. Six ROD-positive trees were felled and wood from each tree was divided into tarped and untarped piles. We sampled *Ceratocystis* viability monthly and reared beetles from a subset of bolts taken from tarped and untarped piles to characterize the beetle community. We found no effect of tarping on the rate at which *Ceratocystis* viability declined with time. The effects of tarping may depend on tarping methodology, the abiotic environmental context, and the beetle community.

Presentation Keywords

ROD

91

Troubled Waters: Assessment of Changing Patterns in Juvenile Shark Abundance Using Local Ecological Knowledge

Dani Bartz[1,2], Timothy Grabowski[3], Mehana Vaughan[1]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Nearshore estuaries are frequently used as nursery habitats by coastal-pelagic sharks. While estuaries are subject to high levels of anthropogenic alteration, the response of shark populations to these changes is poorly understood due to a lack of monitoring. Our objectives were to reconstruct the abundance patterns of juvenile sharks in Hilo Bay, Hawai'i and identify potential ecological drivers of observed changes using local ecological knowledge (LEK) provided in unstructured interviews of fishers (n = 28) active during 1950-present. Fishers consistently noted a decline in the catch rates of juvenile Scalloped Hammerhead (Manō Kihikihi) *Sphyrna lewini* coinciding with increasing catches of Oceanic Blacktip Sharks *Carcharhinus limbatus*. Fishers frequently mentioned targeting Scalloped Hammerheads as a bait species, whereas Oceanic Blacktip Sharks were generally identified as a nuisance or bycatch. Fishers consistently cited increased rainstorms and sedimentation, decreased bagasse from the sugar plantations, fluctuations in baitfish populations, increases in invasive fish populations, and increased fishing pressure as factors most likely driving changing shark abundance patterns. The degree of change noted by individuals was associated with the length of time they had been fishing in Hilo Bay. Further, fishers noted that shark pups were arriving in Hilo Bay earlier in the year. The LEK contributed by fishers suggests that fishing pressure, climate change, and changing land use patterns in the Hilo Bay watershed have altered the suitability of the bay as a nursery habitat for at least two species of coastal-pelagic sharks, and has identified potential options for restoration or management strategies.

Presentation Keywords

sharks, local ecological knowledge, nursery habitat, fisheries, population dynamics

92

Conserving Endangered Hawaiian Picture-Wing Flies via Reintroduction: Mass Rearing Methods and Novel Monitoring Approaches

Kelli Konicek[1,2], Joanne Yew[2], Karl Magnacca[1], William Haines[1,2], Alexander Samori[3], Cynthia King[1]

[1]Department of Land and Natural Resources, Honolulu, HI. [2]University of Hawai`i at Manoa, Honolulu, HI. [3]Kupu 'Āina Corps, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Hawaiian picture-wing flies (Drosophilidae: *Drosophila*) are one of the oldest lineages of insects in Hawai`i. Their unique evolutionary history, interactions with native host plants via decomposition, and decline in areas where they were once common make this group a priority for conservation management. In 2020, Hawai`i Department of Land and Natural Resources began a project to mass rear and reintroduce two endangered Hawaiian picture-wing fly (*Drosophila*) species to restored habitat on the island of O`ahu. Because a reintroduction for picture-wing flies has never been attempted, captive rearing protocols were modified to transition flies from the lab to the wild. Here, we present new methods to mass-rear and tag Hawaiian picture-wing flies, as well as the first monitoring data from releasing one listed species, *Drosophila hemipeza*, to restored habitat in the Southern Ko`olau range. Monitoring data suggests that lab-reared picture-wing flies released to the wild can survive over a month in the wild, and that the presence of rotting host plant material in the wild will stimulate lab-reared flies to lay eggs. Evidence that flies have completed a successful generation post reintroduction has also been observed. This work informs future conservation efforts for other endangered picture-wing Drosophila, and provides functional insight into their symbioses with a wide variety of native plant species.

Presentation Keywords

Endangered, Native , Insect , Conservation, Drosophila

093.

Forest Inventory and Analysis (FIA) in Hawai‘i: Trends in Tree Mortality, Damage, and Disturbance Agents.

Jonathan Marshall[1], Julian Dendy[2]

[1]USDA Forest Service, Hilo, Hawaii. [2]USDA Forest Service, Corvallis, Oregon

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The Forest Inventory and Analysis (FIA) program of the U.S. Forest Service (USFS) provides forest status and trend information to land management agencies and the public through a nationwide network of forest measurement plots. Pacific island plots are measured on a 10-year cycle. The Hawai‘i inventory was recently completed in 2021 and measured acre-sized forested plots across the state (n=246) between 2019 and 2021. As part of this dataset, we collected information about damage agents, damage types, species-specific dead and live tree numbers, and pig damage as a percentage of forest area. Preliminary damage agent results for ‘Ōhi‘a (*Metrosideros polymorpha*) show a flat trend: 24.52% (SE=2.36) of ‘Ōhi‘a had at least one damage recorded in the 2010 inventory, while 24.07% (SE=3.00) did in 2019-2021. A negative trend was observed in Koa (*Acacia koa*) populations, with 79.2% live trees (SE=4.7) in 2010 declining to 58.9% live trees (SE=9.9) in 2019-2021. Pig damage increased, with 2.97% (SE=0.48) of forested area affected in 2010 increasing to 5.68% (SE=0.63) in 2019-2021. While overall forest area is increasing across the state, invasive tree cover, tree diseases, and ungulate damage remain serious challenges for Hawai‘i’s forests. The 2019-2021 FIA Hawai‘i dataset will be published late 2023/early 2024 and the next inventory cycle will begin in 2028.

Presentation Keywords

Forest, Inventory, Analysis, Hawaii, Trends

094.

Evaluating Habitat Complexity Loss on Foraging Behaviors of Reef Fish Communities in Kāneʻohe Bay, Oʻahu, Hawaiʻi

Aimee Cook McNab[1,2], Nina Schiettekatte[2,1], Elizabeth Madin[2,1]

[1]University of Hawaiʻi at Mānoa, Honolulu, HI. [2]Hawaiʻi Institute of Marine Biology, Kāneʻohe, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Herbivorous fish perform the essential function of limiting algal stocks on coral reefs, but in Hawaiʻi and globally herbivores are threatened by climate and human-induced stressors. Herbivorous reef fish foraging patterns are constrained by predation risk, indicated primarily by preferential grazing near the perceived shelter of coral reefs. As climate change leads to the flattening of reef structural complexity, how this loss of reef shelter will alter grazing patterns remains unknown. The objective of this study is to understand how herbivorous fish feeding patterns respond to changes in coral reef structural complexity. We approached this objective by first collecting structure-from-motion (SfM) orthomosaic that measured reef fractal dimension, height, and rugosity at natural reef sites in Kāneʻohe Bay, Oʻahu. Secondly, artificial reef structures of known complexity were 3D-printed in clay to reflect ranges of fractal dimension values. At both types of reefs, we deployed feeding arrays and performed diver-based fish surveys of herbivore biodiversity, abundance, and foraging patterns. These data were used to test for relationships between benthic community structural complexity, reef fish community composition, and foraging efforts using generalized linear models and principal components analyses. By comparing changes in reef fish foraging behaviors over a range of habitat complexities, we aim to isolate the role benthic structural complexity plays in shaping spatially-explicit grazing patterns on coral reefs. With a push for improved herbivore management in Hawaiʻi, our findings aid managers in understanding and predicting the impacts of reef degradation on herbivorous fish biodiversity and abundance.

Presentation Keywords

Coral reefs, benthic complexity, fish biodiversity, foraging, fractal dimension

95

Restoring Life to the Urban ʻĀina Through Ola Nā Kini Biocultural Education

Mariah Gaoiran[1], Pauline Sato[1], Adam Hanohano[1], Aiko Kawakami[1], Jesse Mikasobe-Kealiinohomoku[1], Chelsey Jay[2], Evy Braum[2]

[1]Malama Learning Center, Kapolei, Hawai'i. [2]Malama Learning Center, Kapolei, Hawaiʻi

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Living on islands, limited land availability is a given. Conservation, agriculture, and development have long entered battlegrounds, with the former typically losing. Based in West Oʻahu, with its burgeoning growth in population and development, Mālama Learning Center (MLC), has built on its strong roots in conservation and education to transform lands marginal in conservation value but powerful for accessibility and social equity. Through the Ola Nā Kini program, MLC has developed outdoor classrooms of biocultural education and innovation across the region, from mauka to makai, fueled by the energy of students, teachers, and community members who live and work in West O'ahu. Serving a largely Native Hawaiian population, Ola Nā Kini carefully and deliberately integrates biocultural foundations in conservation to bring life back to the land as well as people. Volunteers of all ages have grown and outplanted native plants in restoration sites and now, with the growing need for food sustainability and resilience, MLC has established Awawalei, a site that merges conservation and agriculture into an indigenous food forest. Started as a college intern project on lands owned by the Hawai'i Agriculture Research Center, this area left fallow for decades is, in less than three years, burgeoning with more than 25 species of native Hawaiian and culturally significant plants, including 40 varieties of kalo. Experimentation in co-planting indigenous food crops and native plants has developed a site with endless potential to reframe contemporary resource management and engage residents in strengthening their identity, self-resilience, and support for conservation.

Presentation Keywords

indigenous, biocultural, agroforestry, stewardship, education

097.

Where Kāhuli Wander: Quantifying Post-release Dispersal of an Endangered Hawaiian Mollusk to Inform Translocation Strategies

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[1]Department of Natural Resources & Environmental Management College of Tropical Agriculture & Human Resources University of Hawai‘i at Mānoa, Honolulu, HI. [2]State of Hawai'i Department of Land and Natural Resources - Division of Forestry and Wildlife Snail Extinction Prevention Program, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Hundreds of Hawai‘i’s native species have no overlap between current and future climate-suitable habitat. Species unable to migrate to these discrete areas will need assistance. However, assisted translocations risk high mortality in relocated animals establishing novel home ranges to meet their ecological needs. Loss of individuals representing a large proportion of the population, as is common with endangered species, amplifies the importance of optimizing translocation strategies. Hawaiian tree snails, kāhuli in the Hawaiian language, have dramatically declined over the last century due to invasive predators, habitat loss, and climate change. Predator-exclusion fences have proven effective in protecting snails from invasive predators such as rats, predatory snails, and Jackson’s chameleons. Efforts are underway to translocate captive-bred and remaining wild snails into predator-exclusion fences in climate-suitable areas outside their known historical range. These translocations provide an optimal case study examining the home range establishment of a climate-sensitive species. In this study we used capture-mark-recapture techniques to evaluate movement patterns and home range establishment of translocated Achatinella concavospira, a species endemic to O‘ahu’s Wai‘anae mountains. Establishing stable home ranges approximately 5 - 15 meters from the release location, within 1-2 months large movements (>5 horizontal m) of individual snails were rare. As climate-induced habitat-shifts maroon increasing numbers of climate-sensitive species, assisted translocations will be a necessary tool in preventing biodiversity loss. Barring early mortality due to novel threats, these results demonstrate that translocated populations are likely to persist, establishing novel home ranges when translocated into climate-suitable habitat.

Presentation Keywords

Home range, Translocation, Extinction, Invertebrates, Capture-mark-recapture

98

Survival and Reproduction of Tree Snails in Captivity Maintained on Indigenous and Non-Native Vegetation Versus Native Vegetation

Philip Kitamura, Geneviève Blanchet, Sidney Stiefel, Kūpa‘a Hee, David Sischo

Division of Forestry and Wildlife, Department of Land and Natural Resources, Honolulu, Hawaii

Track

IV. Advancement in Conservation Research and Management

Abstract

The Snail Extinction Prevention Program, Bishop Museum Malacology Department, and the Honolulu Zoo rear over 40 species of terrestrial snails in captivity. Tree-snail species, such as those in the Achatinellinae subfamily, eat microbial biofilms composed of fungus, bacteria, and algae from leaf surfaces. In conservation rearing, Achatinelid snails are provided with fresh native vegetation on a bi-weekly basis. Unfortunately, native forests with appropriate leaf material are increasingly difficult to access on O‘ahu due to their remoteness and overall decline across the state. There is a need to identify suitable non-native vegetation alternatives that are more abundant and accessible to reduce the reliance on native vegetation collection. In our study, we used *Auriculella ambusta* as a surrogate for rare and endangered snail species. *Auriculella* are in the Achatinellidae family and share similar dietary needs to other Achatinelid snails maintained in captivity. We examined adult survival and egg production of *A. ambusta* maintained on non-native vegetation (coralberry, *Ardisia elliptica*; golden pathos, *Epipremnum pinnatum*; ti, *Cordyline terminalis*; banana, *Musa sp.*), compared to snails maintained on native vegetation. Snails were kept in small Talenti ice-cream containers and were censused every two weeks. There was a statistically significant difference ($p < .001$) in the fecundity of snails between native and non-native vegetation, with snails maintained on native vegetation laying the most eggs. This indicates that our initial leaf choices may not be suitable substrate alternatives for snails maintained in captivity; thus captive rearing facilities must remain reliant on native vegetation until suitable alternatives are found.

Presentation Keywords

tree snails, captive rearing, kāhuli, endangered species, diet

99

Evaluating Drivers of Revegetation Following Agricultural Disturbance

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University of California, Santa Barbara, Santa Barbara, CA

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Sugarcane plantations caused substantial land use change in Hawai‘i during the last 150 years. Once a booming industry, sugarcane plantations began systematically closing in the 1980s due to cheaper sugar production elsewhere. Over 35,000 ha of former sugarcane land, abandoned between 4-117 years ago, are not currently used for agriculture and have not been converted to alternative land uses. In a recent study, we characterized patterns of revegetation on abandoned sugarcane land, finding that secondary vegetation can recover the tree structure of nearby undisturbed ecosystems over several decades, but other sites remain in a degraded vegetated state and invasive species are dominant. We still lack an understanding of what environmental conditions cause vegetation succession on abandoned fields to tend toward ecosystems resembling their pre-agricultural conditions or degraded alternative vegetated states. Here we leverage fixed and random effects models to assess how environmental variables influence the structure and composition of recovering vegetation on former sugarcane fields. Preliminary results indicate that the recovery of shrubs was driven by precipitation and soil traits (pH and cation exchange capacity); the recoveries of trees and grasses were affected by those same environmental conditions as well as elevation, slope, and the age of the volcanic substrate. Both native and invasive vegetation cover increased with more basic soil pH. This ongoing research effort uses multidisciplinary methods to analyze remote sensing and GIS datasets to guide the future management of abandoned fields for a variety of local sustainability goals such as conserving biodiversity and increasing carbon storage.

Presentation Keywords

Vegetation recovery, Agricultural disturbance, Conservation planning, Geographic Information Systems

100

Adaptive Management of *Vicia menziesii*: A Collaborative Approach Toward Recovering Hawai‘i’s First Endangered Plant Species

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[1]Kamehameha Schools, Hilo, HI. [2]State of Hawai‘i - Division of Forestry and Wildlife, Hilo, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Vicia menziesii is a liana in the family *Fabaceae* with the distinction of being the first Hawaiian plant to be listed as Endangered under the United States Endangered Species Act. Despite forty-five years of protected status, it remains at high risk of extinction. It is known only from Hawai‘i Island and is now limited to a restricted range on private land at Keauhou Ka‘ū. Fewer than 25 individuals persist in the wild. Once more abundant and widely distributed, seed predation by rodents, land-use change, and herbivory by invertebrates have all contributed to its decline. Adaptive management strategies initiated by the Division of Forestry and Wildlife, the Plant Extinction Prevention Program and Kamehameha Schools aim to reduce threats and work toward meeting downlisting criteria for the species. This renewed effort builds upon decades-long and ongoing landscape-level habitat protection and restoration, previous reintroductions, innovative tools, and shared experiences that helped to establish collaboration between government agencies and private landowners in rare species conservation. Since the signing of the 2017 Keauhou Safe Harbor Agreement, our team has conducted monitoring and surveys, collected propagules from 11 individuals, and has achieved initial propagation success at the Volcano Rare Plant Facility. Planned future actions include additional propagule collections, ex-situ representation in replicate collections, establishing a managed breeding program, and new reintroductions across the species’ historic range. This project demonstrates how endangered species recovery is a long-term commitment enabled by strategic partnerships to conserve biodiversity at all levels-landscape, species, and genetic.

Presentation Keywords

Hawaiian flora, Extinction, Vicia menziesii, Management

101

Pacific Regional Biological Control Facilities in Hawai‘i

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[1]State of Hawai‘i Division of Forestry and Wildlife, Honolulu, HI. [2]Coordinating Group on Alien Pest Species, Honolulu, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

A broad coalition is working to increase the capacity and scope of biocontrol work on tropical pests and weeds through the planning, construction, base funding, and core staffing of new Pacific Regional Biocontrol Facilities in Hawai‘i. New facilities would support regional and international projects, enhance climate resilience of tropical forests and ecosystems, reduce pest loads and the likelihood of spread to new areas, promote agriculture and food security, and protect local and regional economies and the environment. Biological control is often the only feasibile option to control invasive species once they become established and widespread.

In Hawai‘i, the U.S. Department of Agriculture-Agricultural Research Service’s Pacific Basin Agricultural Research Center (USDA ARS PBARC), USDA Forest Service (USDA FS), Hawai‘i Department of Agriculture (HDOA), and University of Hawai‘i (UH) each have some capacity to conduct biocontrol research, however their facilities fall far short of meeting the needs for addressing high-impact, area-wide tropical pests and weeds of local, regional, and national significance.

The construction and operation of two facilities are currently planned, one in Honolulu and one in Hilo. The estimated cost for the planning and construction is $55.1 million, although modular facility options may reduce some costs. While construction and other costs may be high, the return on investment is undeniable. A conservative benefit:cost ratio for biological control starts at 30:1, with some projects reaching 300:1.

Presentation Keywords

Invasive Species, Biological Control, Funding Needs, Capacity Building, Collaborative Research

102

The Role of Cat Colonies in Disseminating *Toxoplasma gondii* to Hawaii's Nearshore Marine Mammals

Sherine Boomla

none, Kailua, Hawaii

Track

IV. Advancement in Conservation Research and Management

Abstract

Toxoplasmosis, caused by the parasite *Toxoplasma gondii*, is a serious disease affecting not only humans, but also warm-blooded animals and birds. In Hawaii, nearshore marine mammals such as the spinner dolphin (*Stenella longirostris*) and the Hawaiian monk seal (*Monachus schauinslandi*) have died from toxoplasmosis. Restriction FLP PCR testing (PCR-RFLP) of two Hawai‘i, stranded spinner dolphin remains showed that the dolphins died from a *T. gondii*, subtype 24 infection, not from other parasites. The common house cat, the essential reservoir host of *T. gondii*, spreads oocysts through its feces, but the land-to-sea connection carrying these oocysts to nearshore waters and infection mechanisms infecting marine mammals are not known. Hawai‘i has also experienced an increase in feral cat colonies located near watersheds and streams. The study's goal is to determine, through soil, water sampling, and PCR analysis, if cat colonies are major *T. gondii* sources through cat feces movement into watersheds, streams, and then into nearshore coastal waters thereby infecting dolphins, seals, and whales. Sampling will be conducted along a gradient from an elevated cat colony to the nearest streams and following a lower elevation watershed gradient to stream mouths emptying into nearshore coastal waters. Sewage outfalls, rain run-off, and storm water events may also play a role in transporting *T. gondii* from land to nearshore ocean water. Results will most likely demonstrate that cat colonies contribute, through feces dispersal, to increased *T. gondii* in both fresh and nearshore ocean water and pose a serious health threat to Hawaii's marine mammals.

Presentation Keywords

Toxoplasma gondii, marine mammals, cat colonies, spinner dolphin , Hawaiian monk seal

103

Mālama ʻĀina Wiki Student Presentations

Mina Viritua Jr

UH Hilo, Hilo, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

As collaborative and holistic efforts are becoming more widespread in natural resource and environmental policy-making processes, young people entering these fields require practical experience in applied and participatory research, community engagement, facilitation and collaboration across diverse groups. An important aspect of that learning is gaining experience communicating their knowledge and experiences to a wider audience. This 1 hour session will provide undergraduate and graduate students the opportunity to share their mālama ʻāina research and experiences in small groups with the opportunity for feedback and discussion. Student participants will be solicited from different Hawaiʻi-based colleges and programs whose efforts are focused on strengthening the resilience of communities across the islands, building partnerships within and beyond the university, and cultivating pono decision-making regarding land and resources in Hawaiʻi. In addition to sharing their projects, students will reflect on their learning and how it has impacted their career paths in conservation. Listen and support our emerging scientists and managers as they share their research and internship experiences. Student presentations are limited to 10 minutes each. Target audience is anyone interested in what young people coming into conservation fields are doing and how we can collectively enhance conservation capacity in Hawaiʻi.

Presentation Keywords

Student focus , Research , community, internship

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda: Opening and welcome. Introductions. Break out groups with student presentations in small groups with rotating participants. Return to the whole group for discussion and sharing.

The goal of this session is to provide students with the opportunity to present their current research experience in the fields of natural resource management, environmental education and community engagement. The target audience for this session are all individuals who want to learn about student research experiences.

104

How are we doing? A 15 year progress report on Hawaiian land snail conservation

Norine Yeung[1], Keahi Bustamente[2], Kelli DeLeon[1], Jaynee Kim[1], Taylor Maruno[1], David Sischo[2], John Slapcinsky[3], Kenneth Hayes[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Hawaii once supported a spectacular radiation of land snails, including more than 759 species; 99% endemic. These species each tell distinctive stories of evolutionary, ecological, and cultural relevance in the islands, and they play important roles in island ecosystems. Unfortunately, they are heavily impacted by extinction. Prior to 2010, it was often stated that 90% or more of Hawaiian land snails were extinct, but these estimates were based on partial surveys or research limited in taxonomic scope. Much of the historical conservation efforts failed to account for the many land snail species that did not readily capture the public's fascination, or that were not protected under the U.S. Endangered Species Act. Over the last 15 years we have attempted to address major knowledge gaps hampering conservation of land snails, starting with what is left, where are they, and what do they need to thrive. Positive outcomes include rediscovering extant species, describing new species, assessing biogeography, revising systematics, and informing land snail ecology and conservation. However, approximately 60% of the fauna is still likely extinct, and at least 70% of the families have lost at least half of their species, with four families ≥ 90% extinct. Here we provide a conservation progress report for the 13 families and include 100 species that will go extinct within the next decade if we do not fill major gaps in understanding through research, conservation support, and outreach. We also offer recommendations for the information needed to develop effective conservation strategies.

Presentation Keywords

Extinction, Conservation, Terrestrial mollluscs, Systematics, Invertebrates

105

What we don't know can hurt our endangered species: Undercounting powerline collisions is a conservation threat for Hawaiian birds.

Marc Travers, Karim Hanna, Scott Driskill, André Raine

Archipelago Research & Conservation, Hanapepe, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Over the last decade, our research has demonstrated that powerline collisions are one of the most important threats to endangered seabirds on Kauai. This was discovered through the development of novel collision monitoring techniques that demonstrated traditional carcass searches dramatically underestimate landscape scale collisions. For example, on average for every one Newell's Shearwater found grounded there are 300 shearwaters grounded but undetected; this undercounting has similarly led to a massive underestimate of the collision risk for Hawaiian Petrels. The mechanisms by which undercounting occurs is environmental bias (when searches cannot occur in areas of variable collision risk), crippling bias (birds are grounded well beyond standard search space), and obfuscation of powerline collision when birds that hit powerlines are grounded in the road and secondarily run over by a vehicle. The latter scenario is particularly important for multiple endemic waterbird species, for which powerline collisions have not previously been considered a significant issue. In total, our research on Kauai has confirmed that 13 native and endemic Hawaiian species collide with powerlines. Documenting this undercounting of powerline collisions with novel methods has shown that powerline collisions are one of the largest anthropogenic threats to Hawaiian birds. As a result of these findings, the Kauai Island Utility Co-operative (KIUC) has modified over 170 km of powerlines for the protection of birds, resulting in an immediate reduction of powerline collisions. KIUC's leadership on collision monitoring and collision reduction methods should greatly aid other power companies in taking efficient action to reduce collisions.

Presentation Keywords

Collisions, powerlines, grounded, birds, threats

106

What's up man? Experiments in lure types to increase captures of male *Culex quinquefasciatus* on Maui and Kaua'i

Allison Cabrera[1], Gabriel Figueroa Torres[2], Olivia Snowden[1], Riley Temkin[1], Layla Rhode[2], Mia Hope[1], Laura Navarrete[2], Hillary Foster[2], Hanna Mounce[2], Cali Crampton[1], Paul Howell[3], Sara Mitchell[3], Ku'ulei Wong[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

The devastating effects of mosquito-borne disease on Hawaiian forest bird populations has reached a breaking point. The 'akikiki of Kaua'i and the kiwiku of Maui have suffered severe population declines. Researchers anticipate new extinctions from the wild within the year. Forest bird recovery is not possible without landscape-level mosquito/disease suppression and tools are under development for such. Before effective mosquito control can be implemented and monitored, using any tool, we need a better understanding of how these mosquitoes (*Culex quinquefasciatus*) move through and use the Maui and Kaua'i environments.This understanding requires being able to capture and monitor both male and female *Culex.* In continental mosquito capture studies, males typically make up at least 5% of the capture rates. However, in Hawai'i, male captures are rare, because the traps used in mosquito research are designed to target females, the sex that bites and spreads disease. Using these same traps, we have employed a variety of lure combinations: CO2, BG lure stick, sound lure (MAST), and floral lure stick on both Kaua'i and Maui to evaluate techniques to increase male captures. Preliminary results suggest that lure combinations produce varied results between islands, female by-catch remains high, and techniques need to be further refined as capture rates of males remain low. Here we present the results of these trapping experiments and hope to find novel techniques in order to be able to continue the development of a mosquito suppression tool.

Presentation Keywords

mosquitoes, novel techniques, forest bird conservation, insect trapping, inter-island collaboration

107

Using Community Science to aid Conservation of Nēnē in Hawai`i

Ariel Imoto[1], Jordan Lerma[1,2]

[1]Nene Research and Conservation, Keaau, HI. [2]Cascadia Research Collective, Olympia, WA

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Title: "Community Science: Compiling Banded Nēnē Sightings to Aid Conservation in Hawai'i"

The monitoring of nēnē populations, particularly in remote or scattered areas of Hawai‘i, poses a significant challenge due to their dispersal. The lack of a statewide network of volunteers exacerbates this issue, leaving gaps in data collection and understanding. Nene.org is a community science project designed to bridge these gaps by aggregating and documenting sightings of nēnē (Branta sandvicensis), the Hawaiian goose. The project enlists the participation of the local community and collaborates with various government agencies and conservation organizations, aiming to become a key resource in the ongoing monitoring of nēnē. We have launched a transparent, publicly available, and centralized database of banded nēnē sightings. Since our establishment as a 501(c)(3) non-profit corporation in January 2023, we have aggregated 1,803 re-sightings of nēnē across five Hawaiian Islands from 568 different contributors. These sightings have been acquired through diverse channels, including community contributions, freedom of information act requests, social media, USGS band reporting, and our own opportunistic encounters. This initiative has started informing habitat restoration efforts and also serves as a learning resource for local middle and high school students to enhance their data collection and analysis skills. Despite the project's potential value for resource managers in delivering comprehensive population data and facilitating community involvement in conservation, it has been met with mixed opinions. We believe that continued data collection and demonstrating its utility will encourage further collaboration.

Presentation Keywords

Community Science, Collaborative technology, nene, government relations, threatened species

108

Current and Past Efforts of Captive Rearing Nēnē (Branta sandvicensis) at Haleakalā National Park

Joshua Higa, Joy Tamayose, Liam Kahoe-Morrison

Haleakala National Park, Kula, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The nēnē (Branta sandvicensis), is a federally threatened species that was extirpated from Maui by 1890. They were reintroduced on Maui at Haleakalā National Park (HALE) in 1962. Nēnē at HALE face many dangers including harsh conditions during early stages of development, predation from invasive species like mongooses and feral cats, along with mortalities caused by vehicular strikes. HALE has implemented several mitigations to protect the growing nēnē population. One mitigation for these losses is the opportunistic captive rearing of nēnē broods. Small temporary pens have been used prior for a variety of reasons including helping injured birds and temporarily holding birds to be released at the park. Larger pens have been occasionally used by HALE to provide optimal conditions and ensured successful fledging of goslings between 2011 to the present. Several broods had been caught in the wild and temporarily raised in captive rearing. The most recent brood was caught in 2022. Families are monitored and provided supplemental feed of lettuce, poultry crumble, and native vegetation. Once the goslings were of fledgling age, families are sexed, banded, and successfully released. Additional sightings of families during the year and through future seasons helps to determine the health status of fledglings' post-release. Though nēnē lost to hazards cannot be replaced, opportunistic captive rearing and release increases success of individuals that may not have survived.

Presentation Keywords

Haleakala National Park, Nene, Mitigation , T&E species, management

109

Relation between optimal group size and population abundance in foraging birds

Aubtin Rouhbakhsh[1], Jake Ferguson[2]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Group foraging occurs when individuals in a population form groups while searching for resources. Fitness advantages that drive group formation include reduced per capita predation risk as well as increased resource uptake. These advantages play an important role in managing species of conservation concern as group formation can affect stability across predator-prey populations. While there are many drivers of group size, its relation with overall population density has not been studied. Here, we described a model which predicts how optimal group size is determined by population density in bird populations. Per capita costs and benefits of group formation in our model are represented by predation risk and intragroup competition, respectively. Under this model, group size is predicted to be density dependent due to the differences in the density dependence of the factors that drive group formation. We then conducted a meta-analysis to test the predicted relationship. We digitized and analyzed the relationship between population abundance and group size across 24 species of foraging birds. We found evidence that population density is a factor driving group formation and therefore per capita fitness. This confirmed that the preliminary analysis of our data was consistent with our theoretical predictions. Future implications of this study include understanding how optimal group size and social behaviors can drive the stability of populations. Many native Hawaiian species form groups, including numerous coastal seabird populations. Understanding the factors that play a role in population stability is key to developing management strategies that successfully promote growth in these populations.

Presentation Keywords

Population Ecology, Behavioral Ecology, Predator-Prey Interactions, Foraging Theory, Optimal Group Size

110

Dramatic Declines Lead to Decision to Remove Remaining ‘Akikiki from Kaua’i into Captivitiy

Justin Hite[1,2], Lisa Crampton[1,2], Eben Paxton[3]

[1]Kaua'i Forest Bird Recovery Project, Hanapepe, Hawai'i. [2]Pacific Cooperative Studies Unit, Honolulu, Hawai'i. [3]Unite States Geological Survey, Volcano, Hawai'i

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Hawaiian honeycreepers continue to suffer from a wave of extinctions, driven by mosquito-borne diseases, such as avian malaria, that are exacerbated by climate change. The situation is particularly dire on Kaua’i. We present data indicating that the ‘akikiki (*Oreomystis bairdi*), an endangered honeycreeper endemic to Kaua’i, will go functionally extinct (<10 females remaining) in the wild in 2023. The ‘akikiki declined from 440 birds in 2018 to approximately 45 individuals in 2021 and 40 individuals in 2022. Annual adult survival probability at Halepa’akai, thought to be the last stronghold for the species, crashed from 0.75 in 2015 to 0.34 in 2020. The number of breeding pairs at Halepa’akai plunged from 35 in 2015 to zero in 2022, and the number of fledglings observed plummeted from 39 in 2018 to zero in 2022. The population declined slowly from 2015-2018 and much more rapidly from 2019-2022. A small number of breeding pairs continue to persist in low density along wetter, windier, clifftop portions of their range. Landscape level mosquito control is under development, but its initial deployment is still several years away, likely too late to save ‘akikiki on Kaua’i. Thus, federal and state agencies determined that the best course of action to prevent extinction was to remove the remaining ‘akikiki from the wild in spring 2023 and place them in managed human care until mosquito control on Kaua’i has rendered their home habitable again.

Presentation Keywords

decline, extirpation, extinction, honeycreeper, human care

111

Investigating the Elusive 'Akeke'e (*Loxops caeruleirostris*), a Hawaiian Honeycreeper in Peril

Bow Tyler[1,2], Tyler Winter[1,2], Justin Hite[1,2], Eben Paxton[3], Lisa Crampton[1,2]

[1]Kaua'i Forest Bird Recovery Project, Hanapepe, HI. [2]Pacific Cooperative Studies Unit, Honolulu, HI. [3]United States Geological Survey, Volcano, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Hawaiian honeycreepers are experiencing a wave of extinctions due to introduced mosquito-borne avian malaria, which expanded into forest bird habitat due to climate change. The ‘akeke’e, an endangered species endemic to Kaua’i, declined by >90% in recent decades, with approximately 1,000 birds left in 2018. Recent data suggest that the decline continues, with approximately 650 birds remaining, and the species is likely to go extinct by 2030. To help determine the best conservation strategies to prevent extinction, since 2018 we conducted research that included capturing, banding, resighting, and radiotracking ‘akeke’e to document nesting biology, territory size, and movement patterns. Despite hundreds of netting hours, we caught only 19 ‘akeke’e. Most radiotracked birds (N=4) disappeared within a few days of transmitter attachment, suggesting large scale movements that were corroborated by resight data. Nests are frequently attended by >2 adults and often contain 3-4 eggs, not 2 eggs as formerly reported. We confirmed that since 2018, ‘akeke’e have retreated from elevations <1200m and are less common in the range core. However, landscape-level mosquito control to interrupt the disease cycle is expected to be deployed on Kaua’i in 2025. Given the difficulty capturing and finding nests of these birds, the probability of successful captive breeding or translocation was considered low. Therefore, managers determined that the best strategy is to continue to monitor this elusive species with a combination of occupancy surveys and song meters to ensure they are persisting on the landscape while we await mosquito control.

Presentation Keywords

honeycreeper, declines, mosquito control, conservation strategy, natural history

112

Catch-up and Keep-up: A Strategy for Marine Debris Mitigation in the Papahānaumokuākea Marine National Monument

James Morioka, Kevin O'Brien

PMDP, Kailua, Hawaii

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The Papahanaumokuakea Marine Debris Project (PMDP) (www.pmdphawaii.org) is a U.S. 501(c)(3) non-profit organization developed to conduct large-scale marine debris removal operations in the Papahānaumokuākea Marine National Monument (PMNM). PMDP actively works with U.S. Federal and State Government agencies on the management of the critical resources, habitat, and wildlife of the PMNN. 115,000 pounds of marine debris is estimated to accumulate on the coral reefs of PMNM annually. In 2022, PMDP spent 60 days in the PMNM and removed over 200,000 pounds of marine debris, and cleaned and restored over 2,700 acres of sensitive coral reef habitat. "Catch-up and Keep-up" is a strategy developed by PMDP to remove historically backlogged marine debris (over 1,000,000 pounds of marine debris estimated to be in PMNM currently) while simultaneously "keeping up" by removing the 115,000 pounds of marine debris which enters the PMNM annually. PMDP hopes that by 2028, the backlog of marine debris will be removed, and focus can be shifted towards shoreline marine debris clean-ups and annual coral reef maintenance.

Presentation Keywords

marine debris, papahanaumokuakea, northwestern hawaiian islands, hawaiian monk seal, ghost net

113

Isodendrion pyrifolium: Phylogeny and Morphological Variation

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Track

IV. Advancement in Conservation Research and Management

Abstract

The endemic Hawaiian genus *Isodendrion* (Aupaka) contains four species that are threatened or endangered. *Isodendrion pyrifolium* (Wahine noho kula) was presumed extinct until its rediscovery in North Kona in 1991. Additional populations presumed to be *I. pyrifolium* were discovered on O‘ahu in 2016 and Kaua‘i in 2022. Populations on Hawai‘i and O‘ahu appear to have different growth forms, an observation not apparent in historic taxonomic treatments of *I. pyrifolium*. To clarify the identity of recently-discovered populations for future conservation efforts, a phylogenetic analysis of the genus was conducted using nuclear ribosomal and chloroplast DNA. A principal components analysis incorporating basal diameter, plant height, and Apical Dominance Index was conducted to determine differences in branching architecture of the O‘ahu and Hawai‘i populations. Preliminary phylogenetic analyses show that the populations presumed to be *I. pyrifolium* on O‘ahu, Hawai‘i, and Kaua‘i form a clade with *I. hosakae*, endemic to the island of Hawai‘i. A multivariate analysis of the branching architecture of the Hawai‘i and O‘ahu populations was not able to discern differences between these populations. The identity of the populations on Kaua‘i, O‘ahu, and Hawai‘i is confirmed to be *I. pyrifolium*. The close relationship between *I. pyrifolium* and *I. hosakae* is not surprising, as the two species share similarities in leaf shape and pubescence, stipule morphology, and corolla color. This taxonomic reevaluation will aid in future conservation of this species that was presumed extinct.

Presentation Keywords

Phylogeny, Isodendrion, Rediscovery , Taxonomy

114

Kaiāulu: Using ʻĀINAVIS to Map Community Care of ʻĀina in Hawaiʻi

Mehana Vaughan[1], Dawn Mahi[2], Sean Connelly[3], Reinier Paul Santiago[1], Kaiqing Su[1]

[1]University of Hawaiʻi at Mānoa, Honolulu, HI. [2]Consuelo Foundation, Honolulu, HI. [3]AFTEROCEANIC, INC, Honolulu, HI

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Over the past few decades, many community groups dedicated to ecosystem restoration, cultural resurgence, and community wellbeing have emerged across Hawaiʻi, taking care of land and waters. This research is a collaboration between ʻĀINAVIS, an artist-driven community-based mapping effort of ʻāina hui across Hawaiʻi, community groups and networks, and UH students and faculty, many of whom are also community members and leaders. The project aims to enhance the growth and resilience of these community groups by documenting their challenges, needed areas of support, and broader collective impact, and contribute to conservation efforts. The project combines public web research, mapping of community groups, and qualitative interviews conducted by students from two graduate-level courses. Thirty students volunteered with and conducted interviews with thirteen community partner groups that care for a wide array of sites from loʻi kalo to loko iʻa, documenting place-based ecosystem-community relationships and visions for the future. Our results focus on how groups form and participate in networks, supporting each other in the face of accelerating shocks from land use, climate change, and recently COVID-19. Community elders mentor groups, passing down knowledge and experiences, to help build communities of care and momentum for the ongoing Indigenous resurgence. Connections between groups illustrate the importance of formal and informal relationships to nurture movements, build commons and solidarity, and emphasize transnational relationships manifested in local community-based resource management efforts. Lastly, this project highlights the connection between Hawaiʻi resurgence and global movements such as Landback, emphasizing their common goals and the potential for collaboration.

Presentation Keywords

community-based, artist-driven, collaborative management, interdisciplinary methods, Indigenous resurgence

115

Conservation Status of Hawai‘i’s Freshwater Lymnaeidae

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Freshwater ecosystems are the most critically imperiled habitats in the world, with nearly one in three freshwater taxa threatened with extinction. Accurate taxonomy, distributions, abundances, and range contractions are all critical for developing effective aquatic resource management practices and to stem the tide of extinction. Native freshwater snails of Hawai‘i are comprised of Neritidae, with three species, and Lymnaeidae with four or five species. Unfortunately, the taxonomic framework for the Hawaiian Lymnaeidae is more than 70 years old, and except for *Erinna* newcombi, no conservation assessments of lymnaeids in Hawaii have been done in the last century. In the 1950s Hubendick recognized five species of native lymnaeids, and considered all widespread on multiple islands, except for *Erinna newcombi.* Other researchers recognized two species of *Erinna* and two in *Lymnaea*. To enable effective conservation planning we have surveyed freshwater habitats across the main Hawaiian Islands and are analyzing historical and recent collections of lymnaeids. Integrative analysis of these snails indicates that there are at least a dozen endemic species, and possibly as many as twenty-eight, including the only two species of sinistral lymnaeids in the world. Species in this small radiation of lymnaeids are geographically restricted, and in some cases consist of only a handful of individuals in a single drainage. Most are found in highly ephemeral ‘vertical wetlands’ associated with waterfalls and seeps. Negative impacts from habitat modification, climate change, and invasive species are likely to extirpate these populations, resulting in the extinction of a diverse fauna that remains poorly understood.

Presentation Keywords

snails, taxonomy, mollusc, cryptic species

116

Assessment of Biological Carrying Capacity at Kapoʻo in the Pūpūkea MLCD

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The Pūpūkea marine life conservation district (MLCD) on the north shore of Oʻahu is the second most highly visited marine protected area in the state of Hawaiʻi. The Kapoʻo (Sharks Cove) tidepools and cove are more accessible than other areas in the MLCD and are home to a variety of species including fish, corals, algae, and mobile invertebrates. There are concerns that these living resources may be displaced, damaged, or otherwise impacted by the high rates of visitation and a need to better understand the effects of visitor crowding to inform management strategies. Over the 2022 summer season, human use, and marine species at Kapoʻo were monitored in parallel. A variety of methods were used to quantify, characterize, and map human use. At the same time, in-water surveys of fish and invertebrates were conducted along with surveys of physical damage to corals. For mobile organisms such as fishes and select invertebrates, temporal patterns of human use were compared with abundance measures, while spatial patterns of human use were compared with patterns of occurrence and damage for non-mobile organisms such as corals. Results showed significant effects of human presence on both fish and mobile invert abundance and incidence of coral damage. Patterns and potential thresholds of human use were identified and documented to inform management actions. Based on these findings, managing human visitation to these ecologically sensitive areas is recommended.

Presentation Keywords

MPA, Visitation, Fishes, Corals, Management

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Advancing Endangered Hawaiian Bird Species Monitoring Using Bioacoustics and Machine Learning

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Track

IV. Advancement in Conservation Research and Management

Abstract

To prevent further loss in avian diversity in the Hawaiian archipelago, accurate and timely assessment of population health and the effectiveness of conservation actions is imperative. As hardware and software technologies improve, the use of passive acoustic monitoring (PAM) of wildlife is rapidly growing in popularity. Collecting automated bioacoustic data provides an appealing, relatively low-cost approach to assessing the status of endangered species, particularly in difficult-to-access habitats like dense forests in Hawai‘i. Machine learning provides rapid analysis of recordings for vocalizing wildlife, allowing researchers and managers to effectively use PAM at ecologically relevant spatiotemporal scales. However, machine learning algorithms require large training datasets to achieve high accuracy, which limits their usefulness for rare and endangered species. Here, we assess a Hawai‘i-specific model of BirdNET, a deep neural network for identifying birdsong in soundscape recordings. We describe the BirdNET-HI model, training data collection (across Hawai‘i, Maui, and Kaua‘i) for 25 native species, performance metrics analyzed, model performance on a per-species basis, and a performance comparison against the global BirdNET model (v. 2.2). The number of training samples varied by species from 37 to >23,000, however, this was not the sole determinant of model performance. Preliminary results show improvement for many species (e.g., accuracy for Nēnē increased from 0.267 to 0.941). BirdNET-HI will be a powerful tool for Hawai‘i conservation managers to monitor bird population abundance, range expansion and contraction, and cultural changes (i.e., song variation) over time on an archipelago-wide scale.

Presentation Keywords

Bioacoustics, Passive Acoustic Monitoring, Wildlife Monitoring, Machine Learning, Conservation Tools

119

Opening Remarks: Betsy and Wayne Gagne Memorial Invertebrate Conservation Symposium (Part 2)

Sheila Conant

Bishop Museum, Honolulu, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Betsy and Wayne Gagne have had an extraordinary impact in Hawaii's invertebrate research and conservation. To open the second half of this symposium which focuses on molluscs, I will be providing highlights from both of their careers and their continuing impact in today's conservation of Hawaiian invertebrates, in particular the conservation trajectory of Hawaii's freshwater and terrestrial molluscs.

Presentation Keywords

Invertebrate, Extinction, Conservation, Educational outreach, Community Service

120

More Than Meets the Eye: Uncovering the Hidden Symbiome of Hawaiian Land Snails and What This Means for Their Conservation

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Track

IV. Advancement in Conservation Research and Management

Abstract

Hawaiian land snails are known for their high diversity and endemicity, but are equally infamous for their high extinction rates. Only about 300 of the more than 759 species remain; many only in captivity. As we race to prevent further extinctions in this fauna, we find ourselves lacking foundational knowledge needed to devise effective conservation strategies. One substantial knowledge gap involves symbiotic organisms associated with these snails, including disease causing pathogens, parasites, and mutualists. This knowledge is critical for captive and wild conservation management of Hawaiian land snail hosts, as a key to reducing disease-induced mortalities and creating optimal conditions for population growth. Here we present the initial results of a DNA-based approach to characterizing Hawaiian land snail symbiomes developed as part of a collaborative research project between the Bishop Museum and Hawai‘i’s Department of Land and Natural Resources Snail Extinction Prevention Program. This work provides a first glimpse of the symbiomes for several remaining species of the Achatinellidae and Amastridae families. We also compare the symbiomes of healthy snails and those of apparently diseased snails from captive rearing operations to identify, and begin mitigating, likely drivers of mortality. This enhanced understanding of symbiont community composition will provide another crucial piece of the puzzle needed to prevent further extinctions of these ecologically important, culturally relevant, but rapidly disappearing Hawaiian fauna, and highlights the holistic, ecosystem-level approaches needed for effective conservation action.

Presentation Keywords

Applied ecology, Microbiome, Symbionts, DNA techniques, Invertebrate conservation

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Spatial Population Genomics to Enhance Landscape-scale Suppression of Mosquito Populations using Incompatible Insect Technique

M. Renee Bellinger[1], Corinna Pinzari[2], Lisa "Cali" Crampton[3], Hanna Mounce[4], Allison Cabrera[3], Hillary Foster[4], Adam Vorsino[5], Dennis LaPointe[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Key factors impacting the imminent extinction of several Hawaiian forest bird species include an interaction between climate change, changes in mosquito distribution, and transmission of avian diseases vectored by the invasive southern house mosquito (*Culex quinquefasciatus*). One strategy proposed to change this extinction trajectory is to interrupt the avian disease cycle by suppressing wild *Culex* populations using Incompatible Insect Technique (IIT). The IIT involves repeated inundative releases of laboratory-reared *Wolbachia*-transinfected *C. quinquefasciatus* males that are reproductively incompatible with wild *C. quinquefasciatus* females because of the *Wolbachia pipientis* strain (*w*Pip) that they naturally carry. To enhance the efficacy of the *Culex* IIT program, currently under development, we are investigating *Culex* invasion histories and patterns of population connectivity within and across the islands of Kauaʻi, Maui, and Hawaiʻi. Preliminary population genomic results indicate that mosquito populations sampled to date are reproductively isolated by island, based on ~250 individual specimens genotyped at ~15,000 genetic markers. Expanded mosquito sampling across low- and high-elevation sites may reveal additional spatial genetic patterns, allowing for finer-scale assessment of population connectivity. Accordingly, genotyping efforts have been expanded to nearly 1,000 mosquito specimens, with next-generation sequencing data currently under analysis. A comprehensive understanding of spatial population genomics can be applied to characterize source-sink population dynamics and identify potential re-invasion pathways, information that may be useful for adjusting how the IIT program is implemented thus enhancing its efficacy.

Presentation Keywords

Insect Incompatible Technique, Birds, mosquitoes, genomics, Wolbachia

123

Arthropods are Kin: Operationalizing Indigenous Data Sovereignty to Respectfully Utilize Genomic Data from Indigenous Lands

Leke Hutchins[1], Ann Mc Cartney[2], Natalie Graham[1], Rosemary Gillespie[1], Aidee Guzman[3]

[1]UC Berkeley, Berkeley, California. [2]UC Santa Cruz, Santa Cruz, California. [3]UC Irvine, Irvine, California

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

With many island taxa groups threatened or teetering on the edge of extinction, conservation efforts must expand past nature preserves and into our working landscapes. ʻŌiwi have cultivated abundant and biodiverse ecosystems since ka wā kahiko. The rise of metagenomics and high-throughput sequencing technologies to characterize biodiversity has rapidly expanded the scale of data collection and generation from these lands. A respectful and informed approach to the data life cycle grounded in the sovereignty of Indigenous communities is imperative to not perpetuate harm. Here, we operationalize Indigenous data sovereignty to outline workflow considerations that spans the collection, governance, and communication aspects of genomic data. As a case study for this workflow, we utilize metabarcoding data collected from the Kona and Kaʻū Field Systems to characterize how arthropod communities shift in relation to crop diversification, while discussing realistic considerations researchers must make in their data's life cycle – from developing research questions to sharing results. Through this example, we emphasize the context-dependent opportunities and challenges for operationalizing Indigenous data sovereignty. In addition, we present our metabarcoding data showing diversified farms have higher native arthropod richness in comparison to simplified farms, as well as the role ʻōiwi crops have in shaping a unique assemblage of arthropods. Overall, the workflow and the example presented here can help researchers take tangible steps to achieve data sovereignty, a goal that often seems elusive.

Presentation Keywords

data sovereignty, agroecology, hybrid restoration, metabarcoding

125

Passive Deer Removal from a Fenced Area: See Yourselves Out

Christina Pisani, Jonathan Sprague

Pulama Lanai Conservation, Lanai City, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Invasive ungulates pose significant risks to entire ecosystems, especially delicate communities of native species on islands. On the Hawaiian island of Lānaʻi and in many other parts of Hawaiʻi, fences are being strategically built to exclude ungulates from sensitive habitat. Once a fence is complete, removal of remaining ungulates inside the fenced area can be quite costly. Under optimal conditions, traditional removal techniques such as night hunts or pushes can range from $20 to $200 per animal depending on a range of variables (terrain, proximity to residential/resort areas, size of enclosure, etc). A 900-acre exclosure was recently built on Lānaʻi's south coast to protect cultural, natural, and economic resources from invasive ungulates, particularly Axis deer (Axis axis). Removal via hunting in the fenced area currently averages about $100 per animal. However, observations from cameras placed at several funnel-shaped openings in the fence suggest that fencing constructed in a strategic orientation may aid in deer passively exiting the exclosure, while allowing minimal ingress. Over an initial 2 month period, 181 Axis deer were documented leaving the exclosure at one of the funneled exit points vs only 40 Axis deer entering. This unique observation is leading us to test similarly designed funnel-shaped exits on other fences as potential tools to more affordably remove ungulates, especially during the early stages of clearing exclosures.

Presentation Keywords

invasive, ungulates, fences, removal, deer

126

Estimation of climatic suitability for the restoration and potential translocation of Haleakalā ʻāhinahina threatened by climate change

Paul Krushelnycky[1], Lucas Berio Fortini[2], Jeffrey Mallinson[3], Jesse Felts[3]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Accurate estimates of current and future climatic suitability are needed for species that may require assistance in tracking a shifting climate. Standard species distribution models (SDMs) using occurrence data are the most common approach for evaluating climatic suitability, but these may suffer from inaccuracies stemming from disequilibrium dynamics and/or an inability to identify suitable climate regions with no analogues within the current range. An alternative approach is to test performance with experimental introductions across and beyond a species' current range, and model suitability from the empirical results. We employed this method with the Haleakalā ʻāhinahina (silversword, *Argyroxiphium sandwicense* subsp. *macrocephalum*), using a network of out-plant plots across the top of Haleakalā volcano. Survival varied strongly across this network and was largely explained by a simple model including mean daily rainfall and mean daily air temperature. We applied this model to present and historical climate conditions to produce estimates of current climatic suitability for restoration or translocation activities, and to define trends in suitability over the past three decades. We then extended these trends into the future to produce maps of projected suitability through 2051. This empirical approach identified areas of high climatic suitability around the summit, and in a second region on the northwest slope where plants no longer occur. Unfortunately, much of the current range was estimated to now have low suitability for restoration. These patterns contrast strongly with projections obtained with a standard SDM, which predicted continued suitability and ʻāhinahina presence throughout the current range.

Presentation Keywords

climate change, assisted migration, restoration, outplanting, suitability modelling

127

Invasive Species Resource Management: Utilizing trained detection canines in containing Chromolaena odorata populations on Hawai’i Island

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[1]Big Island Invasive Species Committee, Hilo, Hawai'i. [2]Conservation Dogs Hawai'i, Aiea, Hawai'i

Track

IV. Advancement in Conservation Research and Management

Abstract

Invasive species are one of the largest threats to Hawaiian ecosystems, and the list of invaders is constantly growing. Timely detection is important for successful eradication, which is a major challenge given limited resources. In 2021 the Big Island Invasive Species Committee detected the high-risk invasive plant Devil Weed (Chromolaena odorata). Further surveys revealed 9 populations of the plant spread across 105 square miles. Several of these populations are near high-value conservation or agricultural land and it was vital for us to quickly and accurately delimit population boundaries so we could focus our control work. This species is difficult to detect on UAV surveys, and Devil Weed can seed quickly and at very small sizes. The O'ahu Invasive Species Committee has had success with canine surveys as part of their Devil Weed eradication program, so we were hopeful this method would be useful on Hawai'i Island as well. We worked with Conservation Dogs of Hawai'i to survey a variety of areas using a trained canine in summer 2022. We discovered that this survey method has some restrictions but in suitable locations the dog surveys are extremely effective, particularly along the outer boundaries of populations. In our work canine surveys were up to 10x as time-efficient compared to ground crew surveys and were more likely to detect small or hidden plants. This allowed us to better focus our crew time on plant control. We are excited to continue refining and expanding our use of canine surveys.

Presentation Keywords

Invasive Species, Canine, Survey, Plants, Devil Weed

128

PI CASC Immersive Climate Adaptation Education and Training: Elementary to Professional

Emily Sesno, Heather Kerkering, Rachel Lentz, Beth Lenz, Scott Laursen, John Borja, Mari-Vaughn Johnson

Pacific Islands Climate Adaptation Science Center (PI CASC), Honolulu, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

The Pacific Islands Climate Adaptation Science Center (PI-CASC) fosters collaborative, place-based knowledge exchange and growth opportunities at every stage of climate adaptation learning and practice. Successful adaptation to climate change impacts will not be accomplished by science alone; our future depends on our ability to connect with youth and early career professionals in co-developing community-driven research and directly engaging management practices. The interactive and innovative educational and training programs led by PI-CASC span disciplines and experience, to include students of all ages, teachers, and community members. These programs include 1) a K-12 Education Hub that supports students, teachers, and researchers to enhance climate literacy in education by providing access to science-based curriculum and opportunities; 2) the Summer Undergraduate Research Fellowship (SURF) connects outstanding students with faculty mentors to conduct meaningful climate adaptation research, exposing them to a potential career path; and 3) graduate and early-career training programs: the Graduate Scholars Program hosted by UH Mānoa, the Manager Climate Corps (MCC) at UH Hilo, and the Climate Adaptation for Resource Management (CARM) program through the University of Guam. The Scholars Program offers important professional development opportunities for all graduate students within PI CASC; MCC engages both graduate students and early career professionals in co-produced research with community partners; and CARM presents early and mid-career natural resource managers an opportunity to bolster their professional capacity through further academic training. This poster will share details from these PI-CASC programs that nurture workforce development to enhance adaptive capacities for the future in the Pacific.

Presentation Keywords

Education, Training, Climate, Adaptation, Students

129

Nocturnal Lethal Control of *Axis axis* on the Island of Lāna'i

Zane de la Cruz

Pūlama Lāna'i, Lanai City, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Axis deer were introduced to Lāna'i in 1920. Released from the predators and diseases of their home range the only checks to their population growth became hunting and the landscapes limited resources. The local flora of Lāna'i having evolved in the absence of ungulates have no effective countermeasures against herbivory, therefore today with small exception there is no native plant recruitment on Lāna'i due in part to the selective grazing of Axis deer.

To mitigate landscape degradation and the pollution of the near shore waters associated with Axis deer an integrated management plan is needed to control the Axis deer population. While managed hunts are used to control herd size, hunting alone is not always sufficient to meet harvest goals. This is where a professional control staff utilizing methods not available to the general public can be effective. With the proper permitting and training performing control work at night is significantly more efficient and potentially more effective than a typical managed hunt. The use of artificial visible light to locate and target animals, and "night vision" enabled scouting devices and weapon sights are two methods used by Pūlama Lāna'i. Between these two methods the training, personnel, and equipment requirements are drastically different, and where they can be equally effective they are discreet tools that fulfill different roles in a complex management strategy.

Presentation Keywords

Axis deer, Control, Invasive Mammal

130

From 3 to 503: Early Successes Towards the Recovery of a Critically Rare Hāhā

Susan Deans[1], Scott Heintzman[1], Adam Williams[2], Matthew Keir[3], Lauren Weisenberger[4]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Reintroduction of endangered plants into protected wild sites is a critical step in the recovery of native species and a core function of the Plant Extinction Prevention Program (PEPP). In 2022-2023, 500 individuals of the Kauaʻi-endemic, critically endangered *Cyanea rivularis* (hāhā) were outplanted into upper Hanakoa valley in northwest Kauaʻi. The site was selected based on threat density and management, then additional threat control was conducted to prepare for outplanting. Plants were transported by helicopter external load to Hanakoa, outplanted by PEPP staff and partners, and then individually tagged and mapped. Hand cross-pollinations were conducted among flowering individuals to produce diverse seeds to replenish ex situ collections. 282 fruits were then collected, only 12 of which resulted from hand-pollination. ~85,000 seeds resulted from these fruits, which were then banked for long-term storage. Kauaʻi ʻamakihi (*Hemignathus kauaiensis*) were observed visiting the flowers among numerous plants, presumably providing pollination services resulting in high fruit set. Additionally, larvae of the Kauaʻi-endemic Campanulaceae-specialist ʻaumakua moth (*Aumakua omaomao*) were observed feeding on the leaves of plants throughout the site. While initial survival (99.4% of initial 340 plants after 8 months) and reproduction are high, threats will continue to encroach on the site, necessitating ongoing management. Going forward, success will be measured by the survival and growth of the plants, biotic interactions, and regeneration, towards the goal of creating a healthy, diverse, self-sustaining population of *C. rivularis* and recovering the species from the brink of extinction.

Presentation Keywords

species recovery, extinction, pollination, Campanulaceae, Kauaʻi

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30 Years in the Making: Outplanting Design and Recovery of *Cyanea rivularis* (Campanulaceae)

Scott Heintzman[1], Susan Deans[1], Adam Williams[2], Matthew Keir[3], Lauren Weisenberger[4]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

With only three individuals remaining in the wild, the Kauaʻi Plant Extinction Prevention Program (KPEPP) and partners are implementing a US Fish and Wildlife Service-funded plan to reintroduce 2,500 individuals of *Cyanea rivularis* (hāhā) across five sites to recover one of the island's rarest plants. Efforts were undertaken to design five genetically diverse outplantings of a species with small population size, numerous threats, and limited collections in ex situ facilities. Forty accessions containing 36,000 seeds representing 13 founders, most of which are no longer extant, were carefully selected from accessions in two seed banks to maximize genetic diversity. There was a lower-than-expected germination rate (9% average), and the total loss of some founders due to lack of germination and extirpation in the wild. These unexpected results required KPEPP to shift their strategy to focus more on collecting from wild plants and mature outplanted individuals to have a sufficient number of propagules for all five sites. Furthermore, identifying five outplanting sites that were ecologically similar to the in situ sites proved challenging, requiring collaboration with partner agencies and surveys of historical localities to select sites that met prerequisites for species recovery. During the project's planning process, some of the lessons learned were that successful reintroductions always requires a large investment of time and resources, along with an adaptable strategy.

Presentation Keywords

Seed Bank, Species Recovery, Extinction, Kauaʻi, Campanulaceae

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Biocultural Conservation in Lower Limahuli Preserve

Kassandra Jensen

National Tropical Botanical Garden, Kalaheo, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Restoration of native habitat and maintenance of threatened and endangered plant populations are a few of the multiple biocultural conservation goals in Limahuli Valley. Unfortunately, invasive plants and animals, and valley terrain can pose difficulties. The National Tropical Botanical Garden (NTBG), in partnership with the U.S. Fish and Wildlife Service, focus on two restoration zones within the lower 600 acres of Limahuli Valley: a 500 meter stretch of riparian area, and 5 acres of lowland mesic forest enclosed by an ungulate proof fence. While multiple projects in these areas are ongoing, there has been a focus over the last five years to restore two landslides that occurred within the fenced restoration zone. These sites are particularly challenging as they have occurred within a remnant agroforest containing Kukui (Aleurites moluccana) and 'Ōhi'a ai (Syzygium malaccense) that hold historical importance and often cannot be cut down. By removing weeds, planting native plants, and selectively thinning newer growth kukui and 'Ōhi'a ai, we hope to combat erosion and maintain a hybrid native and agroforest.

Additionally, seed collection from threatened and endangered plants found in Limahuli is key in restoring habitat. Over the last three years, there has been a focus on collecting from populations of Ochrosia kauaiensis, Pritchardia napaliense, Charpentiera densiflora, and Hibiscus waimeae subsp. hannerae to be stored in the NTBG seed bank or grown and outplanted in restoration sites. As restoration continues NTBG hopes to continue the legacy of stewardship by conserving Limahuli Valley and maintaining a 21st century ahupua'a.

Presentation Keywords

mesic forest, biocultural, ahupua'a, endangered flora, landslide

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Pacific Islands Managed and Protected Areas Community: A Model for an Adaptive Cross-Sector Capacity Building Network

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

The Pacific Islands Managed and Protected Areas Community (PIMPAC) is a proven model of a regional cross-sector capacity building network that promotes communication and collaboration to improve conservation outcomes. By applying adaptive management principals to its existing organizational structure, PIMPAC strives to create and implement a nimble and reactive capacity building network which is responsive to changing needs from a diverse group of conservation practitioners. PIMPAC has developed a streamlined coordination structure, and is cultivating a cohort of engaged capacity building providers, who communicate and coordinate to improve support for communities and practitioners. This model has proven effective at establishing cross-sector partnerships, creating innovative financing mechanisms, and implementing science to policy solutions. Additionally, PIMPAC focuses on amplifying locally effective solutions to a regional audience, to elevate accomplishments that may be replicable in other places. After completion of a programmatic evaluation in 2019, and an updated strategic plan in 2023, PIMPAC is now working to improve how it measures management effectiveness, to better link capacity building activities to natural resource and managed area outcomes. PIMPAC aims to continually improve its adaptive management cycle as an organization to better support managed areas throughout the Pacific region.

Presentation Keywords

Capacity Building, Best Practices, Regional Network, Cross-Sector Collaboration, Management and Evaluation

134

Efforts to seed new yellow-faced bee populations using translocations

Paul Krushelnycky[1], Molly O'Grady[2], Maria Aihara-Sasaki[2], Cynthia King[3], Sheldon Plentovich[4]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Hawaiian yellow-faced bees (Hylaeus spp.) are the only native bees in the islands. Many of the 60+ species comprising this important pollinator group are now extremely rare owing to habitat loss, habitat degradation, and predation and competition from invasive species. In 2016, seven species were formally listed as Endangered, including Hylaeus anthracinus, a species occurring in coastal habitats on several islands. In an effort to increase the number of H. anthracinus populations on Oʻahu, we attempted to translocate this species from existing populations at Marine Corps Base Hawaiʻi and James Campbell National Wildlife Refuge to two new locations within Kaʻena Point State Park and the Kalaeloa Unit of Pearl Harbor National Wildlife Refuge. Approximately 150 bee nests constructed within artificial nest blocks were moved to each translocation site in July and August, 2020. Bees began emerging and constructing local nests within the first week after translocation, indicating successful establishment, at both sites. However, subsequent reproduction was lower at Kalaeloa than at Kaʻena, despite a greater floral resource base, and the Kalaeloa population perished after about five months. In contrast, the Kaʻena population has persisted, at low levels, to the present. Potential causes for the eventual failure of the Kalaeloa population include much greater parasitism and a possible shortage of natural nesting habitat. Both translocations provided useful insights into the factors contributing to the success or failure of bee establishment and persistence, and serve as foundations for similar future efforts.

Presentation Keywords

yellow faced bees, translocation, pollination, insect conservation, coastal ecosystems

135

Developing a High Resolution 'Ohi'a Lehua Distribution Map for Hawai'i Island

Megan Seeley, Roberta Martin, Nicholas Vaughn, Gregory Asner

Arizona State University, Tempe, AZ

Track

IV. Advancement in Conservation Research and Management

Abstract

In an effort to aid conservation efforts that protect native Hawaiian forests, we developed novel geospatial data of 'ohi'a lehua across Hawai'i Island. Previously, spatial data of 'ohi'a did not exist at the resolution nor accuracy required to effectively aid in forest conservation objectives such as Rapid 'Ohi'a Death monitoring. To address this information gap, we used imaging spectroscopy and light detection and ranging (LiDAR) data collected by Arizona State University's Global Airborne Observatory in 2019. Imaging spectroscopy, or hyperspectral remote sensing, is a method that creates high spectral-resolution images by capturing the reflectance of surfaces along a continuous portion of the electromagnetic spectrum from visible (400 nanometers) to short-wave infrared (SWIR; 2500 nm). These data were processed to remove the effect of atmospheric distortion, brightness normalize the spectra, and filter pixels to obtain only those representing sunlit portions of the canopy. Next, we collected training data by identifying 4986 crowns as either 'ohi'a or other vegetation. Two thirds of these data were randomly selected to train a support vector machine (SVM) model. We achieved 96.7% accuracy on the remaining one third of the dataset. This model was applied to imagery from across Hawai'i Island, and the results were interpolated to fill crown gaps in the dataset that represented shaded portions of the canopy. The 'ohi'a canopy map will be freely available as a presence/absence map (2 m x 2 m) and as a canopy density map (30 m x 30 m).

Presentation Keywords

'ohi'a lehua, remote sensing, species classification, Rapid 'Ohi'a Death

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Effects of Invasive Plant Removal on Frugivory Network Structure and Robustness

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Removing invasive species is a key tool for conservation, however, this removal disrupts important species interactions including frugivory (animals eating fruits). To identify how invasive species removal changes interactions, we manipulated frugivory networks in experimental plots on O‘ahu, Hawai‘i. We removed the fruits of key invasive plants (*Miconia crenata* and *Rubus rosifolius*) in impact plots to test interaction changes (rewiring) and functional resilience. We predicted that rewiring would increase but functional resilience would decrease after invasive fruit removal. We used a Before/After and Control/Impact design on eight 20x20m plots for 6–8 weeks before and after fruit removal. Birds and rodents eating fruit were captured using motion-triggered game cameras and observations and compiled to build frugivory interaction networks. We measured functional resilience through network structure and robustness to subsequent random species loss. Across all plots, we detected 16 animal species (15 introduced) and 15 plant species (6 introduced) in 1,211 frugivory interactions (79% with introduced plants). Higher levels of rewiring occurred on impact plots compared to controls suggesting that invasive fruit removal forces animals to feed on other fruits. Network structure and robustness were highly variable across plots and treatments with no clear directional change. In conclusion, removal of key invasive fruits increased interaction rewiring but did not affect functional resilience in a clear direction. From a conservation lens, it is promising that invasive species removal did not negatively impact functional resilience, however, the idiosyncratic effects on network structure and robustness require further investigation.

Presentation Keywords

plant-animal interactions, mutualistic networks, frugivory

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Restoring Native Ecosystems Through Multi-Sector Collaborations

Marian Chau[1], Jason Preble[2,1], Sebastian Marquez[3,4], Mashuri Waite[5], Miles Thomas[6,7], Johannes Seidel[1], Kimberly De Souza[1], Lehua Todero[1], Michael Sthreshly[1], Brian Tucker[1], Timothy Gallaher[6]

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Reflecting on our past, the Hawai‘i conservation community was ahead of its time in recognizing the need for collaborative efforts to address many intersecting environmental and social concerns. However, we are faced with some of the most serious challenges humanity has seen, such as climate change, biodiversity loss, habitat degradation, invasive species, and long-term effects of colonialism. The urgency of these problems has never been greater. Dreaming of our future, we can build on the momentum of our collaborative history and keep expanding partnerships to effectively address these challenges. We recognize the need to innovate environmental solutions from our mauna to our kai, and to integrate the spectrum of biocultural, scientific, educational, and practitioner perspectives from diverse sectors across the islands. In this forum, we highlight a public-private-nonprofit partnership across two islands working to restore native ecosystems holistically for the benefit of our local communities. Hosted by Terraformation and Bishop Museum, the forum will highlight ongoing and proposed native ecosystem restoration projects by various partners on O‘ahu and Hawai‘i islands. We will then hold breakout sessions to discuss ways to increase cross-sector collaborations on existing projects and ask for community feedback in planning upcoming projects. We will also share lessons learned in deepening pilina with the natural world and provide tools that participants can apply to their own work. Group sharing and synthesis will empower us to identify key themes and ideas that we can apply to ecosystem restoration into the future.

Presentation Keywords

restoration, partnerships, community engagement, native ecosystems, biocultural conservation

Agenda & Additional Required Information for Forums, Workshops, and Trainings

- Agenda & list of speakers (2 hours)

- Opening ʻOli/Grounding to Place; Sharing simplified version of Moʻokūʻauhau; Speaker Introductions - Marian Chau (10 min)
- Protect & Preserve Hawaiʻi - Jason Preble (2 min)

  A community-based group dedicated to restoring the native ecosystems and cultural heritage of Hawaiʻi and its people. Ahupuaʻa of Waikīkī, moku of Kona, mokupuni of Oʻahu.

- Mānoa Cliff Trail Restoration Project - Sebastian Marquez (2 min)
  A volunteer-driven project dedicated to significantly turning back the decline of native plants and to protect and promote native plant growth. Ahupuaʻa of Waikīkī, moku of Kona, mokupuni of Oʻahu.
- Gill ʻEwa Lands - Mashuri Waite (2 min)
  A family trust working to restore the health of the Waiʻanae Mountain ecosystem at Pālehua and preserve and protect the land's important biological, cultural, economic and historical resources. Ahupuaʻa of Honouliuli, moku of ʻEwa, mokupuni of Oʻahu.
- Bishop Museum - Miles Thomas (2 min)
  A nonprofit museum with a mission to inspire their community and visitors through the exploration, celebration, and perpetuation of the extraordinary history, culture, and environment of Hawaiʻi and the Pacific. Ahupuaʻa of Kapālama, moku of Kona, mokupuni of Oʻahu.
- Terraformation - Johannes Seidel (2 min)
  A company with a mission to accelerate natural carbon capture by solving the biggest bottlenecks to forest restoration, accelerating global progress toward this climate solution. Based in the ahupuaʻa of ʻOʻoma, moku of Kona, Hawaiʻi Island, with projects in the ahupuaʻa of Kaupalaoa, moku of Kohala; ahupuaʻa of Waikoʻekoʻe, moku of Hamakua; and ahupuaʻa of Pāpaʻikou, moku of Hilo.
- Breakout Group Discussions (25 min)
  Led by presenters and additional moderators
- Full Group Sharing & Synthesis (10 min)
  Led by volunteer participants from each breakout group
- Conclusions (5 min)

- Description of innovative audience engagement techniques

We will take a place-based approach to our breakout discussion sessions, inviting participants to join groups centered (depending on the size of the full group) on mokupuni, moku, and/or ahupuaʻa whose waters feed them, or to which they have kinship ties and/or aloha ʻāina relationships. Representatives of the restoration projects will facilitate open conversations that could include feedback on information shared in presentations, suggestions on additional considerations to improve restoration outcomes, and ideas for how projects can benefit local communities, increase engagement, and broaden partnerships.

When we colloquially speak of engaging a community, we understand that we are likely referencing the community of people who populate a place. However, from the Hawaiian perspective, we recognize that there is no difference between our human communities, and our

natural communities. So how do we engage our natural ecosystems? Oftentimes this process can feel esoteric, guarded, or intimidating. We will innovatively engage our audience by offering them the personalized chance to remove the barriers to engaging the natural community in their individual spaces.

We will provide our audiences with a workbook to take home, full of resources to begin engaging with their natural world. This workbook will include a simplified version of Moʻokūʻauhau adapted by Hālau ʻŌhiʻa & Hui Kūmokuhāliʻi. Attendees will be able to identify: kulaiwi, ʻāina, mauna/puʻu, wai/kai, and lāʻau i ʻoluʻolu. With this individualized foundation participants will then be guided to resources that can deepen their pilina with their ecological community. The forum's speakers will lead breakout session groups to provide case studies and success stories of how these relationships improved restoration outcomes, benefited local communities, increased engagement, and broadened partnerships.

- Explanation of goals and target audience

Our target audience is any members of the conservation community (by its broadest definition) with interest in ecosystem restoration activities, especially in the moku of Kona and Waiʻanae on Oʻahu, and the moku of Kohala and Kona on Hawaiʻi Island. Our goals are to (1) openly share various approaches, outcomes, and/or lessons learned for a diverse set of restoration projects being undertaken by partners from multiple sectors, (2) invite feedback from any interested groups/individuals on ecological, cultural, and other considerations in restoration planning and implementation, and (3) facilitate pathways for additional collaborations.

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Classifying Small Wildlife in Trail Camera Photos: Using AI to Improve Predator Control on Kaua‘i

Roy Gilb[1,2], Lisa Crampton[1,2], Mari Reeves[3], Jean Fantle-Lepczyk[4], Christopher Lepczyk[4], Kathryn Temple[4], Cozette Romero[5], Tyler Winter[1,2], Justin Hite[1,2], Liba Pejchar[5], Lainie Berry[6]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Trail cameras provide a low-impact and comprehensive method for biologists to monitor a wide array of wildlife data, however the overwhelming number of photos collected present challenges in organizing data into actionable results. Artificial intelligence (AI) algorithms can automate species’ detection and remove the need to review “blank” images. To date most AI has focused on large species, not smaller species like birds and rats of interest to many managers in Hawai‘i. Our goal was to assess available AI systems to identify an accurate and efficient system to streamline photo processing and identification. We leveraged Zendo, made by DeepAI, to classify photos collected in the Alaka‘i Plateau on Kaua‘i and remove blank images from our review. Zendo has a simple interface and allows training using segmented outlines rather than bounding boxes. We trained the model using 2,412 randomly selected photos to identify rats, birds, cats, deer, and pigs, which was then used to classify 225,456 photos. We used Timelapse software to ingest Zendo metadata to remove blank photos resulting in 84% fewer photos to review. We assessed Zendo’s precision (probability of correct prediction, given a species presence) in identifying rats, the target species. Preliminary results indicate Zendo performed with a precision of 0.83 in identifying rats when using the lowest confidence threshold (0.25). Future steps include comparisons to other AI interfaces and additional accuracy metrics for all species. Assessing these different systems and determining accuracy will be an important advancement in monitoring small non-native species and efficient predator control.

Presentation Keywords

camera, ai, birds, rats, data

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On the Movements of Acoustically Tagged Sharks Detected at North Shore, Oʻahu Ecotour Sites

Julia Hartl[1], Carl Meyer[1], Yannis Papastamatiou[2], Noelani Puniwai[3], Randall Kosaki[4], Kim Holland[1]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Shark ecotourism is a non-extractive alternative to fishing with capacity to generate revenue, offer employment, and support conservation. Little is known about the spatial ecology of common coastal sharks in Hawaiʻi, even the most abundant species encountered at Oʻahu ecotourism sites. I am investigating how these shark populations are responding to the growing number of ecotourism operations (2 in 2007; >15 in 2023) by assessing historical (2007-2018) and contemporary (2019-2023) movements, residency and abundance of sharks associated with these sites. From 2019-2023, I tagged 38 Galapagos, sandbar and tiger sharks at ecotourism sites to compare their movements with 47 sharks tagged at these sites from 2007-2014. Preliminary analyses show sharks captured at ecotourism sites visit these sites regularly but range widely around Oʻahu and beyond. Sharks associated with ecotourism sites show clear diel behavior patterns, associating with these sites by day, roaming further afield at night. There is evidence of contiguous seasonal migrations by sharks in the number of sharks detected at ecotourism sites. 62 sharks that were tagged at distant locations and detected at ecotourism sites occasionally passed through the area remaining for a few minutes or a few days. Analyses are ongoing to determine whether shark residency is increasing over time at these sites. This data will fill key knowledge gaps by addressing both fundamental and applied questions about shark ecology, specifically the movement patterns and habitat use of Galapagos, tiger, sandbar species around these shark ecotourism sites. These results will facilitate science driven management of shark ecotourism.

Presentation Keywords

shark, ecotourism, O'ahu, Hawai'i, acoustic telemetry

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To Know, You Gotta Go: Surveys for Native Maui Nui Land Snail Species

Lilly Thomey[1], Keahi Bustamente[1], Jordan Tabura[1], David Sischo[1], Kenneth Hayes[2], Norine Yeung[2], Jaynee Kim[2], Chandra Earl[2], Taylor Maruno[2], Jonathan Price[3]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Native Hawaiian land snails (kāhuli) are in steep decline due to a confluence of historical and current threats including: over-collection, habitat loss, invasive species, climate change, and limited population size. Additionally, taxonomic uncertainty and severe knowledge gaps about habitat requirements, life history, and conservation status hinder effective conservation efforts critical to preventing extinction. Data from museum collections including physical specimens, hand-drawn maps, and field notebooks, can inform contemporary survey work to locate extant populations before they too are lost. But to know, you gotta go! As such, this project is using historical information in the Bishop Museum's Malacology collection to inform surveys across Maui Nui. Our efforts are aimed at gathering information on presence/absence, range, habitat, host plants, threats, and microclimates needed for the snail's survival. These fundamental data are needed to inform the placement of future snail predator-proof fences under climate change projections, enhance captive rearing approaches, and facilitate conservation of native plant and animal species where they overlap with kāhuli. Since September 2022, this project has spent 43 days conducting surveys across 24 Maui Nui sites, referencing roughly 200 historical records for future surveys, and re/discovering 14 different populations and/or species. There are still many days, sites, species, and records ahead of us, with forthcoming work to be shared at the conference. Grounded in the initial findings and knowledge of early snail stewards, informed, constant, and thorough surveying is key for the conservation actions we take and, ultimately, the futures of the kāhuli.

Presentation Keywords

Kāhuli, Survey, Maui Nui, Museum Records, Future Habitats

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Assessing Habitat Types on Teraina Island, Kiribati Using Satellite Imagery to Aid Management of an Endangered Bird, the Bokikokiko

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Understanding habitat use by the endangered Bokikokiko (*Acrocephalus aequinoctialis*), a bird endemic to the Line Islands in Kiribati, is key for species' management on the only two islands where it remains, Teraina and Kiritimati. Habitat management on Teraina could focus on the bird's preferred habitat of Te Buka (*Pisonia grandis*) and Te Ren (*Tournefortia argentea*) forest. To assess habitat cover, we conducted a supervised classification using ESRI's ArcGIS feature analyst tool on multiband raster imagery collected in 2016 by WorldView-3 satellites. Training samples for image classification were based on historic maps identifying various land cover classes. Our resulting land cover layer consisted of seven vegetation classes (coconut, *Pisonia*, breadfruit, strand, *Scaevola taccada*, *Pandanus tectorius* fringe, and swamp) and four non-vegetation classes (water, bare ground, roof/sand, and cloud). Coconut trees comprised the greatest cover class (1,768 acres), followed by water (661 acres) and swamps (321 acres). Only 250 acres comprised the presumed favored Te Buka forest. Visual image inspection showed Te Ren within the strand and *Scaevola* land classes, but also erroneously included portions of the lake. The tally of 193 acres of strand and *Scaevola* is thus an overestimate that needs adjusting. Protection of the densest cluster of Te Buka forest on the east end of Teraina should be a high priority. Besides translocations to establish additional populations in locations free of introduced mammalian predators, habitat management may prove beneficial on Teraina, where the Bokikokiko has access to more diverse habitats than on the island of Kiritimati.

Presentation Keywords

imagery, classification, habitat, Bokikokiko, Teraina

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Cryopreservation of Hawaiian Stony Coral Microfragments

Emmett Henley[1,2], Matthew Powell-Palm[3], Anthony Consiglio[4], Claire Lager[1,2], Brooke Chang[5], Riley Perry[1], Kendall Fitzgerald[1], Jonathan Daly[1], Boris Rubinsky[4], Mary Hagedorn[1,2]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Corals and the reefs they build provide numerous benefits, are culturally relevant to coastal populations, and serve as oceanic nurseries for thousands of marine species. Today their continued persistence is threatened by combinations of local and global stressors. The loss of species and genetic diversity has stimulated an interest in reef conservation, and these intervention strategies include marine protected areas, oceanic coral nurseries, and land-based repositories in aquaria and aquaculture facilities. Additionally, advances in cryopreservation have allowed for the emergence of "cryoconservation" wherein live, cryopreserved cells (coral sperm) from reefs in the Caribbean and Pacific are secured in gene banks as insurance against loss of genetic diversity; this material has also been used for assisted gene flow, and more recently, live coral larvae have been successfully cryopreserved. Although corals can reproduce sexually through spawning, these annual events provided limited opportunities to secure genetic diversity, and reproductive material is increasingly negatively impacted by ecosystem stressors. Coral asexual reproduction via fragmentation allows for cryopreservation of the whole coral organism (and genome) and decouples the process from yearly reproductive events. Here we use a novel technique, isochoric vitrification, to cryopreserve and revive small (1 cm^2) coral "microfragments" and use oxygen-uptake respirometry to determine 24-hr post-thaw survival. Immediate next steps will explore techniques to allow for the continued survival of fragments beyond this initial benchmark and, if successful, unlock the potential for rapid securing of global coral diversity.

Presentation Keywords

genetic diversity, coral reef, cryopreservation, reproduction, gene banking

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Examining the structural and functional impacts of invasive *Psidium cattleianum* on forest in Hawai‘i Island: An application of terrestrial LiDAR

Tara Seely[1], Lucas Berio Fortini[2], John Battles[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Invasive trees are one of the most significant drivers of ecological change threatening the resilience of Hawaiian forests. *Psidium cattleianum* (strawberry guava) is a particularly aggressive invasive species that causes cascading impacts to forest function. Previous research links *P. cattleianum* invasion to altered water fluxes and soil characteristics. However, the underlying mechanisms driving these impacts are not well understood. We investigate whether forest structure is a functional link between *P. cattleianum* and ecosystem changes in wet and mesic forests in Hawai‘i Island. First, we quantify structural change across a gradient of *P. cattleianum* invasion using terrestrial Light Detection and Ranging (LiDAR) technology, which captures high-resolution 3D models of forest structure. Our results indicate that forest height and structural heterogeneity decrease as *P. cattleianum* abundance increases, mediated by differences in the characteristics of individual study sites. Second, we use biophysical model simulations to assess if the structural changes caused by *P. cattleianum* impact radiative transfer and water fluxes through the forest canopy. These simulations incorporate multiple levels of canopy structural data compared to the traditional simplified one-layer model, and therefore may offer a more robust simulation of canopy function. We conclude *P. cattleianum* substantially alters the canopy structure of Hawai‘i’s native forest, and terrestrial LiDAR technology can add remarkable detail to the parameterization of models which assess canopy function. This improved understanding of mechanisms of functional change allows for conservation efforts that directly preserve ecosystem function, rather than exclusively targeting the preservation of species composition.

Presentation Keywords

Invasive species, Terrestrial LiDAR, Canopy structure, Water fluxes, Ecosystem function

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Seasonality in the Southern House Mosquito (*Culex quinquefasciatus*) and Avian Malaria Transmission Across an Elevational Gradient on Hawai‘i Island

Katherine McClure[1,2], Villena Oswaldo[1], Carter T. Atkinson[2], Richard J. Camp[2], Dennis A. LaPointe[2], Helen R. Sofaer[2], Lucas Berio Fortini[2]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The southern house mosquito (*Culex quinquefasciatus*) in Hawai‘i is an efficient and ubiquitous vector of avian malaria, a mosquito-borne disease that threatens the persistence of endangered Hawaiian honeycreepers. Seasonality in mosquitoes, including the timing and magnitude of peak abundance, shapes host-vector contact rates and disease outbreak intensity, representing key information gaps for effective disease management. We leveraged mosquito and malaria infection data collected on Hawai‘i Island from 2002-2004 spanning an altitudinal gradient from 25– 1680 m to explore patterns of seasonality in *Cx. quinquefasciatus* and mosquito infection prevalence. We used hierarchical generalized additive models to predict peak *Cx. quinquefasciatus* abundance and test the hypothesis that strong patterns of seasonality in mosquito abundance influence avian malaria seasonality. We found signals of seasonality of variable strength, mode, and synchronicity in mosquito abundance and infection prevalence. Two of three lowland sites exhibited a bimodal abundance pattern, with peaks in early fall and winter, while most mid-elevation sites showed a unimodal pattern, with peaks in October. At high elevation sites, mosquitoes were caught infrequently and included only one infected mosquito. Patterns of malaria seasonality showed signals of synchrony with vector abundance at some sites as predicted, while others indicated asynchrony or decoupling between mosquito abundance and infection prevalence, suggesting unexplored drivers of seasonal variation underlying malaria transmission at these sites. An improved understanding of seasonality in mosquitoes and avian malaria transmission could aid in planning optimal release times of mosquito suppression techniques, in support of native bird conservation in Hawai‘i.

Presentation Keywords

avian malaria, southern house mosquito, seasonality, mosquito control, native forest bird conservation

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Cultivating the Antifragility of Community-based Restoration

Jason Preble

Terraformation, Kailua-Kona, HI. Protect & Preserve Hawai‘i, Honolulu, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Reflecting on the weight of our past biocultural loss, we can see that Hawai‘i has enormous restoration potential. However, social-ecological restoration is complex and to realize the dream of restoring and sustaining our biocomplexity long-term, we will need an antifragile system–one that improves when subjected to change or stress. This presentation aims to introduce antifragility and highlight how cultivating community-based restoration groups enhances the conservation movement's long-term viability. We unfortunately have little room for error when it comes to conserving our most vulnerable species and ecosystems, but underutilized lands dominated by non-native species provide a low-stakes opportunity to complement existing conservation efforts with a network of decentralized community-based restoration groups. Drawing on Hawai‘i and international examples, I discuss some general characteristics of antifragile systems including diversity, redundancy, decentralization, and low-risk learning. Proliferating restoration groups can help alleviate some long-standing issues including insufficient community engagement, limited reach for enforcement and information gathering, and waning hope. Restoration work provides the public a direct way to engage with biodiversity conservation while improving community well-being and without threatening sensitive habitats. Having kuleana over an area’s restoration also offers a powerful way to harness the motivating power of pride in one’s place. The most antifragile benefit of proliferating restoration groups may be the mainstreaming of a stewardship ethic, the proactive and protective force of a mālama ‘āina movement. The more we see ourselves as stewards of our biocultural heritage navigating complexity, the more resilient we become in the face of inevitable challenges.

Presentation Keywords

resilience, ecosystem restoration, community, systems analysis, sustainability

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Machine Learning Models: Two Use Cases, Two Weeds, Two Islands

Kerri Fay[1], Theresa Cabrera Menard[1], Alison Cohan[1], Lucas Behnke[1], Niraj Swami[2]

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Track

IV. Advancement in Conservation Research and Management

Abstract

The emergence of data technologies is scaling up conservation data collection, while machine learning (ML) techniques are gaining popularity in ecological data analysis. The Nature Conservancy has invested in and amassed a portfolio of natural color, high-resolution aerial images collected from drone footage and fixed-wing and helicopter-based camera systems. We've been assessing the utility of ML models to identify invasive weeds through partnerships with Amazon Web Services (AWS) and other artificial intelligence (AI) web-based vendors. On Kaua'i, the ML model developed with AWS was successful in finding an invasive tree fern (*Sphaeropteris cooperi*) in 3-band imagery from 2017, though a different model will be needed for our more recent 4-band imagery. On Maui, we investigated whether a self-serve AI platform could identify Himalayan ginger (*Hedychium gardnerianum*) from aerial photographs. The platform uses pre-trained networks, which did not give us the ability to train the model on ginger. We also had a small data size limit of 10GB. Besides ginger being a particularly challenging use case, we believe that image quality was an issue, with color/shadows, edge effects, and resolution contributing to the unsuccessful model. We have since collected very high resolution (down to 2 cm) imagery and will try this platform again. We also utilized a real-time active learning data annotation platform to find ginger in drone videos, which was incredibly promising. We continue to seek collaborations with AI vendors who can develop an algorithm for ginger, and are eager to explore new opportunities with ML.

Presentation Keywords

machine learning, model, weeds, imagery, identification

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Creating reference native communities for conservation efforts by modeling dominant plant species across Hawai‘i

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Track

IV. Advancement in Conservation Research and Management

Abstract

Understanding past, present and future spatial distributions of Hawaiian plant species is key to management. However many species not only extend across a wide range of physical environments, but also vary widely in terms of local abundance (cover). We have complied an extensive database of over 3,000 vegetation plots across Hawaii to develop spatially explicit models of cover for key native and invasive species. We statistically relate vegetation cover values to biophysical variables including temperature, precipitation, cloud frequency, and substrate age, resulting in projections of potential cover that represent estimates of cover for dominant native species across Hawai‘i. One key result of these models is a spatially explicit quantification of the influence of cloud moisture (fog) on native plant distributions. This observed effect is independent of rainfall, and may be essential in modeling other climate-dependent species. By combining individual species models, we have also successfully modeled native community distribution that serve as a baseline to 1) assess habitat quality, 2) define specific ecological restoration objectives, and 3) identify potential for key invasive species to threaten a site (even where they are presently not found). Future work will project abundances under climate change conditions to anticipate shifting baselines of native dominance and invasive threats.

Presentation Keywords

Vegetation, Modeling, GIS, Restoration, Climate

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An Evolving Partnership in Molokaʻi: Generating Momentum for Wetland Restoration

Helen Raine[1], Pulama Lima[2], Judith Drexler[3], Butch Haase[4], Nancy M McPherson[5], Jason Misaki[6], Arleone Dibben-Young[7], Monica Iglecia[8], Bret Wolfe[9], Carrie L Harrington[10], Sheldon Plentovich[10]

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

The Molokaʻi Wetland Partnership (MWP) was formed in 2019 with five initial partners and a proposed objective to explore opportunities for wetland restoration across the South Shore. Restoration of functional wetland habitat is crucial for the recovery of ʻalae keʻokeʻo – Hawaiian Coot (*Fulica alai*) and aeʻo – Hawaiian Stilt (*Himantopus mexicanus knudseni*). The existence of a coordinated 'proto-partnership' enabled a key grant application to the USGS Pacific Islands Climate Adaptation Science Center (PI-CASC) to succeed. This PI-CASC project has just completed a prioritized plan for coastal wetland restoration on the island. The resulting baseline information provided a springboard for the success of two community-focused grant initiatives and two grant applications in support of an acquisition to protect a critically important wetland. As MWP's momentum grew, additional local partners joined and brought important community perspectives regarding wetland restoration needs and values to further refine MWP's approach, planning, research – and eventual impact. Today, MWP seeks to incorporate both traditional ecological knowledge and western science to support the needs and preferences of the Molokaʻi community and improve habitat for endangered birds and invertebrates. MWP has been able to develop wetland restoration options to share with the community and is developing the capacity for community-based restoration planning which will deliver climate mitigation and community benefits. The collaborative and evolving MWP process is represented in a new document explaining the 'vision, goals and objectives' of the partnership, which now includes eight partners.

Presentation Keywords

Wetland, Partnership, Community, Indigenous Knowledge, Waterbirds

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Natural Cycles Affecting ʻŌpaeʻula Abundance Within the Makalawena Loko Waiʻōpae Complex

Kekuʻiapōiula Keliipuleole[1], Natalie Kurashima[2], Rosie Alegado[3]

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Loko waiʻōpae (anchialine pools) habitats are tidally influenced, land-locked aquatic habitats with subterranean connections to the sea that are home to unique assemblages of organisms, such as the endemic shrimp ʻōpaeʻula (Halocaridina rubra). These shrimp are highly valued as superior palu (chum/bait) to catch ʻōpelu (mackerel scad, Decapterus macarellus), and their abundance is intimately linked to the perpetuation of Native Hawaiian fishing practices along the North Kona coast. Decreases in ʻōpaeʻula abundances are of critical concern to lineal descendants, customary practitioners and loko waiʻōpae caretakers. In this study, we worked with resource managers to characterize the Makalawena loko waiʻōpae complex and investigate extrinsic drivers of ʻōpaeʻula abundance. Informed by practitioner knowledge, we investigated the relationship of ʻōpaeʻula behavior/abundance and natural cycles (tides, moon phase, diel). ʻŌpaeʻula are preyed upon by invasive fish species that are more active during the day, and ʻōpaeʻula are not able to reproduce in high salinity environments, yet oral reports have stated that they emerge to mate in the pools during certain moon phases. Therefore, we hypothesized ʻōpaeʻula abundance would be highest at night, during low tides, and during full moons. Our data indicate that ʻōpaeʻula prevalence is highest at night but are not affected by tidal phase or moon phases. Understanding the relationship of these factors to ʻōpaeʻula abundance will inform the development of ʻōpaeʻula monitoring and sustainable harvesting approaches for ʻōpelu fishing.

Presentation Keywords

Tidal Cycles, Moon Phases, ʻōpaeʻula, Halocaridina rubra, anchialine pools

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Testing planting strategies to restore native Hawaiian forests after land-use change

Michala Phillips[1], Corie Yanger[2], Jonah Kuwahara-Hu[3], Stephanie Yelenik[4]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Large portions of native forest have been lost throughout Hawai‘i, in part due to historic land-use change, such as the conversion of forest to pastureland. These pastures were often planted with aggressive exotic pasture grasses that suppress native woody seedlings. Targeted efforts to restore historically deforested areas have the potential to create multilayered native forests that allow for the return of key ecosystem functions. Yet, information is lacking about the efficacy of different strategies to successfully reforest degraded areas. Here, we test how the density and diversity of plantings affects restoration success. We hypothesized that greater diversity and higher density plantings would better exclude invasive grasses over time. We established 55 experimental out-planting plots in the Upper Honohina forest tract in areas under mature, out-planted *Acacia koa* canopy, with an understory of *Cenchrus clandestinum* (kikuyu grass) and scattered *Rubus argutus*. A total of five different planting combinations were used in single and double densities, along with one control plot. Planted species included: ‘ōhi‘a (*Metrosideros polymorpha*), ‘ōlapa (*Cheirodendron trigynum*), kāwa‘u (*Ilex anomala*), laukahi (*Dryopteris wallichiana*), pilo (*Coprosma rhynchocarpa*), ‘ākala (*Rubus hawaiensis*), pūkiawe (*Leptocophylla tameiameiae*), and mā‘ohi‘ohi (*Stenogyne calaminthoides*). Preliminary results showed high survivorship (92% + 19%) in the first year. Pilo and ‘ākala, an understory subtree and shrub, respectively, had the highest survivorship after 12 months. Across species, density did not affect survivorship. These results suggest that double density plantings may not lead to higher mortality during establishment, and thus have potential to exclude grasses more expediently than single density plantings.

Presentation Keywords

invasive species, forest restoration, plant communites

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Social Attraction for Endangered Seabirds on Maui: Who are we Inviting to the Party?

Jenni Learned[1], Kenneth Hayes[2], Martin Frye[1], Skye Anderson[1], Mariah Rivera[1], Joshua DeCambra[1], Katelynn Gulley[1], Jay Penniman[1]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Native Hawaiian seabird species are suffering significant population declines and loss of habitat. Active seabird restoration projects foster breeding populations of threatened seabird species within protected areas. In Hawai‘i, social attraction methods are being used or are in development across the islands and for several species. On Maui, decoys and broadcast call playback are used to attract endangered ‘a‘o (Newell’s shearwater, *Puffinus newelli*) into predator-proof exclosures at Makamaka‘ole on the slopes of Mauna Kahālāwai. Over the past 8 years, adult ‘a‘o attendance and egg production have increased; however, only one pair has successfully fledged chicks. In order to better understand the small yet growing population, we took blood samples from adults captured at Makamaka‘ole during the 2022 and 2023 breeding seasons. Results to date show that all sampled individuals are female. The low proportion of males present in this group explains the high rate of non-viable egg production. Based on current findings, we question some assumptions about our social attraction methods. Are the particular calls used in the playback at Makamaka‘ole selecting for females? For the 2023 breeding season, a diversified recording of ‘a‘o call will be used, and adults will be monitored for changes in attendance, behavior, and sex-ratio. In addition, by comparing ‘a‘o from Makamaka‘ole and Kaua‘i, genetic analysis will provide more information about the population structure of this species. Refining social attraction methods is crucial for the management of endangered Hawaiian seabirds. Establishing resilient and self-sustaining populations will secure their future on the islands.

Presentation Keywords

seabirds, genetics, endangered species, breeding biology

152

Reintroduction Efforts for the Endangered Orangeblack Hawaiian Damselfly (*Megalagrion xanthomelas*) – Successes and Challenges

Matthew Sandrich[1,2], Will Haines[1,2], Katie van Dyk[1,2], Kelli Konicek[1,2], Katrina Scheiner[1,2], Cynthia King[1]

[1]Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, Hawaii. [2]University of Hawai‘i, Center for Conservation Research and Training, Honolulu, Hawaii

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*) was once among the most common species of endemic damselfly (pinapinao) in Hawai‘i. Now endangered, it exists only in small, fragmented populations on O‘ahu, Moloka‘i, Maui, and Hawai‘i. Extirpations of *M. xanthomelas* have been attributed to habitat loss and invasive predators, particularly mosquito fish (*Gambusia affinis*). On O‘ahu, the only population precariously persists in a short, fish-free section of stream at Tripler Army Medical Center (TAMC). In late 2018, the Hawai‘i Invertebrate Program (HIP) of the Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW) began a captive rearing program, with the goal of reintroduction of *M. xanthomelas* within its historical range. In the summer of 2019, the TAMC population crashed, heightening concern about the long-term viability of the population. HIP and the Army Natural Resources Program of Oahu (ANRPO) began releasing lab-reared *M. xanthomelas* at Dillingham Military Reservation (DMR) in June 2020. To date, over 7000 adult damselflies have been released there. Wild-born adults were first detected in November 2020 and continue to be observed, albeit in low numbers. Attempts to enhance the habitat for orangeblack damselflies have included fencing for ungulates, outplanting native vegetation, clearing canopy, and creating retention ponds. Despite initial success in captive rearing and reintroduction, there have been multiple setbacks, including flooding events at reintroduction sites and the detection of *Hydra vulgaris* at TAMC, yet another invasive predator not previously known to be a threat to native damselflies.

Presentation Keywords

Insect, Endangered Species, Reintroduction, Captive Rearing, Fresh Water Invertebrates

153

Optimizing Conservation Actions to Recover Sensitive Species Across Maui Nui

Melissa Price[1], Kristen Harmon[1], Abbey Camaclang[2], Brissa Christophersen[1], Tara Martin[2], Scott Fretz[3]

[1]University of Hawai'i, Honolulu, Hawai'i. [2]University of British Columbia, Vancouver, British Columbia. [3]Division of Forestry and Wildlife, DLNR, Kahului, Hawai'i

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

With hundreds of species at risk and on the brink of extinction, conservation practitioners must decide where to focus effort and which conservation actions to implement given limited funds. Decision processes should address multiple values, complementarity of actions to ensure that species in low-diversity habitats are not excluded, and both cost and effectiveness of different actions across taxonomic groups. To address this need we modified a Priority Threat Management approach to guide resource allocation decisions for the conservation of biodiversity on the islands of Maui, Molokaʻi, Lānaʻi, and Kahoʻolawe. Over a series of online meetings and in-person workshops, species experts and conservation managers contributed: (1) key threats to sensitive species; (2) management strategies to address key threats; and (3) expected cost, feasibility, and benefit of management strategies. Elicited data were analyzed to identify strategies that would provide optimal gains in recovery across multiple taxonomic groups given costs and feasibility. Predator and ungulate control were both identified as cost-efficient actions with gains in recovery across taxonomic groups, but those actions alone were not effective at recovering many plants and invertebrates. Participants emphasized the importance of investing in research and development of novel techniques to address persistent problems such as avian malaria, pests, and diseases. Further, despite the high initial cost of landscape-scale control of invasive species, participants highlighted the importance of long-term benefits. Findings from this study will improve both the efficient use of existing funds, and competitiveness for increased resources needed to achieve recovery.

Presentation Keywords

Conservation planning, Endangered species management, Priority Threat Management

154

Mule-ing Over the Options: Control Techniques for Invasive Mule's Foot Fern (*Angiopteris evecta*)

Wynter Lim[1], Dylan Davis[2], Jenna Masters[1]

[1]Department of Land and Natural Resources Native Ecosystem Protection and Management, Honolulu, Hawai'i. [2]Ko'olau Mountains Watershed Partnership, Honolulu, Hawai'i

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Populations of the invasive tree fern *Angiopteris evecta* are spreading across O'ahu and degrading native forests. Given the scale of the infestation (over 71,000 individuals identified so far across 20,000 acres), traditional ground control treatments are no longer sufficient for containment. Chemical control via helicopter has become an increasingly effective way to treat dense stands or plants on remote or steep terrain. Until recently, other islands have been able to manage small infestations through ground treatment methods. However, recently mapped populations detected from aerial imagery may pose an increased threat that could lead to similar logistical hurdles for continued ground control, prompting adoption of new techniques, such as aerial treatment. To expedite and improve control efforts to keep populations at manageable levels, cooperation between organizations is needed, both within and across islands. Through a collaborative effort between conservation organizations of O'ahu and Maui Nui, an ESRI Storymap was developed to share lessons learned for current and future personnel for *A. evecta* treatment. It catalogs and compares all different manual, chemical, ground, and aerial control methods used, as well as data management, remote analysis, and ground truthing topics. Feedback on the effectiveness of this resource is ongoing, with a survey available at the end of the document. Responses so far from those that have participated have been positive, stating that they are satisfied that they can effectively control *A. evecta* in their areas. We are continually collaborating and updating our information to tailor it to different organizational needs.

Presentation Keywords

Angiopteris evecta, Aerial Chemical Control, Invasive Species Management, Remote Analysis, Invasive Species Control

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An island of its own: exploring the contribution of the Pu‘u Maka‘ala NEON site to studies of management and conservation

Brandon McNellis[1], Mike Long[2], Christian Giardina[1], Susan Cordell[1]

[1]USDA Institute of Pacific Islands Forestry, Hilo, Hawaii. [2]National Ecological Observatory Network, Boulder, Colorado

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Hawai‘i supports a unique set of ecosystems driven by complex geological, climatological, and evolutionary histories. Anthropogenic disturbances have compounded this complexity, especially the introduction of invasive plant and animal species. Long-term forest dynamics plots are ideally suited to quantifying the effects of diverse drivers on Hawaiian forests, while providing ecosystem reference conditions that may be desirable to management and conservation. Towards these ends, the National Ecological Observatory Network (NEON) recently established a long-term forest dynamics plot on 4,720 hectares of wet montane forest at the Pu‘u Maka‘ala Natural Area Reserve on Hawai‘i Island. The primary design relies on standardized measurements used across the NEON platform. Here, we analyze published data from the Pu‘u Maka‘ala study area to enhance the utility of this NEON site to conservation and resource management. We focus on supplemental spatial data that can be connected to currently published NEON data products and used to inform land management efforts in Hawai‘i. Preliminary results suggest that ungulate disturbance history plays a critical role in shaping vegetation dynamics. Soil processes, including pedogenesis and nitrogen fertilization, also plays a strong role in structuring plant communities. These results may have significant implications for conservation efforts in Hawai‘i, especially in the context of restoration after successful management for invasive species. In addition, this information provides important ecological context to researchers working with data from Pu‘u Maka‘ala in cross-site and broad-scale analyses across the entire NEON network.

Presentation Keywords

forest, disturbance, invasive, data, Big Island

156

Designing a Statewide ʻĀina-Based Education Certification Program for Teachers and Students of Hawaiʻi Nei

Chelsey Jay[1], Joey Cronin[2], Pauline Sato[1], Pa'ahana Kincaid[2]

[1]Mālama Learning Center, Kapolei, HI. [2]Kupu, Honolulu, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

The ʻĀina-Based Education Certification (ABEC) is a new program initiated by the Mālama Learning Center (MLC) with the support of multiple organizations across Hawaiʻi. The primary goal is to create a prototype statewide program for teachers and students to support and grow the field of ʻĀina-Based Education (ABE). MLC is partnering with various organizations, including Kupu, to design and implement a Basic Level ABEC through Kupu's Natural Resources Professional Development program for Oʻahu educators. MLC is also developing other tracks and levels of the ABEC to reach more educators and students across Hawaiʻi. The ABEC pilot enhances educators' knowledge and skills related to ABE and conservation careers in Hawaiʻi and engages their students in learning about their place, culture, careers, and community through immersive educational programming.

This project is centered on innovative professional development and capacity building intended to elevate the prominence of ABE making it a more accessible and affirmed profession across multiple sectors. The ABEC will give formal educators, informal ABE practitioners, and their students the foundations for understanding Hawai'i's unique environments and those working to protect them by illuminating conservation career pathways. Ultimately, this certification will help to educate and empower educators and the next generation of conservation professionals (students) so they are well informed on how to meet the conservation needs of the future.

Forum presentations will highlight ABEC's vision, share key takeaways from the pilot, and conclude with how it will advance the conservation workforce in Hawai'i.

Presentation Keywords

Professional development, Capacity building, Education, Certification, Careers

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Forum Agenda:

- 2 mins – Welcome & Introduction

- 10 mins – MLC ABEC Presentation
- 10 mins – Kupu NRPD & Natural Resources Sector Partnership Presentation
- 10 mins – Teacher Presentation
- 3 mins – Mentimeter audience polling
- 3 mins – Transition to small group discussions
- 20 mins – Small group discussions facilitated by panel speakers
- 2 mins – Closing & Mahalo

Total Time: 60 minutes

-List of Speakers: Pauline Sato (MLC), Pa'ahana Kincaid (Kupu), Jeremy Soriano (MLC/Teacher) *Subject to change

-We will seek audience participation through Mentimeter polling, audience Q&A, and small group discussions facilitated by panel speakers that will capture audience mana‘o and suggestions for future growth.

-This forum is meant for students, formal and informal educators, emerging professionals, and established professionals who want to learn more about this ABEC program and its potential for growing and advancing the conservation workforce in Hawai‘i.

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Identification of Relevant Hawaiian Cultural Values and Protocols for Common Terrestrial Conservation Actions

Aimee Sato[1], Brissa Christophersen[2], Laura Ka'akua[3], Kawika Winter[2], Melissa Price[2]

[1]Hālau ʻŌhiʻa Hawaiʻi Stewardship Training & Kaiāulu ʻo Kahaluʻu, Kahaluʻu, Hawai'i. [2]University of Hawai'i, Honolulu, Hawai'i. [3]Division of Land and Natural Resources (DLNR), Honolulu, Hawai'i

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Cultural values underpin the decisions we make in conservation, yet existing processes for engaging communities in the planning of conservation actions often fail to identify these values early in planning processes. Further, the training of conservation professionals in values and protocols is not standard practice across agencies, and may even be discouraged. This lack of appropriate engagement and integration of Hawaiian values into conservation planning and implementation has resulted in project delays and increased costs, but more importantly, a loss of trust by communities and a loss of professional fulfillment for cultural practitioners working for state and federal agencies. Further, this is a missed opportunity to improve conservation outcomes by incorporating Indigenous and Local Knowledge into planning processes. In this workshop participants will discuss common conservation actions such as invasive species removal and identify: (1) What is beneficial in regards to this action from a Hawaiian cultural perspective? (2) What is potentially problematic in regards to this action from a Hawaiian cultural perspective? (3) At which stage in planning processes for this action should management agencies engage with communities, and what should this engagement look like? (4) Which Hawaiian cultural protocols may be appropriate to include when taking this action? Results will be compiled and shared with state and federal agencies, as well as the broader conservation community, to improve the integration of cultural values during conservation planning and implementation.

Presentation Keywords

cultural values, invasive species removal, conservation planning, community engagement, Indigenous & Local Knowledge

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Room Facilitators: Aimee Sato, Brissa Christophersen, Laura Ka'akua, Kawika Winter, Melissa R. Price

** 7-10 Table facilitators will be identified upon abstract acceptance

Goals & Target Audience:

We will identify: (1) What is beneficial in regards to common terrestrial conservation actions from a Hawaiian cultural perspective? (2) What is potentially problematic in regards to these actions from a Hawaiian cultural perspective? (3) At which stage in planning processes for this action should management agencies engage with communities, and what should this engagement look like? (4) Which Hawaiian cultural protocols may be appropriate to include when taking these actions? Results will be compiled and shared with state and federal agencies, as well as the broader conservation community, to improve the integration of cultural values during conservation planning and implementation.

Timing and structure:

**Tables will be themed based on types of common management actions: (1) Invasive vertebrate predator control; (2) invasive invertebrate predator control; (3) ungulate fencing and removal processes; (4) vegetation restoration (invasive weed removal and native plant outplanting); (5) hydrology, wetland, and stream restoration; (6) infrastructure modification (lights, power lines); (7) captive rearing of animals (birds and invertebrates); potentially others as needed.

5 min: Meet at door, provide with consent form, and provide general guidance regarding table choice. Participants choose table/topic and are seated.

10 min: Review consent forms. Give space for people to leave if there is discomfort with participation in something that will be formalized (in an anonymous form) to inform agency processes and a potential publication.

20 min Introductions within tables. Introduce name, ʻāina (place), affiliation/day job

60 min Facilitated discussion led by table leader: (1) What is beneficial in regards to this action from a Hawaiian cultural perspective? (2) What is potentially problematic in regards to this action from a Hawaiian cultural perspective? (3) At which stage in planning processes for this action should management agencies engage with communities, and what should this engagement look like? (4) Which Hawaiian cultural protocols may be appropriate to include when taking this action? Results will be compiled and shared with state and federal agencies, as well as the broader conservation community, to inform improved engagement with communities during conservation planning stages.

25 min Larger group (room) share-out: Compare and contrast take-homes regarding which stage in planning processes should management agencies engage with communities, and what should this engagement look like?

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Pacific RISCC Science Integration Workshop: Climate Adaptation Strategies for Invasive Species Professionals

Elliott Parsons[1], Heather Kerkering[2], Jeff Burgett[3], Chelsea Arnott[4], Laura Brewington[5,6]

[1]University of Hawai‘i at Mānoa, Honolulu, Hawai‘i. [2]USGS Pacific Islands Climate Adaptation Science Center, Honolulu, Hawai‘i. [3]U.S. Fish & Wildlife Service Science Applications Program, Honolulu, Hawai‘i. [4]Hawai‘i Department of Land and Natural Resources, Division of Forestry & Wildlife, Honolulu, Hawai‘i. [5]Arizona State University, Honolulu, Hawai‘i. [6]East-West Center, Honolulu, Hawai‘i

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Communities across the Pacific are threatened by the individual and interacting impacts of invasive species and climate change. Invasive species are the leading cause of biodiversity loss on Pacific Islands, and also negatively affect food and water security, trade, livelihoods, and cultural practices. Climate change is expected to exacerbate these impacts and magnify management challenges. To address these issues, the Pacific Regional Invasive Species and Climate Change management network (Pacific RISCC) aims to increase knowledge about how climate change may impact invasives so that monitoring efforts can be strengthened, and threats prioritized. This workshop will host an interactive and facilitated session focused on diversifying the portfolio of actions available to invasive species managers by integrating climate change. First, participants will discuss how climate change may impact invasive species in Hawai‘i and the Pacific. Second, participants will divide into break-out groups focused on priority topics identified in the 2020 Pacific RISCC survey and discuss the current state of science on their selected topic. They will be introduced to a place in the Pacific Islands and a likely future scenario based on their topic (e.g., an invasive species moving to higher elevations). Group members will then be guided to develop a portfolio of adaptive management actions to address the scenario. Finally, group representatives will report on the main outcomes and opportunities for incorporating climate change adaptation into invasive species management. A workshop report will be generated highlighting the key outcomes.

Presentation Keywords

Invasive Species, Climate Change Adaptation, Synergistic Impacts, Scenario Planning, Science Integration

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Day/Time Requested: 2 hours on Day 3, (June 29)

Workshop Goals:

- Increase knowledge of how climate change may impact invasive species and their management in Hawai‘i and the Pacific Islands, and why this matters
- Promote relevant research and tools & identify research needs
- Facilitate conversations between managers regarding best management practices and lessons learned
- Introduce Scenario Planning as a valuable climate adaptation planning tool
- Develop management strategies and actions to these combined threats

Explanation of Goals:

Ecosystems and the services they provide in Hawai‘i and the Pacific Islands are transforming due to the combined threats of climate change and invasive species. These threats alone are significant, yet a recent study found that up to a third of invasive species issues may be exacerbated by climate change. Therefore we need greater understanding of how impacts may manifest and more tools and managers trained to use those tools in order to successfully mitigate these elevated impacts. This workshop will facilitate conversations around these issues, train participants in the use of a valuable planning tool, and generate strategies and actions to help managers proactively deal with these threats.

Workshop Agenda:

Hour 1:

1. Welcome
2. Introductions, share name & affiliation, what interested you in coming to this workshop (10 minutes)
3. Introduce schedule, structure, and goals of the workshop, and introduce speakers (5 minutes)
4. Short Talk 1: Purpose & Need of the Pacific RISCC, Jeff Burgett & Heather Kerkering (10 minutes)
5. Short Talk 2: State of the Science at the Nexus: Elliott Parsons (10 minutes)
6. Short Talk 3: Values at Risk: Why the Nexus Matters, Chelsea Arnott (10 minutes)
7. Explanation of Priority Climate Research Topics, 2021 Survey Report, (5 minutes)
8. Break into small groups (below); explanation of scenario planning, (10 minutes)

- Range Shifting Species & Hotspots
- Resilience of Native Communities
- Changes in Extreme Events
- Wet and Dry Season Changes
- Pathways of Introduction

Hour 2:

1. Small group facilitated discussion on the current state of the science on their selected group topic (5 minutes).
2. Place and Scenario introduced by group facilitator (5 minutes).
3. Group discusses the scenario and comes up with management actions that will help reveal & mitigate threats to ecosystems, communities, human wellbeing (35 minutes)
4. Large group discussion and voting on best adaptation actions (15 minutes)

Break-out Group Facilitators:

- Heather Kerkering
- Jeff Burgett
- Chelsea Arnott
- Elliott Parsons

Innovative Audience Engagement Techniques:

Scenario planning, which is a valuable facilitation tool for planning management actions in the face of uncertainty, will be used in this workshop. Given the large uncertainty in how climate change will impact Hawai‘i and the Pacific Islands, a large portfolio of management options in a manager’s toolbox (combined with monitoring and adaptive management) is likely the most robust approach to dealing with this uncertainty. However, this approach has seldom been used by the conservation community to generate novel management options in Hawai‘i, and training in the use of this approach is needed. Participants will be introduced to and guided through the scenario planning process in small groups.

Participants in this workshop will learn 1) how climate change may impact invasive species and therefore management in the Pacific, 2) how to engage in scenario planning to create a portfolio of management options, and 3) management actions that may be taken to mitigate threats due to the impacts of climate change on invasive species.

Target Audience:

Resource managers are the main targeted audience; Cultural Practitioners, Community Members, and Researchers interested in this topic are highly encouraged to attend and participate.

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Resilience Through Ecosystem Connectivity: The Role of Manu o Kū Guano

Meeya O'Dell[1,2], Wendy Kuntz[1], Miku Lenentine[1]

[1]Kapiʻolani Community College, Honolulu, HI. [2]University of Hawaiʻi at Hilo, Hilo, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Nutrient cycling is an important ecosystem service that connects and encourages resilient ecosystems. Seabirds play a role in this ecosystem connectivity and nutrient transfer, but humans interrupt this cycle with urbanization that prevents seabirds from traveling inland. When terrestrial environments are deprived of these important marine inputs, it leads to a suite of ecological disturbances and issues that are difficult to reverse. The manu o Kū or White Tern (*Gygis alba*) is one example of seabirds that re-established this connection, which they accomplished by recolonizing in Honolulu. This presentation will highlight the resilience through ecosystem connectivity by focusing on the role of manu o Kū guano at Kapiʻolani Community College (KCC) and Honolulu on Oʻahu. The study involved quantifying guano, obtaining their area and perimeter, and determining the amount excreted during a twenty-four-hour period at a nesting location. Using published excretion estimates for this species, we followed with a calculation of the nitrogen (N) and phosphorus (P) content deposited in the KCC and Honolulu breeding range by manu o Kū guano. We estimate that at its current population size, the manu o Kū contributes 5040 g N at KCC, 193,872 g N in Honolulu, and 840 g P at KCC and 32,312 g P in Honolulu per year. These three approaches confirm the non-trivial contribution of this native seabird in nitrogen and phosphorus. By recolonizing Honolulu, the manu o Kū increase the connectivity and resilience of the island and the ocean’s ecosystems.

Presentation Keywords

Gygis alba, seabird guano, nutrient cycling, ecosystem connectivity, ecosystem resilience

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Enhancing Community Resilience in Hanalei Basin: Flood Assessment and Mitigation Design

Andrew Hood[1], Ayahna Mack[1], Maka'ala Ka'aumoana[2]

[1]Sustainable Resources Group Intn'l, Inc., Kailua, HI. [2]Hanalei Watershed Hui, Hanalei, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

When healthy and functioning, the Hanalei River and its floodplain are a contiguous area of natural habitat that can mitigate impacts from riverine floods and sea level rise, enhance ecosystem function, and support important wildlife habitat. However, for nearly two decades, community members have voiced concerns that changes to topography, encroachment of invasive plants, and wetland alterations have affected the river's hydrodynamics during flood events, by redirecting, increasing depth, and increasing flood water duration. Flooding also negatively impacts health and safety and the local economy, including extended road closures. Flooding is expected to occur more often due to heavier and more frequent rain driven by climate change and rising sea levels. It is important for the community to make informed decisions about sustainable flood mitigation solutions that offer the best outcomes for people, property, infrastructure, and wildlife habitat in Hanalei. This project conducted a robust analysis of the flooding regime of the Hanalei River using high-resolution topographic and bathymetric data, predicative modeling, and an assessment of individual and cumulative issues. Location-specific and general mitigation strategies to reduce flood risk were designed considering habitat needs of endangered waterbirds and using nature-based options (e.g. wetland restoration) to solve flooding issues. The local community was engaged to provide input on mitigation strategies and prioritization, including for private property. The results are being used to prioritize funding for implementation, inform updates to existing hazard mitigation plans, and provide a blueprint for flood mitigation planning that can be replicated in other areas of Hawai'i.

Presentation Keywords

Flooding, Mitigation, Hanalei, Modeling

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Understanding the Impacts of Ciguatera Poisoning on Fishers in Hawai‘i

Eileen Nalley

Hawai‘i Sea Grant College Program at the University of Hawai‘i at Mānoa, Honolulu, Hawai‘i

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Ciguatera poisoning (CP) is a seafood borne illness caused by toxins produced by dinoflagellates (primarily *Gambierdiscus*) in tropical, coastal ecosystems. This disease can have devastating, long-lasting impacts on fishers and fishing communities. In Hawai‘i these risks are amplified, as many communities are reliant on reef fishes as an essential source of nutritional, financial, and cultural well-being. Despite this vulnerability, most cases of CP in this region go unreported. This study used anonymous online surveys (n=106) and targeted interviews (n=20) to address data gaps on the prevalence, distribution, and impacts of CP among fishers in Hawai‘i. Survey results indicated that most CP cases (75%) are unreported, despite the fact that most respondents (67%) experienced symptoms lasting more than a week, and some (10%) were affected for more than a year. Certain locations (e.g., north shore of Kaua‘i) and species (e.g., uku - *Aprion virescens* and knifejaw - *Oplegnathus punctatus*) emerged frequently as being problematic, though they have received little research, monitoring, or management attention for ciguatera historically. Interviews revealed common interests and themes among affected individuals, including a desire for more data on the environmental drivers of *Gambierdiscus* population dynamics, information on factors affecting individual CP response variability, and increased education and awareness, particularly for vulnerable populations. This study offers essential information for managers to mitigate the risk of CP, provides baseline information that can be used to inform future studies in Hawai‘i and throughout the region, and supports conservation by identifying priority areas that could benefit from habitat restoration to reduce *Gambierdiscus* growth.

Presentation Keywords

ciguatera, reef fish, recreational fisheries, Gambierdiscus, health

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Back to our Roots Conservation Horticulture

Hayley Walcher[1], Rhian Campbell[1], Sarah Bryce[2]

[1]NTBG, Kalaheo, HI. [2]NTBG, Kalaheo, Hi

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Approximately 90% of Hawaiian plants make relationships with vesicular arbuscular mycorrhizae (VAM) in their native habitat; these relationships assist plants in their ability to absorb, receive or transfer nutrients to neighboring flora, and alert these neighbors to the presence of harmful insects and pathogens, enabling them to form defensive strategies. Sterile horticultural practices commonly used in conservation nurseries statewide have been shown to suppress or exclude the relationship of VAM with plant roots; some of these include the use of soilless media, heavy watering, frequent fertilizing, and the regular use of pesticides.

At the conservation nursery within the National Tropical Botanical Garden, we grow rare and endangered Hawaiian plant species for the purposes of restoration, conservation, seed production, and research. Growing these plants in cultivation presents unique challenges because the endemic plants of Hawai'i evolved and adapted with many different microorganisms to survive and colonize land within the many microclimates caused by the varied terrain and elevation. Low survival rates in ex-situ nurseries as well as transition to exclosures, have prompted us to explore further methods (early inoculation by use of native soils, minimal watering, using natural phosphorus fertilizers and other soil amendments) to improve the health and survival of the unique plants in our care as well as transition to field. This presentation is created to share ideas that horticulturalists can consider for use as this area of science develops over the coming years.

Presentation Keywords

horticulture , mycorrhizae , rare and endangered , restoration , soil

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Phytoplankton community and productivity dynamics in a Native Hawaiian fishpond

Lani Musselman[1], Rosie Alegado[1], Yoshimi Rii[2], Sheldon Rosa[1]

[1]University of Hawaii at Manoa, Honolulu, HI. [2]National Estuarine Research Reserve, Kane'ohe, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

A comprehensive understanding of the base of the microbial food web in Heʻeia Fishpond (Oʻahu, Hawaiʻi) is critical knowledge for resource managers. Current knowledge on phytoplankton in the fishpond is lacking productivity rates, a key measurement to help understand biogeochemical processes in a dynamic, estuarine ecosystem. This project will build upon data that examined water biogeochemistry and bacterial and eukaryotic diversity within the pond, which indicated differences in wet vs dry season dynamics. Knowing seasonal variation in primary productivity will aid in understanding fishpond health allowing for development of strategic management plans to predict variations in fish production as a result of changes to productivity rates. We will perform nutrient amendment experiments to discover the limiting nutrient and if it changes between seasons. We will measure primary productivity rates, biomass, species richness, and the drawdown of nutrients in each in-situ bioassay. Additions of nutrients were determined under the scenario of heavy rainfall causing increased stream flow leading to stream water entering the pond at nutrient amounts similar to that of the upper watershed. Non-profit organizations such as Paepae o Heʻeia and Kākoʻo ʻŌiwi continuously work to remove invasive species; this restoration has opened up new water flow into the pond as well as continuing to improve existing water flow. The overarching goal of this research is to create a comprehensive understanding of the phytoplankton community response to shifting nutrient regimes as a result of increased stream flow and their impact on primary productivity between the wet and dry seasons.

Presentation Keywords

Phytoplankton, Indigenous resource management, Nutrient bioassays, Primary Production

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Effects of a warmer world on life-history traits of invasive Culex quinquefasciatus mosquitoes in Hawai'i

Christa Seidl[1,2], A. Marm Kilpatrick[1]

[1]University of California Santa Cruz, Santa Cruz, CA. [2]Maui Forest Bird Recovery Project, Makawao, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Climate change is altering the transmission of many vector-borne diseases. Describing the effects of temperature on the development, life-history traits, and distributions of specific vectors is important for understanding the epidemiological patterns of vector-borne diseases under current and future climate. In the Hawaiian Islands, the quantification of temperature relationships for Hawaiian populations of *Culex quinquefasciatus* Say (Diptera: Culicidae) is needed to improve control of a pathogen, *Plasmodium relictum,* considered a significant threat to endemic avifauna. Here, we examine the effects of five cycling temperature regimes (9.5–28.5˚C ± 5°C) on development time, adult emergence proportions, and adult longevity of female and male mosquitoes from wild populations of Hawaiian *Cx. quinquefasciatus*. These temperature regimes simulate the average daily temperatures for different elevations, seasons, and 2 °C of warming in Hawai'i. With increasing temperature, adult development time and longevity of both sexes decreased, while the proportion of larvae emerging as adults increased. Adults survived 2 times longer at an average temperature of 13.5 °C than at 28.5 °C but needed 4x longer to emerge. We calculated the number of adult mosquito days (AMDs) and projected these values onto maps from the hottest and coldest months (August, January) in 2012, 2022, and with 2 °C of warming to 2022 in Hawai'i. AMDs increased (January = 0.30%; August = 2.39%) from 2012-2022 and with 2 °C of warming (January = 7.74%; August = 6.98%). Our results suggest that *Cx. quinquefasciatus* populations will continue to increase in size and distribution across Hawai'i.

Presentation Keywords

mosquitoes, invasive species, climate change, life-history, avian malaria

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Persistence of Ma‘o Hau Hele Populations Considering Fire and Climate Change

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

As climate change continues to increase temperatures and decrease precipitation in many dry regions, fire risk continues to increase, threatening Hawaii’s native species. To address the aforementioned factors, assisted migration to climate-resilient locations may be needed. In this study, we utilized a Structured Decision-Analysis framework to provide insights into whether the Army Natural Resource Program of O‘ahu (ANRPO) should outplant the endangered ma‘o hau hele (*Hibiscus brackenridgei* ssp. *mokuleianus*) to a novel area outside its historical range given recent impacts from wildfire at ANRPO's lower-elevation sites. To address this, we utilized a decision tree to help ANRPO assess proposed actions within their control (to translocate or not to translocate) with factors outside their control (wildfire risk and probability of persistence), while considering the high labor cost of managing grassy fuels. A decision tree integrates probabilities in a series of potential scenarios to identify which actions under a decision maker's control are most likely to result in desirable outcomes. We interviewed experts in wildfire risk, plant conservation, and ecosystem management to elicit the probabilities and utility associated with each potential scenario, then performed calculations. Based on our results, management of ma‘o hau hele should be moved to the higher-elevation proposed site. However, elicitation processes also highlight major differences in expert opinion regarding fire risk and the probability of persistence, underscoring a need for facilitated conversations among experts to collaborate. Our results demonstrate the utility of facilitated decision-making for providing insights into challenging conservation problems with a high degree of uncertainty

Presentation Keywords

Structure decision analysis, Decision tree, Assisted migration, Climate change, Ma‘o hau hele

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Optimizing Coral Microfragmentation to Produce Large Colonies in a Land-based Coral Nursery for Restoration

Morgan Short, Christina Jayne, Norton Chan, Angel Demers, Taylor Engle, Samara Neufeld, Honor Weber

Hawai'i Coral Reef Initiative/Division of Aquatic Resources, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The close proximity of Hawaiian reefs to urban areas exposes corals to a growing number of anthropogenic stressors, such as impacts from coastal development, point and nonpoint source pollution, and ship groundings. These stressors, combined with those driven by climate change, limit the ability of coral populations to recover from disturbance. Additionally, native Hawaiian corals have some of the slowest coral growth rates in the world, and approximately 25% of these species are endemic to Hawai‘i (i.e., not found anywhere else). These unique issues prompted the development of Hawai‘i-specific practices for coral restoration and mitigation. The State of Hawai‘i Division of Aquatic Resources’ (DAR) Hawai‘i Coral Restoration Nursery (HCRN) developed a fast-growth process using microfragmentation and fusion at its land-based coral nursery. Small coral colonies are cut into 1 cm^2 microfragments that are glued onto a concrete pyramid module and fast-grown in controlled aquaria. These microfragments grow and fuse together, producing a large coral colony in a fraction of the time it would take naturally. This process takes a 10 - 15 cm coral and produces a 42 cm coral in 1 - 2 years, which is equivalent to a 20 - 25 year old coral on a natural reef. The HCRN has further scaled up this process to produce 1 m corals, which are equivalent to 100 - 150 year old natural corals. This innovative restoration strategy produces extremely large coral colonies that can drastically accelerate the recovery of ecological functions and ecosystem services on damaged or degraded reefs.

Presentation Keywords

coral restoration, endemic species, coral reef, animal husbandry, management

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Plant Pono: Influencing Change in the Horticulture Industry on Hawaii Island.

Molly Murphy

The Big Island Invasive Species Committee, Hilo, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Ninety percent of the invasive plants in Hawaii were imported intentionally for agriculture, forestry, or horticulture, and yet there are few legal barriers to new plant importations in the state. The Plant Pono (PP) program on Hawaii Island has adopted a two-pronged approach to encouraging voluntary behaviors by nurseries and the public to prevent the importation, sale, and cultivation of invasive plants. Our public education program works through multiple channels to educate residents on the problem of invasive plants and on the use of the PlantPono.org tool to choose non-invasive plants for their landscape. PP also offers an endorsement program for nurseries that agree to discontinue the sale of identified invasives on the PP "No Grow" list. Since 2017, the Big Island Invasive Species Committee (BIISC) has surveyed over 40 nurseries annually to document trends in the prevalence of invasive plants and to find incipient horticultural introductions appearing in HI. The Hawaii-Pacific Weed Risk Assessment is used to evaluate the plants, and stakeholders from the Green industry and conservation consulted to develop the "No Grow" list for nurseries. The program has seen a 50% drop in the number of nurseries selling invasive plants in less than a decade, and four of the original "No Grow" plants are no longer found being sold on island. In this talk, we will discuss the challenges and successes of pursuing a voluntary "good neighbor" campaign in the absence of formal regulation and planned future efforts for PP.

Presentation Keywords

horticulture, invasive plant sales, nursery survey

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Victory is Nigh! An update on aerial treatments of Maui's largest little fire ant infestation

Brooke Mahnken[1], Monte Tudor-Long[1], Adam Knox[1], Teya Penniman[1], Michelle Montgomery[2], Casper Vanderwoude[2], David Duffy[3]

[1]Maui Invasive Species Committee, Paia, HI. [2]Hawaii Ant Lab, Hilo, HI. [3]University of Hawai'i, Honolulu, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

In 2019, the Maui Invasive Species Committee (MISC) in cooperation with the Hawaiʻi Ant Lab, launched an aerial strategy to control a remote population of little fire ants (Wasmannia auropunctata) in Nāhiku, Maui. The approach uses a gel-bait matrix containing s-methoprene (brand name Altosid), an insect growth regulator. A custom-made, externally-mounted tank and sprayer system, designed for use with an MD 500 helicopter, delivered aerial treatments over a 175-acre area. After 13 treatments over 19 months from October 2019 to May 2021, MISC conducted a large-scale effort to assess progress; fewer than 1% of the samples collected contained little fire ants, marking a dramatic reduction in the presence of the target species at the site. In December 2021, treatments focused on 61 acres, which included locations where the ants persisted and areas of rough terrain or vegetation that prevented ground surveys to assess progress. From December 2021 to February 2023, staff completed an additional 11 treatments. Ground surveys conducted in 2022 and most recently in May 2023 are indicate that little fire ants are no longer detectable in what was once the largest-known infestation on Maui. These results mark an unprecedented success in the fight against one of the world's most destructive invasive ant species. We review other aerial operations conducted to control invasive ants worldwide, and suggest our strategy as a roadmap to control little fire ants in difficult-to-access areas or for landscape-level infestations.

Presentation Keywords

Little Fire Ant, Aerial, Treatment, Maui, Insect growth regulator

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Using Native Vegetation Restoration to Offset Invasive Species Expansion on O‘ahu

Christopher Lum, Michelle Elmore Akamine

Army Natural Resources Program on Oahu, Wahiawa, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The introduction of invasive non-native plants has significantly altered the landscape of O‘ahu and disrupted its delicate ecosystems. This has led to a loss of biodiversity and precipitous declines in endangered native plants. A lack of comprehensive vegetation monitoring data, and the cost associated with gathering such data, hinders the understanding of these ecosystem declines for many natural resource management programs. However, collecting and analyzing such data is essential in developing effective conservation management strategies that can safeguard the island's ecosystems for future generations. The Army Natural Resources Program on O‘ahu (ANRPO) manages over 50 endangered taxa and their habitats. ANRPO’s monitoring data collected over several years highlights a trend of increasing non-native cover overall, despite historic weeding efforts to manage vegetation. To mitigate this, ANRPO has recently incorporated larger restoration efforts into management plans. This presentation will examine the negative trends in vegetation composition and highlight beneficial changes in monitored plots where restoration has occurred. It will also summarize clearing efforts, native plant inputs, and follow up weed control needed for effective long-term management and how these practices noticeably change environments. Lessons learned from this dataset have important implications for future conservation management and restoration efforts in Hawai‘i, emphasizing the need for increased native plant supply and restoration endeavors.

Presentation Keywords

Restoration, Vegetation, Monitoring, Ecosystem, Management

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The Spatial Distribution of a Newly-discovered Alga at Manawai in the Northwestern Hawaiian Islands

Leiana Opunui[1], Tomoaki Miura[1], Kauaoa Fraiola[2], Heather Spalding[3], Taylor Williams[4], Randall Kosaki[5], Jonathan Martinez[2]

[1]University of Hawaii at Manoa, Honolulu, HI. [2]United States Fish and Wildlife Service, Honolulu, HI. [3]College of Charleston, Charleston, SC. [4]University of Alabama at Birmingham, Birmingham, Alabama. [5]NOAA Papahānaumokuākea Marine National Monument, Honolulu, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

In 2019, a new alga species, Chondria tumulosa, was discovered outcompeting all native coral species and radically changing the benthic ecology of the NWHI. Given the alga's invasive characteristics, the alga poses a potential threat to the ecological structure of the Northwestern Hawaiian Islands and spread to the main Hawaiian Islands. The main objective of this study was to identify the spatial distribution of C. tumulosa at Manawai (Pearl and Hermes Atoll) in the NWHI to support management efforts. WorldView-2 and -3 commercial high-resolution satellite image data were obtained for a 12-year period from 2010 to 2021. Time-series animations were created from the 12-year satellite image dataset, overlaid with the geo-located field survey data on C. tumulosa cover collected in 2019-2021. The animations were visually inspected to detect dark features likely to be C. tumulosa in comparison to the field survey data as a very recent study reported that C. tumulosa appeared as distinctively-dark features on satellite imagery. Using those dark features as a reference and a machine learning algorithm (MLA), the latest satellite images were classified into a distribution map that detects C. tumulosa in 2019, 2020, and 2021. The spatial distribution pattern of C. tumulosa indicated the highest percent cover in the western and northern regions of Manawai. Additional field surveys are critical in the verification of these suspected areas to increase the accuracy of these results. This study provides resource managers with information on the distribution and priority areas to further monitor the alga for long-term management.

Presentation Keywords

Chondria tumulosa, Nuisance species, Geospatial analysis and modeling, Remote sensing, Papahānaumokuākea Marine National Monument

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He Pūkoʻa Kani ʻĀina Safeguarding the Future of Culturally Important Marine Taxa

Jonathan Fisk[1], Kirsten Leong[2], Kalani Quiocho[3], Alexander Mawyer[4], Kawika Winter[5], Noelani Puniwai[6], ʻAlohi Nakachi[1], Melissa Poe[7]

[1]Cooperative Institute for Marine and Atmospheric Research, Pacific Islands Fisheries Science Center, Honolulu, Hawaiʻi. [2]National Oceanographic and Atmospheric Administration, Pacific Islands Fisheries Science Center, Honolulu, Hawaiʻi. [3]National Oceanographic and Atmospheric Administration, Office of National Marine Sanctuaries, Honolulu, Hawaiʻi. [4]University of Hawaiʻi at Mānoa, Pacific Islands Studies, Honolulu, Hawaiʻi. [5]University of Hawaiʻi at Mānoa, Hawaiʻi Institute of Marine Biology, Honolulu, Hawaiʻi. [6]University of Hawaiʻi at Mānoa, Kamakakūokalani Center for Hawaiian Studies, Honolulu, Hawaiʻi. [7]Washington Sea Grant, University of Washington, Seattle, Washington

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

As forces and disruptions such as climate change and the COVID-19 pandemic affect the future of our environment and people's relationships with the seas, it's imperative to clarify the purpose and improve the efficacy of marine management and stewardship strategies. Owing to inherent challenges and resource and capacity constraints, it's unfeasible for management institutions to monitor and manage every marine taxon. Biologists use established constructs and criteria to prioritize species for management. Managers are increasingly requesting assistance in identifying culturally important species as additional standardized prioritization criteria. Social scientists use many methods to systematically consider various aspects of culture that could inform selection, yet these tools have seldom been applied to determining culturally important taxa for marine management, largely due to imbalances in power and representation in decision making.

This workshop will explore how community members, natural and social scientists, managers, and Indigenous Knowledge keepers can collaboratively construct culturally grounded processes to guide prioritization of marine taxa within research, management, and stewardship efforts that reflect community concerns and values. These processes will be founded upon tradition and cultural paradigms.

Starting with a short presentation then splitting into breakout groups, including some in ʻŌlelo Hawaiʻi, we will collectively discuss key principles and values, explore balancing place-specificity with management geographic scale, and consider how to keep transparency and accountability at the forefront. Together, we hope to identify guidance for marine taxa researchers, managers, and stewards that includes cultural considerations in prioritizing how to protect and nurture the abundance of our seascapes.

Presentation Keywords

Cultural values, Marine ecology, Indigenous and local knowledge, Marine management, Community-based management

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda:

Introduction (10 minutes)

Introductory presentation outlining the background of this topic, why creating this process is necessary, and certain goals and contentions to be addressed by the process (10 minutes)

Breakout Groups (60 minutes)

Discussion of traditional & cultural values to be centered in the overall process (10 minutes)

Discussion of how to handle geographic scale and changes over time (15 minutes)

Discussion of priority factors to consider (importance as food source, cosmological status, biocultural versatility, concern of vulnerability, ceremonial value, etc.) (20 minutes)

Discussion of procedure for implementing the process (15 minutes)

Large Group (20 minutes)

Breakout groups share with everyone the main points they discussed (10 minutes)

Large group discussion of any emergent themes or notes not yet touched on or matters that resonated across groups (10 minutes)

Closing Out (5 minutes)

Thank everyone for their participation and discuss follow-up communication (5 minutes)

Innovative audience engagement techniques:

We will offer to have some breakout groups in ʻŌlelo Hawaiʻi and/or mixed English and ʻŌlelo Hawaiʻi. The exact composition will depend on audience background and desires.

Goals and target audience:

By the end of this workshop, we will have collectively generated insight into methods of crafting and implementing a culturally appropriate process to determine a list of culturally prioritized marine taxa. We will then publish a summary report, a peer-reviewed journal paper, and guidelines for the process discussed in the workshop.

The target audience for this workshop includes cultural practitioners, fishers, and other community members who have intimate relations with and vested interest in the seas. We want to ensure ample consideration of the voices of Kānaka ʻŌiwi since the conference is focused on Hawaiʻi. That said, we aim to be inclusive of the values, concerns, and insights of all people, and hope that the process will resonate with diverse communities and possibly beyond Hawaiʻi.

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Kau ka Haliʻa: Manifesting Shared Dreams of Ahupuaʻa Restoration

Puaʻala Pascua[1], Billy Kinney[2], Pua Chin[2], Kanekoa Kukea-Shultz[3], Keliʻiahonui Kotubetey[4], Hiʻilei Kawelo[4], Pulama Lima[5], Lohiao Paoa[6], Ekolu Lindsey[7], Karin Osuga[8], Tiara Stark[9], Brutus LaBenz[10], CJ Elizares[10], Kaikea Nakachi[11], Malia Lightner[12], Lehua Alapai[13]

[1]Ahupuaʻa Accelerator Initiative, Keaʻau. [2]Hui Makaʻāinana o Makana, Hāʻena. [3]Kākoʻo ʻŌiwi, Heʻeia. [4]Paepae o Heʻeia, Heʻeia. [5]Ka Ipu Makani Cultural Heritage Center, Kawela. [6]ʻOhana Kawela, Kawela. [7]Polanui Hiu, Polanui. [8]Kipuka Oluwalu, Oluwalu. [9]TNC, Polanui. [10]Protect Kahoʻolawe ʻOhana, Kahoʻolawe. [11]Moana ʻOhana, Kaʻūpūlehu. [12]ʻOhana Kaʻūpūlehu, Kaʻūpūlehu. [13]Hoʻola ka Makanaʻā, Kaʻūpūlehu

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

In 2022, the Ahupuaʻa Accelerator Initiative (AAI) convened a Peer-to-peer Learning Cohort, bringing together 15 community stewardship practitioners from six AAI Partner Sites across the paeʻāina. With the support of their home sites, during a series of deep-dive thematic sessions the cohort was asked to draw from their significant lived experience to collectively dream on the future of biocultural conservation, stewardship, and ahupuaʻa restoration in Hawaiʻi. Importantly, the cohort was also tasked with beginning to articulate the steps and processes that may enable us to birth those dreams into reality. This session invites the 2022 AAI Peer Cohort representatives to share lessons learned and takeaways of relevance to multi-sector collaborative conservation, in particular centering community-based, culturally grounded approaches and recognizing the multidimensional factors that impact ahupuaʻa restoration. Attendees are invited to join the representatives in small breakout groups for continued exchange. The session also coincides with the formal launch of the AAI Action Agenda, a compilation of priorities identified and refined with AAI Site Partners and collaborators which aims to mobilize resources and catalyze critical support for ahupuaʻa-scale restoration. The Action Agenda is one key aspect of the AAI's systems-focused approach to strengthen foundational enabling conditions, address key challenges, and solidify continued opportunities to advance biocultural conservation, stewardship, and ahupuaʻa restoration efforts now and into the future. Together the AAI's Action Agenda, continued support for AAI Site Partners, and coordinated efforts with surrounding communities of practice aim to identify meaningful pathways to enable, support, and appropriately accelerate ahupuaʻa-scale restoration.

Presentation Keywords

Ahupuaʻa Accelerator Initaitive, Ahupuaʻa Restoration, Biocultural, Collaboration, Community

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Draft Agenda (120 min)

10min Welcome Remarks, Session Introduction, and Overview

40min Peer Cohort Representative Hoʻolauna and Speed Sharing (~6 min x 6 sites)

10min AAI Action Agenda Overview

5min Transition to Small Breakout Groups (Rotation 1 of 2, Grouped by AAI Partner Site or Thematic Area)

20min Breakout Group 1

5min Transition to Small Breakout Groups (Rotation 2 of 2, Grouped by AAI Partner Site or Thematic Area)

20min Breakout Group 2

10min Session Wrap Up and Closing Remarks

Draft List of Presenters

Billy Kinney and Pua Chin, Hāʻena

Kānekoa Kukea-Shultz, Keliʻiahonui Kotubetey, and Hiʻilei Kawelo, Heʻeia

Lohiao Paoa and Pulama Lima, Kawela

Ekolu Lindsey, Karin Osuga, and Tiara Stark, Polanui

Brutus La Benz and CJ Elizares, Kahoʻolawe

Kaikea Nakachi, Lehua Alapai, and Malia Lightner, Kaʻūpūlehu

Plans for Innovative Interaction

This session will incorporate large group sharing as well as prompted discussions in small breakout groups.

Session Goals

- To highlight conservation opportunities and obstacles as identified by a small collective of community stewardship and ahupuaʻa restoration practitioners.
- To share lessons learned and takeaways of relevance to multi-sector collaborative conservation, in particular centering community-based, culturally grounded approaches and recognizing the multidimensional factors that impact ahupuaʻa restoration.

Target Audience

Conservation practitioners from government, cultural, community, educational, and non-profit organizations from across the state

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Reintroduction of Extirpated Leafroller Moths (*Omiodes* spp.) to O‘ahu

Kathryn van Dyk[1,2], Jana Maravi[1,3], Matthew Sandrich[1,2], Kili Walsh[1,3], Alexander Samori[1,3], William Haines[1,2], Cynthia King[1,2]

[1]Hawai’i Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, Hawaii. [2]University of Hawai’i, Center for Conservation Research and Training, Honolulu, Hawaii. [3]Kupu Conservation Leadership Development Program, Honolulu, Hawaii

Track

IV. Advancement in Conservation Research and Management

Abstract

Hawaiian moths in the genus *Omiodes* (Lepidoptera: Crambidae) were once among the most common moths in the Hawaiian Islands and likely functioned as important pollinators. However, threats including habitat loss and the introduction of invasive species have resulted in drastic declines of *Omiodes* populations. By the 1980s, 14 species of *Omiodes*, including *O. continuatalis*, a grass-feeding generalist, and *O. anastrepta*, a specialist on native *Carex* sedges, were listed as possibly extinct. Populations of these two species have since been rediscovered on Hawai‘i and Maui but remain extirpated from much of their native range, including O‘ahu. To reestablish these species, the Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife, Hawai‘i Invertebrate Program have established and maintained captive colonies of *Omiodes* sourced from Maui and Hawai‘i. We identified several reintroduction sites on O‘ahu and enhanced them by outplanting host plants. Releases of captive reared adults and larvae of *O. continuatalis* began in March 2022 at the summit of Ka’ala and are ongoing. We reintroduced *O. anastrepta* adults and larvae to Mānoa Cliffs Restoration Area from April to July 2022 and to Pahole from July 2022 to present. These were the first interisland reintroductions of native moths in Hawai‘i. While establishment at Ka’ala and Pahole remain unclear, monitoring suggests *O. anastrepta* has successfully established at Mānoa Cliffs, with caterpillars and adults continuing to be sighted at least ten months after the last release.

Presentation Keywords

Moths, Reintroduction, Extirpated , Insects

174

Saving Plants with Teamwork: 20 Years of Hawai‘i's Plant Extinction Prevention Program

Matthew Keir[1], Shaya Honarvar[2], Cliff Morden[3], Lauren Weisenberger[4]

[1]DLNR-DOFAW-NEPM, Honolulu, Hawaii. [2]Pacific Cooperative Studies Unit, Honolulu, HI. [3]Pacific Cooperative Studies Unit, Honolulu, Hawaii. [4]U.S. Fish and Wildlife Service, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Over the last twenty years, the Plant Extinction Prevention Program (PEPP) has maintained a singular goal: to halt the loss of native plant species in Hawai‘i. To be effective, PEPP relies on an expanding partnership of public agencies, private landowners, scientific researchers, propagation experts, and volunteers. This symposium will review the challenges PEPP faces in working with conservation-reliant species, provide an overview of the best management practices for controlling threats and securing propagules, and consider some next steps for the recovery of critically rare plant species in a changing climate. Techniques for saving species ex situ, in seed banks, plant nurseries, micropropagation, and cryopreservation were developed and improved to provide a safety net that averted the total extinction of twenty-eight species. Identifying limiting factors for population growth is complicated by overlapping impacts of predators, limited gene flow between individuals and populations, and reduced habitat available for restoration outplanting. Methods for reducing the impacts of invasive species have improved, but are not deployed broadly or frequently enough to make a lasting impact, especially for rats and slugs. This session will describe ongoing recovery activities for multiple plant species across several islands in Hawai‘i, as well as what is needed to protect threatened plants in Hawai‘i. It will also challenge the audience to consider novel scenarios including moving species to new islands and genetic rescue, especially in the face of changing climates and habitats.

Presentation Keywords

Conservation-reliant, Extinction, Teamwork, Plants, PEPP

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Endangered Flora Awaits Benefits from Memorandum of Understanding by Property Owners & USFWS as Feral Goats Irrupt at Kaloko, Kona

Steven Lee Montgomery[1], William W. M. Steiner[2]

[1]Ahahui Malama I Ka Lokahi /Hawaiians for the Conservation of Native Ecosystems, Kailua, HI. [2]Ahahui Malama I Ka Lokahi /Hawaiians for the Conservation of Native Ecosystems, Hilo, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

On this 50th Anniversary of the Endangered Species Act of 1973, many Hawai'i species are benefitting from protections under it, but rare plants at Kaloko may not survive their 7 year wait for a simple fence. In 1998, Winona Wahinekona Char conducted environmental surveys on Kaloko Makai a'a lavas bisected by Hinalani Road. Botanists found many endangered flora in a forest gem as feral goats were starting to destroy endangered species and their habitat relict. We report on attempts to salvage dry forest samples under an official MOU between Kaloko Entities and Fish and Wildlife Service. Recovery of 10 endangered species and their habitats were intended to benefit from setting aside 150 acres of lowland ecosystem by property owners and land developers, Kaloko Entities, after exclusion of another 631 acres from critical habitat designations. In the 2016 MOU, the owners (foreign & local) committed to pursuing protection of the preserve in perpetuity via transfer or by donation of the preserve to a third party*. The options include land trusts, or National Park Service, which manages the adjacent Kaloko-Honokōhau National Historical Park. Because of ancient pahoehoe paved trails, excellent cultural interpretation opportunities await. The MOU includes commitments from owners to provide $2,000,000 toward implementing conservation actions to benefit 3 plant species' recovery: constructing and maintaining fencing to exclude ungulates, goat removal, fire breaks, weeding, out-planting and irrigation. Monitoring programs would ensure that conservation measures are effective and modifiable responding to new information. Absence of fences makes vehicle/goat collisions frequent. * usfwspacific.tumblr.com/post/177249816740/state-and-private-landowners-to-protect-habitat; www.fws.gov/policy/library/2018/2018-17514.html

Presentation Keywords

plant, Endangered, fence, feral goats

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Investigating Predictors of Oahu ‘Elepaio (*Chasiempis ibidis*) Nesting Success Between Rodent-Controlled and Uncontrolled Areas

Nikki Preston[1,2], Philipe Taylor[2], Kristen Harmon[1], Tyler Bogardus[3], Melissa Price[1]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Rodent control actions such as rodenticide application are common when protecting endangered birds, but questions remain regarding whether the benefits of these practices extend to nearby areas without predator control. Nesting success of breeding populations of O ‘ahu ‘Elepaio (*Chasiempis ibidis*) has increased following rat control in targeted areas over the last decade and as a result of this success, dispersing individuals sometimes establish breeding territories in nearby areas without rat control which may leave their nests vulnerable to predation. In this study we compared the nesting success and nest-site characteristics between a site with rodent control to a nearby site without rodent control. In the 2022-2023 nesting season I identified 55 ‘Elepaio nests and used logistic exposure models to investigate the relationship between survival probability and nest-site characteristics. Rat tracking tunnels were utilized to evaluate rodent presence and nesting success and potential causes of nest failure were determined using game cameras and direct observations. Rodent activity was higher at the site without rodent control ($p=0.007$, SD±2.17), however nest survival between both sites were not significantly different ($p = 0.96$, $= 0.002$). Models with the lowest AICc values predicted that nest survival was highest as nest placement height increased. Conversely, daily survival rate decreased as nest tree height exceeded 10m. Future studies should examine the relationship between rat activity and tree height at sites with and without rodent activity, to determine whether there might be a limit to the effectiveness of ground-based rodent control, particularly for arboreal rodent species.

Presentation Keywords

predator control, breeding biology, passerine, management decisions, habitat characteristics

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Kuku Kapa and Pilina ʻĀina: Using Oral History to Explore Relationships between Kapa Practitioners and Environment

Avalon Paradea

University of Hawaiʻi at Hilo, Hilo, Hawaiʻi

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Kapa (Hawaiian barkcloth) was the historic fabric of Hawaiʻi, crafted for such uses as bedding, clothing, ceremonial purposes, and funeral shrouds. Created from the bast (inner bark) of trees such as wauke (*Broussonetia papyrifera*) and often adorned with natural dyes and pigments, kapa is reflective of the greater ʻāina from which its elements are sourced. The arrival of Western textiles in the late 18th century rapidly replaced kapa, leading to the near disappearance of its production in-step with the degradation of the environments from which needed resources were found and cultivated. During the Hawaiian Renaissance of the 1960s and 70s, several pioneering Kanaka ʻŌiwi individuals revived this art form through research, field work, and much experimentation. Thanks to their passion, kapa has made a steady comeback. An oral history project conducted in 2023 interviewed several prominent kapa practitioners, exploring their relationship with the natural materials they use and the environments from which they are obtained. Oral history is a valuable method to preserve and perpetuate the voices of our kūpuna and their observations of Hawaiʻi's ever-changing landscapes. A product of this research is the creation of an ESRI StoryMap, allowing their words, works, and connections across communities to be shared with the public in a visual narrative. The perpetuation of this cultural practice relies on both the health of our ecosystems and the ongoing transmission of knowledge from kumu to haumāna.

Presentation Keywords

Kapa, Oral history, Hawaiian plants, Ethnobotany, Indigenous knowledge

178

The Next 20 Years: Reaching Towards Recovery with the Plant Extinction Prevention Program Model for Rare Plant Conservation

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The primary threats to plant biodiversity in Hawai‘i and throughout the Pacific islands are invasive species and changing climatic conditions, including temperature and rainfall. Until these global threats are completely eliminated, endangered plants will be reliant on continual threat abatement to achieve and sustain healthy, resilient populations. Preventing extinction is the first phase. Faced with an increasing extinction rate in the wild, the efforts of the partnership formed by the Plant Extinction Prevention Program are essential for these species to persist, and almost all species that have gone extinct in the wild since this partnership was created 20 years ago, have been secured in *ex situ* propagation and reintroductions. The partnership collaborates on research and best practices for species-specific management, threat control, *ex situ* genetic storage and propagation, and reintroduction. After a species is secured, the next phase is to better understand the species’ biology, ecology, and impacts of each threat to build protected habitats that maintain healthy ecosystems. This will involve collaboration with new partners, including ecologists, other researchers, and land managers, to identify the actions needed to increase and maintain long-term viability of conservation-reliant plants. Looking to the next 20 years, we will build on the successes of preventing extinction, threat control and reintroduction design, to reach towards recovery with support from landowners for long-term habitat management. The plants of Hawai‘i can be examples of maintaining species viability for conservation reliant species, by studying how best to overcome limiting factors and effectively engaging with all stakeholders.

Presentation Keywords

extinction prevention, endangered plants, recovery, conservation reliant species

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Dispersal Patterns and Cryptic Species of ‘Opihi (*Cellana exarata*) Revealed on Maui

Christopher Bird

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Endemic Hawaiian ‘opihi (*Cellana* spp.) comprise a crashed fishery, have substantial cultural value, and yet, much remains to be learned about them. Like most marine species, they have a dispersive pelagic larval phase that is difficult to track, and uncovering these dispersal patterns can aid in spatial planning for their recovery. To infer the dispersal patterns of ‘opihi makaiauli (*C. exarata)*, we conducted a population genomic survey of genetic diversity for adults at 13 locations on Maui and one on Lana‘i, and employed forensic assignment testing to determine the locations that juveniles were most likely to have originated from. The patterns of assignment were significantly different than random, revealing ‘Āhihi-Kīna‘u Natural Area Reserve and a community managed ‘opihi rest area, among other sites, as the sources for a disproportionate number of juveniles. Genetic patterns in adults and juveniles support that larvae are moving from the south shore to the north, and from east to west, consistent with larval dispersal models. The biggest surprise was the presence of two very closely related, yet distinct populations. One was more abundant on the north shore, and one on the south with ~50% of all adults being F1 hybrids - putatively sterile. Morphological analysis revealed that the populations differed slightly, particularly on shorelines with few thermal refuges, where the south type exhibited taller shells better able to radiate heat. These results demonstrate that marine spatial management units are sometimes smaller than an island and SNP-based analyses can reveal patterns not detected in previous genetic studies.

Presentation Keywords

spatial marine management, dispersal, endemic cryptic species , adaptive tradeoffs, evolution

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Environmental Variability in Hawaiian Fishponds: Monitoring Prior to Freshwater Restoration

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Hawaiian loko i‘a (fishponds) have always held high value in the islands as an important food reserve for the native people (kanaka maoli). Native Hawaiians continue to care for the connection of fresh and marine water that creates an optimal habitat for diverse fish species. Currently many loko i'a are being stewarded by community groups that are finding ways to restore them. Our Chaminade team has been working in collaboration with Maunalua Fishpond Heritage Center to monitor environmental conditions in advance of a novel water restoration project. For this study we focused on two loko i’a located on the south-east side of Oahu known as Kalauha’iha’i and Kanewai. The freshwater supply to Kalauha’iha’i was significantly reduced by an earlier highway widening project. During the fall 2022 and spring 2023 semesters we gathered temperature, conductivity, pH, and dissolved oxygen concentration data over a span of several weeks. In the fall 2022 data, we observed environmental variability in all measured parameters. Monitoring the loko i’a helps us identify what factors affect the fishpond and the marine life within it. We noticed that every night the dissolved oxygen dropped to hypoxic levels, this causes stress on the fish as there is minimal amounts of dissolved oxygen. Restoring freshwater flow to Kalauha’iha’i should alleviate the stress to marine life. Continuing to collaborate with Maunalua Fishpond Heritage Center in monitoring the health of the loko i’a, we look for solutions to further the wai restoration process.

Presentation Keywords

Environmental Variability, Freshwater, Restoration, Fishponds, Hypoxia

181

Centering Indigenous Ethics in Environmental Science Research to Support Present and Future Generations of Indigenous Data Stewards

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Indigenous communities across the world are coordinating efforts to affirm inherent rights over their cultural traditions, knowledge systems, data, lands, waters, and natural resources after centuries of suppression and genocide driven by settler-colonial agendas. In the U.S., Indigenous communities recognize an ongoing need for research that is guided by the concerns, priorities, and values of their communities, rather than externally-driven agendas. Despite significant recent movement in federal policy in regard to tribal consultation and engaging Indigenous Knowledges, we currently lack a national standard of ethics for environmental science research that engages Indigenous knowledge systems, lands, peoples, and communities. This has led our Indigenous Land & Data Stewards Lab and Collaboratory for Indigenous Data Governance to identify: 1) Key values and principles reflecting effective and ethically responsible research and data practices in Indigenous communities; 2) To what extent these key values and principles are represented in ethics guidelines provided to federally-funded researchers; and 3) Barriers and support mechanisms for applying these key values and principles to research and data practices. We address these objectives through systematic content analysis of 32 Indigenous research and data ethics frameworks from Hawai‘i and internationally. Based on these findings we have developed an analytical framework for assessing federal guidelines for Indigenous research and data stewardship, identifying critical gaps and support mechanisms for Indigenous research and data governance in environmental science research. Through sharing these study findings, we aim to enhance ethical standards in Indigenous research and to support present and future generations of Indigenous data stewards.

Presentation Keywords

indigenous, environmental science, research, data, ethics

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Relocation of Laysan Albatross (*Phoebastria immutabilis*) as a Tool to Reduce Bird Air Strike Hazard

Daniela Casillas[1], Katherine Finney[1], Stephen Rossiter[1], Tessa Broholm[1], Leah Miller[1], Brooke McFarland[2]

[1]Pacific Cooperative Studies Unit, Kekaha, HI. [2]NAVFAC HI Pacific Missile Range Facility, Kekaha, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The Laysan albatross (*Phoebastria immutabilis*, mōlī) is a Migratory Bird Treaty Act protected seabird that has historically nested at the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauaʻi. Nesting attempts and presence of albatross near the PMRF airfield pose significant Bird Aircraft Strike Hazard (BASH) potential. Management efforts to deter albatross, a natal philopatric species, from returning to PMRF to breed protect both aircraft and albatross from interactions. The Pacific Cooperative Studies Unit (PCSU) now augments the United States Department of Agriculture - Wildlife Services' (USDA-WS) on-base relocation program for adult albatross by moving birds to existing colonies on Kauaʻi's north shore every January to April. Relocation to these colonies has been ongoing since the program was initiated by USDA-WS in the 1980s, and, in conjunction with long-term and ongoing egg translocation, has the potential to reduce PMRF BASH risk and enhance climate-resilient high-island breeding colonies. Using both in-year and subsequent colony breeding status of birds relocated from PMRF, we analyze the differential return rates of relocated birds within and between seasons. Results from these analyses may also help inform the success of future intraisland relocations as albatross colonies grow within the main Hawaiian islands.

Presentation Keywords

albatross, relocation

183

Incorporating Socio-Cultural Indicators into Marine Management Planning and Evaluations

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Ecological indicators such as coral cover or fish abundance/biomass are commonly used to evaluate the efficacy of marine management strategies. However, many assessments fail to consider the social and cultural impacts of these management actions towards indigenous and local communities. Frameworks for natural resource management need to acknowledge social, cultural, and ecological factors in the planning and evaluation of management approaches. Socio-cultural design principles, or foundational objectives that support equitable management and community wellbeing, have been defined by local communities through previous work that began in 2020 in collaboration with the University of Hawai‘i at Mānoa and the State of Hawai‘i Division of Aquatic Resources (DAR). These socio-cultural principles fall under four main themes: Place-Based Knowledge and Education; Physical, Mental, and Spiritual Wellbeing; Community Relationships, Engagement, and Commitment; and Efficacy and Equitable Governance. This project builds upon the 2020 efforts, where proposed indicators that could be used to measure each principle were tested. Using the Pūpūkea Marine Life Conservation District on O‘ahu as a pilot study site, both quantitative and qualitative indicators were collected, examined, and refined based on feasibility, strength, and appropriateness. This project will help DAR incorporate socio-cultural measures into marine management planning and assessments to investigate how changes in management affect local communities on social and cultural levels. These results and indicators can also be applied in other conservation efforts to ensure a holistic approach to management that integrates cultural values and supports community connections to place and biocultural resources.

Presentation Keywords

Indicators, Marine Management, Socio-cultural, Management Evaluations, Social Equity

184

Variation in Evasion Behavior of Hawaiian Damselfly Naiads May Impact Vulnerability to Fish Predation

Kili Walsh[1,2], William Haines[1,3], Katie van Dyk[1,3], Matthew Sandrich[1,3], Cynthia King[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Nonnative fish have had devastating impacts on Hawaiian damselflies (*Megalagrion* spp.), but some species appear to be more vulnerable than others. Little is known about the behavior of *Megalagrion* naiads (aquatic immatures), so it is unclear whether differences in susceptibility are due to behaviors or environments. The Hawai‘i Invertebrate Program (HIP) of the Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW) currently rears two endangered damselfly species: the blackline Hawaiian damselfly (*M. nigrohamatum nigrolineatum*), which often co-occurs with mosquito fish (*Gambusia affinis*), and the orangeblack Hawaiian damselfly (*M. xanthomelas*), which never co-occurs with mosquito fish. During the process of captive rearing, we recorded behavioral responses of naiads of each species to various disturbances including water changes and various other stimuli. Blackline naiads tended to cling tightly to substrates and were less likely to swim away when disturbed, while orangeblack naiads readily swam away when disturbed. Blackline naiads also were more likely than oragngeblack naiads to hide beneath shelters. These stark behavioral differences may explain why orangeblack Hawaiian damselflies are more heavily impacted by mosquito fish, which prey on animals in the water column. The different behaviors may be adaptations to the different habitats occupied by the two species; orangeblack Hawaiian damselflies inhabit relatively slow moving streams or ponds, while blackline Hawaiian damselflies are found in more rapidly flowing streams that are more prone to flash floods. This research highlights the need for species specific management strategies even in closely related taxa.

Presentation Keywords

Predation, Damselfly, Behavior, Invertebrate, Aquatic

185

Protecting kāhuli: A threat level protocol for removing Jackson's chameleon (Trioceros jacksonii) from native Hawaiian snail predator-proof fences

Justin Chan, Philip Kitamura, Sidney Stiefel, Charlton Hee, Genevieve Blanchet, Riley Nakasone, David Sischo

Snail Extinction Prevention Program, Kailua, Hawaii

Track

IV. Advancement in Conservation Research and Management

Abstract

Kāhuli (Hawaiian land snails) were once plentiful, with over 750 species across Hawai‘i. Due to habitat loss and predation by introduced invasive species, such as Jackon's chameleons (*Trioceros jacksonii*), around 60% have already been lost, with many facing imminent extinction. Conservationists build predator-free exclosures to protect kāhuli populations and release lab-reared individuals into the wild. *Trioceros jacksonii* have proven to be a tricky species to eradicate from exclosures due to their cryptic appearance, arboreal nature, small juvenile size, early sexual maturation, and high fecundity. The Snail Extinction Prevention Program (SEPP) is working to improve eradication protocols to account for *T. jacksonii* life history to increase removal efficiency. We created a tiered colored threat-level system of red, orange, yellow, and green, with red being a high threat level and green being the lowest threat level. Fence units in the green level would be ready to receive new kāhuli. We based this protocol on an existing *Euglandina* species removal protocol developed by the Army Natural Resources Program, successfully applied across predator-proof fence units. Conservation groups across islands could use this *T. jacksonii* removal protocol to provide safe environments for all native Hawaiian invertebrates.

Presentation Keywords

Kāhuli , Jackon's chameleons, Snail Extinction Prevention Program, Fence units, Protocol

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Using Ornithological Radar and Acoustic Surveys to Determine Population Trends of Hawaiian Petrels on the Island of Maui

Skye Anderson[1], Cheryl King[1], Jennifer Learned[1], Stephen Rossiter[2], Martin Frye[1], Cecelia Frisinger[1], Mariah Rivera[1], Joshua DeCambra[1], Jay Penniman[1]

[1]Maui Nui Seabird Recovery Project, Makawao, HI. [2]Rossiter Ecological Consulting, Circle Pines, MN

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Hawaiian petrels (*Pterodroma sandwichensis*; 'ua'u) are endemic and endangered seabird species of the Hawaiian Islands. Maui holds a significant proportion of the breeding population of 'ua'u, the majority nesting on Haleakalā in eastern Maui. The nocturnal habits and remote breeding grounds of this species makes their population trends particularly difficult to study. It is critical to find robust and accurate methods to measure population stability and thus, understand the conservation needs of 'ua'u on Maui. The objective of this study is to combine radar and passive acoustic survey data from eastern Maui to determine how, and if populations of 'ua'u are changing. Using an ornithological radar at 8 sites in eastern Maui in 2001, 2021 and 2022, we found 'ua'u passage rates among sites were highly variable (20-656 targets per sample night); with the mean number of targets lowest in 2001 and highest in 2021. Acoustic surveys in a managed area of leeward Haleakalā in 2014, 2017 and 2020, found a dramatic increase in 'ua'u calls over time. Together, radar and acoustic survey results suggest that conservation efforts are having a positive effect and they support that 'ua'u populations in eastern Maui are at least stable, if not increasing. Consistent, long-term survey data will identify population trends and help better focus our search for unknown seabird breeding areas and target conservation efforts. In this study, the combined and ongoing use of both survey methods will increase our toolkit, giving us a more robust population assessment of 'ua'u on Maui.

Presentation Keywords

Seabird, Radar, Maui, Acoustic, Population trend

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A "Dark Skies" Program Has Reduced Seabird Fallout at PMRF

Leah Miller[1], Stephen Rossiter[1], Tessa Broholm[1], Daniela Casillas[1], Katherine Finney[1], Brooke McFarland[2]

[1]Pacific Cooperative Studies Unit, Kekaha, HI. [2]Naval Facilities Engineering Systems Command HI Pacific Missile Range Facility, Kekaha, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The Navy's Pacific Missile Range Facility (PMRF) on Kaua`i supports training and testing as the world's largest instrumented multi-environment range. Three Federally-designated endangered seabirds fly over PMRF: Newell's shearwater (*Puffinus newelli*), Hawaiian petrel (*Pterodroma sandwichensis*), and Band-rumped Storm-petrel (*Oceanodroma castro*). These species are susceptible to light attraction fallout, occurring when fledglings are disoriented by artificial light on their first flight to the ocean. Fledglings are vulnerable to predation or dehydration if grounded but not located and rehabilitated. To effectively manage risk to these species and support PMRF's mission, the PMRF Commanding Officer has implemented a successful annual Dark Skies program during the seabird fledging season from September 15 to December 15. The Dark Skies program eliminates non-essential exterior lighting and requires an authorized waiver with minimization and monitoring measures for any essential lighting during the fledging season. Future-year risk calendars are distributed for planning purposes to identify opportunities to align essential lighting requests on lower risk nights. Outreach, downed bird rescue training for relevant staff, and weekly lighting surveys to monitor compliance are key components of the program. From 2007 to 2014, average fallout was at 5.75 seabirds per year. In 2014, the Dark Skies program was initiated and subsequently fallout has averaged one seabird per year, with four years of zero fallout. This indicates that by using these tools, serious reductions in fallout-take are possible throughout Kaua`i and the other Hawaiian islands.

Presentation Keywords

seabirds, light attraction, mitigation

188

Aerial Survey Perspectives on Humpback Whale Resiliency in Maui Nui Following an Unprecedented North Pacific Marine Warming Event

Joseph Mobley[1], Mark Deakos[2], Adam Pack[3,4], Guilherme Bortolotto[5]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

After decades of population growth, the central stock of the North Pacific population of humpback whales (*Megaptera novaeangliae*), known as the Hawai‘i Distinct Population Segment (HDPS), was delisted by the National Oceanic and Atmospheric Administration from its endangered status in 2016. At that time, however, an unprecedented heating event, the “Pacific Marine Heatwave” (PMH) was already underway. The PMH coincided with reports of major declines of sightings of humpback whales, including calves of the year, on both the Hawaiian wintering grounds and the feeding grounds of Southeast Alaska. Hawai’i is the major breeding grounds for North Pacific humpback whales which represent both an important biomass and tourism economic driver. To examine the resiliency of the HDPS, we conducted airplane-based aerial surveys of what has historically been the high-density Maui Nui region immediately following the PMH event in 2019 and 2020, using distance sampling methods identical to those used in an earlier series (1993 to 2003). Results showed whale densities at or above those seen earlier, with mean density for 2020 highest overall. Crude birth rates (% groups containing a calf) were similarly comparable to those recorded in the earlier series, with an increase from 2019 to 2020. These findings suggest resiliency of the HDPS in the face of this major climatic event. However, it remains to be determined whether our observations were influenced by whales beyond Maui Nui gravitating to this preferred area. Future aerial surveys that encompass all the main Hawaiian Islands can help address this question.

Presentation Keywords

humpback whale, distance sampling, Pacific Marine Heatwave, climate change, aerial survey

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Lei Hiʻialo: A Glimpse into the Future of Biocultural Conservation Research and Management

Kaʻohu Kalama[1], Kaulike Puaa[2], Puaʻena K. Estocado[3], Māhealani Figueroa-Lee[4], Kalikookalani Teruya[5]

[1]Ke Kula o Nāwahīokalaniʻōpuʻu, Keaʻau, HI. [2]ʻO Hina i ka Malama, Hoʻolehua, HI. [3]Ka ʻUmeke Kāʻeo, Hilo, HI. [4]Ka ʻUmeke Kāʻeo, Hilo. [5]Kula Kaiapuni o Lāhaina, Lāhaina, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

Envisioning the future of biocultural conservation in Hawaiʻi goes hand in hand with envisioning the faces that are likely to lead our future efforts. This Hawaiian language session will bring together high school students from Hawaiian language medium schools across the state to share original scientific research projects and methodologies that center Indigenous approaches and cultural values in resource management. In addition to the students' presentations, the session's interactive format will facilitate critical dialogue between the audience and student panelists on topics including rebuilding and growing biocultural foundations in conservation in addition to pathways to enhance the meaningful inclusion of cultural values and practice in contemporary resource management. Kui ʻia i lei hiʻialo - this session weaves youth and emerging conservation leader perspectives into a lei that serves as a present and timely reminder that the future of biocultural conservation in Hawaiʻi is right before our eyes.

Presentation Keywords

ʻŌlelo Hawaiʻi, Biocultural, Emerging Leaders, Secondary Education

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda (120 min):

10 minute Welcome remarks, session introduction, and overview

30 minutes - First Set of Student Presentations

- Kaʻohu Kalama, Ke Kula ʻo Nawahīokalaniʻōpuʻu
- Puaʻena K. Estocado, Ka ʻUmeke Kāʻeo
- Māhealani Figueroa-Lee, Ka ʻUmeke Kāʻeo

20 minutes - Interactive Audience Activity / Q&A

30 minutes - Second Set of Student Presentations

- Kalikookalani Teruya, Kula Kaiapuni o Lāhaina
- Kaulike Puaa, ʻO Hina i ka Malama

20 minutes - Interactive Audience Activity / Q&A

10 minutes - Session wrap up and closing remarks

Plans for Innovative Interaction: This session will incorporate virtual polling software and real time feedback visualization from both audience members and panelists. Time permitting, small group discussions may also be incorporated into the session via facilitated activities such as think, pair, share.

Presenters:

Haumana 1 - Nawahīokalaniʻōpuʻu, Puna, Hawaiʻi Island

Haumāna 2 and 3 - Ka ʻUmeke Kāʻeo, Hilo, Hawaiʻi Island

Haumāna 4 and 5 - Kula Kaiapuni ʻo Lāhaina, Lāhaina, Maui

Haumana 6 - ʻO Hina i ka Malama, Waialua, Molokaʻi

Session Objectives:

- To highlight current Hawaiian medium high school leadership and capacity development
- To share original scientific research projects and methodologies that center Indigenous approaches and cultural values in resource management
- To invite dialogue and discussion on rebuilding and growing biocultural foundations in conservation, and on pathways to enhance the meaningful inclusion of cultural values and practice in contemporary resource management

Target Audience: Conservation professionals and biocultural conservation practitioners; Individuals and organizations implementing, supporting, or interested in biocultural education

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Distribution of Ungulates on Kaua‘i Highlight Threat to Critical Habitat for Endemic Forest Species

Derek Risch[1], Jason Omick[2], Melissa Price[1]

[1]University of Hawai‘i Mānoa, Honolulu, HI. [2]Division of Forestry and Wildlife, Honolulu, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The impacts of invasive species are not distributed evenly throughout the landscape. Thus, distribution models are critical to prioritize targeted removal efforts in areas where native species and ecosystems are most heavily impacted. This study focused on the island of Kaua‘i to inform decision making for three invasive ungulate species, feral pigs (*Sus scrofa*), black-tailed deer (*Odocoileus hemionus*), and feral goats (*Capra hircus*). We aimed to identify patterns in ungulate distribution across ecosystems and potential species interactions among the three-ungulate species. Game camera data were collected from July 15, 2020 to July 12, 2021 in a multitude of habitats ranging from 100 m to 1,300 m elevation. Feral pigs were the most frequently detected species, observed at 53 out of 59 locations, black-tailed deer at 30 locations, and feral goats at 9 locations. Black-tailed deer preferred areas with native vegetation, in contrast to feral pigs and feral goats which showed no preference between areas dominated by native and nonnative vegetation. Distribution models indicate some degree of niche partitioning between ungulate species and show considerable overlap between black-tailed deer distribution and much of the last remaining critical habitat for endemic flora and fauna. Our results suggest that targeted removal of black-tailed deer is critical to conserving these areas and they may yet pose a threat to areas outside of their current range if unmanaged. Differences in the distribution of these species highlight the divergent impacts invasive ungulates have on native ecosystems throughout Hawai‘i and may help identify high priority areas.

Presentation Keywords

ungulates, invasive species, species distribution model, Kaua‘i, deer

191

Creating a Pathway for Community-based Monitoring to Inform Nearshore Resource Management

Katie Nalesere

Hawaii Coral Reef Initiative and Division of Aquatic Resources, Hilo, HI

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Communities around Hawai‘i have contributed to filling data and management gaps found within conventional governance systems by utilizing both traditional ecological knowledge and contemporary western methods to collect data and support the sustainability of nearshore resources at local levels. Despite their efforts, community collected data is rarely used to inform management planning and rule making. The Kōkua Community-based Monitoring Framework seeks to develop a pathway to elevate community-based monitoring data and support its incorporation into management decisions and evaluation while ensuring community ownership of that data is honored. The Department of Land and Natural Resources, Division of Aquatic Resources (DLNR-DAR) worked with division biologists, community organizations and non-profit partners to develop a framework that lays out a collaborative process for developing a monitoring plan that focuses on community priorities. The framework will guide the development of a robust monitoring plan targeted at delivering guidance for management, outline roles and responsibilities of partners to support implementation, and identify appropriate opportunities for reciprocal sharing of data between communities, partners, and DLNR-DAR. The goal of the Kōkua Monitoring Framework is not only to provide more and better data for management of Hawai‘i’s marine resources but also to create more opportunities for dialogue and collaboration between DLNR-DAR and communities. This framework will be piloted with interested communities over the summer of 2023 and will be further refined based on lessons learnt through implementation. This poster will share the proposed Kōkua Community-based Monitoring Framework and how it fits into DLNR-DAR’s ongoing initiatives.

Presentation Keywords

Community-based, Monitoring , Co-management

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Integrating Restoration and Education: BYU-Hawaii's Ecological Project Serves as a Model for the Future

Rocky Seeley, Spencer Ingley, J Ungos, Zoe Lyman, Mitchell Christensen

Brigham Young University - Hawaii, Laie, HI

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

In the midst of the global climate crisis, the need to restore ecosystems and the services they provide has never been greater. Despite efforts to restore native habitats around the world, many restoration projects fall short when it comes to ongoing monitoring and management of restored sites. Integrating habitat restoration projects, particularly their monitoring and upkeep, into undergraduate curricula and community outreach programs has the potential to address this challenge. At the BYU–Hawaii Habitat Restoration Project, we are developing a model for such an approach. To date, we have developed a concrete, long-term management and monitoring plan that involves engagement through a team of dedicated undergraduate research assistants, coursework tailored to the restoration project, and broader campus involvement and community engagement. This project also strives to integrate traditional ecological knowledge about plants and ecosystems as a way to increase the participation of native Hawaiian and Pacific Island individuals. Since its inception two years ago, the project has yielded great success in restoring over 40 species across nearly 2 acres of habitat and engaging over 500 students and community members. Here, we provide a roadmap for other sites to develop similar initiatives.

Presentation Keywords

Habitat restoration, Terrestrial, Cultural, Education, Native species

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Conservation is a Key Motivation for, and Outcome of, Agroforestry Transitions in Hawai‘i

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Indigenous agroforestry was widespread in Hawai‘i prior to colonization and included a diversity of tended and harvested native and non-native trees, shrubs, and understory plants. Studies have documented the cultural and food production value of restoring Indigenous agroforestry today. However, the conservation value of agroforestry is less well understood. We designed a statewide, qualitative study to explore, 1) to what extent do conservation values motivate agroforestry practitioners, 2) what conservation outcomes have agroforestry practitioners observed, and 3) what are the obstacles to starting and sustaining agroforestry? We interviewed agroforestry practitioners from 31 sites, analyzed the data using constructivist grounded theory, and then held a focus group with interviewees to discuss the results. Conservation and other non-economic values were the primary motivation for practitioners to steward agroforestry systems, rather than production or economic goals. The most referenced themes of outcomes observed included the return of native birds (35% of sites) and better soil health (32% of sites). Practitioners also expressed how their stewardship has led to enriched relationships between people and the places they steward as well as to ‘āina momona (fertile, abundant land). Yet, practitioners face many obstacles within four domains: systems for accessing land, capital, and markets favor short-term production and economic value; Indigenous and local knowledge is not adequately valued; regulatory, funding, and other support institutions are siloed; and not enough appropriate information is accessible. Our results highlight the significant opportunity of agroforestry as a conservation strategy and the need for collaboration across sectors to realize this potential.

Presentation Keywords

agroforestry, biocultural, forest restoration, agriculture

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Understanding How Engagement With an Agroforestry Restoration Site Impacts Volunteers Over Time in He‘eia, O‘ahu

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Long-term collaborative restoration projects are an opportunity for the community to become involved in conservation restoration. These are efforts that cultivate learning and connection among community and with place. The impact of restoration on a community is often immense, but is also difficult to measure. The restoration of a mixed-native agroforestry at Pu‘ulani in He‘eia on O‘ahu has garnered a growing community with loyal volunteers. We assessed the longitudinal effect of sustained engagement with Pu‘ulani on participants' connection to place, perceived responsibility to place, and accumulated knowledge of mo‘olelo and ecology related to place. Our initial surveys conducted with 120 community members volunteers suggested that “pilina”, the desire to “mālama Pu‘ulani” and the opportunity “to learn and connect to place” were major motivations and perceived benefits for volunteers. When asked, 85% of volunteers said they would come back. In surveys carried out 3 years later, we found that pilina, perceived kuleana, and knowledge deepen as volunteers visit Pu‘ulani repeatedly. Our findings help to illuminate the reciprocity between people and place, and help us record and measure the early benefits of long-term restoration projects.

Presentation Keywords

biocultural, agroforestry, survey, restoration

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Cyanea procera, 15 Years of Rare Species Conservation at the Molokaʻi Plant Extinction Prevention Program

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Over the last twenty years, the Plant Extinction Prevention Program (PEPP) has maintained a singular goal: to halt the loss of native plant species in Hawaiʻi. This presentation will highlight the case study of *Cyanea procera* (Campanulaceae), a short-lived perennial palm-like shrub endemic to the island of Molokaʻi, and the added challenges to rare plant conservation on a rural island with limited conservation resources. *Cyanea procera* was listed as an Endangered species in 1992 because uncontrolled threats from invasive species were causing a continuing decline in the remaining populations. Since then, fewer than ten plants have been observed in three small populations, making it a high-priority target for PEPP. Over the last fifteen years, field surveys located a new population, threat control has been implemented to protect the remaining plants, and innovative propagation techniques were used to collect seeds for propagation, but the population continued to decline. Today, just four wild plants are remaining in two populations. Over this period PEPP has used all available tools to recover this species and built a partnership of public and private landowners, conservation agency staff, propagation experts, helicopter companies, and volunteers. Some of the obstacles encountered along the way include ungulate ingress, predation by native invertebrates, challenging terrain that limits access, and limited staff and resources available on the island. To manage this conservation-reliant species into the future, this partnership will need to expand to increase the number of restoration sites with adequate control of the known threats and maintain management in perpetuity.

Presentation Keywords

Molokai, Extinction, Conservation-reliant, Teamwork, PEPP

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Division of Aquatic Resources' Comprehensive List of Aquatic Species Project and its Implications for Marine Resource Management in Hawai‘i

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Track

IV. Advancement in Conservation Research and Management

Abstract

The Department of Land and Natural Resources' Division of Aquatic Resources (DAR) relies heavily on catch data when making management decisions. However, identification of aquatic species can be difficult and confusing, making catch reporting cumbersome and time-consuming. Further, fishers identify aquatic species by a variety of names, raising questions about the accuracy of reported catch data. There is currently no comprehensive list of aquatic species developed and/or adopted by the State; instead, knowledge of assorted names for each species is sprinkled throughout print and online resources as well as in the memories of fishers, which is passed down orally through generations. Through the Comprehensive List of Aquatic Species Project, DAR is taking the first steps in compiling a master database, including taxonomic, Hawaiian, and common names of aquatic species found in Hawai‘i.

The main goals of this project are to: 1) Compile a comprehensive list of aquatic species, by taxonomic name, with any and all corresponding Hawaiian and common names; 2) Update the commercial catch reporting database to streamline reporting of catch; 3) Convene an advisory group of fishers, cultural practitioners/scholars, and Hawaiian language experts to review the list, fill knowledge gaps, provide revisions, and decide on an accepted Hawaiian name for each species to be used in official government documents; and 4) Encourage proper use of Hawaiian names for aquatic species. This presentation will discuss the database compilation process, short- and long-term implications on catch reports, monitoring data, and management decision-making.

Presentation Keywords

Aquatic Resources, Aquatic Species, Marine Management, Catch Reporting, Species Database

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At the Mercy of Mother Nature: Impacts of Environmental Variables on Feral Cat Activity on Kauaʻi

Emma Karlok, Kyle Pias, Alex Dutcher

Hallux Ecosystem Restoration, Lihue, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Within the Hawaiian Islands, feral cats (*Felis catus*) are an introduced and highly destructive predator, posing a significant threat to biodiversity and survival of native fauna. Specifically, feral cats are present in seabird colonies on Kauaʻi within the Hono O Nā Pali Natural Area Reserve (HONP), where depredation events disrupt the breeding of the ʻuaʻu (Hawaiian petrel, *Pterodroma sandwichensis*) and ʻaʻo (Newell's shearwater, *Puffinus newelli*). In efforts to mitigate predator impacts within these colonies, managers remove invasive species, particularly feral cats, in the HONP. Understanding behavioral patterns of these cats is imperative to effective predator control. Studies have shown that ʻaʻo behavior is influenced by the lunar cycle, so we aim to investigate if similar environmental factors impact predator behavior. Presently, the relationship between feral cat activity and abiotic factors in this landscape is understudied. Variables of consideration include the lunar cycle, daily temperatures, and daily rainfall, as these factors have the potential to impact both prey availability and hunting success. Cat detections from game camera photos were compared against existing lunar, temperature, and rainfall data from 2020 to 2022 across 7 study sites. Results demonstrate the relationship of environmental variables to both time and overall likelihood of target species detection. These findings provide a framework for managers to develop a more effective removal strategy for cats within the HONP, supporting the ecological recovery of these seabird species.

Presentation Keywords

Feral Cats, Predator Control, Seabirds, Management, Environmental Variables

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Applications of Technology in Feral Cat Trapping Regimes in Remote Seabird Colonies

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Hallux Ecosystem Restoration, Lihue, Hawaii

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Feral cats (*Felis catus*) are a significant threat to the ongoing survival of Aʻo (*Puffinus newelli*) and ʻUaʻ u (*Pteradroma sandwichensis*) within the Hawaiian Islands. The recovery of our ground nesting bird populations is dependent on resource managers utilizing proper trapping techniques to reduce feral cats within and around at-risk bird habitat. Such habitats on Kauaʻ i are often difficult to access, and have complex terrain, limiting the ability of managers to access seabird colonies and critical cat ingress routes. Managers trapping feral cats in bird habitats face an abundance of challenges due to cat mobility, elusiveness on the landscape, and potential food preferences. With advances in monitoring and trapping technology, managers may be able to overcome these and other obstacles to effective predator control. Utilizing over seven years of cat trapping experience in remote seabird colonies, we provide an in-depth examination of several technologies applied in feral cat removal, exploring the advantages and pitfalls for each application in determining the most effective or efficient trapping regime for different scenarios. Trapping technologies to be discussed include body grip traps, manually-checked cage traps, VHF telemetry-monitored cage traps, and cellular network camera-monitored cage traps. The adoption of new and emerging technologies and techniques have the potential to overcome our limitations and allow us to reach our management goals, better protecting our native resources.

Presentation Keywords

feral cats, seabirds, predator control, trapping, technology

201

Applying Microbial Metagenomic Tools to Distinguish Sources of Coastal Sewage Pollution in Hilo, Hawai‘i

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Leaking on-site sewage disposal systems (OSDS) and failing urban sewage infrastructure release raw sewage, severely threatening human and environmental health globally. Culture-dependent monitoring for sewage pollution does not resolve fecal sources, which is central to management strategies and risk assessment, and while microbial source tracking (MST) exploits gut-associated bacteria to differentiate among fecal sources, it cannot distinguish between wastewater sources. This study aimed to develop and validate MST methods to differentiate among wastewater sources in Hilo, HI which houses a wastewater treatment plant and over 10,000 cesspools, the highest density in the state. We employed 16S rRNA amplicon sequencing to characterize the microbial communities of OSDS septage, untreated sewage, treated effluent, and submarine groundwater discharge across 20 coastal sites. Distinct microbial communities were identified among septage, sewage, and effluent samples. We then employed random forest algorithm to identify indicator bacteria that are effective in differentiating among wastewater sources. The algorithm correctly classified nearly 100% of sewage and effluent samples, but incorrectly classified 100 % of OSDS septage samples due to limited sample size. All wastewater sample types shared similar abundant taxa including Arcobacter, Acinetobacter, and Aeromonas with unique ASVs associated with each source but future research to examine their potential to discriminate among sewage sources is required. This study highlights the application of random forest algorithm with 16s rRNA amplicon sequencing to identify non-fecal associated taxa useful in discriminating sources of wastewater pollution in coastal waters.

Presentation Keywords

sewage, water quality , coastal , microbial , pollution

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Eliminating single-use plastic water bottles in Hawaii: Choose to Refuse Plastic Initiative

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The Hawaiian Islands face a significant challenge with plastic waste, especially single-use plastic water bottles, due to limited recycling infrastructure. To address this issue, the "Choose to Refuse Plastic" initiative was introduced in 2021, aiming to reduce plastic bottle consumption in Hawaii. This research focuses on the impact of filtered water stations in local schools on the Island of Hawaii.

Extensive research reveals the alarming escalation of plastic production and consumption, particularly in the form of water bottles, leading to detrimental environmental consequences. In the US, only 9% of water bottles are recycled annually, highlighting the inadequacy of current recycling rates. Additionally, Hawaii lacks industrial recycling facilities for plastic water bottles, exacerbating the accumulation of plastic waste and posing immediate physical and chemical hazards to indigenous flora and fauna.

The study advocates for reusable bottles by providing accessible filtered water through the "Choose to Refuse Plastic" initiative. The installation of filtered water stations in local schools proved effective in encouraging individuals to opt for reusable bottles when convenient alternatives were available. These findings underscore the potential of grassroots-driven, community-based initiatives in transforming the habit of single-use water bottle consumption.

This study emphasizes the importance of promoting sustainable grass root alternatives and reducing reliance on single-use plastics. By implementing similar initiatives throughout Hawaii and potentially expanding to other regions, a significant reduction in plastic waste can be achieved, thus contributing to environmental preservation and the well-being of native species.

Presentation Keywords

Plastic, Drinking water, Single-use plastic water bottles, Lack of plastic recycling , marine microplastics contamination

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The Significance and Challenges Faced by the Increasing Number of Nesting Honu (Hawaiian Green Sea Turtles) on O‘ahu

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The honu or Hawaiian Green Sea Turtle (*Chelonia mydas*) once nested in large numbers on all the main Hawaiian Islands. Starting in the 1800s and continuing until the 1970s, widespread, unsustainable harvest, primarily for consumption of adults and eggs by humans, constrained and eventually eliminated all significant nesting areas with one exception; Lalo or French Frigate Shoals. Hard-wired life history traits like late maturation and natal site fidelity work synergistically to impede recovery which will require expansion into previously used nesting areas. Although honu numbers have increased at ~5%/year, there is little evidence of any significant nesting outside of the low-lying atoll of Lalo. Expansion in nesting to high-elevation islands that will persist as sea-level rises is necessary for survival and recovery. A collaborative, community-based project using citizen scientists to find, monitor and protect honu nests on O‘ahu started in 2016 and revealed a dramatic increase in sea turtle nesting starting in 2020 and continuing through the present. Nest numbers increased from 0 – 2 nests found in 2016 – 2018 to a high of 58, 67 and 31 nests found in 2020, 2021 and 2022, respectively. Hatching success and emergence success were generally high (>85% & >75%, respectively). However, many nests and hatchlings require protection from artificial lights, vehicles driving on the beach, invasive predators, and discarded fishing line. Management and public education focused on these threats, especially on the responsible use of artificial light, is needed to protect honu as they once again begin to nest on O‘ahu.

Presentation Keywords

honu, Hawaiian Green Sea Turtle, Community-based, Citizen scientist, nesting

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Exploring Conflicts and Challenges Facing Communities in Establishing Community-Based Subsistence Fishing Areas (CBSFAs) in Hawai´i

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Native Hawaiian communities have long been engaged in a struggle to safeguard their customary ways of life and incorporate Indigenous traditional knowledge in stewardship of natural and cultural resources. As contemporary management systems that govern Hawaiian marine resources fall short of dealing with the pressures of climate change, alternative and traditional management structures are desperately needed. The formulation of the legislation on Community-Based Subsistence Fishing Areas (CBSFAs) opened up opportunities for communities to assert a more prominent role in the management of their biocultural resources. CBSFAs allow Native Hawaiian communities to regulate and oversee the management of resources that are important to their subsistence and culture. However, decades later, only two communities have been able to enact management plans under CBSFA legislation. This slow progress is indicative of issues inherent within the processes that govern the CBSFA law. This research employed a qualitative study design to conduct interviews with rightsholders who have engaged in the process of establishment of CBSFAs in multiple Native Hawaiian communities. The results provide insights on the conflicts and challenges that communities face while partnering with state agencies during the CBSFA establishment process. These include issues of capacity within state agencies, lack of outreach and resources, lack of political will, and inequitable burden on communities. Recommendations are made that suggest increasing support for communities, building strong and long-term partnerships, and knowledge exchange among others. The project will contribute and mobilize knowledge on Native Hawaiian community-led conservation efforts for the biocultural resources of Hawai´i.

Presentation Keywords

CBSFA, Community-led management , Native Hawaiian rights, Collaboration, Biocultural conservation

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Innovative Framework for Hosting Youth Camps in Ahupuaʻa Stewardship

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Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

Educational experiences outside of the classroom have been shown to improve social relations, academic performance, enhance cognitive abilities, problem solving, and improve student understanding of the environment around them by 75%. Schools are limited in how they can incorporate outdoor experiences because of constraints with school hours, access to transportation, and lack of established relationships with groups who offer such experiences. Tree to Sea Camp offers opportunities for scientific inquiry blended with place-based experiential learning. The camp is supplemented by grants to minimize costs and is offered during school breaks. Tree to Sea Camp was uniquely designed to be completely nature-based, requiring no facilities, and bringing together experts in the field such as cultural practitioners, kai and ʻāina scientists, conservationists, and environmental community leaders. Students learn about traditional and modern ahupuaʻa resource management while developing stewardship skills and deepening their understanding of science and Hawaiian culture. The framework developed for Tree to Sea Camp can be applied throughout the State of Hawaiʻi for educators and non-profit organizations to develop similar experiences for area youth to become stewards of their ahupuaʻa. This framework includes program development, targeted recruitment strategies, mauka to makai activities and supplies, simplifying logistics, communications, evaluation, and establishing long-term relationships with partnering organizations to diversify experiences. Tree to Sea Camp was modeled after the NOAA Meaningful Watershed Educational Experience framework, then launched in 2022 with 18 middle school students and 20 students in 2023. The successful program will continue to be refined moving forward.

Presentation Keywords

Youth Camp, Stewardship, Place-based learning, Environmental Education, Ahupuaʻa management

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Wastewater Indicating $\delta^{15}N$ in *Gracilaria salicornia* and *Codium edule* in Kāneʻohe Bay and Effects on Fibropapillomatosis Rates in *Chelonia mydas*

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Populations of green sea turtles (*Chelonia mydas*) in Hawaiʻi have become a source of concern over the past decade due to the tumor-causing disease fibropapillomatosis (FP), the number one cause of mortality in green sea turtles. FP forms internal or external tumors, inhibiting foraging, movement, and organ functions. Previous research suggests a possible cause of FP is elevated levels of the amino acid arginine in algae, their primary food source. Elevated levels of arginine have been associated with high levels of nitrogen in wastewater, as indicated by $\delta^{15}N$. In this study, FP amongst the green sea turtle population in Kāneʻohe Bay and two of their primary food sources, *Gracilaria salicornia* and *Codium edule*, were analyzed. The objective of our research was to assess if there is a relationship between high levels of $\delta^{15}N$ along the coast, indicated by algae in the diet of green sea turtles and rates of FP in Kāneʻohe Bay, Hawaiʻi. To do this, we surveyed turtles to estimate the distribution of FP and collected algae to analyze $\delta^{15}N$ to determine wastewater pollution in the bay. We found a significant relationship ($*p<0.05$, Fisher's exact test) between levels of FP in green sea turtles (n=20/59 with FP) and $\delta^{15}N$ (n=60, range=2.1-10.1‰) in algae. This suggests a link between levels of wastewater along our coastlines and rates of FP in endangered green sea turtles, providing further insight of the causes and distribution of FP and pollution in Kāneʻohe Bay.

Presentation Keywords

Fibropapillomatosis, Wastewater, Invasive algae, Kaneohe Bay, Green Sea Turtle

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Reflecting on 20 Years of E Alu Pū to Guide the Future of Community-Based Resources Management in Hawai‘i

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

E Alu Pū is a network of community-based practitioners that hold kuleana (responsibility) to mālama ‘āina (care for land and sea) in spaces where they have lineal connections. Celebrating the 20th anniversary of this network in 2023, members have changed the face of conservation and resources management in Hawai‘i. Practitioners have developed innovative approaches informed by traditional ecological knowledge and kilo (consistent observation), generated original research, and influenced effective policy changes.

To support the continued positive influence of community-based resources management in Hawai‘i, we conducted an explanatory mixed methods case study of E Alu Pū to better understand the facilitators and barriers these groups have experienced in their pursuit of healthy and abundant ‘āina. Our methods integrated longitudinal surveys; documents and archival records; and interviews with current and past network members, coordinators, partners, and supporters. Analyses included social network analysis, qualitative comparative analysis, constant comparative thematic analysis, and pattern-matching.

We will share what we learned about intended and unintended outcomes that have been achieved by E Alu Pū, the difference networking has made to participants, the conditions that help these communities and practitioners achieve resource management results, and the barriers that frustrate and limit their impact. With 20 years of experience from which to draw, E Alu Pū can help other communities and networks, their partners, and their supporters pursue a future that builds upon the proven success of community-based resources management in Hawai‘i. Our presentation will center the voices and experiences of E Alu Pū participants.

Presentation Keywords

Community-based resource management, Practitioners, Facilitators and barriers

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Imaging and Digitizing the Seeds of Hawaii

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Track

IV. Advancement in Conservation Research and Management

Abstract

Seed banks are critical resources for ex-situ conservation and biological research. They are one of the most prevalent and practical approaches to conserving resources used for habitat restoration and the conservation of wild species. Despite seed collection's utility for research, limitations in terms of accessibility do exist. Travel restrictions, such as time and funding, might impede researchers from accessing seed collections for in-person visits. Further, many seed collections across seed banks and herbaria are not digitized (i.e., imaged or databased) or are photographed insufficiently for identification. However, technological advances, such as Z-stacking software that can bring into focus an entire specimen with an increased depth of field, have been applied to quantify morphological traits like size and shape. At the Harold L. Lyon Arboretum in Honolulu, Hawaii, a curation project was started in 2021 to image all 141 genera across 63 families currently held in the Lyon Arboretum Seed Lab in the hopes that it will be a valuable reference to researchers for identification and source for seed morphological data. This involved: updating the names in the collection to the current taxonomy, photographing the seeds at different focal planes and combining them to increase the depth of field, uploading the images onto a newly developed website, SeedsOfHawaii.org, and promoting the utility of this new, digital collection. Seed banks that digitize their collections through modern imagery can expand their utility and use for reference further than physical collections by increasing their visibility through online availability.

Presentation Keywords

Seeds, Microscopy, Digitizing, Rare plants

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Advancing Seabird Conservation through Partnership in Honopū Valley, Kauaʻi

Helen Raine[1], Andre Raine[1], Adam Williams[2], Alex Dutcher[3], Jessi Hallman Behnke[4], Lindsay Young[5], Scott Hall[6], Michelle Bogardus[7], Brooke McFarland[4], Chris Mottley[2], Sheri Mann[2], Emma Yuen[8], Kyle Pias[3], Jody Olson[6], Aaron Nadig[7], Nicole Olmsted[9]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The US Navy's Pacific Missile Range Facility developed a partnership with the National Fish and Wildlife Foundation (NFWF) to bring key stakeholders together to carry out a project on State of Hawaiʻi-owned lands within Honopū Valley, northwest Kauaʻi. As the first conservation project funded by the Office of the Secretary of Defense (OSD) Readiness and Environmental Protection Integration (REPI) Program under the Sikes Act authority, its cooperative implementation plan called for the protection of critical breeding areas through the construction of conservation fences, predator control, seabird social attraction, and monitoring of outcomes. Completed in 2023, this 3-acre predator-proof and 239-acre ungulate fence-within-a-fence design offers prime predator-free habitat with low light pollution that improves the baseline ecological conditions for three federally listed Hawaiian seabirds: Band-rumped Storm-petrels (ʻAkeʻake, Oceanodroma castro), Newell's Shearwaters (ʻAʻo, Puffinus newelli) and Hawaiian Petrels (ʻUaʻu, Pterodroma sandwichensis).The site is already experiencing early success with four records of ʻAʻo on cameras in 2022 and nocturnal auditory surveys recording multiple observations of circling ʻAʻo . Critically rare plants are also responding to conservation efforts at a landscape scale due to removal of ungulates and suppression of rats. In its fifth year, the Navy and NFWF are preparing to transfer project oversight to the Kauaʻi Island Utility Cooperative to be funded for a minimum of 50 years. The REPI Program supports partnerships that work across boundaries to protect working lands, wildlife habitat, water resources, natural spaces for recreational opportunities and endangered species.

Presentation Keywords

Endangered, Landscape, Seabird, Partnership, Collaboration

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Assessing Public Attitudes on a Native Seabird Colony Within a Public Park

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Native ecosystems across the globe are reliant on ecosystem engineers such as seabirds. Seabird populations face existential threats from anthropogenic stressors. The general public should have an awareness of local seabirds and seabird conservation efforts. Maui Nui Seabird Recovery Project, in collaboration with state and county organizations manages several seabird colonies around Maui, Hawai'i. An 'ua'u kani (wedge-tailed shearwater, *Ardenna pacifica*) colony located in the popular Kama'ole III Beach Park, has been under reinvigorated management since 2018. Initiatives include invasive plant removal, trapping mammalian predators, and establishing roped boundaries to keep foot traffic away from the nesting area. Since starting these efforts, reproductive success has risen from 9.68% (2018) to 68% (2022). This study gauges public attitudes, awareness and knowledge around the 'ua'u kani colony and other wildlife at Kama'ole III. Random park visitors and volunteers were asked to complete a 20-question survey about their use of the park and knowledge of the 'ua'u kani. There was a comparable number of residents and visitors who took the survey. It was found that while residents were three times more likely to know about the 'ua'u kani (62%: 22%), visitors were twice as likely to say they would commit to protections in the park (56%: 27%). Almost all participants were supportive of environmental management. Future work on this study will include incorporating cultural significance, comparisons across sites and islands, and determining if length of residency correlates to knowledge about native seabirds.

Presentation Keywords

seabirds, survey, park, conservation, public opinion

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No Ka Lāhui: Using IUCN Data to Inform Recovery of Imperiled Species of Hawai‘i, for Hawai‘i

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Hawai‘i has earned the unfortunate moniker of “extinction capital of the world” with a total of 586 imperiled species on state, federal, and international listings. Collaborative efforts that integrate multiple knowledge systems, communities, and innovative ideas are needed to recover endangered species populations, yet conservation efforts are often siloed among taxonomic groups, agencies, and land “owners.” Potential synergies in conservation actions across taxonomic groups can inform proactive conservation management. The purpose of this study was to evaluate IUCN Red List data regarding at-risk species in Hawai‘i to: (1) evaluate threats and conservation actions across taxonomic groups; (2) discern if conservation actions explicitly address climate change; and (3) investigate the incorporation of Indigenous and Local Knowledge (ILK). Of 420 species with a listing status, 401 species had threat and conservation action data available. Overall, results reflect that taxonomic groups are impacted by different threats, but some threats impact multiple taxonomic groups disproportionately. Though the effects of climate change were articulated as threats for these species, none addressed this explicitly in conservation actions needed. The disparity in data availability limited analyses for invertebrates, with threat data only available for eight arthropods and absent for tree snail species known to be on the brink of extinction. None of the listings included ILK, despite published and written repositories of knowledge regarding Hawaiian species that are readily available. These results highlight the need for a structured elicitation process to be incorporated into the IUCN listing framework to increase inclusion of ILK for globally threatened species.

Presentation Keywords

Red List of Threatened Species, Endangered Species, Wildlife Conservation, Indigenous & Local Knowledge, Threat Analysis

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Investigation of Barn Owl Diet and Depredation of Seabirds on Kaua'i

Anne Wiley[1], Alex Dutcher[2], Taylor Wilcox[3], Joanna Elmore[3], Michael Schwartz[3], André Raine[4], Kyle Pias[5]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Kaua'i is home to many native species of seabird, including the federally endangered 'ua'u (Hawaiian Petrel, *Pterodroma sanwichenses*) and the federally threatened 'a'o (Newell's Shearwater, *Puffinus newelli*). In the remaining 'ua'u and 'a'o colonies on Kaua'i, predator control is essential, preventing the local decline of both species. Barn Owls (*Tyto alba*), introduced in the 1970's, depredate both adults and chicks within colonies and predator-proof fences, however the scale of the problem is not well understood. Despite the urgent need, little is known about Barn Owl diet and subsequent impact on 'ua'u and 'a'o. Between 2017 and 2022 Barn Owls were lethally removed within and around seabird colonies on Kaua'i and each owl was necropsied to collect morphometric data and digestive tract samples. Prevalence of seabirds in owl diets was investigated utilizing stable carbon and nitrogen isotope analysis of partially grown contour feathers and genetic meta-barcoding of cloaca and esophagus swabs. Based on isotope data, individual Barn Owl diet varied widely, consisting of 0-50% seabirds in the weeks before death. Notably, owls with lower wing loading (and presumably greater maneuverability) consumed significantly more seabirds. Molecular analysis showed depredation of multiple seabird species, and depredation of certain species outside of known breeding areas. Contradicting past hypotheses, our data show unexpected foraging behavior of Barn Owls and highlight the vulnerability of seabirds in flight. Our results emphasize a need for Barn Owl control beyond seabird colonies on a landscape-wide scale, and a need for further research on Barn Owl behavior.

Presentation Keywords

predator control, seabirds, barn owl, invasive species, management

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Could a Molecular Tool Be the Future of Managing Avian Botulism Threats in Hawai‘i

KaiLei'a Duriano, Carmella Vizza

Hawaii Pacific University, Honolulu, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The ‘alae ‘ula (*Gallinula chloropus*), ‘alae ke‘oke‘o (*Fulica alai*), ae‘o (*Himantopus mexicanus knudseni*) and koloa maoli (*Anas wyvilliana*) are endangered, endemic species of Hawaiian waterbirds. While habitat loss and predation by invasive species are primarily responsible for their decline, avian botulism is an emerging threat likely to increase with climate change. Understanding the environmental parameters that influence avian botulism is essential to prevent or minimize outbreaks. We conducted an environmental survey using quantitative polymerase chain reaction (qPCR) to identify if the Clostridium botulinum type C neurotoxin (BoNTC) that causes avian botulism is present in sediments across five wetlands in O‘ahu: 1) Kalou Fishpond, 2) Ulupō, 3) James Campbell National Wildlife Refuge - Ag Ditch, 4) James Campbell National Wildlife Refuge - Pond C and 5) Waiauia. Water quality (salinity, temperature and dissolved oxygen) were measured to identify environmental patterns associated with the abundance of BoNTC. Preliminary water quality data from our five sites during the summer of 2022 are consistent with past scientific research describing ideal conditions for Clostridium botulinum growth. We found the presence of BoNTC DNA in two of our sites using qPCR that aligns with environmental parameters of low dissolved oxygen, low salinity and within a temperature range of 20-40ºC. Identifying the presence and abundance of BoNTC in Hawaiian wetlands is a novel undertaking that will inform managers about the likelihood of avian botulism outbreaks in their wetlands and could be used as a tool in future adaptive management efforts.

Presentation Keywords

Clostridium Botulinum , Wetlands , Hawaiian Waterbirds , qPCR, Adaptive Management

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Genetic Diversity and Population Structure of *Wolbachia* in *Culex quinquefasciatus* in Hawai‘i and Palmyra Atoll Relevant to Landscape-level Mosquito Control

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Track

IV. Advancement in Conservation Research and Management

Abstract

Introduced mosquito-borne avian diseases have led to population declines, range limitations, and increased extinction risks for many endemic Hawaiian honeycreepers. As a conservation strategy, plans are underway to implement Incompatible Insect Technique (IIT) to suppress wild *Culex quinquefasciatus* populations in critical Hawaiian forest bird habitat. The IIT operates through repeated releases of laboratory-reared *Wolbachia*-transinfected *C. quinquefasciatus* males that are reproductively incompatible with wild *C. quinquefasciatus* female populations. To support IIT efforts, we are using next-generation sequencing approaches to study the genetic diversity and population structure of naturally occurring *Wolbachia pipientis* (strain *w*Pip) that infect wild *Culex* in Hawai‘i and the Pacific. Preliminary genotypic data from ~250 *w*Pip sampled from Hawai‘i, Maui, and Kaua‘i shows that *Wolbachia* possess moderate levels of genetic diversity, yet phylogenetic structure was not detected at a cross-island scale. Efforts are underway to increase sample size to over 1,000 *Wolbachia* isolates to test for genetic outliers, develop a genetic marker panel focused on genes associated with reproductive incompatibility, and deploy the marker panel to characterize *w*Pip diversity across five islands, including O‘ahu and Palmyra Atoll. Preliminary results will be presented at the conference. This research builds upon the knowledge and occurrence of *Wolbachia* strains on the landscape, while development of high-volume sample processing and genomic-based tools may assist future mosquito population monitoring efforts and support continued IIT efficacy across the islands, crucial for recovery of endemic and endangered island birds.

Presentation Keywords

Insect Incompatible Technique, Mosquitoes, Birds, Wolbachia, Genomics

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Connecting Actions to Outcomes to Achieve Endangered Species Recovery

Melissa Price[1], Kristen Harmon[1], Abbey Camaclang[2], Brissa Christopherson[1], Tara Martin[2], Scott Fretz[3]

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Over the last year a team of ~100 conservation experts that manage spaces within Maui Nui collated knowledge regarding the cost, benefit, and feasibility of commonly employed conservation strategies to gain insights into achieving recovery for 300+ at-risk species on the islands of Maui, Moloka‘i, Lāna‘i, and Kaho‘olawe. We then identified strategies that provide maximum gains in recovery across and within taxonomic groups, considering costs and feasibility. To ground-truth our list of optimal strategies, we are providing HCC participants with a look “under the hood” at our process. This forum will consist of: (1) a brief overview of the methods and results to date; (2) breakout discussion tables to discuss each action strategy considered in this process (e.g., fencing & ungulate management, invasive vertebrate control, invasive invertebrate control, landscape scale control of small mammals, bird disease, stream/wetland hydrology, coastal & non-coastal terrestrial habitat management), outputs (a list of optimal action strategies considering cost, benefit, and feasibility), and potential applications of this process elsewhere in the islands; (3) share-out time with all attendees to discuss potential synergies and collective actions moving forward.

Presentation Keywords

Endangered species, Conservation synergies, Decision framework, Costs/benefits

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda

30 min: Project overview and results to date (Presented by Kristen Harmon)

60 min: Breakout tables by strategy (fencing & ungulate management, invasive vertebrate control, invasive invertebrate control, landscape scale control of small mammals, bird disease,

stream/wetland hydrology, coastal & non-coastal terrestrial habitat management). Breakout groups will discuss: (1) details of each action (e.g., timing & frequency, spatial scope, mechanisms & steps); (2) a list of optimal strategies; (3) potential additional applications of this process (Breakout groups facilitated by Kristen Harmon, Melissa Price, Brissa Christopherson)

30 min: Share-out of discussion from individual tables to the larger room (discussion facilitated by Kristen Harmon)

Audience Engagement

We will use breakout groups and share-out techniques to engage participants during the forum.

Goals & Target Audience

The goal of this forum is to elicit feedback from conservation practitioners regarding outputs of a conservation action optimization process that aimed to identify cost-effective conservation actions that provide optimal gains in species recovery. Our target audience is taxonomic experts and natural resource managers.

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Midway Seabird Protection Project 2023- It's Finally Happening

Amanda Boyd

U.S. Fish and Wildlife Service, Papahānaumokuākea Marine National Monument, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

After COVID related delays over the past several years, the U.S. Fish and Wildlife Service (Service) will be implementing a plan to remove invasive mice from Sand Island, Midway Atoll National Wildlife Refuge. This removal is necessary to protect the largest colony of albatross in the world as well as 29 other species of birds that rely on Midway Atoll (Kauihelani). On more than 500 other islands worldwide, similar invasive rodent removal campaigns successfully resulted in long-term benefits to native species and outweighed the limited, short-lived negative impacts from an eradication operation. The multiple agency effort on Midway Atoll has many challenges including endangered non-target species, extensive infrastructure, and a community of 50 people that live on the island. This 5-minute speed talk will provide updates on the project including: scientific data collected, lessons learned from trialing methodologies, and how monitoring and data collection are interwoven throughout the project to make management decisions. The lessons learned from these research and monitoring projects can be applied to rodent eradication efforts in Hawaii and across the world.

Presentation Keywords

eradication, conservation collaboration, Seabirds, management, lessons learned

220

Life History and Conservation Status of *Cookeconcha hystricella,* One of the Last Extant Snail Species in the Family Endodontidae

Mina Lam, Geneviève Blanchet, Riley Nakasone, David Sischo

Snail Extinction Prevention Program, Kailua, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Cookeconcha hystricella is one of three known extant snail species in the Endodontidae family, out of 33 species originally described from the Hawaiian Islands. While endemic land snails across Hawai'i are important native plant mutualists and ecosystem nutrient cyclers, they are in decline due to introduced predators and climate change. The endodontids have been hit particularly hard resulting in extreme range reductions and extinction. C. hystricella is endemic to O'ahu, but aside from that, little is known about the life history of this entire group of snails. In 2018, individuals were brought into The Division of Forestry and Wildlife's Snail Extinction Prevention Program's captive rearing lab from the last known wild population. Our rearing methodology consists of the snails being placed into plastic boxes that are modified to simulate the conditions of their native habitat. The data collected includes the number of births, deaths, the amount of food consumed, monthly pictures of individuals for the calculation of growth rate, the number of eggs laid, and their hatching success over the course of three years. This project analyzes these life history data to quantify, survival, growth rate, number of eggs produced per individual, time to maturity, lifespan, death rate by size class, etc. These life history traits have never been reported before and will inform captive and wild management of the species. Additionally, we will report the number of individuals released back into the wild to date.

Presentation Keywords

Invertebrate, Snails, Conservation Rearing, Life History, Data Analysis

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Effects of climate change and eutrophication on the carbon concentrating mechanisms in select Hawaiian reef algae

Migiwa Kawachi, Celia Smith

University of Hawai‘i at Mānoa, Honolulu, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Coastal eutrophication caused by the anthropogenic nutrient input has triggered blooms of invasive macroalgae and threatened the health of Hawaiian coral reefs. Reefs are expected to further decline via climate change impacts of ocean warming and acidification that negatively affect the coral. While the effects of climate change on coral and other calcified organisms are relatively well studied, impacts on macroalgae are understudied. Further, predicting the effects of climate change on most macroalgae is not easy, because many maintain carbon concentrating mechanisms (CCMs) to provide high intracellular CO_2 concentrations. Thus, because of CCMs, algal photosynthetic abilities do not appear to be limited by CO_2 concentrations in coastal regions. Yet, operation of CCMs requires metabolic energy and limiting resources, thus algae may change their CCMs with increasing CO_2 concentration or resource availability. This study investigated how ocean acidification and eutrophication affects CCMs in two common Hawaiian brown algae which often co-occur in tidal to shallow subtidal habitats. *Asteronema breviarticulatum* and *Chnoospora minima* were grown with experimental combinations of elevated CO_2 and nitrate-nitrogen. These two species quickly responded to elevated CO_2 and nitrogen by changing their CCMs. While *C. minima* reduced CCMs with elevated CO_2, *A. breviarticulatum* increased CCMs with elevated nitrogen. Regardless of the alga’s reaction, ocean acidification and eutrophication will likely favor macroalgae in our future reef settings.

Presentation Keywords

climate change, eutrophication, algae, coral reef, carbon concentrating mechanisms

222

Linking the Functional Traits of Leaf Litter and Litter-Dwelling Arthropods in a Restoration Setting

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Track

IV. Advancement in Conservation Research and Management

Abstract

The interactions between leaf litter and litter-dwelling arthropods are often overlooked in restoration strategies, despite their importance in facilitating key ecosystem processes and functions. It is also unclear how plant community composition affects our litter-dwelling faunal communities, and the factors governing these relationships. Trait-based ecology presents a good opportunity to study the interactions between leaf litter and litter-dwelling arthropods, and can be useful in uncovering the underlying principles behind their community assemblage patterns. We studied the relationship between the traits of leaf litter and litter-dwelling arthropods in a Hawaiian lowland wet forest (Hilo, Hawai‘i) by 1) identifying how arthropod community composition and functional traits differ between native and introduced plant species, 2) determining if there are correlations between the traits of leaf litter and litter-dwelling arthropods, and 3) comparing the litter-dwelling arthropod functional trait variation of different plant community assemblages used in restoration. We collected leaf litter samples from twenty plant species and four plant communities to quantify their arthropod community composition, and compared their functional trait relationships. Overall, plant species and their traits were found to influence arthropod community composition and species richness. Slow, conservative plants were found to be strongly associated with larger, more predatory arthropods; and moderate, acquisitive plants were strongly associated with smaller arthropods lower in trophic position. Establishing significant linkages between the traits of leaf litter and litter-dwelling arthropods can deepen our understanding of principles governing these relationships, and guide restoration managers in creating strategies that are inclusive to species interactions on a micro-scale.

Presentation Keywords

Arthropods, Leaf litter, Multi-trophic interactions, Functional ecology, Restoration

224

New tools, data sources, and approaches for managing climate impacts in Hawai‘i

Gina McGuire[1,2], Ryan Longman[3], Derek Ford[3], Cherryle Heu[2], Alix Toulier[1,2], Alyssa Anderson[4]

[1]USDA Forest Service ORISE, Hilo, Hawai‘i. [2]University of Hawai‘i at Mānoa, Honolulu, Hawai‘i. [3]East West Center, Honolulu, Hawai‘i. [4]Pacific Islands Climate Adaptation Science Center, Honolulu, Hawai‘i

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

This two hour forum hosted by the Hawai‘i Conservation Alliance's Climate Crisis Action Subcommittee seeks to provide participants with updates on state-of-the-science tools, data sources, and approaches for engaging climate change. This session will feature a series of six talks (seven minutes each) followed by three minutes of audience question and answer. This hour long series of talks will be followed by 45 minutes of break-out groups where participants will be asked to identify strengths, weaknesses, potential applications, and future needs for each of the tools, approaches, and perspectives. The forum will end with a 15 minute report out by each of the break out groups. Based on previous forum experiences, we anticipate 50-70 participants (5-7 breakout groups), each answering the same set of questions. As with previous efforts, breakout group input will be compiled, synthesized, and summarized for all participants. The talks represent a diversity of cross-disciplinary tools, data sources, and approaches, and input during question / answer periods and breakout rooms will be used to strengthen efforts to create adaptation or mitigation actions on the lands or in waters that the participant stewards. Engagement will seek: 1) reactions to and questions about the presented tools, data, and approaches; 2) ideas on how these tools, data and approaches could be used; 3) input on how the presented tools, data, and approaches fill perceived gaps with either respect to availability or quality. The session aligns with the Subcommittee’s recent emphasis on knowledge exchange.

Presentation Keywords

Climate management toolss, Data informed decision making, Holistic stewardship approaches

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Introduction - Christian Giardina (5 min)

Presentations by Panel (six panelists at 10 minutes each with questions)

Name: Gina McGuire

Title: An ʻŌiwi Model of Wai - a Moʻolelo Based Methodology for Supporting Watershed Decision Support in an era of Climate Change

Name: Ryan Longman

Title: Improving Access to Climate Data and Information for Conservation Professionals in Hawaii and the USAPI

Speaker: Derek Ford

Title: New Knowledge Tools for Delivering Site-specific Climate and Drought Information in Hawaii

Speaker: Cherryle Heu

Title: A Decision Support and Information Portal for Hawaiʻi Ranchers

Speaker: Alix Toulier

Title: Watershed hydrology for Decision support – A Comparison across Contrasting Geographies

Affiliation: USDA Forest Service ORISE

Speaker: Alyssa Anderson

Title: Insights from Hawaiian Language Newspapers on Drought and Fire

Affiliation: Pacific Islands Climate Adaptation Science Center, University of Hawaiʻi Mānoa

Breakout Groups (facilitated; 45 minutes)

Innovative Engagement: Following each presentation in the session, Q&A will provide opportunities for audience participation. We also will provide opportunities for during the

session to share comments and suggestions via email, including post-session follow up and collaborative production of session synthesis and executive summary. For the Breakout groups and Large group report out, speakers will serve as facilitators and designated note takers will assist with documenting input.

Our goals for this session include: 1) rolling out new climate related tools, data, and approaches; 2) receive feedback from participants on the utility of the tools, data, and approaches and possible applications; 3) build a network of potential users and possible collaborators; and 4) collaboratively identify ideas for future tool development.

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The onlyest Hawaiian biota: High throughout metabarcoding to infer arthropod biodiversity and resilience to perturbation across the Island chronosequence

Rosemary Gillespie[1], Natalie Graham[1], George Roderick[1], Henrik Krehenwinkel[2]

[1]University of California, Berkeley, CA. [2]University of Trier, Trier, Germany

Track

IV. Advancement in Conservation Research and Management

Abstract

Biodiversity is shaped by interactions between members of a community that change over space and time. These interactions dictate the properties of the biological community as a whole; yet we know very little about how this changing fabric of life can afford resilience to perturbation. We have developed an approach to understand how entire communities vary over extended evolutionary time using next generation sequencing based metabarcoding. Metabarcoding enables the study of biological communities at unprecedented taxonomic breadth and resolution. We present a metabarcoding analysis of arthropod community assembly in native rainforest ecosystems of the Hawaiian Archipelago ranging in age from 50 years to 4.15 million years of age. We have measured relative abundance and diversity of, and interactions between, all arthropods across the different snapshots in time, controlling for elevation, and precipitation, and all within Metrosideros forest. The results show regular patterns of change in diversity, specialization, and resilience to biological invasion, across the island chronosequence, showing a strong association of island age and invasion success. The current massive impacts affecting the "onlyest Hawaiian biota" (WC Gagné, in Howarth & BH Gagné, 2012) make development of metrics of change in biological communities ever more critical.

Presentation Keywords

Arthropods, Genetic, Biodiversity, Invasive species, Gagne

226

Partnering with the Local Fishing Community to Inform Conservation Efforts for the Endangered Population of False Killer Whales in Hawai‘i

Whitney Raffipiy

University of Hawai‘i at Hilo, Hilo, HI. Cascadia Research Collective, Olympia, WA

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Cetaceans are important culturally and for ecosystem stability, as noted in the Kumulipo, which speaks of the connections that unite all life. One species of interest to stakeholders is false killer whales (*Pseudorca crassidens*, FKW). Three distinct populations of FKW exist in Hawai‘i, of which the Main Hawaiian Islands insular (MHII) population is endangered. In collaboration with Cascadia Research Collective and the Division of Aquatic Resources Protected Species Program, I led outreach efforts to the local community, specifically lawai‘a (fishers), in hopes of better understanding the population status of and anthropogenic impacts to MHII FKW. There is evidence of scarring from depredation and entanglement events due to fishery interactions. Knowing community members have valuable insights to offer, I sought to connect our perspectives and knowledge through interviews, distribution of informational materials, and an online survey. Using modeling, I analyzed the results of the survey to better understand the experience and knowledge lawai‘a have with FKW. Approximately half (51.4%) of respondents were able to correctly identify FKW. Many expressed interest in learning more and were concerned about interactions with FKW. Numerous comments made by lawai‘a indicated that interactions with FKW may be more likely to occur near fish aggregating devices (FADs). These findings can inform future research and policy to better protect FKW, simultaneously helping lawai‘a avoid losing gear and catch to depredation events. Conservation of FKW will benefit from partnering with the local community to address these concerns.

Presentation Keywords

false killer whales, outreach, survey, fishery interactions

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Size Doesn’t Matter: Working with Landowners Large and Small to Save Hawai`i’s Rarest Plants

Hank Oppenheimer, Zach Pezzillo

Maui Nui Plant Extinction Prevention Program, Kahului, Hawaii

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

The Plant Extinction Prevention Program (PEPP) expanded from O‘ahu to Maui Nui in 2006 to assess targets, initiate protection, and secure conservation collections of rare plant taxa on Maui, Moloka‘i, Lāna‘i, and Kahoolawe. Rare species are distributed across public and private lands from the coast to the summit and it is critically important for PEPP to have access to all species, populations, and individuals on the PEPP list. When plant populations decline precipitously, genetic diversity is reduced, so representing every remaining individual plant is the primary objective. To represent every individual in each population in ex situ collections, permission from all landowners, large and small, is imperative. Natural Area Reserves, National Parks, and Private Nature Reserves provide the space and protections for many PEPP targets. However, remnant native forests and important habitats harboring endemic species also remain on private land throughout Maui Nui. From the entire island of Lāna‘i to small two-acre farm lots, PEPP staff works with any willing landowner. To obtain permission for surveys and collections, PEPP staff works closely with private landowners to avoid trespassing and develop collaborative relationships. Approaches to this collaboration vary widely depending on the history of land ownership and their awareness of the value of conservation. Maui Nui PEPP will highlight some successes coming from these agreements and address some of the challenges faced by landowners big and small.

Presentation Keywords

Maui, Extinction, Teamwork, PEPP, Conservation-reliant

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Assessing adaptive capacity through thermal resilience: are selectively bred juvenile *Montipora capitata* climate ready?

Joshua Hancock, Carlo Caruso, Crawford Drury

HIMB, Kāneʻohe, Hawaiʻi

Track

IV. Advancement in Conservation Research and Management

Abstract

Coral conservation and the long-term viability of contemporary reefs are inextricably linked to rapidly warming sea surface temperatures. In Hawaiʻi, end of century temperature models for Kāneʻohe Bay predict corals will spend more than two months above the present-day bleaching threshold each year. While recent studies have shown that thermal tolerance is heritable in Hawaiian corals, very little in know about how extant thermal tolerance will persist in the future. Furthermore, development of propagation techniques which proactively incorporate climate readiness strategies are few. Here we used a selective breeding approach in a dominant reef building species *Montipora capitata* to investigate how juveniles from known phenotypic crosses will fare under future climate scenarios. Using gametes collected from healthy parents previously identified as bleaching tolerant or sensitive, we created bulk crosses in varying proportion (e.g., 100% tolerant gametes, 90% tolerant gametes, etc.). Each cohort of juvenile corals were allowed to settle and grow for 6 months in an ex-situ rearing facility before undergoing simulated temperature profiles predicted for future decades (i.e., 2020, 2030, 2050, 2075, 2100). These 6-month profiles incorporated natural diel and seasonal variation allowing us to measure realistic outcomes in a fully crossed design. Our study documents adaptive capacity in existing corals and demonstrates how selective breeding can be leveraged for restoration.

Presentation Keywords

coral, selective breeding, thermal resilience , adaptive capacity, restoration

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The Journey to Sanctuary Designation for the Papahānaumokuākea Marine National Monument and UNESCO World Heritage Site

Kelli Ann Kobayashi[1], Ryan Okano[1], Kanoe Morishige[2], Alyssa Miller[2]

[1]DLNR-DAR, Honolulu, HI. [2]NOAA-ONMS, Papahānaumokuākea, Honolulu, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Papahānaumokuākea Marine National Monument (Monument) encompasses the Northwestern Hawaiian Islands from Nīhoa to Mokupāpapa (Kure atoll) and surrounding waters. The Monument falls within the realm of Pō, the place of akua, the gods and ancestral spirits. For those here in the Main Hawaiian Islands, within the realm of Ao, the Monument tells a story of where we came from and provides insight into what can be achieved through effective marine resource management. The continued commitment of Monument co-managers to preserve the natural and cultural resources of this sacred place is showcased by the ongoing effort to designate the waters of the Monument as a National Marine Sanctuary.

Sanctuary designation is a management tool that will provide an additional layer of protection within the Monument that is meant to complement the current management regime. Because national marine sanctuaries are established through federal legislation, rather than through presidential executive order as with national monuments, it is much more difficult to remove sanctuary designation. However, in contrast to instant monument designation via executive order, the sanctuary designation process is a long and thorough process that includes a joint National Environmental Policy Act and Hawai'i Environmental Policy Act Environmental Impact Statement (EIS), a management plan, and regulations. This poster will highlight the implications of sanctuary designation, review the steps of the sanctuary designation process, describe where we are in the designation process, and highlight upcoming opportunities for community participation and input.

Presentation Keywords

Papahānaumokuākea, PMNM, Sanctuary, Environmental Impact Statement, Aquatic Resources

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Discovery of an Endangered ʻAkēʻakē (Band-rumped Storm-Petrel) Population on the Island of Lānaʻi

Rachel Sprague[1], Matthew McKown[2], John Deslippe[1], Grazel Caceres[1], Jennifer Rothe[3], Jeff Schlueter[2], Zoe Gustafson[2], Kerry Dunleavy[2], André Raine[3]

[1]Pūlama Lānaʻi Conservation Department, Lānaʻi City, HI. [2]Conservation Metrics, Inc., Santa Cruz, CA. [3]Archipelago Research and Conservation, Hanapēpē, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Acoustic monitoring for seabirds on Lānaʻi, Hawaiʻi has focused on the endangered ʻuaʻu (Hawaiian petrel, *Pterodroma sandwichensis*), a nocturnal, montane-nesting seabird. These surveys have also provided valuable insight into the distribution of other endangered seabird species, specifically the endangered ʻakēʻakē (band-rumped storm-petrel, *Hydrobates castro*). From 2016-2022, we used automated acoustic recorders, analyzed by Conservation Metrics' deep neural network machine learning, to detect ʻakēʻakē calls and to measure call rates. Between 2016-2018, we detected only single ʻakēʻakē calls at four locations out of 137. However from 2019-2022, we recorded ʻakēʻakē calling at 18 of 28 new survey sites along the edges of steep canyons on the windward side of Lānaʻi. In Maunalei, Hauola, and smaller canyons south of Hauola, consistent calling patterns throughout the breeding season and detection of ground calls strongly suggest a breeding colony of ʻakēʻakē, the first of its kind on Lānaʻi. ʻAkēʻakē calling spanned 4-5 km of the windward slopes, between approximately 365-700 m elevation. It has not been possible to inspect potential nest sites due to the extremely steep terrain and hazardous conditions, but several relatively level locations on the rims of two canyons provide an excellent opportunity for management and protection actions. Work is currently underway for siting and construction of a predator-proof fenced enclosure for social attraction, and long-term acoustic monitoring of the population.

Presentation Keywords

endangered, seabird, breeding, distribution

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Factors influencing Pueo (*Asio flammeus sandwichensis*) occupancy and detectability

Kaleiheana-a-Pohaku Stormcrow[1], Kawika Winter[1], Noelani Puniwai[2], Melissa Price[1]

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Track

IV. Advancement in Conservation Research and Management

Abstract

Species interactions, season, moon phase, and vegetation structure can all influence animal occupancy patterns, particularly for predators. Pueo (Asio flammeus sandwichensis) as apex predators are indicators of ecosystem health who occupy every terrestrial habitat type across Hawai‘i. Survey protocols for Short-eared Owls utilize stationary viewpoints in open habitat, as they are considered grassland specialists in North America, and thus were not optimal for the diversity of vegetation types utilized by Pueo in the Hawaiian Islands. To determine associations with vegetation type and moon phase, and improve survey protocols, we conducted 175 audio broadcast surveys at 89 points along 22 survey routes randomly selected from eBird data between June 2021 and January 2023, utilizing audio playback for Pueo, ‘Io (Buteo solitarius), Barn Owl (Tyto alba), and noted the presence of native passerines at each site. We detected Pueo at 25 sites for a naïve occupancy estimate of 28%. Only four detections occurred before playing callback. We detected ‘Io at 12 sites for a naïve occupancy estimate of 13%. Only two Barn Owl were detected and were not included in analysis. Preliminary data suggest that seasonality has a strong influence on Pueo detectability, and that elevation is the strongest predictor of occupancy. Models suggest that Pueo are more likely to occupy a site if ‘Io are present, and less likely to occupy a site if native passerines are present, but these results were not statistically significant due to a relatively low number of detections for both raptors.

Presentation Keywords

Pueo , occupancy , detectability, survey, ecology

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Investigating the Effect of Coastal Seawater Inundation on Native Hawaiian Coastal Dune Plants

MAILE WONG[1], Dustin Wolkis[2], Seana Walsh[2], Shyla Kaninauali‘i Villanueva[2], Kasey Emoto[2], Anna McKormick[1], Kasey Barton[1]

[1]University of Hawai‘i at Mānoa, Honolulu, HI. [2]National Tropical Botanical Garden, Koloa, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Hawai‘i‘s coastal dune ecosystems are threatened by global sea-level rise. Coastal habitats are salinified through belowground intrusion into the freshwater lens, increased coastal flooding from high tides, and more frequent storms. Coastal flooding events are emerging as the most significant drivers of coastal salinity stress because they have the most significant fitness effects. As periodic flooding increases for coastal dune plants, characterizing tolerance to seawater inundation across species may aid in conservation, highlighting tolerant species useful for the restoration and vulnerable species needing intensive management to conserve. This research investigates the effects of seawater inundation on coastal dune plants both in field conditions and in a controlled greenhouse setting. In the greenhouse experiment, a suite of key native coastal dune species were inundated with seawater, and metrics of tolerance (survival and growth) as well as photosynthetic performance (chlorophyll content) were monitored. For the field experiment, a similar suite of species was used but only metrics of tolerance were recorded. Our preliminary results for these experiments indicate plants were strongly affected by sea water inundation, but this varied dramatically across species.

Presentation Keywords

native plants, coastal dune, inundation, sea-level rise, salinity

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Temporal and spatial variation in pua‘a (Feral pigs; *Sus scrofa*) activity across the Hawaiian Islands

Wade Naguwa, Derek Risch, Melissa Price

University of Hawaii at Manoa, Honolulu, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Human activity and environmental conditions are drivers of species behavior and activity patterns. Thus, understanding species behavioral dynamics may improve the efficiency of invasive species removal actions. In this study we identified trends across three islands in the behavior and activity of feral pigs in relation to both environmental and anthropogenic activity factors. We utilized a dataset from motion-activated game cameras at 144 unique survey locations on the islands of O‘ahu, Maui, and Kaua‘i. A total of 814 cameras were deployed from 2016 to 2021 resulting in a total trap effort of 3,426 trap nights. We found that foraging was the most frequently observed behavior (n = 2018 events) followed by general movement (n = 1497 events) and digging (n = 831 events). The group size of pigs varied between the spring and fall (spring adults n = 1.81± 0.01 pigs; spring juveniles n=3.21±0.17 piglets; fall adults n=1.08±0.01 pigs; fall juveniles n=1.92±0.08 piglets). Feral pigs had two daily peaks in activity between the hours 0200 to 0700 and 1400 to 2000. Vegetation density, human modification, and the presence of hunting pressure all had a significant influence on nocturnal activity levels with feral pigs becoming more active with increasing human modification and hunting pressure and less active with vegetation density. Our results are similar to previous studies that suggest pigs shift their activity toward nocturnal hours when human activity is present.

Presentation Keywords

Feral pigs, Behavior, Activity, Nocturnality

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Reviving the Hawaii Weed Management (and Restoration) Forums

Clay Trauernicht

University of Hawaii at Manoa, Honolulu, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The goal of this forum is to organize interest and participation in reviving statewide, county-level workshops targeting weed management and restoration among Hawai'i's conservation practitioners. At present, the O'ahu Weed Management and Restoration Workshop is the only such event still going in the state, bringing together conservation practitioners across programs for over 10 years to share practical, hands-on information and address new challenges. In the past, Dr. James Leary (now at University of Florida) initiated similar workshops in Maui and Hawai'i Island, targeting invasive weeds. With the revival of in-person events and the ongoing challenges of weed management and restoration challenges, the UH Ecosystems Work program (www.ecosystemswork.org) seeks to generate interest in and gather feedback on organizing statewide and county-level workshops. The forum's specific objectives are to: 1) provide an overview of prior workshops; 2) assess the need and interest in reviving county-level and statewide workshops; 3) develop a longer-term plan (e.g. 2-3 years) for in-person and/or virtual meetings (eg. topics, meeting frequency and formats, within-county and cross-county interactions); and 4) organize committees to plan future events.

Presentation Keywords

restoration, weeds, conservation

Agenda & Additional Required Information for Forums, Workshops, and Trainings

The target audience for this forum are watershed and conservation workers engaged in terrestrial ecosystem protection and restoration. The forum will begin with a 5-minute overview covering prior events and findings from participant surveys followed by a 15-minute panel discussion among organizers of previous workshops (Panelists: Tim Chambers, Julia Lee, Will Weaver). Each panel member will provide their perspective on two topics: 1) Lessons learned about what's worked and what hasn't worked in prior workshops; 2) the pros/cons of adapting the Oahu workshop to cover both weeds and restoration. After the panel discussion, the audience will be engaged using a combination of online surveys and break-out discussions. An initial 5-minute survey will be used to assess attendee's interest in participating in county-level workshops and/or statewide gatherings, preferences for combining weeds and restoration, and meeting frequency. After reviewing these results, attendees will break into groups (e.g., by

county and/or table) for 15 minutes to: 1) brainstorm and prioritize workshop topics and 2) identify preferences for information delivery (eg. short presentations, hands-on skill development, field trips/work exchanges). Each group will be given 2 minutes for a brief report out. Finally, a link will be provided for a sign-up up form to identify volunteers for county- and state-level committees to organize future events. After the forum, notes summarizing the discussions and potential next steps will be emailed to participants and posted on the Ecosystems Work website.

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60% of the time it works every time: Influence of gland-based lures on cat capture

Kimberly Shoback, Alex Dutcher, Kyle Pias

Hallux Ecosystem Restoration, Lihue, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Feral cats (*Felis catus*) threaten Hawaii's native wildlife. Removing cats from the landscape is paramount to the continued survival of the A'o (Newell's Shearwater, *Puffinus newelli*) and 'Ua'u (Hawaiian Petrel, *Pterodroma sandwichensis*), which are known to be depredated by feral cats. A variety of baits and lures are used to attract feral cats into live-capture cage traps. Trapping techniques are often customized for an individual cat that has been detected on a game camera. Trapping techniques can be customized based on the size, sex, and/or apparent preferences of an individual cat. Anecdotally, avoidant behavior was observed in females with kittens when lures were present on the landscape. Only when lures were removed from the landscape, the females were caught in non-lured live-capture cage traps. This study examines whether the sex of a feral cat determines if it is more likely to get caught on bait or lure in a live-capture cage trap. Whether the cat is fixed or intact, or pregnant or not was also examined. Proportionally, females in wilderness locations are caught more often on non-lured trap sets than females in urban areas. If the sex of a feral cat on the landscape is known, baits or lures can be used to target them. Additionally, if the proportion of the sex of the feral cat population in an area is known, baits and lures can be used strategically to target and catch them.

Presentation Keywords

feral cat, invasive species, predator control, trapping, lures

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Conservation Connections: Explore Your Possible Pathways - Nāhululeihiwakuipapa Networking Session

Tara Meggett[1], Clay Trauernicht[2], Joby Rohrer[2], Paahana Kincaid[3]

[1]Hawai‘i Conservation Alliance Foundation, Honolulu, Hawai‘i. [2]Army Natural Resource Prorgam, O‘ahu, Honolulu, Hawai‘i. [3]Kupu, Honolulu, Hawai‘i

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

Join the Hawai‘i Conservation Alliance’s Nāhululeihiwakuipapa Subcommittee during this networking session to meet with professionals from across the Hawaiian Islands! This includes fellow students and emerging professionals, as well as established professionals who we all look up to! This is an opportunity for you to make connections and cultivate relationships to enhance your career in conservation. Meet professionals who have similar interests and can share their advice to give you guidance on your career path. No one career path is the same, but that's why it's so important to talk story with folks from across the Hawaiian Islands to discover the right path for you.

This networking session has been hosted the past two years in a virtual format and has been very well attended! We aim to re-create the enthusiasm for the networking session with an in-person format this year by having multiple topic specific tables that session attendees can choose from. Topics have been provided by the subcommittee as well as from previous session evaluation feedback.

This is a networking session meant for students, emerging professionals, and established professionals to engage in knowledge sharing and connection building.

Presentation Keywords

networking, knowledge sharing, intergenerational, next gen

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda: (2 hours)

- 5 mins – Welcome & Introduction to the Nāhululeihiwakuipapa Subcommittee
- 5 mins – Networking Session Instructions
    - QR code for facilitator contact info & resources
    - You MUST switch every 25 mins

    - Room / Table Topic map on screen
    - If too crowded, please join another table
- 5 mins – Go to your 1st topic table
- 25 mins – 1st Topic Table Discussion
- 5 mins – Switch to 2nd topic table
- 25 mins – 2nd Topic Table Discussion
- 5 mins – Switch to 3rd topic table
- 25 mins – 3rd Topic Table Discussion
- 15 mins – Live Polling/Open Mic/Closing Remarks
    - Polling questions to be determined
    - Pre-select 1 or 2 topic tables to report out

Total Time: 115 minutes (5 min buffer)

Networking Table Topics

- Biocultural Stewardship
- Climate Adaptation & Solutions
- Best Practices for Conservation Outreach & Communication
- Conservation Research
- Environmental Education
- Cross-boundary conservation partnerships
- Ask Me Anything Career Related! Finding Your Pathway
- Applying for federal jobs (kinds of jobs available)
- Kūlana Noiʻi - Best Practices for Connecting Researchers with Communities
- Applying for State Jobs (kinds of jobs available)
- Writing for Grants & Funding Opportunities
- Polish Your Resume!
- Ways to Advocate for Conservation (Engaging with the Legislature)
- Women in Field Work
- Applying for Jobs with RCUH

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Lives Caring for Island Life: Legacies of Wayne & Betsy Harrison Gagne'

Steven Lee Montgomery

AML, Kailua, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Dr. Wayne Charles Gagne' (1942-1988) entomologist and conservationist during 20 years at Bishop Museum, was a gifted entomologist, educator and naturalist. A native of Quebec, he produced a monumental biosystematic study on leaf bugs (Nesiomiris), naming 50 species. In Papua New Guinea (1976-79) his agro-forestry project at Wau Ecology Institute tested alternatives to slash and burn agriculture so destructive of tropical forests, and serves as a model worldwide. With Foundation funding, he began anHawai'i Environmental Education program, the 'Ohi'a Project. He led the Hawaiian conservation movement with national scale essays like "Hawaii's Tragic Dismemberment" in Defenders of Wildlife, Bioscience and Natural History journals. His death from atherosclerosis at 45 robbed the world of a first class scientist and diligent advocate for nature. Botanist Betsy Harrison Gagne' (1947–2020) joined NSF student camps on Maui, where ability to pitch tents in rainstorms deep in cloud forests (relictual home of birds yet-unknown), impressed Wayne, and soon the pair cemented an engagement in the volcanic crucible of Kalaupapa, then embarked on explorations from PNG to Tahiti to Fatu Hiva. Betsy joined the fencing of Haleakala National Park, and urged controls against Miconia, knowing the devastation on French Polynesia after escaping a garden. She became Secretary for DLNR Natural Area Reserves System and a tireless communicator because of her passion for all of Hawaii's "critters"—from snails to plants to bugs, birds and oceanic life. Many celebrate their works and cherish memories of the Gagne's friendship and humor.

Presentation Keywords

conservation, entomology, history, botany, educator

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A decade of results and lessons learned from the Hawai‘i Permanent Plot Network and the Forest Global Earth Observatory

Christian Giardina[1], Rebecca Ostertag[2], Creighton Litton[3], Susan Cordell[1], Thomas Giambelluca[3], Lawren Sack[4], Faith Inman[2]

[1]USDA Forest Service, Hilo, Hawai‘i. [2]University of Hawai‘i at Hilo, Hilo, Hawai‘i. [3]University of Hawai‘i at Mānoa, Honolulu, Hawai‘i. [4]UCLA, Los Angeles, California

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Hawai‘i is home to a remarkable but threatened biocultural heritage, with many species found nowhere else in the world. Long-term data are a cornerstone for understanding variability and change in forest ecosystems, both locally and globally, and for informing sustainable management, but such information about the composition, structure, function and dynamics (CSFD) of Hawaii’s native ecosystems is lacking. Here we synthesize a decade of results from 36 studies for two 4-ha forest dynamics plots (FDPs) in Hawai‘i (montane wet FDP in Laupāhoehoe and a lowland dry FDP in Pālamanui); some papers allow for comparisons of these Hawaiian forests with 73 other global FDPs within the Smithsonian’s Forest Global Earth Observatory (ForestGEO), which spans the Americas, Africa, Asia, Europe, and Oceania. For each FDP, including those in Hawai‘i, researchers regularly monitor tree growth and survival of 7,000,000 trees representing 13,000 unique woody species. The Hawai‘i FDPs are paired with two smaller 1-ha plots in montane mesic forest (Pu‘uwa‘awa‘a) and lowland dry shrubland (Māmalahoa) to collectively form the Hawai‘i Permanent Plot Network (HIPPNET). Two examples of local to global scale drivers of forest CSFD include: strong global influence of climate on the structure of forests, with climate predicting structure of our Hawaiian forests; and strong latitudinal variation in negative density dependence of seedling survivorship, with increasing density dependent mortality with increasing temperature. In this talk will highlight these and other findings and their value for understanding how our native forests and forests globally vary in response to Global Change.

Presentation Keywords

ForestGEO, Diversity, Productivity, Recruitment

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Characterizing the Diet of the *ʻAmaʻama* (Mugil Cephalus) and the Kanda Mullet (Osteomugil engeli) at Loko Iʻa Heʻeia, Hawaiʻi.

Sheldon Rosa[1], Lani Musselman[1], Rosie Alegado[1], Shimi Rii[2], Hiʻilei Kawelo[3], Keliʻi Kotubetey[3]

[1]University of Hawaiʻi at Mānoa, Honolulu, HI. [2]Heʻeia NERRs, Heʻeia, HI. [3]Paepae o Heʻeia, Heʻeia, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

The traditional practice of rearing fish within Hawaiian aquaculture systems called loko iʻa (fishpond) has great potential to elucidate and alleviate many sustainability and food security issues in Hawaiʻi. The *ʻamaʻama* (*Mugil cephalus* – Hawaiian-striped mullet) is one of the primary species that is grown within many *loko iʻa* (fishponds) throughout the Hawaiian archipelago. After the mid-19th century, the introduction of the kanda mullet (*Osteomugil engeli*) has raised concerns about the potential threat imposed on *ʻamaʻama* populations, due to similar habitat preferences and resource competition. Understanding the dietary niche of the *ʻamaʻama* is critical to the development of sustainable fisheries management plans to inform *kiaʻi loko iʻa* (fishpond caretakers) about resource availability and trophic transfer of nutrients in *loko iʻa* at present and anticipated climate change conditions. In previous studies, specific diatoms have been identified as a source of nutrients for *ʻamaʻama* in Hawaiʻi island, Molokaʻi, and other parts of Oʻahu. In order to characterize the diet preference of native and non-native mullet species at Heʻeia fishpond, metabarcoding analyses will be conducted on water, sediment, and fish gut samples. This will provide an overview of the various microbial and metazoan species that can be traced in the guts of the mullet species, relative to the *in situ* sediment and water samples gathered throughout the fishpond. Amino Acid Compound Specific Isotopic Analyses of δ15N and δ13C will be used to infer the two mullet species' potential trophic position and trophic source.

Presentation Keywords

Heʻeia, ʻAmaʻama, Loko Iʻa, Metabarcoding, AA-CSIA

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Kāhuli Screening, If You Can't Take Care of the Small Stuff How Will You Take Care of the Big Stuff

David Sischo[1], Chris Johns[2], Kennth Hayes[3], Norine Yeung[3], Keahi Bustamente[4], Charlton Hee[1], Sidney Stiefel[1]

[1]Department of Land and Natural Resources, Honolulu, HI. [2]Florida Museum of Natural History, Gainesville, FL. [3]Bishop Museum, Honolulu, HI. [4]Department of Land and Natural Resources, Kahului, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Pacific Island Land snails have experienced the highest levels of documented extinction events in the world. Nowhere has more to lose than the Hawaiian Islands. Approximately 60% of the 759 known snail species are already extinct, and at least 100 additional species are teetering on the very brink. *Kāhuli*, a documentary film, produced in collaboration with Hawai'i's Snail Extinction Prevention Program, Bishop Museum, and with support by Pacific Islanders in Communication, takes an in-depth look, through both a scientific and cultural lens, of Hawai'i's snails and the people racing to save them. This film, which has already won accolades at film festivals will be shown for the first half of the forum. After the film, a panel discussion with Director Chris Johns, and featured Wildlife Biologists from the Bishop Museum's Malacology Department, and the Division of Forestry and Wildlife's Snail Extinction Prevention Program will be facilitated. Audience participation will be encouraged with a question-and-answer session, and time for the panelists to pose questions back to the audience.

Presentation Keywords

Wildlife, Invertebrate, Extinction, Snail

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Agenda:

Film Screening of the documentary *Kāhuli* – Approximately 30 mins

Facilitated Panel Discussion – Approximately 15 mins

Panelists: Chris Johns, Kenneth Hayes, Norine Yeung, Keahi Bustamente, Charlton Hee, Sidney Stiefel, David Sischo

Audience Q&A – Approximately 15 mins

Innovative audience engagement techniques:

Given that a good chunk of time will be taken up screening the documentary, we feel the best way to engage with the audience is through Q&A, with maybe some questions being poised back to the audience from the panelists. We realize this is not innovative, but given the time it fits best.

Explanation of goals and target audience:

Hawai'i's Governor Josh Green issued a proclamation declaring 2023 the year of the Kāhuli, which kicks off a yearlong education and outreach blitz. This forum and film screening is being proposed as part of this effort to shine a spotlight on a rapidly developing extinction crises, with little time left to intervene. Our target audience is conservationists from across the state and those interested in the intersection of ecology, conservation, and culture.

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Intraspecific Variation in Space Use of ‘Io – the Hawaiian Hawk

Amy Durham[1], Diego Johnson[2], James Sheppard[3], Bryce Masuda[4]

[1]University of Hawaii at Hilo, Hilo, Hawaii. [2]American Eagle Research Institute (AERIE), Maricopa, Arizona. [3]San Diego Zoo Wildlife Alliance, Escondido, CA. [4]Hawaii Endangered Bird Conservation Program, Volcano, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Despite the cultural and ecological importance of ‘Io (Hawaiian Hawk, *Buteo solitarius*), limited scientific information exists regarding their space-use behavior. ‘Io home range patterns are likely influenced by individual differences, season, and territoriality. Investigating how these variables shape ranging patterns is critical to understand how ‘Io use their environment, and for guiding conservation management for the species. To assess how age, sex, and season affect ‘Io spatial patterns, we have been collecting GPS location data from 46 birds since June 2022. We are determining both the annual/seasonal home range sizes, and the degree of home range overlap between conspecifics. Preliminary results suggest adult ‘Io to have high site attachment and restricted ranging patterns during the non-breeding season. Additionally, we are starting to see varying sizes of home ranges based on habitat features. This study is the largest ever conducted on an ‘Io population and has many future conservation implications. We plan to use these tracking data to help our conservation partners, such as by informing future Hawai‘i island reintroduction efforts for ‘Alalā (Hawaiian crow, *Corvus hawaiiensis*).

Presentation Keywords

home range, home range overlap, seasonality , space-use, spatial organization

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Evaluating Reproductive Success of Wedge-tailed Shearwaters at Kilauea Point National Wildlife Refuge Prior to Predator Exclusion Fence Construction

Lauren Pederson[1], Dylan Blanchard[1], Lindsay Young[1], Eric VanderWerf[1], Tristan Luxner[2], Brooke Burrows[2], Heather Tonneson[2]

[1]Pacific Rim Conservation, Honolulu, HI. [2]U.S. Fish & Wildlife Service, Kilauea, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Predator-exclusion fences, capable of excluding all mammalian predators, have been highly effective tools for protecting island bird species across Hawai‘i and New Zealand. In 2022 construction began on a predator-exclusion fence to replace an existing ungulate fence to protect more than 160 acres of native bird habitat at Kīlauea Point National Wildlife Refuge (KPNWR) on the island of Kaua‘i, Hawai‘i. The purpose of the fence is to protect the eight breeding species of seabirds and water birds that reside on the refuge against predation by non-native mammals (pigs, cats and rats). Upon completion this will be the longest predator-exclusion fence in Hawai‘i. Baseline biomonitoring was conducted from April-October 2022 to assess the nesting success of five native seabird species. Approximately 21,000Wedge-tailed shearwater (*Ardenna pacifica*) pairs nest on the refuge, making predation by feral cats and pigs particularly noticeable and thus an ideal indicator species for eradication outcomes. We monitored more than 500 active nests to determine Wedge-tailed shearwater reproductive success. This dataset provides a pre-eradication baseline of Wedge-tailed shearwater reproductive success in different habitat types across KPNWR, resulting in an overall nest success rate of 58.1%. Following the eradication of invasive mammalian predators inside the fence, the biomonitoring will be repeated to determine the fence’s effectiveness.

Presentation Keywords

Seabirds, Eradication, Kauai, Fence, Conservation

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Pulling back Hawaii's coral reefs from the precipice of extinction

Manuel Mejia, Jennifer Vander Veur, Taylor Cook, Makayla Richmond, Erica Perez, Brooke Hoffman

Coral Reef Alliance, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

In the face of climate change, a rapidly changing marine environment and multiple stressors, coral reefs worldwide are in sharp decline. Globally and locally, the stressors are myriad--ocean acidification, harmful algal blooms, rising ocean temperatures (prolonged warm blobs causing bleaching), sedimentation, raw sewage, illegal and overfishing. There are also many groups and agencies working towards mitigating these threats. In Hawaii, some reefs have declined in coral cover by as much as 50% in the last 50 years. We propose that the single and most effective thing we can do to give Hawaii's coral reefs a fighting chance is to mitigate for these threats. In particular, reducing threats from land-based pollution such as sedimentation and raw sewage. We will go over how our clean water for reefs interventions in Hawaii Island and West Maui help reduce threats and assist evolution of coral reefs so that they can survive and thrive in the face of climate change.

Presentation Keywords

Coral reefs, Clean water, Land-based pollution, Resilience, Assisted evolution

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Discovering the Importance of Windward Habitats for Spinner Dolphins Off Hawai'i Island

Petrisha Alvarez[1], Adam Pack[1], Patrick Hart[1], Marc Lammers[2]

[1]University of Hawaii at Hilo, Hilo, HI. [2]Hawaii Islands Humpback Whale National Marine Sanctuary, Kihei, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

In Hawaiian waters, spinner dolphins (*Stenella longirostris*) are known for their predictable diel behaviors of hunting offshore throughout the night, and then returning to calmer nearshore bays or coastlines to rest, socialize and recover during the day. The species' preference for resting habitat in close proximity to their foraging grounds along the steep island slopes can be found throughout the Hawaiian archipelago. Previous studies of spinner dolphins in the main Hawaiian Islands have focused on leeward coastlines. The current study used long-term passive acoustic monitoring (PAM) and boat-based visual and acoustic surveys, to investigate spinner presence along the windward coast of Hawai'i Island. Bottom-resting hydrophones were positioned along the Hilo coastline from July-December, 2020 in which bimonthly boat-based visual surveys were conducted over the recording locations. Single species spinner dolphin pods were encountered on 60% of boat surveys, with a mean group size of 73.2 + 33.9, including calves of the year, exhibiting resting and socialization behaviors that extended for hours. PAM recorder data revealed the presence of spinners across the study area for 83% of the diurnal recording period, with significantly greater acoustic presence during morning hours. Taken together, these findings indicate that the windward coast of Hawai'i Island is an important habitat for spinner dolphins. Thus, future abundance estimates of spinners should take into account both leeward and windward coastlines.

Presentation Keywords

Bioacoustics, Passive Acoustic Monitoring, Spinner dolphins, Windward, Diurnal

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Effectiveness and Efficiency of Landscape Level Management Tools for Axis Deer (*Axis axis*) on Lānaʻi, Hawai'i

Jonathan Sprague[1], Zane Dela Cruz[2]

[1]Pūlama Lānaʻi, Lānaʻi City, HI. [2]Pūlama Lānaʻi (former), Lānaʻi City, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Mismanagement of introduced ungulates (e.g. deer, goats, pigs) is one of the most significant threats to natural resources in Hawaiʻi, from individual species to entire terrestrial and near-shore aquatic ecosystems. Successful long term management of ungulates requires an integrated management strategy that includes a variety of tools at spatial units that range from sub-hectare to entire islands. Much of the focus of ungulate management in Hawaiʻi has been directed towards protecting sensitive natural resources through targeted, relatively small-scale exclusion fencing and eradication. However, managing ungulate numbers on a landscape or island-wide scale where true eradication is impossible or undesirable, is a less considered, but important component in an integrated management strategy. Tools for managing ungulates on these larger scales have included public hunting, incentivized hunting (e.g. “buy-a-buck” or free doe tags), and various methods of professional control. However, these methods have different costs and effectiveness, which can vary based on herd density, and geographical and political constraints. Employing the ‘right’ tool in the right place and time is not always a simple task. In this talk, we 1) review the last seven years of harvest data on the 22,200 hectare island of Lānaʻi including hunting, incentivized hunting, and professional control methods, 2) examine the relative cost and effectiveness of using these tools and lastly 3) propose how these tools can be used to manage axis deer on Lānaʻi in the long term.

Presentation Keywords

deer, ungulates, landscape, control, hunting

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Improving Water Quality and Coral Health Through Collaborative Watershed Management

Doug Harper[1], John Carl Watson[2], Tyrone Montayre[3], Pam Weiant[1], Greg Koonce[4]

[1]Malama Maunalua, Honolulu, HI. [2]Koolau Mountains Watershed Partnership, Honolulu, HI. [3]Protect and Preserve Hawaii, Honolulu, HI. [4]Inter-Fluve, Honolulu, HI

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

In East Honolulu, numerous private companies, non-profits, and the government are working together to improve the region's water quality, with the added benefit of improving local resilience, in a ridge-to-reef restoration structure. The multi-million dollar project is undertaking native plant reforestation, stream redesign, green infrastructure installation, and ungulate removal in an effort to reduce pollutants from reaching Maunalua Bay, where a coral restoration project is underway. By partnering together, the organizations are addressing every aspect of runoff in East Honolulu in a collaborative structure where resources are shared, and funding sought together. The symposium will detail the various aspects of the initiative, with an overview of how it is structured and operating collaboratively.

Presentation Keywords

Ahupua'a management, Watershed Management, Collaboration, Improving water quality, Ridge-to-reef

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Restorative Aquaculture of Native Hawaiian Species for Conservation, Restoration, and Economic Development

David Anderson[1], Timothy Leichliter[2]

[1]Kauai Sea Farm, Kalaheo, HI. [2]Hoomalu Ke Kai, Koloa, HI

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

Aquaculture contributes to a major portion of agricultural production in Hawai‘i, but largely focuses on non-native species. There are numerous native Hawaiian species that have high-value market presence and may additionally offer ecosystem services. Restorative aquaculture involves production of typically low-trophic species that have an overall net benefit on the environment where they are grown, whether for food production or conservation-focused projects. Kaua‘i Sea Farm is partnering with public sector institutions and non-profit groups to research and establish a hatchery supply for native Hawaiian species with restorative aquaculture potential. An ongoing federally funded research project is investigating propagation of native Hawaiian sea cucumbers for restorative production in fishponds throughout Hawai‘i. This project aims to establish a hatchery supply for juvenile sea cucumbers and create a training program for Hawaiian fishpond practitioners who may be interested in sea cucumber aquaculture for restoration or commercial production. A partnership between Kaua‘i Sea Farm and non-profit Ho‘omalu Ke Kai has demonstrated production of native sea urchins, and seeks to extend the benefits of the Kaua‘i Sea Farm hatchery to accommodate more conservation-based projects. Utilizing a cost-sharing model between an existing hatchery and non-profit entity allows for significantly reduced costs to undertake such projects. This approach will be especially effective for place-based solutions in small island communities such as Kaua‘i, where resources may be limited to undertake restorative aquaculture projects which otherwise require massive investment for infrastructure and facilities.

Presentation Keywords

Aquaculture, Restorative, Interdisciplinary, Collaboration, Fishpond

250

Hoʻomalu Wahi: Developing Indicators of Urban Kumu Lāʻau Biocultural Services and Relationships

Dustin Palos

University of Hawaiʻi Maui College, Kahului, Hawaiʻi. University of Hawaiʻi Mānoa, Honolulu, Hawaiʻi

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Kauluwehi was developed by the University of Hawaiʻi Maui College (UHMC) Sustainable Living Institute of Maui (SLIM) as a biocultural restoration project. Kauluwehi is home to diverse native and introduced plants that promote cultural specimens and food crops that feed the community. A priority of Kauluwehi is to ensure that living laboratories become a resource to produce biocultural, regenerative, and added value to different species of flora that support kānaka maoli. Kīpuka divides the garden into different zones: dry land forest, cultural sections for hula, lei, lāʻau lapaʻau, māʻawe in the southern entrance, a central area for traditional farming mala kalo (*Colocasia esculenta*), ʻuala (*Ipomoea batatas*), maiʻa (*Musa spp.*), and ʻōlena (*Curcuma longa*); the northern section features a variety of tropical fruit trees. Over the four years, over 6,000 pounds of kalo, maiʻa, ʻulu, exotic fruits, and cassava (Manihot esculenta) have been provided to native Hawaiian community entities, which have easily distributed these quantities. There is, therefore, potential for considerable expansion with proper support. Being able to provide healthier food sources is essential for a healthy lāhui. The next step is to build a ranking system to value kumu lāʻau appropriately by conducting interviews with practitioners, kūpuna, and kumu. Participants at Kauluwehi practice kilo (environmental observations) and draw on ʻike kūpuna (ancestral knowledge) as indigenous and intergenerational science finds new relevance to current projects and lifeways across our pae ʻāina (archipelago).

Presentation Keywords

biocultural, regenerative , ʻike Hawaiʻi, ethnobotany, sustainability

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Sustaining Viable Populations of Endangered Hawaiian Waterbirds: Overcoming Threats from Invasive Species

Kelly Goodale[1], Rachel Rounds[2], Ty Spangler[3]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Invasive species are a constant threat to Hawai‘i’s endangered waterbirds: ae‘o (Hawaiian stilt, *Himantopus mexicanus knudseni*), ‘alae ke‘oke‘o (Hawaiian coot, *Fulica alai*), ‘alae ‘ula (Hawaiian gallinule, *Gallinula galeata sandvicensis*), and koloa maoli (Hawaiian duck, *Anas wyvilliana*). To adequately protect these species, predator control is the first line of defense; however, it requires a substantial amount of staff time and resources. Implementation of predator proof fences relieves the burden of constant predator control and allows managers to focus staff and resources on other threats to endangered waterbirds. The first predator proof fence to protect wetlands was constructed in 2018 at the Honouliuli Unit of Pearl Harbor National Wildlife Refuge (NWR), protecting 37 acres. In 2024 – 2025 a 372-acre predator proof fence will be constructed at James Campbell NWR to protect 126 acres of core wetland habitat in addition to seabird nesting habitat. Predator proof fences may be one of the best tools we have to aid in the recovery of endangered waterbirds, but there are numerous challenges after the fence is constructed. This presentation will examine the reproductive success of the endangered waterbirds pre and post fence construction. These data have proven to be extremely important and provides an interesting glimpse of the challenges that these endangered waterbirds still face at our managed refuge units.

Presentation Keywords

waterbirds , invasive species , wetlands, management

252

Temporal ecology can inform adaptive management of biocultural restoration efforts: He‘eia as an example

Matthew Kaho‘ohanohano[1,2], Kawika Winter[1,3], Kanekoa Kukea-Schultz[4], Leah Bremer[5,6], Natalie Kurashima[7,1], Noelani Puniwai[8], Tamara Ticktin[1]

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Biocultural restoration is a growing approach to restore social-ecological systems and cultural integrity in Hawai‘i. Essential to any restoration project is an understanding of historical reference conditions, assessment of current conditions, and a clear vision for the future. In this study we use an interdisciplinary approach to biocultural restoration planning to aid efforts being undertaken by community-based and ‘Ōiwi-led non-profit organizations in He‘eia, O‘ahu. We draw on methods from the emerging fields of temporal ecology, botany, and participatory social science to characterize the past, present, and future landscapes and conservation potential of the wetlands and coastal mesic forests of He‘eia. We reconstructed one potential reference landscape by mapping the spatial distribution of of inoa ‘āina (place names), kahuahale (house lots), lo‘i (wetland agroecology), and other agroecosystems and habitat types as well as some of their associated species found in Māhele record data. To understand the current landscape, we conducted vegetation surveys in lowland forest and found that current plant populations are dominated by at least 46 invasive species while only 6 native species were detected. We conducted participatory visioning exercises with He‘eia stewards to develop future landscape scenarios, which indicate a vision of a functional landscape with a mosaic of habitats ranging from aquatic to upland forest which prioritize food production, support habitat for native species, increase sediment retention, and facilitate education and cultural practices. This temporal focused approach to understanding He'eia's biocultural landscape is key to guiding on-the-ground adaptive management and restoration of lowland areas in Hawai‘i.

Presentation Keywords

biocultural restoration, indigenous resource management, temporal ecology, social-ecological systems

253

Investigating Nest Site Selection, Success, and Failure in an Embattled Population of Hawaiian Coots (*Fulica alai*) ('alae ke'oke'o)

Adrian Dougherty

KUPU/U.S. Fish and Wildlife Service, Kihei, Hawai'i

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Reproductive success of the endangered Hawaiian coot at Keālia Pond National Wildlife Refuge (KPNWR), which holds the most significant breeding population in Maui Nui, has plummeted in recent years. Since 2020, it has only fledged two chicks and produced sixteen nests, whereas in the early 2000s over 100 nests were often produced each year. Maui has been experiencing historic drought and changing rainfall patterns over the past few years, which has heavily impacted KPNWR's hydrology. Recently, water levels have either been insufficient for nest initiation or haven't stayed high enough for successful nest completion. Factors such as habitat degradation, water quality, disease, and vegetation composition could play greater roles in their reproductive success than is known. KPNWR staff want to better understand the most important factors to focus on as they initiate habitat improvement efforts. This project will research which environmental variables are most influential in determining nest site selection, success, and failure of the Hawaiian coot at KPNWR, and determine whether they are responding to current management efforts. I will use results expected in May 2023 to compare the difference in nesting success between "high" and "low" quality nesting sites. This data will be analyzed using general linearized models and model selection based on criteria in Burnham and Anderson (2002). By better determining the impact of these factors, the results will guide adaptive management plans to support the success of the entire Hawaiian coot population as it faces an uncertain future due to changing weather patterns.

Presentation Keywords

Hawaiian coot, reproductive success, waterbirds, wetland management

254

Reducing Cetacean (Whale and Dolphin) Injury and Death by Vessel Strike

Ilse Silva-Krott, Kristi West

Hawaii Institute of Marine Biology, Kaneohe, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Twenty whale and dolphin species are permanent residents of Hawaiian waters including the endangered false killer whale *Pseudorca crassidens,* deep diving beaked whales and elusive pygmy and dwarf sperm whales *Kogia sp*. Humpback whales *Megaptera novaeangliae* migrate to Hawai‘i for calving and newborn calves may be especially vulnerable to vessel strikes. Whale and dolphin tours and other recreational and commercial boating activities, including cargo and naval vessels, contribute to heavy boat traffic around the main Hawaiian Islands. Collisions between boats and cetaceans result in physical injury to the animals, typically blunt force trauma of the skull and vertebral column, with extensive bruising and internal hemorrhage, and may lead to death. The University of Hawai‘i Health and Stranding Lab identified blunt trauma injury in 16 out of 126 stranded cetaceans since 2006 (12.5%) where partial or full necropsies were performed. Examples of vessel strikes on Oahu include the 2022 deaths of a humpback whale calf stranded in Wailupe and an adult, female pygmy sperm whale stranded in Kaneohe Bay. Management actions based on science to reduce the collision risk to whales and dolphins are needed. Use of tracking devices to identify marine megafauna in shipping lanes and reduced speed would limit vessel strikes by large cargo and supply ships. Avoidance maneuvers can be effectively used by fishing boats when pods of dolphins or smaller whales are sighted. Conservationists need to develop strategies to protect vulnerable marine mammals from boat collisions, including working with legislators to implement effective education and management efforts.

Presentation Keywords

Cetacean, Boat collision, Conservation, Injury, Mortality

255

Will more seabirds change water quality on a remote atoll? Mapping groundwater and nutrient fluxes at Palmyra Atoll

Kim Falinski[1], Henrieta Dulai[2], Megan Donahue[2], Katie Franklin[1], Tristan Mckenzie[3], Alex Wegmann[4]

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Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Seabirds play an important connectivity role for terrestrial and marine island ecosystems through allochthonous nutrient transfer. Rainforest restoration activities to increase seabird nesting and roosting habitat by restoring native rainforest tress may change the overall fluxes of nutrients from land to sea. Here we quantified freshwater inputs and nutrient loading across a gradient of restoration of native forest at Palmyra Atoll, including both lagoon facing and ocean facing shorelines. Using a variety of geochemical and manmade tracers including Rn, Ra, and glyphosate, along with nutrients and nutrient isotopes, we identified the location and approximate residence time of submarine groundwater discharge (SGD) and the nutrient flux to assess the current conditions for hydrologic connectivity across a range of environments on Palmyra.

Results confirm the spatially heterogenous presence of SGD in the lagoon and nearshore at low tides. Nutrient concentrations ranged from 0.33 to 30.6 uM in the lagoon and 0.05 to 22.6 uM on the reef facing shore, with isotopes indicating very high contributions of wastewater. The entirely man-made island that is nearly entirely restored with native vegetation had negligible indicators of groundwater and very low nutrient concentrations, while the native forested island showed the most consistent coastal groundwater signal.

This study provided a baseline for both locations and fluxes of freshwater and nutrients into a remote atoll. Considering the disproportionate impacts of climate change to coral reef dependent atolls like Palmyra, better understanding how bird-island-marine connections change with terrestrial management actions can inform management for island ecosystems around the world.

Presentation Keywords

seabirds, groundwater, nutrients, coral ecosystem, atoll

256

Uncovering Hawaiian Lava Tube Biodiversity: Genetic and Morphological Diversity of cave-adapted Millipedes

Stefan Cranston, Megan Porter, Mireille Steck, Rebecca Chong

University of Hawaii, Honolulu, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Hawai‘i is home to two native millipede families (Polyxenidae and Cambalidae), both poorly studied groups, and many other exogenous species of detritivorous insects whose distribution and diversity is largely uncharacterized across Hawaii, and especially within subterranean lava tube habitats. To better characterize millipede diversity in lava tube systems across Hawai‘i Island, we investigated genetic diversity using mitochondrial barcoding to identify species and estimate phylogenetic relationships. Our results indicate that there are at least four distinct groups based on CO1 sequence divergence. We also examined preserved specimens to identify distinguishing morphological characters in cave dwelling millipedes. In documenting their biology and characterizing the life history relationships between these lineages, we have identified a previously undescribed millipede diversity in Hawaii's subterranean habitats, which highlights the importance of protecting these unique habitats.

Presentation Keywords

Millipedes, Biodiversity , Cave-adapted, Phylogenetic, Morphology

257

Stream Restoration and Watershed Best Management Practices in the Ahupuaʻa of Waipā

Matt Rosener, Kaipo Like

Waipā Foundation, Hanalei, HI

Track

I. Managing Conservation Reliant Species and Habitats into the Future

Abstract

Waipā is an intact ahupuaʻa owned by Kamehameha Schools and managed by the Waipā Foundation whose mission is to restore Waipā's vibrant natural systems and resources and inspire healthy, thriving communities connected to their resources. The Waipā Watershed Project is one example of the ways the Waipā Foundation is working towards these goals. This project was designed to restore watershed function and health with a focus on improving water quality and aquatic habitat in Waipā Stream which is the lifeblood of Waipā. The project approach combines the use of traditional ahupuaʻa management practices with science-based knowledge. Funded by the Hawaiʻi Department of Health - Clean Water Branch - Polluted Runoff Control section, the project has used a community-based conservation approach to restoring degraded areas of the Waipā Stream corridor and implementing a comprehensive suite of Best Management Practices (BMPs) throughout the watershed that includes upland erosion control, livestock exclusion, feral ungulate removal, constructed wetlands, taro loʻi BMPs, and cesspool replacements, in addition to the stream and riparian restoration component. Although much of the project has been carried out by Waipā Foundation staff and interns, thousands of community volunteers have been instrumental in achieving the project's objectives over the years. Various monitoring programs for the project have helped to document significant improvements in stream water quality (e.g. dissolved oxygen, fecal indicator bacteria, etc.), in-stream habitat, and populations of native stream life. Many lessons have been learned so far, and this project serves as an important example of community-based stream restoration in Hawaiʻi.

Presentation Keywords

stream, watershed, restoration, community-based, BMP

258

RhinoCam Deployment- a distributed trap-surveillance system for Coconut Rhinoceros Beetle pest management

Mohsen Paryavi[1], Keith Weiser[2], Michael Melzer[1], Reza Ghorbani[1], Daniel Jenkins[1]

[1]University of Hawaii at Manoa, Honolulu, Hawaii. [2]The Research Corporation of the University of Hawai'i, Honolulu, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

The introduction of the Coconut Rhinoceros Beetle (CRB), Oryctes rhinoceros, on the island of Oahu was discovered in late 2013. Adults of this invasive beetle preferably feed on the coconut palm (Cocos nucifera), posing a threat to iconic palm trees on the island and potential spread to other Hawaiian Islands or commercial palm plantations in California. Over three thousand CRB traps are installed throughout Oahu, with each visually inspected by human operators at regular intervals to identify trap catches in an effort to understand the population distribution and direct control efforts. We have developed an automatic trap surveillance system to make the process more efficient. We recently deployed a dozen of our autonomously powered custom electronic surveillance trap camera boards, RhinoCams, mounted in panel traps. RhinoCams communicate trap data to our customized cloud server through a cellular network. The system enables high-frequency and potentially live monitoring of remote traps, reducing personnel and transportation costs associated with manual checking, improves the temporal resolution for population mapping, and provides data on diurnal behavior that may be used to improve control operations. Here we report our trap data from which diurnal foraging habits of adult CRB may be inferred, and our progress with the automatic classification of the trap images on our cloud server using our machine vision models.

Presentation Keywords

Camera-based insect monitoring, Low-cost surveillance, Internet of Things, Invasive Pest control, Remote insect pest monitoring

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The Role of Natural Lands in Hawai'i's Statewide Climate Change Mitigation Action Strategy

Leah Laramee

Hawai'i Climate Change Mitigation and Adaptation Commission, Honolulu, Hawaii

Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

The State of Hawai'i has long been a leader in climate change action, yet no comprehensive statewide plan is currently in existence. The Hawai'i Climate Change Mitigation and Adaptation Commission (CCMAC) has been designated to coordinate an application and prepare a detailed work plan for the state to accept Climate Pollution Reduction Planning Grant (CPRPG) funding to create a statewide Climate Change Mitigation Action Strategy. Natural Lands such as our native forests and wetlands are the State's only carbon sink yet are often left out of the discussion when tackling largescale mitigation strategies. Furthermore, competitive funding of $4.6 billion will be available through the Climate Pollution Reduction Implementation Grant, and only projects outlined in the plan will be eligible for implementation funding. Therefore, it is essential that the statewide climate plan be as encompassing as possible. This hour-long workshop will engage conference participants in facilitated discussion to inform the State Priority Climate Action Pland on current projects and solutions that have resulted in measurable change, strategies to implement these solutions on a statewide level and barriers to implementation. By participating, conference attendees will be a part of the planning process to preserve Hawai'i's biodiversity, and advocate for solutions in a setting that will result in the incorporation of cutting-edge plans into Hawai'i's future climate mitigation and resiliency efforts.

Presentation Keywords

Climate Change, Climate Action, Planning, Mitigation, Future

Agenda & Additional Required Information for Forums, Workshops, and Trainings

-Workshop facilitator: Leah Laramee. Agenda: as described in abstract.

-The workshop will be in the format of facilitate discussion to provide information for the State Priority Climate Action Plan

- Agenda: 10 Minutes welcome and introduction to the CPRG

40 minutes break out discussion

10 Minutes next steps - Technical working Groups

-Goals: to facilitate collaboration and discussion regarding the role of natural lands in climate change mitigation. Target audience: professionals in the conservation field.

260

Mālama ʻĀina through Micro:bits in Kāneʻohe

Derek Esibill[1], Amanda Nelson[2]

[1]Pacific American Foundation, Kailua, HI. [2]Pūʻōhala School, Kāneʻohe, HI

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

This experience report describes two years of work integrating coding with Micro:bits and Makecode into a Hawaiian immersion bilingual school setting to teach computer science (CS) skills in a place-based approach. This report highlights the collaborative partnerships between a public Hawaiian immersion school, a non-profit organization that manages important cultural sites, and a university lab that develops sustainable technology. Students can identify the importance of sustainability in computing by engaging with past, present, and future technologies in culturally relevant contexts. Further, we describe ongoing work to improve the way we support students in a Hawaiian immersion bilingual school setting.

Presentation Keywords

Computer Science, Traditional Ecological Wisdom and Knowledge, Place Based Education, Hawaiian Fishpond, Sensory

261

Investigating links between plant characteristics and transfer learning success with invasive species object detection in aerial imagery

Erica Ta

University of Hawai‘i at Hilo, Hilo, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Invasive species detection has improved with remote sensing techniques and deep learning applications like object detection. However, large datasets typically used in deep learning may not be practical for incipient invasive species. Transfer learning is a machine learning approach to overcome data limitations, information from learning one task is applied to learn a related task. Object detection performance was compared with and without cross-species transfer learning for three invasive species in Hawai‘i: Miconia (*Miconia calvascens*), Guinea grass (*Megathrysus maximus*), and the introduced fungal pathogens responsible for Rapid ‘Ōhi‘a death (ROD) categorized into four symptomatic visible classes of red, brown, fine white, and skeleton. Plant features of contrast, shape, size, and texture were measured to understand how plant morphologies provide easier or more challenging scenarios for plant object detection using aerial visible imagery. 9 of the 30 transfer learning instances had significantly higher mean average precision (mAP) scores than instances without transfer learning ($p < 0.00167$, $\alpha = 0.00167$ (0.05/30). Transfer learning was most effective between red, brown, fine white, and skeleton ROD classes and least effective among miconia and guinea grass. The contrast feature measurement was significantly correlated with source model mAP ($R = 0.82$, $p = 0.045$) whereas texture was strongly correlated ($R = 0.77$, $p = 0.073$), size ($R = 0.54$, $p = 0.27$) was moderately correlated, and circularity ($R = -0.096$, $p = 0.86$) was weakly correlated. Results may inform how existing data can be best leveraged through transfer learning to detect plant targets with limited datasets.

Presentation Keywords

invasive species, deep learning, transfer learning, automated detection, management

263

The impact of construction material on coral health and growth: lessons for hybrid reef restoration.

Christopher Suchocki[1], Rob Toonen[1], Claire Lewis[1], Claire Bardin[1], Ji Hoon Han[1], Kuulei Rodgers[1], Joshua Madin[1], Tamaki Bieri[2], Micheal Foley[3]

[1]University of Hawaii at Manoa, Honolulu, Hawaii. [2]The Nature Conservancy, Arlington County, Virginia. [3]Oceanit Laboratories, Honolulu, Hawaii

Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Coral reefs are under threat from a myriad of anthropogenic stressors, most notably warming ocean temperatures. Globally reefs are declining in coral cover with a resulting loss of vital ecosystem services. To accelerate the recovery of these ecosystems, active restoration of coral reefs is being undertaken by many coastal communities, including in Hawai‘i. The critical importance of coral reefs for wave dissipation and coastal protection has many looking to nature-based solutions that pair rapidly-deployed, engineered structures with longer-term restoration activities. Crucial to such efforts is an understanding of the interplay between various substrates used in such engineered structures and coral health and growth. Here, we report on an experimental test of 15 potential materials used for the construction of coastal defense structures and their impact on the growth and condition of two primary reef-building coral species. Using a subset of materials, we then surveyed a broad range of Hawaiian reef building coral species with different life histories and functional roles. Additional work remains to examine the overall biodiversity of non-coral colonists to these substrates, but we found minimal effect of construction material on coral health and growth. Instead of substrate, we find the majority of variation in performance is explained by individual coral colonies in terms of their health and growth on all artificial substrates. This work highlights the importance of maximizing genetic diversity for coral restoration efforts.

Presentation Keywords

marine, coral reefs, hybrid reefs, engineering, restoration

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Strengthening Capacity in Community Based Resource Management: Maui Holomua 30x30 grantee cohort facilitated by the Hawaii Community Foundation (HCF)

Niegel Rozet

Kuaaina Ulu Auamo, Kaneohe, Hawaii

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

In January of 2023 the Hawaii Community Foundation (HCF) started funding a network of Maui organizations to build capacity and develop relationships to understand and help guide the Marine 30x30 Holomua initiative. The Maui focused, Community based organizations included in this cohort are; Kaehu, Kipuka Olowalu, Maui Hui Malama, Na Mamo o Muolea, Ke Ao Halii and Kipahulu Ohana. Each of these organizations work to care for and build Maui's nearshore ecosystems and communities. For the duration of this two year grant, Kuaaina Ulu Auamo (KUA) has served as network coordinator to continue and help spark internal network connections and external support systems. In this forum we will hear from cohort members about their efforts and learn how their connections might foster stronger community-based partnerships, prototype and refine lessons/ methodologies, and move Maui towards effective Natural resource management in Hawaii. Grantees with share their triumphs and challenges to achieving their restoration goals. We hope that attendees will leave with an appreciation and awareness of how much goes into community based resource management on Maui and identify ways that they might build capacity.

Presentation Keywords

Maui, Community, Holomua, Capacitybuilding, Cohort

Agenda & Additional Required Information for Forums, Workshops, and Trainings

(10min) Hoʻolauna (Panel Introductions)

(90 min)Community Panelist Presentations/ Videos (about 15 min each)

-Kaehu

-Ke Ao Halii

-Maui Hui Malama

-Kipuka Olowalu

-Kipahulu Ohana

-Na Mamo o Muolea

(20min) Questions/ Close

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Control of the introduced Barn Owl to protect colonies of Newell's Shearwater and Hawaiian Petrel in Limahuli valley

Zachary DeWalt, Marcus Collado

National Tropical Botanical Garden, Kalaheo, HI

Track

IV. Advancement in Conservation Research and Management

Abstract

Upper Limahuli Preserve (ULP) on the north shore of Kauaʻi is home to some of the largest known breeding populations of two species of threatened seabird, the aʻo (Newell's shearwater, Puffinus newelli) and ʻuaʻu (Hawaiian petrel, Pterodroma sandwichensis), who utilize the steep cliffs to build burrows. Both species are vulnerable to Owl predations from March to December when they return from the sea to conduct nesting and chick rearing activities. Young seabirds are also predated when they leave the burrow to exercise and fledge. While terrestrial predators are maintained at low rates by ongoing trapping programs, this avian predator poses a new challenge.

To address this threat, a new barn owl control program was established. After three years of testing techniques, the program has finely tuned its protocols to the prevailing conditions within the ULP. The current preferred approach involves nocturnal hunting using decoys, vocalizations, night vision, and laser sights. With these techniques, barn owl captures within the 400-acre valley have increased from 0 per year in 2011-2018 to 11 in the year 2022.

This presentation will highlight successful techniques utilized by the ULP team, terrain-specific adjustments, as well as techniques that were found to be ineffective. We will also discuss owl behavioral observations, specific management challenges, and opportunities for research into owl management.

As more predator exclusion fences are built and terrestrial predator management methods advance, barn owl control efforts and management-focused research must also increase – as avian predators are not contained by fences or terrestrial-only management.

Presentation Keywords

predator control, seabirds, barn owl, management

266

How do we better Retain and Grow Local Professionals?

Joby Rohrer[1], Clay Trauernicht[2], Tara Meggett[3], Sharon Ziegler-Chong[4], Noelani Puniwai[2], Marigold Zoll[5], Lorena "Tap" Wada[6], Elia Herman[7]

[1]Army Natural Resources Program on Oahu, Schofield Barracks, Hawai‘i. [2]University of Hawai‘i at Manoa, Honolulu, Hawai‘i. [3]Hawai‘i Conservation Alliance Foundation, Honolulu, Hawai‘i. [4]University of Hawai‘i at Hilo, Hilo, Hawai‘i. [5]State of Hawai‘i DLNR Division of Forestry and Wildlife, Honolulu, Hawai‘i. [6]U.S. Fish and Wildlife Service, Honolulu, Hawai‘i. [7]Kupu, Honolulu, Hawai‘i

Track

V. Growing the Workforce of the Future through Education and Capacity Building

Abstract

The Hawai‘i Conservation Alliance’s (the Alliance) mission is to ‘strive to provide unified leadership, and collaborative action to conserve and restore native ecosystems’. In working toward this mission, we realize there are significant challenges recruiting, retaining and growing local employees without losing staff due to higher paying jobs. In order to not only make the conservation industry better for those currently in it, but also for those to come, the Alliance’s Nāhululeihiwakuipapa (Next Gen) Subcommittee committee has been actively exploring workforce development and retention topics.

The goal of this interactive forum is to gather direct input from working professionals in all career stages in order to inform future work, advocacy and initiatives by the Alliance. We plan to present results from a recent survey conducted among the Alliance Steering Committee, as well as a survey available to conservation professionals before and during the Hawai‘i Conservation Conference, conducted by the Alliance via social media. We will use these as prompts to facilitate discussion among an invited panel and the audience on how we can revalue conservation jobs to recruit and retain a local workforce and further the careers of working conservation professionals.

Hawai‘i Conservation Workforce Pulse Check Survey - https://forms.gle/Tf1DqTrck64vNRyo6

Presentation Keywords

Education, Compensation, Retention, Recruiting , Training

Agenda & Additional Required Information for Forums, Workshops, and Trainings

20 min - Introduction

- Overview + Survey Results; Introduce Speakers
- Kupu's Natural Resource Sector Partnership
- UHERO report summary – Characterizing Hawaii's Natural Resource Sector

35 min - Panel Discussion

- "What are the barriers and solutions to increasing retention in the Natural Resources field?"
- **Panel Members:** Sharon Ziegler-Chong (UH Hilo), Noelani Puniwai (UH Mānoa), Marigold Zoll (DOFAW), Lorena "Tap" Wada (USFWS), Elia Herman (Kupu)

25 min – Small Group Discussions on Solution-oriented Themes

- Task 1 (10 min): Identify barriers for the assigned theme
    - Encourage groups to think about barriers both from the perspective of new/emerging and mid-career professionals
- Task 2 (10 min): For each barrier, identify at least one solution
- Task 3 (5 min): Enter 2 solutions into Mentimeter survey for report out

- Theme 1 - Developing "industry" standards in pay scales and job skills
    - Forming a Conservation guild
    - Comparative economic study of conservation jobs and advocating for increasing salaries
- Theme 2 - Provide value-added incentives
    - Networking, training, professional development
- Theme 3 - Address and reduce bureaucratic and administrative barriers
- Theme 4 - Improve public perception and education about the value of the conservation field

15 min - Report Out

- Moderator will call on 2 pre-identified Facilitators to give report out from their breakout group

15 min - Wrap up and Mahalo

- Ask 2-3 panelists to comments on Mentimeter results or conversations they heard
- (if time) Take 1 or 2 questions from the audience
- Mention next steps to move this effort forward - A summary of the discussion points and survey will be reported to the Alliance Steering Committee for comment/response and posted to Alliance's website to share results with a broader audience.

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Hāʻena ʻĀina Momona: Building a Thriving and Abundant Education for Youth & Community in Hāʻena, Kauaʻi

Emily Cadiz

Limahuli Garden & Preserve, Haena, HI. Hui Makaainana o Makana, Haena, HI

Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

In this section of the symposium, we will discuss how our approach to biocultural conservation education in Hāʻena has created a deeper understanding of the ahupua'a and its cycles, seasons, and resources. **Limahuli Garden and Preserve, Hui Makaʻāinana o Makana, and Na Maka Onaona** are the non-profit organizations that have been spearheading our comprehensive education and outreach. We will share how our programs, events, and workshops have been designed to align with the production of the Hāʻena watershed, and how this has allowed us to create meaningful and sustainable learning experiences for our youth and community. **Huli ʻia** is an observational tool and process we use to document and facilitate collective discussions about seasonal changes and shifts in Hāʻena from mauka to makai (mountain to ocean). **Na Lauaʻe o Makana** is our place-based education curriculum and workbook to create better awareness of seasonality and the biocultural resources specific and famous to Hāʻena. By the end of this presentation, participants will have gained an understanding of how our programs are grounded in the practices and knowledge systems of the Hāʻena community, and how we are creating a space for ʻOiwi (Native Hawaiian) leadership and knowledge to be shared, perpetuated, and celebrated.

Presentation Keywords

Place-Based Education, Seasons, Education and outreach, Community, Ahupuaʻa

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Green Fee Advocacy Maps for Hawai‘i Legislators

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Track

III. Opportunities for Conservation Collaboration Across Sectors

Abstract

The goal of the Hawai‘i Green Fee advocacy maps is to help legislators visualize how the innovative conservation finance policy touches down in their district from mauka to makai. This new tactic for advocating for the Hawai‘i Green Fee in the 2023 legislative session introduced legislators to a map of various types of conservation projects within their jurisdiction that could benefit from a statewide visitor use fee. We will discuss how these draft maps were made, and invite emailed suggestions on how to improve these maps. These legislative maps may have additional uses for other conservation advocacy efforts.

Presentation Keywords

Advocacy Maps, Conservation Finance, Community-based Conservation, Natural Resource Management

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Aerial pesticide application for control of adult Coconut Rhinoceros Beetle in palm trees

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Track

II. Understanding and Addressing Longstanding Problems and Needs

Abstract

Ongoing control efforts for the Coconut Rhinoceros Beetle (CRB) on Oahu include sanitation / remediation of potential breeding sites in organic mulch and pesticide application in palms trees, the primary host for adult feeding. Previously pesticides have been applied via trunk injection. As part of an integrated pest management approach with pesticide rotation, we have evaluated the efficacy of aerial application of the pesticide “Demon Max” (active ingredient / a.i. cypermethrin) directly into palm crowns. In a controlled trial we drenched 29 defruited coconut palm trees with 0.5 gal of diluted emulsion (to 0.5% a.i.) through a single orifice-plate nozzle from a commercial unmanned aircraft (PrecisionVision 22X, Leading Edge Aerial Technologies). For comparison, we applied an alternative “organic” product “Evergreen” (pyrethroid concentrate; 0.5 gal drench of dilution to 0.02% a.i.) to a second group of 29 coconut palm trees at the same golf course using the same delivery platform, and reserved another 29 trees at a different location on the course as untreated controls. Demon Max was shown to be effective at killing adult CRB in palm crowns, with an average 2.1 dead or dying adult beetles found at bases of Demon Max treated trees on the day of application, compared to 0.28 at Evergreen treated trees and no dead beetles ever found at the base of untreated control trees. Analysis of aerial imagery and trap catch data near treated trees indicate significant depression of CRB populations and arresting of adult CRB boring.

Presentation Keywords

Aerial Pesticide Application, Invasive Pest Control, Unmanned Aircraft, Spraying Drone

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The need for seed: Assessing native seed production requirements and bottlenecks for Hawaii

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Track

IV. Advancement in Conservation Research and Management

Abstract

According to a 2023 report by the National Academies of Sciences, Engineering, and Medicine, "the insufficient supply of seeds from native plants a major barrier to ecological restoration and other revegation projects across the US". Although this may be apparent to many projects in Hawaii working on ecological restoration or post-fire response, we lack both a clear picture of what the current and future needs for native seed are in the islands and a coordinated plan to provision seeds for these purposes. This 2-hour forum has two objectives: 1) Present recent developments at the national and local level with regards to working groups, demonstration sites, and current knowledge of seed provisioning gaps; and 2) Draw on participant expertise to gather input/feedback for an survey of current seed production capacity and needs across the conservation community. The results from the group work will be integrated into a future survey to assess seed production capacity and needs across Hawaii, reported back to participants via email, and will posted to the Ecosystems Work extension program website. We anticipate this forum to kickstart statewide efforts and identify training needs to amplify seed production for conservation and restoration of terrestrial ecosystems.

Presentation Keywords

native seed, common species, restoration, direct seeding, plant supply chain

Agenda & Additional Required Information for Forums, Workshops, and Trainings

This interactive workshop invites conservation professionals working across all levels of plant provisioning - from seed collection, greenhouse production, and active restoration - to help identify the needs in terms of information and material resources to address native seed supply in Hawaii.

Overview (40 minutes): The forum will begin with three, 10-minute presentations to provide context for the audience group work. First, Clay Trauernicht from UH Manoa will provide an overview of a recent initiative at the 2023 Native Seed Conference to form a national consortium of seed banks to coordinate best practices and funding opportunities for the provisioning of

common, ‘workhorse’ plant species for ecological restoration. He will also present results from a novel analysis of Hawaii’s potential ‘restoration footprint’ as a model to quantify seed production needs. Second, Tim Chambers from the Army Natural Resource Program will present work by the Hawaii Seed Bank Partnership which applies the Native Plant Materials Development Process as a framework to conduct strategic planning, identify funding, and address research needs for the wild collection of native seed, storage, propagation, amplification, and successful deployment of seeds. Finally, Matt Keir, State Botanist with the Division of Forestry and Wildlife will briefly review results of a 2019 Native Plant Users survey and present the plan for an expanded survey to fill in key gaps for the native plant production for Hawaii.

Group work (50 minutes): After these presentations, the forum will invite participants to join one of four thematic groups to discuss current knowledge and key questions: 1) Species selection; 2) Partnerships and Locations; 3) Seed to tree pipeline; and 4) Labor, materials, and Seed Access. Each group will be facilitated by a forum organizer and have a designated note-taker and presenter to report back to the larger group. The groups will be given 50 minutes for introductions and be presented 2-4 key questions to brainstorm current knowledge, identify key questions, and prioritize these questions for either user surveys or research.

Guiding questions:

Group 1 - Species Selection: What habitats, functional groups, and plant species are most used/needed for restoration? Which species would be best suited for orchard-based production? What plant traits would be valuable to test for restoration purposes?

Group 2 – Partnerships, Locations, and Sponsors: What sites and seed sources currently exist? Who are the agencies, organizations, working groups, etc. who would most benefit from increased seed availability? What locations would be suitable to for pilot projects?

Group 3 – Seed to Tree Pipeline: To what extent is greenhouse production/restoration limited by seed availability? What are genetic/geographic concerns with seed sources (eg. Seed Zones) and how might these be addressed? What quantities of seeds are currently required for restoration projects? How might orchards facilitate direct sowing?

Group 4 – Labor, materials, and Seed Access: How much effort/funding is currently put into seed collections? What resources (e.g., labor) would be required to manage orchard production? How do we manage seed access (i.e., seed sovereignty) between state, private, and non-profit/community projects?

Report-outs (20 minutes): Each group will have 5 minutes to present their key ideas and questions to the larger group.

Wrap up and Mahalos (10 minutes): The presenters will respond and summarize the group reports in term of new ideas, research ideas, and future work. The participants will be invited to join a Seed Orchard Working Group and a presented with a brief, online survey to collect contacts and communication preferences. Results from the forum will be summarized, emailed to participants and posted on the UH Ecosystems Work website: EcosystemsWork.org.

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‘Ōiwi (Hawaiian) Perspectives on Native Species and Ecosystems

Amber Nāmaka Whitehead[1], Pua‘ala Pascua[2], Natalie Kurashima[3], Kaikea Nakachi[4], Kainalu Steward[5,6], C.J. Elizares[7], Diamond Tachera[8], Joshua Silva[9], Kristy Lam[10], Mike DeMotta[11], Sam ‘Ohukani‘ōhi‘a Gon III[12]

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Track

VI. Collaborative Community-Based and Culturally Grounded Management

Abstract

Kanaka ‘Ōiwi (Hawai‘i’s indigenous people) share a genealogy with the plants, animals, elements, and landscapes of our island home. The lifeways of Kanaka ‘Ōiwi weave together science and culture, and are based in reciprocity, acknowledging that their survival is dependent upon the health of the environment in which they live. Much of this knowledge and associated practices can still be found within the oli (chants), mo‘olelo (stories, traditions), and other sources left to us by our kūpuna (ancestors), and an increasing number of Hawai‘i resource stewards are reconnecting to this traditional ecological knowledge in order to improve resource management today. Presenters will share their deep knowledge on topics ranging from native ferns, and manō (sharks), Ka Palupalu a Kanaloa (*Kanaloa kahoolawensis*), and wai (fresh water), to meaola (species) of place, atoll reef systems, and even ke kinohi o ka lepo (soil genesis). In hopes of encouraging others to pursue their own investigations into the species and ecosystems that give us all life, presenters will also describe how they conducted their research. A moderated discussion will provide opportunities for the audience to build on the knowledge of the presenters by sharing their own perspectives on native species and asking questions. Throughout the forum, polls and other interactive elements will be used to stimulate audience thinking, generate insights, and guide the panel discussion.

This Forum is organized by the Hawai‘i Conservation Alliance Cultural Subcommittee and will build on the foundation set by similar forums held at past conferences.

Presentation Keywords

ʻōiwi, Indigenous knowledge, Indigenous science, Traditional Ecological Knowledge

Agenda & Additional Required Information for Forums, Workshops, and Trainings

Presenters and Topics:

- Kaikea Nakachi- Manō (Sharks)
- Kainalu Steward- Atoll Reef Systems
- C.J. Elizares- Ka Palupalu a Kanaloa (*Kanaloa kahoolawensis*)
- Diamond K. Tachera- Wai (Fresh water)
- Joshua Silva and Kristy Lam- Ke Kinohi o Ka Lepo (Soil Genesis)
- Mike DeMotta- Native Ferns
- Sam 'Ohukaniʻōhiʻa Gon- Meaola (Species) of Place

Tentative Agenda (2 hours):

- (80 min) Individual 10 minute presentations
- (40 min) Moderated discussion

Audience Engagement:

A moderated discussion will provide opportunities for the audience to build on the knowledge of the presenters by sharing their own perspectives on native species and asking questions. Throughout the forum, polls and other interactive elements will be used to stimulate audience thinking, generate insights, and guide the panel discussion.

Goals and Target Audience:

The goals of the forum are (1) to share ʻŌiwi perspectives on native species and ecosystems and (2) to encourage other resource stewards to reconnect to traditional ecological knowledge in order to improve resource management today.

The target audience are native biodiversity stewards, managers, researchers, educators, and students.