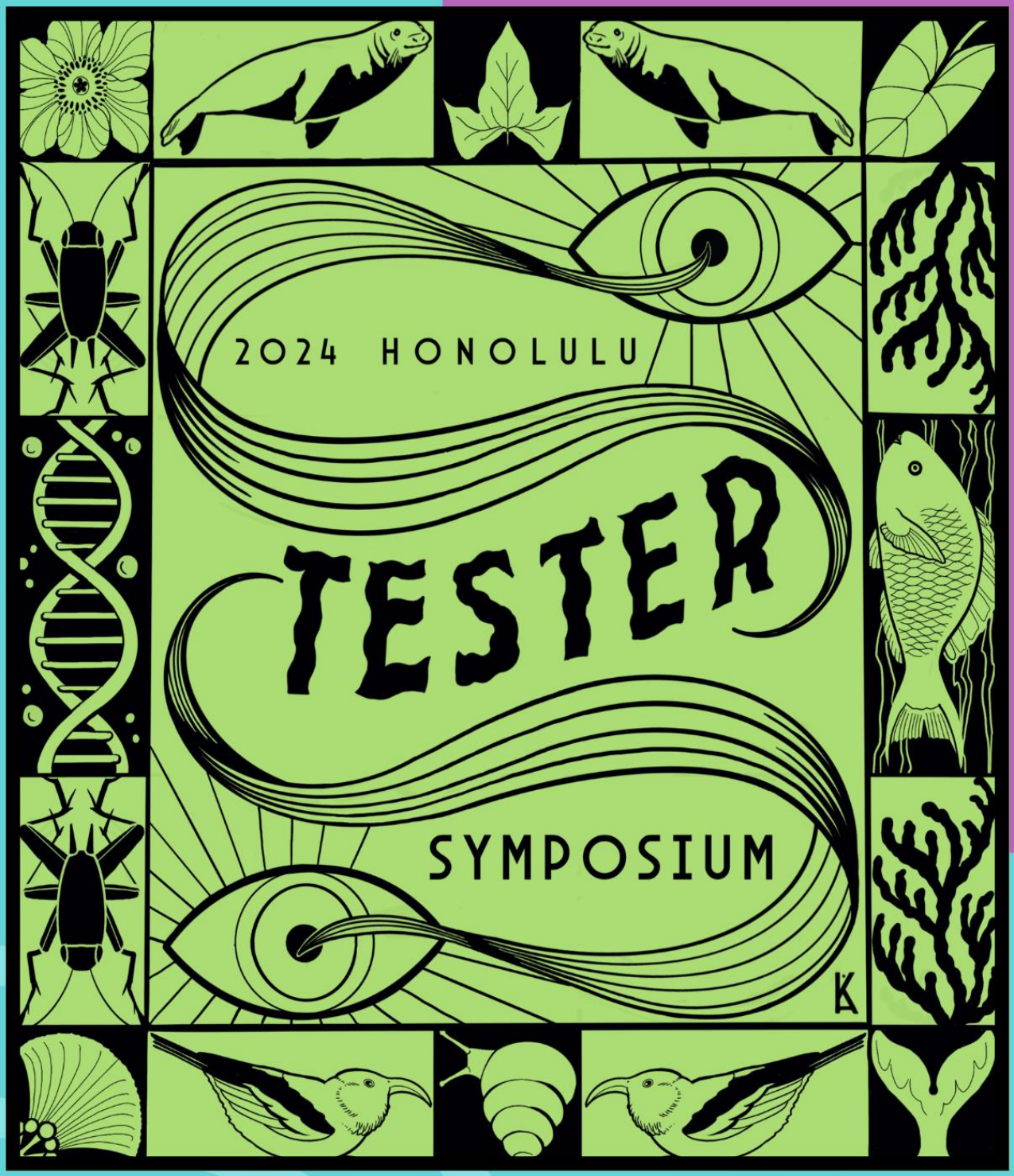

48TH ANNUAL TESTER MEMORIAL SYMPOSIUM

2024

48th Albert L. Tester Memorial Symposium

Two Eyed Seeing

April 10 – 13, 2024

School of Life Sciences

University of Hawai‘i at Mānoa

About the Tester Symposium

The Albert L. Tester Memorial Symposium is held in honor of Professor Albert Tester who, at the time of his death in 1974, was a professor of Zoology at the University of Hawai’i. Faculty and students of the Department of Zoology proposed an annual student research symposium to honor and continue Dr. Tester's encouragement of student research in a broad range of fields across Biology. Today, the Tester Memorial Symposium is organized by graduate students, and features student research from across the life sciences.

This year’s event will include oral presentations, a poster session, a workshop connecting students to conservation practitioners, lunchtime trivia, and a soirée to close the symposium. Oral presentations, either 5-minute rapid-fire talks or full-length 12-minute talks, and posters will be presented by graduate and undergraduate students, post-baccalaureate students, and post-doctoral researchers from the School of Life Sciences and related programs.

This year’s theme, Two-Eyed Seeing, focuses on seeing through one eye with a western science lens and through the other with an indigenous science lens. When viewed equally and together, the vision is clear. This theme encourages a two-way stream of knowledge, promoting stronger relationships between and amongst researchers, community, and ‘āina.

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Locations

Student talks

Information Technology Center
Room 105
2520 Correa Road
Honolulu, HI 96822
In person and virtually via Zoom

Poster session

Marine Science Building and Hawai‘i Institute of Geophysics
Lanai areas
2525 Correa Rd
Honolulu, HI 96822

Awards ceremony

Waikīkī Aquarium
2777 Kalākaua Ave
Honolulu, HI 96815

Code of Conduct

The School of Life Sciences supports an environment that is inclusive, supportive, respectful, and free from all forms of harassment and discrimination. To ensure all symposium participants can enjoy a safe and productive experience, we ask everyone to comply with the vision presented by The National Diversity in STEM Conference Code of Conduct, as defined:

- We are dedicated to provide a harassment-free conference experience for everyone, regardless of race, national origin or ancestry, ethnicity, gender, gender identity and expression, sexual orientation, physical or mental disability, physical appearance, age, academic level or experience, or any other basis protected by federal, state, or local laws.
- The symposium promotes both professional development and personal growth. Therefore, any harassment, microaggression, intimidation, and/or insinuative behavior will not be tolerated.

To promote respectful and constructive dialogue, please use the following guidelines when participating in the symposium via all modes, including video conferencing, live chat, live stream, email, social media, and any other in-person, or group communications:

- Structure your critiques in a proactive and constructive way
- No profanity or expletives (explicit or implied)
- No racial epithets
- No homophobic or transphobic language
- No denigrating or bigoted remarks
- No attacking individuals or groups
- No discriminatory or offensive language towards disabled persons, the LGBTQIA community, or people from other ethnic or religious backgrounds
- No commentary, content and/or images that are pornographic, proprietary, harassing, libelous, or that can create a hostile and toxic conference environment

The School of Life Sciences does not tolerate harassment, discrimination, or inappropriate behavior (see below) toward or by conference participants (attendees, sponsors, judges, speakers, staff, or guests) in any form. Violators of the policy—in part or entirety—will be asked to leave the symposium immediately, may not return, and may be banned from future symposia and/or School of Life Sciences seminars and events. We thank all our Tester Symposium attendees in advance for respecting these policies to ensure a positive experience for everyone.

Defining Inappropriate Behavior

Harassment, microaggression, intimidation, and/or insinuations are hurtful and interfere with the experience and participation of attendees to the Tester Symposium. These behaviors are inappropriate and unacceptable. Inappropriate behavior can take many forms such as but not limited to slurs, jokes, derogatory or discriminatory statements, foul or obscene language, offensive clothing, stalking, gestures, pictures, drawings, violating personal space by impeding or blocking another person's movement, harassing photography or recordings, offensive emails, direct messages, texts, voicemail messages, social media postings, or any other content in any other form than can create a hostile or toxic conference environment.

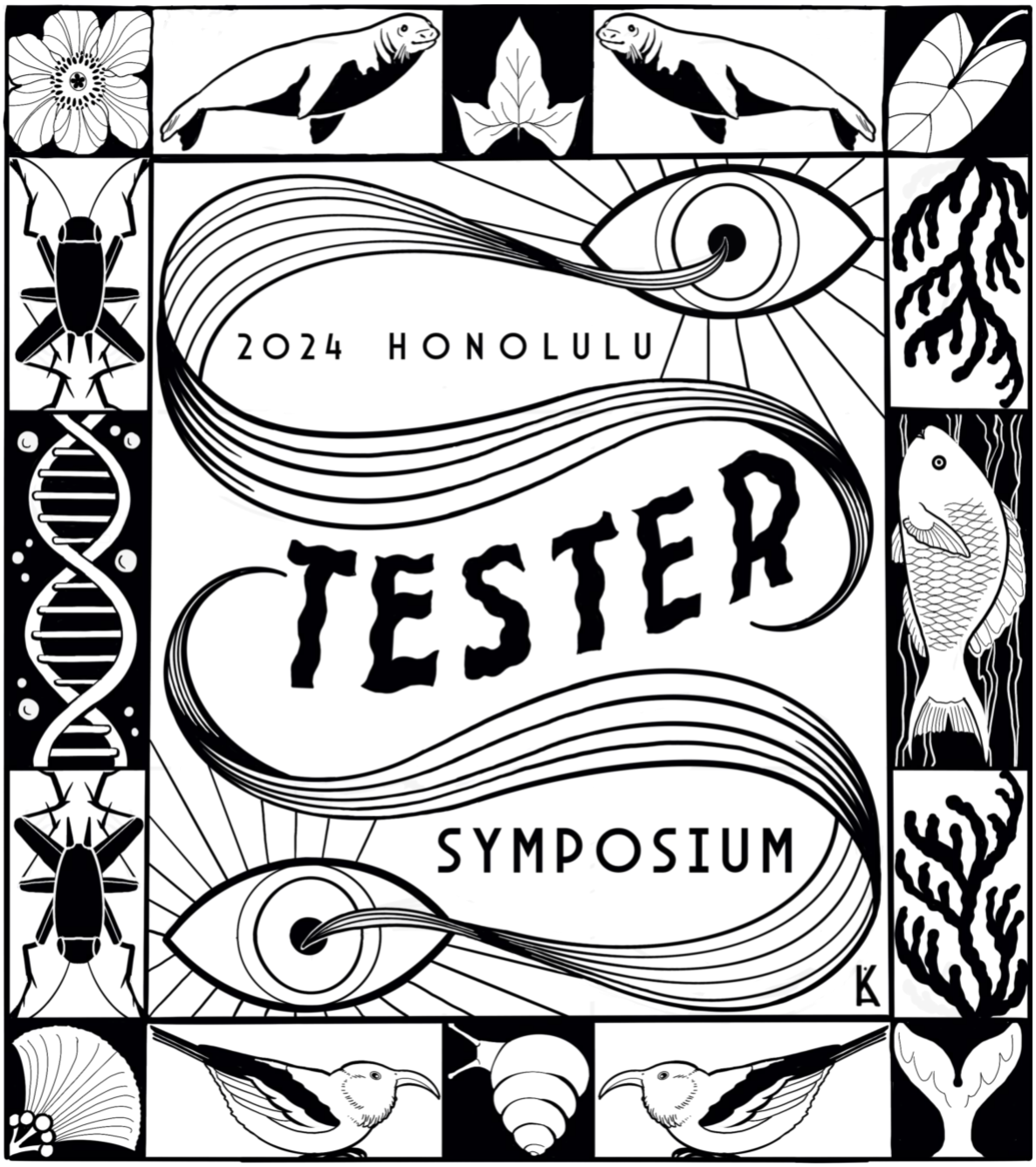
Other Important Resources

- Title IX and the Office of Institutional Equity (OIE): https://www.hawaii.edu/titleix/
- To report a sex discrimination or gender-based violence related incidence: https://report.system.hawaii.edu/student
- Campus Department of Public Safety: (808) 956-9293

Want to submit a concern pertaining to the Code of Conduct?

If you witness or are subjected to inappropriate behavior or have any other concerns, notify the School of Life Sciences as soon as possible. Click here to submit concern, or scan the QR code below.

About the 2024 Logo



Designed by the skilled tattoo artist Kai Smart, this year's logo beautifully captures the theme of ‘Two Eyed Seeing’. Central to this theme is the concept of a two-way exchange between knowledge systems, transcending disciplinary boundaries and challenging the confines of a singular colonialist worldview. Illustrated by two eyes with intertwining streams, the logo embodies the essence of this year's message: when we integrate Western science with one eye and traditional ecological knowledge with the other, our vision becomes clear.

The logo's border showcases a small sample of the diverse array of elements and species that our student body passionately studies. From the minutest molecules to the ocean's behemoths, our research spans a vast spectrum. And much like our overarching theme, when we amalgamate this diverse research, we can weave intricate narratives that deepen our comprehension of the world and inform strategies for its conservation.

On land, our studies delve into a myriad of fascinating creatures, including the remarkably adapted blind cave crickets, the elusive honeycreepers, and the uniquely diverse land snails indigenous to Hawai‘i. Our attention also extends to the vital plant life that sustains numerous species, from the delicate Hawaiian poppies and culturally significant taro to the enchanting ‘Ohi‘a lehua and the diverse limu thriving beneath the waves. In the ocean, our research encompasses majestic humpback whales, iconic monk seals, and the ecologically vital uhu. Collectively these diverse species form intricate systems which we strive to comprehend more deeply through our research.

You can see more of Kai’s work on her Instagram via @ladymisskai.

Organizers and Contributors

Graduate Student Organizers

Danielle (Dani) Bartz, Daniela (Dani) Escontrela, Kapono Gaughen

Faculty Organizers

Mark Hixon, Cynthia Hunter, Peter Marko, Tamara Ticktin

Staff Organizers

Jenna O'Neill, Audrey Shintani

School of Life Sciences Chair

Mark Burgman

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Kevin Faccenda
Alison Fischer
Ana Flores
Jessica Glazner
Kauanoe Greene
Amy Knowles
Kerri Luttrell
MeiLin Precourt
Malayaj Rai
Mireille Steck
Callie Stephenson
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Stefan Cranston
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Natasha Isaac
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Ivy Vo
Mamo Waianuhea
McLean Worsham

Artwork

Kai Smart, Instagram @ladymisskai

Photography

Patrick Nichols, http://www.eternaltidesphoto.com/

Thank You for Your Support

The 48th Annual Albert L. Tester Memorial Symposium could not be possible without the generous support of private donors, UH Mānoa associated departments and programs, and community partners. We are grateful for their support, including that of anonymous donors.

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Virtual Event

The Tester Symposium has returned to a primarily in-person event. However, we recognize the importance of providing an online venue that increases accessibility for both presenters and attendees. The symposium will be a hybrid event with in-person talks broadcast via. You can join us using the following Zoom information:

Zoom Link: https://hawaii.zoom.us/j/99923727860?pwd=dWQ3ZWlFYzI1RTh4bHRHVVZhQXBMQT09

Meeting ID: 999 2372 7860

Password: 184926

Invited Speakers

Maile Wong

Land Acknowledgement
Wednesday, April 10, 2024 at 9:10 am
He kupa ʻo Maile Wong no ke awāwa uluwehi ʻo Mānoa, ʻo kona ʻāina hānau nō ia. He haumāna ʻimi lae ʻula ʻo ia ma ka lālā kālai lāʻau o ke Kula Nui o Mānoa.
Maile Wong was born and raised in Mānoa Valley. She is a Ph.D. student in Botany at the University of Hawaiʻi at Mānoa. She is interested in understanding positive plant-plant relationships and how those relationships might be cultivated to improve and integrate conservation and food systems restoration.

Dr. Tamara Ticktin

Opening Remarks
Wednesday, April 10, 2024 at 9:10 am
Tamara Ticktin is a Professor in the School of Life Sciences at the University of Hawaiʻi at Mānoa . Her lab carries out collaborative research at the intersection of plants, people and conservation, including on the ecology of forests and agroforests stewarded and restored by local and indigenous communities; natural and anthropogenic drivers of common and rare plant population dynamics; and resilience of social-ecological systems.

Dr. Noelani Puniwai

Opening Keynote
Wednesday, April 10, 2024 at 9:20am
Dr. Puniwai is an Associate Professor at Kamakakūokalani Center for Hawaiian Studies at UH Mānoa. Her academic achievements include a PhD in Natural Resources and Environmental Management from UH Mānoa, a Master of Science in Environmental Science from Washington State University, and a Bachelor of Arts in Marine Science from UH Hilo. Dr. Puniwai is passionate about cultivating the next generation of pono scientists who will mālama `āina and kai for an abundant future. She braids together her culture, her scientific background, and her experiences as an educator to facilitate communication between local communities, management agencies, and scientists with the goal of promoting `āina momona. Dr. Puniwai's research includes coastal ecosystems, cultural seascapes, ancestral Hawaiian knowledge of `āina and kai, and knowledge co-production.

Dr. Judy Lemus

Closing Remarks
Friday April 12, 2024 at 3:10PM – 3:50PM

Dr. Lemus is a Specialist in science education at the Hawai'i Institute of Marine Biology (HIMB) and Interim Associate Dean of Academic Affairs for the School of Ocean and Earth Science and Technology at the University of Hawai'i at Mānoa. She received MS and PhD degrees in marine biology investigating the physiological and cellular interactions of tropical marine symbiotic organisms. She has since dedicated her career to building collaborative research, scientific education, and outreach programs through initiatives such as makerspace learning environments, place-based education mobile apps, and community-focused research internships. She directed the UH Center for Ocean Science Education Excellence - Island Earth, and the Laulima A 'Ike Pono community research internship program, two National Science Foundation funded programs designed to facilitate collaborative scientific engagement among all ocean users and to empower future Native Hawaiian and Pacific Islander geoscientists. Dr. Lemus has previously served as Interim Director of HIMB; Co-Director of the UHM Marine Biology Graduate Program; Chair of the UH Mānoa General Education Foundation Board; Education Chair of the Hawaiian Islands Humpback Whale National Marine Sanctuary Advisory Council; Chair of the Oceania Regional Chapter of the National Marine Educators Association; President of the Board of Directors for Paepae o He'eia fishpond stewardship organization; and Chair of the Kāne'ohe Bay Regional Council.

Workshop Leaders

Suzanne Case

Connecting Research & Conservation Management Workshop
Thursday April 11, 2024 at 12:00 PM – 2:00PM

Suzanne Case is the inaugural Director of the University of Hawai‘i Office of Land and Ocean Conservation Futures, established in 2023. She served as Chair and Director of the State of Hawai‘i Department of Land and Natural Resources for two terms, from 2015 to 2022. Prior to that she worked at The Nature Conservancy, for 28 years, as Executive Director of the Hawai‘i and Palmyra Atoll program from 2001 to 2015, and as Asia/Pacific and Western Regional Counsel from 1987 to 2001 doing conservation land transactions and general business for international conservation operations. She began her legal career as an Associate practicing real estate transactions at the law firm of Pettit & Martin in San Francisco from 1983 to 1987. Suzanne was born in Hilo, Hawai‘i, and raised in Hilo and Honolulu. She was educated at Waiakea-Kai and Keaukaha Elementary Schools, Punahou School, Williams College, Stanford University (B.A. History), and University of California Hastings College of the Law. Her interests include hiking and backpacking, travel, history and genealogy, land stewardship and conservation.

Dr. Melissa Price

Connecting Research & Conservation Management Workshop
Thursday April 11, 2024 at 12:00 PM – 2:00PM

Melissa Price is a Wildlife Biologist in the Department of Natural Resources & Environmental Management at the University of Hawai'i. Dr. Price utilizes a diverse toolbox including behavioral ecology, spatial modeling, genetics, and decision analysis to conduct research aimed at improving conservation outcomes.

Workday Organization

Paepae o He‘eia

Community Workday

Saturday April 13, 2024 at 8:00 AM – 12:00 PM

Paepae o He‘eia (POH) is a federally recognized 501(c)(3) non-profit organization founded in 2001 to restore and manage He‘eia Fishpond as place of traditional Hawaiian aquaculture. The 88-acre fishpond is located in He‘eia in the moku of Ko‘olaupoko on the island of O‘ahu. The fishpond is approximately 800 years old, is the second largest remaining fishpond in Hawai‘i, and was added to the National Register of Historic Places register on January 17, 1973. Our vision is to perpetuate a foundation of cultural sustainability for communities (‘ohana) of Hawai‘i through education. Our missionis to implement values and concepts from the model of a traditional fishpond to provide intellectual, physical, and spiritual sustenance for our community. Through our multi-faceted fishpond programs, we engage the community to facilitate the restoration of He‘eia Fishpond and in the process, address a variety of environmental issues. The issues related to coastal fishpond restoration are that of invasive species, both terrestrial and aquatic, water quality and watershed management and health, food security and local seafood production, marine debris, community health and well-being and the informed and appropriate restoration of a historic site.

2024 Symposium Schedule

Day 1 – Wednesday April 10

9:00 AM	Land Acknowledgement
9:10 AM	Opening Remarks
9:20 AM	Keynote Address
10:20 AM	Break
10:30 AM	Session 1 – Surviving Stress: From Reefs to Restoration
11:45 AM	Break
12:00 PM	Keynote Speaker Lunch
1:00 PM	Break
1:15 PM	Session 2 – Cracking the Code: Cutting-edge Insights from DNA to Disease
2:45 PM	Break
3:00 PM	Session 3 – Aquatic Odyssey: Exploring Hawai'i's Waters from Restoration to Genetics
4:00 PM	End of Day 1

Day 2 – Thursday April 11

8:50 AM	Land Acknowledgement
9:00 AM	Session 4 – Fishing for Knowledge: Navigating Fisheries from Reefs to Caves
10:15 AM	Break
10:45 AM	Session 5 – Under the Microscope: Unveiling the Enigmatic World of Invertebrates
11:45 AM	Break
12:00 PM	Connecting Conservation Research and Management Workshop
2:00 PM	Break
2:15 PM	Session 6 – Roots and Reclamation: Insights into Plant Dynamics from Hawai'i's Pastures to Caves
3:00 PM	Break
3:10 PM	Session 7 – Charting Change and Cultivating Connections: Insights from Pu'uloa to He'eia
4:00 PM	**Poster Session & Pau Hana**
6:00 PM	End of Day 2

Day 3 – Friday April 12

8:50 AM	Land Acknowledgement
9:00 AM	**Session 8 – Moana Manaʻo: Exploring the Mysteries of Marine Megafauna**
10:15 AM	Break
10:30 AM	**Session 9 – Moana Manaʻo: Exploring the Mysteries of Marine Megafauna**
11:05 AM	Break
11:10 AM	**Session 10 – From Kai to ʻĀina: A Diverse Dive**
11:45 AM	Break
12:00 PM	Lunchtime Trivia
1:00 PM	Break
1:10 PM	**Session 11 – Under the Sea and Above: Fringe Reefs and Feathered Friends**
2:25 PM	Break
2:35 PM	**Session 12 – Biodiversity Buzz: From Wai to Kai to Nalo Meli Maoli**
3:05 PM	Break
3:10 PM	Closing Remarks
4:00 PM	End Day 3

Day 4 – Saturday April 13

8:00 AM	Workday with Paepae o Heʻeia
6:00 PM	Awards Banquet at the Waikīkī Aquarium
9:00 PM	End of Symposium

Workshops & Special Events

Keynote Speaker Lunch

with by Dr. Noelani Puniwai

Wednesday, April 10 at 12:00 PM, Information Technology Center Room 105

Hosted lunch with the keynote speaker at the Information Technology Center. Limited space available. Registration required.

Connecting Research & Conservation Management Workshop

Led by Suzanne Case and Dr. Melissa Price

Thursday, April 11 at 12:00 PM, Information Technology Center Room 105

The goal of this workshop is to connect research and conservation management in Hawaii. Specifically, students will learn about forming relationships with conservation managers, what sorts of questions resource managers are looking to answer, and how to tie the results of their research back to conservation. Participants will also get the chance to meet and network with conservation resource managers in Hawai‘i, including representatives from government, non-profit and community groups. Limited space available. Registration required.

Lunchtime Trivia

Led by the Trivia Subcommittee

Friday, April 12 at 12:00 PM, Information Technology Center Room 105

During this game of trivia, participants will answer questions submitted by their fellow students related to the presentations they gave during the Tester Symposium. The winning team will win a prize. Limited space available. Registration required.

Community Workday

with Paepae o He‘eia

Saturday, April 13 at 8:00 AM, Location TBD

The 48th Annual Tester Memorial Symposium is proud to partner with Paepae o He‘eia for a workday event caring for the He‘eia fishpond. Limited space available. Registration required.

Awards Banquet

Saturday, April 13 at 6:00 PM, Waikīkī Aquarium

We are excited to bring back the awards banquet to the Waikīkī Aquarium where attendees will enjoy a delicious meal catered by DaSpot and enjoy the amazing exhbits the Aquarium has to offer. We will announce the winners of talks, the poster session, and the art and photo contest during the banquet. Limited space available. Registration required.

Wednesday April 10 – Information Technology Center

9:00 AM	**Land Acknowledgement**	**Maile Wong**
9:10 AM	Opening Remarks	Dr. Tamara Ticktin
9:20 AM	Keynote Address	Dr. Noelani Puniwai
10:20 AM	Break	
10:30 AM	**Session 1 – Surviving Stress: From Reefs to Restoration**	
	Seasonal Reproducibility of Relative Heat Tolerance in Hawaiian Reef-Building Coral Montipora capitata using a Novel Short-Team Heat Stress Assay	Madeleine Hardt
	Coral and Symbiont Dynamics Under Natural Nutrient Enrichment	Callie Stephenson
	How are ecosystems in the Equatorial Pacific affected as a result of changes in the iron cycle due to climate change?	Rudresh Megha
	Population variation in drought tolerance of ʻAʻaliʻi (Dodonaea viscosa) to inform restoration under climate change	Kauanoe Greene
	Making it Count: Ecosystem Accounting in the Main Hawaiian Islands (MHI)	Chua Louis
11:45 AM	Break	
12:00 PM	Keynote Speaker Lunch	
1:00 PM	Break	
1:15 PM	**Session 2 – Cracking the Code: Cutting-edge Insights from DNA to Disease**	
	Environmental DNA: a silver bullet for coral reef bio-monitoring?	Patrick Nichols
	RGD Promotes Follicle Growth and Theca Cell Differentiation Through Integrins αvβ3/αvβ5 in Three-Dimensional Culture	Kaelyn Kitazumi
	Advancing the characterization of viral functional modules from metagenomic data using Large Language Models	Will Harrigan
	Transcriptomic Analysis of Sea Cucumber Vision	Anneke Wirth-Yap
	eDNA: a promising tool for population genetics	Taylor Ely
	Protective Effects of FOXO3 Gene Longevity and Resilience Associated Variants in Aging Related Diseases	Lovina Abdi
2:45 PM	Break	

3:00 PM	**Session 3 - Aquatic Odyssey: Exploring Hawai'i's Waters from Restoration to Genetics**	
	Restoration of an Indigenous aquaculture system can increase reef fish density and fisheries harvest in Hawai'i	Annie Innes-Gold
	Species Distribution Modeling of Non-native Snappers (Lutjanus spp.) across the Hawaiian Archipelago	Maya Otsu
	Predicting Extinction Risk of Ray-Finned Fishes Not Assessed by the IUCN	MeiLin Precourt
	Questions for first half of session	
	Comparative Transcriptome Analysis of Vision-Related Genes in Snapping Shrimp.	Jacquelyn Benson
	Developing a DNA Barcode Reference Library for Hawaiian Elasmobranchs	Cameron Angulo
	Impact of cryopreservation on collector urchin larvae's thermal tolerance	Charley Westbrook
	The Pacific Islands Chapter of the American Fisheries Society: UH student subunit	McLean Worsham
	Questions for Second half of session	
4:00 PM	**End of Day 1**	

Thursday April 11 – Information Technology Center

8:50 AM	**Land Acknowledgement**	Maile Wong
9:00 AM	**Session 4 – Fishing for Knowledge: Navigating Fisheries from Reefs to Caves**	
	Loss of habitat complexity affects reef fish foraging behavior in Kāneʻohe Bay, Oʻahu, Hawaiʻi	Aimee Cook McNab
	The influence of structural complexity on reef fish communities	Mollie Asbury
	Metabolic impacts of marine heatwaves on striped mullet, Mugil cephalus and the kanda mullet, Osteomugil engeli	Jonathan Rosen
	~24 chromosomes and Actinopterygii, cause or coincidence?	McLean Worsham
	Environmental DNA reveals hidden Hawaiian Agariciidae coral diversity	Cecile Vimond
10:15 AM	Break	
10:45 AM	**Session 5 – Under the Microscope: Unveiling the Enigmatic World of Invertebrates**	
	Hyper olfactory sensing may evolve through fluid-flow dynamics at the olfactory epithelium but not diversifying the olfactory receptor gene families in the blind cavefish.	Natalie Choi
	Who Are You Calling A Shrimp? Evaluating Aggression, Boldness, and Behavioral Strategies in Invasive Stomatopods	Sophia Hanscom
	Effect of temperature on the utilization of endogenous reserves by Antarctic marine invertebrate embryos and larvae	Aaron Toh
	Determining the expression patterns of ultraviolet opsins in Gonodactylaceus falcatus	Noah Doeden
11:45 AM	Break	
12:00 PM	Connecting Conservation Research and Management Workshop	
2:00 PM	Break	
2:15 PM	**Session 6 – Roots and Reclamation: Insights into Plant Dynamics from Hawaiʻi's Pastures to Caves**	
	From the pasture to present: the history of grass introductions in Hawaiʻi	Kevin Faccenda
	Monitoring the survival and performance of outplanted seedlings to inform coastal dune restoration	Amanda Jennings
	Rooted in darkness: plant and rhizobial nutrient variation in Hawaiian cave ecosystems	Amir Van Gieson

3:00 PM	Break	
3:10 PM	**Session 7 – Charting Change and Cultivating Connections: Insights from Pu‘uloa to He‘eia**	
	Using ArcGIS Tools to Analyze Land Use Change in Pu‘uloa	Allen Austin
	Assessing the Impact of Historical Land Use on Pollutant Dynamics and Community Vulnerability in Pu‘uloa, Hawai‘i	Dingyi Liu
	A case study from the He‘eia National Estuarine Research Reserve: Why do graduate students participate in biocultural restoration?	Olivia Boucher
4:00 PM	Poster Session & Pau Hana (Marine Science Building Lanai)	
6:00 PM	**End Day 2**	

Friday April 12 – Information Technology Center

8:50 AM	**Land Acknowledgement**	Maile Wong
9:00 AM	**Session 8 – Moana Mana'o: Exploring the Mysteries of Marine Megafauna**	
	Comparing the underwater soundscape of the Hawaiian Islands Humpback Whale National Marine Sanctuary and potential influences of the COVID-19 pandemic	Brijonnay Madrigal
	The energy dilemma: how might the energetic demands of false killer whales and reduced prey availability be contributing to fishery depredation rates.	Jens Currie
	Captive testing of magnetic and electromagnetic stimuli on tiger sharks (Galeocerdo cuvier)	Edward Cardona
	Inter- and intra-annual variation in humpback whale body condition on their Southeast Alaskan foraging grounds	Martin van Aswegen
10:15 AM	Break	
10:30 AM	**Session 9 – Moana Mana'o: Exploring the Mysteries of Marine Megafauna**	
	Elevating photo identification: Aerial identification of humpback whales.	Lewis Evans
	Harnessing 13 years of citizen science data to investigate the dynamics of reef manta ray aggregations in Kona, Hawaii	Corey Nevels
	A seal's POV: Using biologging instruments to describe the underwater behavior of Hawaiian monk seals	Kirby Parnell
	Monitoring marine mammals around wave energy devices – a Kaneohe Bay case study	Kyleigh Fertitta
	Modeling Coral, Macroalgae, and Turf Competition in Coral Reef Ecosystems	Nathan Fitzpatrick
	Questions for first half of session	
11:05 AM	Break	
11:10 AM	**Session 10 – From Kai to 'Āina: A Diverse Dive**	
	Reliability of indirect environmental DNA assessments on coral reef diversity over time	Zoe Hill
	A Case Study of Nutritional Symbioses in Hawaiian Cixiids	Stefan Cranston
	Pilot data helps design an eDNA tool for Hawaiian fishponds	Maryann Webb

	Investigating the utilization of phytoplankton produced dissolved organic matter by SAR11 bacteria	Kerri Luttrell
	Investigating the diversification of map turtles, Graptemys (Testudines, Emydidae) in the southeastern US	Karina Moreno
	Questions for second half of session	
11:45 AM	Break	
12:00 PM	Lunchtime Trivia	
1:00 PM	Break	
1:10 PM	**Session 11 – Under the Sea and Above: Fringe Reefs and Feathered Friends**	
	Relative contributions of size and shape to coral demography	Guan-Yan Chen
	Mechanical vulnerability of Hawaiian coral reefs: adding to the conservation and restoration toolbox	Jon Ehrenberg
	From Seabirds to Sewage: Investigating Nutrient Effects on Coral Bleaching	Jessica Glazner
	Weaving Indigenous and Western Science in Shorebird Monitoring	Claire Atkins
	Investigating Factors of Understaffing for Natural Resource Management Agencies of Hawai‘i	Tatum Kauka
2:25 PM	Break	
2:35 PM	**Session 12 – Biodiversity Buzz: From Wai to Kai to Nalo Meli Maoli**	
	A Mechanistic Framework to Predict Reef Ecosystem Outcomes Based on Sediment Concentration and Herbivorous Fish Community Composition	Jacob Snyder
	Genetic Identifications of Pond-raised Tilapia Using Fin Clippings and Microsatellite DNA Genotyping	Alexander Nguyen
	Hylaeus in Hawai’i: Tracing Co-Extinction Through a United Genealogy of Place	Korey Wetherell
	Investigation of the photobiology of an endemic Hawaiian octocoral: Sarcothelia edmondsoni	Erika Cabell
	Questions for session	
3:05 PM	Break	
3:10 PM	Closing Remarks	
4:00 PM	**End Day 3**	

Abstracts

Session 1 | Surviving Stress: From Reefs to Restoration

Wednesday April 10th at 10:30AM to 11:45AM

Seasonal Reproducibility of Relative Heat Tolerance in Hawaiian Reef-Building Coral Montipora capitata using a Novel Short-Team Heat Stress Assay

Presenter: **Madeleine Hardt** – Graduate – School of Ocean and Earth Science and Technology
M. Hardt, C. Lewis, C. Suchocki, R. Toonen

Coral reefs have been experiencing increasingly frequent coral bleaching events in recent decades, primarily driven by ocean warming. Continued temperature increases at the present rate may surpass the natural adaptive capacity of modern corals, severely impacting their essential functions and ecosystem services. Coral out-planting emerges as a popular restoration strategy because it offers immediate results through established techniques. To improve efficiency amidst anticipated ocean warming, the selection of coral phenotypes that have higher heat tolerance within their populations is a promising strategy. A novel short-term heat stress assay, the Coral Bleaching Assessment Stress System (CBASS), promises to identify the relative heat tolerance of coral genets in just 8 hours. However, the critical evaluation of the reproducibility of CBASS and its methodology is imperative to understand its implications for reef restoration. This project focuses on assessing the seasonal reproducibility of CBASS in evaluating thermal tolerance within a Hawaiian reef-building coral, Montipora capitata by directly comparing the response of CBASS assays on identical genets during multiple seasons. Current findings indicate a significant difference in photosynthetic efficiency between bleached and non-bleached corals in March 2023, which subsequently diminished upon retesting in October 2023. Results from this experiment will provide crucial insights to the utility of CBASS as a tool for selecting heat-tolerant phenotypes within a population, informing decision-making for future reef restoration initiatives.

Coral and Symbiont Dynamics Under Natural Nutrient Enrichment

Presenter: **Callie Stephenson** – Graduate – Marine Biology
C. Stephenson

The coral holobiont exhibits discernible responses to different nutrient regimes, with ramifications on symbiosis and holobiont growth. We examine these responses of the holobiont to nutrient enrichment on a well characterized natural environmental gradient induced by submarine groundwater discharge (SGD) through a field experiment conducted in Moorea, French Polynesia. In coastal waters, SGD establishes a connection between land and sea through the marginal seabed, reshaping the nutrient regime adjacent to seep sites. This study exposed two coral species, Pocillopora acuta and Porites rus, both prevalent in the fringing reef of this region, at 20 stations across different relative influences of SGD over a 7-week soak period. We examined coral growth and endosymbiont counts against parameters indicative of nutrient enrichment. From prior research, we expect to see a monotonically increasing

response of endosymbiont density and coral growth in holobionts subjected to increasing levels of SGD.

How are ecosystems in the Equatorial Pacific affected as a result of changes in the iron cycle due to climate change?

Presenter: **Rudresh Megha** – Graduate – School of Ocean and Earth Science and Technology
R. Megha, N. Hawco

Ocean biogeochemical models may have a hard time predicting the future of primary production due to the complexity of the iron cycle. Iron is a limiting nutrient, especially in the equatorial Pacific, and modelled future declines in the equatorial Pacific productivity hinge on uncertain iron uptake parameters. To constrain iron uptake in the equatorial Pacific, we set up incubation experiments at sea. The filters and filtrates collected from that experiment were subjected to particle digestion protocols in lab to calculate maximum iron uptake rates (Vmax). To produce a more accurate climate model, constraining changes in Vmax and the ability of phytoplankton to downregulate their iron uptake rates is crucial. To achieve this, we propose sampling across the Pacific to understand how the Vmax rates and Fe:C ratios change across different gradients and therefore, we can ultimately gather a more robust dataset that can be used to prove future ocean circulation models.

Population variation in drought tolerance of ʻAʻaliʻi (Dodonaea viscosa) to inform restoration under climate change

Presenter: **Kauanoe Greene** – Graduate – Botany
K. Greene, M. Akiona, T. Chambers, C. Lum, C. Trauernicht, K. E. Barton

Climate change is increasing aridity globally, leading to declines in plant performance. Seedlings are particularly vulnerable to drought stress, and reduced recruitment under climate change is threatening population stability. In Hawaiʻi, many plant species are widespread, growing across steep precipitation gradients, and populations likely vary in seedling drought tolerance due to local adaptation. In this project, we experimentally tested seedling drought tolerance in a widespread, common restoration species, ʻaʻaliʻi (Dodonaea viscosa), testing 9 populations spanning a 450-1325 mm mean annual rainfall (MAR) gradient sampled from Oʻahu and Hawaiʻi Islands. We predicted survival, growth, and photosynthetic performance under drought would decline as MAR increased across the populations as a result of local adaptation to historical rainfall patterns. Survival under drought varied significantly among populations, ranging from 54 – 90%. However, survival rates were not related to MAR as predicted, suggesting that other factors may account for this population variability. For those seedlings surviving drought, we detected significant reductions in growth, the magnitude of which also varied among populations in complex patterns. For insights into the mechanisms underlying population variation in survival and growth under drought, we monitored photosynthetic performance throughout the drought and recovery periods. Photosynthesis is highly plastic in ʻaʻaliʻi, with strong responses to experimental drought, and variable degrees of recovery following watering treatments. These experimental results showcase the tremendous intraspecific variability in

climate stress tolerance, highlighting the value of a population-scale focus for conserving widespread plant species.

Making it Count: Ecosystem Accounting in the Main Hawaiian Islands (MHI)

Presenter: **Chua Louis** – Graduate – Natural Resources and Environmental Management
L. Chua, K. Oleson

Recent US policy initiatives seek to better understand the importance of nature for people and the economy. Ecosystem accounting (EA) can organize important information about the status and trends of a jurisdiction‘s natural assets and their associated benefits. EA is in its nascency, particularly as applied to tropical coastal systems. In this project, we integrate data from multiple agencies using the United Nations System of Environmental and Economic Accounts Ecosystem Accounting (UN SEEA EA) framework to create ecosystem accounts for the Main Hawaiian Islands (MHI). EA involves synthesizing spatial data related to ecosystem extent and condition, and quantifying ecosystem service flows. Specifically, we focus on coastal and nearshore habitats (wetlands, beaches, dunes, coral reefs) and three services (tourism, recreation, fishing). We use Indigenous Knowledge-informed geographical boundaries (“moku”) as the spatial reporting unit, which showcase the interconnectedness of land and sea and enhance local policy relevance of the accounts. Results include synthesized ecological extent data, mapping of ecosystem conditions that mediate ecosystem service flows, and estimates of ecosystem service flows and their values. This information can inform conservation actions including spatial management, as well as sustainable development economic policy.

Session 2 | Cracking the Code: Cutting-edge Insights from DNA to Disease

Wednesday April 10th at 1:15PM to 2:45PM

Environmental DNA: a silver bullet for coral reef bio-monitoring?

Presenter: **Patrick Nichols** – Graduate – School of Life Science
P. K. Nichols

Coral reefs support the most diverse assemblages of marine life on Earth, yet are declining due to local and global stressors. Rapid and widespread monitoring is essential for tracking ecosystem responses, but assessment of coral communities traditionally relies on time-consuming visual estimates of biodiversity. Bio-surveillance of rare taxa can be enhanced with environmental DNA (eDNA) analysis, the analysis of genetic material shed by a target organism is isolated from its environment, providing a snapshot of biodiversity. The analysis of eDNA offers fast and efficient insights into the abundance and distribution of species, oftentimes with greater sensitivity than traditional visual methods. Using coral reefs as a model ecosystem, I investigate the tradeoffs of molecular bio-monitoring in Hawai'i, focusing on three core aspects of eDNA surveillance: inference of community composition, effectiveness of eDNA capture methods, and sensitivity of species detection. Despite the power and sensitivity of molecular tools, eDNA applications have drawbacks that must be considered by managers. Balancing tradeoffs in sensitivity and scope is crucial for effective use of eDNA methods in coral reef conservation.

RGD Promotes Follicle Growth and Theca Cell Differentiation Through Integrins αvβ3/avβ5 in Three-Dimensional Culture

Presenter: **Kaelyn Kitazumi** – Department of Anatomy, Biochemistry, and Physiology
K. Kitazumi, C. Matsushige, A. Beaman, M. Miyagi, Y. Yamazaki

In vitro follicle growth is a promising technology to preserve fertility for cancer patients. We previously developed a three-dimensional (3-D) ovarian tissue culture system supported by dextran hydrogel. To mimic the natural environment, dextran hydrogel was modified with Arg-Gly-Asp (RGD), an extracellular matrix derived triple peptide. Culturing ovarian tissue using the RGD-modified dextran hydrogel significantly promoted follicle growth compared to those cultured using dextran hydrogel alone. In this study we determined how RGD stimulates follicle growth in the 3-D culture system. As a ligand, RGD selectively binds to eight integrins. Using qPCR and immunohistochemical analyses, we found that integrins αvβ3 and αvβ5 are the main targets of RGD in the immature ovary. To examine the effect of RGD-integrin interaction on follicle growth, we used Cilengitide (Ci), an inhibitor for integrins αvβ3/αvβ5. Ovarian tissues were cultured under three different conditions: RGD−, RGD+, and RGD+Ci. In the presence of Ci (RGD+Ci), RGD-induced follicle growth was dramatically suppressed, similar to the RGD− condition. Next, we examined the direct effect of RGD on ovarian interstitial cells. Aggregates of ovarian interstitial cells were 3-D cultured under the three conditions. The RGD+ condition significantly enhanced cell migration and the expression levels of theca cell marker genes in the aggregates. The RGD- induced cell activity was totally suppressed in the RGD+Ci condition,

similar to those in the RGD− condition. In conclusion, these results suggest that RGD promotes follicle growth via binding to integrins αvβ3/αvβ5 which are expressed in the ovarian interstitial compartment in our 3-D culture system.

Advancing the characterization of viral functional modules from metagenomic data using Large Language Models

Presenter: **Will Harrigan** – Graduate – Marine Biology
W. Harrigan, K. E. Wommack, S. W. Polson, B. D. Ferrell, Z. D. Schreiber, M. Belcaid

Accurate annotation of viral genotypes to the corresponding function from metagenomic data is essential for understanding microbial ecosystems. Traditional methods rely on the homology of assembled proteins to reference sequences, and grouping proteins that co-occur across different viral genomes into functional groups, or modules. The biochemical characteristics of modules are indicative of virus function. However, the rapid mutation rates and high sequence diversity of viruses complicate the accurate prediction of these proteins to their corresponding modules. Recent developments in protein large language models provide a robust method for encoding proteins into numerical vectors (i.e., embeddings). Each amino acid within a protein is represented by an embedding that includes contextual information based on its relationships with other amino acids in the sequence. This method significantly enhances the ability to assess similarity across proteins, even when there is considerable variation in their sequences. Here, we aim to refine the application of protein embeddings for module identification by analyzing the interactions between amino acids across different proteins. Specifically, we identify proteins as part of the same module if there are significant interactions, or ""attention,"" between amino acids in one protein and those in another protein within the same genome. Preliminary results suggest this method increases the accuracy of pinpointing sequence positions that are functionally interconnected, independent of sequence homology or evolutionary lineage. This approach represents a significant advancement in the field of viral metagenomics, offering a more reliable tool for the study of viral diversity and function in microbial communities.

Transcriptomic Analysis of Sea Cucumber Vision

Presenter: **Anneke Wirth-Yap** – Undergraduate – Marine Biology
A. Wirth-Yap

Echinoderms are a unique group of marine invertebrates including sea cucumbers, sea stars, and sea urchins. Echinoderms' evolutionary proximity to early vertebrates makes their sensory capabilities particularly interesting. The conspicuous sea cucumber, or Opheodesoma spectabilis is one of few sea cucumbers with eyespots. Despite the morphological and behavioral evidence of their eyespots, little is known about their vision on a molecular level. To investigate sea cucumber vision, we collected eye and skin tissue from seven O. spectabilis specimens, and assembled transcriptomes from the tissue samples. Within the transcriptomes, several visual proteins called opsins were identified. These findings are significant because the identified opsins are typically associated with vertebrates, which is incongruent with the sea cucumbers' invertebrate identity. Overall, the findings in transcriptomes of O. spectabilis showed similarities between vertebrate and invertebrate visual systems, reflecting their placement as basal

deuterostomes. Understanding sea cucumber vision is important for understanding their behavior, ecosystem role, and place in evolutionary history.

eDNA: a promising tool for population genetics

Presenter: **Taylor Ely** – Graduate – School of Life Sciences
T. Ely

Community-wide population genetics is a powerful approach that can reveal concordant patterns including shared genetic breaks. This comparative approach uses natural experiments of co-distributed populations of multiple species that have undergone similar evolutionary conditions independently. Traditional, individual-based methods take years, even decades, to accumulate enough data, limiting studies to a small subset of the community. Environmental DNA (eDNA) has the potential to reduce the time and cost constraints on these studies. However, the performance of eDNA methods has yet to be directly and systematically compared to studies that used traditional individual-based methods. Previous studies have shown eDNA methods can reliably detect haplotypes in marine ecosystems. However, the primary issue for eDNA as a population genetics tool is that the frequency of haplotypes cannot be directly determined. This issue is due to eDNA in the water column originating from an unknown number of individuals. Fine-scale population structure is often limited to variations in haplotype frequencies and not necessarily variation in the presence and absence of haplotypes. Therefore, the scale of population structure that can be detected with eDNA methods is uncertain. We investigated whether eDNA methods can accurately detect population structure in a Hawaiian marine fish community previously studied using traditional, individual-based methods. eDNA methods is a promising tool for community-wide population genetics because sampling detects hundreds of species in a timely and cost-effective manner. This opens the possibility to large comparative studies of shared genetic breaks, responses to past environmental changes, and links between life history traits and realized dispersal.

Protective Effects of FOXO3 Gene Longevity and Resilience Associated Variants in Aging Related Diseases

Presenter: **Lovina Abdi** – Graduate – Anatomy, Biochemistry and Physiology
L. Abdi, R. Allsopp, G. Lockwood, D. Le Couteur

The Forkhead box O3 (FOXO3) gene has emerged as a key player in the regulation of aging and longevity. This abstract provides a concise overview of recent studies conducted within the CHAMP (The Concord Health and Ageing in Men Project) cohort, University of Sydney, in collaboration with JABSOM University of Hawaii, where we will focus on the longevity and resilience associated genetic variants of FOXO3 and their potential implications for longevity within the CHAMP cohort. The CHAMP cohort, comprising an Australian population of men over the age of 70, serves as a very good platform for investigating the genetic determinants of healthy aging. Our research within the CHAMP cohort plans to replicate and expand on longevity associated FOXO3 variants, first identified here in Hawaii, and their association with increased lifespan and improved healthspan, such as decreased risk of age-related diseases. Previous findings by Kuakini Medical Center, University of Hawaii and multiple other labs around

the world have underscored the importance of FOXO3 in the molecular pathways governing longevity. Lifestyle factors, such as diet, exercise, and stress management, have been previously explored in conjunction with FOXO3 genotypes to assess their collective impact on aging trajectories, however, further work needs to be done to better understand the impact of FOXO3 on healthy aging and longevity in humans. The CHAMP cohort study started in 2005 at the University of Sydney at the Concord Hospital where data from 1705 men were collected. Four follow up assessments were done to assess physical performance, cognitive function, blood test and medication inventory in these patients. The CHAMP studies also focus on the health trajectories of older men, which can help examine potential determinants of mortality. CHAMP research has led to publications on a broad range of ageing and geriatric health issues, especially frailty, reproductive hormones, osteoporosis, and medication. In conclusion, the studies we plan to conduct in the CHAMP cohort should provide valuable insights into the role of the longevity associated FOXO3 genetic variants with respect to effect on longevity and healthy aging. Understanding the intricate relationships between genetic predispositions and environmental factors can pave the way for personalized interventions aimed at promoting longevity and preventing age-related diseases. The goals presented here are expected to contribute to the growing body of knowledge surrounding FOXO3 and its potential as a target for interventions aimed at enhancing the quality of life in aging populations.

Session 3 | Aquatic Odyssey: Exploring Hawai'i's Waters from Restoration to Genetics

Wednesday April 10th at 3:00PM to 3:55PM

Restoration of an Indigenous aquaculture system can increase reef fish density and fisheries harvest in Hawai'i"

Presenter: **Annie Innes-Gold** – Graduate – Marine Biology
A. Innes-Gold

Biocultural restoration efforts in Hawai'i, aimed at revitalizing Indigenous stewardship, have included restoration of loko i'a (fishponds) to sustainably increase the availability of local seafood. While it is clear from historical accounts that loko i'a can augment fish within estuaries, their role as a nursery ground that supplements surrounding fish populations and fisheries harvest (i.e., providing spillover) remains unstudied in current literature. This study aimed to test the extent to which loko i'a restoration can supplement fish populations and fisheries harvest both inside the loko i'a and in the surrounding waters. A food web model was constructed representing nutrients, phytoplankton, fish, and fisheries in three distinct habitats. The model, set in Kāne'ohe Bay revealed that there were interactive effects of the area under loko i'a management, bay fishing effort, and fish dispersal rates on fish density and fisheries harvest. We found that increasing the area under loko i'a management not only increased loko i'a fish density and fisheries harvest but also created the potential to supplement bay fish populations and fisheries harvest under certain scenarios. Our results support the idea that restoration of Indigenous aquaculture systems can positively impact conservation efforts and food security by increasing local fish availability, both through direct production and supplementation of surrounding fish stocks.

Species Distribution Modeling of Non-native Snappers (Lutjanus spp.) across the Hawaiian Archipelago

Presenter: **Maya Otsu** – Graduate – Marine Biology
M. S. Otsu, L. J. Tuttle Raz

The Bluestripe Snapper or Ta'ape (Lutjanus kasmira) and Blacktail Snapper or To'au (L. fulvus) were intentionally introduced to Hawai'i in the 1950s for fisheries enhancement. Now, they are commonly considered invasive, neither being targeted as a fishery. Both species are generalist predators of small fish, crustaceans, and invertebrates. Today, Ta'ape inhabit shallow to mesophotic depths (1-265 m) in relatively dense shoals (40 individuals/km2) as far as Manawai (Pearl and Hermes Atoll), 1300 miles northwest of Honolulu. To'au inhabit shallower waters (1-75 m) in lower densities (0.2 individuals/km2) as far as Lalo (French Frigate Shoals), 550 miles northwest of Honolulu. It is unclear what drives these differential distribution patterns, though they may be linked to environmental and biological variables such as temperature, salinity, and habitat. We are employing species distribution modeling with boosted regression trees to understand how environmental variables correlate and predict spatial distributions across temporal and spatial scales for these two snappers, and explore how patterns may shift with climate change. Species data will be derived from the National Oceanic and Atmospheric

Administration (NOAA) National Coral Reef Monitoring Program dataset, and abiotic data from NOAA's Environmental Data Summary and the Ocean Tipping Points Project. Studying drivers of differential distributions of these species is crucial, especially in the face of potential climate change-induced range shifts and further expansion into the Papahānaumokuākea Marine National Monument. Identifying factors that facilitate their success can provide insights into invasive species trophic interactions and management strategies to prevent their further spread.

Predicting Extinction Risk of Ray-Finned Fishes Not Assessed by the IUCN

Presenter: **MeiLin Precourt** – Undergraduate – School of Life Sciences
M. Precourt, M. Worsham

The class Actinopterygii is composed of ~34,000 species of ray-finned fishes found in virtually all aquatic habitats worldwide. Of these species, only ~19,000 species have been assigned an extinction risk by the International Union for Conservation of Nature (IUCN). According to the Convention on International Trade in Endangered Species, there are only 259 species that have some form of government protection, although there are 3496 species categorized as threatened by IUCN. Similar to terrestrial species, initial signs of a mass extinction event in fishes have been seen in recent years. Increased anthropogenic factors such as ocean acidification, plastic pollution, oil spills, over harvesting and other forms of human exploitation have been shown to contribute to declining fish biodiversity. The importance of ray-finned fishes' cannot be overstated, filling both crucial ecological roles within their environments, and economically important roles within our fisheries. The best chance we have of mitigating extinction risk is making well informed fisheries management decisions. Therefore, this project aims to use a machine learning model to estimate extinction risk for the species currently categorized as either Not Evaluated (NE) or Data Deficient (DD) by the IUCN. This model was trained using ecological, phenotypic and life history trait data for up to 18,798 species with evaluated extinction risk found worldwide. This project aims to contribute to identifying potentially vulnerable species worldwide to aid informed conservation management strategies.

Comparative Transcriptome Analysis of Vision-Related Genes in Snapping Shrimp

Presenter: **Jacquelyn Benson** – Undergraduate – Marine Biology
J. Benson

There is a significant knowledge gap in the molecular aspects of snapping shrimp vision. These crustaceans employ appendages to generate cavitation bubbles, necessitating an orbital hood for eye protection. Biologists assumed the orbital hood limited their vision, particularly in species forming mutualistic bonds. The prevailing hypothesis proposed that such partnerships, especially with goby fish known for exceptional vision, were formed due to the visual limitations of snapping shrimp. However, recent research challenges this notion, proposing that snapping shrimp possess the fastest sampling eyes among aquatic animals. Despite these findings, molecular investigations into their vision remain unexplored. This study aims to fill this gap by unraveling the color detection capabilities of snapping shrimp and exploring variations in opsin

expression between two ecologically distinct species. The objectives of this study will be met by sequencing transcriptomes from their eyes to analyze patterns of opsin expression. DNA barcoding will additionally be conducted to establish a comprehensive database of intertidal snapping shrimp species, enhancing the resources available for this project. The first species - Alpheus rapax - is native to Hawai'i and engages in mutualistic relationships with a goby fish. The second species, which will be identified through DNA barcoding, exists independently without any mutualistic associations. This approach promises insights into the diversity and expression of opsins and seeks to unveil the factors contributing to these mutualistic relationships.

Developing a DNA Barcode Reference Library for Hawaiian Elasmobranchs

Presenter: **Cameron Angulo** – Graduate – Marine Biology
C. Angulo

Many elasmobranchs are Critically Endangered, threatened, or vulnerable to extinction due to anthropogenic pressure. Environmental DNA (eDNA) poses an opportunity to detect highly mobile, elusive, or rare elasmobranch species as a conservation and management tool that is fast, efficient, and relatively cheap compared to traditional surveying methods. A primary limitation in eDNA metabarcoding is the availability of 'barcodes', complete and accurate reference sequence databases. Species detected without complete or accurate reference sequences are unassigned or misidentified and can bias interpretations of community compositions. Mitochondrial 12S primers are becoming the standard barcode locus for marine vertebrate metabarcoding studies, yet the reference databases remain relatively incomplete. There is a need for complete, accurate mitochondrial genome reference sequences for elasmobranch species and a regional database for Central Pacific species, to optimize eDNA biomonitoring. Regional databases limited to local taxa and excluding high sequence similarity non-native species can maximize identification of local species, providing higher assignment accuracy than global databases. Here I propose to sequence the mitochondrial genomes of 56 Hawaiian elasmobranch species from vouchered tissue samples, in support of a Hawaiian barcode database.

Impact of cryopreservation on collector urchin larvae's thermal tolerance

Presenter: **Charley Westbrook** – Graduate – Marine Biology
C. Westbrook

Due to the persistent threat of global climate change and the predictions of future sea surface temperature rise, I would like to investigate the interaction of these projected thermal regimes with the early larval development of the ecologically valuable collector urchin. Furthermore, I would like to find out how thermal stress may interact with artificial reproductive techniques (such as cryopreservation). Cryopreservation has long been a useful tool in livestock husbandry and agriculture, but the appeal of its versatility has expanded its applications to the management and conservation of wild species, as well. Cryoprotocols are even being developed for the research and aquaculture of marine species. However, little is known on the interactions of climate change with cryopreserved specimens. The collector urchin, Tripneustes

gratilla, could serve as a model organism to investigate the effect of cryopreservation on thermal resilience, by analyzing impacts on early larval developmental stages. Climate change models have predicted a global sea surface temperature increase by as much as 4oC by 2100 (IPCC 2013, 2014). By exposing collector urchin larvae to predicted future thermal regimes, development rates, morphological measurements and overall survival could be examined to elucidate the potential influence that temperature may have on the early ontogeny in this species. Additionally, comparisons between cryopreserved and non-cryopreserved offspring would provide valuable insight into the potential conditioning affects that cryopreservation may, or may not, have on urchin larvae, as it pertains to thermal stress.

The Pacific Islands Chapter of the American Fisheries Society: UH student subunit

Presenter: **McLean Worsham** – Graduate – School of Life Sciences
M. Precourt, D. Bartz, L. Engel, C. Vimond, M. Worsham

In the past year the Student Subunit of the Pacific Islands Chapter of the American Fisheries Society at the University of Hawai'i (UH Subunit) has been officially established. The UH Subunit's mission is to create a supportive and collaborative network of marine focused students, alumni and faculty across UH, and the Pacific Islands. In addition, the Subunit also has the following objectives: encourage communication and collaboration among members of the UH Subunit and the American Fisheries Society as a whole; promote education and awareness of fisheries and ecology topics; prepare members for careers within the fisheries field; incorporate hands-on experience to fisheries methods, research, academic and career opportunities; and foster engagement within the local community through service learning and educational outreach events, acting as stewards of the land, melding both traditional and western knowledge systems. Currently, we are recruiting student members for the newly established UH subunit. AFS was established in 1870, and has over 8000 members worldwide, making it the oldest and largest professional fisheries society in the world. AFS wears many hats in the fisheries world, taking an active role in policy and education/outreach, publishing several scientific journals, and holding workshops and conferences for like-minded early career professionals in fisheries. A unique opportunity for members will be the 154th AFS Annual Conference hosted in Honolulu, HI from Sept 15-19th, 2024. This will be the first time the annual conference has ever been hosted in Hawai'i or anywhere in the Pacific Islands.

Session 4 | Fishing for Knowledge: Navigating Fisheries from Reefs to Caves

Thursday April 11th at 9:00AM to 10:00AM

Loss of habitat complexity affects reef fish foraging behavior in Kāneʻohe Bay, Oʻahu, Hawaiʻi

Presenter: **Aimee Cook McNab** – Graduate – Marine Biology
A. C. McNab, A. Innes-Gold, J. Madin, E. Madin

The structural complexity of coral reefs is tightly linked with the health of reef fish communities. As stressors such as rising water temperatures and disease cause coral mortality and reduce reef benthic complexity, the impact of this loss of structure on associated reef fishes and their behavior remains unclear. In Hawaiʻi, herbivorous reef fish are particularly important both for ecosystem function and reef fisheries and depend on coral structure as their key habitat. This project aims to assess the effects of habitat complexity loss on fish community composition and herbivore foraging behavior using natural reef sites in Kāneʻohe Bay with varying levels of structural complexity. We used structure-from-motion (SfM) orthomosaics to calculate fractal dimensions to quantify the habitat complexity of each site. Snorkeler observations and remote video surveys assessed fish community composition and foraging behavior at each site using algal-baited feeding arrays. We found that at higher levels of complexity, the reef fish community diversity was site-dependent. Foraging behavior differed across fractal dimensions, with fish spending more time foraging away from the reef at lower levels of complexity. By comparing foraging behaviors across complexity levels, this study helps to elucidate the role that habitat complexity plays in shaping the grazing patterns of herbivorous fish on coral reefs. By increasing our understanding of how the key ecological function of herbivory may change under continued climate change, these results may aid in the development of conservation and management strategies for promoting the long-term sustainability of Hawaiʻi's coral reefs.

The influence of structural complexity on reef fish communities

Presenter: **Mollie Asbury** – Graduate – Marine Biology
M. Asbury, N. Schiettekatte, T. Kindinger, J. Madin

Reef fishes maintain many key coral reef functions and services. Interactions with their environment have the potential to mediate these processes. Specifically, habitat complexity can affect predator-prey interactions, competition, and resource availability across a range of spatial scales. Technological advancements have granted the ability to study different elements of complexity across large spatial extents. Leveraging these methods to introduce more specific quantifications of habitat complexity is needed to build upon our understanding of how the physical environment shapes reef fish communities and construct better linkages to predict ecosystem functioning. Across 89 sites in the main Hawaiian Islands, stationary point count surveys and structure-from-motion photogrammetry were conducted to estimate reef fish assemblages and three high-resolution measures of structural complexity: fractal dimension, rugosity, and height range. We investigated the influence of habitat structural complexity, environmental conditions, and anthropogenic pressures for determining biomass, diversity, and

functional composition of reef fish communities. Habitat complexity was the primary driver of reef fish biomass, but distribution of biomass between functional groups varied with specific elements of structure. Small fish biomass increased with fractal dimension while large fish biomass decreased. Meanwhile, the relationships between diet group and complexity reflected those we would expect when we consider individuals' food resources and benthic preference. Finally, functional diversity was driven by structural complexity, where rugosity drove functional richness and fractal dimension drove functional evenness. I will discuss possible mechanisms driving these patterns and how they provide insights into the functions and services that habitat complexity supports.

Metabolic impacts of marine heatwaves on striped mullet, Mugil cephalus and the kanda mullet, Osteomugil engeli

Presenter: **Jonathan Rosen** – Graduate – Marine Biology
J. Rosen, J. Johansen, D. Dicksion

Thermal stress driven by rising ocean temperature typically increases the metabolic and energetic demands of ectothermic marine organisms to maintain homeostasis while challenging the efficiency of oxygen uptake and energy processes3. The speed with which standard metabolic rate (SMR) rises across temperatures is seen as an indicator of thermal resilience or stress. Simultaneously, maximal metabolic rate (MMR) initially increases with temperature but eventually collapses at the upper limit of thermal tolerance for the species4. The absolute difference between SMR and MMR known as the aerobic scope denotes the metabolic energy available for critical functions such as foraging, swimming, reproduction, and growth and provides a metric for assessing evidence of thermal stress. This study will compare the likely effects of projected ocean warming conditions on the preferred temperature ranges, tolerance, and aerobic scope of the two mullet species found in Hawai‘i: native Striped mullet (Mugil cephalus, ‘ama’ama) and the invasive Marquesan mullet (Osteomugil engeli; kanda). Three treatment temperatures will be used to simulate heatwave conditions, ambient summer temperatures (27.5° C), and marine heatwave temperatures at +2° C (29.5° C) and +4° C (29.31° C)1. The effects of each temperature acclimation on juvenile mullet will be quantified with a shuttle box system measuring temperature preference range, CT-max measuring maximum temperature tolerance, and respirometry measuring parameters for aerobic scope through oxygen consumption. In Hawai‘i, native mullet are key species in traditional fish pond aquaculture and an important herbivorous nearshore species, understanding these physiological impacts will help guide decisions of our future fisheries.

~24 chromosomes and Actinopterygii, cause or coincidence?

Presenter: **McLean Worsham** – Graduate – School of Life Sciences
M. Worsham, R. Zenil-Ferguson, G. Cho, J. Kim

Actinopterygian fishes account for nearly half of all vertebrate species and are arguably the most phenotypically diverse vertebrate clade in earth’s history. Despite having an exceptionally broad range of haploid chromosome number, ranging from 6 to 223, most species have 23 to 25 haploid chromosomes. The constancy of chromosome number occurs in a multitude of distantly

related species which raises some interesting questions: namely, how did so many species come to have the same number of chromosomes, and has chromosome number affected diversification? To answer these questions, we estimated rates of chromosome number evolution (in particular, the rate of polyploidy and single chromosome number changes) across a large phylogeny of ~2,200 species. We found that the rate of polyploidy is slow although with high probability of being different than zero and that losing a single chromosome is faster than gaining a chromosome. In addition, we analyzed the effect that changes in chromosome number have on diversification rates and found that transitions in chromosome number are generally associated with slower net diversification. Finally, we showed that having ~24 haploid chromosomes could be linked to the diversification process by using a state-dependent diversification model. However, when we incorporated a hidden state-dependent diversification model it became clear that something other than chromosome number is driving diversification. We hypothesize that whatever trait this is must have arisen in an ancestor that had 24 chromosomes and that evolution away from 24 chromosomes is associated with loss of this trait and thus slowing of diversification rates.

Environmental DNA reveals hidden Hawaiian Agariciidae coral diversity

Presenter: **Cecile Vimond** – Graduate – Zoology
C. Vimond

Corals can exhibit considerable physical variation within-species which often obscures cryptic diversity and interspecific relationships using traditional, morphology-based methods. However, advances in molecular analysis have revolutionized coral systematics, exposing cryptic species assemblages among closely related taxa. Within the coral family Agariciidae, species exhibit unusual biogeographical patterns and extensive ranges, suggesting the presence of unrecognized species. Recent research using mitochondrial data from across the Indo-Pacific, including Hawai‘i, revealed cryptic taxa concealed among widespread species. Resolving such cryptic species complexes expands our understanding of speciation and ecological differentiation among sympatric relatives but requires accurate knowledge of species presence and distribution. In Hawai‘i, uncertainties persist regarding the number and distribution of shallow-water agaricids based on visual surveys, which likely underestimate local species diversity and mask ecological and biogeographic patterns in this group. To address this, the present study employed environmental DNA (eDNA) analysis to uncover hidden agaricid diversity and distribution patterns across shallow reefs in the Main Hawaiian Islands. Preliminary eDNA findings revealed the presence of at least eight distinct monophyletic agaricid clades within the Pavona genus, indicating potentially twice the species richness compared to visual estimates. Species diversity analyses across islands and sites show no differences in diversity between islands but indicate notable site-specific variability. These findings demonstrate that an eDNA approach can uncover cryptic agaricid species thereby providing insight into the distribution and diversity of these corals in shallow Hawaiian reefs. This research thus contributes to our understanding of coral diversity patterns across an isolated archipelago, critical for informing management and conservation efforts of coral reefs in Hawai‘i.

Session 5 | Under the Microscope: Unveiling the Enigmatic World of Invertebrates

Thursday April 11th at 10:45AM to 11:45AM

Hyper olfactory sensing may evolve through fluid-flow dynamics at the olfactory epithelium but not diversifying the olfactory receptor gene families in the blind cavefish

Presenter: **Natalie Choi** – School of Life Sciences
N. Choi, M. E. Lazzeroni, E. Rice, M. Nikaido, W. Warren, M. Yoshizawa

Olfactory abilities and the diversity of olfactory receptors (OR) have garnered strong research interests throughout genome evolution. A prevailing hypothesis posits a tradeoff between vision and olfaction, that is, the elaboration of the visual system negatively impacts OR diversification, as seen in primates versus other mammals. Our study investigates this phenomenon in a single species, Astyanax mexicanus (the Mexican tetra), consisting of the blind cave (cavefish) and sighted surface populations (surface fish). Previous studies have uncovered the remarkable olfactory sensitivity of amino acids (105 times higher) in cavefish compared to surface fish. Comparative genomic analysis between 1 surface and 3 independent cave populations revealed slightly smaller numbers of ORs (i.e., 159 vs. 142-148 ORs, respectively) and similar numbers of other olfactory receptor families, which declined the proposed hypothesis in Astyanax. To uncover the mechanism behind this hypersensitivity, our morphological study revealed (1) diversified numbers and sizes of the olfactory lamellae in cavefish, (2) indistinguishable cell densities of 4 major olfactory sensory neuron types among surface and cave populations, and (3) extensive motile cilia coverage on the olfactory lamellae in cavefish. Single-nucleus transcriptomes unveiled increased cell numbers in stem cells and ciliated cell clusters, but not the olfactory sensory neurons, suggesting that cilia may contribute more to hypersensitivity than the receptor. Our water flow tests in the olfactory pits demonstrated prolonged fluid retention within cavefish olfactory pits. Our findings indicate a novel possible mechanism for olfactory hypersensitivity through a surprisingly parsimonious evolutionary change.

Who Are You Calling A Shrimp? Evaluating Aggression, Boldness, and Behavioral Strategies in Invasive Stomatopods

Presenter: **Sophia Hanscom** – Graduate – Marine Biology
S. Hanscom, M. Porter

Animal behavior can have enormous ecological impacts on a species ability to invade new habitats and compete for resources. In particular, behavioral differences in traits such as aggression and boldness have been shown to play an important role in the interactions between native and invasive species. Previous studies have shown two behavioral strategies that contribute to the success of an invasive species: behavioral syndromes and the ability to learn. Stomatopods are marine crustaceans recognized for their spectacular visual systems and forceful raptorial appendage strikes. While behavioral comparisons have been made between stomatopod species through territorial contests, the differences in aggression or other

behavioral traits within a smasher species, specifically in the context of invasive species and success in a non-native range, have not been thoroughly studied. This study aims to characterize the boldness and aggression within and between individuals of the invasive stomatopod Gonodactylaceus falcatus to determine if learning ability or a behavioral syndrome is present, the behavioral variation within and between individuals of this species, and how these behaviors may affect intraspecific interactions. Following individual assessments of boldness and aggression, randomly selected pairs will be placed in territorial contests to analyze the impacts of individual behavioral traits on fighting sequence and contest outcome. Studying invasive individuals in multiple aspects of behavior will allow for inferences regarding their pathway to success and provide a repeatable experimental setup to test native species in the future to understand how the behavior of invasive species impacts its current sympatric native counterpart.

Effect of temperature on the utilization of endogenous reserves by Antarctic marine invertebrate embryos and larvae

Presenter: **Aaron Toh** – Graduate – Zoology
M. W. A. Toh, G. T. Lobert, A. L. Moran

A paradigm of Antarctic marine biology is that ectotherms in the Southern Ocean are highly sensitive to temperature change. Despite this understanding, the specific effects of temperature on the catabolism rate of endogenous egg energy remain poorly understood, particularly in the early stages of Antarctic invertebrates with lecithotrophic development. Higher temperatures may cause larvae to use more energy to complete development, affecting larval quality and survival. In this study, we characterized differences in utilization of endogenous reserves by embryos and larvae of two species of nudibranchs and two species of sea spiders collected in McMurdo, Antarctica, over four different temperatures. Single broods (sea spiders) or egg masses (nudibranchs) were collected from the field and divided into five subsets of embryos/larvae. One subset was immediately frozen at -80°C as a baseline, and others incubated at -1.8°C, -0.4°C, +1°C, and +4°C for two months before being frozen and transported to Hawai'i for proximal composition analysis. We found that all four species generally deplete phospholipids and proteins over early development. However, we also found an increase in phospholipid quantity in sea spider eggs reared at intermediate temperatures of -0.4°C and 1°C over the two-month period, suggesting that these stages can enhance their lipid reserves, a possible response to environmental temperature changes. We found no significant effect of temperature on protein depletion. We are currently assessing carbohydrate quantity and changes in total energy content over the development period, which will be presented at the Symposium.

Determining the expression patterns of ultraviolet opsins in Gonodactylaceus falcatus

Presenter: **Noah Doeden** – Graduate – Zoology
N. Doeden, M. Steck, M. Porter

Quantifying opsin expression patterns is essential for understanding how animals view the world. Opsins are a diverse group of light-detecting proteins typically associated with vision but can also appear in other parts of the body, including skin, brain, and nervous tissues. Stomatopod crustaceans have the greatest opsin diversity observed in the animal kingdom, including three ultraviolet-sensitive (UV) opsins; uv1, uv2, and uv3. Previous transcriptome work identified the same three UV opsins in both adult and larval stomatopods, despite inhabiting different environments, utilizing UV light for different functions, and completely reconstructing their retina between stages. This work unfortunately did not determine the UV opsin localization patterns in either life stage. Using a combination of reverse transcription (RT) PCR and immunohistochemistry (IHC), RNA expression and protein localization of the three UV opsins is being investigated in the eyes, head, and bodies of larval and adult Gonodactylaceus falcatus individuals. This is the first study to investigate UV opsin localization patterns across life stages and explore the role of UV opsins beyond the eye in stomatopods. Preliminary trials have found uv1, uv2, and uv3 present in multiple tissues both inside and outside of the eye. The presence of UV opsins outside of the eye implies a previously unexplored, secondary, nonvisual function.

Session 6 | Roots and Reclamation: Insights into Plant Dynamics from Hawai'i's Pastures to Caves

Thursday April 11th at 2:15PM to 3:00PM

From the pasture to present: the history of grass introductions in Hawai'i

Presenter: **Kevin Faccenda** – Graduate – Botany
K. Faccenda

Before European contact, natural grasslands covered relatively little of Hawai'i, with a grass flora composed of ~48 species, 40 of which are endemic. Following the proliferation of cattle ranches after the great mahele (land division) in the 1840s, it was quickly realized that the native grasses were not suitable for high intensity grazing, thus sparking the importation of "improved" pasture grasses. The importation of foreign grasses for forage accelerated dramatically in the early 1900s with the establishment of the Hawai'i Agriculture Experiment Station (HAES) on O'ahu by the United States government. The HAES imported seed, trialed grasses in introduction gardens, and distributed seed to ranchers across the islands. I performed a systematic review of literature produced by the HAES and similar organizations, newspapers, herbarium specimens, and floristic treatments to compile a record for the timeline of grass introductions and provide detailed historical context surrounding the introduction of these grasses. In total, 578 species of grasses were recorded to have been introduced after 1778, 158 of which were likely accidental introductions whereas 420 were deliberately imported. There are 232 species of grasses naturalized in Hawai'i, including 102 deliberately introduced and 130 were likely accidental. While deliberate introductions largely plateaued after 1970, new accidental introductions and some deliberate introductions with long lag periods continue to naturalize, with 30 newly naturalized grass species recorded between 2000 and 2023.

Monitoring the survival and performance of outplanted seedlings to inform coastal dune restoration

Presenter: **Amanda Jennings** – Graduate – School of Life Sciences
A. Jennings, P. Krushelnycky, S. Plentovich, K. Barton

Coastal dune ecosystems in Hawai'i foster unique biodiversity of culturally valued plants, native invertebrate pollinators, and nesting seabirds. Plants in this narrow habitat are presumably adapted to the stressful coastal conditions, but face threats of human disturbance and increasing salinity and drought under projected climate change. These pose challenges to restoration efforts that include outplanting seedlings into degraded and rehabilitated coastal dune sites. In a multi-site coastal dune restoration project on O'ahu, numerous native coastal species, including rare and endangered species, were outplanted throughout the 2023-24 rainy season. This study monitors outplant performance through regular surveys to document survival and growth. In addition, photosynthetic performance is investigated at a single site within Ka'ena Point State Park for mechanistic insights into species variability in survival and growth following outplanting. Preliminary results indicate considerable variability in survival and photosynthetic performance, with some evidence that low-lying species and those planted with lower exposure to trade winds carrying salt spray have higher survival rates. Continued

monitoring will inform restoration efforts to conserve these critical ecosystems under climate change.

Rooted in darkness: plant and rhizobial nutrient variation in Hawaiian cave ecosystems

Presenter: **Amir Van Gieson** – Graduate – Zoology
A. V. Gieson, M. Porter, M. Steck, A. Engel, R. Chong

The lava tube caves of Hawai‘i are home to an immense diversity of endemic cave-adapted arthropods which rely on “root galleries” that penetrate into caves. Hawai‘i’s most dominant forest tree, the native ‘ōhi‘a lehua (Metrosideros polymorpha), is suggested to be the primary species in these root galleries. However, recent surveys reveal a wider plant diversity that includes non-native taxa which has unclear implications for cave ecology and conservation management. And though rhizobiome (root microbiome) composition heavily influences root functional ecology, its role in root galleries is poorly understood. In light of Hawai‘i’s changing forests, particularly the spread of Rapid ‘Ōhi‘a Death and non-native taxa, understanding the functional ecology of plant and rhizobial diversity is crucial to informed management of cave ecosystems. In this study, we apply stable isotope ratios to compare root nutritional composition across the landscape and plant taxa. Our results reveal geographic variation while nitrogen ratios suggest nutritional composition may vary between M. polymorpha and other plant taxa. We also incorporate fungal and bacterial metabarcoding to characterize rhizobial diversity. Preliminary analyses suggest that microbial diversity varies geographically, potentially influenced by substrate age. Roots from younger lava flows retain diverse rhizobiomes while roots from older flows are less variable and dominated by few bacterial families, particularly acidophilic taxa. Multivariate analyses are currently underway to quantify core microbial communities and account for microbial nutrient contributions. Collectively, these results will allow for forest management above caves that is informed of the relationship between root communities and cave ecosystem functions.

Session 7 | Charting Change and Cultivating Connections: Insights from Pu‘uloa to He‘eia

Thursday April 11th at 3:10PM to 3:55PM

Using ArcGIS Tools to Analyze Land Use Change In Pu‘uloa

Presenter: **Allen Austin** – Undergraduate – Geography & Environment
A. Allen, E. Nalley

Ke awa lau o Pu‘uloa (Pearl Harbor) offers an example of how waterways, watersheds, and estuaries can accumulate contaminants. This project observes the changes in land use types and how contaminants may have been released into water systems. This project uses historic maps dating back to 1825 to examine land use changes. Using ESRI ArcGIS, the maps are downloaded and geo-referenced. Polygons were then created to record the four land use types of agriculture, urban, conservation, and military. If an area was labeled as a subcategory of a land use type, it was consolidated into the larger category. Throughout the translations, the polygons only reflected what is shown and didn’t assume the land use based on previous maps. Points of interest, which are labeled on the maps, are listed due to their significance in the area. The data is then shared as layer and shape files so they can be used for further research and community involvement. While analyzing these maps, many land use types and points of interest were consistent in locations where contamination could have been introduced. For example, sugar mills in ‘Aiea, Hālawa, and ‘Ewa were constructed as agricultural practices started in surrounding areas; these mills were often built near streams that drain into the Pearl Lochs. Polygons and data can be compared to show the changes that have occurred across periods. Using this approach, we can see the region develop and change as land uses are introduced.

Assessing the Impact of Historical Land Use on Pollutant Dynamics and Community Vulnerability in Pu‘uloa, Hawai‘i

Presenter: **Dingyi Liu** – Graduate – Urban and Regional Planning
D. Liu, E. Nalley

It is crucial to grasp how pollutants travel and build up within watersheds to build and maintain healthy coastal ecosystems and communities. Toxins introduced into the environment vary with different land uses. In the absence of comprehensive pollutant monitoring programs, understanding how land use history affects current pollution risks can help inform management and restoration strategies. In this project, we integrated maps spanning 200 years (1825-2023) to trace land use changes in Pu‘uloa (Pearl Harbor) on O‘ahu in Hawai‘i to assist in developing containment risk profiles. We observed a marked increase in agricultural land use following the United States annexation of Hawai‘i in the late 1890s, followed by a decrease before World War I due to military activities. Post-World War II, there was a resurgence in agriculture. Since Statehood in the late 1960s agricultural land significantly decreased due to urbanization. There are at least 28 documented chemicals, with arsenic emerging as an important risk, that are present in the area, and many of the contaminated spots are currently located in residential or commercial zones. We found that there are 8% more vulnerable populations in census tracts that have experienced chemical contamination, considering factors such as unemployment,

people of color, low income, limited English proficiency, those with less than high school education, children under age 5, and seniors over age 64. With the data being outdated or incomplete, we urge local and federal governments to support efforts in this area to document complete contamination profiles.

A case study from the He‘eia National Estuarine Research Reserve: Why do graduate students participate in biocultural restoration?

Presenter: **Olivia Boucher** – Graduate – Natural Resources and Environmental Management
O. Boucher, R. Dacks

The profound effects of engaging with nature are widely acknowledged, with a growing interest in the potential advantages associated with purposeful activities within natural settings, such as participation in environmental volunteerism. These impacts can be conceptualized as cultural ecosystem services (CES), encompassing the intangible benefits individuals gain from ecosystems, including a sense of connection to both people and place, that contribute to overall well-being. In the proposed study, semi-structured interviews will be conducted with graduate student volunteers involved in biocultural restoration projects in He‘eia, Hawai‘i and qualitatively analyzed to identify the nonmaterial benefits of biocultural restoration such as positive impacts on mental health, a heightened sense of place, and strengthened social connections. These benefits hold particular significance for graduate students, a demographic known to face mental health and well-being challenges. Moreover, graduate students comprise a population going through a time of academic growth as they develop into scientists and professionals. Participating in biocultural restoration could potentially enable co-prodduction of advancing research. The findings of this study will provide valuable guidance for integrating CES assessment into biocultural restoration monitoring, fulfilling a recognized need voiced by environmental stewardship groups in Hawai‘i. This approach may also facilitate effective communication of the comprehensive benefits associated with biocultural restoration, including its benefits to graduate students, to acknowledge the value of participation in academic contexts.

Session 8 | Moana Manaʻo: Exploring the Mysteries of Marine Megafauna

Friday April 12th at 9:00AM to 10:15AM

Comparing the underwater soundscape of the Hawaiian Islands Humpback Whale National Marine Sanctuary and potential influences of the COVID-19 pandemic

Presenter**: Brijonnay Madrigal** – Graduate – Marine Biology
B. C. Madrigal, A. Kügler, E. J. Zang, M. O. Lammers, L. T. Hatch

Passive acoustic monitoring is an effective technique for long-term monitoring of the soundscape in marine protected areas. Ocean noise is a key concern for the U.S. Office of National Marine Sanctuaries and has been identified as a research priority. The Sanctuary Soundscape Monitoring Project ("SanctSound") was implemented to support efforts to address ocean noise across seven U.S. sanctuaries using a comprehensive and standardized approach. In this study, acoustic recordings were collected in the Hawaiian Islands Humpback Whale National Marine Sanctuary during the humpback whale seasons (November-May) from 2018-2022. Data encompassed 14 deployments across four sites in the main Hawaiian Islands: Hawaiʻi, Maui, Oʻahu, and Kauaʻi. The soundscape was dominated by biological sources, most prominently the seasonal detection of humpback whale song. Third octave level monthly medians ranged from 70.4-105 dB re 1 µPa across sites with distinct peaks from January to April particularly at both Hawaiʻi and Maui sites. Overall, we reported relatively low vessel detection rates, with Maui having the highest daily average of vessel detections (x = 19.16). No COVID-19 impact could be observed acoustically using soundscape metrics which was likely due to the dominance of humpback whale chorusing. However, vessel detections and AIS data revealed a reduction in vessel activity after the onset of the pandemic at the Maui and Hawaiʻi sites. This study demonstrates that standardized metrics are a useful tool for obtaining long-term, baseline soundscape levels to understand the various contributions to the underwater soundscape and potential changes within marine protected areas in Hawaiʻi.

The energy dilemma: how might the energetic demands of false killer whales and reduced prey availability be contributing to fishery depredation rates

Presenter**: Jens Currie** – Graduate – Marine Biology
J. Currie, S. Stack, N. Imanishi, A. Fahlman, M. V. Aswegen, L. Bejder

The persistently low population size of the endangered Main Hawaiian Islands Insular distinct population segment of false killer whales, estimated at only 130-150 individuals since 2012, presents a critical conservation challenge. Concurrent threats, including bycatch in fishing gear and the depletion of large prey species, collectively impact the population's health and potential for recovery. Using drone morphometrics, we detected changes in body condition over a five-year period that revealed instances of nutritional stress and prompted an investigation into the metabolic expenses inherent to false killer whales. We utilized data from false killer whales in human care to quantify metabolic rates via respirometry and doubly labelled water techniques and extended our findings to their free-ranging counterparts in Hawaiʻi. We

estimated energetic expenditure across various activity states by applying movement data quantified by non-invasive tri-accelerometer inertia tags deployed on false killer whales in Hawai'i. Preliminary results suggest that sustained high swim speeds (3-5 m/s), movement patterns spanning over 100 km/day, and observations of high foraging rates indicate significant caloric need. This underscores the critical importance of sufficient prey to support the population's energetic demands. By understanding the energetic needs of false killer whales in conjunction with trends in commercial fisheries catch data of preferred prey, we can better understand whether the observed high depredation rates are driven by their substantial energetic demand. Such information will help advise on ongoing conflicts with fisheries and will be instrumental in formulating precise management strategies for the conservation of this endangered population.

Captive testing of magnetic and electromagnetic stimuli on tiger sharks (Galeocerdo cuvier)

Presenter: **Edward Cardona** – Graduate – Marine Biology
E. Cardona

Despite being predominantly non-fatal, shark-human interactions are becoming increasingly common leading to a growing interest in the development of shark deterrent technologies. Putative shark deterrents focus on the "over-stimulation" of the shark's sensory system, aiming to dissuade them from engaging in potentially harmful interactions for both themselves and humans. Unfortunately, most commercially available putative shark deterrents have not been independently validated and current research lacks testing on tiger sharks (Galeocerdo cuvier). This study aims to be the first independent rigorous testing of magnetic and electromagnetic putative shark deterrents on tiger sharks in captivity. The goal is to determine whether magnetic and electromagnetic stimuli are viable options for shark deterrents. We also examine how shark behavior varied over exposures (habituation), and whether it was consistent over a range of sexes, sizes and shark densities within the pen. We tested the effectiveness of one electromagnetic and two magnetic stimuli in both baited and unbaited scenarios. Individual sharks were subject to identical research protocols involving standardized feeding amounts, schedules and a pseudorandomized testing sequence. Quantitative data was extracted using various stereo imagery techniques and qualitative data was collected using a comprehensive behavioral ethogram. These results will allow resource users to make informed decisions about the use and suitability of commercially available putative shark deterrent products.

Inter- and intra-annual variation in humpback whale body condition on their Southeast Alaskan foraging grounds

Presenter: **Martin van Aswegen** – Graduate – Marine Biology
M. V Aswegen, A. Szabo, S. Atkinson, K. West, L. Bejder

In Southeast Alaska (SEAK), a principal foraging ground for North Pacific humpback whales (HW), declines in HW abundance, reproductive output, and calf survival were documented between 2013-2019. Understanding how HW health metrics vary naturally and in response to stressors is essential to better predict future population viability. Between 2019-2022, 868

drone flights were conducted to quantify inter- and intra-annual variation in HW body condition (BC) on their foraging grounds. 1965 measurements were taken from 845 identified individuals, partitioned into age and reproductive classes (calves, immature and mature whales of unknown sex and lactating females). BC was calculated from residuals of the linear relationship between body volume and length ($p<0.001$,$R2=0.89$). Lactating females consistently exhibited the lowest and most variable BC of all reproductive classes. Among lactating females, BC was significantly lower in 2021 (-9.23%,SE=4.2) and 2022 (-8.72%, SE=5.0) relative to other years (2019:5.02%; 2020:0.26%). For non-lactating adults, BC was significantly lower in 2021 (4.6%, SE=1.3) relative to 2019 (10.1%, SE=1.38), 2020 (12.4%,SE=1.43) and 2022 (10.5%,SE=1.06). BC generally improved throughout each four-month foraging season by 25% (SD=8.5), 9.9% (SD=8.0), and 13.9% (SD=6.9) among calves, immature and mature whales, respectively. Lactating female BC decreased by 2.2% over the 2021 season. These results likely reflect variability in environmental conditions and subsequent prey availability and suggest foraging conditions for whales were comparatively poor in 2021. Elucidating the complex interplay between HW BC (health), environmental conditions and prey dynamics offers insights into how HWs, as ocean sentinels, are responding to key stressors such as climate change.

Session 9 | Moana Mana'o: Exploring the Mysteries of Marine Megafauna

Friday April 12th at 10:30AM to 11:05AM

Elevating photo identification: Aerial identification of humpback whales

Presenter: **Lewis Evans** – Graduate – Marine Biology
L. Evans, M. V. Aswegen, S. Fienberg, L. Bejder

The capacity to monitor and identify changes within a population, such as distribution, abundance, demography, and residency times, is essential to assess the health of a population and implement effective management schemes. Photo identification is an effective tool used for capture-mark-recapture (CMR) models within cetacean studies. However, the ability to identify humpback whales (Megaptera novaeangliae) is contingent on capturing a photograph of the ventral fluke. This photograph can be used to access the individuals' profile on HappyWhale where sighting history, calving rates, and feeding ground fidelity can be assigned. Capturing a photograph of the fluke is difficult notoriously hard on humpback whale breeding grounds due to restricted energy budgets and shallow waters (42% of lactating female encounters result in an acquired fluke image (van Aswegen 2022, pers comm.)). This study implemented a novel technique utilizing aerial videography and partially automated recognition software (I3S Classic) to establish an identification database for lactating female and mature adult humpback whales. This method used cookiecutter shark (Isistius spp.) scarring and tubercle patterns captured from unmanned aerial systems (UAS) as identifying features. This study investigated if aerial videography and I3S Classic could increase the number of repeat sightings and assigned fluke IDs compared with traditional fluke photo identification. Our findings suggest that utilizing I3S Classic in conjunction with aerial videography can be used as an efficient tool to identify lactating female and adult humpback whales with an increase of 227% in lactating female resighting rates.

Harnessing 13 years of citizen science data to investigate the dynamics of reef manta ray aggregations in Kona, Hawaii

Prenter: **Corey R. Nevels** – Graduate – Marine Biology
C. R. Nevels

The reef manta ray (Mobula alfredi), experiencing global declines, highlights the urgent need for region-specific studies to strengthen conservation strategies. In Hawai'i, where they significantly contribute economically and ecologically, a lack of comprehensive data hinders effective population monitoring, especially in tourism-impacted areas. This research compiles thirteen years of community-reported sightings data from two high-use tourism sites and employs modeling techniques to advance our understanding of reef manta ray population dynamics off the Kona coast of Hawai'i Island with a comparison to earlier research (Clark 2010). The objectives include providing new insights into population structure, residency and movement patterns, and annual abundance estimates at year-round aggregation sites. Preliminary insights highlight shifts in residency and site usage, and long-term site fidelity up to 39 years, the longest reported for this species, indicating the critical need for targeted habitat protection and tourism

regulation to support proactive management. Additionally, a notable change in the demographic composition among the most resident individuals at one study site has been observed, suggesting shifts in this aggregation's characteristics. Harnessing 23,106 sightings from 200 contributors, this study showcases the value of citizen science, offering a comprehensive dataset that enhances our collective efforts in local manta ray conservation and supports informed policymaking. This research not only contributes to broader conservation efforts but also emphasizes the importance of community involvement in scientific research.

A seal's POV: Using biologging instruments to describe the underwater behavior of Hawaiian monk seals

Presenter: **Kirby Parnell** – Graduate – Marine Biology
K. Parnell, W. Gough, T. Mercer, M. Barbieri, S. Robinson, I. Charrier, L. Bejder

Animal-borne biologging instruments provide information on the fine-scale movement and behavior of free-ranging animals. For the endangered Hawaiian monk seal (HMS), Customized Animal Tracking Solutions (CATS) tags have been used to elucidate seal foraging and diving behavior, but their complex acoustic behavior, sonic environment, and responses to man-made sounds have remained largely unstudied. To understand this aspect of their at-sea behavior in more detail, we deployed CATS tags with hydrophones on two adult male HMS on O'ahu in January 2024. One tag was successfully retrieved and recorded over four days of continuous audio, 3D accelerometer data, and depth data, and approximately 8.5 hours of video data. This seal, R330 (known as "Squinty"), regularly performed foraging dives to subphotic depths with a max dive depth of over 400 m. This seal was also shown on video to wedge itself into underwater caves near Ka'ena Point and sleep for extended periods of time. The corresponding acoustic data is currently being processed and will provide insights into the underwater vocal behavior of HMS, as well as their sonic environment and behavioral responses to anthropogenic noise. Using this deployment as a proof of concept for the newest version of the CATS tag, we intend to deploy additional instruments on HMS to gain a broader understanding of their behavioral repertoire.

Monitoring marine mammals around wave energy devices – a Kaneohe Bay case study

Presenter: **Kyleigh Fertitta** – Graduate – Marine Biology
K. Fertitta, C. Lacey, K. Parnell, J. Haxel, M. Richlen, L. Bejder, A. Pacini

In the face of rising emissions and climate change, the White House has set a target of 80% renewable energy generation by 2030. Renewable energy devices most commonly utilize wind or solar energy to generate electricity, however wave and tidal energy devices are emerging as additional options. In order to comply with environmental federal regulations, a risk assessment is required for such devices. For marine mammals especially, risks can include entanglement or collision with devices, underwater noise, and habitat fragmentation. Limited data for the U.S. wave energy industry is currently available, and therefore data collected around operational devices is valuable for addressing data gaps and understanding potential environmental risks. This information is essential in informing permitting requirements for future developments and

can provide support for other wave energy testing initiatives. The Wave Energy Test Site, located in Kāneʻohe Bay on the windward side of Oʼahu, serves as a testing ground for various models of wave energy converters before their production and deployment. Additionally, it provides opportunities to collect data on the potential impact these devices have on marine mammal species. My master's project focuses on collecting such data through boat surveys and the application of static acoustics.

Modeling Coral, Macroalgae, and Turf Competition in Coral Reef Ecosystems

Presenter: **Nathan Fitzpatrick** – Graduate – Marine Biology
N. Fitzpatrick, L. C. McManus

Coral reef ecosystems face significant threats from environmental stressors, leading to shifts in benthic regimes from healthy, coral-dominated states to degraded, coral-depleted states. Understanding these transitions and their potential to constitute alternative stable states is crucial for effective management and conservation efforts. Previous work has demonstrated the ability of coral reef ecosystems to exhibit four distinct benthic regimes: coral dominance, turf dominance, crustose coralline algae dominance, and frondose-macroalgal dominance. However, current mechanistic models tend to exhibit regimes of only two taxa – macroalgae and coral – except in extreme cases. In this paper, we constructed a novel mechanistic model to explore the competition between three benthic taxa: coral, turf, and macroalgae by building upon the 2007 Mumby et al. model to better match empirical findings. Through simulations across the parameter space of our model, we demonstrated both the presence of alternative stable states and states of coexistence among all combinations of taxa. Furthermore, using a random forest regression model to conduct a sensitivity analysis, we identified macroalgal and turf algal growth rates as the primary determinants of relative dominance when coral growth and mortality rates were held constant. Browsing was the third most significant. Our findings highlight the criticality of considering complex interactions in coral reef ecosystems and demonstrate our model's ability to delineate regimes of coexistence and alternative stable states similar to those of coral reef ecosystems. As such, we posit our model as a simple theoretical framework for further explorations of the competitive dynamics of coral, macroalgae, and turf.

Session 10 | From Kai to ʻĀina: A Diverse Dive

Friday April 12th at 11:05AM to 11:45AM

Reliability of indirect environmental DNA assessments on coral reef diversity over time

Presenter: **Zoe Hill** – Undergraduate – School of Life Sciences
Z. Hill, P. Marko, P. Nichols

Coral reefs are among the most biodiverse ecosystems on Earth and play vital roles supporting marine communities, protecting coastlines, and providing economic benefits and food for millions of people. Similar to those in many tropical regions, coral reefs in Hawaiʻi face several major threats from human impacts. Therefore, effective conservation relies on more accurate, reliable, and sensitive monitoring methods to inform conservation decisions. While direct, visual assessments have been the predominant method of coral reef monitoring, they pose several logistical challenges. Indirect eDNA assessments are becoming more common for monitoring diversity and abundance because they have the advantage of detecting rare, elusive, and cryptic taxa. An important step in planning an eDNA project is the choice of PCR primers, as they have the potential to determine the specificity, sensitivity, and taxonomic coverage of the organisms of interest. This has led to knowledge gaps in the reliability of primers and in the ability of eDNA to capture accurate data over extended periods. This study aims to assess the reliability of eDNA inferences about coral community structure over time. Three widely used coral-specific markers (16S, 12S, and ITS2) will be used in eDNA samples at four sites on Oʻahu, from 2019-2021. I plan to statistically compare concordance among markers from different time points to monitor the accuracy of eDNA assessments. The results will establish baseline community structure, allowing detection of trends of decline and recovery, in turn prioritizing reefs for effective conservation interventions.

A Case Study of Nutritional Symbioses in Hawaiian Cixiids

Presenter: **Stefan Cranston** – Graduate – Zoology
S. Cranston

Evolutionarily rooted obligate nutritional endosymbioses have enabled many of Hawaiʻi's phytophagous arthropods to colonize novel ecological niches. The supplementation of essential nutrients by endosymbionts is differentially sustained in arthropod lineages inhabiting contrasting environments by way of selection and evolution. Planthoppers in the family Cixiidae have differentially retained Candidatus Sulcia muelleri, Ca.Vidania fulgoroidea, and Ca. Purcelliella pentastirinorum, provisioning essential nutrients to complement various plant sap diets. Hawaiian endemic cixiids in genera Oliarus and Iolania, contain two independently evolved cavernicolous (cave-adapted) lineages less than 500,000 years old found to co-occurr in lava tube caves. Cavernicolous Oliarus and Iolania species provide a comparative framework to study the evolution of nutritional symbioses in divergent hosts constrained to the same extreme cave environment, to test for functional convergence exhibited by endosymbionts from phylogenetically distant hosts. Iolania endosymbionts have yet to be identified. Due to the recent divergence of cavernicolous species from an epigean ancestors, the metabolic

requirements in a nutrient depauperate cave environment, and the genomic stability of endosymbionts; Sulcia, Vidania, and Purcelliella are hypothesized to be present in cavernicolous Iolania perkinsi as has been found in cavernicolous Oliarus polyphemus. Collectively, endosymbionts of a host should retain a similar set of biosynthesis capacities. Complete genome analyses of endosymbionts from epigean Iolania perkinsi and cavernicolous Iolania frankenstonei host species will be compared to Oliarus species, revealing the intricate evolutionary histories and trajectories of endosymbionts in Hawaiian Cixiids inhabiting surface and cave environments.

Pilot data helps design an eDNA tool for Hawaiian fishponds

Presenter: **Maryann Webb** – Graduate – Marine Biology
M. K. Webb, K. Viehl, V. Wishingrad, R. J. Toonen

Hawaiian loko i‘a (fishponds) have seen a resurgence in recent decades resulting in collaborations of traditional practices with western scientific advancements in pursuit of restoring and maintaining these aquaculture systems. Here we work to develop a method that combines environmental DNA analyses with abiotic factors to identify the important environmental drivers shaping biological communities within these ponds. Before the addition of abiotic factors, we conducted an initial test of eDNA collection and analysis techniques within a small percolation ditch adjacent to a larger fishpond complex on the windward side of O‘ahu, HI. We collected water from seven sites across the ~1000 m2 percolation ditch. We targeted four genetic markers, 12S, 18S, 28S and COI for our eDNA metabarcoding analysis, resulting in the identification of 27 phyla. A large proportion of 12S and COI reads were from the class Actinopteri (ray-finned fishes) across all sites. Five of seven sites had over half of the reads within the class Chlorophyta (green algae) for our 18S analysis. Finally, within 28S most reads were from the class Cryptophyceae (protist algae). Although certain species had greater representation via read abundance, ample diversity was detected across 12S, 18S, 28S and COI markers, with 29, 45, 30, and 15 families identified (respectively). This pilot study provided a snapshot of biodiversity for a pond of interest to resource managers and identified problem areas within our methodology that can be optimized before scaling up to a larger fishpond complex.

Investigating the utilization of phytoplankton produced dissolved organic matter by SAR11 bacteria

Presenter: **Kerri Luttrell** – Graduate – Marine Biology
K. Luttrell

The dissolved organic matter (DOM) pool is one of the oceans’ major carbon reservoirs. Marine microbes utilize this pool for nutrient recycling, reuse, and catabolism. Peligibacterales, a heterotrophic marine bacterium commonly known as SAR11, is one of the ocean’s most abundant organisms; followed closely by Prochlorococcus and Synechococcus cyanobacteria. These phytoplankton produce a significant amount of labile, dissolved organic matter (DOMp) that can fulfill some of the metabolic demands of SAR11 cells. Differences in DOMp composition has been tied to ecotypic diversity within cyanobacteria. While progress has been made in

defining cyanobacterial DOMp composition, few studies have extended their investigations to the utilization of specific DOMp compounds by heterotrophic bacteria, such as SAR11. Within the Pelibacterales order exist distinct phylogenetic subclades that appear to associate with different environmental conditions. Herein, I propose to study the differential utilization of Prochlorococcus and Synechococcus DOMp by diverse SAR11 strains to shed light on some of the ecological and evolutionary processes that impact ocean carbon cycling. I hypothesize that (1) the composition of DOMp produced by Synechococcus and Prochlorococcus strains will vary with phylogeny and location of isolation, (2) the utilization of DOMp and subsequent growth response will vary with SAR11 ecotypic diversity, and (3) DOMp production acts as a biotic influence on the development of SAR11 ecotypic differentiation, leading to SAR11 specialization on co-occurring DOMp sources.

Investigating the diversification of map turtles, Graptemys (Testudines, Emydidae) in the southeastern US

Presenter: **Karina Moreno** – Graduate – School of Life Sciences
K. Moreno, R. Thomson

In evolutionary and conservation biology we aim to understand what evolutionary processes drive and maintain biodiversity. Being able to identify these drivers of biodiversity is significant, especially for species that are declining due to habitat loss and anthropogenic threats. High levels of biodiversity have been observed to occur within geographic 'hotspots' for species. Species appear to radiate within these hotspots at much faster rates, obscuring species boundaries and posing challenges for investigating their evolutionary biology. The river systems of the southeastern US are a significant global biodiversity hotspot, where multiple radiations of diverse taxa (e.g. mollusks, fish, and turtles) have occurred. The map turtles (Genus Graptemys) are a clade of river endemics in the southeastern US, hypothesized to have allopatrically radiated into fifteen lineages within the last 1.5 million years. The recent radiation of this species, along with their long generation times and slow rates of molecular evolution makes this an ideal group to explore evolutionary processes of diversification. The objectives for this planned study are to resolve the species boundaries, patterns of gene flow, and diversification with Graptemys. We will use genomic data obtained from 278 specimens encompassing the geographic ranges of described species for downstream analyses. We will conduct phylogenomic analyses using these data to resolve the evolutionary relationships among Graptemys species. We will use population genomic methods to further investigate species boundaries and search for evidence of introgressive hybridization.

Session 11 | Under the Sea and Above: Fringe Reefs and Feathered Friends

Friday April 12th at 1:10PM to 2:25PM

Relative contributions of size and shape to coral demography

Presenter: **Guan-Yan Chen** – Graduate – Marine Biology
G. Y. Chen, L. C. McManus, T. Y. Fan, J. S. Madin

It has been 45 years since Hughes and Jackson (1980) suggested that size is a much better predictor than age. Since then, coral population models have been almost exclusively parameterized using colony size. However, colonies of similar size may exhibit different shapes, and shape holds ecological significance. This study employed Structure-from-Motion to create orthomosaics of coral reefs, tracking the changes of 796 Pocillopora acuta colonies in Kenting National Park, Taiwan over 3 years. We quantified the relationships between population demography (survival, growth, shrinkage, fusion, fission and proportional area change) and three morphological traits (size, circularity and perimeter/area ratio). Size and circularity are independent measures of morphology, while perimeter/area ratio captures size and shape in a single trait. The best models include both size and circularity for all modular processes except shrinkage, which is highly correlated with size. The size and circularity models also explained more variation than perimeter/area ratio models, demonstrating that both should be included independently in demographic modeling. Incorporating circularity significantly enhances predictions of survival and fission, with large and circular colonies tending towards survival, while large and irregular colonies are prone to fission. Considering circularity also improves predictions of proportional change, with smaller and circular colonies experiencing higher proportional change. However, all morphological traits show no significant relationship with fusion. Our results highlight the importance of considering both size and shape in demographic modeling. We hope that these insights result in the development of more accurate matrix population models and integral projection models for coral populations.

Mechanical vulnerability of Hawaiian coral reefs: adding to the conservation and restoration toolbox

Presenter: **Jon Ehrenberg** – Graduate – Marine Biology
J. Ehrenberg, J. Madin

The mechanical vulnerability of corals growing on a reef can determine how well the reef responds to hydrodynamic disturbances (i.e., abnormally strong waves or storms). In this study, relationships between colony size and the mechanical vulnerability of growth forms from three dominant Hawaiian coral genera were calculated. A range of different sized colonies, varying in growth form, from the three genera were laser-scanned to create 3D meshes. Mechanical vulnerability was estimated based on the shape of the colony scan and the hypothetical strength of attachment to the reef. Using structure from motion photogrammetry to capture large patches of reef, coral colonies from the same three coral genera with varying growth forms will be outlined to estimate colony sizes. The mechanical vulnerability of the outlined corals on the reef patches can then be estimated based on their size. Reef patches will likely differ

dramatically in the mechanical vulnerability due to the corals growing there. For example, reefs dominated by small colonies or bottom-heavy growth forms may be resistant to wave damage, while sheltered reef habitats could be more vulnerable. With the threat of more frequent severe wave and storm energy, a product of climate change, understanding the mechanical vulnerability of corals will be imperative to determine what the future of our coastlines may look like, serve to inform local communities and governments of vulnerable coastal areas, and assist in directing coral reef restoration and conservation efforts in Hawai‘i.

From Seabirds to Sewage: Investigating Nutrient Effects on Coral Bleaching

Presenter: **Jessica Glazner** – Graduate – Marine Biology
J. Glazner, M. Donahue, C. Nelson, C. Drury, C. Moreland-Ochoa, J. Berg, K. Falinksi

Local environmental conditions contribute to either the resilience or susceptibility of corals to the global stress of climate change. One such factor is the local nutrient input from terrestrial sources. Prior studies have indicated that corals around islands with abundant seabird populations may be more resilient to bleaching events, and it has been hypothesized that this is due to nutrient enrichment from seabird guano. In contrast, corals near human-populated islands can have high levels of anthropogenic nutrients entering the coastal environment via wastewater effluent, which can negatively affect coral health and survivorship. This experiment investigated corals' response to natural vs anthropogenic nutrient sources to disentangle their contrasting effects. Corals were exposed to one of four nutrient treatments: seabird guano, wastewater effluent, inorganic nutrients, or an ambient control. Half of the fragments were subjected to a simulated bleaching event after nutrient exposure. Coral growth rates, photosynthetic output and symbiont density measurements were taken to compare how each nutrient treatment affects the coral's response to increased water temperatures. Local managers can use these findings to implement targeted nutrient management strategies, bolstering reef resilience in the face of climate change.

Weaving Indigenous and Western Science in Shorebird Monitoring

Presenter: **Claire Atkins** – Graduate – Natural Resources and Environmental Management
C. Atkins, K. Kotubetey, H. Kawelo, L. Tibbitts, Y. M. Rii, K. Winter, M. R. Price

Migratory shorebirds are declining worldwide, with serious implications for social-ecological systems. Indigenous stewardship facilitates an ability to sustain abundant biocultural resources and could play a role in the recovery of migratory shorebirds. Our co-developed research wove Indigenous science methodologies with those of conventional science to understand patterns for five species of shorebirds who connect Hawai‘i with Arctic and Nearctic regions through their semi-annual migration: ‘Akekeke (Arenaria interpres); Hunakai (Calidris alba); Kioea (Numenius tahitiensis); Kōlea (Pluvialis fulva); ‘Ūlili (Tringa incana). A layered exploration of Indigenous observation methodologies from a loko i‘a (Hawaiian aquaculture system) and regional eBird data show (1) a regional decline in shorebird observations over the last 7 years; (2) discrepancies in oversummering patterns of juvenile shorebirds between datasets; (3) environmental characteristics that support rich assemblages of migratory shorebirds. Co-interpretation of data showed strong phenologies of seasonal anchor events and highlighted the

importance of local, long-term, and participatory observations. Our findings strengthen and inform stewardship, conservation, and management practices for shorebirds at both ends of the migratory pathway.

Investigating Factors of Understaffing for Natural Resource Management Agencies of Hawai‘i

Presenter: **Tatum Kauka** – Graduate – Natural Resources and Environmental Management
T. Kauka

Increased natural resource depletion has encouraged initiatives at various levels to better conserve, protect, and manage them. Unfortunately, these objectives are impossible to achieve in Hawai‘i due to current understaffing within natural resource management agencies. Public data reveals that excessive staff shortages are a large contributor of failure to meet sustainable goals. This project aims to better understand the factors affecting the understaffing crisis across natural resource management agencies of Hawai‘i. Primary sources reveal that there are roughly eight existing factors that affect understaffing in the workplace. An evaluation of each factor was performed using a perception survey amongst current and potential employee candidates for this field. A total of 132 survey responses were collected in which the data was analyzed. Through the analysis, a respondent data set was generated to separate respondents into groups based on their responses to demographic questions. Then a regression analysis was performed to evaluate the differences or similarities of groups' perceptions of the factors. Findings reveal that across all respondents, factors related to compensation and work environment were ranked as highly important, while factors such as career advancement and recognition were ranked as least important. Further results provide an understanding of the exact levels of importance for each factor and the correlation between groups' perceptions. Project outputs help to identify particular advantages or barriers that are adding to the understaffing crisis, which agencies may then target for improved retention and recruitment. These changes could enhance staffing and refine management operations in the near future.

Session 12 | Biodiversity Buzz: From Wai to Kai to Nalo Meli Maoli

Friday April 12th at 2:35PM to 3:05PM

A Mechanistic Framework to Predict Reef Ecosystem Outcomes Based on Sediment Concentration and Herbivorous Fish Community Composition

Presenter: **Jacob Snyder** – Graduate – Marine Biology
J. Snyder, K. Grellman, M. Soerensen, J. L. Johansen, L. C. McManus

Coral reefs contribute nearly $400 million/year to the local Hawaiian economy and possess great value in Indigenous Hawaiian identity and genealogy. Mitigating local stressors, notably sediment runoff, can improve the resilience of these economically and culturally relevant reefs in the near term. Despite sediment runoff's status as a primary contributor to coral decline and algal dominance, there is no clear mechanistic understanding of how to avert this sediment-mediated ecosystem decline. This study constructs a mechanistic framework to predict reef ecosystem outcomes based on sedimentation levels and herbivore community composition. Namely, we track the direct and indirect impacts of sediment runoff, the reduction of which is an effectual management target, on the fractional cover of coral, macroalgae, and epilithic algal matrix (EAM), as well as the biomass of herbivorous fish, a trophic guild responsible for preventing shifts from coral to algal dominance via algal foraging. Expanding upon a previous coral-algal competition model, this framework inputs data-driven rates (e.g., bite rates) and environmental metrics (e.g., sediment concentrations), making it a tractable tool to forecast the outcomes of vulnerable reef ecosystems globally. This investigation utilizes multiple runoff sites in Oʻahu, Hawaiʻi as a case study, leveraging preliminary field and lab data to parameterize the foraging responses of three herbivorous fish functional groups (grazers, scrapers, and browsers) to sediment runoff. Results suggest that ecosystem outcomes—including critical sedimentation thresholds that lead to rapid declines in coral cover and herbivorous fish biomass—are highly dependent on the herbivore functional groups present in the system.

Genetic Identifications of Pond-raised Tilapia Using Fin Clippings and Microsatellite DNA Genotyping

Presenter: **Alexander Nguyen** – Undergraduate – College of Tropical Agriculture and Human Resources
A. Nguyen

Objectives: Tilapia is a commonly farmed fish, able to accommodate limiting resources and living conditions. They are ideal for small farm aquaculture in pond rearing. Because of the limited population size and isolated farms, it is important to have accessible, cost effective, streamlined protocol for rapid and efficient assessment of Tilapia genetic diversity to mitigate genetic risks and disease vulnerabilities. Methods: Fin clipping of hundreds of fish can be harvested quickly with minimal trauma. DNA isolation can be done on alcohol preserved, refrigerated samples for DNA amplification with selectively optimized microsatellite DNA primers. Amplified DNA was carried through several rounds of amplifications and used in Genotyping-by-Sequencing (GBS) to look at microsatellite DNA patterns. Microsatellites possess unique tracts of repetitive DNA, such as short tandem repeats (STRs), forming patterns that

allow for DNA profiling. Closely related Tilapia specimen will exhibit similar loci of STRs while unrelated specimens are not likely to have the same STRs due to their high variability. GBS usage leverages lower cost and time savings as compared to whole genome sequencing methodology. Conclusion: This project is part of a larger study developing streamline protocols for accessible and efficient assessment of Tilapia genetic diversity. Maintaining genetic diversity would reduce the chance of accumulation of lethal mutations and increases the adaptive capacity of the Tilapia toward changing environmental condition or diseases. Thus, this protocol can serve as a template for other facilities to assist fish farmers in remote geographic regions.

Hylaeus in Hawai'i: Tracing Co-Extinction Through a United Genealogy of Place

Presenter: **Korey Wetherell** – Graduate – Geography and the Environment
K. Wetherell

Hawai'i, the world's most secluded island archipelago, stands as a battleground for biodiversity conservation within the United States. It hosts many threatened and endangered species, including the native Hawaiian Yellow-Faced Bee (Hylaeus), that play a vital role in plant reproduction and societal co-production within this unique ecological and cultural landscape. This research project explores the intricate web of relationships between Hylaeus, native Hawaiian ecosystems, and Indigenous knowledge and culture systems, recognizing the urgent need to address the impending threats of extinction facing both species and cultures. Through a mixed-methods approach and a cultural geography lens, this study seeks to document the decline of Hylaeus populations and amplify the voices of Native Hawaiians and their rich heritage of mo'olelo (stories) and place-based knowledge. Utilizing traditional Hawaiian place names, particularly ahupua'a, I aim to situate Hylaeus within the broader context of Hawaiian culture, history, and genealogy, uncovering hidden narratives and reinforcing the importance of these pollinators within the fabric of Hawaiian society. Ultimately, this research aims to shed light on the interconnectedness between the decline of Hylaeus populations and the erosion of Indigenous knowledge systems and biodiversity in Hawai'i and beyond. By recognizing the shared risks of co-extinction faced by Hylaeus and Native Hawaiian communities, I seek to prompt a paradigm shift in understanding extinction dynamics and the lack of attention given to loss of this nature, rooted in respect for both the human and more-than-human world, offering crucial insights into the broader implications of species loss and cultural decline.

Investigation of the photobiology of an endemic Hawaiian octocoral: Sarcothelia edmondsoni

Presenter: **Erika M. Cabell** – Graduate – Marine Biology
E. M. Cabell

Coral reef ecosystems are increasingly threatened by coral bleaching, a breakdown in the symbiosis between coral hosts and their algal endosymbionts that may result in coral mortality and reduced reef resilience. However, the Hawaiian endemic octocoral, Sarcothelia edmondsoni, has demonstrated resistance to stress. Moroever, it has exhibited opportunistic behavior by colonizing degraded reefs. This species is characterized by two distinct morphologies: the blue morph and the brown morph. These morphs occupy different habitat

regimes, and consequently different light environments. As the availability and quality of light are widely known to influence the distribution, morphology, and physiology of corals, this study investigated the influence of irradiance and thermal stress on this endemic's photophysiology. Using Pulse-Amplitude-Modulated (PAM) fluorometry and reflectance spectrophotometry, the photosynthetic potential of each morph was quantified. Additionally, this study seeks to document the expression of photosynthetic pigments from the symbiont, or fluorescent pigments from the host.

Poster Session

Thursday April 11th at 4:00PM to 6:00PM
Marine Science Building Lanai

Protective Effects of FOXO3 Gene Longevity and Resilience Associated Variants in Aging Related Diseases

Lovina Abdi – Graduate – Anatomy, Biochemistry and Physiology
L. Abdi, R. Allsopp, G. Lockwood, D. L. Couteur

The Forkhead box O3 (FOXO3) gene has emerged as a key player in the regulation of aging and longevity. This abstract provides a concise overview of recent studies conducted within the CHAMP (The Concord Health and Ageing in Men Project) cohort, University of Sydney, in collaboration with JABSOM University of Hawaii, where we will focus on the longevity and resilience associated genetic variants of FOXO3 and their potential implications for longevity within the CHAMP cohort. The CHAMP cohort, comprising an Australian population of men over the age of 70, serves as a very good platform for investigating the genetic determinants of healthy aging. Our research within the CHAMP cohort plans to replicate and expand on longevity associated FOXO3 variants, first identified here in Hawaii, and their association with increased lifespan and improved healthspan, such as decreased risk of age-related diseases. Previous findings by Kuakini Medical Center, University of Hawaii and multiple other labs around the world have underscored the importance of FOXO3 in the molecular pathways governing longevity. Lifestyle factors, such as diet, exercise, and stress management, have been previously explored in conjunction with FOXO3 genotypes to assess their collective impact on aging trajectories, however, further work needs to be done to better understand the impact of FOXO3 on healthy aging and longevity in humans. The CHAMP cohort study started in 2005 at the University of Sydney at the Concord Hospital where data from 1705 men were collected. Four follow up assessments were done to assess physical performance, cognitive function, blood test and medication inventory in these patients. The CHAMP studies also focus on the health trajectories of older men, which can help examine potential determinants of mortality. CHAMP research has led to publications on a broad range of ageing and geriatric health issues, especially frailty, reproductive hormones, osteoporosis, and medication. In conclusion, the studies we plan to conduct in the CHAMP cohort should provide valuable insights into the role of the longevity associated FOXO3 genetic variants with respect to effect on longevity and healthy aging. Understanding the intricate relationships between genetic predispositions and environmental factors can pave the way for personalized interventions aimed at promoting longevity and preventing age-related diseases. The goals presented here are expected to contribute to the growing body of knowledge surrounding FOXO3 and its potential as a target for interventions aimed at enhancing the quality of life in aging populations.

Assessing the Population Genetics of Leptastrea purpurea, Clusters of Thermally Resilient Coral in Kāneʻohe Bay, Hawaiʻi

Tyra Arends – Undergraduate – Global Environmental Science
T. Arends, C. Lewis, C. Suhoki, C. Bardin, R. Toonen

Leptastrea purpurea is an encrusting coral shown to be resilient to increased ocean temperatures and acidification that is widely distributed across the Indo-Pacific, yet understudied. Leptastrea purpurea is often found in clusters with multiple small colonies grouped closely. This grouping could be explained by the reproductive nature of L. purpurea as it is a brooding coral, and larvae are known to settle close to the parent colony. Alternatively, the formation of clusters of L. purpurea could be a result of selective larvae settlement due to environmental constraints. As global sea temperatures continue to rise, the need to study resilient corals such as L. purpurea increases. In this study we used 2bRADseq to investigate the genetic relationship between individual colonies, and colonies within clusters of L. purpurea in Kāneʻohe Bay, Oʻahu, Hawaiʻi. We hypothesize that low distance dispersals relate to highly structured populations on a reef-by-reef scale, as well as across a ~2 km distance. This study offers valuable insights into the biology of this understudied species, and enhances our capacity to utilize L. purpurea in restoration and conservation.

Sea Level Rise Exposure of Cultural Sites in Koʻolaupoko

Sarah Blichfeldt – Undergraduate – School of Ocean and Earth Science and Technology
S. Blichfeldt "

Around the world, there are many cultural sites located along the coast. These sites have and will be impacted by rising sea levels. Many will be impacted and many will be lost. For many colonized societies, these sites are the last of the indigenous community and their way of life. They showcase each place's unique identity and history. In Hawaiʻi, many of the most important cultural heritage sites are located along the coast. And currently, the physical impacts of sea level rise in the Koʻolaupoko district on the east side of Oʻahu are being thoroughly researched and modeled by the Climate Resilience Collaborative. However, in this region and throughout the Hawaiian islands, not much research has been conducted specifically about the exposure of Hawaiian Cultural Sites to sea level rise. This is done by overlaying a Hawaiian Cultural Site GIS Layer with Wave, Erosion, Groundwater, and Hydrostatic Flooding Layers from the Koʻolaupoko MIRR onto a map of the district. As each layer highlights the affected area from that variable, the exposed sites will be revealed through overlap with one or more of the other layers and the sites. The poster will display the website viewer for these layers along with a map of the located Hawaiian Cultural Sites. It will also include examples of the Hawaiian Cultural Sites that are being looked at. This research is intended to inform decision makers and caretakers for these sites about the future exposure of these sites to ensure timely adaptation.

How a Floating Upwelling System Impacts Oyster Growth Rates at He'eia Pond

Jacqueline Clem – Undergraduate – School of Ocean and Earth Science and Technology
J. Clem

Aquaculture in Hawai'i has played an essential role in supplying local populations with the food needed to thrive. Historically, fishponds have been highly productive resources that help fill this necessity. In recent years, fishponds in Hawai'i have aimed to return to their roots of providing food for local communities, improving the quality of the ponds, and re-establishing native species populations. He'eia Pond is working to accomplish all three goals through the growth and production of the Hawaiian Oyster, Dendostrea sandvicensis, and the Pacific Oyster, Crassostrea gigas. However, a challenge this pond faces is the slow-growing nature of oyster spat, which can often lead to higher mortality rates. Therefore, through a floating upwelling system (FLUPSY), juvenile oysters can grow more rapidly, allowing fishponds to achieve their goals faster and with greater success. It has been shown in other regions that oysters respond well to upwelling and, as a result, grow more quickly. The production of oysters can allow He'eia Pond to filter water, re-establish the Hawaiian Oyster populations, and provide an additional food source for the community. The results of this study show that both Hawaiian and Pacific Oysters grow significantly quicker in a FLUPSY than they would if they were grown using a more typical method, which is via hanging baskets. These results highlight how beneficial a FLUPSY can be, even for small-scale oyster production. Additionally, it helps open the door for other ponds to implement the same or similar device if they wish to expand to oyster production.

Selenomethionine and Selenite Modulates Lipid Species in Mouse White Adipose Tissue

Kayla Colaruotolo – Graduate – Department of Cell and Molecular Biology
K. Colaruotolo, B. Shimada, N. Alfulaij, J. Yew, L. Seale

The micronutrient selenium (Se), vital for protection against oxidative stress and metabolism regulation, has been suggested to participate in lipid accumulation in white adipose tissue (WAT) when present in excessive amounts. Dietary Se occurs mainly as organic selenomethionine (SeMet) and inorganic selenite. We have previously shown differing effects of SeMet and selenite on body weight and oxidative capacity. Nevertheless, it is unclear how dietary Se forms influences white adipocyte growth, including size, number, and lipid composition, within WAT depots. We used a mouse model of Se-dependent obesity, the selenocysteine lyase (Scly) knockout (KO), to characterize the predominant lipid species in WAT adipocytes upon a SeMet or selenite diet. Methods: Wild-type (WT) and Scly KO male and female mice were fed low (0.08 ppm) or adequate (0.2 ppm) SeMet/selenite diets for 8 weeks. Afterwards, inguinal WAT tissue was collected for lipidomics analysis. Lipids were extracted from the WAT tissue using a chloroform-methanol method, followed by lipid separation using LC-MC to identify alterations induced by different diet concentrations. Results: WAT lipid species of the WT and Scly KO mice were unchanged by either the SeMet or selenite diets, except for a significant increase in stearic acid and palmitic acid levels in the low SeMet diet in both genotypes and a significant increase in myristic acid levels in the low selenite diet. Conclusion:

Our study shows that feeding SeMet and selenite have minimal impact on lipid composition within WAT depots during obesity development; however, selenomethionine impacts stearic acid and palmitic acid while selenite impacts myristic acid levels.

The Carbon Benefits of Restoring Invasive Forests to Native Agroforests in Hawai'i

Hugh Donlon – Undergraduate – School of Ocean and Earth Science and Technology
H. Donlon, T. Ticktin, L. Bremer

Carbon is the essential building block of life and can be found in corse woody debris (sticks), as well as the above-ground stalks of the trees. Having available carbon in the soil and as woody debris can help other portions of the ecosystem thrive. However, invasive forest may contain less carbon in their soil and stalks than native plants as invasive plants interact with soil differently. Therefore to gain an understanding of how large the variation in carbon maybe, invasive forest plots can be measured and compared to restored forests. Pu'ulani Agroforest is a restored forest plot in He'eia where native food trees are the focus of the restoration. Carbon measurements were taken using above ground methods. The measurements were made by collecting and weighing the leaf litter samples, while using allometric equations to determine carbon in stalks. Allometric equations use the diameter at breast height, (DBH) to help determine wood density and carbon content. The control plot serves as the invasive forest using the same methods. The restored forest will utilize more carbon in the structure of the forest through leaf litter and corse woody debris.

Large-Scale Weather Patterns Leading to the Maui Wildfire

Kyra Dyer – Undergraduate – Department of Oceanography
K. Dyer

This poster explores the influence of large-scale weather patterns on the occurrence of the Maui wildfires that occurred on August 8th, 2023, emphasizing their significance in the understanding and mitigation of the impacts of such events. By examining factors like high strong trade winds, dry air advection from the west coast, and Hurricane Dora this project sheds light on the complex factors that shaped the wildfire. Through this analysis, insights are gained into the role of large-scale weather patterns inflaming wildfire risk throughout the Hawaiian Islands, providing valuable information and guidance for future preparedness and response efforts.

The Ocean's cobalt cycle and its correlations with other metals

Stephanie Gonzales Briones – Undergraduate – School of Ocean and Earth Science and Technology
S. G. Briones

Cobalt cycling in the oceans can be detected with different concentrations which can be influenced by the metal that is found along with it. Cobalt concentrations for over 100 samples from the Tara ocean expedition have been measured across the global ocean. I focus on four

regions North Pacific, South Pacific, West Pacific and North Atlantic that demonstrate how different areas and other metals can trace the cobalt cycle in the ocean. Cobalt exhibits similar behavior to phosphate and manganese when they are present.

Impacts of Jet Fuel on Groundwater Microbes in O‘ahu

Skye Inn – Undergraduate – Oceanography
S. Inn

Petroleum and petroleum-derived product contamination, also known as hydrocarbon contamination, has been a significant environmental issue for decades. In November 2021, the Red Hill Bulk Fuel Storage Facility on O‘ahu spilled 19,000 gallons of diesel jet fuel (JP-5) into the Red Hill drinking water shaft, contaminating the groundwater aquifer it draws from. However, due to limited knowledge of hydrocarbon contamination in the context of O‘ahu’s aquifers, it is unknown how microbial communities in groundwater ecosystems can facilitate the degradation of petroleum products. Therefore, we performed an experiment focused on quantifying the shifts and changes of microbial communities in the presence of JP-5. For 28 days, groundwater was incubated with JP-5, and samples for scanning excitation-emission fluorescence spectroscopy, flow cytometry, dissolved organic carbon (DOC), and microbial community profiling were collected. Fluorescence spectroscopy and flow cytometry measurements allowed for the analysis of microbial growth and fluorescent dissolved organic matter compositional changes while DOC and DNA allowed for the analysis of JP-5 consumption and microbial community compositional changes. Results included a significant growth of microbes in the presence of fuel as well as the domination of a singular microbe within the community, Novosphingobium (Class Alphaproteobacteria, Family Sphingomonadaceae). Throughout the experiment, DOC decreased, indicating that the microbes were consuming and respiring the diesel. While additional research would be necessary to further analyze the chemical composition of JP-5 as it biodegrades, from this experiment, we can infer that aquifers on O‘ahu can be a valuable source of bacterial bioremediation for future hydrocarbon contamination events.

A Review and Comparison of Different Fecal Indicator Microorganisms for their Effectiveness in Predicting Waterborne Disease

Zachary Loo – Undergraduate – Global Environmental Science
Z. Loo, Y. Lu

Water is essential to all forms of life and there are many efforts to keep the water we use for drinking, washing dishes, showering, etc. clean and suitable for everyday use. Additionally, waterborne diseases pose a global threat due to fecal contamination of water sources. One widely used method to test water quality is the collection and detection of fecal microorganisms in wastewater. However, uncertainties persist regarding the comparative effectiveness of these indicators. This knowledge gap poses a substantial challenge in precisely predicting and preventing waterborne disease, a significant burden on public health. Water quality assessments rely heavily on these indicators as proxies, therefore, this study comparatively evaluates the efficacy of Escherichia coli (E. coli) and Enterococcus in predicting waterborne

diseases. Water quality and public health data will be collected from numerous repositories and compiled into a comprehensive dataset. The goal is to find a correlation of whether one indicator is 'better' than the other. A logistic regression, and potentially other common statistical methods, will be used to predict disease rates. This research systematically analyzes the performance of these indicators and through rigorous statistical analysis, we anticipate identifying the most effective indicator, providing crucial insights to contribute to the improvement of global water quality management.

Comparing Manual and Convolutional Neural Network Taxonomic Classifications in the North Pacific Subtropical Region

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Understanding the dynamics of planktonic organisms within the North Pacific Subtropical Gyre (NPSG) is crucial for comprehending its ecological significance. This study explores the importance of the Imaging FlowCytoBot (IFCB) in classifying taxa within the NPSG. The IFCB facilitates the monitoring and documentation of algal blooms, which play a vital role in nitrogen cycling and carbon regulation within the NPSG ecosystem. To efficiently analyze the vast dataset produced by the IFCB, Convolutional Neural Networks (CNNs) are employed for image classification, enhancing the speed of taxonomic sorting. This paper quantifies the performance of CNNs compared to manual annotations, focusing on two taxa, Hemiaulus and Ciliophora, during the PARAGON 1 expedition. The training set is composed of images from various research cruises that took place within the NPSG, including PARAGON 1, to provide various time periods of IFCB data in the region. Metrics derived from CNN classifiers provide insights into the effectiveness of automated classification over time, shedding light on the variability of taxa such as Hemiaulus and the unique sub-categories within Ciliophora. Manual annotations, facilitated by the Ecotaxa platform, ensure the accuracy of taxonomic classifications, further enhancing the reliability of the analysis. Overall, this study highlights the significance of employing advanced technologies like the IFCB and CNNs in plankton research, contributing to a more comprehensive understanding of marine ecosystems and their ecological dynamics.

Comparison of Reproductive Success in Tripneustes Gratilla Around Oʻahu

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Sea urchins are often regarded as an indicator species, meaning that their fertility and reproductive success can be used as a metric for water quality. The Environmental Protection Agency utilizes this in a protocol comparing water quality samples using the fertilization rate of urchin gametes. A previous study conducted at Moku o Loʻe sought to use this protocol to compare water quality of sites within Kāneʻohe Bay using hāwaʻe maoli (Tripneustes gratilla/Collector Urchin). However, this study revealed the potential for broader comparisons of fertilization rate of Collector Urchins from different areas of Oʻahu- especially between fertilization crosses of urchins from two different locations. In this study, four locations:

Kāneʻohe Bay Patch Reefs, Kāneʻohe Bay Sampan Channel, Kahe Point and Kahanamoku Beach were used to compare. As a result of data from the previous study, fertilization rates were assessed from fertilization crosses of urchins from the same location, as well as fertilization crosses of urchins from different locations. It was revealed that the clearest comparison of the results compared fertilization success by location of the male urchins. Fertilization rates are as follows: Kāneʻohe Bay Patch Reefs - 54.4%, Kāneʻohe Bay Sampan Channel- 73.8%, Kahe Point- 67.2% and Kahanamoku Beach- 78.8%. At 54.4%, urchins from Kāneʻohe Bay Patch Reefs had a significantly lower fertilization rate than any other location. Given the unique characteristics of this location, including lower water turnover rates, it is possible that these urchins are subjected to lower water quality. Further research is needed to determine why urchins from Kāneʻohe Bay Patch Reefs consistently yield lower rates of fertilization.

The effect of Damselfish territorial behavior on the movement patterns of heterospecific fishes on a coral reef

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E. Sena

Coral reef fishes often exhibit high competition for space and resources, which can affect their behavior and movement in the environment. One group of fish known for their competitive behavior are the algal farming damselfish (Stegastes spp.), which affect the movement of heterospecifics on coral reefs through the aggressive defense of their algal “farms”. This project aims to study the territorial behavior of Stegastes nigricans (dusky farmerfish) using video analysis from S. nigricans territories on a coral reef off Varari, a township in Moorea, French Polynesia. Data is collected on the type of territorial behavior (classified into 6 categories: 3 aggressive, 3 non-aggressive) in conjunction with the identity of intruding fish species. Results from this project will allow for an understanding of which group of fish the damselfish exhibit more territorial behavior toward, such as competing herbivores or species known to prey on damselfish eggs. The hindrance of access to areas on a coral reef imposed by S. nigricans on other reef fish may also have larger-scale impacts such as shifts in local biodiversity or alteration of the benthic community. These findings will support an increased understanding of the patterns of territorial behavior of S. nigricans and help to create a clearer picture of how the community structure on a coral reef habitat is mediated by its inhabitants.

Chemical Analysis of Rain and Stream Water of a Catchment in Mānoa, Hawaiʻi

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Understanding the relationship between precipitation and stream water is essential in identifying potential sources of pollution. Identifying the source is important to understand where the water in rainfall travels to, whether that be leached into groundwater or transported through surface runoff. Correlation plots were used to compare ions against each other. Precipitation and stream water chemistry has been widely studied across the continental United States but little or no research exists regarding a tropical catchment system and the complex

relationship that this system might have. Therefore, rainwater and streamwater samples were collected weekly and analyzed using Ion Chromatography to find the concentration (mg/L) of each major ion in the sample. The analysis of precipitation and stream water in a tropical climate can add to the understanding of water quality and which processes contribute the most to meeting those standards. Chloride and sodium were determined to be in abundance compared to other ions in both rain and stream water samples, leading to the assumption that the rainwater was mostly sourced from marine aerosols. The comparison between rainwater and stream water can identify potential hazards that can impact long-term water quality and can pinpoint techniques for preventing those hazards from occurring. This study has analyzed the unique chemical interactions that occur in a tropical catchment system and underscores the critical role of rainfall and streamwater interactions and their influence on water quality.

Iron and Cobalt Limitation in Atlantic Prochlorococcus

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Prochlorococcus is an abundant marine microorganism playing a vital role in the Earth's carbon cycle and therefore climate. A large portion of the ocean's phytoplankton populations are limited by various trace metals such as iron and cobalt. Limiting nutrients in an environment determines the size a population can reach before there are not enough resources to sustain more growth. Future climate change will likely alter ocean circulation and supply of trace metals to the surface ocean, and may impact Prochlorococcus populations, which can affect marine food webs. Therefore, we performed culturing experiments to understand the growth and decay of Prochlorococcus in a lab environment with changes in levels of iron and cobalt.

Quantifying Active Carbon Flux from Krill Respiration in the Clarion-Clipperton Zone

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Many different processes in the ocean work together to create a steady state environment that supports the food web. One of which is carbon storage. The process of moving carbon from the atmosphere into the ocean is called carbon flux. This process has two main components, active flux and passive flux. Passive flux is only considering non-living matter such as dead flesh, and waste. However, active flux includes the process of respiration. The Clarion Clipperton Fracture mining zone falls directly below an oxygen minimum Zone (OMZ). Krill are organisms that travel at night through the OMZ to the feed and avoid predators. During krill migration their metabolism burns through the phytoplankton they consumed respiring the excess dissolved carbon, therefore, contributing to active carbon flux. This paper aims to quantify the amount of active flux that krill contribute to total carbon flux in this OMZ. There have been similar studies done, but none in an OMZ. This study helps demonstrate the larger role types of micronekton have on storing carbon through respiration. The data can also be compared to other forms of carbon flux to show the contribution krill makes to total active carbon flux. Within mining zones,

massive sediment plumes are released in the mid water column. If these organisms are suffocated by mid water column sediment plumes from mining, that amount of respired carbon will stay in the atmosphere and not be stored.

ZooScanning the CCZ

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Zooplankton, small animals that inhabit the water column, are the dominant secondary producers of the global ocean. They serve several important roles in food web dynamics and ecosystem function but may be at risk due to the emerging industry of deep-sea mining of polymetallic nodules. This project examines deep-sea plankton within the Clarion Clipperton Zone (CCZ), a region of the eastern tropical Pacific (ETP) that is rich in polymetallic nodules, as part of a baseline survey of ecosystem function prior to mining impact. Samples were collected over the NORI-D exploration mining claim using a 1m2 Multiple Opening and Closing Net and Environmental Sensing System (MOCNESS) to obtain depth-stratified material. Zooplankton abundance was highest in the near surface (upper 100m) compared to the midwater oxygen minimum zone (OMZ) (100-700m) as well as below the OMZ (>700m). At the collector test area (CTA) site, significant seasonality was observed only within the core of the OMZ in the small and large size fractions, with higher zooplankton abundance in spring. These site-specific differences in the strength of seasonality may have been due to higher oxygen concentrations in the upper portion of the OMZ during spring (100-300 m). This study will provide some of the first information on zooplankton community structure in the Eastern Tropical Pacific, as well as seasonality in the mid-trophic levels in this region.

Thank you for another great year of showcasing student research!

Dani B., Dani E., & Kapono