39th Annual Albert L. Tester Memorial Symposium
March 12 - 14, 2014

“Ridge to Reef, Native Hawai‘i” by Melissa Wright
Thanks to our many volunteers!

James Anderson  
Keisha Bahr  
Silke Ballmer  
Kari Barber  
Jake Buehler  
Ian Caldwell  
Richard Coleman  
Adrienne Copeland  
Chelsie Counsell  
Rachel Dacks  
Caroline Dong  
Mary Donovan  
Mackenzie Gerrier  
Jonatha Giddens  
Giacomo Gilori  
Whitney Goodell  
Melanie Hutchinson  
Katie Kamelamela  
Keith Kamikawa  
Stephen Karl  
Katie Lubarsky  
Tayler Massey  
Jessica Maxfield  
Zack Oyafuso  
Angela Richards  
Donà  
Raphael Ritson-Williams

Lindsay Root  
Mark Royer  
Eva Schemmel  
Steve Scherrer  
Maggie Sogin  
Yuko Stender  
Nadiera Sukhraj  
Jamie Sziklay  
Kaho Tisthammer  
Eric Tong  
Carlie Weiner  
Christie Wilcox  
Heather Ylitalo-Ward

Special thanks to our Faculty Judge:  
Ruth Gates

Poster Judges:  
James Anderson  
Keisha Bahr  
Anuschka Faucci  
Mark Heckman  
Melanie Hutchinson  
Florence Thomas

Session Chairs:  
Charles Birkeland  
Brian Bowen  
Kathleen Cole  
Heinz Gert de Couet  
Cynthia Hunter  
Peter Marko  
Amy Moran  
Floyd Reed  
Andy Taylor  
Florence Thomas  
Robert Thomson  
Timothy Tricas
Special contributions from:

2014 Tester Organizing Committee

Matthew Iacchei
Nyssa Silbiger
Jonathan Whitney

Cynthia Hunter
Steven Robinow
Robert Thomson

We also acknowledge the office staff of the Department of Biology for logistical assistance:

Shelley Deakins
Matthew Lim
Audrey Shintani

“Sleeping Wrasses” by Yuko Stender
39th Annual Albert L. Tester Memorial Symposium

Sponsors
The Department of Biology gratefully acknowledges financial support provided by:

The Albert L. Tester Fund (UH Foundation)
Dr. Andrew Rossiter, Waikīkī Aquarium
Student Activity and Program Fee Board
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Native Hawaiian Student Services
Sidney Stern Memorial Trust
Dr. Ian Cooke Foundation
The Judy Pyle Hawai'iinuiākea School of Hawaiian Knowledge Deans Endowment
Dr. Mark Hixon
Dr. Cynthia Hunter
Dr. Thomas Ranker
Dr. Steven Robinow
Dr. Robert Thomson
Dr. Robert Toonen
Dr. Alvin Yoshinaga
Past Symposia Invited Speakers

1976 A. A. Myrberg, Jr., University of Miami
1977 R. Glenn Northcutt, University of Michigan
1978 Karel F. Liem, Harvard University
1979 Edmund S. Hobson, SW Fisheries Center, Tiburon Laboratory
1980 Gareth Nelson, American Museum of Natural History
1981 Stephen Jay Gould, Harvard University
1982 Howard A. Bern, University of California, Berkeley
1983 Robert T. Paine, University of Washington, Seattle
1984 Joseph Connell, University of California, Santa Barbara
1985 George W. Barlow, University of California, Berkeley
1986 Jared Diamond, University of California, Los Angeles
1987 Lynn Margulis, Boston University
1988 Eric Davidson, California Institute of Technology
1989 Jonathan Roughgarden, Stanford University
1990 Corey S. Goodman, University of California, Berkeley
1991 John Maynard Smith, University of Sussex
1992 Robert Warner, University of California, Santa Barbara
1993 Stephen Hubbell, Princeton University
1994 Nancy Knowlton, Smithsonian Tropical Research Institute
1995 Mimi A.R. Koehl, University of California, Berkeley
1996 George L. Gabor Miklos, The Neurosciences Institute
1997 Stephen A. Wainwright, Duke University
1998 Kenneth B. Storey, Carleton University
1999 Robert E. Ricklefs, University of Missouri-St. Louis
2000 John A. Endler, University of California, Santa Barbara
2001 Steve Jones, University College, London
2002 Marc Mangel, University of California, Santa Cruz
2003 William G. Eberhard, Smithsonian Tropical Research Institute
2004 Phillip J. Motta, University of South Florida
2005 Stephen R. Palumbi, Stanford University
2006 Scott F. Gilbert, Swarthmore College
2007 Paul Dayton, University of California, San Diego
2008 Tyrone B. Hayes, University of California, Berkeley
2009 Daniel Pauly, University of British Columbia
2010 Alex Badyaev, University of Arizona
2011 Monica Turner, University of Wisconsin
2012 Terry Hughes, ARC Center of Excellence for Coral Reef Studies
2013 Fiorenza Micheli, Stanford University
Introduction

The Albert L. Tester Memorial Symposium is held in honor of Professor Albert Tester who, at the time of his death in 1974, was Senior Professor of Zoology at the University of Hawai‘i. The faculty and students of the Department of Zoology proposed an annual symposium to honor Dr. Tester's encouragement of student research in marine biology. Today the Tester Memorial Symposium welcomes research from any scientific field.

Papers reporting original research on any aspect of science are solicited from students at the University and are presented at the Symposium. Contributions to the Albert L. Tester Memorial Fund of the University of Hawai‘i Foundation are used to provide prizes for the three best papers, judged on quality, originality, research significance, and quality of public presentation. Judges include faculty members and the previous year's student award winners. Further, a distinguished scholar from another university or research institution is invited to participate in the Symposium as a judge and to present the major Symposium address.

“Fish Pyramid” by Lee Shannon
39th Annual Albert L. Tester Memorial Symposium
March 12-14, 2014

2014 Invited Speaker
Dr. Sylvia Earle

Wednesday, March 12th, 4:00 – 5:00 PM:
Distinguished Visitor’s Address
BIOMED Building, B103

"Sustainable Seas:
The Vision, The Reality"

Friday, March 14th, 4:00 – 5:00 PM:
Keynote Lecture
East-West Center, Keoni Auditorium

"Exploring the Deep Frontier"
Sylvia A. Earle
National Geographic Society Explorer-in-Residence

Dr. Sylvia Earle, called *Her Deepness* by the New Yorker and the New York Times, *Living Legend* by the Library of Congress, and first *Hero for the Planet* by Time Magazine, is an oceanographer, explorer, author and lecturer with experience as a field research scientist, government official, and director for corporate and non-profit organizations including the Kerr McGee Corporation, Dresser Industries, Oryx Energy, the Aspen Institute, the Conservation Fund, American Rivers, Mote Marine Laboratory, Duke University Marine Laboratory, Rutgers Institute for Marine Science, the Woods Hole Oceanographic Institution, National Marine Sanctuary Foundation, and Ocean Futures.

Formerly Chief Scientist of NOAA, Dr. Earle is the Founder of Deep Ocean Exploration and Research, Inc., Founder of Mission Blue and SEAlliance, Chair of the Advisory Council of the Harte Research Institute, the Ocean in Google Earth, and leader of the NGS Sustainable Seas Expeditions. She has a B.S. degree from Florida State University, M.S. and PhD from Duke University, 24 honorary degrees and has authored more than 200 scientific, technical and popular publications, lectured in more than 80 countries, and appeared in hundreds of radio and television productions.

She has led more than 100 expeditions and logged more than 7000 hours underwater including leading the first team of women aquanauts during the Tektite Project in 1970, participating in ten saturation dives, most recently in July 2012, and setting a record for solo diving in 1000 meters depth. Her research concerns marine ecosystems with special reference to exploration, conservation and the development of new technologies for effective operations in the deep sea.

Her special focus is on developing a global network of areas on the land and in the ocean, “Hope Spots,” to safeguard the living systems that provide the underpinnings of global processes, from maintaining biodiversity and yielding basic life support services to providing stability in response to accelerating climate change.

Her more than 100 national and international honors include the 2013 National Geographic Hubbard Medal, 2013 French Legend of the Planet Medal, 2011 Royal Geographical Society Gold Medal, 2011 Medal of Honor from the Dominican Republic, 2009 TED Prize, Netherlands Order of the Golden Ark, Australia’s International Banksia Award, Italy’s Artiglio Award, the International Seakeepers Award, the International Women’s Forum, the National Women’s Hall of Fame, Academy of Achievement, Los Angeles Times Woman of the Year, and medals from the Explorers Club, the Philadelphia Academy of Sciences, Lindbergh Foundation, National Wildlife Federation, Sigma Xi, Barnard College, and the Society of Women Geographers.
This Symposium is dedicated to Dr. Albert Lewis Tester, scholar and teacher, who died on November 27, 1974 in Honolulu, Hawai‘i. He had an international reputation in several aspects of marine biology, and as an outstanding teacher. Dr. Tester was a delightful friend, a meticulous worker, and a valued colleague.

A native of Toronto, Canada, Dr. Tester received his doctorate from the University of Toronto in 1936. In 1931 he joined the Pacific Biological Station of the Biological Board of Canada. In 1948 Dr. Tester joined the Department of Zoology at the University of Hawai‘i where he remained until his death. From 1955 to 1958, he was director of the Pacific Oceanic Fisheries Investigations of the U.S. Fish and Wildlife Service in Honolulu. In 1957 he served as chief of the Service's Division of Biological Research in Washington, D.C. and returned to the University of Hawai‘i as Senior Professor of Zoology in 1958.

Dr. Tester studied the life history of tuna baitfish for a program designed to improve tuna fishing in the Pacific. Dr. Tester served on the Governor's Task Force on Hawai‘i and the Sea, the Marine Resources Committee of the Pacific Islands Development Commission, and as chairman of the Department of Zoology.

Dr. Tester's most valuable work was in the field of elasmobranch biology and included studies in ecology, behavior, sensory biology of sharks, and aspects of shark attack and control. His major research interest in shark sensory systems resulted in significant morphological and behavioral studies of olfaction, vision, and the chemical senses. Dr. Tester intensively studied the acoustico-lateralis system (e.g., innervation and morphology of neuromasts and the cupula structure in the lateral line), and the inner ear (e.g., carcharinid sharks).

From 1967 to 1969, Dr. Tester directed the Cooperative Shark Research and Control Program of the State of Hawai‘i and was appointed to the Shark Research Panel of the American Institute of Biology Sciences in 1967.
Dr. Tester authored more than 100 publications and the excellence of his work was acknowledged by the University of Hawai'i Research Medal in 1974. While his scientific contributions are highly significant, many remember Dr. Tester best as warm and congenial, a dedicated teacher, active and respected participant in the university community, organist, hula dancer, and singer: the complete man.


Selected Bibliography


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“Spotted Dolphin” by Jessica Chen (Permit 14682)
### Session I

**Chaired by Dr. Cynthia Hunter**

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<th>Time</th>
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<tr>
<td>2:30</td>
<td><strong>Introduction to Symposium</strong></td>
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<tr>
<td>2:35</td>
<td><strong>Albert L. Tester Introduction</strong> – Dr. Timothy Tricas</td>
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<td>2:45</td>
<td><strong>Spatial Patterns in Biodiversity: A Look at the Cryptic Reef Communities Living within <em>Pocillopora</em> Corals around O'ahu</strong></td>
<td><strong>Chelsie Counsell</strong></td>
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<td>2:50</td>
<td><strong>Assessing the Effect of Benthic Community Assemblage on Coral Bleaching Resilience</strong></td>
<td><strong>Catherine Lubarsky</strong></td>
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<td>2:55</td>
<td><strong>Reef Fish Nursery Habitat and Benthic Habitat Mapping for Community-based Fisheries Management in Ha'ena, Kaua'i</strong></td>
<td><strong>Whitney Goodell</strong></td>
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<td>3:00</td>
<td><strong>SCUBA Diver Environmental Perceptions and Willingness to Contribute to Conservation in Guam</strong></td>
<td><strong>Shanna Grafeld</strong></td>
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<td>3:05</td>
<td><strong>Modeling Coral Reef Ecosystem Goods and Services to Inform Management: a Case Study of Maui Nui</strong></td>
<td><strong>Jade Delevaux</strong></td>
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<td>3:10</td>
<td><strong>Sediment Retention as a Key Ecosystem Service: Challenges and Opportunities to Modeling Sediment Export in West Maui</strong></td>
<td><strong>Kim Falinski</strong></td>
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<td>3:15</td>
<td><strong>Irradiation for Control of Post-Harvest Rots</strong></td>
<td><strong>Mark Dragich</strong></td>
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<td>3:20</td>
<td><strong>Impact of Wildfire on Aboveground Carbon Storage in Tropical Ecosystems Across a Precipitation Gradient in Hawai'i Volcanoes National Park</strong></td>
<td><strong>Emily Guynn</strong></td>
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<td>3:25</td>
<td><strong>Characterization of a Novel Gammaproteobacteria HIMB30 with Genes for Photoheterotrophy</strong></td>
<td><strong>Eli Wong</strong></td>
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<td>3:30</td>
<td><strong>Comparative Toxicity of Antifouling Coatings on the Larval Development of <em>Tripneustes gratilla</em></strong></td>
<td><strong>William Thomas</strong></td>
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<td>3:35</td>
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4:00 – 5:00  Distinguished Visitor’s Address

Dr. Sylvia Earle
Sustainable Seas: The Vision, The Reality

He lawai'a no ke kai papa'u, he pokole ke aho; he lawai'a no ke kai hohonu he loa ke aho.

Translation: A fisherman of shallow seas uses only a short line; a fisherman of the deep sea uses a long line.
Interpretation: You will reach only as far as you aim and prepare yourself to reach.

“Message from the Uhu” by Jonatha Giddens
## Session 2  Chaired by Dr. Heinz Gert de Couet

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>8:30</td>
<td>Introduction and Announcements</td>
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<tr>
<td>8:35</td>
<td>Cumulative Human Impact Mapping for Marine Ecosystems of Hawai'i</td>
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<td>Joey Lecky</td>
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<td>8:40</td>
<td>Assessing Predictive Models of Acoustic Telemetry Network Design in a Real World Context</td>
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<td>Stephen Scherrer</td>
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<td>8:45</td>
<td>Vermetid Gastropods and Sedimentation: Environmental Factors Can Become ‘Stressors’ When Combined in a Coral Reef</td>
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<td>Julie Zill</td>
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<td>8:50</td>
<td>Examining the Role of a Reef Predator, Greater Amberjack (Seriola dumerili), in the Hawaiian Islands through Diet Analysis</td>
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<td>Zack Oyafuso</td>
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<td>8:55</td>
<td>Common But Unknown: the Ecophysiology of the Green Alga Microdictyon setchellianum</td>
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<td>Nicole Yamase</td>
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<td>9:00</td>
<td>Corals Under Multiple Climate Change Stressors: How Much is Too Much?</td>
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<td>Keisha Bahr</td>
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<td>9:15</td>
<td>Investigation of the Etiology, Spatial Extent, and Virulence of Black Band Disease on Kaua’i</td>
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<td>Christina Runyon</td>
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<td>9:30</td>
<td>Bacterial Community Comparisons Between Healthy and Montipora White Syndrome-affected Corals</td>
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<td>Amanda Shore-Maggio</td>
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<td>10:00</td>
<td>Deep-water Sharks: Their Ability to Withstand Hypoxic Conditions Provides Hints on How Animals May Respond to Climate Change</td>
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<td>10:15</td>
<td>Ambient Seismic Noise Tomography Illuminates Shallow Structures of Kīlauea Volcano, Hawai‘i</td>
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<td>10:30</td>
<td>Trends and Impacts of Kona Lows on Rainfall in Hawai‘i</td>
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<td>10:45</td>
<td>Exploring Cross Modal Facilitation in Perceptual Learning</td>
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<td>11:00</td>
<td>Prevalence of <em>Fusarium</em> on Orchids in Hawai‘i and Discovery of Three New Pathogenic Species of <em>Fusarium</em></td>
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<tr>
<td>11:30</td>
<td>Four Fish, Two Fish: Re-evaluating Evolutionary Relationships Within the Subfamily Pteroinae</td>
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<td>11:45</td>
<td>Investigating a Low Dispersal Cardinalfish at the Evolutionary Boundary between Indian and Pacific Oceans</td>
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<td>12:00</td>
<td>Investigating the Relationship between Foraging Odontocetes and Ocean Acoustic Biomass off the Kona Coast of the Island of Hawai'i</td>
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<td>12:30</td>
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“Red Fern” by Lee Shannon
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<tr>
<th>Time</th>
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<th>Speaker</th>
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<tbody>
<tr>
<td>1:30</td>
<td>Perception of Magnetic Fields in Sandbar Sharks (<em>Carcharhinus plumbeus</em>)</td>
<td>James Anderson</td>
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<tr>
<td>1:45</td>
<td>Canned Tuna and the Plight of the Silky Shark</td>
<td>Melanie Hutchinson</td>
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<td>2:00</td>
<td>Phylogeny and Adaptive Evolution of Righteye Flounders</td>
<td>Kirill Vinnikov</td>
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<td></td>
<td>(Teleostei: Pleuronectidae) to Different Oceanic Depths and Geographic Regions</td>
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<td>2:15</td>
<td>Experimental Removal of the Introduced Predatory Grouper, Roi (<em>Cephalopholis argus</em>) in Puakō, Hawai‘i: Methods for Assessing and Managing Marine Invasive Species</td>
<td>Jonatha Giddens</td>
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<td>2:30</td>
<td>The Connection between Land-Use, Groundwater and Coastal Nutrient Pollution on Maui</td>
<td>Daniel Amato</td>
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“Puakō Hee” by Jonatha Giddens
Session 6  Chaired by Dr. Floyd Reed

3:00  *Spongiochrysis*, Subaerial Algal Communities, and a Preliminary Look at Transitions between Marine and Terrestrial Habitats in the Hawaiian Cladophorales (Ulvophyceae)

**Emily Johnston**

3:15  Molecular Determination of Kleptoplast Origins of the Common Sea Slug *Plakobranchus ocellatus* Supports the Presence of Cryptic Bryopsidalean Diversity in the Hawaiian Islands

**Rachel Wade**

3:30  Variation in Coral Metabolite Production After Exposure to Global Climate Change Stressors is Species Specific

**Emilia Sogin**

3:45  Can We Predict Coral Disease Outbreaks Before They Occur?

**Jamie Sziklay**

4:00  Damaging Interactions between the Coral Holobiont and Pathogenic Bacteria: Undetectable until it is Too Late

**Angela Richards Donà**

“Sage Advice” by Mark Royer
Anna Ahti
Phylogeography of Coris Wrasses (*Coris cuvieri* and *C. gaimard*) in the Pacific Ocean, Indian Ocean and Red Sea

Silvia Beurmann
Microbial Investigation of the Acute *Montipora* White Syndrome Outbreaks in Kāne'ōhe Bay, O'ahu

Bishnu Bhandari
Stem and Leaf Galling Wasps Control on Chinese Banyan in Hawai’i

Andrew Burger
The Role of Quorum Sensing on Virulence and Antimicrobial Production in the Coral Pathogen *Vibrio Corallilyticus* Strain OCN008

Kaile Costa
Genetic Variation of the Hawaiian Endemic *Alectryon macrococcus* (Māhoe)

Tiffany Nicole Gutlay
Does Size Matter? The Impact of Coral Head Size on the Abundance and Diversity of Fishes and Invertebrates

Daniel House
A Global Analysis of Feral and Domestic Cat Predation in Continental and Insular Environments

Julian Leon
Ampullariidae Revisionary Systematics: Clarifying the Taxonomic Status of *Asolene platae* (Maton, 1811) and *Asolene pulchella* (Anton, 1838)

Gavin Mura
Microdiversity of SAR11 in Kāne'ōhe Bay Based on petB Assay Sequencing

Gabriel Schierman
Control for Powdery Mildew on Wild Endangered & Endemic Mint on O'ahu

Yuko Stender
Thirty Years of Coral Reef Change in Relation to Coastal Construction and Increased Sedimentation at Pelekane Bay, Hawai’i

Kaho Tisthammer
Understanding the Adaptive Ability of Lobe Coral, *Porites lobata*, Using
Genetics

Sarah Maile Vasconcellos
Development of Methods Leading to Successful Outplanting of Native Reef Algae

Chaminda Wijesundara
Divergence of Bill Morphometrics in the Sympatric Sri Lanka White-eye Zosterops ceylonensis: Possible Indication of Character Displacement

Erin Yokote
Distribution of Infective Angiostrongylus cantonensis Larvae within Intermediate Gastropod Hosts

“Kaupō Beach, Oahu” by Rachel Wade
### 39th Annual Albert L. Tester Memorial Symposium

**Student Seminar Sessions**
Friday, March 14<sup>th</sup>
East-West Center, Keoni Auditorium

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<tr>
<th>Session 7</th>
<th>Chaired by Dr. Kathleen Cole</th>
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<tr>
<td><strong>8:30</strong></td>
<td>Introduction and Announcements</td>
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<tr>
<td><strong>8:35</strong></td>
<td>Uncovering the Secret of Sex Change: Mapping the Sex Change Pathway in two Gobiid fishes with Implications on the Effect of Climate Change on this Process</td>
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<td><strong>Jessica Maxfield</strong></td>
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<td><strong>8:40</strong></td>
<td>Viral Relationships and Population Dynamics of <em>A. tumida</em> in Honeybee Colonies</td>
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<td><strong>Jason Wong</strong></td>
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<td><strong>8:45</strong></td>
<td>The Search for Hawaii's Sleeping Functional Groups</td>
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<td><strong>Eileen Nalley</strong></td>
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<td><strong>8:50</strong></td>
<td>Growth, Feeding Rates and Feeding Preferences of the Collector Urchin, <em>Tripneustes gratilla</em></td>
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<td><strong>Charley Westbrook</strong></td>
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<td><strong>8:55</strong></td>
<td>Local or Exotic Cuisine? Testing Herbivory Pressure and Preference for Native or Invasive Macroalgae</td>
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<td><strong>Scott Chulakote</strong></td>
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<td><strong>9:00</strong></td>
<td>Structure-from-Motion Photogrammetry: An Innovative Technique for Quantifying 3-Dimensional Characteristics of Coral Reefs</td>
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<td><strong>John Burns</strong></td>
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<td><strong>9:15</strong></td>
<td>Coral Larval Settlement Variability; Statistical Headache or Evolutionary Insight?</td>
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<td><strong>Raphael Ritson-Williams</strong></td>
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<td><strong>9:30</strong></td>
<td>Stable Isotopes of Carbon and Nitrogen in the Study of Ampullariid Trophic Ecology</td>
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<td><strong>Bruno Oliveira</strong></td>
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<tr>
<td>10:00</td>
<td>Do Mesophotic Coral Reefs Provide a Depth Refuge from Climate Change for Cryptic Crab Communities?</td>
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<td>10:15</td>
<td>Coral Reef Resilience Under Climate Change, Ocean Acidification, and Local Human Impacts</td>
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<td>10:30</td>
<td>Elevated-DIC Stimulates Coral Calcification in Juvenile Porites spp. Exposed to Ocean Acidification in situ</td>
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<td>10:45</td>
<td>Disappearing Suitable Days for Plant Growth Under Projected Climate Change</td>
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<td>11:00</td>
<td>Predicting Local Scale Climate Change Impacts on Endangered Birds by Integrating Watershed Models and Expert Knowledge-based Models for Decision-support</td>
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"Humu" by Sean Hixon
Session 9  Chaired by Dr. Andrew Taylor

11:30  Relational Learning in Foraging Honeybees  
       Nicole Muszynski

11:45  Prevalence and Potential Impact of Varroa Mite Infestation on Honeybee (Apis mellifera) Brood Survival  
       Scott Nikaido

12:00  Low-Frequency Temporary Threshold Shift in a Bottlenose Dolphin (Tursiops truncatus)  
       Adam Smith

12:15  Humpback Whale Mother-Calf Communications: What do They Say to Each Other?  
       Jessica Chen

12:30 – 1:30  LUNCH BREAK

"Humpback Whale Breach Off Maui" by Jessica Chen (Permit 14682)
<table>
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<tr>
<th>Time</th>
<th>Presentation Title</th>
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<tr>
<td>1:30</td>
<td>Passive Acoustic Monitoring Reveals Differences in the Foraging Strategy of Deep Diving Odontocetes in the Ligurian Sea: Nighttime Foraging Odontocetes Adjust Their Foraging Activity in Relation to the Length of the Night</td>
<td>Giacomo Giorli</td>
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<tr>
<td>1:45</td>
<td>Mating Behavior in <em>Octopus oliveri</em>: the Effect of Male Order and Size in Observed Mating Success</td>
<td>Heather Ylitalo-Ward</td>
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<td>2:00</td>
<td>The Effects of <em>Sry</em>-to-<em>Sox9</em> Replacement on Adult Male Fertility and Spermatogenesis</td>
<td>Egle Ortega</td>
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<td>2:15</td>
<td>The Role of the X Chromosome Encoded <em>Eif2s3x</em> Gene in Spermatogenesis</td>
<td>Victor Ruthig</td>
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"After the Gold Rush" by Mark Royer
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<tr>
<td>2:45</td>
<td>Modeling and Ground-truthing the Reef Fish Larval Pool Around the Hawaiian Islands</td>
<td>Johanna Wren</td>
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<tr>
<td>3:00</td>
<td>Production of the Antibiotic Andrimid is Involved in the Infection of the Coral <em>Montipora capitata</em> by <em>V. corallilyticus</em> Strain OCN008</td>
<td>Blake Ushijima</td>
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<td>3:15</td>
<td>Using Spatial Statistics to Understand Patterns of Reef Coral Mortality in Relation to Environmental Factors at Kahekili Beach Park, Kā'anapali, Maui</td>
<td>Megan Ross</td>
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<td>4:00</td>
<td>4:00 – 5:00 Keynote Lecture</td>
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<td><strong>Dr. Sylvia Earle</strong></td>
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<td>Exploring the Deep Frontier</td>
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“Tiger Shark” by Yuko Stender
39th Annual Albert L. Tester Memorial Symposium

Banquet and Ceremony
Graciously hosted by the Waikīkī Aquarium
Friday, March 14th, 6:00 - 9:30 PM
Buy Tickets in Biology Office
(Edmonson Hall 216)

8 AM - 3 PM  Drop off alcohol with ID label in Biology Office (Edm 216)
6:00 PM  Happy hour; enjoy Waikīkī Aquarium
6:45 PM  Awards and Presentations
7:30 PM  Dinner (catered by Da Spot)
9:30 PM  Clean up Kokua

Live Music by:
Bobby Tangaro & Sam Henderson

* Spanakopita
* Egyptian Baked Chicken
* Malaysian Yellow Coconut Fish Curry
* Thai Coconut Vegetable Curry
* Moussakka
* Coconut Pandan & Yellow Saffron Rice
* Green Salad w/ Garlic Ginger Dressing
* **Dessert:** Baklava & Chocolate Brownies

BYOB (by prior arrangement)
Abstracts
Contributed talks and posters
Anna Ahti  
Hawai‘i Institute of Marine Biology  
(Advisor: Brian Bowen)  

Phylogeography of Coris Wrasses (*Coris cuvieri* and *C. gaimard*) in the Pacific Ocean, Indian Ocean and Red Sea

The Yellowtail Coris (*Coris gaimard*, family Labridae) is a widely distributed reef fish in the Pacific Ocean. What makes it especially interesting is that the juveniles of this species mimic the clownfish (*Amphiprion* spp.) colour pattern, even in locations like Hawai‘i where clownfish do not occur. This raises questions about whether the Hawaiian population, although geographically isolated, is genetically connected to the populations occurring elsewhere in the Pacific Ocean. The African Coris (*C. cuvieri*) is a sister species to *C. gaimard* and occurs in the Indian Ocean and the Red Sea. These two bodies of water are connected by the relatively shallow and narrow Strait of Bab-el-Mandeb, which may constitute a substantial barrier to gene flow. It has been shown that some reef fishes are able to surmount this barrier, while others show ancient separations. The current study aims to investigate the connectivity and phylogenetic relationships of *C. cuvieri* populations in the Red Sea and the Indian Ocean to evaluate possible barriers to gene flow. To answer these questions and to investigate the evolutionary history of Coris wrasses, this study employs DNA sequences from mitochondrial and nuclear gene regions. This comparative study of the two closely related species, inhabiting isolated regions such as the Hawaiian Islands and the Red Sea, will contribute to the scientific foundations of marine conservation in these regions.

Daniel Amato  
Co-authors: James Bishop, Craig Glenn and Celia Smith  
Botany Department  
(Advisor: Celia Smith)  

The Connection between Land-Use, Groundwater and Coastal Nutrient Pollution on Maui

Nutrient pollution is a major threat to many tropical coastal reefs yet impacts of nutrient loading via submarine groundwater discharge (SGD) on near shore environments have not been explicitly examined. To test the role of SGD in coastal regions, resident invasive marine algae (*Ulva lactuca*, *Acanthophora spicifera*, and *Hypnea musciformis*) where used as experimental bioassays where plants were deployed and/or collected at select sites on Maui. Algal tissue nitrogen (N) paired with conventional water samples were used to compare land-use activities with coastal water quality to generalize anthropogenic impacts. Our results showed that all sites had a substantial flux of SGD with an onshore-offshore gradient of nutrients and salinity as judged by conventional water sampling. Nitrogen concentration and $\delta^{15}N$ (from plant tissues and water samples) were elevated at a site impacted by wastewater (Kahului) and low at more pristine sites (Honomanu, Honolua). Agriculturally impacted sites (Tavares Bay and Ma‘alae) had low $\delta^{15}N$ values and high N concentrations from water
samples and plant tissues. Near shore nitrate concentrations at agriculturally impacted sites were two orders of magnitude greater than our most pristine site (Honomanu). New approaches to track paths of nutrients into coastal waters were established using relationships between algal tissue N and distance from the shoreline. Thus, our results suggest that groundwater pollution loads many coastal regions with excess wastewater, nitrogen and/or fertilizer components and may play a role in supporting persistent invasive algal blooms on Maui.

James Anderson  
Co-authors: Luisa Queiroz and Kim Holland  
Department of Biology  
(Advisors: Kim Holland & Timothy Tricas)  
**Perception of Magnetic Fields in Sandbar Sharks (Carcharhinus plumbeus)**

A diverse range of organisms across a number of taxa are thought to be able to orient to geomagnetic fields. For migratory animals, the earth’s magnetic field arguably provides the only globally persistent cues to navigation, regardless of time of day or year. Thus an animal can in theory determine its approximate position on the earth, and navigate to known destinations through the use of these cues. The elasmobranch fishes (sharks, skates and rays) are widely thought to use geomagnetic cues to orient themselves in both large and small-scale movements. Yet the mechanisms by which this may be achieved have yet to be firmly established, and empirical data on their ability to perceive magnetic fields is remarkably scant. Here we provide current results of ongoing conditioned-behavior trials that aim to definitively describe magneto-perceptive capabilities in elasmobranch fish, using the Sandbar shark (Carcharhinus plumbeus) as the subject species.

Keisha Bahr  
Co-authors: Ku'ulei Rodgers and Paul Jokiel  
Department of Biology  
(Advisor: Paul Jokiel)  
**Corals Under Multiple Climate Change Stressors: How Much is Too Much?**

Numerous environmental factors (e.g. irradiance, temperature) that regulate coral calcification rates and productivity are predicted to change alongside future elevated carbon dioxide emissions. Therefore, an experiment was performed in continuous flow mesocosms under full solar radiation to describe the biological response at the upper lethal temperature threshold of the Hawaiian reef building coral, Montipora capitata. Using a split plot design, corals were grown under treatments differing in temperature (summer ambient, heated +2°C), pCO$_2$ (present day and 2X present day levels), and ambient solar irradiance (100%, 50% 8%) operating independently and together, to test the effect each factor independently, as well as pairwise comparison of these variables, and interactions of all three. Temperature stress was determined to have the strongest influence on coral growth and mortality. Low irradiance levels potentially provide refuge for...
Montipora capitata from thermal and irradiance stress; however, these corals may be more susceptible to ocean acidification stress.

Silke Ballmer  
Co-authors: Robert Dunn, Matthew Haney, Cecily Wolfe, Paul Okubo and Clifford Thurber  
Department of Geology & Geophysics  
(Advisors: Robert Dunn & Cecily Wolfe)  
Ambient Seismic Noise Tomography Illuminates Shallow Structures of Kīlauea Volcano, Hawai‘i

Kīlauea volcano on the Island of Hawai‘i is one of the world’s most active volcanoes posing a hazard to property and population, but at the same time offering a spectacular opportunity to witness the creation of new land. For hazard mitigation it is essential to understand the volcano’s internal structures – a target, towards which imaging with seismic tomography has contributed considerably over the past decades. This technique exploits the propagation of earthquake-generated sound waves through the subsurface to map spatial heterogeneity in rock properties. Tomography with earthquakes, however, requires long periods of data acquisition and hence cannot well resolve structural changes through time. In contrast, ocean-generated ambient “noise” is a continuous signal and, although relatively weak, can be utilized to gain information about the shallow subsurface with good resolution in both space and time. In this study we test the imaging capabilities of ambient seismic noise tomography in Hawai‘i for the first time and show that despite the presence of perturbing volcanic tremor, Kīlauea’s internal structures can be imaged successfully with this technique. Good agreement of our results with prior earthquake tomography studies – such as a clear contrast between the volcano’s flanks, rift zones, and central magmatic plumbing system – is a fundamental success that will allow the implementation of this technique as a constant monitoring tool for the Hawaiian volcanoes.

Silvia Beurmann  
Department of Microbiology  
(Advisor: Sean Callahan)  
Microbial Investigation of the Acute Montipora White Syndrome Outbreaks in Kāne‘ohe Bay, O‘ahu

Montipora white syndrome is a tissue loss disease affecting the coral Montipora capitata in Kāne‘ohe Bay that is found in two forms: a progressive chronic form (cMWS) and a faster-spreading acute manifestation (aMWS) that leads to rapid colony mortality. Exposure of corals with cMWS often shift to aMWS when exposed to a strain of Pseudoalteromonas, OCN003. In March 2010 and December 2011, outbreaks of aMWS occurred in Kāne‘ohe Bay (approximately 300 and 1000 cases per outbreak, respectively). The objectives of this study were to identify the etiological agent(s) of these outbreaks and assess the microbial contributions to aMWS susceptibility and community shifts following infection. A
total of 265 bacterial isolates cultured from diseased corals during the 2010 outbreak were tested for their ability to induce disease in laboratory infections. Three isolates named OCN050, OCN051, and OCN052 with 16S sequences identical to that of OCN003 induced disease, however infection of healthy *M. capitata* was not consistent. Switches from cMWS to aMWS similar to those induced by OCN003 were observed with isolates OCN050, OCN051, and OCN052. *Montipora capitata* colonies with compromised health are seemingly more susceptible to Pseudoalteromonas infection. Therefore we will investigate the effect of different environmental stressors on infection and analyze the microbial communities associated with healthy and diseased *M. capitata*. This study will help determine what factors facilitate sudden outbreaks of tissue loss disease, which is important for potential management of this disease.

**Bishnu Bhandari**  
Plant & Environmental Protection Sciences  
(Advisor: Zhiqiang Cheng)  
**Stem and Leaf Galling Wasps Control on Chinese Banyan in Hawai‘i**

Chinese Banyan (*Ficus microcarpa*), family-Moraceae, native from Ceylon to India, Southern China, Ryukyu Islands, Australia, and New Caledonia, is a widespread landscape tree in tropical regions in the world. On University of Hawai‘i at Mānoa campus, arborists noticed stem gall formation on the tree in Oct. 2012 and further inspection and study found that the galls were formed by the agaonid wasp, *Josephiella* species that was different from the leaf gall wasp (*Josephiella microcarpae*), which was first found in Hawai‘i in 1989. This new wasp species appears to be widespread on different islands of Hawai‘i resulting progressive dieback of branches that may eventually cause tree mortality. This study evaluates the efficacy and longevity of two systemic insecticides, imidacloprid and emamectin benzoate (with or without phosphorus acid), delivered through injection around root flare. Forty-five trees were selected randomly with nine replications each treatment and control. Data on number of stem galls, stem infestation level, leave infestation level and percentage of infested leaves are being collected on 1, 2, 3, 4, 5, 6, 12, 18, 24 months after treatment. Based on data collected so far, all the four treatments are significantly different from the control, but the initial two-month data after treatment shows that emamectin benzoate with phosphorus acid is more effective compared with other treatments whereas emamectin benzoate is more effective 3-6 months after treatment. These trees will be continuously monitored for two years to evaluate the long-term effect and longevity of various treatments.

**Andrew Burger**  
Department of Molecular Biosciences & Bioengineering  
(Advisor: Sean Callahan)  
**The Role of Quorum Sensing on Virulence and Antimicrobial Production in the Coral Pathogen *Vibrio Corallilyticus* Strain OCN008**
*Vibrio coralliilyticus* strain OCN008 has recently been shown to infect the Hawaiian reef coral *Montipora capitata* and induce the tissue loss disease acute *Montipora* white syndrome (aMWS). Vibrio species have been studied as models of quorum sensing, a density-dependent cell-to-cell communication system that facilitates coordinated gene expression, often involved in pathogenesis. Here, we investigate the involvement of possible quorum-sensing genes in the production of several virulence factors utilizing bioassays and *M. capitata* infection. Eight quorum sensing genes (aphA, cqsS, luxP, luxT, luxN, luxO, hapR and varA), defined by amino acid homology, were deleted from the OCN008 genome and production of exoenzymes and the antibiotic andrimid were assessed. Lipase, protease, and hemolysin activity was greatly reduced in ΔluxP and ΔhapR mutant strains, but not in the ΔluxT mutant. In contrast, all three mutants abrogated production of andrimid and virulence was attenuated in *M. capitata* infection by roughly 50%. Previous work with OCN008 has shown that strains incapable of andrimid production display a 60% reduction in *M. capitata* infection. Taken together, these results suggest that quorum sensing genes regulate andrimid expression in OCN008 and that the reduction in virulence observed from ΔluxP, ΔhapR, ΔluxT mutant strains may be due to a defect in andrimid production, rather than production of the exoenzymes tested. While *V. coralliilyticus* has been widely studied as a coral pathogen, this work provides the first experimental evidence of the effect of quorum sensing on *V. coralliilyticus* virulence.

John Burns  
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**Structure-from-Motion Photogrammetry: an Innovative Technique for Quantifying 3-Dimensional Characteristics of Coral Reefs**

The structural complexity of reefs plays a major role in the biodiversity, productivity, and overall functionality of coral reef ecosystems. However, the complexity of coral reefs cannot be adequately quantified with conventional metrics that only assess 2-dimensional properties. A 3-dimensional (3D) approach more realistically characterizes coral reef structure in the context of topography and rugosity of habitat, as well as estimates of live coral tissue. Structure-from-Motion (SfM) is an emerging low-cost photogrammetric method for high-resolution 3D topographic reconstruction. We utilized multiple 3D reconstruction software tools to create textured mesh models of Hawaiian coral reef environments. The reconstructed digital elevation models were then used to quantify metrics pertaining to 3D complexity. The resulting data provides novel information relating to both the physical and biological properties of these habitats. These data provide a framework to which information on coral biomass, structural complexity, growth, and calcium carbonate deposition can be further integrated to develop reliable ecosystem models and improve capacity to monitor changes in the health and function of coral reef ecosystems in the future.
**Jessica Chen**  
Department of Biology  
(Advisor: Whitlow Au)  
**Humpback Whale Mother-calf Communications: What do They Say to Each Other?**

Humpback whales (*Megaptera novaeangliae*) migrate to warmer waters in Hawai‘i to give birth during winter. It is assumed that mothers and calves communicate vocally during growth and development. There are few studies of calf vocal repertoire in all mysticete species. Early in the humpback whale calf’s development, the mothers and calves often stay close together. As the calves grow older, they move farther away from the mother. We believe that as the calf becomes more independent, it will vocalize more in order to remain in contact with the mother. Suction cup acoustic tags and a vertical hydrophone array will be deployed to study the vocalizations of humpback whale mothers and calves. Tags will be deployed on both the mother and calf to track the animals’ movement in the water column. The hydrophone array will be used to localize and identify the vocalizing animal. In addition, a snorkeler will use a photogrammetry system to determine the size of the animals so its age can be estimated. This project should provide insight into calf vocalization source levels, dive patterns of mother-calf pairs, and calf vocalization repertoire in relation to age.

**Scott Chulakote**  
Co-authors: Celia Smith  
Botany Department  
(Advisor: Celia Smith)  
**Local or Exotic Cuisine? Testing Herbivory Pressure and Preference for Native or Invasive Macroalgae**

Dominance by invasive algae on coral reefs has detrimentally impacted the health of many coral reef communities and their abilities to support biodiversity. Recent assessments of Hawai‘i’s reefs document fish biomass and assemblages, however herbivory pressure remains understudied. Herbivore studies presented here evaluated preferences exhibited by native reef fish by offering pairwise and multiple-choice comparisons of native and invasive macroalgae for grazing. These studies were conducted in situ and in a simulated reef environment to quantify grazing pressure and preference. Grazing pressure in situ varied between summer seasons 2012 and 2013, however grazing pressure was moderately low for all macroalgae in both years. Preference for the invasive algae *Gracilaria salicornia* and *Acanthophora spicifera* over native algal species was detected in both our pairwise comparisons and multiple-choice preference studies. Observed fish bites in timed tests showed native reef herbivores *Zebrasoma velliferum*, *Acanthurus xanthopterus* and *Kyphosus cinerascens* were top contributors towards the consumption of *G. salicornia* and *A. spicifera* in the simulated reef environment. Of the two factors we investigated, low herbivore abundance, rather than preference in grazing, is an obstacle to re-establishing native reef
communities. Among many steps leading to healthier reefs, linking preference by known fish with in situ studies as well as conducting additional feeding experiments in reef communities with greater fish abundance and diversity could lead to new management options for the control of invasive algae.

Richard Coleman
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Department of Biology
(Advisor: Brian Bowen)
Investigating a Low Dispersal Cardinalfish at the Evolutionary Boundary between Indian and Pacific Oceans

The vast majority of reef fish have a life history consisting of a pelagic larval phase of typically 20 to 60 days followed by larval settlement where they remain through their juvenile and adult phase. Marine organisms with long pelagic larvae often show little genetic differentiation across thousands of kilometers and this life history is associated with wide distributions. However, not all organisms with wide distributions have widely dispersive larvae and the contradiction of limited gene flow and vast distributions remains a paradox in marine biology. Understanding the evolutionary history and biogeography of a marine organism with limited larval dispersal is essential to understanding how genetic diversity is generated and maintained for species with this life history strategy. The life histories of reef fish in the Family Apogonidae are uncommon in that they lack a pelagic larval phase yet they maintain large ranges. This is particularly noticeable in the Iridescent Cardinalfish, *Pristiapogon kallopterus*, whose range extends from the Red Sea to South Africa, across to the eastern expanses of Polynesia and north to the Hawaiian Islands. Having a broad distribution, inhabiting diverse habitats, and being relatively abundant where they occur makes *P. kallopterus* an excellent candidate to investigate evolutionary dynamics for organisms with apparently low dispersal potential despite being distributed across thousands of kilometers. By incorporating molecular and morphological analyses, this study tests whether the assumption for fish with limited dispersal hold: higher rates of genetic subdivision, spatial breaks across geographic and regional scales, and higher rates of speciation.

Adrienne Copeland
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Investigating the Relationship between Foraging Odontocetes and Ocean Acoustic Biomass off the Kona Coast of the Island of Hawai’i

To understand the distribution of deep diving odontocetes, it is important to investigate the relationship between foraging whales and their prey. Tagged sperm whales have been documented to dive as deep as 1202 meters. Short-finned pilot whales in Hawai’i dive deeper during the day down to 600 - 800 m and
shallower dives at night, driven possibly by the migration of organisms at night. Foraging sperm and pilot whales off the Island of Hawai‘i were located using a hydrophone array detecting echolocation clicks. A 500 meter by 500 meter active acoustics survey box was set up over two foraging sites: one during the night above foraging sperm whales and one during the day over foraging pilot whales. A four-frequency (38 kHz, 70 kHz, 120 kHz, and 200 kHz) split-beam echosounder collected acoustic data over foraging populations and non-foraging control sites of a similar bottom depth and time. The Nautical Acoustic Scattering Coefficient (NASC) or acoustic biomass (m²nmi⁻²) profile over the complete water column was statically compared over foraging and non-foraging populations to analyze the relationship between foraging and ocean biomass.

Kaile Costa  
Botany Department  
(Advisor: Clifford Morden)  
**Genetic Variation of the Hawaiian Endemic *Alectryon macrococcus* (Māhoe)**

*Alectryon macrococcus* (Sapindaceae), a flowering berry tree endemic to Hawai‘i and locally known as Māhoe, is currently critically endangered due to invasive species such as rats and habitat destruction. Less than 50 individuals remain in wild populations, and they are small enough to be monitored by the Hawai‘i state Plant Extinction Program. Because of the endangered status of *A. macrococcus*, I determined levels of genetic variation among and within populations using random amplified polymorphic DNA (RAPD). I used 19 different primer sets to measure polymorphism and heterozygosis of 22 individual plants from O‘ahu (3 populations) and Maui (4 populations). Plants from East Maui had been proposed to be distinct from the remainder of the species, due to persistent pubescence on the leaves at maturity. Principal coordinates analysis (PCO) demonstrated that the East Maui population is not a distinct variety, implying that pubescence is a plastic trait for the local populations and may result from environmental factors. The heterozygosis values and percent polymorphism showed that genetic variation is still present within both populations. Future work may include examination of genetic variation in populations on the other two Hawaiian Islands (Moloka‘i and Kaua‘i) where *A. macrococcus* can still be found. If results of such studies are similar to those obtained in this project, it would indicate that increased conservation efforts to control pests would benefit species survival.

Chelsie Counsell  
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Marine Biology Graduate Program  
(Advisor: Megan Donahue)  
**Spatial Patterns in Biodiversity: A Look at the Cryptic Reef Communities Living within *Pocillopora* Corals around O‘ahu**

Biodiversity is a key community characteristic that helps to maintain ecosystem stability and function. *Pocillopora meandrina* (POME) colonies are a common
feature of Hawaiian reefs that provide habitat for closely associated semi-cryptic fish and invertebrates communities. To document a baseline reference of POME community composition and look for spatial patterns in diversity relevant to environmental gradients, we surveyed POMEs at 7 deep sites (30-90 ft; ≥30 colonies/site) and 5 shallow sites (7 to 12 ft; ≥3 colonies/site) around O'ahu. These surveys included quantitative measures of coral colony size and health, high definition photographs of each POME, and identification, counts, and size estimates of the semi cryptic mobile invertebrate and fish species in each community. In this study, diversity was investigated at a variety of levels (e.g., interspecific, within functional groups, across trophic levels, local, regional) to elucidate patterns of community stability at different spatial and temporal scales. The impact of environmental gradients on community composition was also analyzed. At a time when these systems are greatly threatened by anthropogenic effects at local and global scales, we need to better understand how they function at a community level to help conserve them.

Jade Delevaux
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Department of Natural Resources & Environmental Management
(Advisor: Kirsten Oleson)

Modeling Coral Reef Ecosystem Goods and Services to Inform Management: a Case Study of Maui Nui

Coral reefs provide diverse ecosystem goods and services critical to human wellbeing. In Hawai'i, reefs are threatened by human activities and climate change. Observed declines in reef state jeopardize the delivery of these goods and services. To support innovative policy-making, we are constructing an ecological-economic model linking reef state to ecosystem services supply. We are applying predictive spatial modeling techniques to characterize the current ecological state of coral reefs and populate a spatially dynamic ecological coral reef model (CORSET). Then, we will link CORSET to a set of production functions to map and quantify the potential supply of key coral reef services given the reef health state. We expect this approach will allow us to identify specific coral reef ecological attributes potentially responsible for the supply of key services (e.g., for nearshore fisheries). Further, results will provide management targets expressed in ecological terms while being grounded in the local socio-economic context. The model will have the capability to evaluate impacts of alternative land and coastal management options on reef services. This scenario-based approach will allow managers to work with communities to determine site-specific management actions aimed at improving ecosystem service flows. This approach can promote adaptive management by accounting for critical linkages and feedbacks connecting people and reefs.
Mark Dragich  
Co-authors: Janice Uchida and Chris Kadooka  
Department of Plant & Environmental Protection Sciences  
(Advisor: Janice Uchida)  
**Irradiation for Control of Post-Harvest Rots**

We are testing the feasibility of using irradiation as a phytosanitary technique to control post harvest rots of Papaya and Basil. There are several target pathogens for both of these crops. For Papaya *Phytophthora palmivora, Collitotrichum gloeosporioides*, and the fungal genus *Phoma* will be treated. For Basil, two new potential fungal pathogens of the genera *Alternaria* and *Stemphylium* will be treated. The goal of the research is to determine if and at what doses irradiation will be an effective and acceptable treatment for phytosanitation. We will meet this goal by reaching the following objectives. First, we will determine pathogenicity when needed. Then we will find the lethal dose for each pathogen. Next, we will determine maximum doses that the crops can absorb before losing market value. Finally we will test these results by infecting crops and then subjecting them to the ideal rates of irradiation. Any adjustments will be made to the treatments. Conclusions about the efficacy and applicability of this treatment will be given to the public via workshops.

Kim Falinski  
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Department of Tropical Plant & Soil Sciences  
(Advisor: Russell Yost)  
**Sediment Retention as a Key Ecosystem Service: Challenges and Opportunities to Modeling Sediment Export in West Maui**

Land-based sediments are a key threat to shallow coral reef ecosystems in Hawai‘i, yet notably hard to predict with modeling. The coral reef ecosystem at Kā‘anapali in west Maui receives land-based source pollutants that originate from fallow agricultural lands, unmaintained agricultural roads and terraces, feral pig activity and unauthorized recreational dirt bike and four-wheel vehicle use in the forested areas. Despite ongoing management efforts to improve reef health, watershed managers seek a way to estimate the effects of different land use changes on overall sediment export. Estimating sediment export is a critical step to being able to provide an ecosystem services-based decision support tool that could compare and evaluate tradeoffs between multiple ecosystem services. Common USLE-based hydrological models have generally proven difficult to adapt to Hawai‘i. This adds potentially significant uncertainty to using available ecosystem service tools and models. Processes including stream channel erosion and storage, gully and rill erosion and landslides are not addressed. In addition, the models available struggle to capture the storm events leading to runoff that contain the majority of sediments. This talk presents a working framework for considering sediment retention ecosystem services in Hawai‘i, and identifies the
current state of knowledge of the spatiotemporal processes that lead to sediment export in tropical, mountainous watersheds. Proposed research efforts to better parameterize those processes will be explored. I will then discuss opportunities for valuing sediment retention as an ecosystem service, using west Maui as a case study.

Brandon Genco
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Disappearing Suitable Days for Plant Growth Under Projected Climate Change

Ongoing climate change can alter conditions for plant growth, subsequently affecting ecological and social systems. While there have been considerable advances in understanding the physical aspects of climate change, comprehensive analyses integrating climate, biological and social sciences are less common. We used climate projections, from Earth System Models, under alternative mitigation scenarios to show how changes in factors that limit plant growth could impact ecosystems and people. To estimate changes in the number of suitable days for plant growth, we counted the total or consecutive number of days in a year in which fall within the climate thresholds (temperature, soil water content and solar radiation) suitable for plant growth (NPP). We show that by 2100, the global mean number of days for growth will decrease by 1-22% when using these variables (ranges dependent on mitigation scenario). Some areas in the world could gain days suitable for plant growth; but the majority will experience losses, with tropical areas losing annually up to 200 days of plant growth by 2100. These changes will impact most of the world’s terrestrial ecosystems and affect humanity (e.g., ~0.5 to ~2.4 billion of the poorest people in the world will be highly vulnerable to changes in the supply of plant-related goods and services). Our study found contrasts among outcomes of different mitigation scenarios, stressing the urgency for reductions in greenhouse gas emissions. The expected demand for plant production due to human population increase and consumption implores the need for improving climate change mitigation and adaptation strategies.

Jonatha Giddens
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Experimental Removal of the Introduced Predatory Grouper, Roi (Cephalopholis argus) in Puakō, Hawai‘i: Methods for Assessing and Managing Marine Invasive Species
Invasive species are a growing concern for marine biodiversity, particularly in Hawai’i with its large proportion of endemic species. This research focused on the feasibility of removing the introduced predatory peacock grouper, locally known as roi (Cephalopholis argus), as a management tool for Hawaiian coral reef ecosystem restoration. The objectives of this study were to investigate the dynamics of C. argus on 1.2 hectares (ha) of coral reef at Puakō, west Hawai’i, and 1) compare population density estimate methods in order to accurately evaluate abundance 2) estimate population mortality and catchability rates, and 3) quantify the re-colonization rates by mapping distribution and movements in response to a depletion experiment. The actual number of individuals removed during a fish-down experiment at the study site provides a direct measure of the initial population abundance (19.5 roi ha-1). A Leslie depletion model yielded the most accurate assessment of initial density (-12.7% error) compared to belt transects (+82.3% error) and tow-board census (-69.1% error). Estimates of natural mortality were relatively low (0.0–0.08), and fishing mortality ranged from negligible to 8.0 % yr-1 in west Hawai’i. Roi movement was monitored through a mark and re-capture program. Tagged individuals traveled 50-150 m from the periphery of the removal area toward its center at a rate of one roi entering the treatment reef every 1-2 months. This study engaged the local Hawaiian fishing community in quantifying the feasibility of roi removal as an ecosystem management tool, and provides methods for assessing and controlling marine invasive fish species.

Giacomo Giorli
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Passive Acoustic Monitoring Reveals Differences in the Foraging Strategy of Deep Diving Odontocetes in the Ligurian Sea: Nighttime Foraging Odontocetes Adjust Their Foraging Activity in Relation to the Length of the Night

Odontocetes are known to produce sound to echolocate on their prey and their echolocation activity can be acoustically monitored in time as a proxy of their foraging activity. Daily occurrence of Odontocetes echolocation clicks was monitored acoustically over a period of five months in the Ligurian Sea using five Ecological Acoustical Recorders (EAR) to investigate whether Odontocete species forage mainly at nighttime or daytime. Data analysis was performed using automatic detector/classification systems: Marine Mammal Monitoring on Navy Ranges (M3R), a custom MATLAB program, and an operator-supervised custom MATLAB programs to assess the classification performance of the detector/classification systems. Detected Odontocetes include Cuvier’s beaked whales (Ziphius cavirostris), sperm whales (Physeter macrocephalus), Risso’s dolphins (Grampus griseus), and pilot whales (Globicephala melas). The general results show that Risso’s dolphins and pilot whales forage more actively at night in the research area. Beaked and sperm whales’ daily foraging activity differs by
location, and indicates they use different foraging strategies. Beaked whales switch between foraging mainly at night to foraging indifferently at day and at night. Sperm whales switch to nighttime foraging as the winter approaches. Being that winter nights are around five hours longer than summer nights, a deeper analysis shows that pilot whales and Risso’s dolphins adjust their foraging activity with the length of the night, foraging longer during the longer winter nights.

Whitney Goodell  
Marine Biology Graduate Program  
(Advisor: Alan Friedlander)  
**Reef Fish Nursery Habitat and Benthic Habitat Mapping for Community-based Fisheries Management in Hā'ena, Kaua’i**

With the suite of anthropogenic and environmental stressors that threaten Hawaii’s coral reef ecosystems, effective and efficient management of nearshore resources is of critical importance. Overfishing and habitat degradation are leading to reduced stocks of reef fishes, many of which play important ecological and cultural roles. Protection of nursery habitats – areas that provide above-average per-unit-area contribution of individuals to adult populations – allows for efficient allocation of management resources. On the north shore of Kaua’i, the community of Hā'ena has been working to develop an effective management plan for their nearshore resources. In an effort to identify areas of particular importance for focused management efforts, I am utilizing multiple knowledge sources to determine critical nursery habitat areas of reef fishes. Informed by local ecological knowledge (LEK) and ecological surveys, I am assessing fish and benthic communities of fore- and back-reef areas of two reef systems (Ke'e and Makua) on the north shore of Kaua’i. I will be mapping the local benthic habitat at a higher resolution than is currently available, which in combination with fish census data will provide an ecologically relevant tool to further evaluate fish distributions. The combination of LEK, ecological surveys, and GIS mapping will provide for informed management decisions, and help to focus conservation efforts in areas of particular value for sustaining Hā'ena's nearshore reef ecosystems.

Shanna Grafeld  
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**SCUBA Diver Environmental Perceptions and Willingness to Contribute to Conservation in Guam**

Guam’s reef fish populations have declined by as much as 86% since the 1950s, and there are current management goals to protect Guam’s fish stocks by conserving at least 30% of nearshore waters. In order to evaluate SCUBA divers willingness to contribute to conservation efforts, we surveyed 208 SCUBA divers in Guam in August 2013 (26% local divers, 74% tourist divers) to determine diver environmental perceptions, coral reef ecological state preferences, and
willingness to contribute financially to conservation efforts. Our results indicate that divers prefer more diverse reefs with greater fish biomass and more numerous charismatic species. Diver preferences differ in their desire to see sharks on the reef, with the majority of divers preferring to see sharks, and the minority preferring to not see sharks. Diver willingness to pay for improved reef state suggests that SCUBA divers in Guam are willing to pay more to dive on a reef with improved ecological conditions. We also find that divers are willing to contribute a one-time payment of $10 (mean, +/- $5) to runoff reduction projects in Guam. This quantification of economic benefits of improved reef conditions can provide leverage for conservation actions, and indicates that SCUBA divers may be willing partners for conservation initiatives in Guam.

Tiffany Nicole Gutlay
Department of Biology
(Advisor: Megan Donahue)

Does Size Matter? The Impact of Coral Head Size on the Abundance and Diversity of Fishes and Invertebrates

The purpose of this study was to investigate the biodiversity of fish and invertebrates in *Pocillopora meandrina* coral heads in Kāne'ohe Bay in relation to coral volume. Field surveys indicated that the common fish species included *Dascyllus albisella* (found in 34.78% of coral heads), *Thalassoma duperrey* (28.70%), *Plectroglyphidodonjohnstonianus* (21.74%), *Dendrochirus barberi* (6.96%) and *Sebastapistes coniorta* (5.22%). The remaining 19 species were distributed among less than 5% of corals. Common invertebrate species included *Trapezia intermedia* (48.70%), *Sabellastarte spectabilis* (23.48%), *Ophiocomapica* (21.74%), *Hariliopsis depressa* (19.13%) and *Trapezia tigrina* (16.52%). The remaining 24 species were distributed among less than 13% of corals. Moreover, species abundance and diversity increased with coral volume. An average diversity of three species was supported by each *P. meandrina* coral head, and 55 species were found across all surveyed colonies.

Emily Guynn
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Impact of Wildfire on Aboveground Carbon Storage in Tropical Ecosystems Across a Precipitation Gradient in Hawai‘i Volcanoes National Park

Tropical ecosystems cover a relatively small portion of the Earth’s land surface, but play a critical role in global carbon cycling. Wildfires impact terrestrial carbon storage via direct consumption, mortality, and postfire changes in species composition. However, the magnitude of wildfire-induced impacts on terrestrial carbon storage is poorly quantified in tropical ecosystems. Models predict an increase in wildfire frequency and intensity with climate change, making it critical to better understand the impacts of wildfire on carbon storage. The objective of
this study was to determine the impact of wildfire on aboveground carbon storage in detritus and live biomass in tropical ecosystems spanning a precipitation/elevation gradient from dry grassland to wet forest. We quantified aboveground carbon storage in paired burned and unburned plots resulting from wildfires in Hawai’i Volcanoes National Park in 2002 and 2003. Aboveground carbon storage in unburned areas increased across the elevation/precipitation gradient from 6.8 Mg C/ha in grassland to 179.5 Mg C/ha in wet forest. Overall, wildfire shifted aboveground carbon storage from live to detrital pools, as expected. Comparing burned vs. unburned plots indicates that wildfires consumed a significant portion of aboveground biomass in these systems with 35%, 61%, 30% and 34% of aboveground carbon consumed in the grassland, shrubland, mesic forest, and wet forest respectively. Better understanding of the impacts of wildfires on carbon storage in tropical ecosystems is essential for predicting what role these ecosystems will play in determining atmospheric carbon dioxide concentrations in a warming world.

Daniel House
Department of Natural Resources & Environmental Management
(Advisor: Christopher Lepczyk)

A Global Analysis of Feral and Domestic Cat Predation in Continental and Insular Environments

Cats are considered one of the world’s 100 worst invasive species and are of particular concern because they have been directly linked to species population’s declines and extinctions across the globe. Given the widespread introduction of cats our objectives were to quantify the: 1) prey diet of domestic cats throughout the world; 2) component of the diet that comes from threatened and endangered species; and, 3) predation by domestic vs. feral cats in both insular and continental systems. We identified 236 studies that contained data on cat prey items. Globally, cats depredated a total of 1017 unique species, of which 673 (66%) were continental and 417 (41%) were insular. Birds comprised the majority of prey (497), followed by mammals (213), herpetofauna (200), and insects (89). Feral cats preyed on more than 3 times as many species than domestic cats globally. Of the species depredated, 116 were listed as near threatened or greater on the IUCN Red List. The majority of studies were from developed nations and the Pacific Ocean. Species accumulation curves suggest that our current cat prey species estimate may be conservative. Our findings considerably increase the previous estimates of species depredated by cats around the world and further highlight the degree to which cats are generalist predators and impact a large variety of the globe’s ecosystems.

Hla Htun
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Predicting Local Scale Climate Change Impacts on Endangered Birds by
Integrating Watershed Models and Expert Knowledge-based Models for Decision-support

Climate change is expected to have significant impacts on native, threatened and endangered bird species, particularly in terms of habitat alteration. Understanding and modeling these impacts in a manner that is useful for decision-makers or management, however, remains difficult as many empirical modeling frameworks require costly and extensive long-term data. To address this issue, we propose an innovative decision support approach to understand climate change impacts on the habitat, life history functions, and abundance of endangered bird species by coupling regional watershed simulation models (e.g. AnnAGNPS) under IPCC define scenarios and an expert knowledge-based model of bird ecology using Fuzzy-Logic Cognitive Mapping (FCM) software. To test our approach, we use data for the Hawaiian Stilt, Hawaiian Coot, Hawaiian Moorhen populations and habitat (Hanalei watershed, Kaua‘i) as a case study. Model results based on IPCC scenarios suggest that increased precipitation will increase Stilt abundance, but decrease Coot and Moorhen abundance. On the other hand, decreasing precipitation may have similar effects across all three species. Additionally, our integrated model scenarios suggest that climate change scenarios will impact life functions (parental care, breeding and foraging success) differently across the three species. Combining empirical and expert-based conceptual models allows managers to understand the local ecological impacts associated with global climate change, making it relevant to the management scale and develop variable-specific mitigation efforts. Additionally, we suggest this framework can be easily employed by wildlife managers to understand the impacts of climate change on different types of species (e.g. Marine) and across different ecological conditions.

Kaleonani Hurley
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Do Mesophotic Coral Reefs Provide a Depth Refuge from Climate Change for Cryptic Crab Communities?

Mesophotic coral reef ecosystems (MCEs) are hypothesized to play a critical role in maintaining reef biodiversity. According to the deep reef refugia hypothesis (DRRH), shallow-water species may move deeper during climatic disturbances; these deeper reefs then serve as a source from which shallow reefs may be repopulated as pre-disturbance conditions return. Shallow coral reefs of Hawai‘i are extensively studied, and although scleractinian corals have been recorded to 165 m, little is known about other reef inhabitants. Brachyuran crabs are fundamental to reefs and fill many ecological and trophic niches, making them ideal candidates for evaluating species richness on a depth gradient (30, 60, and 90 m) relative to among shallow sites. Autonomous Reef Monitoring Structures (ARMS) were deployed for two years for the collection of samples. Species richness was assessed using morphological and molecular systematics. Over 15
genera (representing over 8 families) were found across the depth gradient. As communities are more consistent across geographically disparate shallow sites than among depths at the same site, the DRRH is not supported. In other words, if sea levels rise, crabs from deeper reefs cannot be expected to repopulate future shallow reefs, and crabs from the shallows may not be maintained.

Melanie Hutchinson  
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**Canned Tuna and the Plight of the Silky Shark**

The tropical tuna purse seine fishery in the western and central Pacific Ocean (WCPO) is the largest volume tuna fishery in the world. Targeting primarily skipjack tuna (*Katsuwonus pelamis*) for the cannery. Juvenile silky sharks (*Carcharhinus falciformis*) comprise the largest component of the incidental elasmobranch catch taken in this fishery. Population analyses on silky sharks have shown that high mortality during the juvenile life stages has the largest impact on population growth. During a research cruise on board a commercial purse seine vessel we investigated the interaction rates and post release survival of incidentally captured silky sharks. Post release survival rates were measured using a combination of satellite linked pop-up tags and blood chemistry analysis. To identify trends in survival probability, animals were sampled during every stage of fishing operations, including animals that were captured by hook and line while they were still free swimming inside the net and also at FADs prior to being encircled by the purse seine. Consequently, we were able to obtain blood gas, electrolyte and metabolite levels to determine stress levels throughout the fishing and loading process. Our results indicate that pH and lactate are the best predictors of mortality and that survival precipitously declines once the silky sharks have been confined in the sack portion of the net just prior to loading. Blood chemistry analysis estimated total mortality rates of silky sharks captured in tuna purse seine gear exceeds 84%. Shark interactions recorded by the scientific party were also markedly higher than those recorded by vessel officers and the on-board observer. Future efforts to reduce the impact of purse seine fishing on juvenile silky shark populations should be focused on avoidance and releasing animals while they are still free swimming in the net.

Emily Johnston  
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**Spongiochrysis, Subaerial Algal Communities, and a Preliminary Look at Transitions between Marine and Terrestrial Habitats in the Hawaiian Cladophorales (Ulvophyceae)**

*Spongiochrysis hawaiiensis* is a subaerial alga endemic to O’ahu’s windward
coast. It is found growing on tree bark and rocks between 0 and 30 m from the high-tide shoreline over a salinity gradient ranging from near 0 ppt salinity to hypersaline conditions. A community metabarcoding study of the SSU V4-V5 hypervariable region (rRNA nuclear), sequenced using Roche 454 pyrosequencing, shows the subaerial communities where *Spongiochrysis* is found are diverse assemblages of algal species. These communities include up to 12 lineages of the order *Trentepohliales* (Ulvophyceae), up to 10 lineages of the Trebouxiophyceae, one each dinoflagellate and cryptomonad lineage, and a potentially dominant cladophoralean species (Ulvophyceae). Sequences generated in previous studies from environmental samples have either allied *Spongiochrysis* with the predominantly marine Cladophorales or the entirely terrestrial Trentepohliales. Phylogenetic analyses of sequences generated from unialgal culture material demonstrate this alga belongs to the Cladophorales, likely sister to the marine genus *Pseudocladosiphora*. It is hypothesized that *Spongiochrysis* evolved directly from an intertidal common ancestor of the two genera. Transitions between marine and terrestrial habitats are rare and thought to be limited by steep gradients in osmotic pressure. *Spongiochrysis*'s ability to grow over a large salinity gradient may have facilitated its transition on to land. *Spongiochrysis* is the only described terrestrial species within the Cladophorales. Additional phylogenetic analyses of the SSU and LSU rRNA markers of Hawaiian Cladophorales specimens show this order contains a large amount of undescribed diversity, including at least two additional and unreported transitions to terrestrial habitats.

**Chris Jury**
Co-authors: Robert Toonen
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(Advisor: Robert Toonen)

**Coral Reef Resilience Under Climate Change, Ocean Acidification, and Local Human Impacts**

Climate change, ocean acidification, and various local human impacts are each capable of damaging coral reefs, and some investigators have argued that the global collapse of coral reef ecosystems is all but inevitable over the next few decades. Such projections generally assume that these stressors will intensify over the foreseeable future, that corals will show little capacity to adapt or acclimatize to novel conditions, and that the potential for reefs to recover after disturbance will be compromised by chronic stress. Here we report on a coral reef system that allows for a rare test of these assumptions. The reefs of Kāne'ohe Bay, Hawai‘i were devastated by eutrophication due to sewage input following World War II. In the southern sector of the Bay, mean coral cover on the reefs fell to only ~1-2%, relative to a baseline of ~50-90%. These reefs also experience elevated summertime temperature (mean ~1-1.5°C above the regional normal) and elevated pCO$_2$ (~100-200 µatm above normal). In spite of catastrophic disturbance, and global-change-like temperature and pCO$_2$ conditions, the reefs of Kāne'ohe Bay have shown remarkable recovery since the sewage was diverted in
the late 1970s. The corals also show evidence of local adaptation or acclimatization to higher temperature and pCO$_2$, implying that at least some corals have the potential to tolerate moderate global change. Taken together, these data suggest that it is still possible to preserve some coral reefs by reducing global and local stressors.

Lauren Kaiser  
Co-authors: Lauren Kaiser, Oliver Elison Timm, Thomas Giambelluca, Henry Diaz  
Department of Geography  
(Advisor: Thomas Giambelluca)  
**Trends and Impacts of Kona Lows on Rainfall in Hawai'i**

On small islands, understanding water resources and changes in the local hydrologic cycle is vital for management of freshwater supplies. In Hawai'i, winter storms and frontal system are important sources of precipitation. Some of these storm events cut-off from their extratropical storm track source and create stationary ‘Kona Lows’ west of the Islands. They can contribute more than 50% of the total annual rainfall in the drier leeward regions. In this study, we analyze the potential impact of climatic changes on extratropical winter storm events and rainfall variability in the Hawaiian Islands. The effect of Kona storms on precipitation is investigated with a station network from the Global Historical Climate Network (GHCN) daily climate summary database. By assessing 644 daily reporting rainfall gauges in Hawai'i, the relationship between the presence of Kona storms and precipitation is determined. Kona storm days have been identified with an objective storm tracking analysis method developed by Dowdy et al., (J. Climate, 26, 1403-1417, 2013) in conjunction with data and methods provided by Caruso and Businger (Wea. Forecasting, 21, 193-205, 2006). Our working hypothesis is that the probability of rain events and rainfall amounts are significantly higher during Kona Low weather patterns than the long-term average. We will present new results showing the effects of synoptic Kona Low circulation pattern on rainfall statistics. We will further evaluate to what degree Kona Lows increase heavy rain probabilities in comparison to non-Kona-Low days.

Joey Lecky  
Co-authors: Kim Selkoe and Kirsten Oleson  
Department of Natural Resources & Environmental Management  
(Advisor: Kirsten Oleson)  
**Cumulative Human Impact Mapping for Marine Ecosystems of Hawai'i**

Understanding the spatial distribution, overlap, and cumulative influence of human activities, both on land and at sea, is essential for effective management of ocean resources. A project proposal will be presented which aims to build a database of all available spatial data related to human impacts on the marine environment in Hawai'i, and undertake a process to determine the relative significance of each human activity to ecosystem function. Next, this information will be used to conduct an analysis resulting in continuous maps of the level of cumulative impact
sustained across the marine environment of the populated Hawaiian Islands. Previous applications of this analysis in other regions have helped marine managers identify priority areas for protection, surveillance, threat mitigation, ocean zoning, and monitoring for climate change effects.

**Julian Leon**  
Department of Biology  
(Advisor: Kenneth Hayes)  
**Ampullariidae Revisionary Systematics: Clarifying the Taxonomic Status of *Asolene platae* (Maton, 1811) and *Asolene pulchella* (Anton, 1838)**

Historically, gastropod species delineation has relied heavily on shell characters alone. Unfortunately, shell morphology is often phenotypically plastic, making it unreliable as the sole source for species diagnoses. The overreliance on shell morphology has led to considerable taxonomic confusion within Gastropoda. Such confusion is especially rampant in Ampullariidae. Apple snails, as ampullariids are often called, are a group of freshwater snails comprising ten genera distributed throughout the humid tropics and subtropics. *Asolene*, an ampullariid genus containing six species, of which two, *Asolene platae* and *Asolene pulchella*, have been frequently confused with one another and the former is the type species for the genus. Recent phylogenetic studies indicated that *A. platae* and *A. pulchella* were conspecific, calling into question their taxonomic status. To address this, we have characterized genetic and morphological variation, among 140 individuals of three species, *A. spixii*, *A. pulchella*, and *A. platae* from 4 sites throughout their native range in Uruguay and from samples from the pet trade in Hawai‘i.

Preliminary anatomical analyses of the alimentary, reno-pericardial, digestive, nervous, and reproductive systems failed to reveal diagnostic differences between the two species. Similarly, preliminary genetic analyses indicate a mean maximum likelihood distance of 0.03 at COI between them. Additionally, shell morphology of both *A. platae* and *A. pulchella* are consistent with the original description of *A. platae*. Continued comparative analysis of *Asolene* spp. will provide the data necessary for taxonomic revision and redescription of the genus, and yield insights into the evolutionary relationships among Ampullariidae broadly.

**Catherine Lubarsky**  
Marine Biology Graduate Program  
(Advisors: Megan Donahue & Erik Franklin)  
**Assessing the Effect of Benthic Community Assemblage on Coral Bleaching Resilience**

Coral reefs worldwide are in decline, and are subject to many stressors at both global and local scales. Climate change will continue to cause sea surface temperatures to rise globally, subjecting every coral reef on earth to continuous thermal stress and increasing the threat of coral bleaching and associated mortality. Nutrient input from land, such as dissolved inorganic nitrogen from fertilizers and pollutants, have been shown to lower the temperature at which
corals bleach, making them more sensitive to thermal stress. As these stressors compound, it will become important to understand how resilient various reef communities will be to increased stress. This study proposes to utilize both laboratory and field experiments to assess how benthic community type will affect the bleaching response of corals under thermal and nutrient stress. The proposed research will investigate how and whether the presence of macroalgal populations in a coral community will affect the bleaching responses of corals. I hypothesize multiple possible outcomes: macroalgae may take up excess nutrients, ameliorating nutrient effects on bleaching point depression; conversely, the presence of algae may further stress corals, exacerbating stress responses; or, algal populations may have no effect on coral bleaching responses. This research will give insights as to the resilience of reefs hosting various community types, and will set the stage for more informed and appropriate reef-specific management strategies.

Jessica Maxfield  
Co-authors: Kathleen Cole  
Department of Biology  
(Advisor: Kathleen Cole)  
**Uncovering The Secret of Sex Change: Mapping the Sex Change Pathway in Two Gobiid Fishes with Implications on the Effect of Climate Change on this Process**

Reproduction in marine fishes is an extremely diverse process and the scientific literature is only beginning to explore how reproduction in fishes will be effected by global climate change. In most animals sexual function is predetermined by genetics, established during embryogenesis and is fixed for life. This is not true of the many fishes that have been described as hermaphroditic. This complex process is not well understood on a molecular level and the impact on these systems from global climate change are unknown. This study aims to characterize the molecular nature of sex change in two Gobiid fishes and to understand the link between genes and phenotype using next generation sequencing and coexpression network analysis. These models can then be used to make predictions about the effect of global climate change on the process of sex change in marine fishes, with possible implications for the adaptability of this trait.

Gavin Mura  
Center for Microbial Oceanography: Research & Education  
(Advisors: Christine Shulse & Mike Rappé)  
**The Microdiversity of SAR11 in Kāne'oehe Bay Based on petB Assay Sequencing**

The free-living marine bacterial clade known as SAR11 is one of the most abundant groups of microorganisms in seawater ecosystems across the globe. While its general ubiquity is well known, the nature of fine-scale SAR11 population structure and the forces that shape it are relatively unexplored and thus are not
understood. To investigate high resolution, population-level microdiversity within the SAR11 clade, we developed an assay to amplify and sequence a portion of the gene encoding cytochrome b6 (petB), directly from both cultured isolates and natural populations of SAR11 cells. In order to evaluate the assay, SAR11 petB genes from coastal surface seawater were amplified, cloned, and sequenced. Samples were taken from 10 locations within Kāne'ohē Bay, off the northeastern coast of the island of O'ahu, Hawai'i and a total of 78 genes were sequenced. This work will focus on sample locations in the southern half of the bay. Phylogenies based on petB sequences uncovered a robust subclade structure that extended well beyond the resolving power of the ribosomal RNA gene and revealed microdiversity within sub-clades not related to novel sequenced genomes.

Nicole Muszynski
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Psychology Department
(Advisor: Patricia Couvillon)

Relational Learning in Foraging Honeybees

Honeybee learning is similar to learning in vertebrates, implying that the learning principles are the same for invertebrates and vertebrates. This research extends the work to more complex cognitive phenomena. The training technique (von Frisch, 1915) relies on the natural tendency of honeybees to seek nectar. Free-flying foragers were trained individually to visit a window box in the wall of the laboratory. The bee found sucrose, drank to repletion, flew back to the hive to unload, and returned to the window in a few minutes. On each visit, for both Experiments 1 and 2, the bee found three stimuli, two identical and one different, displayed on a computer monitor mounted in the floor of the window. The stimuli were circular patterns of white, yellow, purple, or green color combinations. A different triad of stimuli was presented for each visit. In Experiment 1, choice of the odd stimulus (correct) was rewarded with a 100-µl drop of 50% sucrose and choice of a nonodd stimulus (error) was “punished” with a 100-µl drop of 15% salt solution. On every visit, the bee was allowed to find the sucrose. The honeybees learned to choose the odd stimulus. In Experiment 2, choice of the odd stimulus was “punished” and choice of a nonodd stimulus was rewarded. The honeybees learned to choose a nonodd stimulus. The results suggest that honeybees can learn to choose based on relationships among stimuli. In the natural environment, the bees may use relationships among patches and flowers to make foraging decisions.

Eileen Nalley
Marine Biology Graduate Program
(Advisor: Stephen Karl)

The Search for Hawaii's Sleeping Functional Groups

Algal dominated reefs are becoming increasingly prevalent as alternate stable states, simultaneously making the importance of reef herbivores exquisitely...
apparent. A degraded reef that has undergone a phase shift to an algal dominated system presents a fundamentally different habitat than an intact coral reef. Some reef fishes may shift their functional roles to exploit new herbivorous niches—a phenomenon coined by Bellwood et al. (2006) as the emergence of a sleeping functional group. Utilizing the experimental conditions provided by a gradient of anthropogenic impact ranging from Papahānaumokuākea Marine National Monument (PMNM) to the Main Hawaiian Islands, I plan to explore whether these potentially ubiquitous, yet undefined components of reef communities may be critical to maintaining resilience and stability in impacted habitats. Through stomach content and stable isotope analyses I will investigate increased herbivory as evidence of shifting functional roles in target species. Using a new primer developed by Leray et al. (2013), gut contents can be further characterized using molecular techniques. *Naso brevirostris*, *N. unicornis*, and *N. lituratus* will be targeted as ontogenetic diet shifters that may delay their transition from herbivory to planktovory with increased algal abundance, and *Thalassoma duperrey*, *Stegastes fasciolatus*, *Abudefduf sordidus*, and *Forcipiger flavissimus* will be representative of generalists who may similarly alter their functional role to exploit expanded herbivorous niches. As the health of marine ecosystems declines precipitously, understanding the impact of alternate herbivores on the mechanisms driving resilience in the dynamic reef communities of the Hawaiian Archipelago should be a research priority.

Scott Nikaido
Co-authors: Ethel Villalobos
Department of Plant & Environmental Protection Sciences
(Advisor: Ethel Villalobos)

**Prevalence and Potential Impact of Varroa Mite Infestation on Honeybee (*Apis mellifera*) Brood Survival**

*Varroa destructor* is an ectoparasitic mite of the European honeybee (*Apis mellifera*), and is also the vector and incubator of a deadly honeybee virus, the deformed wing virus (DWV). High mite infestation levels are correlated with increased prevalence of DWV and higher levels of viral disease, often resulting in colony losses. DWV has been detected in all bee castes, developmental stages, and hive products. High DWV titers in adult bees are often linked to serious developmental and immunological problems, but there is relatively little information on the effect of varying mite levels on bee brood survival. The goal of this study was to assess the prevalence, and potential impact of DWV on the survival of bee brood under different levels of mite infestation. Methods: Prevalence of DWV in bee brood was assessed using RT-PCR. The survival of bee eggs and larvae from study colonies was monitored every other day for two weeks, using close up digital photography. Results: Prevalence of DWV on eggs and bee larvae was higher than that reported for comparable colonies in the mainland US. Mortality (from egg to pupae) was higher in colonies that had not received mite control treatments compared to those that had (29.1% vs 14.6%, respectively). The highest brood mortality rates for all colonies occurred during the
1st to 3rd instar (19.9% untreated and 7.3% treated). Further work is needed to elucidate the link between the high prevalence of DWV in Hawai‘i and increased larval mortality in untreated hives.

Bruna Oliveira  
Co-authors: Kenneth Hayes and Robert Cowie  
Department of Biology  
(Advisor: Robert Cowie)  
**Stable Isotopes of Carbon and Nitrogen in the Study of Ampullariid Trophic Ecology**

As global biodiversity collapses at unprecedented rates, there is urgency in attaining a thorough understanding of the factors that threaten it. Next to loss of habitat and landscape fragmentation, invasion by alien species is the main contributor to biodiversity loss. The family Ampullariidae, freshwater gastropods commonly known as "apple snails," constitutes a significant portion of the native molluscan fauna of Neotropical habitats. In an effort to combine ecological, phylogenetic and phylogeographic data into an integrative study of ampullariid biology, specimens were collected in Uruguay for both stable isotope and molecular analyses. Inhabited by three of the four New World genera, Uruguay is a prime location for maximizing sampling of generic variability. Collected material includes 139 ampullariids of five species (*Pomacea maculata, Pomacea megastoma, Pomacea canaliculata, Asolene platae, and Felipponea iheringi*) representing three New World genera, 28 plant specimens, five sediment samples, six detritus samples, 772 invertebrates, 83 fish, bird feathers, and *Pomacea* egg clutches. By quantifying differences in the flow of elements, stable isotope analyses can help to characterize the trophic structure and relationships in a biological community. Using the collected material, I am undertaking stable isotope analyses of the trophic positions of the five snail species in Uruguay. *Pomacea canaliculata* is a major invasive pest in Asia and Hawai‘i. As such, comparison of individuals from the native (Uruguay) and non-native (Hawai‘i) environments will provide insights into differences in feeding behavior that may be related to its invasiveness and allow assessment of potential impacts on native Hawaiian communities.

Egle Ortega  
Co-authors: Yasuhiro Yamauchi and Monika Ward  
Department of Anatomy, Physiology, and Biochemistry  
(Advisor: Monika Ward)  
**The Effects of Sry-to-Sox9 Replacement on Adult Male Fertility and Spermatogenesis**

Y chromosome encoded gene Sry is responsible for sex determination in mammals. It acts briefly during fetal development and induces the development of testes rather than ovaries by turning on the expression of its autosomal downstream target Sox9. It has been shown that activation of Sox9 in the absence
Sry is sufficient for initiation of male specific sex determination. Sry-to-Sox9 replacement has mostly been studied in the context of sex determination during early embryogenesis. Here, we tested whether Sry-to-Sox9 replacement affects male fertility in adulthood. We examined spermatogenesis and fertility of males with a deletion removing the endogenous Sry (YTdym1) and testis determination driven either by the Sox9 (XYTdym1Sox9) or the Sry (XYTdym1Sox9) transgenes, as well as wild-type males (XY). To assess the fecundity, 3-6 males of each genotype were mated with young wild-type females for the duration of 10 weeks. All tested males were fertile and generated offspring. XYTdym1Sry and XYTdym1Sox9 males yielded similar average number of litters and pups per male. Sperm analyses revealed no differences between the examined groups in respect to sperm number, motility and morphology. When sperm function was tested in vitro, sperm from XYTdym1Sry and XYTdym1Sox9 males fertilized oocytes with similar efficiency but were less effective than sperm from the wild type males. The majority of 2-cell embryos (>70%) developed to normal, healthy blastocysts in vitro. Our findings support that males lacking the testis determinant Sry can be fertile and reinforce the notion that Sry does not play a role in mature gonad.

Zack Oyafuso
Marine Biology Graduate Program
(Advisor: Erik Franklin)

Examining the Role of a Reef Predator, Greater Amberjack (Seriola dumerili), in the Hawaiian Islands Through Diet Analysis

The discovery of ciguatoxicity in kahala (Seriola dumerili) in the late 1970s in Hawai‘i has led to a decline in commercial landings of kahala for the past 40 years. The ecological implications and possible alterations of the marine food web due to reduced fishing pressure on kahala, a deepwater piscivore, are concerning to the local fisher community in Hawai‘i. The first stomach content analyses of kahala in the early 1980s highlighted the importance of mackerel scad (Decapterus spp.) to the prey field of kahala. The proposed study revisits the role of kahala in the Hawaiian marine food web after decades of reduced fishing pressure. Kahala specimens will be collected from reef and deep slope habitats on O‘ahu in summer and winter to reflect possible spatial and/or temporal dietary patterns. This investigation will incorporate molecular genetic metabarcoding approaches in addition to standard visual inspection of prey items to increase the taxonomic resolution of the stomach content analysis. The mitochondrial gene cytochrome c oxidase subunit I will be utilized to identify prey to species level. Intended results from this study include differences in diet that reflect habitat type, season, or size or sex of the specimen. Evidence of ecologically and/or commercially important fish species in the diets of kahala will improve our understanding of trophic relationships in the marine environment, as well as possess potential implications to fisheries management.
M. Gadea Perez-Andujar  
Co-authors: Christina Comfort and Kevin Weng  
Marine Biology Graduate Program  
(Advisor: Kevin Weng)  

Deep-water Sharks: Their Ability to Withstand Hypoxic Conditions Provides Hints on How Animals May Respond to Climate Change

As a result of rising atmospheric CO$_2$ levels and increased temperatures, density changes are occurring in the oceans, upper-ocean stratification will increase and the intermediate water ventilation will diminish. These changes are already causing oxygen minimum areas (i.e. hypoxic zones) in the oceans to expand. To understand the implications of decreasing dissolved oxygen concentrations, we are studying organisms that are likely to intersect low oxygen environments. The prickly shark (Echinorhinus cookei) and the sixgill shark (Hexanchus griseus) live in deep slope environments where they may encounter the oxygen minimum layer, a feature of most of the world’s oceans. While the sixgill shark’s diel patterns have been studied, no research yet exists on the behavior of E. cookei and the comparison between both species. We compare the behavior of H. griseus and E. cookei using acoustic telemetry and popup satellite tags. We then analyze the data with reference to oxygen measurements obtained from the Hawaiian Ocean Time Series and the World Ocean database. Preliminary data reveal that E. cookei inhabits mixed layer and pycnocline waters, thus avoiding hypoxic conditions, whereas H. griseus enters sub-pycnocline waters during the day, spending much of its time in hypoxic conditions.

Angela Richards Donà  
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Marine Biology Graduate Program  
(Advisor: Cynthia Hunter)  

Damaging Interactions between the Coral Holobiont and Pathogenic Bacteria: Undetectable until it is Too Late

Coral disease is recognizable in the field only when visible lesions are present. Colonies lacking obvious signs of stress are often considered healthy, but irreversible cell damage commonly occurs before visible signs emerge. Montastraea faveolata coral fragments were challenged with high doses of Vibrio spp. over the course of six days to induce Caribbean yellow band disease (CYBD)-like lesions. Although no lesions were detected, histopathological analysis encompassing 33 criteria showed that exposed specimens scored consistently high for karyorrhexis and karyolysis in the gastrodermis, changes to nuclei of zooxanthellae, and loss of epidermis integrity with average severity scores representing 55–70% frequency per tissue section. Additionally, a novel association between basophilic structures resembling bacteria and the calicodermis and endolithic organisms was discovered in control and treated fragments. This research highlights the importance of histology for the diagnosis
of coral health and serves as a reminder that a lesion is simply the final, visible stage in coral disease progression.

**Raphael Ritson-Williams**  
Department of Biology  
(Advisor: Ruth Gates)  
**Coral Larval Settlement Variability: Statistical Headache or Evolutionary Insight?**

Understanding patterns of larval behavior are critical to determining the processes that drive connectivity in marine benthic organisms. It is typically assumed that brooded coral larvae settle within 24 hours of their release, and that they have limited dispersal potential as a consequence. Many studies suggest that larvae that haven’t settled after 24 hours are essentially lost to the ecosystem. However, evolutionary theory suggests that a bet-hedging strategy could increase species persistence among habitats. Experiments with larvae from the Caribbean corals *Favia fragum* and *Porites astreoides* show that there is a great deal of settlement variability among larvae exposed to the same settlement substrata, and that not all of the larvae settle within 24 hours. A comparison of larvae from multiple colonies and from the same colony showed considerable settlement variability within the same brood. Some larvae continued to swim and were competent to settle more than 19 days after their release. Inherent variability in pelagic larval duration is probably an important adaptive mechanism that could help species persist over larger spatial scales than was previously recognized.

**Megan Ross**  
Co-authors: Darla White and Erik Franklin  
Department of Biology  
(Advisor: Paul Jokiel)  
**Using Spatial Statistics to Understand Patterns of Reef Coral Mortality in Relation to Environmental Factors at Kahekili Beach Park, Kāʻanapali, Maui**

Long-term monitoring, conducted by the Hawai‘i Coral Reef Assessment and Monitoring Program (CRAMP) and the Hawai‘i Division of Aquatic Resources (DAR), shows a decrease in coral cover of approximately 30% over the past 15 years at the Kahekili Herbivore Fisheries Management Area (HFMA), located in Kā‘anapali, Maui. Resource managers with the Maui branch of DAR observed discrete patches of degraded corals, referred to as “dead zones”, within the HFMA. In 2010, benthic data were collected in 1,115 contiguous, non-overlapping 5 x 5m cells in order to quantify and characterize “dead zones” along the dominant stretch of reef at Kahekili Beach Park. These census data were used to create a baseline map of the “dead zones” and relative coral condition. The increased spatial resolution and extent, relative to the ongoing monitoring in the area, revealed that coral coverage varied dramatically within the HMFA (0-70%), and that the variation in coral coverage was clustered, resulting in patches of high or low coral coverage. Spatial statistics were used to investigate the effect of
environmental variables, such as herbivore density, and surface ground water input, on the observed distributions and relative conditions of reef building corals.

Christina Runyon  
Co-authors: Blake Ushijima, Silvia Beurmann, Amanda Maggio, Thierry Work, Sean Callahan and Greta Aeby  
Department of Biology  
(Advisor: Sean Callahan)  
Investigation of the Etiology, Spatial Extent, and Virulence of Black Band Disease on Kaua‘i

In 2011, The Eyes of the Reef program received reports of a disease affecting *Montipora* on Kaua‘i. An investigation was initiated in accordance with Hawaii’s Rapid Response Contingency Plan. Initial rapid surveys confirmed the report, finding corals exhibiting lesions resembling Black Band Disease (BBD) at outbreak levels (average of 7.5% prevalence). Histology revealed a mixed assemblage of cyanobacteria and gliding bacteria invading intact tissues associated with cell necrosis. BBD has been reported in the Caribbean, and Indo-Pacific but this was the first report of BBD in Hawai‘i. BBD is a tissue loss disease caused by a microbial consortium with three key players: a filamentous cyanobacterium, sulfide-oxidizing bacteria and a suite of sulfate-reducing bacteria. The objectives of this study were to confirm whether the disease was BBD, examine the distribution of the disease around Kaua‘i, and ascertain the degree of disease virulence. We confirmed the presence of the three dominant bacterial players of BBD from the disease lesions: a cyanobacteria similar (99% sequence identity of a portion of the 16S rRNA gene) to *Pseudoscillatoria coralii* strain identified from BBD in other Indo-Pacific regions, a sulfide-oxidizer (*Beggiatoa sp*) identified in BBD worldwide and several sulfate-reducing bacteria (*Vibrio sp*). Aquaria studies confirmed infectivity of lesion material (94.4% infection rate). Surveys conducted around Kaua‘i revealed BBD was widespread (19 of 38 survey sites), affected three species of *Montipora* (*M. capitata*, *M. patula*, and *M. flabellata*) and averaged 0.075(SE±0.05) BBD-affected colonies/m2 of host coral. Tagged colonies followed over time showed progressive tissue loss.

Victor Ruthig  
Co-authors: Yasuhiro Yamauchi, Jonathan Riel and Monika Ward  
Department of Developmental & Reproductive Biology  
(Advisor: Monika Ward)  
The Role of the X Chromosome Encoded Eif2s3x Gene in Spermatogenesis

During male development, the Y chromosome gene, *Sry*, initiates testis formation. In the post-pubertal testis germ cells enter spermatogenesis as spermatogonia and develop to spermatocytes, then spermatids, and finally spermatozoa. The murine Y chromosome gene *Eif2s3y* regulates spermatogonial proliferation and differentiation into spermatozoa. *Eif2s3x* is an X chromosome gene with a high homology to *Eif2s3y* but whether it plays a role in spermatogenesis is unknown.
Here we propose a hypothesis that *Eif2s3x* can replace *Eif2s3y* function and act as the regulator of spermatogonial proliferation and differentiation. To test this hypothesis, we produced mice with a single X chromosome and lacking a Y chromosome (XO) transgenic for either *Sry* alone, or *Sry* and *Eif2s3y*, or *Sry* and *Eif2s3x*. Testis sections from all three transgenic lines as well as from wild type XY mice were histologically assessed and compared. *XOSry* males had spermatogonial proliferation arrest and no spermatogenesis took place. Both *XOSryEif2s3y* and *XOSryEif2s3x* males had functional spermatogonia capable of initiating spermatogenesis and allowing for the development of round spermatids, but never spermatozoa. Similar numbers of spermatogonia were present in both male types but *XOSryEif2s3x* had ~13 fold decrease in spermatid number. Both transgenic lines had significantly less germ cells when compared to wild-type males, and exhibited variable testicular defects distributed differently in each line. In conclusion, we provide evidence that *Eif2s3x* is capable of taking over the regulation of spermatogonial proliferation and germ cell differentiation in the absence of *Eif2s3y* but this substitution causes a decrease in spermatogenesis efficiency.

**Stephen Scherrer**  
Co-authors: Greg Burgess, Martin Pedersen and Kevin Weng  
Marine Biology Graduate Program  
(Advisor: Kevin Weng)  
**Assessing Predictive Models of Acoustic Telemetry Network Design in a Real World Context**

The use of acoustic receiver networks to obtain detailed records regarding the movements of tagged marine species has become an accepted practice in a variety of ecological applications. However the deployment locations of stationary receiver networks, which listen for and record the regular transmission of coded acoustic pulses from tagged individuals, has primarily been an ad hoc endeavor utilizing researcher intuition and prior knowledge of the survey site. Recent development of idealized deployment models, accounting for detection probability, noise, local bathymetry and animal behavior, have attempted to estimate return rates for receivers deployed at specific locations. As well, these models also suggest idealized network design, based on the goals of the survey, in an effort to maximize the ratio of received to sent transmissions. At this time these approaches remain theoretical. We evaluated the model using data from several species obtained from acoustic networks deployed in the Hawaiian Islands and Palmyra Atoll. Observed recovery rates were compared to theoretical predicted recovery rates to ground-truth and assess the efficacy of predictive model methods in the design and implementation of future acoustic networks.

**Gabriel Schierman**  
Department of Plant & Environmental Protection Sciences  
(Advisor: Janice Uchida)  
**Control for Powdery Mildew on Wild Endangered & Endemic Mint on O'ahu**
In the Waianae and Ko'olau Mountains Wild mint is being reestablished on protected lands that were once used for military training. Powdery mildew has become the most noticeable and reoccurring pathogen that overwhelms seedlings when transplanted back into the field. The purpose of this project is to focus on an IPM without the introduction of fungicide compounds in natural forested areas, and to gain a better understanding of the underlying problem.

Lee Shannon
Department of Biology
(Advisor: Whitlow Au)

In Extremis Warfare Ecology: The Marine Biological Support and Ecological Impact Survey in Response to the 2013 Salvage of USS Guardian (MCM-5) on Tubbataha Reef, Republic of the Philippines

At 2:25 AM on 17th of January 2013, the USS Guardian, a U.S. Navy mine countermeasures vessel, ran aground on the south atoll of Tubbataha Reef, Palawan, Philippines. This designated UNESCO World Heritage Site is one of the last remaining intact coral reef ecosystems in the Sulu Sea. The author conducted an ecological damage assessment and provided subject matter expertise to the U.S. Navy salvage task force and incident response team. The objective of the assessment was to document damage to natural resources impacted by the incident, and inform salvage planners of best practices to minimize further damage during extraction of the vessel. A subjective initial damage assessment based on in-water observations and overhead photography was produced. Upon removal of the ship, the author was re-deployed to conduct a joint ecological damage assessment with the biological survey team from the Republic of the Philippines using three methods: aerial survey with geo-referenced photo analysis, benthic transects, and swimmer GPS contour mapping. Additional SCUBA dives to 30 m and ROV surveys to 45 m on the reef slope revealed no evidence of damage from salvage vessel propeller wash or large debris from salvage operations. The resulting combined-nation damage estimate area was endorsed by the Tubbataha Reef National Park Management Office. In the final analysis, secondary damage to Tubbataha Reef National Park caused by removal of ex-USS Guardian was minimal due to high priority of environmental considerations during salvage operations. The reef is currently on a trajectory to natural recovery.

Amanda Shore-Maggio
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Bacterial Community Comparisons Between Healthy and Montipora White Syndrome-affected Corals

In Hawai'i, the tissue loss disease, Montipora white syndrome (MWS) affects the
reef coral, *Montipora capitata*. *M. capitata* exists in two color morphs, red and orange, that display differential susceptibility to MWS. We compared the bacterial communities associated with red and orange morphs of healthy *M. capitata* to red and orange morphs displaying chronic (cMWS) and acute (aMWS) forms of MWS using 454 pyrosequencing of the V3 region of the 16S rRNA gene. Healthy red and orange morphs had significantly different bacterial communities. Healthy red morphs were dominated by bacteria such as *Listonella*, *Bacillus*, and *Shimia* whereas orange morphs were dominated by *Vibrio*. There was a significant shift in bacterial communities of red morphs in response to both chronic and acute MWS, with an increased abundance of *Vibrios* and decreased abundance of other usually dominant genera. In contrast, orange morphs only showed a shift in bacterial communities in response to aMWS with no significant differences found between healthy and cMWS bacterial communities. Orange morphs were dominated by *Vibrios* regardless of health state (e.g. healthy, cMWS, aMWS) but within aMWS samples there were significant increases in Enhydrobacter, and significant decreases in two previously dominant genera. Interestingly, bacterial communities of healthy orange morphs are more similar to orange morphs displaying cMWS than they are to healthy red morphs. The differences in bacterial communities between healthy color morphs and the similarities in bacterial communities between healthy and cMWS-affected orange morphs may help explain the patterns of MWS occurrence observed in the field.

Adam Smith  
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(Advisor: Paul Nachtigall)  
**Low-frequency Temporary Threshold Shift in a Bottlenose Dolphin (*Tursiops truncatus*)**

There is growing concern about the increasing levels of anthropogenic noise in the oceans and the impacts it may have on the biology and behavior of marine mammals. Much of this noise increase has occurred at lower frequencies due to activities such as shipping traffic, seismic exploration, and naval and research sonar. While multiple studies have investigated the effects of mid-frequency noise exposure on the hearing of odontocetes, few studies have looked at the effects of similar exposures at lower frequencies due to the difficulty of obtaining accurate hearing threshold measurements below 4 kHz. Investigations on hearing capabilities at these low frequencies are vital to the understanding of potential impacts of increased noise exposure, and are important for decisions concerning conservation and management. We report the development of methodologies to measure low frequency hearing thresholds down to 2.4 kHz using auditory evoked potentials (AEP). These AEP methods are being used to investigate low frequency temporary threshold shift (TTS) in a bottlenose dolphin (*Tursiops truncatus*) after exposure to a broadband fatiguing noise from 0.5 to 2.5 kHz. Preliminary experiments indicate significant threshold shift of up to 16 dB occurs at a test frequency of 4 kHz after exposure to sound at 161 dB SPL(rms) re: 1 uPa, with
recovery occurring within 80 minutes post exposure. These results indicate that the hearing system of \textit{Tursiops truncatus} may show increased susceptibility to TTS at lower, less sensitive frequencies of hearing.

\textbf{Emilia Sogin}
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(Advisor: Ruth Gates)
\textbf{Variation in Coral Metabolite Production After Exposure to Global Climate Change Stressors is Species Specific}

Reef building corals are ecologically, economically and culturally important to tropical regions worldwide. Unfortunately, global climate change stressors are threatening their persistence into the future. Reef response to stress is non-uniform and the composition of coral reef ecosystems reflects differences in performance limits among coral species. Understanding the molecular mechanisms that drive these variations in response is a central question in coral biology. To contribute to this area of research, we were able to detect variation in metabolite production after replicates of \textit{Montipora capitata} and \textit{Pocillopora damicornis} were experimentally exposed to ambient and high levels of pCO$_2$ and temperature. Corals displayed variation in how they regulated their metabolite pools in response to stress exposure, indicating that metabolic response to global climate change at the molecular level is species specific. Our work forwards our understanding of differential patterns in coral mortality on reefs in a changing world.

\textbf{Shikha Srivastava}
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\textbf{Prevalence of \textit{Fusarium} on Orchids in Hawai'i and Discovery of Three New Pathogenic Species of \textit{Fusarium}}

Fungal pathogens especially those belonging to the \textit{Fusarium} genera have long been associated with the reduction in production of tropical orchids in Hawai'i. Precise identification of \textit{Fusarium} is always a challenge for plant pathologists largely because of tiny variations in microscopic morphological characteristics. There is a lack of information about the accurate identification of orchid associated \textit{Fusarium} that prevents creating of efficient management practices. This study reports the isolation, characterization and identification of pathogenic \textit{Fusarium} species on four common orchid genera of commercial importance. 610 fungal isolates were obtained from 60 plant samples of different varieties of 9 genera and hybrids of orchids showing disease symptoms, collected from different nurseries on O'ahu and the Island of Hawai'i. \textit{Fusarium} was found in 78\% of isolates and was present in all plant samples. Morphological characteristics and by using the conserved TEF1-\alpha gene sequence, eleven species of saprophytic and pathogenic
Fusarium associated with orchids were identified. Pathogenicity assays on different orchids showed six species (F. proliferatum, F. oxysporum, F. solani, F. poae, F. begoniae and F. circinatum) were pathogenic on Dendrobium and Cymbidium while F. oxysporum was also pathogenic on Miltonia and Cattleya varieties. Three species, F. poae, F. begoniae, and F. circinatum were found for the first time in Hawai‘i. This study presents identification of Fusarium spp. associated with orchids, which will aid in development of efficient management options.

Yuko Stender  
Department of Geography  
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Thirty Years of Coral Reef Change in Relation to Coastal Construction and Increased Sedimentation at Pelekane Bay, Hawai‘i

Coral reefs are being critically impacted by anthropogenic processes throughout the world. Long term monitoring is essential to the understanding of coral reef response to human impacts and the effectiveness of corrective management efforts. Here we reevaluated a baseline of reef communities established in 1976 and resurveyed in 1996 at Pelekane Bay, Hawai‘i where there has been historically impacted by alterations in the adjacent watershed and harbor construction. While coral and fish communities show dramatic declines from 1976 to 1996, our survey reveals that coral cover since 1996 has increased slightly accompanied by a significant increase in overall fish abundance, diversity, and evenness and numerically higher herbivorous fish populations. This improvement can be attributed to lower fishing pressure since 1996 due to reduced shoreline access, tighter fishing regulations and increased monitoring of legal and illegal fishing activities. Stabilization of the coral community can be attributed partially to reduced sedimentation resulting from watershed restoration efforts. Insights into the mechanism that removes sediment from reefs was provided by a major storm event and a tsunami that remobilized and flushed out sediment deposits. The increase in herbivorous fishes probably played a role in reducing algal competition in favor of corals. The data suggest that the precipitous reef decline in this area has been arrested and offers support for the corrective actions previously undertaken.

Jamie Sziklay  
Co-authors: Scott Heron, Mark Eakin, Megan Donahue and Greta Aeby  
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Can We Predict Coral Disease Outbreaks Before They Occur?

Coral disease outbreaks have been occurring more frequently in Hawai‘i and we have developed a database of disease observations in order to identify potential environmental drivers of disease outbreaks. We have expanded the Hawai‘i Coral Disease database (HICORDIS) of observational surveys from across the Hawaiian
archipelago from 2004-present. This operational database compiles scientific surveys of coral health from the National Oceanic and Atmospheric Administration Coral Reef Ecosystems Division, Hawai'i Institute of Marine Biology, Hawai'i Coral Reef Initiative, Hawai'i Coral Reef Assessment and Monitoring Program and Department of Aquatic Resources. HICORDIS will continue to serve as a central repository for disease data into the foreseeable future. While it is not possible to monitor the entire archipelago for disease outbreaks, it is possible to remotely monitor environmental conditions associated with those outbreaks. We are using the HICORDIS data to associate disease prevalence with remotely monitored sea surface temperatures, irradiance and chlorophyll and modeled wave action. This analysis is part of a larger project where we will develop a forecasting tool to detect coral disease outbreak risk, which will be incorporated into NOAA Coral Reef Watch experimental network of regional tools to detect coral disease outbreaks globally.

William Thomas
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Department of Biology
(Advisor: Michael Hadfield)

Comparative Toxicity of Antifouling Coatings on the Larval Development of *Tripneustes gratilla*

Research from summer 2012 showed that normal development of the collector urchin, *Tripneustes gratilla* is disrupted in Kā'ne'ohe Bay waters, a coastal region with numerous anthropogenic impacts. Antifouling coatings (AF) deliver heavy metals to the surrounding waters and disrupt settlement via toxic mechanisms. The focus of this study was to examine the extent to which bay waters and AF coatings disrupt development of larvae. Urchin embryos were allowed to develop for three days in 10 mL samples of water collected from coastal off-shore or near-shore bay locations. Resultant echinoplutii were then categorized as normal, abnormal or underdeveloped, based on visual assessment of morphology. Larvae that developed in water from off-shore locations in the bay had higher percentages of normally developed larvae than comparable studies of larvae in water collected from several near-shore sites. To determine at what concentrations of leachate larvae develop normally, cuprous oxide, cuprous thiocyanate or zinc-based ablative coatings were coated on replicate surfaces, dried and steeped in filtered seawater. These AF-conditioned waters were then serially diluted over a wide range of concentrations and used as experimental solutions in larval development assays. Results suggest that larvae are sensitive to leachates of all AF coatings, even at extremely low (very dilute) concentrations. Various anthropogenic activities coupled with numerous boats from at least four Kā'ne'ohe Bay marinas and the substantial release of AF agents from those vessels are likely to be responsible for the lowering of water quality and increase of abnormal urchin development in shallow waters in Kā'ne'ohe Bay.
Kaho Tisthammer  
Marine Biology Graduate Program  
(Advisor: Robert Richmond)  
**Understanding the Adaptive Ability of the Lobe Coral, *Porites lobata*, Using Genetics**

Corals in Maunalua Bay, Hawai’i are under chronic pressures from sedimentation and terrestrial run-off containing multiple toxicants. However, some individuals thrive despite the prolonged exposure to these environmental stressors, which suggests that these individuals may have been under selection to withstand such stresses. The lobe coral, *Porites lobata*, in Maunalua Bay showed increasing levels of stress response along the environmental gradient that exists from nearshore toward offshore. Therefore, the lineage(small)-scale population genetic structure of *P. lobata* was investigated to understand the genetic basis for observed differential stress responses. The genetic structure was analyzed using known DNA markers. The clear genetic differentiation in *P. lobata* was found between the offshore and inshore individuals, which suggests that the individuals nearshore may have been selected for higher tolerance to these stressors.

Understanding the little-known, small-scale genetic variation will provide critical information for saving not only severely degraded corals in Maunalua Bay, but also for global coral reef conservation, since the coping ability of corals to environmental stressors depends on the underlying genetic variability. The results will also help predict the effects of climate changes on coral reef and resilience based on population genetics.

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**Production of the Antibiotic Andrimid is Involved in the Infection of the Coral *Montipora capitata* by *V. coralliilyticus* Strain OCN008**

The resident bacterial community present on healthy coral is thought to protect against potential bacterial pathogens though competition for resources or direct inhibition of pathogen growth. However, if the coral’s defenses are compromised, pathogenic bacteria are able to colonize and induce disease. The pathogenic bacterium *Vibrio coralliilyticus* strain OCN008 infects the reef coral *Montipora capitata*, a common coral in Hawai’i, causing the tissue loss disease acute *Montipora* white syndrome. OCN008 is distinguished from other pathogenic strains by the production of the broad-spectrum antibiotic andrimid, which is thought to be involved with pathogenesis. The genes for andrimid biosynthesis were identified in the OCN008 genome and deletion of these genes created a
mutant strain of OCN008, Δadm, unable to produce andrimid that displayed attenuated virulence. The Δadm mutant had a 60% reduction in virulence compared to wild-type OCN008. When *M. capitata* fragments were pre-treated with spectinomycin and ampicillin, which inhibited the growth of resident coral bacteria, the Δadm strain displayed a wild-type level of virulence. Functional complementation of the Δadm mutation suggested that the production of andrimid by the pathogen may serve to inhibit the growth of the normal microflora allowing for successful colonization by OCN008. These results provide indirect evidence for the protective role of the coral microflora against bacterial pathogens and describe a novel mechanism of infection utilized by OCN008 to infect *M. capitata*.

Sarah Maile Vasconcellos  
Botany Department  
(Advisor: Celia Smith)  
**Development of Methods Leading to Successful Outplanting of Native Reef Algae**

Invasive algae are the principal threat to the health of native coastal ecosystems in Hawai‘i. Healthy reefs sustain substantial populations of herbivorous reef fish and urchins. As numbers of herbivores have declined, resource managers employ tools that simulate massive herbivore grazing (Supersucker) or the release of generalist grazers (*Tripneustes gratilla*). We proposed a new tool that will lead to outplanting the once-dominant native species of reef algae into places where community based cleanups will remove invasive biomass (Waikīkī and He‘eia fishpond coastal regions). In Summer 2013, *Sargassum aquifolium* (limu kala) was collected and invertedly hung to allow for external fertilization to occur and resulting zygotes to settle on tiles that lined the bottom of the water bath. After 12 weeks of growth, juveniles grew to two cm in height demonstrating the potential for juvenile to grow in tank culture. In early 2014 we will repeat and refine this effort with 200 five cm² limestone tiles site-1 seeded with zygotes of limu kala by hanging 20 fertile adults from a PVC rack placed in a 500 L, 1.5 m² fiberglass outdoor mesocosm filled with flowing, filtered, low nutrient seawater. After a week, adults will be removed; seeded tiles will remain in the mesocosm with air bustling and filtered seawater for up to 14 days before outplanting. Outplanting in Waikīkī and He‘eia fishpond will evaluate survivorship as well as direct interactions with invasive algae and recruitment of other native species.

Kirill Vinnikov  
Department of Biology  
(Advisor: Kathleen Cole)  
**Phylogeny and Adaptive Evolution of Righteye Flounders (Teleostei: Pleuronectidae) to Different Oceanic Depths and Geographic Regions**

Clinal variation in quantitative morphological traits associated with temperature gradient or geographic latitude is well-known among fishes. It shows that some species from the northern cold regions, including several righteye flounders
(Pleuronectidae), have higher average number of vertebrae and fin rays in comparison with their southern conspecifics. However, many flounder species, which share sympatrically and allopatrically similar latitude-temperature regimes, differ by the same quantitative traits demonstrating significant change in their mean phenotypes. Furthermore, some sister species of flounders show an opposite direction of interspecific variation, having lower character values in the north and higher in the south, which may indicate some adaptive response confounded with ecological heterogeneity. In the present study, I propose the most complete phylogeny of Pleuronectidae including 55 species out of 62 from the North Pacific and North Atlantic and test several adaptive hypotheses to explain their morphological differences in shape and meristic characters. Interspecific character variation nested by the gender was analyzed first with principal components and ANOVA. Then it was tested for the different selective regimes such as geographic latitude and oceanic depth in R package OUCH (Butler and King, 2004). Bayesian and maximum likelihood phylogenetic trees were reconstructed using RAG1, RAG2, cytb and COI partial gene sequences (~4200 bp in total). The best-supported model for variation in meristic characters was the adaptive response to depth, and shape variation was explained mostly by geographic factor. These results provide new insights into character variation, and the responsivity to selection pressures, of quantitative traits among flatfishes.

Rachael Wade  
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Molecular Determination of Kleptoplast Origins of the Common Sea Slug  
*Plakobranchus ocellatus* Supports the Presence of Cryptic Bryopsidalean Diversity in the Hawaiian Islands

The study of herbivore-plant interactions has the potential to uncover essential, new knowledge for both organisms involved. The Sacoglossan sea slug *Plakobranchus ocellatus* is a common algivore throughout the pantropical Pacific, including the Hawaiian Islands. *P. ocellatus* is known for its long-term retention of stolen chloroplasts (“kleptoplasts”) from ingested algal cytoplasm that maintain photosynthetic activity and sustain the slug in times of low food availability. Early studies assessed *P. ocellatus*’ diet using electron microscopy of kleptoplast morphology, however in many cases this only lead to family or genus recognition of plastid origins. Using the chloroplast tufA and rbcL gene regions, a molecular assessment of the kleptoplasts of *P. ocellatus* has led to the discovery of unrecorded levels of diversity within several algal genera in Hawai‘i, including species divergence in the monospecific genus *Caulerpella*, *Chlorodesmis*, *Rhipidosiphon*, and the polyphyletic genus *Pseudochlorodesmis*. Other studies have found *P. ocellatus* to feed primarily on larger, psammophytic Bryopsidalean taxa (e.g., *Halimeda*); however feeding study results suggest that a Hawaiian population prefers diminutive, epilithic Bryopsidalean taxa, such as *Rhipidosiphon*. Mitochondrial COI data demonstrate genetic divergence between a Hawaiian
population and eastern Pacific Ocean populations of *P. ocellatus*, which may further explain the difference in diet and algal-substratum preference.

**Maegen Walker**  
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**Exploring Cross Modal Facilitation in Perceptual Learning**

Perceptual learning for ignored items is enhanced provided they frequently appear synchronously with attended targets in a primary task presented earlier (see Dewald & Sinnett, 2013). Research suggests that when the primary task is presented in the auditory modality, administering the secondary task, a surprise recognition test, across modalities (audiovisual), compared to unimodal (auditory or visual) presentations, leads to higher recognition rates for ignored items previously aligned with attended targets in the primary task. This study extends these findings to test the effect of modality presentation on the facilitation of perceptual learning when the primary task is presented visually and the secondary task is presented in either the same (visual), different (auditory), or across (audiovisual) modalities. Participants viewed a rapid serial visual presentation (RSVP) stream of relevant items (pictures) superimposed with irrelevant distractors (words). The primary task was to identify immediate picture repetitions (targets) in the RSVP stream while ignoring superimposed words. Later, a surprise recognition test for the previously ignored words was administered in a single sensory modality, or across modalities. As expected, ignored words that had previously been aligned with target pictures were recognized at significantly higher rates than non-aligned words for all three recognition tests. Critically, cross-modal presentation of the secondary task lead to the highest degree of facilitation for recognition of target aligned words. These findings suggest two important conclusions: first, temporal synchrony between irrelevant and relevant information is crucial for later recognition and, second, cross-modal presentation of information enhances perceptual learning rates for unattended stimuli.

**Christopher Wall**  
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**Elevated-DIC Stimulates Coral Calcification in Juvenile *Porites spp.* Exposed to Ocean Acidification *in situ***

Increased atmospheric pCO₂ leading to ocean acidification (OA) is predicted to negatively affect reef corals by reducing calcification rates and is hypothesized to affect rates of respiration and metabolism. In this study, juvenile colonies of massive *Porites* were exposed to manipulated pH and [HCO₃⁻] *in situ* to test the hypothesis that OA does not affect respiration, calcification and metabolic costs concurrent with calcification. Incubations lasted 28h and exposed corals to
ambient temperature and light with ecologically relevant water motion. Three treatments were applied: (1) ambient conditions of pH 8.04 and 1751 µmol HCO₃⁻ kg⁻¹ (Treatment 1), (2) pCO₂ induced ocean acidification of pH 7.73 and 2011 µmol HCO₃⁻ kg⁻¹ (Treatment 2), and (3) pCO₂ and HCO₃⁻ enriched seawater of pH 7.69 and 2730 µmol HCO₃⁻ kg⁻¹ (Treatment 3); elevated [HCO₃⁻] was used to test for stimulatory effects of DIC on calcification under conditions of low pH & Ωarag. Calcification was affected by treatments, with an 81% elevation in Treatment 3 versus Treatment 1, but no difference between Treatments 1 and 2. Respiration and the metabolic expenditure concurrent with calcification were unaffected. These findings indicate massive Porites spp. is resistant to short exposures to OA in situ, and can increase calcification at low pH and low Ωarag if [HCO₃⁻] is elevated. Porites may therefore be DIC-limited under ambient conditions.

Charley Westbrook
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Growth, Feeding Rates and Feeding Preferences of the Collector Urchin
Tripneustes gratilla

In an attempt to aid State efforts to control invasive macrophytes (Acanthophora spicifera, Gracilaria salicornia, Eucheuma denticulatum, Kappaphycus alvarezii) in Kāne’ohe Bay, we measured the survivorship, growth rates, feeding rates and dietary preferences of the collector urchin, Tripneustes gratilla. Juvenile urchins from the DAR hatchery of three size classes - small (17.5-22.5mm), medium (29.8-43.8mm) and large (45.1-65.1mm) - were housed in flow through tanks and fed each the 4 alien algae species in choice and no-choice trials. Urchins were also caged on reefs to determine survivorship of outplanted hatchery animals. Growth rates varied significantly among different algal diets. Urchins fed exclusively on G. salicornia or K. alvarezii grew significantly faster than those fed on diets of E. denticulatum. In non-choice feeding trials small urchins consumed more G. salicornia than other algae species, whereas large urchins consumed all four species at equal rates. In choice feeding trials, however, urchins of all sizes preferred A. spicifera over other algal species, although secondary diet preferences varied among urchin size classes. Survivorship was highest on the reef flat, intermediate in the lagoon, and lowest on the reef slope. Urchins deployed on the reef flats are surviving at high rates, and consuming the target species of algae for which they are being outplanted. T. gratilla grows quickly on these alien algae, and appear an effective biocontrol agent for the reefs of Kāne’ohe Bay.

Chaminda Wijesundara
Department of Biology
(Advisor: Leonard Freed)

Divergence of Bill Morphometrics in the Sympatric Sri Lanka White-eye
Zosterops ceylonensis: Possible Indication of Character Displacement
When two ecologically similar, sympatric species compete in their zone of overlap, their traits are expected to diverge in the area of sympatry, while remaining more similar in the areas of allopatry. The objective of the present study was to document the divergence of some morphological characters in two species of white-eye that occur both allopatrically and sympatrically in Sri Lanka, namely the Sri Lanka white-eye *Zosterops ceylonensis* and the Oriental white-eye *Z. palpebrosus*. The study was carried out from February 2013 – January 2014. Birds were captured using mist-nets in selected locations of the sympatric and allopatric zones of the two species, and measurements (in mm) of bill length to skull, bill length to feathering, and tarsus length were obtained from each individual. Bootstrap tests showed that the bill length measurements of the Sri Lanka white-eye in the sympatric zone were significantly different from those in the allopatric zone (T-Test of difference = 0 (vs not =): T = -6.690 P-Value = 0.014 for bill length to skull in mm; T = -3.289 P-Value = 0.002 for bill length to feathering in mm). However, tarsus length of the Sri Lanka white-eye did not show a significant difference in the sympatric zone (T-Test of difference = 0 (vs not =): T = -3.289 -1.316 P>0.05). The results may indicate that this species is adapted for exploiting a different food niche in sympatry. They may also demonstrate ecological character displacement in this species in the zone of overlap.

Christie Wilcox  
Department of Cell and Molecular Biology  
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**Four Fish, Two Fish: Re-evaluating Evolutionary Relationships within the Subfamily Pteroinae**

The Pteroinae comprise twenty-one species in five genera: *Pterois* (ten species), *Dendrochirus* (five species), *Ebosia* (two species), *Brachypterois* (two species) and *Parapterois* (two species). Taxonomic ambiguities between *Dendrochirus* and *Pterois* led to previous molecular phylogenetic investigations of the two genera alone, revealing that both are paraphyletic. Until now, no molecular study has investigated all five genera of lionfishes or used nuclear markers to examine the relationships. In this study, phylogenetic relationships between lionfishes (subfamily Pteroinae) were investigated by comparing mitochondrial gene and nuclear gene intron sequences from 18 of the 21 species representing all five lionfish genera. Bayesian, maximum likelihood, and parsimony results all supported previous findings that *Pterois* and *Dendrochirus* are paraphyletic genera. The other three genera are monophyletic and well-supported. Population-level analyses revealed overlapping haplotypes in all markers between *Pterois miles* and *P. volitans* and between *P. volitans*, *P. lunulata* and *P. russelli* - four species with overlapping meristic characteristics and native ranges. These data suggest that the separation into four species is not warranted. The four putative species instead group into two evolutionary lineages: one in the Pacific and one in the Indian Ocean and southern Pacific. In addition, individuals were identified with haplotypes from both lineages. When location of collection was taken into
account, a clear hybridization zone where the native ranges of these species emerged.

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Characterization of a Novel Gammaproteobacteria HIMB30 with Genes for Photoheterotrophy

The aim of this study was to determine the physiological characteristics of HIMB30, novel gammaproteobacterium in order Oceanospirillales. HIMB30 was isolated from coastal surface water in Kane'ohe Bay, Hawai'i and is notable for having genes for proteorhodopsins and CO$_2$ fixation. Proteorhodopsins are light-dependent proton pumps found in bacteria that allow bacteria to generate biochemical energy from light in the form of ATP. Because HIMB30 also has genes for CO$_2$ fixation, it may be that HBH30 can both generate ATP and fix inorganic carbon, traits not yet observed within class Gammaproteobacteria. Exposure to varying oligotrophic nutrient concentrations and light/dark settings yielded the following results: 1) HIMB30 grew fastest in high thiosulfate and glucose concentrations, and 2) HIMB30 did not show higher growth rates in light vs. dark settings. Radio-labeled carbon (14C) uptake experiments revealed that HIMB30 did fix carbon, but data indicated that fixation was achieved through sulfur-oxidation. Although light-driven fixation was not observed in this study, phototrophy remains a possibility. The ability of HIMB30 to sulfur-oxidize and the location at which it was found render the strain unusual and different from its benthic, sulfur-oxidizing gammaproteobacteria relatives. While the abundance of HIMB30 in oceans requires more study, its capability to sulfur-oxidize and grow in oligotrophic nutrient compositions may contribute to its survivability in predicted low-nutrient oceanic conditions. Because of the essential role of bacteria in marine food webs, the results of this study allow for a deeper understanding of the function of bacteria in ocean ecosystems.

Jason Wong
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Viral Relationships and Population Dynamics of A. tumida in Honeybee Colonies

Honeybee populations have been devastated by the spread of the Varroa mite, V. destructor, an ectoparasite and vector for a deadly strain of deformed wing virus (DWV). Bees with high levels of DWV exhibit shrunken wings, enlarged abdomens, and have shortened lifespans. The higher the mite infestation and associated viral level the more likely a colony is to collapse. Small hive beetle
(SHB) is a secondary pest of honeybees, which feeds on bee brood, honey, pollen, and dead bees. Although severe infestations of SHB can destroy hives, it is still unclear whether this pest can become another route for viral transmission. The objectives of this work were to: 1- Examine the relationship, if any, between SHB and DWV and, 2- Document the population dynamics of SHB in honeybee colonies in a subtropical climate. Methods: A laboratory feeding study was conducted in which SHB were reared on multiple food sources, and then tested for the presence of DWV. Population densities of SHB in the field were quantified weekly via in-hive traps and colony dynamics and productivity were also noted. Results: In the feeding study, only SHB larvae fed bee pupae were positive for DWV, and no adult SHB were positive for DWV. SHB populations fluctuate seasonally and appeared to be greatest in hives that were most productive, and hives that were least productive. The results of the feeding study suggest that SHB is not a likely vector for DWV. SHB populations vary throughout the season and with colony characteristics.

Johanna Wren
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Modeling and Ground-truthing the Reef Fish Larval Pool Around the Hawaiian Islands

Understanding connectivity of marine organisms is imperative to effectively manage and protect marine ecosystems. Most adult reef fish show site fidelity thus dispersal is limited to the mobile larval stage of the fish. In this study we assess larval reef fish distributions in the waters around the Island of Hawai‘i using both in situ and model data. Catches from three years of Cobb midwater trawls off west Hawai‘i Island shows that reef fish larvae are most numerous in offshore waters deeper than 3000 meters and consist largely of pre-settlement Pomocanthids, Acanthurids and Chaetodontids. Larval reef fish abundance shows no relation to total trawl catch or total fish catch. Using a rearward trajectory simulation we identify depth layers and pelagic larval durations (PLD’s) resulting in the greatest settlement probability, and develop a model that predicts relative larval abundances. By comparing in situ larval shore fish catch with modeled larval abundances we hope to identify physical drivers of connectivity, and highlight geographic areas of high importance to maintaining marine fish populations. This study lays the groundwork for better understanding connectivity in marine fish populations, ultimately leading to the ability of making better-informed management decisions.

Nicole Yamase
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(Advisor: Celia Smith)
Common but Unknown: the Ecophysiology of the Green Alga Microdictyon setchellianum
Studying the physiological ecology of dominant invasive macroalgae has been important to understanding the basis for changes to reef communities in Hawai‘i. The native green alga *Microdictyon setchellianum* can be a dominant reef plant across the Hawaiian archipelago, yet its rates of growth and photosynthesis remain unstudied. We began characterizations of growth and physiological ecology of *M. setchellianum* using manipulations of irradiance from ambient (>700 µmol photons m\(^{-2}\) s\(^{-1}\)) to shaded levels (350 µmol photons m\(^{-2}\) s\(^{-1}\)) in mesocosms while monitoring temperature (HOBO data loggers) during July, October, November and December 2013. Specific Growth Rates (SGR) were calculated as increases in wet weight over seven days (g g\(^{-1}\) d\(^{-1}\)). Photosynthetic parameters were measured using a Walz’s Junior Pulse Amplitude Modulated (PAM) Fluorometer. Results showed a significant increase in growth rate (P<0.001) when water temperature increased from the seasonal field maximum of 29.0ºC to 29.5ºC, but with no further growth increase up to 32ºC. Photosynthetic parameters, e.g., maximal rates of electron transport (ETRmax), were high (40 µmol electrons m\(^{-2}\) s\(^{-1}\)) through this timeframe in both irradiance regimes. *M. setchellianum* is a shade-tolerant plant that can grow in a wide range of irradiance and temperate regimes. In oligotrophic conditions, the plant can sustain growth comparable to other abundant native and nonnative species, suggesting a basis for ecological success by *M. setchellianum* in healthy ecosystems. Future experiments will examine this alga’s ability to grow in water temperature above 32ºC, the projected increase expected by 2100.

Heather Ylitalo-Ward
Department of Biology
(Advisor: Les Watling)

**Mating Behavior in *Octopus oliveri*: the Effect of Male Order and Size in Observed Mating Success**

Extremely little is known about *Octopus oliveri*, its life history, distribution, or behavior. *Octopus oliveri* was first described by Berry in 1914 from the Kermadec Islands and has since been identified in Hawai‘i. As is true with most octopuses, female *O. oliveri* have two oviducts for sperm storage and may be able to store viable sperm for at least 100 days and up to 10 months. In addition, they mate with several males before laying their eggs at the end of their lives. This suggests that sperm selection or competition may be occurring, however it has rarely been studied in octopods and never in *O. oliveri*. Four sets of behavioral experiments were recorded wherein six females were mated with three males in varying order, for a total of 24 females and 12 males. Video analysis of mating behavior shows the rates of aggression and duration of mating for 66 successful mating pairs. By observing the difference between the first, second, and third mating males, one may discern whether one male is more successful behaviorally than another in inseminating a female. The weights of both the males and females were recorded, as well as whether eggs were subsequently laid after mating and when. This work
is a first step in understanding this poorly described species and its role in the Hawaiian intertidal ecosystem.

Erin Yokote  
Department of Biology  
(Advisor: Kenneth Hayes)  
**Distribution of Infective Angiostrongylus cantonensis Larvae within Intermediate Gastropod Hosts**

*Angiostrongylus cantonensis*, the rat lungworm, is a parasitic nematode that is a major threat to human health in Southeast Asia and the Pacific Islands. It is invasive in Hawai‘i, probably resulting from accidental human mediated introductions of infected definitive and/or intermediate hosts, rats and snails, respectively. The life cycle of *A. cantonensis* involves five stages. Snails are infected by ingesting first-stage (L1) larvae in rat feces, which develop to the third (L3), infective stage, in the snails. Infected snails are eaten by rats, in which the larvae mature and reproduce. Humans become accidental hosts by eating snails infected with L3, which travel to the brain and mature to L5, but then die, causing neurological damage. While the parasites’ movements in the definitive hosts, rats, are well understood, little is known about their location and development in the intermediate gastropod hosts. Infection in a snail is primarily by ingestion but may also result from penetration of the tegument. *Parmarion martensi*, a gastropod host of *A. cantonensis* in Hawai‘i, was studied to address the broad objective of understanding the distribution of L3 among various organ systems and tissues. Preliminary results show that the head/foot region of *P. martensi* has the most larvae (200-37,000), followed by the reproductive system (27-7,580) and the digestive system (3-420). The final results of this study may allow development of more effective controls that target the larvae and more consistent and rigorous detection of the larvae in hosts.

Julie Zill  
Co-authors: Michael Gil and Craig Osenberg  
Hawai‘i Institute of Marine Biology  
(Advisor: Megan Donahue)  
**Vermetid Gastropods and Sedimentation: Environmental Factors Can Become ‘Stressors’ When Combined in a Coral Reef**

Recent meta-analyses indicate that combinations of environmental stressors most often produce results not predicted by individual effects. Though most stressor studies focus primarily on physical (i.e., abiotic) stressor combinations, here we tested whether an abiotic and biotic stressor interact, by examining the individual and combined effects of sedimentation and vermetid snails (*Dendropoma maximum*) on the growth of a reef-building coral. High sedimentation and vermetid snail mucus secretions have each been shown decrease coral growth and survivorship. In a 54-day field experiment, we subjected juvenile massive *Porites* corals to: 1) neither stressor, 2) sedimentation, 3) vermetids, or 4) both
sedimentation and vermetids. Interestingly, we found no effects of each stressor in isolation, but we observed a significant decrease in the growth of corals exposed to both high sedimentation and vermetids. Additionally, an average of 70% less sediment was removed from corals in the presence (vs. absence) of vermetids. These results suggest that the combination of sedimentation and vermetid snails may contribute to coral declines in South Pacific reef systems. More generally, our results indicate that environmental factors can have negative interactive effects even when individual effects are not detectable, suggesting ‘ecological surprises’ may be more common than previously thought.

Lawe i ka ma'alea a ku'ono'ono
Translation: Acquire skill and make it deep
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“Octopus Diver” by Lee Shannon