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In Our Lifetime

Image: Bringing new stakeholders to the table to discuss issues of sustainability can help to create cooperation between traditionally separate groups. These new symbiotic relationships can create new revenue streams, build new links within the community, increase resource security, and reduce environmental harms. Image courtesy of Marian Chertow of the Center for Industrial Ecology at Yale School of Forestry & Environmental Studies.



"As important as it is to change the light bulbs, it's more important to change the laws. When we change our behavior in our daily lives, we sometimes leave out the citizenship part... In order to be optimistic about this, we have to become incredibly active as citizens in our democracy. In order to solve the climate crisis, we have to solve the democracy crisis." – Al Gore, speaking in Monterey, California in March 2008. [Watch Al Gore's latest talk on TED.com.](#)

Working together with the Hawaii County Department of Research and Development, with the County's Energy Specialist, and with other experts throughout the State, The Kohala Center and the School of Forestry and Environmental Studies at Yale University have developed a **comprehensive energy plan for the Island of Hawaii**. Development of the plan involved meetings with public and private sector stakeholders, sessions for community input held around Hawaii Island, and sessions for Hawaii County administrators and County Council members. This work was initiated in 2006, when Hawaii County Council members Pete Hoffmann, Angel Pilago, and Bob Jacobson funded the initial preparation of the plan through a contract with The Kohala Center.

This effort is now resulting in research-based legislation. When the Hawaii County Energy Sustainability Plan was finalized in October 2007, these three Council members allocated additional funding in order to begin implementing the priorities articulated in the plan. "The systems analysis and policy recommendations developed with our academic partners are now resulting in positive community and Council action," reports Betsy Cole, Kohala Center Deputy Director.

Key energy-related legislation passed since the start of 2008 includes:

- Resolution 546-08 requires the County to purchase fuel-efficient (average 35 MPH) vehicles for its fleet and assess the overall cost-benefits of this investment;
- Resolution 550-08 requires the County to install solar water heating systems and photovoltaic systems on new County buildings; and
- Resolution 578-08 proposes that new County facilities comply with the energy-efficient building practices contained in the International Energy Conservation Code.

Pending legislation (at press time):

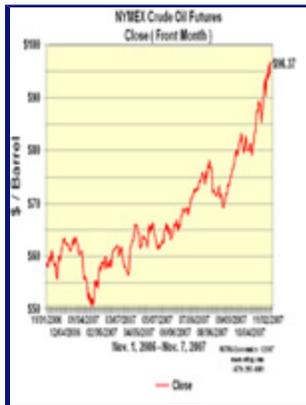
- Requires that the County budget reflect funding for a Hawaii Island energy advisor at the cabinet

level;

- Requires the Department of Water Supply to seek out ways to increase energy efficiency in its water pumping and delivery systems; seek out ways to use distributed and renewable energy generation to pump and transmit water within its system; and draft a comprehensive water conservation policy which identifies ongoing practices to reduce water and energy demand within the County on a day-to-day basis; and
- Requires the Hawaii County Transit Agency and the County administration to draft a strategic plan designed to increase ridership 20% per year through 2015 in order to meet the target established by the Hawaii County Energy Sustainability Plan; the strategic plan will include short- and long-term measures to expand the County's public bus service.

Learn more about [recent energy initiatives](#) in Hawaii County.

Island Energy Forum



[click to enlarge](#)

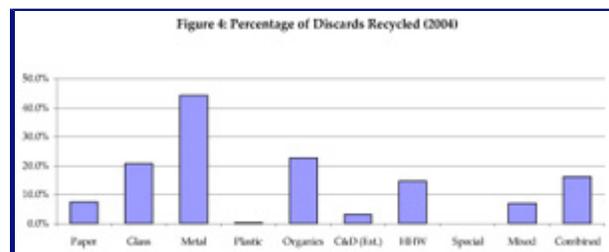
Image: This graph shows the precipitous increase in the price of a barrel of crude oil from November 2006 through November 2007. Image courtesy of Miles Kubo, President of [Energy Industries](#).

Rising fuel costs trickle down into most every aspect of doing business on Hawaii Island, from higher utility costs, to higher shipping costs, to the ripple effects of recent airline bankruptcies. So what can Island businesses do to preserve their profitability in the face of recent economic trends? The Kohala Center is hosting a one-day forum on Friday, June 6, to address energy issues of critical concern to the Island business community. The forum will feature energy experts and economists who will explain the local implications of rising global fuel prices. National, State, and local facilitators will discuss how to increase the use of renewable energy resources on the Island, how to address transportation challenges in the public and private sector, and "green" investment and business opportunities in the local market.

"Business Challenges, Business Opportunities, and the New Energy Reality" was organized by The Kohala Center at the request of public and private sector leaders, and it is co-sponsored by the Hawaii Island Chamber of Commerce, the Kona Kohala Chamber of Commerce, and the Hawaii Island Economic Development Board (HIEDB). Members of these organizations are invited to attend. The June 6 forum will be held at the Hilo Hawaiian Hotel from 9:30 am to 5:00 pm. The cost to Chamber, HIEDB, and Kohala Center members is \$60, which includes a continental breakfast and lunch. For more information and to register, contact The Kohala Center at 808-887-6411 or via email at info@kohalacenter.org.

Call for Citizens to Serve

Image: Hawaii County recycling rates by commodity for 2004, the most recent year for which information considered reliable was available. The County's goal (codified by the County Council on June 23, 2003 in Resolution 28-03) is 50% diversion from disposal by 2008 and 80% diversion by 2013. To meet the 50% goal, the estimated diversion rates for specific commodities need to add up to a cumulative 45%. Image and caption from The Kohala Center study, "[Waste Management on the Big Island](#)."



[click to enlarge](#)

In 2006-07 East Hawaii buried 83,408 tons of waste (an average of 228.5 tons per day) in the Hilo landfill, which is slated to reach its maximum allowable capacity in about four years. Currently, East Hawaii diverts or recycles approximately 25% of its waste stream from the landfill. An aggressive recycling and diversion program would aim to double the existing diversion rate to 50%. Increased diversion could reduce the volume of waste requiring disposal,

but it will not eliminate the need to develop an alternative means of dealing with the remaining 50% of East Hawaii's waste when the Hilo landfill closes in 2012.

The issue at hand is an interesting one, for it operates at the intersection of financial models and environmental health: now that the County Council is wrestling with a decision about a waste-to-energy (incinerator) project, we need to ask fundamental questions. We even need to question our fundamental concept of waste. For example, if a large percentage of the waste that is currently being buried in our landfills is made up of compostable materials, would it be economically and ecologically viable to help build local composting businesses, so that Island residents and growers could replace imported soil amendments? In such a situation, "waste" becomes productive "inputs."

There may not be a "silver bullet" solution for dealing with trash, and the options are very, very interesting to consider. The good news is that the County of Hawaii is about to begin the process of updating its long-range waste management plan, the Integrated Solid Waste Management Plan (ISWMP). The DEM is currently seeking applicants to assist with this process. Representatives from citizen organizations, the private solid waste industry, or private recycling or scrap material processing industry operating within the County, and other interested stakeholders are invited to submit applications to serve on the Solid Waste Advisory Committee (SWAC). The SWAC will review the plan during its preparation and propose changes its members feel are appropriate.

If you would like to help chart a new course for the County in managing its solid waste, you may download a SWAC application from the [County website](#). For more information, contact Lincoln S. T. Ashida, Corporation Counsel of the County of Hawaii, via email at Lashida@co.hawaii.hi.us.

For a comprehensive look at waste management issues on Hawaii Island, please read The Kohala Center study, "[Waste Management on the Big Island](#)."

Working in Alignment: Kohala Center Senior Scientists



Photo: Dr. Drew Harvell and Dr. Charles Greene, two of The Kohala Center's Senior Scientists, accompanied Cornell undergraduate students on their hike into Haleakala Crater earlier this spring.

"It has been a great privilege to work with an organization like The Kohala Center (TKC), with which I am in philosophical alignment. Through our work with TKC, we are rediscovering the Hawaiian ahupua'a (traditional land division running from the mountains to the sea) practice of including land

management considerations into coral reef sustainability." – Dr. Drew Harvell, TKC Senior Scientist and professor in the Department of Ecology and Evolutionary Biology at Cornell University

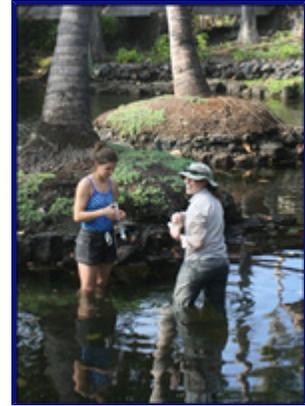
Harvell's partnership with The Kohala Center began seven years ago, when TKC Director Matt Hamabata first encouraged her and fellow Cornell professors to bring their Cornell classes to Hawaii Island. Harvell has since brought two cohorts of Cornell doctoral students to the Island for an intensive ecology and evolutionary biology field study class. Read more about some of the research done by the 2007 cohort in the following story, "[A Fine Bit of Research](#)." Harvell and her colleagues Jed Sparks and Nelson Hairston look forward to returning with a third cohort of Cornell PhD students in January 2009.

This spring Harvell and two of her fellow Senior Scientists at The Kohala Center, Dr. Charles Greene, Cornell professor of marine science and an internationally recognized oceanographer, and Dr. Karen Kemp, a Geographic Information Systems expert, have been meeting with two Island-based resource managers to find better ways to monitor water quality at Kahalu'u Bay. Dr. Bill Walsh, an aquatic biologist with the Hawaii Division of Aquatic Resources, and Sarah Peck, UH Sea Grant Extension Agent, are working proactively with the three TKC Senior Scientists to pursue new management practices on Hawaii Island. [Learn more](#).

A Fine Bit of Research

Photo: Cornell University PhD students Krista Capps (**right**), lead author, and co-author Danica Lombardozi (**left**) collecting data at Ho'onanae, an anchialine pond at Four Seasons Resort.

Back in January 2007, 13 doctoral students, one Teaching Assistant, and three professors at Cornell University spent a few weeks on the Island, conducting research projects here as part of their Hawaii Field Ecology course. The Kohala Center helped to fund this course and provided logistical support to the Cornell group while they were on the Island. The graduate students were divided into teams, with one professor supervising the work of each team, according to his or her specialty. Professor Drew Harvell mentored the Reef Team, Professor Jed Sparks led the Forest Team, and Professor Nelson Hairston supervised the Pond Team. Fifteen months later, after analyzing their results back in the laboratory at Cornell University, the five Pond Team members have had their research results accepted for publication in the January 2009 issue of *Pacific Science*, a UH journal focusing on biological and physical science research in the Pacific Region.



"We chose *Pacific Science* because we thought our study was relevant to scientists studying this region of the world. Several of the other studies pertaining to anchialine ponds have also been published in *Pacific Science*," explains Pond Team member Krista Capps.

The three Cornell professors couldn't be more proud of their students. The students are to be commended for their follow through to publish their results, for the high quality of their research, and for their contribution to our understanding of the Hawaiian anchialine pond ecosystem. Bravo to the Pond Team! Read more about their [brilliant work](#).

Eruption Update

Story & Photo by Alexandra Moore



Photo: A close-up of the new vent at Halema'uma'u Crater. [Click here](#) to view a web-cam of Halema'uma'u.

Volcanic activity has returned to the summit of Kilauea Volcano. On March 12 a new vent opened in the wall of Halema'uma'u Crater within Kilauea Caldera. A few days later, on March 19, Kilauea experienced its first explosive eruption in 74 years. This was followed by a second, smaller explosion on April 10. The explosions damaged the visitor overlook and covered Crater Rim Drive with ash and blocks of volcanic rock. Although no lava flows have issued from the new vent, small droplets of molten lava are thrown from the volcanic conduit, and evidence of lava at shallow depth is seen after dark

when the area above the vent is brightly incandescent, illuminating the plume of ash and steam. Sulfur dioxide gas emissions from the new vent are very high, periodically reaching ten times the normal background value of 200 tonnes/day.

The vent area is currently experiencing a significant volcanic tremor – easy to see on instrument displays, but undetectable to humans. The events of March and April are unusual, in that they were not preceded by the usual precursor signs of a volcanic eruption. Kilauea often experiences elevated earthquake activity prior to a new eruptive event, and there can be significant inflation of the summit of the Volcano. None of these things have happened, and no precursors other than the increased gas emissions were observed. When viewing conditions are good, the glowing summit of Kilauea is extraordinarily beautiful.

Students of *Kumu pa'a i ka 'aina*, the [Cornell University environmental science field program](#), have made

three visits to Kilauea this spring. We have observed the new lava flow that has reached the ocean in the Puna district, as well as the newly incandescent summit of Kilauea Volcano. One of our Cornell students, Ty Huth, is currently working as a volunteer with the Hawaii Volcano Observatory.

"I got to visit Kilauea's active lava flow field on April 19. Looking down into a lava tube, I could only see a bright orange glow. We could not even tell it was flowing or what direction it was flowing except when we tossed a rock in. It is an odd experience. Seeing directly how small the flow was in comparison to the Island really speaks to the enormity of the geologic processes that created the islands we have today. Human efforts simply pale in comparison." - Tyler Edward Huth, Cornell EES student, spring 2008

Note: Dr. Alexandra Moore is Director of the Cornell University Field Program in Earth and Environmental Systems and a Senior Research Associate in the Department of Earth and Atmospheric Sciences at Cornell.

In the Forest & through the Streams

Story & Photos by Melora Purell

Photo: Carly Cappagli and Briana Dodds demonstrate how to walk through the bog. This bog is the source of Waikoloa Stream which flows through the Ulu La'au Nature Park.

Did you know that a bog has high nitrate content and a low level of dissolved oxygen? The mud in the bog is full of decomposing organic matter, which uses up the oxygen and creates nutrients like nitrate. Nitrate is like fertilizer that allows algae to grow. But, by the time the water flows through the bog and downstream to Waimea town, nutrient levels have dropped to where they are below the measurable range.



All of this would come as no surprise to the middle schoolers who participated in the spring session of Waimea Nature Camp. Campers became familiar with the relationship between nutrients and oxygen as they learned to manipulate test tubes, spectrometers, and chemical packets to measure invisible stream chemistry. Field trips to the boggy stream source provided breath-taking views into Waipi'o Valley, as well as plenty of giggles as we squelched through the mud. Puddle-jumping and puddle-sitting were favorite activities at middle elevations, and the dry stream mouth made us appreciate the underground flows that predominate in Hawaiian hydrology. We gave back to the environment as well by spreading mulch over native plants at Ulu La'au Nature Park and controlling weeds in

Waiakamali Gulch.

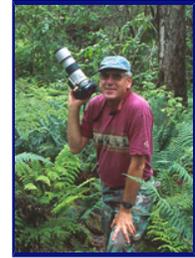
Photo: Ben Purell shows off our water testing equipment. We tested for temperature, nutrients, pH, dissolved oxygen, and turbidity.

Island keiki are invited to join Melora Purell, Coordinator of the Kohala Watershed Partnership and Director of Waimea Nature Camp, at camp this summer. Summer day camp is scheduled for June 16-27 and July 7-18; four one-week sessions will be offered. Campers entering grades 2-8 are encouraged to apply. For more information and to download an application, visit [click here](#).

While There's Still Time

Photo: Your host at Hakalau NWR, Jack Jeffrey.

Discover a hidden treasure in your own backyard – the [Hakalau Forest National Wildlife Refuge \(NWR\)](#). It's not too late to sign up for an exclusive Kohala Center members-only educational tour of the Hakalau Forest NWR on Saturday, June 28. Your guide is Jack Jeffrey, a wildlife biologist at the refuge, an avid birder, and photographer extraordinaire. Join Jeffrey for a grand adventure in the rain forest, surrounded by rare native birds and plants. Learn more about the legacy of ranching on these lands, and about efforts to restore the native koa/mamane forest ecosystem within the refuge. [Register today.](#)



Showing Families the \$\$ for College



Photo: A Harvard graduate garlanded in orchids. Photo courtesy of Harvard Magazine archives.

Bold new financial aid policies at the nation's top universities are bringing the cost of tuition at these schools in line with the cost of an in-state education at public universities. Harvard University spearheaded the movement to liberalize financial aid when it launched a series of policies designed to make access to a Harvard education more affordable in 2004. In the three years since the reforms took effect, Harvard has seen modest increases in applications from lower-income students. In December 2007,

Harvard announced more sweeping changes to its aid packages.

For families with incomes below \$120,000, the family contribution will decline from 10 percent to zero percent – meaning that these families will no longer be expected to contribute to the cost of their child's Harvard tuition. Another big bonus for families is that students will no longer be expected to take out loans to help finance their education. Finally, Harvard will no longer include home equity when determining a family's aid package: this policy alone reduces the family contribution by about \$4,000 annually.

These new policies will extend financial aid to most of the students attending Harvard, and enable many students to graduate from the university without being saddled with an enormous debt. The hope is that more talented middle- and low-income students will consider applying to Harvard, now that some of the financial burden has been removed. More good news for families is that the current round of changes has spawned similar reforms at other competitive institutions, including Amherst, Davidson, Williams, Princeton, Stanford, Yale, and Duke.

[Learn more](#) about Harvard's new financial aid policies in the March issue of Harvard Magazine.

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Leading by Example

By Linda Copman

Photo: County Council Chairman Pete Hoffmann breaks ground for Kamakoa at Waikoloa, the County's workforce housing project, on December 29, 2007. Photo courtesy of Kareen Forrisier, Legislative Assistant to Council member Hoffmann.

"The potential savings from implementing the energy saving strategies in the Hawaii County Energy Sustainability Plan are immense. And the savings apply almost universally. Island residents, businesses, developers, and visitors alike all benefit. There is no reason this island cannot be energy self-sufficient in my lifetime. There is every reason to begin the transition now. I will continue to make energy self-sufficiency my highest priority for as long as I am in public service." – Pete Hoffmann, Hawaii County Council Chairman



Hoffmann has introduced several pieces of research-based legislation to ensure that County government serves as a model citizen in spearheading energy reforms on the island. One by one, the Council is enacting the recommendations outlined in the plan. At the end of 2007 Hoffmann initiated the formation of an Island-wide Energy Commission to advise the County on energy-related issues, and the Council established a new Food and Energy Sustainability Committee to consider legislation on relevant matters pending before the Council.

South Kohala is also leading by example. A new in-town shuttle bus service will begin service in gridlocked Waimea by early May, operating free of charge between 6:30 am and 3:30 pm daily. All new units in the Waikoloa Workforce Housing Project will be constructed with solar water heating systems; Phase I of this project, consisting of 415 townhomes, apartments, and single-family residences, is slated for initial occupancy in mid-2009. In 2007 the Council passed legislation which will permit the Waikoloa Village Association to construct wind energy facilities to provide energy for the common amenities it owns in Waikoloa.

So far, all of these energy initiatives have sailed through the Council unopposed. "We have to take the lead," explains Hoffmann, "as no other entity in the County has stepped forward to spearhead implementation of the County's Energy Plan. Research-based studies such as the Energy Plan are, without a doubt, providing a basis for better policy-making in our County, and helping to pave the way for changes that benefit our entire Island community. My hope is that our new mayor will be fully committed to continuing the important work we have begun."

Several County Council members have also committed to funding a systemic water and waste water management study this summer, coordinated by The Kohala Center in conjunction with its academic partners at Yale University. By providing independent analyses and information of the very highest quality, The Kohala Center hopes to support Island residents and Island leaders as matters of great import for our Island's (and our world's) future are considered.

A Time for Action

By Linda Copman



Photo: Dr. Drew Harvell photographing coral during an assessment dive with Greta Abey from the Hawaii Institute for Marine Biology. The two scientists were assessing coral diseases at Makalawena, in West Hawaii. Photo by Greta Abey.

"As my experience with Hawaiian coral reefs increases, I am shaping a plan for a component of my research program that could be run here," says Dr. Drew Harvell, one of the world's leading experts on coral reef disease. "My particular concern is coral reef health, and I see improvements that could be made in land use practices and in the ways that we assess coral health that could result in healthier reefs," she continues.

In a nutshell, this is how Harvell is hoping to help out:

"Here on the Island, much more care could go into controlling the effects of development on sedimentation and also on allowing pollutants to run off land into the ocean. Coral Reefs are facing massive challenges from climate change that will make local land use practices even more significant for keeping our reefs healthy. Our reefs are home to fantastic biodiversity, and nursery areas for many fish and invertebrate species, as well as beloved big creatures like turtles and dolphins. We are also unusual on Hawaii Island to be such an affluent society on a coral reef - most reefs are under enormous over-fishing and land-based pollution pressure in developing countries, with few resources for effective management. As a Senior Scientist at TKC, I see the opportunity to help shape new initiatives in reef health."

Harvell is also thinking of ways to integrate work being done here on Hawaii Island with another of her major projects: the World Bank Global Environmental Fund (GEF) [Coral Reef Targeted Research and Capacity Building for Management \(CRTR\) Program](#). Harvell chairs the [CRTR Disease Working Group](#), which is monitoring data on the health of coral reefs worldwide, from its research sites in Africa, Asia, the Caribbean, and the Pacific.

Photo: Dr. Drew Harvell in Zanzibar in East Africa, conducting surveys of coral health. The Zanzibar site is part of the World Bank GEF project. Harvell and her CRTR colleagues are providing scientific support, including training in coral ecology and microbiology, for a Center of Excellence CRTR has developed there.



For the past few weeks Harvell has been working with undergraduate students in [Cornell University Program in Earth and Environmental Systems \(EES\)](#) on their internships. The Cornell students have been doing coral surveys with Harvell at Mau'umae Beach in South Kohala in order to evaluate the effects of land use practices above on the coral reef below. "Sadly, there has been a lot of loss of coral from sedimentation at this site, and there is a moderate level of coral disease," Harvell reports.



Photo: Dr. Drew Harvell (left) and Greta Abey (right) prior to one of their dives.

In April Harvell also met with Greta Abey from the Hawaii Institute for Marine Biology to develop preliminary plans for larger studies of coral disease in the Hawaiian Islands. With support provided by Blue Wilderness Divers, Harvell and Abey examined some sites around the Island. They then collaborated with Misaki Takabayashi at UHH to examine an outbreak of Montipora White Syndrome and tumors at her sites near Kapoho in East Hawaii. Montipora White Syndrome is a coral disease which starts as small lesions and eventually kills the entire colony. It is killing Montipora in Kaneohe Bay, but scientists don't know yet how prevalent this disease is on Hawaii Island, so they are studying this very localized outbreak near Hilo.

In between these large projects, Harvell made time to lecture to a Hawaii Preparatory Academy (HPA) high school marine biology class about coral reefs and climate change. "We are grateful to HPA for all they have done to house and support our Cornell programs, and so we are glad to do anything we can to support their programs. It's been a busy couple of weeks," she concedes.

Photo: Cornell 2008 EES students with professors Drew Harvell (**bottom row on far right**) and Alex Moore (**top center**) pose for this photo outside the Paliku Cabin in Haleakala.



Dr. Harvell is putting her expertise in the field of coral reef disease to work to benefit Hawaii Island. The Kohala Center thanks Dr. Harvell, our newest Senior Scientist, for aligning herself with the Center and with our effort "to generate new knowledge about global ecological phenomena and provide systemic solutions to global environmental challenges, so that communities on the island and around the world can thrive -- economically, socially, and culturally."

Harvell recently shared her knowledge of coral reef ecosystems with viewers on KHNL-TV's "Earth and Sea Project: Going Green in Hawaii." To view a video clip of the interview, go to Today.KHNL.com. On the right side of the screen, you'll see a video player. At bottom of the video player, you'll see small thumbnail pictures of the different interviews. Scroll through those by using the arrows on the right, until you get to the interview titled "**Coral Reef – Earth and Sea.**"

Other senior scientists and senior scholars at The Kohala Center are Dr. Lois-ellin Datta, widely recognized as one of the founders of the field of Program Evaluation; Dr. Charles Greene, internationally recognized oceanographer; Kekuhi Keali'iakanaka'oleohaililani, Executive Director of the Edith Kanaka'ole Foundation; and Dr. Karen Kemp, author of the recently published *Encyclopedia of Geographic Information Science*.

Brilliant Work, Pond Team!

By Linda Copman



Photo: The Cornell University PhD students who participated in the anchialine ponds study and as coauthors of the paper in press at *Pacific Science*. **From left:** Scott McArt, Caroline Turner, Krista Capps, Danica Lombardozzi, and Michael Booth.

The Kohala Center congratulates the five Pond Team members whose work will be featured in *Pacific Science* in January 2009, under the title "The behavioral responses of the endemic shrimp *Halocardina rubra* (Malacostraca:Atyidae) to an introduced fish, *Gambusia affinis* (Actinopterygii: Poeciliidae) and implications for the trophic structure of Hawaiian anchialine ponds."

The Pond Team set out to study the behavior of native shrimp in Hawaii's anchialine ponds in response to introduced fish. During the past two decades, it seemed that heavy fish predation has eliminated most or all of the *opae'ula* (small, bright-red crustaceans and the most abundant brackish water shrimp on the Island) from many of Hawaii's anchialine ponds. Previous studies suggested that the shrimp had been entirely eliminated from ponds where fish had been introduced. The Pond Team studied whether the presence of fish triggers potential predator avoidance strategies by the shrimp in the ponds, such as feeding at night. The group wanted to determine if such behavioral changes allow *opae'ula* to survive in fish-invaded ponds.

Photo: Opae'ula and *Metabetaeus lohena*, the big shrimp in the upper left corner of the picture with obvious pinchers. *Metabetaeus* is a species of anchialine pond shrimp that co-occurs with opae'ula, and you will often see them trundling along the bottom of the pond trying to catch opae'ula. Photo and caption by Mike Booth.



To conduct their research, the Pond Team traveled to anchialine ponds along the Kona-Kohala Coast during the day and again during the night. Team members used sweep nets to collect shrimp and then measured the number of shrimp collected. There were no shrimp collected during the day in the ponds with fish - leading understandably to the impression that the shrimp had been wiped out. But at night the ponds were teeming with shrimp.

The Pond Team also set up experiments in buckets, with shrimp and fish that came from the different ponds. The buckets contained lava rocks, to provide a refuge, and water from the ponds. The students then counted the number of shrimp active, the number under rocks, and the number of shrimp which had been eaten by fish.

The team collected samples (fish and shrimp) for stable isotope analysis to determine if the mosquitofish in the ponds were eating the shrimp. These samples were later analyzed at Cornell's stable isotope laboratory in Ithaca, New York.

What the Pond Team found was that in the presence of mosquitofish, the shrimp shifted their foraging behavior from the day to the night. Their results indicate that native shrimp populations can indeed persist in the presence of introduced fishes. Therefore, conservation efforts aimed at fish removal may be an effective way to restore shrimp populations. This finding is especially significant because opae'ula play an important role in anchialine pond ecosystems, by controlling algal overgrowth in the ponds.

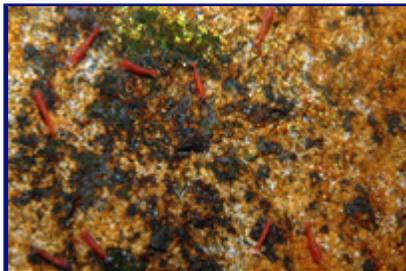


Photo: Close-up of opae'ula. Opae'ula are typically abundant during the day in anchialine ponds where fish have not been introduced. Photo by Mike Booth.

All of the Pond Team members are currently working on their PhD research at Cornell University. The five team members are Mike Booth, Krista Capps, Danica Lombardozzi, Scott McArt, and Caroline Turner. Here, the Pond Team share a bit about their individual work and about what they gained from their opportunity to work in Hawaii:

Mike Booth is a PhD student in the Department of Ecology & Evolutionary Biology at Cornell University. He is researching the ecological role of fish in streams to try to understand how fish modify their environments through differential use of microhabitats. Mike's work is primarily focused on suckers of the family Catostomidae in the southwestern United States but also involves comparative work with an invasive catfish in southern Mexico.

Krista Capps is a PhD student in the Department of Ecology & Evolutionary Biology at Cornell University. She studies the ways in which an invasive fish family, Loricariidae, affects community structure and ecosystem processes in southern Mexico.

Photo: Krista Capps snorkeling in Hawaii with the Cornell Field Ecology course. Photo by Mike Booth.

"Although all of us would love to come back to Hawaii to work, none of our work is focused on the Islands. That is what made this trip and this project so special for us. As a note, several people in the group are working on projects with applications for things happening in the Islands. I think my research may be the most applicable. I am working on an invasive, introduced catfish (Loricariidae) in southern Mexico. This family of fish has also been introduced to several islands in Hawaii and is causing some problems." - Krista



Danica Lombardozzi is a PhD student in the Department of Ecology & Evolutionary Biology at Cornell University. She investigates how ozone pollution changes the amount of water that plants use and the impacts these changes have on ecosystems. She plans to look at a tropical forest in Panama that receives large quantities of air pollution to see if tropical trees respond similarly to temperate trees. She hopes to use her data in a global model to determine the feedbacks on carbon and water cycling.

*"The Hawaii project was valuable for me for a couple reasons. First, I did all my undergraduate thesis research on an invasive tree in Hawaii Volcanoes National Park (*Myrica faya*), so I learned a lot by working in a different system in Hawaii. Second, it was valuable to experience working in a collaborative group and to have a short, pre-determined amount of time to complete our goals. Problems often arise given time constraints and everybody's different approaches to science. It was constructive to learn how to work through these issues in this particular setting. Lastly, my research focus has largely been terrestrial ecosystems, and learning new aquatic and behavioral techniques was a very valuable experience."* - Danica

Scott McArt is a PhD student in the Department of Entomology at Cornell University. He is interested in the ecology and evolution of plant-mediated interactions between herbivores and pathogens. Scott's work focuses on community genetics, which attempts to combine community ecology with evolutionary biology.

"Although my research is currently based in New York, I would love to do more work in Hawaii, so keep me posted regarding ecological problems needing graduate student help to solve!" - Scott

Caroline Turner is a PhD student in the Department of Ecology & Evolutionary Biology at Cornell University. She studies the effects of animals that live in and mix up the sediments at the bottom of the ocean and their influence on how chemicals, including pollutants, are processed in the ecosystem. The Kohala Center extends a special mahalo to Caroline for notifying us that the Pond Team's paper was accepted for publication.

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