The Pacific Center for Environmental Studies

Human Impacts and Hawai‘i’s Coral Reef Health:
An Environmental Science Education, Stewardship and Research Program
for
High School Juniors and Seniors in Hawai‘i

Final Report to the Harold K.L. Castle Foundation Grant # 3035
June 1, 2008 – March 31, 2013

A Project of

The Pacific Center for Environmental Studies
Department of Natural Sciences
Windward Community College
University of Hawai‘i

In partnership with

The Hawai‘i Institute of Marine Biology
School of Ocean and Earth Sciences and Technology
University of Hawai‘i

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1. Organization
Windward Community College Pacific Center for Environmental Studies (PaCES) in partnership with the Hawai‘i Institute of Marine Biology, School of Ocean and Earth Sciences and Technology

2. Project Title
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3. Award Number
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4. Report Period
01 June 2008 – 31 March 2013
5. Introduction

The Windward Community College (WCC) Pacific Center for Environmental Studies (PaCES) and the Hawai‘i Institute of Marine Biology (HIMB) are very grateful to the Harold K.L. Castle Foundation and other donors for their support of the PaCES-HIMB Summer Program in Environmental Science for High School Students during the summers of 2008 through 2012.

PaCES, in partnership with HIMB, have conducted these college-level summer experiences in environmental science education and research for high school juniors and seniors in Hawai‘i since the summer of 2005. Through these intensive six-week summer programs, we broadened students’ understanding of the Kāne‘ohe Bay area watershed and coral reef ecosystem, introduced them to new scientific research areas, added to their knowledge of current scientific methodology, research techniques, and scientific tools, and encouraged environmental stewardship. Embracing the theme that human beings are part of the ecosystem, not separate from it, students learned these concepts and methods in the context of traditional and modern resource management practices. Students were also exposed to the HIMB faculty and state-of-the-art research facilities, and the modern laboratory facilities of the PaCES which supports environmental education and research at WCC.

6. Project Overview

Our summer program for high school students was initiated during the summer of 2005 as the PaCES/B-WET Summer Environmental Science Program for High School Students. The initial funding came from two sources, a Harold K.L. Castle Foundation grant to WCC’s Pacific Center for Environmental Studies and a National Oceanic and Atmospheric Administration (NOAA) Bay Watershed Education and Training (B-WET) grant to HIMB (Dr. Jo-Ann Leong, P.I., and Mr. Manning Taite, Co-P.I.). Both of these grants funded the program during the summers of 2005 through 2007.

Then the Harold K.L. Castle Foundation decided to provide additional support of $85,000 to WCC PaCES for the period of June 1, 2008 through March 31, 2013 (covering the summers of 2008 through 2012). Additional funding for this period came from the following organizations: Hawai‘i Community Foundation, Minami Community Foundation, Ameron Hawai‘i, Inc., Cultural Surveys Hawai‘i, Emmet R. Quady Foundation, Harold K.L. Castle Foundation (as an additional match to the Quady Foundation), several other corporations, and private donors (Appendix I). Finally, during the summer of 2012, we received federal funding (about $15,000) from the Louis Stokes Alliance for Minorities Program (LSAMP, a National Science Foundation, NSF, program).

As has happened since the program’s inception in 2005, most of the lectures, laboratory work, and outdoor activities took place in the Kāne‘ohe Bay area in the Ko‘olaupoko region of Windward O‘ahu. This area is predominantly rural with forest reserves and agriculture and includes kalo farms, cattle ranches, nurseries, horse stables, and other rural economic activities. Kāne‘ohe Bay itself is unique in that it is the only mature barrier reef and lagoon system in the
main Hawaiian Islands. The Kāne'ōhe Bay watershed is divided into nine ahupua‘a, eight of which are associated with major streams entering the Bay. Receiving substantial freshwater input from this watershed, the Bay not only exhibits a semi-estuarine character, but is also under direct influence of human land-based activities. Yet, in spite of this input, Kāne'ōhe Bay is home to some of the most beautiful and productive shallow reefs in the Hawaiian Islands. As a result, Kāne'ōhe Bay is subject to intense recreational and commercial use by divers, fishers, boaters, and thrillcraft users. In addition, the United States Marine Corps conducts training activities in the Bay. Unfortunately, these diverse uses of the Bay’s resources often lead to negative reef impacts and user conflicts. Kāne'ōhe Bay is also the home of HIMB, an important marine science education and research resource. Kāne'ōhe Bay was an ideal setting in which to deliver an environmental literacy training program for Hawai‘i’s high school students.

• As has been done since we began in 2005, the program utilized an integrated mix of conventional lectures, hands-on laboratory exercises, outdoor field exercises, field trips, research projects, and stewardship activities.
  o We made an intentional connection to the ahupua‘a by providing science-based lectures, laboratories, field trips and research expeditions in the Kāne‘ōhe Bay watershed and coral reef environment. These experiences were selected to enhance the students’ understanding of environmental sciences, emphasize the linkage between the land and its adjacent marine environment with a particular emphasis on coral reefs, and promote stewardship and sustainability.
  o The outdoor field experiences were an integral part of the instructional program and were generally preceded by relevant lectures. Lab sessions were scheduled to allow students to process, analyze, and evaluate data samples. For example, a lecture on Hawai‘i’s climate was followed by a field activity that involved using instrumentation (e.g., environmeters and GPS units) to collect climate data (e.g., temperature, humidity, wind speed, light, etc.) at specific locations. Back at the lab, the data were processed using statistical analysis software. As another example, a lecture on coral disease would be followed by a field activity that involved surveying the reef for the incidence of disease and collecting samples for identification of potential pathogens using molecular techniques in the laboratory.
  o The outdoor field experiences gave the students project-oriented, hands-on, and investigative experiences. Each expedition had a specific focus and the objectives and expected outcomes of each expedition were explained clearly to the students during the lecture sessions.
  o The curriculum involved an integrated, multidisciplinary learning approach where hands-on experiences in the field and in the lab were as important as the lectures in providing relevant historical, cultural, and scientific information.
  o The training program engaged students in environmental science with an emphasis on promoting environmental literacy.
  o Students developed group research projects that engaged them in the process of scientific inquiry applying the concepts and tools they learned through the lectures, laboratory exercises, field exercises, and field trips.
The students took part in several stewardship/service projects such as Hawaiian fishpond restoration, native habitat restoration, and mentoring others.

- The project involved external sharing and communication.
  - Students engaged in external projects with our community partners. The projects included the clearing of mangroves, alien seaweed eradication, coral reef assessment, and Hawaiian fishpond restoration in collaboration with other groups.
  - Students shared the results of their research projects in formal written reports and public oral presentations at a closing symposium to which the community was invited.

- The project demonstrated partnerships.
  - We worked collaboratively with high schools on O‘ahu.
    To reach the significant proportion of communities with underserved and underrepresented student populations, Title I schools, especially Windward O‘ahu schools, were specifically targeted by this project.
  - We also worked with various private organizations and non-profits, including Waikalua Loko Fishpond Preservation Society, ‘Ahahui Mālama I Ka Lōkahi, Kāko‘o ‘Ōiwi, Kamehameha Schools, NALU Studies, Pacific American Foundation, and Reef Check Hawai‘i.

- The experiences were for all high school juniors and seniors.
  - Students from all Hawai‘i high schools were encouraged to apply. However, we targeted Title I schools located on the Windward side of O‘ahu.
  - A significant percentage (ca. 34%; see Table I) of the students were of Hawaiian or Pacific Islander ancestry.

To get a feel for what our program is all about, the reader may download and view the movies (mp4 files) made for our Summer 2011 (http://www.wcc.hawaii.edu/paces/paces2011vid.mp4) and Summer 2012 (http://www.wcc.hawaii.edu/paces/PaCES2012.mp4) programs.

7. **Project Purpose**

The long-term sustainability of our islands requires the creation of knowledgeable stewards who are committed to *malama i ka honua* (“caring for the world”), fostering the concept that we are integral components of a balanced ecosystem (both locally and globally). Thus the rationale for developing a program for high school students was that training students in environmental sciences would create a body of stewards who would pass on their knowledge and experience to their peers, promoting environmental literacy and ensuring the future stewardship of Hawai‘i’s coastal environment, especially its coral reefs.

The *ahuπua‘a* of the Windward side of O‘ahu in Hawai‘i have been carefully maintained for many generations and are now facing severe challenges as the population steadily increases. Our
children are destined to inherit the ahupua‘a. Stewardship is the key to maintaining the Kāne‘ohe Bay ecosystem. A deeper understanding of our Hawaiian culture and history and a solid scientific knowledge base are critical to addressing our future environmental challenges.

Furthermore, science education in Hawai‘i will be even more successful if we can establish a seamless educational experience from grade school through higher education. Currently, very few students graduating from Hawai‘i public schools enter the environmental sciences at the college level. Establishing a network among the high schools, WCC PaCES, in partnership with HIMB, is encouraging this learning progression.

Our specific program objectives were as follows:

• To provide Hawai‘i high school juniors and seniors with an understanding of: (a) the integration between the watershed and the adjacent coral reef environment; (b) the influence of human activities in the watershed and the coastal environment on the health of Hawai‘i’s coral reefs; (c) the roles of traditional and modern resource utilization and management practices on reef health and (d) the scientific method and process of research investigation.
• To increase the number of high school students who have the opportunity to participate in college-level environmental science education and research.
• To increase the number of students who decide to enroll in baccalaureate programs in environmental science or other related sciences.
• To create a cadre of stewards who will understand and promote sustainable natural resource utilization practices and environmental literacy.
• To provide students with competency in using a variety of environmental science instrumentation and data acquisition/analysis methods both in the laboratory and the field.
• To help students develop competency in the scientific process by having them develop and implement an environmental science research project.
• To provide students with competency in scientific communication by having them write formal research reports and make oral presentations.
• To promote leadership and collaboration skills by having the students work together in groups.
• To expose students to leading edge research areas at the Hawai‘i Institute of Marine Biology (HIMB).
• To familiarize students with the WCC Pacific Center for Environmental Studies (PaCES) programs and the modern, fully-equipped facilities available for biological, marine, earth and space sciences, and its special emphasis on environmental monitoring and stewardship.

We achieved these objectives by presenting an integrated sequence of lectures, laboratory exercises, field exercises, field trips, and stewardship activities. In addition, students developed and reported on group research projects.
8. General Program Description

Program Marketing and Student Recruitment

Planning and preliminary preparation for each summer’s session usually began in the preceding Fall. We started to market the program in November and began the application and selection process in January. This marketing involved visiting schools, talking to teachers, email and utilization of a website (http://www.wcc.hawaii.edu/paces/highschoolprg.html) that included downloadable application forms. While we specifically targeted high school students from Title I schools from Windward O‘ahu, we did not exclude students from other schools.

Because of classroom size and other logistical concerns, we usually limit total enrollment to 24 students each summer. Eighteen of these are new students and six are returning (from the previous summer) student mentors. These mentors learn important leadership skills and help to provide continuity from summer to summer by passing what they learned on to the new students.

We provided a $500 stipend to each regular student and a $750 scholarship to each student mentor. The students also received college credit (tuition waived) as BIOL 124 (Environment and Ecology) and BIOL 124 (Environment and Ecology Laboratory). The student mentors each received three credits of independent study.

Student Selection

The selection process involved submission of a formal written application, an essay describing the importance of conserving and managing our natural resources and how the student would benefit by participating in the program, one letter of recommendation from a teacher, and one letter of recommendation from a community member. After an initial screening, prospective participants were interviewed, first, in a group interview to assess collaboration skills, leadership, and problem solving ability, and, second, in a personal interview to learn more about the applicants’ motivations and interests in the environment.

The students were selected using the following criteria: junior or senior status in the follow Fall semester following the summer program, motivation and interest in the environment, potential to benefit from participation in the program, and ability to work with others. While we looked at academic performance during the selection process, it was not regarded to be an important indicator of the student’s motivation and potential to benefit. Recognizing that academically-exceptional students often have a plethora of programs available to them, we wanted to provide this opportunity to students who, on the basis of academic performance, might be denied participation in special programs like this. Thus we hoped to “grab” the environmentally-motivated student who might have low confidence for the sciences and, thus, may not have considered science as a viable academic direction. Our philosophy was that through environmental education with a connection to traditional environmental culture, we could encourage these students to become engaged and enthusiastic about modern science.
**Program Topics**

Topics (see Appendix II which presents the 2012 schedule as an example) included the following: coastal processes, coral reef biology, ecology and geology, reef survey methods (nekton, benthos & substrates using various methods), coral disease identification and assessment, coral reef habitat mapping, watersheds, hydrology, water quality analyses (temperature, pH, oxidation-reduction potential, nutrient concentrations, turbidity, suspended solids, dissolved solids, conductivity, salinity, chemical pollutants, water microbiology, etc.), stream bioassessment protocols, molecular approaches to environmental research, soils, global positioning systems (GPS), remote sensing (RS), traditional Hawaiian resource management practices (*ahupua‘a*, fishponds, *lo‘i*, ethnobotany, fishing prohibitions, etc.), modern resource management issues, habitat restoration, and human environmental impacts (local versus global scale impact, pollution, destructive resource extraction practices, alien introductions, etc.). Instruction involved invited guest speakers (e.g., HIMB researchers) as well as program staff.

**Environmental Science Research Project**

Following about four weeks of intense lecture, lab and field work, the students defined and implemented environmental science research group projects during the last two weeks of the program. The purposes of these projects were to provide students with opportunities to (1) apply the knowledge and skills acquired through the lecture, lab and field sessions, (2) do "real" scientific research, (3) learn how to work collaboratively in groups, and (4) gain competency for communicating using the “language” of environmental science.

These projects involved dividing the students into groups, each group led by one of the student mentors. After deciding on a research question to study, each group prepared a proposal that demonstrated an understanding of the problem (citing the appropriate literature), clearly stated the research question and the hypothesis being tested, and outlined a specific approach to testing the hypothesis.

Once the groups clearly defined their research projects, as well as the approaches to studying them, participating researchers and program staff assisted the student groups in securing the resources and additional training that needed to implement the project and interpret the results.

These projects culminated in the preparation of formal written research reports and oral presentations at our closing symposium.
Assessment of Student Learning Outcomes

The student learning outcomes for this project were as follows:

1. The student will have knowledge of how a watershed may be impacted by human activities and how this impacted watershed affects the health of the adjacent coral reef environment, from historical, cultural and scientific perspectives.
2. The student will have knowledge of the various approaches to ensuring the conservation and wise management of natural resources.
3. The student will be able to use the instrumentation and procedures needed to study the environmental characteristics of a watershed and its adjacent coral reef environment.
4. The student will be able to develop a scientific research project that addresses an environmental and/or earth science question.

Assessing the achievement of these outcomes involved several approaches including surveys or quizzes to evaluate content knowledge (Outcomes 1 & 2) and lab/field reports to evaluate lab and field skills (Outcome 3). Assessment of the ability to develop a research project (Outcome 4) involved observations made by program staff and completion of the project proposal, final report, and oral presentation. We also asked the mentors to evaluate each student’s participation in the research project (Outcome 4; see Appendix III for evaluation instrument).

Program Location and Facilities

The program utilized resources on the WCC campus where PaCES is headquartered. The WCC campus is located in the *ahupua'a* of Kāne'ohe at the base of the Koʻolau mountain range, several miles inland from Moku o Loʻe (Figure 1). With WCC's well-equipped laboratories, environmental analysis instruments (water sampling devices, sediment corer, variety of water quality field instruments, GPS units, nutrient analysis equipment, etc.), and distinctive faculty,
PaCES is a leading center for environmental education and research programs and activities in Hawai‘i.

In addition, the program utilized facilities (classrooms, research laboratories, DNA sequencer, seawater system, boat fleet, etc.) at HIMB, which is located on Moku o Lo‘e (Coconut Island) in the ahupua‘a of He‘eia toward the south end of Kāne‘ohe Bay, O‘ahu. HIMB’s access to the coral reef environment offered unprecedented opportunities for education and research about Hawai‘i’s coral reefs and their environmental threats. Finally, HIMB researchers, having a world-class reputation, provided our students with the latest knowledge and technology for studying our reefs.

9. Participating Faculty and Researchers

Principal Instructional Staff

**Dr. David A. Krupp**, Professor of Marine and Biological Sciences and Co-Director of PaCES at WCC, has had considerable experience in administering and teaching education programs in the marine and environmental sciences, most of these involving summer workshops taking advantage of HIMB-WCC collaborations. These programs have involved training younger school children, high school students, college undergraduates, graduate students, school teachers, and even college teachers. Dr. Krupp also holds an affiliate faculty position at the HIMB where he conducts research mainly on the reproductive biology of coral. While Dr. Krupp is an expert in the biology and ecology of coral reefs, he also has considerable experience instructing students in conducting water quality studies in Hawaiian streams. Dr. Krupp also exhibits considerable commitment to the Kāne‘ohe Bay environment and community. He served as HIMB’s representative on the on the Kāne‘ohe Bay Regional Council, a council that makes recommendations regarding management of the Bay to the Hawai‘i State Department of Land and Natural Resources. In addition, Dr. Krupp serves on the board of the Waikalua Loko Fishpond Preservation Society, a society devoted to restoration of Waikalua Loko, an ancient Hawaiian fishpond, and promoting education regarding traditional Hawaiian resource management practices. In cooperation with the Society, this fishpond was used as a resource for some of our summer program’s educational and service activities. The Waikalua Loko Fishpond Preservation Society supported our project in this regard. Finally, Dr. Krupp serves as president of Reef Check Hawai‘i, a non-profit organization devoted to monitoring the health of Hawai‘i’s coral reefs. Reef Check Hawai‘i offers training in coral reef ecology and monitoring. Some components of Reef Check Hawai‘i’s curriculum were adapted to our summer program.

**Dr. Malia Rivera** is HIMB’s Education Specialist that oversees all activities of the HIMB Education Program and manages its core staff. Her background is in marine biology, and her most recent scientific research has primarily centered on studying gene flow and migration in Hawaiian bottomfishes, a commercially important group of species that suffer from intense fishing pressure in the islands. Dr. Rivera has also served for several years as a coordinator and manager of a very large and complex research partnership between HIMB and the Papahānaumokuākea Marine National Monument that focuses on ecosystem function research in the Northwestern Hawaiian Islands. Her numerous roles at HIMB have afforded Dr. Rivera a
broad-based understanding of the wide array of work conducted by the faculty researchers with whom she collaborates. Dr. Rivera, born and raised in Hawai‘i, is a graduate from a Hawai‘i public school, attended the University of Hawai‘i at Mānoa as an undergraduate majoring in Zoology, and continued on to a MS (UHM) and PhD (University of California at Berkeley) with an emphasis in molecular phylogenetics in terrestrial/littoral systems and population genetics in marine systems respectively. Most recently, Dr. Rivera has led an emerging program in K-12 marine science education at HIMB, specifically aimed to better serve the Hawai‘i’s students from the public school system. Dr. Rivera has worked on numerous education-related projects all geared toward providing pathways for Hawai‘i’s underrepresented students to enter STEM careers, including developing marine science curriculum for K-12, teaching intensive summer programs for high school students, and coordinating research internships for high school and early undergraduate students at HIMB. She also led the effort to fundraise, design and build the HIMB Marine Science Research Learning Center. Her own experiences in making the transition into STEM from high school to college and then advanced degrees in the sciences as a lifelong Hawai‘i resident makes her current endeavors in education one of individual importance, and provides her personal insight into the Hawai‘i student perspective.

Mr. Robert Hutchison teaches high school science at Kamehameha Schools, a private school serving students of native Hawaiian ancestry located in Honolulu. A Kamehameha Schools graduate himself, Mr. Hutchison received a Master's Degree in Physiology from the University of Hawai‘i at Mānoa where he studied ways to control the invasive coqui frog species. Mr. Hutchison has been a coordinator and instructor for our summer program since 2006. A key member of our team, he promotes culture-based STEM instruction at Kamehameha Schools.

Mr. Manning Taite, founder of the NALU Studies program whose mission is to design and implement scientific and ecological learning experiences that help to transform the lives of Hawai‘i’s at-risk youth, was the original principal investigator for the initial HIMB B-WET project that collaborated with PaCES to create our summer program. Since then Mr. has contributed significantly to the program’s planning and delivery. He currently teaches at the Myron B. Thompson Academy.

Additional Instructional Staff, Guest Lecturers and Presenters

Our program has relied heavily on the contributions, usually voluntary, of many others, including HIMB researchers and graduate students, WCC faculty, UH Mānoa faculty, and many community members over the years. These individuals have presented guest lectures and mentored our students. Our Castle grant annual reports list these individuals for each of the summers. Their names are also presented in our symposia agendas. These agendas for the summers of 2008-2012 may be downloaded from http://www.wcc.hawaii.edu/paces/symposia/ . A copy of our 2012 symposium program may be found in Appendix .
10. Accomplishments and Evaluation

Through the five years supported by the Castle Foundation grant, the PaCES program accomplished all of its objectives and outcomes.

The PaCES-HIMB Summer Program combined college level lectures, laboratory work, and outdoor study activities to develop an understanding of the Kāne‘ohe Bay watershed and its relationship to the coral reef ecosystem. It encouraged high school students to pursue careers in marine biology, environmental science, and related sciences, or, as a minimum, to become concerned, informed future stewards of the Kāne‘ohe Bay watershed and the surrounding Kāne‘ohe Bay marine environment.

The most significant accomplishment of the PaCES-HIMB Summer Programs was the successful completion of a rigorous program of college level courses and science-based activities by all students. The accomplishment was impressive in view of the program’s intensive schedule (Appendix II provides the Summer 2012 schedule as an example), the level of instruction, the range of academic achievement, and the diverse science backgrounds of the students.

During the Summers of 2008-2012, a total of 104 students participated in the program (Table I). Twenty-seven returned the following summers as mentors. In all, about 34% claimed Hawaiian or part-Hawaiian ancestry.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>STUDENTS</th>
<th>MENTORS</th>
<th>CLAIMED HAWAIIAN ANCESTRY*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>18</td>
<td>6</td>
<td>2</td>
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<td>2009</td>
<td>14</td>
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<td>2010</td>
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<td>2011</td>
<td>11</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>2012</td>
<td>18</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>77</td>
<td>27</td>
<td>35</td>
</tr>
</tbody>
</table>

* Hawaiian or part-Hawaiian ancestry

Although difficult to quantify, we know through anecdotal accounts that many of these students have enrolled in college-level STEM programs - many such programs with an environmental component. We also know the benefits accrued went beyond developing knowledge and skills in STEM – students developed writing, oral communication, quantitative and leadership skills applicable to any academic discipline or career.
Student Research Projects

By the end of the program, all the students had planned and implemented a research program and worked collaboratively on a research team that planned and implemented a research project. These research projects indicated the breadth and depth of learning that resulted from the PaCES-HIMB program. The students presented the results of their projects to the Windward community at a public symposium at the end of the term. Our symposium agendas (http://www.wcc.hawaii.edu/paces/symposia/) list the titles of these research projects. The research topics for the Summer 2012 program may also be found listed in the 2012 symposium agenda in Appendix IV.

Conceptual Knowledge and Technical Skills

As a result of their participation in the PaCES-HIMB Summer Program in Environmental Science for High School Students, the students acquired knowledge and skills of:

- Research techniques (methodology).
- Kāne'ohe Bay watershed history, boundaries, and status.
- Ancient Hawaiian and contemporary land use practices.
- Coral reef biology, ecology, and geology.
- Coral diseases and human impacts on coral reefs.
- Climate and weather.
- Data collection, measurement, and survey methods.
- Water quality and water pollution.
- Soil formation and composition.
- Learned to use scientific equipment and computer technology to process water samples.
- Learned to perform independent research and be a member of a scientific team to plan, develop, and implement research projects.
- Learned to share their findings with the Windward community at a public symposium.

Student achievement of learning outcomes was assessed using several measures: laboratory/field assignments, regular quizzes, and completion of group research projects. Virtually every student passed both the lecture and laboratory sections of the class, most with A’s.

The Student Evaluation

The student evaluation forms were another significant indication of the program’s success. At the end of the program, we asked the students to fill out an evaluation form (see Appendix III) that included ten questions that asked the students to comment on how much they felt they learned from the program, what they learned, the appropriateness of the curriculum content, areas that were challenging or enjoyable, the student selection process, and how to improve the program. The evaluation results (presented in the Annual Reports, except those for Summer 2012, which are presented in Appendix III of this report) were similar each year. The comments
were overwhelmingly positive. Students expressed having a better understanding of the environment and the science of biology. They were especially positive about developing their group research projects. They found the opportunity to work in groups not only challenging, but also very rewarding. They also felt that their participation prepared them better for college. Finally they described their experiences as building character and developing leadership skills. From reading their comments, one gets the impression that many of these students may have had life-changing experiences through their participation.

**NALU Studies**

One of the spin-offs of our summer programs is the use of PaCES facilities and summer program curriculum in support of NALU Studies. NALU Studies provides support for at-risk youth by engaging them in positive activities. Initially, these youth were engaged in nature activities as confidence-building alternatives to the negative engagements these youth might tend to gravitate towards. While the students were engaged in these activities, they also learned about the environment through “talk-story” sessions. The NALU Studies students (about 12 each session; typically 2-3 sessions per year) were brought into the classroom for two weeks and treated to some of the environmental curricular activities developed in the PaCES summer program. The classroom (and field) instruction also utilized PaCES materials and equipment. Finally, Windward Community College granted these students with college credit for their participation. NALU Studies, working under its fiscal sponsor, the Pacific American Foundation, has been funded by Castle Foundation, Hawai‘i Community Foundation, and others.

**Kamehameha Schools Fishpond Study**

Another spin-off of our summer program was the adoption and expansion of our curricular materials by Mr. Robert Hutchison, one of our program teachers, for a study of loko i’a o Waikalua (Waikalua fishpond) by Kamehameha Schools high school students. Once a year, beginning in April 2010, about 260 of these students would come to the fishpond to study and understand its ecology, especially the factors contributing to its productivity. The parameters studied included water quality, sediments, plankton, and fishpond life. In addition to this academic work, the students also engaged in stewardship activities such as the removal of invasive mangrove and seaweed from the pond. WCC PaCES has played a significant role in facilitating this project through providing expertise, student volunteers, and instrumentation.

**Changes/Problems Encountered**

The two most significant problems we faced were funding and student recruitment. Funding has always been a struggle because the program is expensive to operate (see Program Costs below). Support has necessarily come from multiple sources. A lot of time is spent soliciting funds from each of these sources. And, while for each year of the project we were able to secure the funds to operate it, there were often uncomfortable budgetary uncertainties plaguing us right up to the start of each summer’s program.
Such uncertainties make it difficult to recruit students. In today’s economy, students often struggle with balancing the need to earn money during the summer with the desire to engage in summer learning and/or extracurricular activities. We provide students with a small scholarship to reduce concerns about the need to work during the summer. But the scholarship is small and the budgetary uncertainties have prevented us from promising scholarships for some summers.

**The Future**

We are well underway to run the program again this summer (2013) – this summer will be our ninth summer operating the program. We are currently engaged in the selection process. But this summer we will operate with fewer dollars and fewer students.

We continue to apply for grants and are currently awaiting decision on a grant that would fund our Summer 2014 program. However, the ideal situation would be to establish an endowment to fund our program so that we no longer need to scramble to find funds each year.

Fortunately, the College has committed to supporting Dr. Krupp’s efforts by providing him with assigned time for PaCES during 2013-14. This assigned time will allow him to work on the funding and recruitment issues addressed above.

**11. Program Costs**

Operating the PaCES-HIMB summer program is costly because its coordination and delivery requires a large time commitment from its director, teachers and staff. There is considerable work required before the program starts to secure funds, plan budgets, organize schedules, recruit and select students, purchase supplies, update and revise curriculum, test instrumentation, and set up instructional spaces. During its six weeks of operation, the sessions occur 8:30 a.m. until 4:30 p.m. each day Monday through Friday. Laboratory and field activities need to be set up and taken down. Assessment materials (quizzes, lab/field reports, etc.) must be evaluated and returned to the students. During the research project phase of the program, the students need a tremendous amount of support from the instructors and staff. There are also a lot of logistics involved in putting together the closing symposium. After the program has ended, there is much time spent in cleaning up, putting things away, doing program assessment and writing reports. For these reasons, the program’s biggest expenditure is in salaries (Appendix I).

Other significant costs included student scholarships, consumable supplies (especially laboratory supplies), van rentals for transportation to field study sites, and various services (lifeguards, HIMB boat & facilities usage, HIMB analytical services, etc.).
12. Conclusion

The PaCES-HIMB Summer Program for high school students, “Human Impacts and Hawai‘i’s Coral Reef Health: An Environmental Science Education, Stewardship and Research Program for High School Juniors and Seniors in Hawai‘i,” was an exceptionally rewarding experience. The feedback that we received from students, parents, teachers, program staff, and community members was extremely positive. We expect to have a long-lasting positive impact for the promotion of environmental science education, research and stewardship for Hawai‘i.

Submitted by:
Principal Investigator
David A. Krupp, Professor
Marine and Biological Sciences
Windward Community College
University of Hawai‘i
45-720 Kea‘ahala Road
Kāne‘ohe, HI 96744
(808) 236-9121 krupp@hawaii.edu

Co-Principal Investigator
Malia River, Educational Specialist
Hawai‘i Institute of Marine Biology
P.O. Box 1346
Kāne‘ohe, HI 96744
(808) 236-7406 maliar@hawaii.edu
Human Impacts and Hawaiʻi’s Coral Reef Health:
An Environmental Science Education, Stewardship and Research Program
for High School Juniors and Seniors in Hawaiʻi

APPENDIX I
Financial Summary
Supporting Summers 2008 – 2012

<table>
<thead>
<tr>
<th>Donations Received</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Harold K.L. Castle Foundation (this project)</td>
<td>$85,000</td>
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<tr>
<td>Other Donors*</td>
<td>$221,225</td>
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<tr>
<td>NSF LSAMP**</td>
<td>$14,875</td>
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<tr>
<td><strong>Total Donations</strong></td>
<td>$321,100</td>
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</table>

*Minami Foundation, Hawaiʻi Community Foundation, Emmet R. Quady Foundation, Special Castle Match to Quady, Fidelity Charitable Gift Fund, Ameron Hawaiʻi, Cultural Surveys Hawaiʻi, Belt Collins Hawaiʻi, Pacific Legacy, Sea Engineering, and private individuals.

**Federal grant: National Science Foundation Louis Stokes Alliance for Minorities Program.

<table>
<thead>
<tr>
<th>Expenditures</th>
<th>Amount</th>
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<tr>
<td>UH Agreements (Salaries &amp; Student Help)</td>
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<td>Student Scholarships</td>
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<td>Supplies (Lab Supplies, Duplication &amp; Office Supplies)</td>
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<td>Transportation (Van Rental &amp; Gasoline)</td>
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<td>Protocol</td>
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<td>Other Services (Lifeguards, Boat Rentals &amp; Analyses)</td>
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<td>UHF Administrative Fees</td>
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<td>NSF LSAMP Indirect Costs</td>
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<td><strong>Total Expenditures</strong></td>
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Human Impacts and Hawai‘i’s Coral Reef Health:  
An Environmental Science Education, Stewardship and Research Program  
for High School Juniors and Seniors in Hawai‘i

APPENDIX II

Typical Program Schedule - Summer 2012 Example)
2012 PaCES/HIMB Summer High School Program in Environmental Science

<table>
<thead>
<tr>
<th>WEEK 1</th>
<th>4-Jun Monday</th>
<th>5-Jun Tuesday</th>
<th>6-Jun Wednesday</th>
<th>7-Jun Thursday</th>
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<td>Oil &amp; Chant Course Orientation</td>
<td>Recap and Quiz</td>
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<td>Laboratory and Field Safety Lecture Taile</td>
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<tr>
<td>9:00</td>
<td>Science and the Scientific Method Lecture Taile</td>
<td>Using EXCEL to Summarize and Present Data Lab Krupp</td>
<td>Travel to HIMB</td>
<td>Climate and Hydrology Lecture Taile</td>
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<tr>
<td>9:30</td>
<td>Introduction to the ‘Ahupua’a Lecture Evensen</td>
<td>Making Measurements &amp; Collecting Data Lecture Krupp</td>
<td>Welcome Brief History of Moku O Loe and HIMB; Lab and Island Tour (HIMB)</td>
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<tr>
<td>10:00</td>
<td>Introduction to EXCEL Lab Krupp</td>
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<td>Watershed Mapping Lab Krupp</td>
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<td>11:00</td>
<td>Review Use of Environmetners and Barometers</td>
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<tr>
<td>13:00</td>
<td>Kāne‘ohe Ahupua‘a &amp; Watershed Tour Field Trip With Environmetners and Barometers Staff</td>
<td>Using EXCEL for Data Entry and Table Generation Lab Krupp</td>
<td>Properties of Water Lecture Hutchison</td>
<td>Swim Test (HIMB)</td>
<td>Formation and Characteristics of Hawaiian Soils Lecture Hutchison</td>
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<tr>
<td>15:00</td>
<td>Review of Environmeter Data</td>
<td>Data Summarization &amp; Presentation Krupp</td>
<td>Snorkel Tour (HIMB)</td>
<td>Properties of Soils Lab Hutchison</td>
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### 2012 PaCES/HIMB Summer High School Program in Environmental Science

#### WEEK 2

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<tr>
<td>9:00</td>
<td>Introduction to Ecology &amp; Population Growth Lecture Hutchison</td>
<td>Life in Hawaiian Streams Lecture Yee</td>
<td>Water Pollution and Water Quality Parameters Lecture Taile</td>
<td>Estuaries and Wetlands Lecture Hutchison</td>
<td>Native Hawaiian Terrestrial Ecosystems Lecture Yafuso</td>
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<tr>
<td>9:30</td>
<td>Population Growth Lab Hutchison</td>
<td>Stream Bioassessment Survey</td>
<td>Stream Water Quality Survey</td>
<td>Estuary Dynamics Field Study</td>
<td>Ho`omaluhia Botanical Garden Field Trip Yafuso</td>
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<td>13:00</td>
<td>Community Ecology Lecture Krupp</td>
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<td>14:00</td>
<td></td>
<td>Stream Bioassessment Survey Data Workup Staff</td>
<td>Water Quality Parameters Measurement: Analysis of Water Collected Water Samples Lab</td>
<td>Estuary Data Workup Lab</td>
<td>Ulupo Service Project</td>
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<td>15:00</td>
<td>Lab Assignment Catch Up Staff</td>
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## 2012 PaCES/HIMB Summer High School Program in Environmental Science

### WEEK 3

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<td>9:00</td>
<td><strong>Biology and Ecology of Corals and Coral Reefs Lecture Krupp</strong></td>
<td>Travel to HIMB</td>
<td><strong>Intertidal Zone Survey Staff</strong></td>
<td>Intertidal Zone Survey Data Workup Staff</td>
<td>The Hawaiian Fishpond Lecture Tamaru</td>
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<tr>
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<tr>
<td>10:00</td>
<td>Coral Reef Surveys on Coconut Island Field Survey Aeby</td>
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<td>11:00</td>
<td>Coral Lab Krupp</td>
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<td>Travel to HIMB</td>
<td>Coral Reef Survey Methods Lecture/Demo Aeby</td>
<td>Coral Reef Survey Data Workup Lab Staff</td>
<td>Nanakuli Beach Park Fossil Reef (bring snorkel gear) Staff</td>
<td>Human Impacts on Coral Reefs Lecture Krupp</td>
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<td>Reef Species ID Lab Aeby</td>
<td>The Intertidal Zone Lecture Taite</td>
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# 2012 PaCES/HIMB Summer High School Program in Environmental Science

## WEEK 4

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<td>Principles of</td>
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<td>Microbiology</td>
<td>PCR</td>
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<td>Kāne‘ohe Bay</td>
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<td>Literature Krupp</td>
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<td>Lecture Krupp</td>
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## 2012 PaCES/HIMB Summer High School Program in Environmental Science

### WEEK 6

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<tr>
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Human Impacts and Hawai‘i’s Coral Reef Health:
An Environmental Science Education, Stewardship and Research Program
for High School Juniors and Seniors in Hawai‘i

APPENDIX III
Evaluations

Student Evaluation – Survey Results from Summer 2012

<table>
<thead>
<tr>
<th>SURVEY QUESTIONS</th>
<th>Average</th>
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<tbody>
<tr>
<td>I gained useful knowledge through my participation in this program.</td>
<td>4.89</td>
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<tr>
<td>I acquired useful skills through my participation in this program.</td>
<td>4.89</td>
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<tr>
<td>The program goals and objectives were clear.</td>
<td>4.74</td>
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<tr>
<td>The instructors were well-prepared and organized for class.</td>
<td>4.79</td>
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<tr>
<td>The instructors returned exams and assignments promptly.</td>
<td>3.89</td>
</tr>
<tr>
<td>The instructors were knowledgeable about their subjects.</td>
<td>4.79</td>
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<td>The instructors spoke clearly and were easy to understand.</td>
<td>4.68</td>
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<tr>
<td>The instructors made good use of examples in class.</td>
<td>4.89</td>
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<tr>
<td>The instructors related their subjects to the &quot;real world&quot;.</td>
<td>4.89</td>
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<td>The instructors made effective use of presentation media.</td>
<td>4.74</td>
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<td>The instructors encouraged questions.</td>
<td>4.84</td>
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<tr>
<td>The instructors emphasized the main points.</td>
<td>4.84</td>
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<td>The instructors ask questions to see if the students understood difficult concepts.</td>
<td>4.84</td>
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<td>The instructors encouraged an atmosphere of good feeling in the class.</td>
<td>4.89</td>
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<tr>
<td>The instructors treated all students fairly.</td>
<td>4.68</td>
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<tr>
<td>The instructors were interested in the subjects.</td>
<td>4.84</td>
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<tr>
<td>The instructors were genuinely interested in the students.</td>
<td>4.84</td>
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<td>The instructors were willing to help with individual problems.</td>
<td>4.89</td>
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<tr>
<td>The instructors were honest and approachable.</td>
<td>4.95</td>
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<tr>
<td>Overall, this program was a good program.</td>
<td>4.95</td>
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</tbody>
</table>

Students ranked their response 1 to 5: 1 = strongly disagree; 5 = strongly agree.
Student Evaluation - Written Responses to Survey Questions

What do you feel you have gained from this experience and was it meaningful? Please elaborate.

- I learned a great deal about biotechnology.
- An understanding of environmental science anyhow science works as a collaborative effort with all researchers.
- I feel I gained a lot of information because this was my first marine biology class. I feel I can take things I learned and apply it.
- I feel that I gained a lot of knowledge through this program and it will help me in the future.
- I gained a lot of information on microbiology and how hard it is to make CTAB buffer.
- I feel I gained valuable knowledge throughout and this program and gained friends. I'm going to remember all of these people forever.
- I gained a lot more knowledge from this program. I have interacted with the history of this island.
- Knowledge, friends, a good time! It was one of the best classes taken!
- I gained a lot of laboratory experience that seems useful. I also feel more in touch with the island.
- I gained a lot of experience conducting scientific experiments. I also feel more in touch with the ʻāina.
- I gained new relationships and new ideas. When I go back to school I can use the info I learned. I know how to make a hydroponics system and in the future I can use my knowledge of DNA.
- I gained knowledge which will help me in the future.
- I have gained experience in lab work, leadership, and many more things. The experiments and events we went through were the most meaningful to me.
- I learned how to truly apply myself to something I care about.
- I feel more knowledgeable and conscious of the environment around me.
- I have gained more knowledge and skills to perform experiments in labs and out in the field more efficiently.
- I feel that I gained knowledge and realized how hard it can be to do a project in 2 weeks and work with others.
- It was meaningful in all different ways. This program taught me how to be a good leader, friend, and human being.
- I gained insight into the field I would like to go into for the rest of my life.

What were some of the challenges you experienced in this program?

- Having a big project that expands!
- Preparing a PowerPoint and giving an organized presentation and talking in front of people.
- Hard to decide on a project because we couldn't decide on a topic then it was hard to construct the topic.
• Not knowing a lot of things and memorizing.
• Difficult to understand some of the written stuff but I got it!
• I had some challenges working with some people who didn't want to do specific project exercises.
• Some of the challenges in the project was the amount of time to do things.
• Getting along with some people and agreeing.
• The group project and having to deal with all the stress that came with it.
• Some challenges were being able to complete the extensive amount of work in a limited amount of time and dealing with certain people.
• Understanding some of the concepts and using those concepts to figure out a project and applying it to something that you will be devoted to.
• Some challenges were transportation and time.
• The biggest problem was during our final project when about 80% of our crabs died.
• Working in teams is a lot more challenging than I thought.
• Keeping focus, especially in the group project trying to get all four of us to keep focused at the end of the two week project.
• Working as a group when one doesn't want to be told what to do. A group project is supposed to be done as a group.
• Working in research and also getting the quadrate to stay on the coral.
• One of the challenges that I found that I faced was working together with people who have different backgrounds.
• I had minor challenges with the speed that some instructions were given at but everything else was good.

What activity do you feel was the most successful and why?

• Water quality because it is very confusing with lots of steps.
• All activities were well planned out and excellent. The molecular biology was most important because we used it for the project.
• The molecular biology was most important because we used it for the project.
• I feel the project was most successful because we did a lot of research and did it in two weeks.
• The water quality was the most successful and easy to use the kit.
• The survey was engaging and purposeful so it made learning fun.
• The activity that seemed the most successful was the loi because we could help restore the Hawaiian wetlands.
• Reef survey because we used it in our final project.
• The group project because I learned a lot and gained a lot of valuable knowledge.
• The final research project because we immersed ourselves in science and learned a lot.
• The most successful activity was the DNA/PCR. I understood and it was something that I really wanted to do.
• PCR. We got good results.
• All activities that we went through were all very successful but going out and quadrating coral was the best.
Aquaponics
Yes. The final project because it helped me grow as a person.
All of the activities were successful equally due to the fact that they help you all.
Helping out at the loi because it was fun. We helped out and got to throw mud at each other.
All of the activities were a benefit to me to become a better person.
I felt the whole DNA sequencing activity gave me the most new information.

What activity do you feel was the least successful and why?

No response
The activity I found least successful was the beginning labs because we did not understand them all.
Our gels because they were hard to see.
The least successful was I don't know because it was a learning experience for me.
Some topography class time was a little boring because time was dedicated to nothing time (boring).
The activity that seemed the most successful was the loi because we could help restore the Hawaiian wetlands.
Mapping = boring
The activity dealing with the different types of plants.
The excel graphs in the beginning because it was hard.
Least successful was water quality. I had a hard time doing the directions and writing the lab write-ups.
Water quality was hard.
The least successful was when we had to look for DNA, only because it was a lot of steps and really hard.
Everything had a purpose.
Topography because it was physically hard for a job when you have to be.
None. All is a learning experience which can add to your knowledge.
The native plants field trip. She didn't really stop to say what's what and explain the plants.
None
I felt the topography activity did not help me as much because I already knew most of it.

How should students be selected for this program?

Attitude towards working with people.
This year was perfect
By knowledge
Dedication and desire
Interest in science and willingness to work hard
Character and level of respect for others
Dedication to science, restoring culture, and leadership
This year worked. The same way as this year. Someone should recruit.
• Ability to get along with others and willingness to work hard.
• More interviews
• Interest and attitude
• Same as this year
• Select them by how well they get along with others, leadership, love of science, and willingness to work hard.
• Same way as this year
• Keep the same process with interviews
• Same as this year
• They should have the same requirements.
• On interest and involvement.

Do you feel more prepared for college after taking this course? Please explain.

• Yes, because I am in college
• Yes, I feel more confident with college life
• Yes, I know what to expect
• Yes, I learned a lot and like the college atmosphere. Yes, I feel like I experienced college
• Yes, I now take good notes and this will help in college. I can use this prior knowledge.
• Yes, I feel like I have a better idea of time management and work ethic
• Yes, I feel I can work at college level.
• I don't know because I don't know what to expect.
• Yes, because I got a better feel for college life and faculty and atmosphere of students.
• Yes, I feel like I want to go into marine science more.
• Yes, I feel more prepared and want to be marine biologist. PaCES taught me what I need to know to be a marine biologist.
• Definitely! We performed experiments I only heard about in high school.
• Yes, I am more familiar with the environmental sciences.
• Yes, I feel like I was challenged throughout the whole course.
• Yes, because I this course gave me a lot of knowledge.
• Yes, I know what it's like to sit through lectures and pay attention.
• I feel more prepared for lectures and labs
• If there were more pictures and relationships it would be more interesting.

How could the instructors better keep your attention during the lectures?

• More pictures and relationships
• Engaging funny pictures would help
• Getting right to the point.
• Incorporate things teens like - like application and humor
• I was very interested in the lectures
• More things with sounds or more character would be cool.
• Don't do 3 hour lectures. You guys are the best teachers I ever met!
Breaks
Nothing because everyone is unique in their own special way and it's easier.
More pictures and slides and not so many in a row.
They already do a great job, but doing something in between.
Interactions
Telling stories, doing crazy things instead of just talking about the subject.
Talking faster and not going off topic.
Ask more questions about the topics we're covering.
Main points, more hands on only and less over-explaining.
Stay straight to the point.
More pics, less time, or make breaks
More breaks

Do you feel this course challenged you academically? Please explain.

I feel like this course wasn't academically challenging as it was character wise.
I feel I can work harder towards my grades
Yes! Trying to explain things to students is very hard and not knowing is hard.
Yes, I feel like the work was college material.
Not really, only the group project was really helpful.
No, the quizzes were easy, but I still learned a lot.
I didn't know everything discussed so it challenged me to go get the answer. Also how to solve problems.
Yes, the activities were high level.
Yes, keeping up was hard, but learned I had to pay attention.
Yes, I needed to go out and learn new things myself in order to do what was needed.
Yes, because high school isn't at this lever. It's more challenging but fun!
Yes, it was hard work. Had to think a lot. Especially for the research project.
Yes and no. Because I had the stamina to keep up with various harsh activities that this program offered.
Yes, some of the things we did I had never heard of before.
It really made me fine tune my science knowledge.
Yes, I feel like I struggled with a few things, but I was forced to complete the activities.
Yes, because it showed me that I never heard of.
Yes, because much of what I learned was new and different.
A little bit because I learned new things and immediately had to apply it.

How has this program educated you about the environment?

I now know more about the relationship between the ocean and the mountains.
The environment is sensitive to what we do.
We need to take care of the earth because we're starting to kill her.
This program has taught me about coral and the final project on kalo helped me.
• It gave me a clearer picture of the world's ecosystems and the water cycle and Hawaii's specialness.
• I learned exactly how the whole world is connected.
• By taking me to different places like lo'i, fishpond, and HIMB.
• Yes
• It has furthered my education about the environment because it goes more in depth than high school.
• Made me aware of human impacts on the environment and risks involved in changing it.
• I know a lot more about our environment and the Hawaiian culture. Labs helped.
• I learned a lot about marine life.
• It showed me what Oahu is about. I learned about ahupuaʻa, and how everything we do effects the marine environment.
• I learned about how humans effect the environment and what we can do.
• It gave me a different perspective on how to look at the environment and how its related.
• Learned more about ahupuaʻa and more awareness.
• Everything in the environment interacts and depends on one another.
• I learned more about ethics.
• It connected culture which gave the environment more passion.

What suggestions would you make for next year?

• Less lectures
• Importance of mentors. Letting students ask mentors.
• Program was perfect. Nothing needs to change.
• More field trips!
• More field trips
• Three weeks of class and three weeks of the project. Give more time to finish lab write-ups and don't try to condense everything.
• Give more time to finish lab write-ups and don't try to condense everything.
• More field trips
• Focus really hard on the final project PowerPoint.
• More field trips and a small beach outing at the end of the year.
• Keep up the good excellent work. I loved this program!
• More water activities and an end of class field trip.
• Nothing. You guys sacrificed a lot of your time and I really appreciate that you let me do this program.
• Maybe more community service.
• Less junk food in the classroom.
• Groups be more spread out.
• Be prepared. Don't be lazy.
• More field trips. Water field trips.
• More time from teacher sot all groups and not just one per group.
Explain how you have learned to promote stewardship through this program?

- I look to joys of giving back to the community.
- Engaging and educating others is a major part of making a difference.
- Take the knowledge I have learned here and put it to use with my abilities.
- I have learned to voice my opinions and to be heard.
- Apply science to really big issues.
- Community service is a great way to spend free time.
- Made me go outside my comfort zone in a good way.
- By working together with different people to make tasks get done faster and easier.
- I learned about stewardship more in depth and to spread the word.
- I learned stewardship is hard work so young people have to be understanding and learn from our elders.
- Working in the lo'i has taught me so much about the community and the environment.
- I was exposed to malama 'aina.
- I learned to promote stewardship by showing that it is a really fun experience and if you like to get dirty then it's for you.
- I learned that there's a lot we can easily do.
- My experience doing community service gave me a greater perspective of the environment.
- Care more for home. Want to do more to learn what impacts the environment.
- Helping others through community service.
- Making a step by step flow chart.
- I learned that my actions have effects on people and the environment.
# Evaluation Instrument

## PaCES-HIMB Summer Program in Environmental Science
### Mentor Evaluation of Students

<table>
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<tr>
<th>Student's Name</th>
<th>Check the box below that best represents your opinion for each criterion listed.</th>
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<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
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<tr>
<td>This student was able to work well with others.</td>
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<tr>
<td>This student listened well and understood instructions provided.</td>
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<tr>
<td>This student showed initiative and enthusiasm for the project.</td>
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<tr>
<td>This student was able to solve problems when they arose.</td>
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<tr>
<td>I was able to trust this student to complete his/her obligations to the group.</td>
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<tr>
<td>This student contributed significantly to the development and completion of the group project.</td>
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<td>This student was punctual.</td>
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<tr>
<td>This student took care to carry out assigned tasks correctly.</td>
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<td>This student exhibited leadership skills.</td>
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<tr>
<td>I think this student would make a good mentor.</td>
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Please answer the following questions as thoughtfully as possible.

1. What were this student's greatest strengths?

2. In what ways could this student have improved his/her performance?

3. What else would you like to say about this student?
Human Impacts and Hawai‘i’s Coral Reef Health:
An Environmental Science Education, Stewardship and Research Program
for High School Juniors and Seniors in Hawai‘i

APPENDIX IV
2012 Symposium Agenda
2012 Student Research Project Symposium

14 July 2012 ♦ Hale ʻĀkoakoa 105 ♦ Windward Community College

for the

Pacific Center for Environmental Sciences (PaCES) and Hawaiiʻi Institute of Marine Biology (HIMB)

Summer Environmental Science Program for High School Students

Funded By
Ameron Hawaiʻi
Cultural Surveys Hawaiʻi, Inc.
Harold K.L. Castle Foundation
Islands of Opportunity Alliance Louis Stokes Alliances for Minority Participation
Emmett R. Quady Foundation
Minami Community Foundation
Fred Paine
Program Participants

Student Participants
Macie Akai, James B. Castle High School
Brendon Cameron, Mililani High School
Kimberly Chun, Waipahu High School
Rachel Elias, Honolulu Waldorf School
Jayten Galariao, Waipahu High School
Miki Goto, Kalani High School
Darcy Inouye, James B. Castle High School
Kristen Kadooka, Kalaheo High School
Meilin Kalahiki, Kamehameha Schools
Erin Kanda, James B. Castle High School
Dylan Keaweʻehu, Kamehameha Schools
Kevin Liu, ʻIolani School
Andrew Musgrave, Mid-Pacific Institute
Jonathan Rosen, Moanalua High School
Ty Spangler, Mililani High School
Alexis Stearns, The Classical Academy
Sarah Weible, James B. Castle High School
Victoria Westfall, Mililani High School

Guest Speakers and Contributors
John Quincy Adams, Lifeguards Hawai‘i State
Greta Aeby, Hawai‘i Institute of Marine Biology, University of Hawai‘i
Leina‘ala Bright, Hawaiian Studies, University of Hawai‘i at Mānoa
Chuck Burrows, ʻAhahui Mālama I Ka Lōkahi
Carl Evensen, College of Tropical Agriculture and Human Resources, University of Hawai‘i at Mānoa
Kristie Kahale, Kākoʻo ʻOiwi
Herb Lee, Pacific American Foundation
Richard Manshardt, Tropical Plant and Soil Science, College of Tropical Agriculture and Human Resources, University of Hawai‘i at Mānoa
Christina Runyon, Hawai‘i Institute of Marine Biology, University of Hawai‘i
Kaimi Scudder, ʻAhahui Mālama I Ka Lōkahi
Amanda Shore, Hawai‘i Institute of Marine Biology, University of Hawai‘i at Mānoa
Jamie Sziklay, Hawai‘i Institute of Marine Biology, University of Hawai‘i
Clyde Tamaru, College of Tropical Agriculture and Human Resources & Hawai‘i Institute of Marine Biology, University of Hawai‘i at Mānoa

Student Mentors
Jaslynne Kauionapua Mei-Yi Chang, James B. Castle High School
Jacqueline Kim, Pearl City High School
Samantha Shipley, Kahuku High School
Duke Orton, Kahuku High School
Noelle Victoria, James B. Castle High School
Hope Whitney, Hālau Kū Māna PCS

Student Teaching Assistants
Frank Winter, Windward Community College, University of Hawai‘i
Celeste Yee, University of Hawai‘i at Mānoa

Program Faculty and Coordinators
Kelvin Gorospe, Hawai‘i Institute of Marine Biology, University of Hawai‘i
Roxanne Haerkort, Hawai‘i Institute of Marine Biology, University of Hawai‘i
Robert Hutchison, Kamehameha Schools
David Krupp, Windward Community College & Hawai‘i Institute of Marine Biology, University of Hawai‘i
Malia Rivera, Hawai‘i Institute of Marine Biology, University of Hawai‘i
Krista Steinfeld, Windward Community College, University of Hawai‘i
Manning Taite, NALU Studies, Pacific American Foundation
Erin Yafuso, Windward Community College, University of Hawai‘i

Institution Administrators
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Waikalua Loko Fishpond Preservation Society
Parents and Guardians of Student Participants
Symposium Schedule

8:00 A.M.  Refreshments

8:30 A.M.  ‘Oli
Kumu Krista Steinfeld, Instructor in Hawaiian Studies, Windward Community College

8:40 A.M.  Welcome and Introductions
David Krupp, Professor, Windward Community College & Hawai‘i Institute of Marine Biology, University of Hawai‘i
Richard Fulton, Vice Chancellor, Academic Affairs, Windward Community College, University of Hawai‘i
Malia Rivera, Educational Specialist, Hawai‘i Institute of Marine Biology, University of Hawai‘i

9:00 A.M.  Keynote Presentation
How Legislation Impacts Marine Conservation
Senator Clayton Hee, Senatorial District 23, State of Hawai‘i

9:20 A.M.  Break

9:30 A.M.  Student Presentations (Robert Hutchison and Manning Taite)

Self fertilization and larval development in hermaphroditic collector urchins, *Tripneustes gratilla*, on O‘ahu
Meilin Kalahiki, Erin Kanda, Dylan Keawe‘ehu and Ty Spangler
Hope Whitney, Mentor

The effects of environmental changes on the survival and development of fertilized opakapaka, *Pristipomoides filamentosus*, eggs
Kimberly Chun, Jayten Galario, Miki Goto and Alexis Stearns
Duke Orton, Mentor

Brendon Cameron Kristen Kadooka and Kevin Liu
Jacqueline Kim, Mentor

Determining if the presence or absence of the 35S CaMV promoter gene from GMO plants impacts the antibiotic properties in *Colocasia esculenta* (Hawaiian taro)
Macie Akai, Rachel Elias, Darcy Inouye and Sarah Weible
Samantha Emerald Shipley, Mentor

Development of an aquaponic system for gorilla ogo, *Gracillaria salicornia*, and Samoan crab, *Scylla serrata*
Andrew Musgrave, Jonathon Rosen and Victoria Westfall
Noelle Victoria, Mentor

11:00 A.M.  Special Treat

11:15 A.M.  Closing Remarks and Refreshments
Senator Clayton Hee

Senate District 23

State of Hawai‘i State

Senator Clayton Hee represents Hawai‘i’s 23rd Senatorial District and has served in the Hawaii State Senate since 1984. Hee represented Moloka‘i, Lana‘i, and West Maui communities as a State Representative from 1982 to 1984.

Senator Clayton Hee currently serves as chair of the Judiciary and Labor committee. He also sits as a member on the Hawaiian Affairs committee. A longtime supporter of the marine science research and conservation efforts of the Hawai‘i Institute of Marine Biology (HIMB), Senator Hee has also been a vigorous champion of STEM (STEM – Science Technology, Engineering and Mathematics) education at both HIMB and Windward Community College.

Born on March 14, 1953, Senator Hee and his wife, Lynne Waters, have one son, Ka‘ohukauikali‘i. Senator Hee is a graduate from the Kamehameha Schools and received a B.A. from the University of Hawai‘i in 1975. He continued his education receiving his MA in Pacific Island Studies in 1979.