JIMAR

Annual Report for Fiscal Year 2011

For Cooperative Agreements
NA17RJ1230, NA09OAR4320075, and NA08OAR4320910

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Director

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SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
UNIVERSITY OF HAWAI'I AT MĀNOA

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Introduction

Thomas Schroeder, Director

The Joint Institute for Marine and Atmospheric Research (JIMAR) is a cooperative enterprise between the National Oceanic and Atmospheric Administration (NOAA) and the University of Hawaii (UH). JIMAR research covers six themes, all aligned with the NOAA strategic plan and the University's Indo-Pacific mission. The themes are equatorial oceanography, tsunamis and other long-period ocean waves, climate, tropical meteorology, fisheries oceanography, and coastal research. The scope of these efforts spans the U.S. affiliated Pacific Islands as well as the broader Pacific and Indian Ocean basins. JIMAR brings together research scientists from NOAA line offices, UH, and the global community to conduct research in the broad interests of NOAA. NOAA line offices collaborating in the JIMAR program include the Environmental Research Laboratories (especially the Pacific Marine Environmental Laboratory [PMEL], Atlantic Oceanic and Meteorological Laboratory [AOML], and the Earth System Research Laboratory [ESRL]), National Marine Fisheries Service (NMFS), National Weather Service (NWS), National Environmental Satellite and Data Information Service (NESDIS), and National Ocean Service (NOS). JIMAR also promotes student development, outreach, and supports special training programs. JIMAR intends to be the lead agent for all NOAA research in the Indo-Pacific region and maintain standards of accomplishment expected of the School of Ocean and Earth Science and Technology (SOEST) at the UH. Included in this report are projects under award numbers NA17RJ1230, NA09OAR4320075, and NA08OAR4320910.

Our mission and vision statements are:

Mission: To conduct research that is necessary to properly understand and predict the changes in the Indo-Pacific environment and to conserve and manage coastal and marine resources in the U.S.-affiliated Pacific Islands with a special emphasis on the Hawaiian Islands, for purposes of meeting the Nation's economic, social, and environmental needs in these regions.

Vision: To support NOAA's operational and scientific move into the 21st century while recognizing the special character, vulnerabilities, and role of the Pacific Islands in demonstrating the link between our planet's environment and the global and regional economies.

FY 2011 has been a special year. NOAA issued an RFP for a Pacific Islands Cooperative Institute as part of the re-competition of all cooperative institutes. The University of Hawaii submitted a proposal to manage the new institute under the name of JIMAR. The UH proposal was successful and a new JIMAR will be established on October 1, 2011. At this time a new Director, Mark Merrifield, will assume the role. Tom Schroeder will step down and retire at the end of this calendar year. As part of the start-up of a new JIMAR, a new Memorandum of Understanding will be negotiated with NOAA and some of the governance structure mentioned below will be subject to modification.

The anticipated move of many NOAA facilities to new quarters in renovated property on Ford Island in Pearl Harbor, Oahu will place many JIMAR employees at a remote location, relative to the Manoa campus of UH. During FY 2011 we recruited a Deputy Director for the Fisheries programs. Jeffrey Hare assumed this role in March 2011 and has rapidly assumed his responsibilities. He comes from a Cooperative Institute background (CIRES) and has scientific interests that match well with UH faculty in Oceanography and Meteorology.

On March 11, 2011 JIMAR field staff in the northwest Hawaiian islands were exposed to the tsunami generated off Japan. All came through safely although some were subsequently evacuated. JIMAR Fellows (Schroeder and Businger) collaborated with Hawaii Sea Grant to provide public guidance on potential radiation hazards in Hawaii due to the Fukushima nuclear accident. JIMAR also supported some nascent research by International Pacific Research Center scientists on distribution, transport and alteration of marine debris in the Hawaiian Islands.

JIMAR continued to expand outreach efforts in cooperation with the Pacific Islands Integrated Ocean Observing System. A new outreach center is under construction in the Hawaii Institute of Geophysics Building. The Director has assumed the role of chief climate scientist for the National Disaster Preparedness Training Center

at the University of Hawaii. This Center is funded via the Department of Homeland Security. He assisted in designing curriculum on the development of resilient coastal communities and lectured in a series of summer course offerings through the Department of Urban and Regional Planning.

The JIMAR and Sea Grant supported program in cooperation with the UHM School of Hawaiian Knowledge has flourished. A database of over 4000 Hawaiian language articles on natural phenomena (weather and water) has been assembled in a web accessible format. This initiative has served as impetus for development of teacher education programs for Hawaiian instructors and has been recently resulted in support from the education directorate of the National Science Foundation.

JIMAR science encompasses several dozen programs; a few highlights follow. The UH Seal Level Center supports both NOAA's climate and tsunami programs. The Pacific Tsunami Warning Center has long used our tide gages as elements of the tsunami detection and warning system. The gages are designed to sample high-frequency (tsunami) signals as well as longer period tides and other secular sea-level changes. After the Boxing Day (2004) tsunami our existing Indian Ocean gages (climate) were enhanced with additions as part of the nascent Indian Ocean Tsunami Warning Network. NOAA funds these efforts and further support has come from the Asia Disaster Preparedness Center and the United Nations (UNESCO). Dr. Mark Merrifield (UHSLC Director) will serve as director of the new JIMAR (see discussion above).

The Pelagic Fisheries Research Program (PFRP) has continued to serve as a catalyst for research in support of fisheries management for the Western Pacific Ocean. PFRP conducts internal research as well as funds competitive awards through international competitions. Current Federal budget issues have forced a reduction in PFRP activity as we await the future decisions of the Congress.

JIMAR's Pacific El Niño/Southern Oscillation (ENSO) Applications Center (PEAC) has completed 17 years of service to Hawaii, the U.S. Affiliated Pacific Islands, and other international partners. A collaboration among UH Meteorology, JIMAR, the National Weather Service Pacific Region, weather offices of the U.S. Affiliated Pacific Islands, and the University of Guam serves as a prototype climate services center and is a model for future efforts within the proposed NOAA Climate Service. Again, we await final decisions on the future of the NOAA initiative.

The Director of JIMAR is a regular member of the University of Hawaii faculty and is appointed through joint decisions by leaders of the University and NOAA Research. The Director reports to an Administrative Board composed of University and NOAA officials. As both NOAA Research and University research ventures have grown, both agencies have delegated more responsibilities to the field. The Director of NOAA Research has delegated most decision-making authority to the Director of PMEL. The President of the University has delegated his responsibilities as Chair of the Administrative Board to the Chancellor of the Manoa campus. The Director manages day-to-day operations through the administrative staff (fully-supported by the Cooperative Agreement and returned indirect cost funds), Program Managers (Pelagic Fisheries Research Program [PFRP]), and faculty PI/Directors (University of Hawaii Sea Level Center [UHSLC]). A Council, elected among the Fellows, advises the Director on major expenditures on visiting scientists and the selection of new and renewed Fellows. The list of current Fellows and Council members are provided. We renewed the appointments of all current Fellows so that all appointments are synchronized. Owing to the long-distance nature of the NOAA/JIMAR relationship, no single meeting of all Fellows is possible. Business of both the Fellows and the Council are done via e-mail and by visits of the Director to NOAA facilities and professional meetings.

JIMAR Senior Fellows from NOAA are Dr. Steven Bograd (PFEL), Dr. Richard Brill (NMFS), Dr. Richard Feely (PMEL), Dr. Ed Harrison (PMEL), Dr. Gregory Johnson (PMEL), Dr. William Kessler (PMEL), Dr. Frank Marks, Jr. (AOML), Dr. Michael McPhaden (PMEL), Dr. Dennis Moore (PMEL), Dr. Jeffrey Polovina (PIFSC), Dr. Samuel Pooley (PIFSC), Dr. Mark Powell (AOML), and Dr. Frank Schwing (PFEL).

JIMAR Senior Fellows from the University of Hawaii are Dr. Gary Barnes, Dr. Steven Businger, Dr. Eric DeCarlo, Dr. Eric Firing, Dr. Charles Fletcher, III, Dr. Kim Holland, Dr. Roger Lukas, Dr. Douglas Luther, Dr. Julian McCreary, Dr. Mark Merrifield, Dr. Thomas Schroeder, Dr. John Sibert, and Dr. Bin Wang. Visiting Senior Fellows are Dr. Gerald Meehl, Dr. Jagadish Shukla, and Dr. Akimasa Sumi.

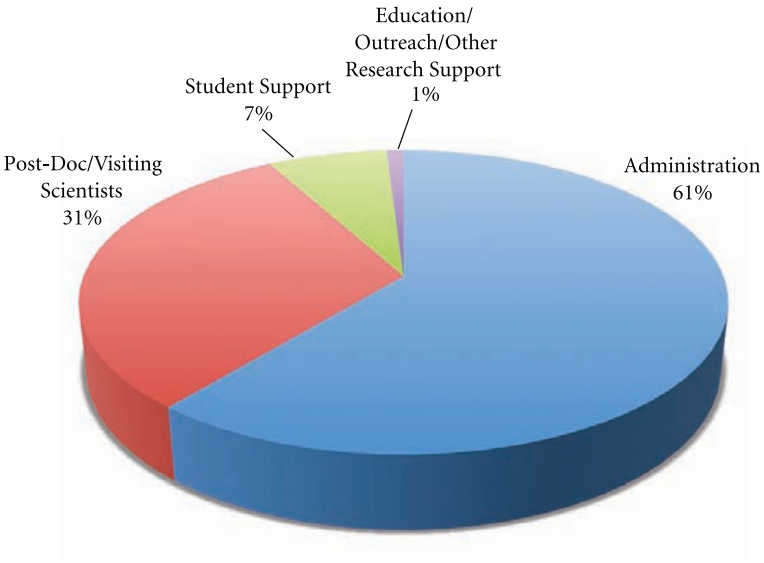
JIMAR Council Members from NOAA are Dr. Michael McPhaden, Dr. Dennis Moore, and Dr. Jeffrey Polovina.

JIMAR Council Members from the University of Hawaii are Dr. Eric Firing, Dr. Julian McCreary, Dr. Thomas Schroeder, and Dr. Bin Wang.

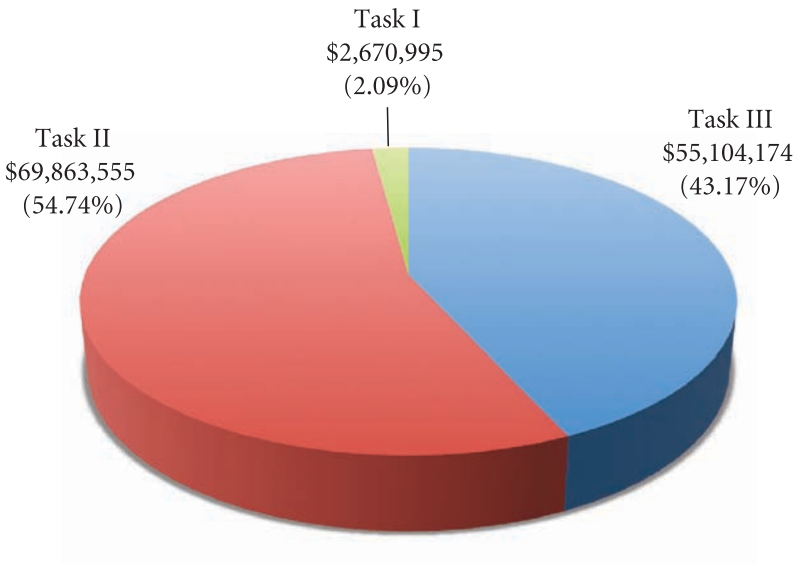
Task I is the base program of JIMAR. It provides research support for the visiting scientist and postdoctoral

programs, and the administrative support for the Institute. The University of Hawaii contributes to this task by bearing all indirect costs, and by paying the salary of the Director. Funding percentages by activity are exhibited in the following chart.

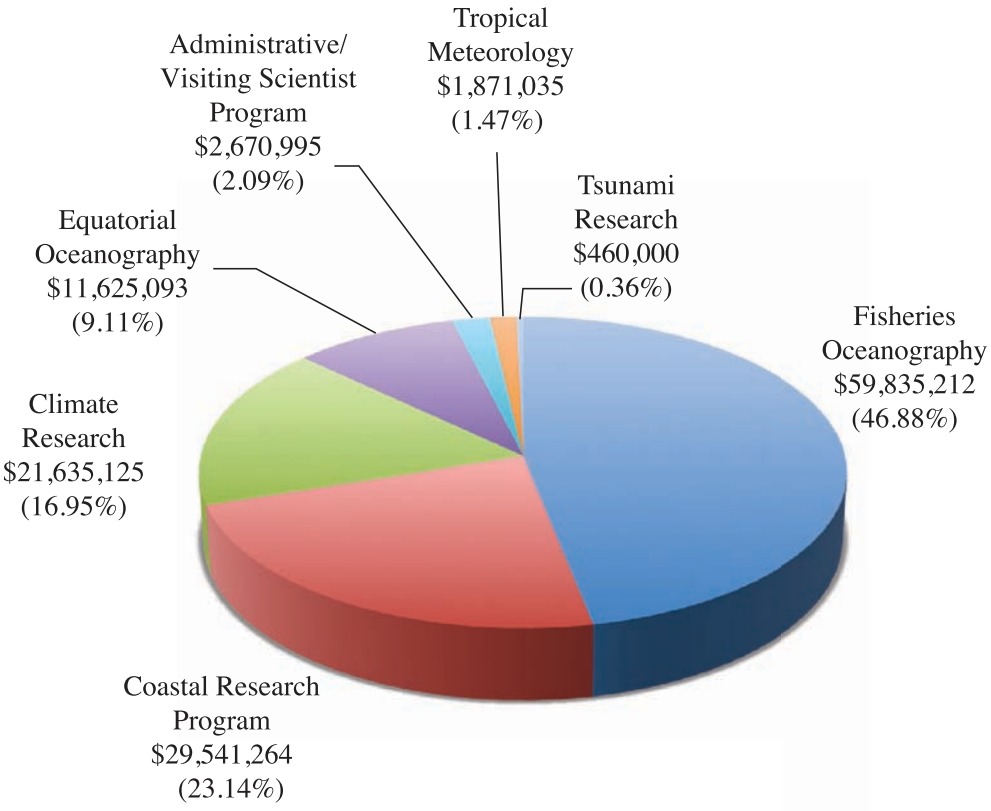
Distribution of JIMAR's Task I NOAA Funding by Activity



Distribution of NOAA Funding by Task
(FY 2002-2011)



Distribution of NOAA Funding by Theme
(FY 2002-2011)



Accomplishments for Fiscal Year 2011

Equatorial Oceanography

JIMAR Senior Fellows are actively involved in equatorial oceanographic research. Current activities include current profiling, sea level monitoring, equatorial circulation studies, and dynamic modeling.

NOAA Shipboard ADCP Support

P.I.: Eric Firing

NOAA Office (of the primary technical contact): Pacific Marine Environmental Laboratory

NOAA Sponsor: Mark Koehn

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

As part of an extensive suite of ocean and atmospheric observations, upper ocean current measurements are made with a shipboard Acoustic Doppler Current Profiler (ADCP) during a series of cruises. The UH contribution is the oversight of these measurements.

Progress during FY 2011

Jules Hummon installed and maintained our UHDAS shipboard ADCP data acquisition and processing system on the NOAA ships *Ron Brown*, *Ka'imimoana*, and *Hi'ialakai*. Daily monitoring is facilitated by automated web posting of diagnostic information and plots at http://currents.soest.hawaii.edu/uhdas_fromships.html. Problems and questions are resolved via communications with shipboard technicians and science personnel. We are particularly interested in data from the TAO maintenance cruises because it contributes to a growing time series of equatorial current sections at the TAO longitudes. Hummon post-processes those data sets and submits them to the National Oceanographic Data Center via the Joint Archive for Shipboard ADCP as time permits.

Penetration of Anthropogenic CO_2 in the Oceans Based on Analysis of Recent WOCE/JGOFS/OACES Carbon Data Using the Remineralization Ratios Obtained by the New Three-End-Member Mixing Model

P.I.: Yuan-Hui Li

NOAA Office (of the primary technical contact): Atlantic Oceanographic and Meteorological Laboratory

NOAA Sponsor: Tseng-hung Peng

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The first task for this project is to use the three-end-member mixing model on the complete set of newly synthesized and quality assured WOCE/JGOFS and NOAA global CO_2 survey data to re-evaluate the remineralization ratios throughout the global oceans. The objective of this task is to obtain new values of remineralization ratios for the oceans and to verify that these ratios do vary systematically among ocean basins as our preliminary results have indicated (Li and Peng, 2002). The second task for this project is to develop a new method for estimating the penetration of anthropogenic CO_2 in the ocean. The objective of this task is to include the variable remineralization ratios for estimating the anthropogenic CO_2 inventory in the ocean and to provide information from an alternative method for comparison with that derived from the popular ΔC^* method.

Progress during FY 2011

The project PI, Yuan-Hui Li, has published two papers on the partition of elements in natural aquatic environments.

University of Hawai'i Sea Level Center

P.I.: Mark A. Merrifield

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: Candyce Clarke

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond
- To serve society's needs for weather and water information

Purpose of the Project

The purpose of the UHSLC is to ensure that tide gauge data from around the world are collected, quality assessed, and archived for climate and oceanographic research. In addition, the Center seeks to implement a global tide gauge observing system as defined by the Intergovernmental Oceanographic Commission Global Sea Level Observing System (GLOSS) and the Global Climate Observing System (GCOS). The Center focuses on high frequency measurements that are available in near-real time as a complement to the Permanent Service for Mean Sea Level (PSMSL), which is the primary archive for delayed mode monthly-averaged sea level time series. The UHSLC acquires tide gauge data from ~ 450 stations maintained by 65 international agencies, and the UHSLC collaborates directly with international partners to maintain 75 high profile stations that are important for the global observing system. The UHSLC is an active participant in the operational and scientific oversight of GLOSS through the GLOSS Group of Experts. UHSLC datasets are used in conjunction with operational numerical models, for the calibration of satellite altimeter data, the production of oceanographic products, and research on interannual to decadal climate fluctuations and short-term extreme events. UHSLC station data is also made available via satellite to the Pacific Tsunami Warning Center, West Coast/Alaska Tsunami Warning Center, and international centers for tsunami monitoring. Over the years the UHSLC has participated in international scientific programs including NORPAX, TOGA, WOCE, GODAE, and CLIVAR.

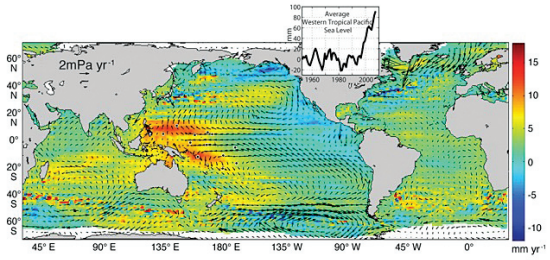


Figure 1. Linear trend (1993-2010) of satellite altimeter sea surface height showing a region of high rates in the western Tropical Pacific. The high water levels are associated with an intensification of the trade winds, depicted as trend vectors based on ECMWF operational ocean analysis/reanalysis system (ORA-S3) wind stress. The inset is the time series of average sea level obtained from 11 tide gauges (locations denoted by solid dot), showing that the high sea levels in the region developed around 1990.

Progress during FY 2011

As a data center, the primary objective of the UHSLC is to ensure that all GLOSS, GCOS, and other scientifically relevant sea level time series are updated each year and archived in the Joint Archive for Sea Level (JASL), a joint project with NODC. The UHSLC also maintains the Fast Delivery Database, which is the primary source for quality assessed, near-real time sea level data available to the research community. For both activities, the project met its objectives in that the core function of each database was maintained, and both databases were expanded to take on new station installations, particularly in the Caribbean and Central America as part of tsunami network upgrades. The project also updated the UHSLC website and improved the user interface for data retrievals. In terms of station maintenance, the objective was to conduct six field trips during FY 2011. The project was able to accomplish three field trips at the time of reporting, although significant support was provided for a new installation at Port Au Prince, Haiti that amounted to a field visit in terms of technician man-hours. The main reasons for the slippage were delays in scheduling collaborative visits with international partners (Indonesia and

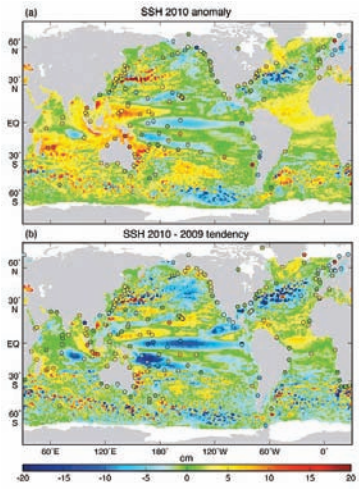


Figure 2. a) A comparison of the 2010 annual mean sea level relative to 1993-2010 from satellite altimetry and tide gauges (circles) showing the predominance of La Niña conditions during 2010. Units are in centimeters. b) The difference in annual mean sea level, 2010–2009. The two sea level observing systems, based on satellite altimeters and tide gauges, provide a consistent and complementary depiction of regional sea level change.

Vietnam), and the loss of one technician that reduced operational capabilities. The savings in travel funds were used for a number of emergency remote repairs, and some funds will be carried forward to FY 2012 for one station visit before Sept. 2012.

In terms of UHSLC research performance, the project is continuing its studies of regional patterns of Pacific sea-level change during 1993-2009 from satellite altimetry compared to previous time periods as sampled by the tide gauge network. Notably, the region with the highest rise rates in the western Pacific was found to be associated with a steady increase in trade wind strength over that time period (paper in press at the *Journal of Climate*). A modeling study that links the trade wind enhancement to the regional sea level response was completed and submitted to *Geophysical Research Letters*. UHSLC researchers contributed a chapter on modern sea level observing systems in the book *Understanding Sea-level Rise and Variability*. They also took part in the NOAA Office of Climate Observation contribution to the *Bulletin of the American Meteorological Society* State of the Climate report, describing sea level patterns during 2010. They worked on a paper on extreme sea level during FY 2011, however, that work is still in progress and will be submitted for publication in FY 2012.

WHOI Hawai'i Ocean Timeseries Station (WHOTS)

P.I.: Thomas A. Schroeder, Roger Lukas

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: David Goodrich

NOAA Goal(s):

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The WHOI Hawai'i Ocean Timeseries Station (WHOTS) is the Woods Hole Oceanographic Institution (WHOI) deep-ocean mooring at Station ALOHA. The WHOTS mooring consists of a moored surface buoy instrumented with a full complement of state-of-the-art meteorological sensors deployed at Station ALOHA since August 2004.

WHOTS is a collaborative effort between Drs. Robert Weller (WHOI), Al Plueddemann (WHOI), and Roger Lukas (UH). Principal funding is provided by the NOAA Office of Climate Observations (OCO). Subsurface instrumentation on the mooring is provided by the UH School of Ocean and Earth Science and Technology (SOEST) under a grant from the National Science Foundation (NSF). The WHOTS mooring site is an OceanSITES Ocean Reference Station, and is World Meteorological Organization station number 51400.

Progress during FY 2011

The WHOTS-6 mooring was recovered and the WHOTS-7 mooring deployed during a cruise on the UH *R/V Kilo Moana* from July 26-August 4, 2010. Ship time was funded by NOAA through JIMAR. The WHOTS-7 mooring was recovered and the WHOTS-8 mooring was set from the NOAA vessel *Hi'ialakai* during July 5-13, 2011. Shipboard CTD, ADCP, and meteorological measurements were made during these cruises for intercalibration with sensors on the moorings.

Further information about this project, including archived data from buoy deployments, can be found online at http://www.soest.hawaii.edu/whots/ and http://uop.whoi.edu/projects/WHOTS/whots.html.

Tsunami Research

JIMAR originated from the Joint Tsunami Research Effort and has maintained a long collaboration with the Pacific Marine Environmental Laboratory (PMEL) in tsunami research. JIMAR scientists have been heavily involved in tsunami hazard mapping and preparedness throughout the Pacific basin with special emphasis on Hawai'i. JIMAR scientists have collaborated with PMEL, the Pacific Disaster Center, and Hawai'i State Civil Defense.

Archive of Rapidly Sampled Hawaiian Sea Level

P.I.: Douglas S. Luther

NOAA Office (of the primary technical contact): Pacific Marine Environmental Laboratory

NOAA Sponsor: Mark Koehn

NOAA Goal(s)

- To serve society's needs for weather and water information

Purpose of the Project

The Archive of Rapidly Sampled Hawaiian Sea Level (ARSHSL) provides an electronically accessible database of rapidly sampled ($\Delta t \leq 6$ minutes) sea level observations from existing Hawaiian coastal sea level gauges maintained by NOAA agencies (NOS and PTWC). The sea level data in ARSHSL is available online for both practical applications and research. The archive was originally established with NOAA funding in 1997 to ensure a consistent repository for rapidly sampled sea level data in the Hawaiian Islands for the study of weak tsunamis and related infra-gravity wave signals (including edge waves and harbor resonances) at periods of 2-40 minutes. The archive is maintained with funding by JIMAR. Beyond studies of the 2-40 minute gravity waves that impact commercial and private boating activities, the ARSHSL data is used by the NOAA-funded Hawai'i Ocean Observing System (HiOOS), and by investigators studying the dynamics of phenomena such as internal and external tides (0.5-1 day periods), coastal trapped internal waves (1.5-5 days period), wind-forced mesoscale variability (3-60 days period), mesoscale eddies (60-180 days period), and interannual variability around the Hawaiian Islands. Sea level data from two-thirds of the gauges we access would otherwise be lost without this archiving activity; that is, the data is not saved by the agency (PTWC) responsible for maintaining the gauges because data archiving is not a mission of that agency. Therefore, this data rescue activity provides as complete a dataset as possible of sea level fluctuations on the coasts of the Hawaiian Islands for current and future research and practical applications.

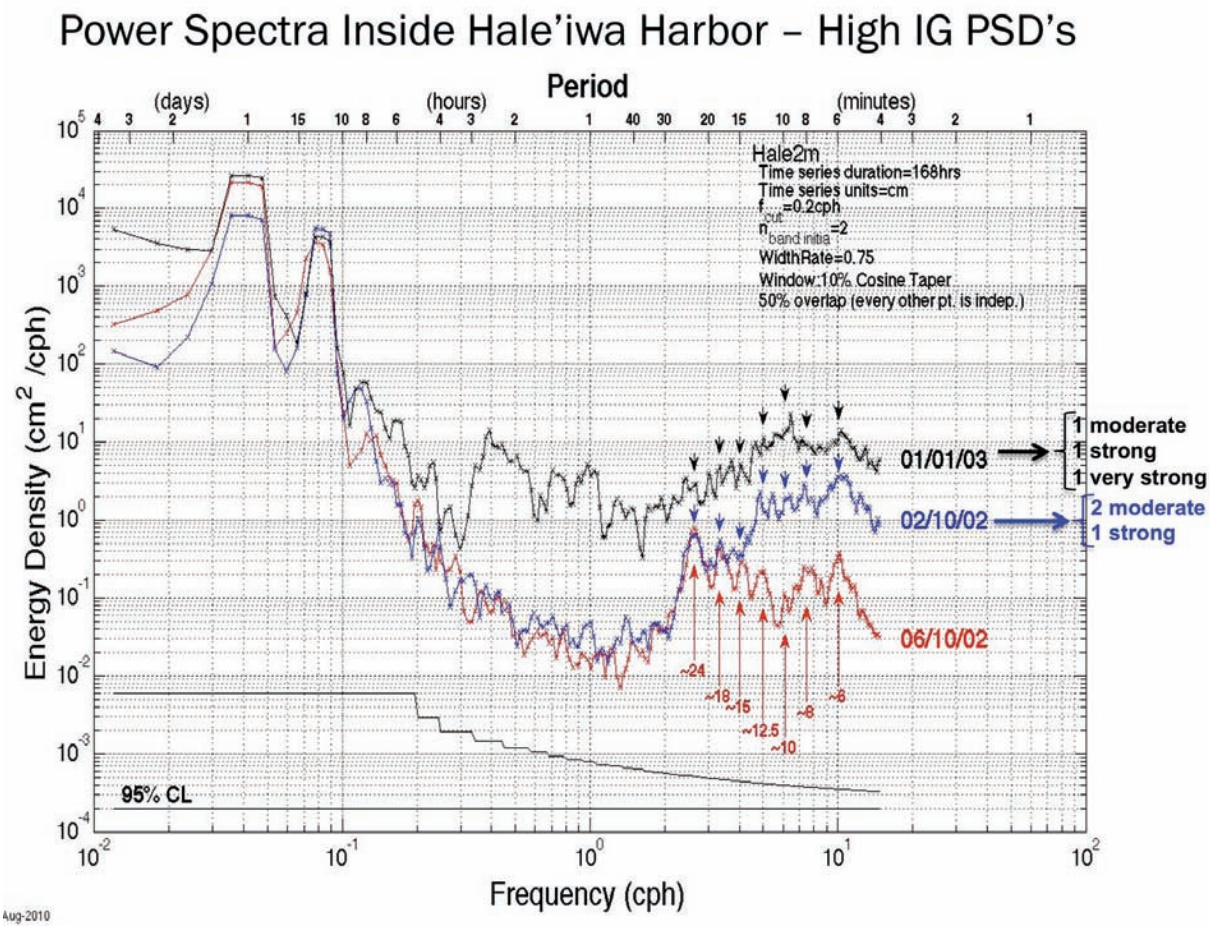
Progress during FY 2011

Per the plans for this past year, the ARSHSL has been maintained online (http://www.soest.hawaii.edu/oceanography/dluther/arshsl.html) by M. Luther and D. Luther, in collaboration with the NOAA-funded UH Sea Level Center (M. Merrifield, Director). One-minute and 6-minute data from six NOS gauges are retrieved from NOAA's tides and currents website (http://tidesandcurrents.noaa.gov/), rather than through the special communications pathways originally established for ARSHSL. PTWC sea level gauge data (1-second or 2-minute samples, depending on the gauge) have been automatically or, if necessary, manually downloaded daily via Internet and telephone links from up to 14 PTWC gauges in 12 harbors. All the sea level data, as originally sampled from a total of 17 harbors (some harbors have multiple gauges and, over time, some gauges have been decommissioned) dispersed around the five main islands of Hawai'i, are stored on the ARSHSL website, usually after both a low-level quality control check and elimination of extreme outliers. Access to the website is unrestricted, with past users ranging from UH graduate students to government civil engineers, and even PTWC. The applications range from hydrogeology to gravity wave studies to dock design. Predominant users in the past year focused on water table fluctuations on the Big Island (USGS) and on infragravity waves at periods of 2 minutes to several hours in support of the development of both harbor surge and beach flooding nowcasts and forecasts for the HiOOS. JIMAR and HiOOS have been supporting a graduate student, Assaf Azouri, who is analyzing the 13 years of PTWC sea level data from Haleiwa Harbor in ARSHSL to determine the relationships between Haleiwa's suite of infragravity wave fluctuations and their many forcing pathways (e.g., wind-generated swell to harbor infragravity wave and swell to coastal infragravity wave to harbor infragravity wave). Azouri is now creating a product for HiOOS that will

predict the occurrence of potentially damaging infragravity wave currents in Haleiwa Harbor up to a few days into the future. This work will eventually be extended to other harbors.

A technical report on the ARSHSL was prepared in January 1998, and is periodically updated on the website. Logs of all data holdings and processing activity are maintained on the website for each station. As expected, archiving activities required most of the budgeted effort this past year. Per the plans stated in last year's report, an additional "value added" activity accomplished this past year was the updating of files of concatenated, quality-controlled, hourly-averaged sea level data for studies of low-frequency phenomena, especially to aid modeling and prediction of sea level inundation hazards around O'ahu for NOAA's HiOOS.

The figure illustrates two of the surprising results to date from the study of infragravity wave excitation in Haleiwa Harbor, O'ahu, which was made possible by the long record of rapidly sampled sea level that is available in the ARSHSL. Three power spectra of weeklong pieces of sea level from Haleiwa Harbor are shown. The red curve is the spectrum from the week starting June 10, 2002, during which there were no long-distance swell events arriving in the Hawaiian Islands; that is, the 1-30 second gravity wave band (whose non-linear interactions are considered the primary source of infragravity waves) contained only locally generated wind waves. Seven coastal and harbor modes in the infragravity wave band are identifiable in this spectrum (their periods in minutes are indicated). The longest period mode (at 24 minutes) was identified by Munger and Cheung (2008) as the gravest infragravity coastal mode of the North Shore of O'ahu excited by tsunamis arriving from the northwest. It was expected that, when high amplitude gravity wave swells impacted the northwest coast of O'ahu around Haleiwa Harbor, the modes identified in the red curve would be more greatly excited and dominate the infragravity band. During the week beginning February 10, 2002, two relatively moderate and one strong swell event impacted O'ahu's northwest coast. The spectrum (blue curve) from this time period shows that some of the previously identified modes still appear to be present, but they by no means dominate; that is, the spectrum appears to be



Results to date from a study on infragravity wave excitation in Haleiwa Harbor, Oahu.

more broad band, with energy distributed more like a continuum. During the week beginning January 1, 2003, one moderate, one strong, and one very strong swell event impacted O'ahu's northwest coast. The spectrum (black curve) from this time period barely suggests the excitation of any coastal or harbor modes. The first surprise from these three spectra, therefore, is that coastal and harbor modes appear to play almost no role in the infragravity wave response to very energetic forcing of the nearshore sea level. The physical system that would be used to model the sea level response under light forcing has changed dramatically. The second surprise is that the strong forcing events have also generated significant very-low-frequency infragravity waves (periods of 30 minutes to 3 hours) that had not been generated under milder forcing. Project researchers believe that these long-period oscillations are the result of a completely different physical mechanism than that which generates the shorter period ($T < 30$ minutes) infragravity waves. They intend to continue to explore these phenomena to unravel the underlying physical concepts.

Three-dimensional Model of Tsunami Generation and Near-field Characteristics

P.I.: Thomas A. Schroeder [Kwok Fai Cheung]

NOAA Office (of the primary technical contact): Office of Oceanic and Atmospheric Research

NOAA Sponsor: Gordon Grau

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The objectives of the research include: 1) implement a continuum mechanics model and develop a non-hydrostatic model to describe seafloor deformation and tsunami generation in three dimensions; 2) implement the non-hydrostatic model for near-field tsunami modeling and determine the applicable range of the conventional hydrostatic approach; and 3) apply the proposed model package to reconstruct and analyze the 1975 Kalapana tsunami in Hawai'i and the 2009 Samoa Tsunami.

Progress during FY 2011

A three-dimensional finite element model of continuum mechanics can provide realistic descriptions of fault slippage and the resulting earth surface deformation. In particular, the Research Organization for Information Science and Technology in Japan developed the finite element model, GeoFEM, to describe tectonic dynamics as part of the Earth Simulator Project. GeoFEM was adapted to provide time-dependent seafloor deformation based on user-specified fault parameters consisting of the focal depth, dimensions, orientation, and slip. The implementation of GeoFEM was verified by the analytical solution for homogeneous and isotropic earth materials and a flat seafloor. GeoFEM can include earth surface relief to produce more realistic deformation over steep trenches or volcanic island slopes for tsunami modeling. Near-field or local tsunamis are not fully developed in terms of wave dynamics and exhibit distinct characteristics specific to the seismic source and local bathymetry that are not amenable to conventional hydrostatic models. A non-hydrostatic model and a grid nesting scheme were developed to describe tsunami generation at the seismic source, propagation across the ocean, and inundation at far or near-field coastlines. Instead of solving the complete three-dimensional problem, a non-hydrostatic term was introduced into the nonlinear shallow-water equations to account for the variation of flow kinematics over the water column. The resulting model remains depth-integrated, but includes an approximate solution in the vertical direction. This computationally efficient approach accounts for the kinetic energy transferred from the seafloor deformation and simulates near-field tsunami characteristics as well as frequency dispersion in far-field propagation. The results have been verified with the Navier-Stokes model TUNA, which was developed jointly by the University of Alaska Fairbanks and the West Coast and Alaska Tsunami Warning Center.

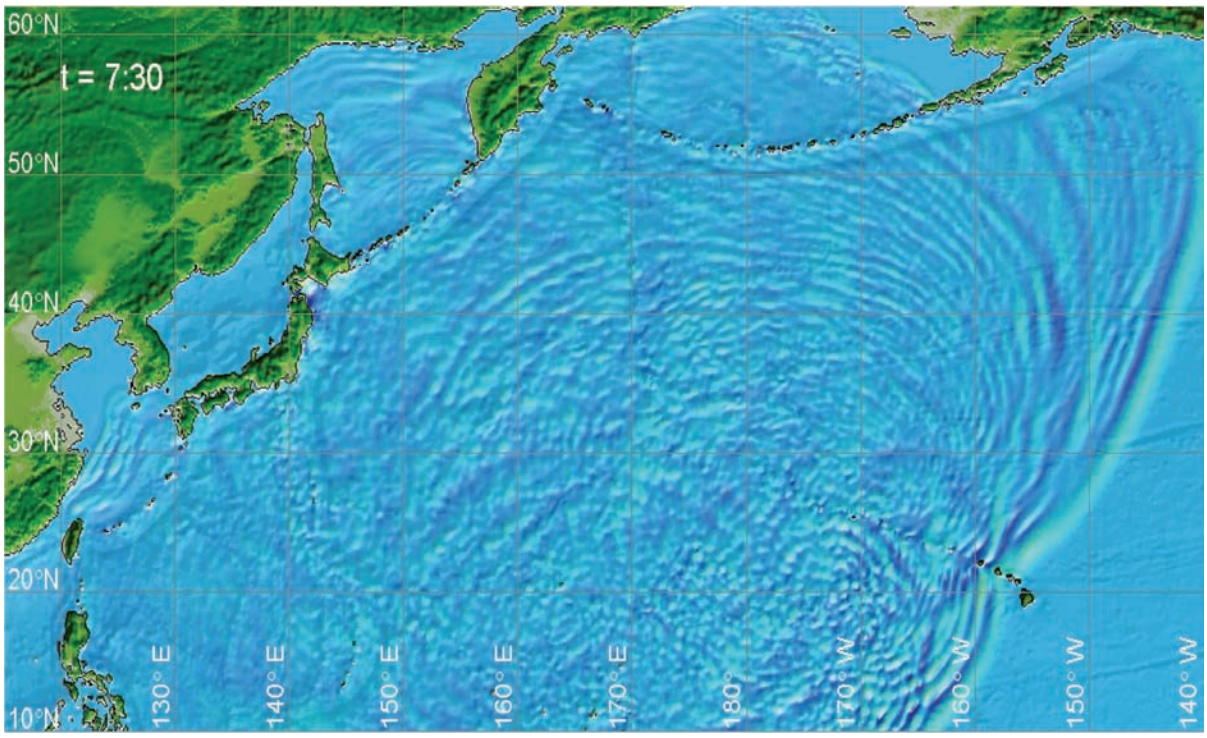


Figure 1. Propagation of the 2011 Tohoku-Oki tsunami across the Pacific.

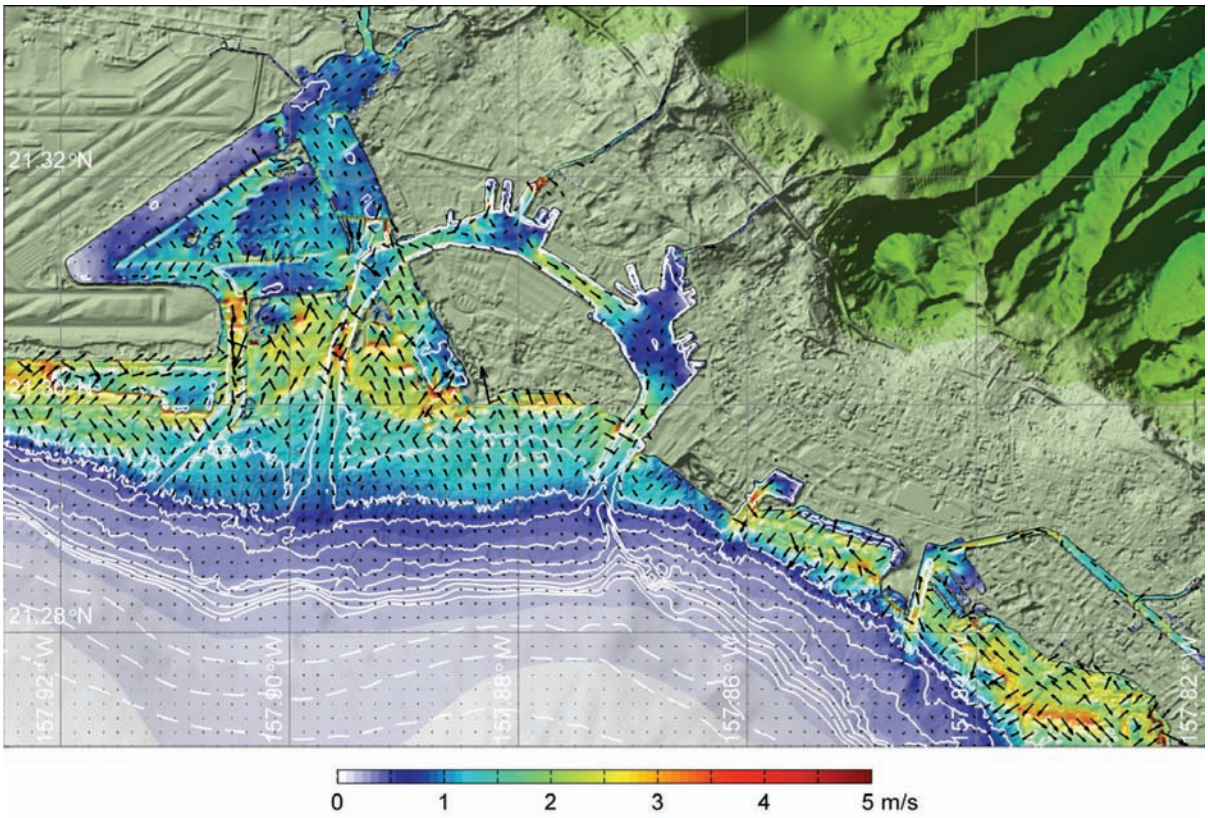


Figure 2. Strong currents caused by the 2011 Tohoku-Oki tsunami in Hawaii.

University of Hawai'i Sea Level Center—Tsunami Research

P.I.: Mark A. Merrifield

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: Jenifer Rhoades

NOAA Goal(s)

- To serve society's needs for weather and water information
- To support the nation's commerce with information for safe, efficient, and environmentally sound transportation

Purpose of the Project

The UHSLC is taking part in the installation and ongoing maintenance of ten water level stations in the Caribbean Sea and 12 water level stations in the Pacific Ocean in support of regional tsunami warning and sea level monitoring. The Caribbean portion of the project is in collaboration with Dr. Victor Huerfano, Director of the Puerto Rico Seismic Network (PRSN). The UHSLC oversees the installation of the stations and provides training for a PRSN technician on the operation and maintenance of the stations. The UHSLC also provides ongoing technical support, and data processing and quality assessment services. The Pacific portion of the project is primarily focused on the upgrade and maintenance of tsunami water level stations previously maintained by the Pacific Tsunami Warning System (PTWS). The UHSLC is working with PTWS counterparts on Pacific station maintenance priorities. UHSLC involvement ensures that the water level stations will comply with global sea level observing system requirements for oceanographic and climate research.

Figure 1. (above) Tsunami water level stations upgraded in the Pacific Ocean include Quepos, Costa Rica, (left) and Acajutla, El Salvador (right).

Progress during FY 2011

For the Pacific Ocean, three stations were upgraded (Nuku Hiva, Hiva Oa, and Legaspi) and equipment for three more stations have been shipped to Peru. The project is awaiting the assistance of local Peruvian contacts to clear the equipment through customs. Once this is finalized, stations at Atico, Callao, and Lobos de Afuera will be installed. Completion of the installation of the new stations is projected to occur within the next two months. The goal was to install one additional Pacific station during FY 2011, La Libertad, but there have been delays in finalizing the work plan with the local agency. The project expects to install the station during FY 2012. For the Caribbean, four stations were installed as planned during FY 2011 (Curacao, Dominica, Grenada, and Puerto Plata). Maintenance work at Limon and Punta Cana will be completed once a subcontract with PRSN is finalized.

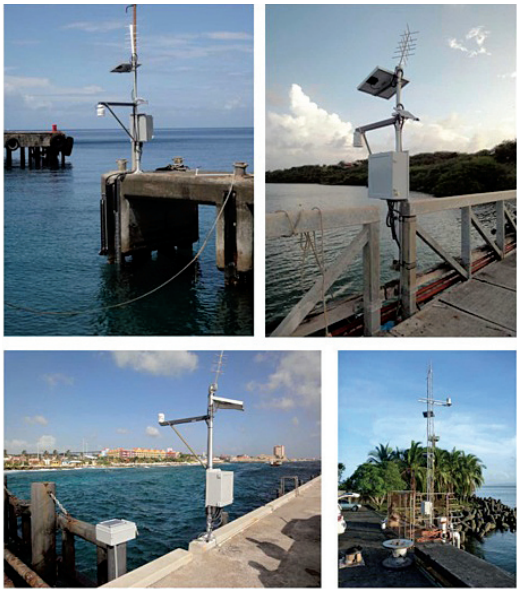


Figure 2. Tsunami water level stations upgraded in the Caribbean include Roseau, Dominica (top left), Prickly Bay, Grenada (top right), Curacao, Netherlands Antilles (bottom left), and Limon, Costa Rica (bottom right).

Climate Research

JIMAR's climate theme evolved in concert with the equatorial oceanography theme. The focus was the El-Niño Southern Oscillation (ENSO) phenomenon in all its oceanic and atmospheric aspects. JIMAR scientists continue to study fundamental aspects of climate and climate variability. The UH Sea Level Center is a major contributor to NOAA's climate program. The project's Pacific ENSO Applications Center (PEAC) has continued the JIMAR tradition by developing interdisciplinary approaches to the study of climate impacts and development of experimental forecasts. Partners in PEAC include the NWS Pacific Region, the University of Guam, the Pacific Basin Development Council and NOAA Research through its Climate Program Office.

Changes in the Tropical Pacific Climate Variability During the Last Millennium: External Forcing Versus Internal Variability

P.I.: Axel Timmermann

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: Chris Miller

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

Separating externally forced signals in tropical Pacific climate reconstructions and model simulations from the signals generated by internal instabilities is a fundamental problem. The project used several existing climate model simulations of the last 500-1000 years and combine different paleo-proxy records for ENSO to elucidate the physical mechanisms responsible for long-term changes of tropical Pacific climate during the last millennium. Questions to be addressed specifically are: 1) what is the degree of consistency between different paleo-ENSO reconstructions during the last millennium; 2) what is the range of internally generated ENSO variability on decadal and centennial timescales in comparison with the externally-induced low-frequency modulation of ENSO; and 3) what are the mechanisms of internally generated and externally-induced long-term changes of ENSO. These questions will be addressed by a careful statistical analysis of existing paleo-proxy data for ENSO and by using coupled-atmosphere ocean general circulation model simulations for the last 500-1000 years. The proposed research will reassess existing paleo-proxy data, provide rigorous uncertainty estimates, and might eventually contribute to a better understanding of ENSO's sensitivity to climate change, with important implications for society.

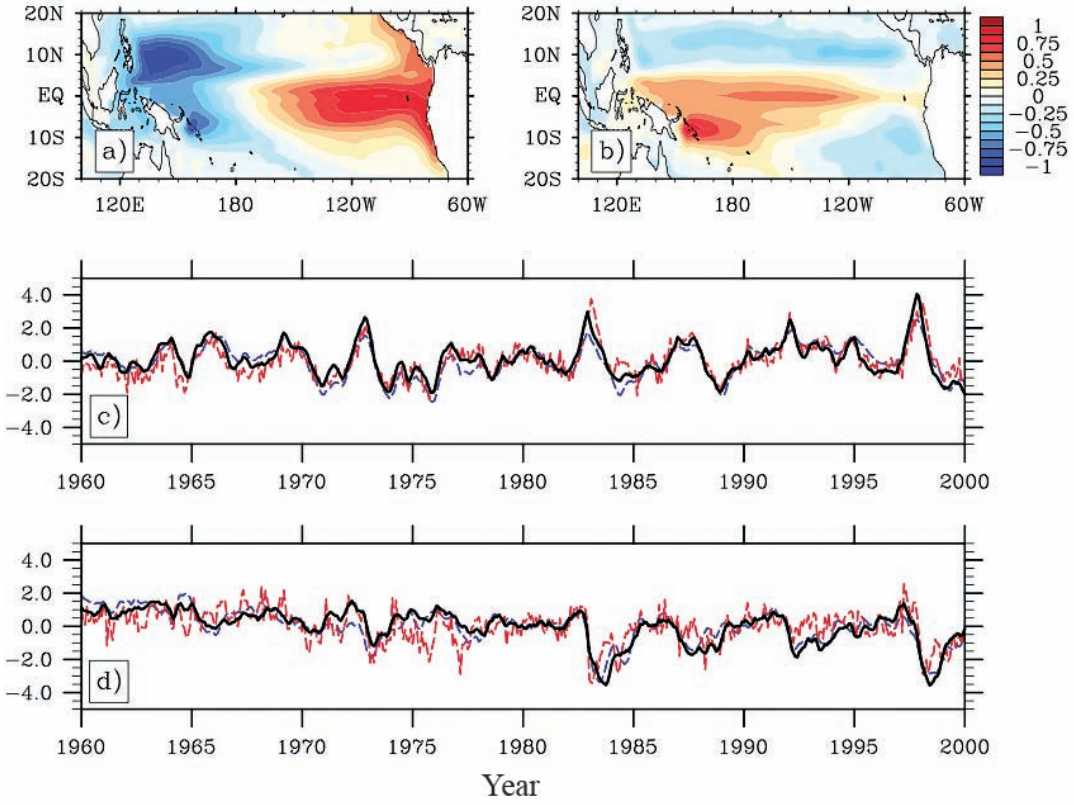
Progress during FY 2011

Our paper on "The Effect of Explosive Tropical Volcanism on ENSO" by S. McGregor and A. Timmermann was published in the *Journal of Climate*. Another paper on "The Effect of the South Pacific Convergence Zone on the Termination of El Niño events and the meridional asymmetry of ENSO" was submitted to the *Journal of Climate*.

- *Understanding the effects of external forcing on tropical Pacific climate.* Researchers analyzed a series of climate modeling experiments covering the last 1000 years that were conducted with the state-of-the art earth system model COSMOS, which is built on the Max Planck-Institute coupled model (MPI-OM1). The main goal was to identify possible influences of centennial-scale solar irradiance changes on ENSO. Previous studies showed that the COSMOS Last Millennium simulations provide a realistic estimate of the climate from 850-1850 and into the 20th century. The first step of our analysis included a verification of the simulated ENSO characteristics in COSMOS. As part of this analysis they found that the COSMOS ocean model, using the resolution employed in the Last Millennium runs, is basically incapable of simulating equatorial Kelvin waves (a key element of ENSO). The reason for this deficiency is the fact that—due to the conformal grid choice—the grid points next to the equator alternate between northern and southern hemisphere. This leads to considerable and unrealistic damping, as the numerical scheme does not provide enough of an equatorial waveguide for the Kelvin waves to propagate eastward and participate in the onset and the termination of El Niño events. This numerical effect was hitherto unknown. The misrepresented ENSO dynamics was considered so unrealistic that it was decided not to continue the ENSO sensitivity analysis with this type of model. A technical note on Kelvin wave damping in non-orthogonal grids is in preparation.

• *Terminating El Niño events: the role of the South Pacific Convergence Zone.* The westerly wind response to an El Niño event shifts southward during boreal winter and early spring, such that the maximum zonal wind is centered about 5-7 degrees south of the equator. The resulting meridional asymmetries, along with a related seasonal weakening of wind anomalies on the equator, are key elements in the termination of strong El Niño events. Using an intermediate complexity atmosphere model it was demonstrated that these features result from a weakening of the climatological wind speeds south of the equator. The reduced climatological wind speeds, which are associated with the seasonal intensification of the South Pacific Convergence Zone (SPCZ), lead to anomalous boundary layer Ekman pumping and a reduced surface momentum damping of the combined boundary layer/lower troposphere wind response to El Niño allowing the maximum wind speed to shift south of the equator. Therefore, the development of a realistic climatological SPCZ in December-January-February is one of the key factors in the seasonal termination of strong El Niño events.

Furthermore, this southward wind shift is shown to play a prominent role in the zonal mean changes in equatorial heat content and the meridionally asymmetric recharge/discharge mode, which is qualitatively similar to the observed. This result leads researchers to question the role of western boundary reflection of oceanic Rossby waves in the recharge oscillator paradigm. This is further illustrated in the figure. The leading two modes of variability of observed thermocline variations in the tropical Pacific are shown in the figure (a and b). The thermocline-tilting mode (EOF1) characterizes the effect of Kelvin waves on the eastern tropical Pacific and the effect of Rossby waves in the western tropical Pacific. Its time-evolution (black curve in graph c) correlates highly with the leading mode of wind-stress variability (red line in graph c). Furthermore, forcing a linear shallow water ocean model with the wind stresses enabled us to capture the dominant features of thermocline variability associated with the tilting mode (blue line in graph c). The zonal thermocline anomaly on the equator that characterizes EOF2 is considered



(a) EOF1 (37% variance) and (b) EOF2 (15% variance) vertically averaged temperature in the upper 300m using the ECMWF Ocean Reanalysis dataset (ORA-S3). The first mode represents the thermocline seesaw, whereas the second mode is associated with the slow asymmetric discharging physics of ENSO involving ocean dynamics in form of Sverdrup transport and Rossby waves. The corresponding principal component time series are displayed in panels (c) and (d) as the solid black lines. The blue lines in panel (c) and (d) display the shallow water control simulation first and second EOF principal component time series, respectively. The red lines in both of these panels display the time series of the ERA-40 first and second PCs of wind stress, respectively.

an expression of ocean dynamics (namely, Sverdrup transport) that eventually leads to the termination of El Niño events, as described in the ENSO recharge paradigm.

However, our analysis demonstrated that this mode is also directly forced by the second EOF of wind stress (red line in graph d), in contrast to existing ENSO theories. The corresponding wind-stress pattern is related to the southward shift of ENSO-induced wind stress anomalies towards the end of boreal winter. The results clearly indicate that the dynamics of the thermocline-discharging mode (figure b) is also wind-forced (blue line in graph d) and not related to ocean dynamics. These results challenge our current understanding of ENSO and the notion that ENSO's predictability is due to the dynamical memory of the ocean. In fact, the results indicate that a large fraction of ENSO's seasonal predictability is related to the annual cycle.

Development of an Extended and Long-range Precipitation Prediction System over the Pacific Islands

P.I.: Hariharasubramanian Annamalai

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: Jin Huang, Annamarita Mariiotti

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The project's goal is to develop and transition a dynamical precipitation prediction system for all U.S. Affiliated Pacific Islands (USAPI) based on the Climate Forecast System (CFS). For the target regions over the USAPI, the current operational seasonal precipitation prediction system is based on empirical methods such as Canonical Correlation Analysis (CCA). When using CCA as a prediction tool, sea surface temperature (SST) provides the most reliable predictive information and higher prediction skill for ENSO winters. For non-ENSO years and also for weak to moderate ENSO events, precipitation forecast skill by empirical model is low even though significant seasonal rainfall anomalies are observed over the USAPI. There are many possible reasons for this including: a) nonlinear relationship between ENSO SST and precipitation is not incorporated; b) details in the space-time evolution of SST during different flavors of ENSO are not properly accounted for; and c) SST anomalies other than ENSO may be responsible for rainfall variations. A prediction system based on a fully coupled dynamical model may overcome some of the above limitations.

Progress during FY 2011

Encouraged by the hindcast skills along the equatorial Pacific and over the USAPI, the 15-member ensemble real-time forecasts with the NCEP Climate Forecast System (CFS) for the period 2006-09 were assessed for seasonal prediction skills—both from deterministic (anomaly correlation, ACC) and probabilistic (Heidke Skill Score, HSS, and Rank Probability Skill Score, RPSS) perspectives. The skill measures were computed for all the four seasons and for leads ranging from 0 to 6 months. In addition, diagnostics such as skill of persistence forecast, root-mean-square-error, signal to noise ratio, and composites were analyzed. The real-time forecast skills were compared and contrasted with the hindcast skills over the target regions.

Figure 1 shows real-time prediction of the 3-month average SST anomalies over Niño3.4 (Fig. 1a), Niño4 (Fig. 1b), SWIO (Fig. 1c), and EEIO (Fig. 1d) regions at three leads (0 and 3 months). Over Niño3.4 and Niño4 regions, moderate warm events of 2006 and 2009 are well predicted at lead 0-month, but at other leads, predicted amplitude and phase are off target. For example, the observed peak warm SST anomaly during fall-early winter of 2006, particularly the early withdrawal of El Niño (phase transition), was not correctly predicted at 3-month lead. A similar problem was also noted during the 2007/8 La Niña phase transition. While hindcasts of different flavors of El Niño demonstrated high skill at various lead times (Sooraj et al., 2011), the real-time forecast skill of these events is modest. The skill measures of ACC and S/N (not shown) for Niño3.4 regions suggest a sharp degradation at 3-months lead onwards. An examination of the real-time prediction of SWIO SST anomalies (Fig. 1c) indicates that systematic errors noted in ENSO prediction (Fig. 1a) are also present here. As noted in hindcasts (Sooraj et al., 2011), prediction of the peak phase of IODZM during fall of 2006 is poor (Fig. 1d). The model also incorrectly predicts a very strong IODZM during the summer of 2008.

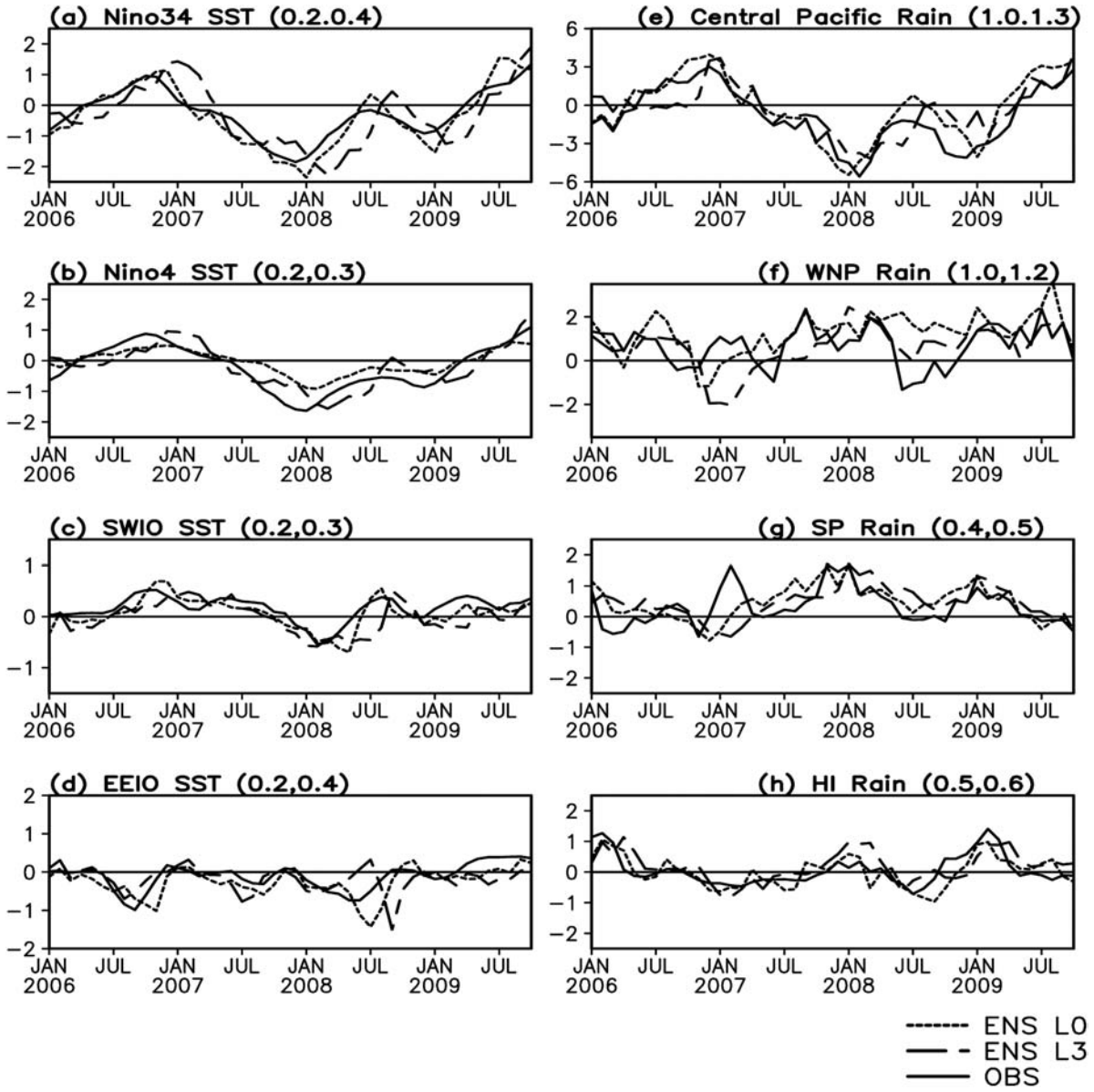


Figure 1. (left) Three-month average CFS ensemble mean real-time prediction of SST (°C) forecast at 0 (dotted), and 3 (dashed) month leads over (a) Nino3.4, (b) Nino4, (c) SWIO, and (d) EEIO regions. The starting period is JFM of 2006, the next period is FMA (Feb through April) of 2006, and so on. (right) The corresponding observed SST is also shown (solid line); same as left panels but for the precipitation (mm/day) over the (e) central Pacific (5°S-5°N, 150°-190°E), (f) west north Pacific, (g) south Pacific, and (h) Hawaii. The standard deviation and spread for the real time prediction system are given in parentheses.

The skill of real-time precipitation forecast over the equatorial central Pacific (Fig. 1e) and over the three regions of the USAPI (Figs. 1f-h), together with the skill measures are examined. As with hindcasts (Sooraj et al., 2011), there is generally a one-to-one correspondence in skill between SST and rainfall over the equatorial Pacific. The model's real-time forecast of precipitation over the Hawaiian Islands is better than the other two regions. While CFS fails to predict negative (positive) rainfall anomalies over the south Pacific region during early months of 2006 (2007), prediction of the anomalous conditions for 2008-2009 is correct. However, the prediction of rainfall variations over the tropical west Pacific (Fig. 1f) is not encouraging compared to the high skill of the hindcasts noted earlier (Sooraj et al., 2011).

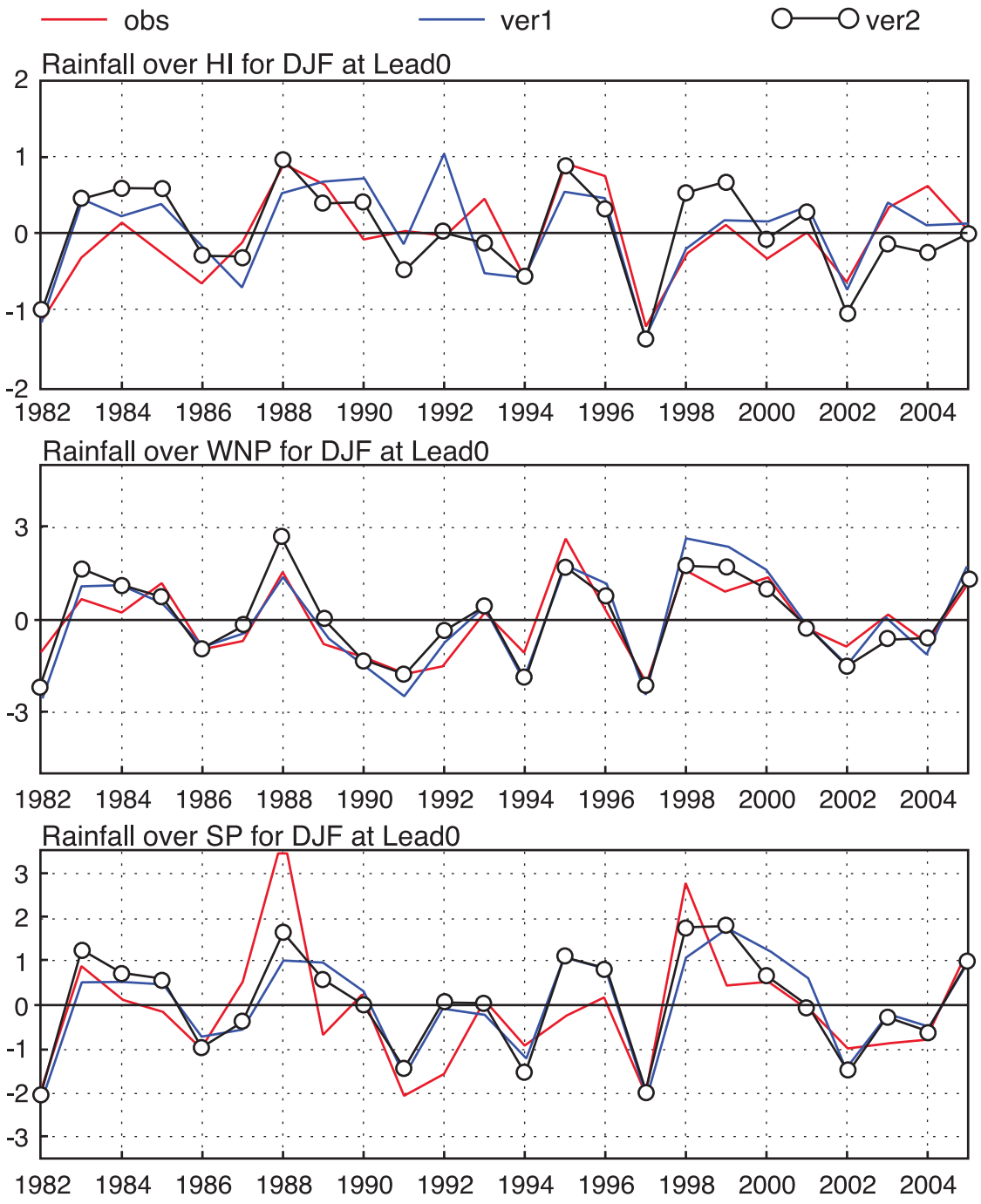


Figure 2. Boreal winter (December through February) seasonal rainfall anomalies (mm/day) forecast at 0-month lead-time over Hawaii (top panel), tropical west north Pacific (middle panel) and South Pacific (bottom panel) for the period 1981-2005. Observations (red), ensemble-mean from CFS_v1 (blue) and CFS_v2 (black) are shown.

Compared to the high skill noted in the hindcasts (Sooraj et al., 2011), the modest skill in real-time forecasts needs attention. As a quantitative measure we provide each of the SST and rainfall indices in Fig. 1 with their respective standard deviation and ensemble spread. Keeping in mind the short verification period, the ensemble spread is comparable to the standard deviation for all the indices. In other words, the variance explained over the target regions is not strong enough. These results, together with the hindcast skills, are incorporated in the revised version of the manuscript (Sooraj et al., 2011).

• *Experimental forecast update and development of a webpage.* As part of the project goals, and encouraged by the overall skill of CFS, the regional precipitation forecast for the USAPI was updated every month and a website was developed to disseminate the results to a wider community. Every month, the real-time forecasts for precipitation (both ensemble mean and all the 15 ensemble members) are transferred from CPC to the IPRC. For all leads (0-6 months) the seasonal as well as three-month running average precipitation prediction are prepared and displayed. These products are available online at http://apdrc.soest.hawaii.edu/projects/seasonal_prediction/.
• *Skill assessment with CFS_v2.* Beginning in January 2011, the project examined the hindcast skill using the CFS_V2 (new operational version). In order to be consistent with an earlier study, researchers examined all the skill scores over all the target regions; the initial results for boreal winter rainfall anomalies at 0-month lead are summarized in Fig. 2. NCEP decided that CFS_V1 will keep running operationally in parallel with the CFS_V2, which will allow the project to keep the real-time experimental forecasts page based on the CFS_V1. More detailed diagnostics will be carried out this year.
• *Role of ENSO in USAPI precipitation skills.* To underscore the dominant role of ENSO-related SST and precipitation anomalies in prediction skills over the USAPI, researchers are now examining a 500-year control run (ENSO included) and a 500-year perturbation run (ENSO suppressed). Initial results are encouraging and more detailed diagnostics will be performed this year.

Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center

P.I.: Kevin Hamilton

NOAA Office (of the primary technical contact): National Environmental Satellite, Data, and Information Service/National Climate Data Center

NOAA Sponsor: Howard Diamond

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond
- To serve society's needs for weather and water information

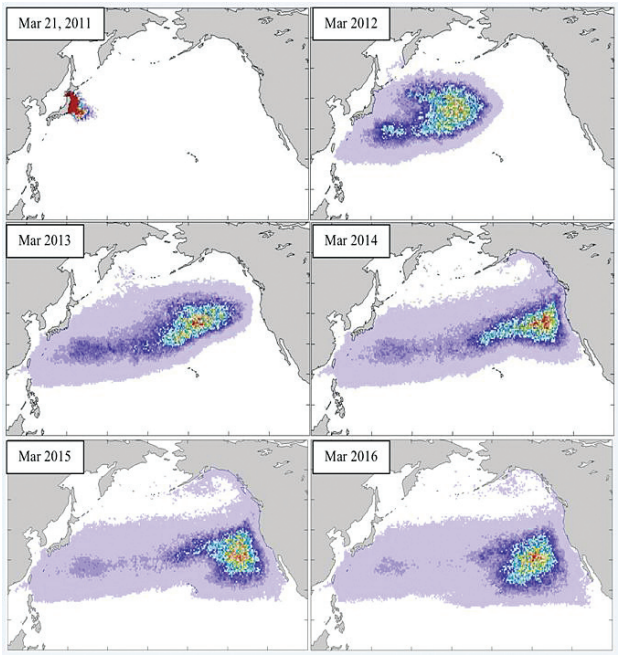
Purpose of the Project

The Asia-Pacific Data Research Center (APDRC) provides the necessary data and data services for researchers at the IPRC (and elsewhere) to conduct research. In addition to maintaining data servers and approximately 80TB of on-line data, the APDRC supports research that leads to data products. One example is the regular production of gridded temperature and salinity fields based on Argo profiles. The vision of the APDRC is to link data management and preparation activities to research activities within a single center, and provide one-stop shopping for climate data and products to local researchers and collaborators, the national climate research community, and the public. The APDRC is organized around three main goals: providing integrated data server and management systems for climate data and products; developing and serving new climate-related products for research and applications users; and conducting climate research in support of the IPRC and NOAA research goals. The data center can be accessed online at http://apdrc.soest.hawaii.edu.

Progress during FY 2011

All APDRC related tasks proceeded on schedule in FY 2011. Highlights include the purchase and configuration of a new server exclusively for high-resolution model output from the JAMSTEC Earth Simulator Group. The Ocean Model For the Earth Simulator (OFES) is an extremely popular data set, and the APDRC now has the complete hindcast run at full resolution (approximately 40TB). This output, along with other OFES runs, is now stored on a dedicated machine with all the APDRC services. Other APDRC data sets were updated as appropriate during the year. An additional hire (M. Mehari) was made to help support data activities and to replace staff that left during the year. Products developed during the period include the Argo products described above, regional ocean and atmospheric forecasts, a new data set of high wind speed occurrence, and a precipitation prediction system over the Pacific Islands. All APDRC products can be viewed at http://apdrc.soest.hawaii.edu/projects.

APDRC derived data products have been used in various projects. One example that received widespread attention (including being featured on national television networks) was the application of the surface current



Snapshots from the model projections for the trajectory of the floating debris washed into the ocean off Japan by the March 11, 2011 tsunami. Red indicates highest debris concentration and light purple the least.

model derived from historical drifter data to the projection of the fate of the debris produced by the devastating Tohoku tsunami of March 11, 2011. The results indicate that the plume of floating debris will spread eastward from the coast of Japan in the North Pacific Subtropical Gyre. The Northwestern Hawaiian Islands will see tsunami debris washing up on their shores in a year; the U.S. West Coast in three years and the remaining debris will drift into the North Pacific Garbage Patch. Some of the debris is then predicted to escape the gyre and arrive on Hawai'i's beaches in about five years.

Investigating the Transport and Transformation Mechanisms of Atmospheric Mercury in the Remote Central North Pacific Marine Free Troposphere

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): Earth System Research Laboratory/ Mauna Loa Observatory

NOAA Sponsor: Winston Luke [Darryl T. Kuniyuki]

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

• *Primary task—Collection of atmospheric mercury speciation data*. The project collects and analyzes semi-continuous high altitude (11,400 feet) measurements of Hg^0, RGM, and Hg^P at Mauna Loa Observatory (MLO), Hawai'i. The objectives of this task will be to accumulate a long-term record of ambient Hg^0, RGM, and Hg^P chemistry to (i) support atmospheric mercury chemistry research, (ii) establish a baseline mercury measurement station, and (iii) investigate the long range transport of mercury from South East Asia across the Pacific.

• *Measurement and collection of other data that may affect the transport and transformation mechanisms of atmospheric mercury.* This includes measurements of aerosol particulates, semi-continuous ozone, sulfur dioxide, elemental

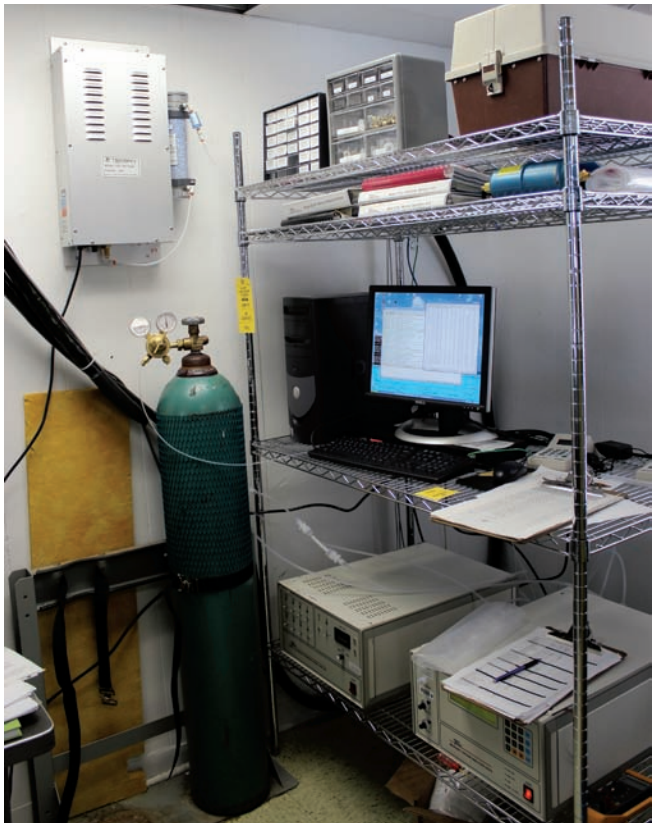


Figure 1. The mercury analyzer inside the observatory.

Figure 2. Poai Suganuma measuring airflow of the mercury system.

carbon, and meteorology measurements. All of the data will be organized and archived in a database. Some data and theories will be placed on the MLO website and other types of media for outreach purposes.

Progress during FY 2011

Semi-continuous measurements of Hg^0, RGM, and Hg^P were conducted at MLO, Hawai'i. The data was archived and added to the long-term record of ambient Hg^0, RGM, and Hg^P. The Hg data is currently being analyzed and compared with the measurements of aerosol particulates, semi-continuous ozone, sulfur dioxide, elemental carbon, and meteorology measurements. A scientific paper, presenting the transport and transformation mechanisms of atmospheric mercury at MLO, is currently being written and scheduled for publication later this year. Funding from EPA ended in 2010 but the project was picked up by Dr. Winston Luke of NOAA's Air Resources Laboratories (ARL).

Multi-Model Ensemble Forecast of MJO

P.I.: Bin Wang

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: Annarita Mariotti

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The purpose of the proposed research is to develop a multi-model ensemble (MME) methodology, based on coupled models, for the operational prediction of the MJO and associated N. American impacts during boreal

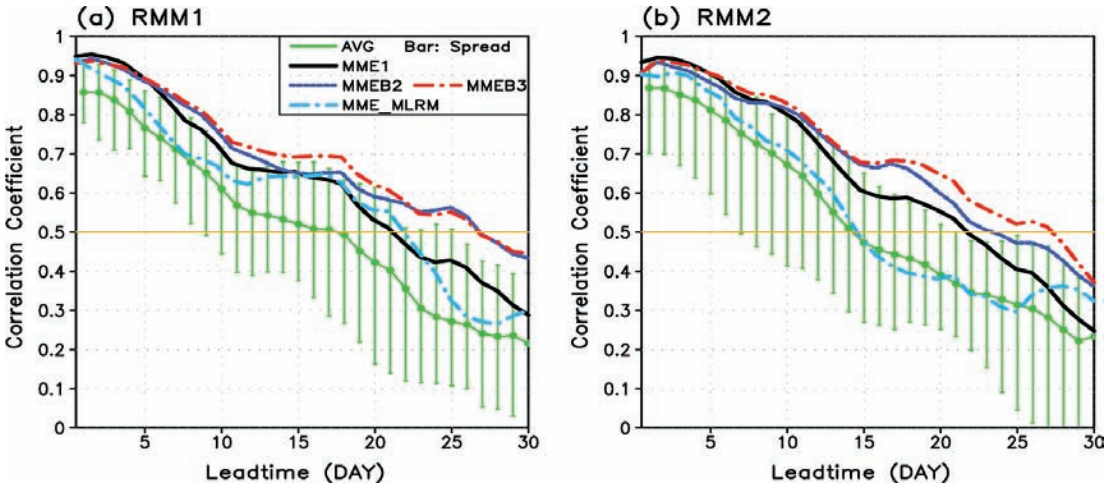


Figure 1. ACC skill for RMM1 and RMM2 as a function of forecast lead time initiated from the first day of each month from October to March for 20 years, 1989-2008. MME1, MMEB2, MMEB3, and MME_MLRM represent MME with simple composite of all models, simple composite of the two best models, simple composite of the three best models, and weight function based on multiple linear regression, respectively. The bar indicates the spread of the individual model's skill and the green line indicates averaged skill of all models.

winter. Our proposed objectives consist of the following: 1) construct a coordinated hindcast experiment using seven coupled global models that can be utilized for MJO forecast assessment (e.g., predictability) and development (e.g., MME); 2) use the hindcast experiment to assess the predictability and prediction skill of the MJO and related N. American impacts during boreal winter; 3) examine the prediction skill sensitivity to aspects of initialization; 4) use the hindcast experiment to develop an MME technique suitable for MJO prediction and assess improvements in MJO prediction skill; 5) combine the MME and the U.S. CLIVAR MJO Working Group multi-model MJO forecast currently available at CPC to deliver an MME forecast methodology suitable for implementation at the National Center for Environmental Prediction (NCEP); and 6) develop composite maps of the N. America weather/climate response to the life-cycle of the MJO using historical data combined with the multi-model hindcast.

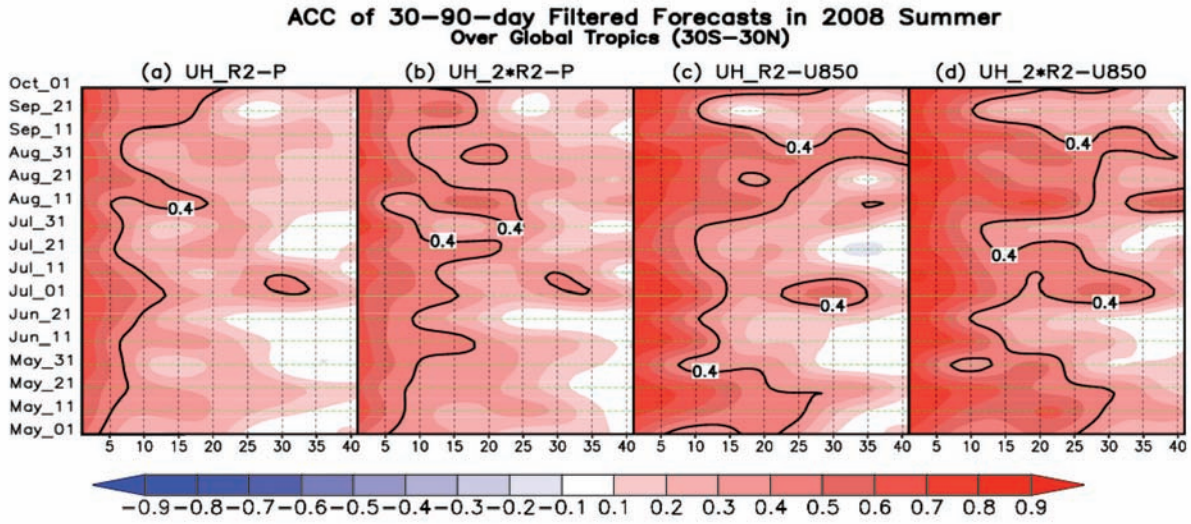


Figure 2. ACC of forecasted ISO against the observations over global tropics in summer 2008 as a function of initial dates: (a) skills of filtered rainfall initialized with the original NCEP_R2; (b) skills of filtered rainfall initialized with doubled ISO signals in the NCEP_R2; (c) skills of filtered U850 initialized with the original NCEP_R2; (d) skills of filtered U850 initialized with doubled ISO signals in the NCEP_R2.

Progress during FY 2011

The first objective has been accomplished and the intraseasonal variability hindcast experiment (ISVHE) has been executed. Ten models' hindcasts have been collected from Europe, United States, Japan, Australia, Korea, and Canada. Objective 2 has been partially conducted and the prediction skills of the models have been analyzed. In addition, research work on objective 3, examine the prediction skill sensitivity to aspects of initialization, has obtained preliminary results.

Pacific ENSO Applications Center

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Weather Service/Pacific Region Office

NOAA Sponsor: Jeffrey LaDouce

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
- To understand climate variability and change to enhance society's ability to plan and respond
- To serve society's needs for weather and water information

Purpose of the Project

The purpose of the project is to conduct research and develop information products specific to the U.S. Affiliated Pacific Islands (USAPI) on the El Niño-Southern Oscillation (ENSO) climate cycle, the latest long-term forecasts of ENSO conditions, and its historical impacts on rainfall, sea level variability and change, and tropical cyclone in support of planning and management activities in such climate-sensitive sectors as water resource management, fisheries, agriculture, civil defense, public utilities, coastal zone management, and other important economic and environmental sectors of the USAPI.

Progress during FY 2011

Over the last 20 years, most of the USAPI recorded sea levels rising faster than projected by the Intergovernmental Panel on Climate Change (IPCC). The rise raised varying degrees of concern, with some of them quite serious and immediate. The project's goal was to examine this broad issue by using global climate models. For this purpose, the objective was to statistically downscale the results of the IPCC model output for the USAPI region. The downscaled result is intended to indicate features of sea surface temperatures (SSTs) as projected by the IPCC runs, and the SSTs in turn provide implication for sea level change.

Downscaled results have shown that with the changing climate, the IPCC projections of sea level rise (excluding rapid ice flow dynamics) are in line with the sea level projections for the USAPI region. In most locations, the projected sea level displays a rising trend (300-400 mm by 2099) that is slightly higher than the IPCC projection. Only Palau and Yap, located in a different regime of the dynamic sea level, responds differently: Palau with a fall and Yap remaining unchanged. From a policy standpoint, the projected rise is a matter of serious concern for some of these islands and the future impact will be devastating if ice continues to melt at the rate recently observed.

Pacific RISA Integrated Climate Program Support

P.I.: Cheryl L. Anderson

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: Caitlin Simpson

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The overall focus of this project is to provide ongoing support and collaboration for a Pacific Regional Integrated Climate and Assessment (RISA) climate program that responds to regional stakeholder climate needs, specifically

related to issues in coping with drought and extreme climate impacts. This scope of work involves three sets of activities, two of which require collaboration with other regional integrated science and assessment programs. The intent of the activities in this project is to engage with stakeholders directly to meet their needs in better accessing and understanding information related to climate, hazards, and drought.

Progress during FY 2011

There were three activities covered in this project. The first activity was to build capacity in the development, analysis, and delivery of climate information tailored to the needs of disaster management communities. The project will use the Climate Information Delivery and Decision Support System (CLIDDSS) as the technical platform for data portfolio management to support the distribution of information through newsletter formats to multi-sector disaster managers about their climate-related risks. The focus for the first year was to lay groundwork by identifying key data sets and by working with the hazards community to better understand the use of climate information. Work with the hazards community has been stalled because of the hazard mitigation planning process that requires all of the counties and the state to meet specific planning deadlines this year. Additional delays came from the collaborating team, because they have been involved extensively in the National Climate Assessment process, which has diverted resources and key personnel to pressing national issues.

The second activity examined user needs for drought decision-making and the potential of climate and drought information. Dr. Finucane, at the East-West Center, helped in the design of a survey instrument used by colleagues in another RISA program in Washington to understand their stakeholder needs related to drought.

The third activity was to continue building stakeholder involvement in the Pacific region, especially through maintenance and postings on the Pacific RISA website. This is an ongoing activity that was maintained during the past year, http://www.pacificrisa.org. Sustained stakeholder outreach included individual and group dialogs in Hawai'i, American Samoa, and Guam with government and non-government representatives from diverse sectors, updating and maintenance of the Pacific RISA website, presentation of a poster about the goals and upcoming activities of the Pacific RISA team at two conferences, and distribution of the Pacific RISA informational flyer at multiple events. Coping with drought project activities included reviewing and revising the interview protocol designed to explore the use and value of drought information, indicators, triggers, responses, and strategic planning. The project also facilitated identification of and access to potential interviewees in Hawai'i. Data collection and report writing are ongoing.

Profiling CTD Float Array Implementation and Ocean Climate Research

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): Pacific Marine Environmental Laboratory

NOAA Sponsor: Gregory C. Johnson

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

JIMAR works with U.S. and International Argo Project partners, especially NOAA/PMEL, on two aspects of the Argo Program. The first component involves float testing, deployment, and data/engineering evaluation. The second component involves climate research using data from Argo floats and other sources.

Progress during FY 2011

E. Steffen and the PMEL float lab took delivery of 56 Argo floats this year. She tested and installed lithium batteries in all the floats. She diagnosed and coordinated solutions to many problems, including identifying a previously undiagnosed and widespread flaw in the floats' pneumatic system and a manufacturing flaw associated with a change in antenna design. She also arranged for float deployments and notified the national and international databases. She traveled to load floats on various ships and train deployers, and participated in the annual U.S. Argo Panel meeting. She worked with others in the lab to continue to implement the system changes necessary to accommodate Iridium telemetry floats now used by PMEL in equatorial regions. Stated goals were met.

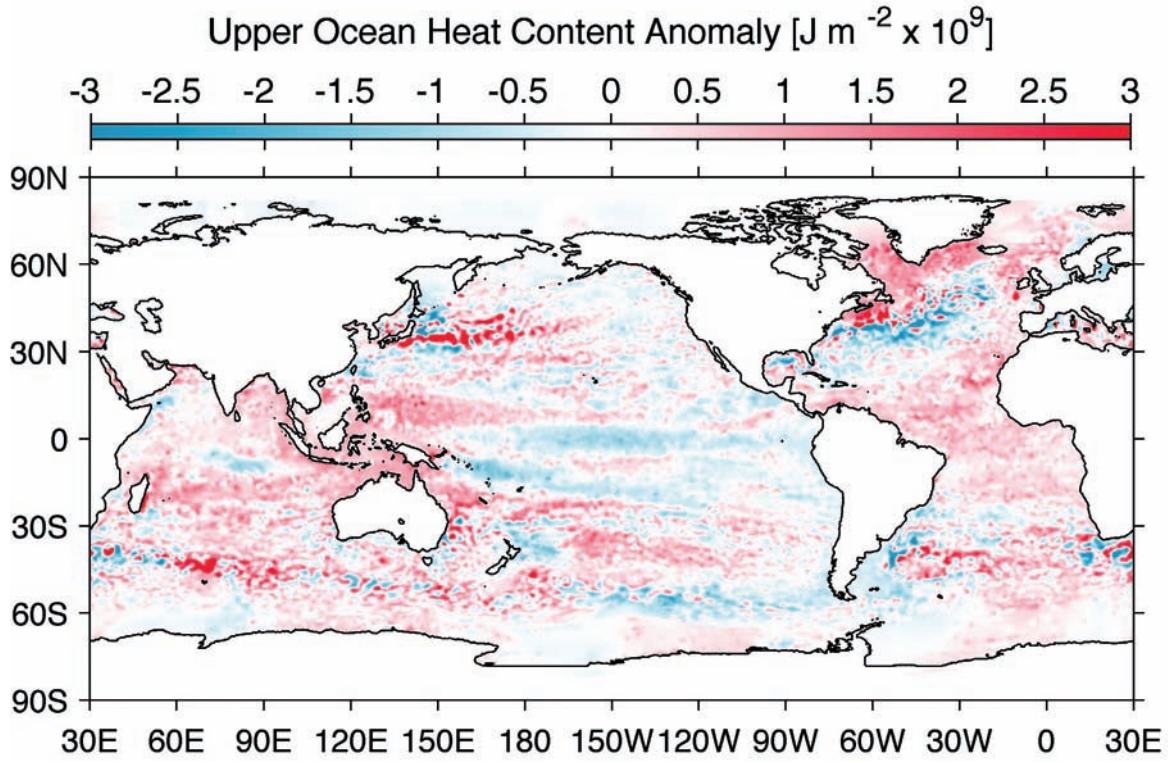


Figure 1. Upper ocean (0–750 dbar) ocean heat content anomaly [10^9 J m^{-2}] for 2010 relative to 1993-2010 estimated using in situ (mostly from Argo in recent years) temperature data and satellite altimeter sea surface height data (in colors, with red being warm and blue cold).

J. Lyman produced and analyzed (with JIMAR Senior Fellow Dr. Gregory Johnson) yearly maps of global upper ocean heat content from 1993 through 2010 (Fig. 1) combining in situ thermal data and satellite altimetry data, as well as yearly maps of sea surface salinity from 2005 through 2010. They continued working on estimating uncertainties in and improving estimates of global ocean heat content anomalies and their trends. This year Lyman was co-author of six published reports. Stated goals were met.

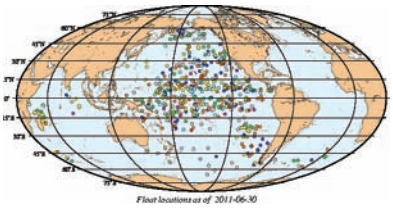


Figure 2. Locations (filled circles) of Argo floats prepared by JIMAR float research analyst E. Steffen as of 30 June 2011. Grey circles indicate floats that have not reported for the last 20 days or more, and colored circles represent more recently reporting floats.

Remote Versus Local Forcing of Intraseasonal Variability in the IAS Region: Consequences for Prediction

P.I.: Shang-Ping Xie

NOAA Office (of the primary technical contact): Climate Program Office

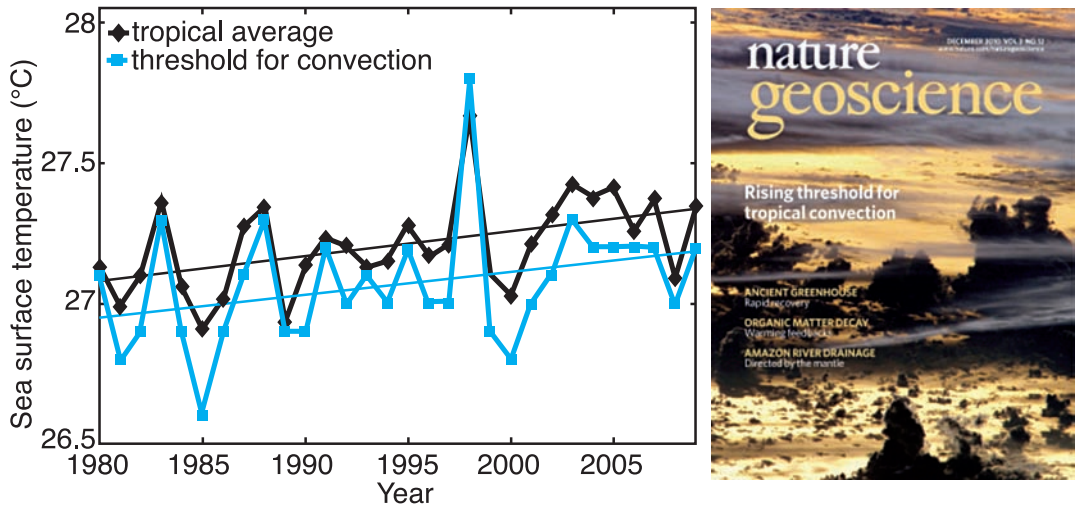
NOAA Sponsor: Annarita Mariotti

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The project investigates the dynamics of intraseasonal variability in the summer Inter-American Seas (IAS), a warm ocean region including the tropical Northeast Pacific and Northwest Atlantic. The scope of the study



(left) Observed SST threshold for tropical convection along with the tropical mean SST for the past three decades. (right) Cover of the Nature Geoscience *1 December 2010 issue.*

includes the connection with the better-known intraseasonal oscillation in the Indo-western Pacific, local feedback in the IAS, and intraseasonal modulation of tropical cyclones.

Progress during FY 2011

• *SST threshold for tropical convection*. How the Madden-Julian Oscillation (MJO) will change in future climate is an important yet poorly studied question because current climate models generally do not simulate MJO well. The current threshold for tropical convection is around 27°C. As the climate warms, it is important to determine changes in this threshold. If the threshold remains unchanged then convective regions will expand, permitting MJO and tropical cyclones to occur over wider regions. Based on an analysis of satellite observations since 1979, Johnson and Xie (2010) showed that the SST threshold has risen steadily by 0.3°C over the past three decades in tandem with the tropical mean SST. This happens because upper-tropospheric temperature is flattened in the spatial structure in the tropics by fast equatorial waves and its value is set by the tropical mean SST. As a result, atmospheric moist instability is determined by the difference between local and tropical-mean SST. Results from future climate projections by models of the Coupled Model Intercomparison Phase 3 (CMIP3) support the observational diagnosis that the SST threshold varies with the tropical mean SST. Based on this result, we do not expect regions of active MJO convection to increase in global warming but the spatial distribution of MJO activity might vary in response to patterns of SST warming. The Johnson and Xie (2010) paper was featured as the cover article in *Nature Geoscience* and on the homepage of the NOAA Climate Program Office.

• *Regional modeling of MJO*. A 10-year integration with iRAM has been completed over the eastern Pacific domain. Analysis confirmed the model's skill in simulating the spatial structure and phase of the observed MJO, as in Small et al. (2011). A sensitivity run is being performed by filtering out intraseasonal variability on the lateral boundaries. The comparison with the control run will enable us to assess the effect of MJO in the Indo-western Pacific region.

Roles of Ocean-Atmosphere-Land Interaction in Shaping Tropical Atlantic Variability and Toward Reducing Climate Model Biases in the Equatorial Atlantic and Adjacent Continents

P.I.: Shang-Ping Xie

NOAA Office (of the primary technical contact): Climate Program Office

NOAA Sponsor: Jim Todd

NOAA Goal(s)

• To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

This project aims to identify and probe the sources of tropical Atlantic biases in coupled climate general circulation models. Tropical Atlantic variability exerts a crucial influence over the adjacent continents and, to a significant extent, on global climate. The tropical Atlantic annual mean, seasonal cycle, and changes on longer time scales in coupled models typically manifest substantial deviations from observations for reasons that are not yet precisely known. The key goal is to further understanding of atmosphere-ocean-land interaction and reduce errors in simulations of the tropical Atlantic climate.

Progress during FY 2011

• *Climate change over the equatorial Atlantic cold tongue.* The project used a suite of bias-corrected observations, including WASWind, and found that cold-tongue variability has weakened during the past six decades in response to the relaxed trade winds. Sea surface temperature has increased across the basin, with a local enhancement over the eastern equatorial Atlantic. This warming pattern of the sea surface is most pronounced during the boreal summer, reducing the annual cycle through a positive ocean–atmosphere feedback. Specifically, the eastward-intensified warming leads to enhanced atmospheric convection in the equatorial eastern Atlantic region, as well as to less vigorous trade winds. These in turn deepen the thermocline in the east, and reinforce the sea surface-warming pattern. The flattened thermocline and reduced thermocline feedback weaken interannual variability of equatorial sea surface temperatures and Guinea coast precipitation associated with the Atlantic Niño. Project researchers suggest that the observed changes could be associated with cooling by anthropogenic aerosols, an effect that is stronger in the Northern than in the Southern Hemisphere. If the aerosol emissions decrease in the next decades, the tropical Atlantic may experience yet another shift as greenhouse gas forcing increases.

• *Tropical Atlantic biases.* A set of sensitivity experiments with the GFDL CM2.1 coupled climate model has confirmed our hypothesis, which is based on diagnosis of CMIP3 and AMIP experiments, that the severe tropical Atlantic cold tongue warming in JJA largely stems from too weak equatorial easterlies in MAM that are associated with a precipitation deficit over the Amazon and excess over equatorial Africa (Richter et al., 2011). Conducted experiments also show that correcting equatorial surface wind or ameliorating terrestrial precipitation errors does not resolve the full spectrum of biases, e.g., improving surface wind field across the entire tropical Atlantic is crucial for substantial reduction of biases poleward of about 7°N/S. The project also used GFDL CM2.1 seasonal forecast to study the initial value problem and time evolution of tropical Atlantic biases. In the off-equatorial south tropical Atlantic it is possible to distinguish an interior basin domain that undergoes quick saturation of errors in surface winds (basically in first month of forecasts), while upper ocean thermal structure develop biases much slower and exhibit non-monotonic growth with seasonal dependence. In contrast, the south African coastal region has persistent monotonic biases that can be associated with errors in coastal winds or in coastal currents (Angola-Benguela front appears to be too far south). A manuscript examining the time evolution of specific fast and slow (intraseasonal and longer time scales) tropical Atlantic biases in CM2.1 seasonal forecast is in preparation.

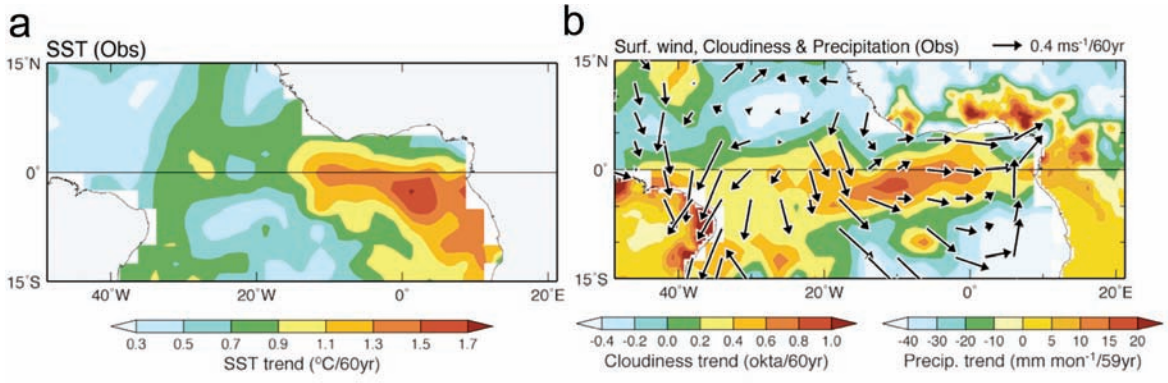


Figure 1. Sixty-year trends for 1950-2009: (a) JJA SST; (b) MJJ surface winds of WASWind (vectors), marine cloudiness, and land rainfall. The equatorial cold tongue has significantly weakened due to a positive ocean-atmosphere feedback, including enhanced atmospheric convections and relaxed trade winds over the eastern tropical Atlantic (Tokinaga and Xie, 2011, Nature Geosci.*).*

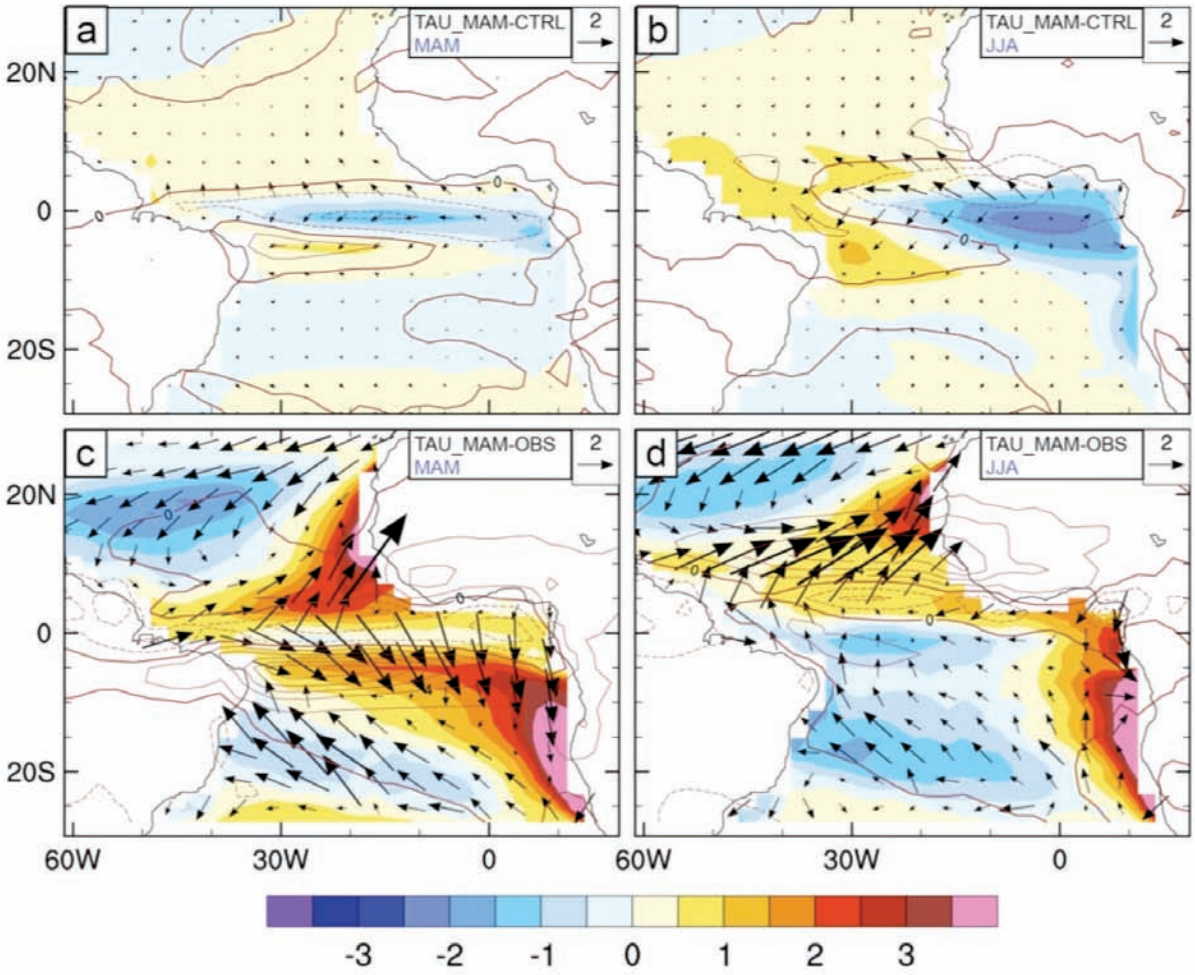


Figure 2. SST (shading C), surface wind (vectors; reference 3m/s), and precipitation (contours; interval 1mm/day) in MAM (left panels) and JJA (right panels) for experiment TAU_MAM, in which equatorial surface wind stress is prescribed from observations during MAM. The top row shows differences relative to the CTRL experiment, while the bottom row shows differences relative to ICOADS and CMAP observations (Richter et al., 2011, Clim. Dyn.*).*

Tropical Meteorology

The JIMAR tropical meteorology theme developed in response to the move of the National Weather Service (NWS) Honolulu Forecast Office to the UH Campus. The move was associated with the modernization of the NWS and motivated in part by the long history of interaction between the Honolulu Forecast Office and the UH Department of Meteorology. Interactions among faculty, students, and NWS staff have been excellent. NWS supports student research through the NWS Education Fund (supported by in-lieu-of-rent monies) and the NWS Pacific Region Fellowship Program. Interactions with the Pacific Region extend to climate service (see ENSO Applications discussion under the climate theme) and establishment of the Pacific Training Desk.

National Weather Service Fellows

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Weather Service/ Pacific Region Office

NOAA Sponsor: Jeffrey Laduce

NOAA Goal(s)

- To serve society's needs for weather and water information.

Purpose of the Project

As part of the memorandum of understanding between the University of Hawai'i and the National Weather Service (NWS), the NWS supports graduate students in SOEST academic units.

Progress during FY 2011

Jessica Garza completed her MS thesis "Climatology and changes of north-east trade winds over the Islands of Hawai'i". A manuscript is in preparation for journal submission. She found a decrease in northeast components and an increase in easterly components of station winds over a 37 year period; trends in strength are less obvious.

National Weather Service International Pacific Training Desk

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Weather Service/ Pacific Region Office

NOAA Sponsor: Jeffrey Laduce

NOAA Goal(s)

- To understand climate variability and change to enhance society's ability to plan and respond
- To serve society's needs for weather and water information

Purpose of the Project

The International Pacific Training Desk provides training in modern operational meteorology to interns selected from the weather services of nations with World Meteorological Organization Regional Association 5. The Honolulu National Weather Service Forecast Office hosts the interns. They attend various functions at the University of Hawai'i Department of Meteorology, and are introduced to climate services provided by the JIMAR Pacific ENSO Applications Center. It is hoped that the training provided at the Pacific Desk will enable the participating countries to begin to issue their own forecast products or upgrade their existing capabilities.

Progress during FY 2011

The Pacific International Training Desk continued to host student trainees through the summer of 2011. However, the operations have now temporarily been halted as the sponsors and clients reassess the structure of the program and plan its future. The meteorologist trainer has completed his employment with JIMAR and has submitted a report documenting all activities and procedures that he developed over the past decade.

Fisheries Oceanography

Fisheries oceanography has become the largest component of JIMAR. The program has three components: collaborative research with the Pacific Islands Fisheries Science Center of the National Marine Fisheries Service (NMFS); collaborative research with the Pacific Environmental Group in Monterey, CA; and the Pelagic Fisheries Research Program (PFRP), managed by JIMAR in cooperation with the NMFS Southwest Fisheries Laboratory, La Jolla, CA and the Western Pacific Regional Fishery Management Council.

Cetacean Oceanography

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Melanie Abecassis]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Jeffrey Polovina

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This JIMAR project works to advance our understanding of the spatial and temporal dynamics of cetaceans and their habitats in the central North Pacific. We work with researchers at the University of Hawai'i to analyze several data sets collected by cetacean ecologists. Specifically, these include data on the movements of cetaceans collected from electronic tags, and physical oceanographic and acoustic data collected from sea gliders.

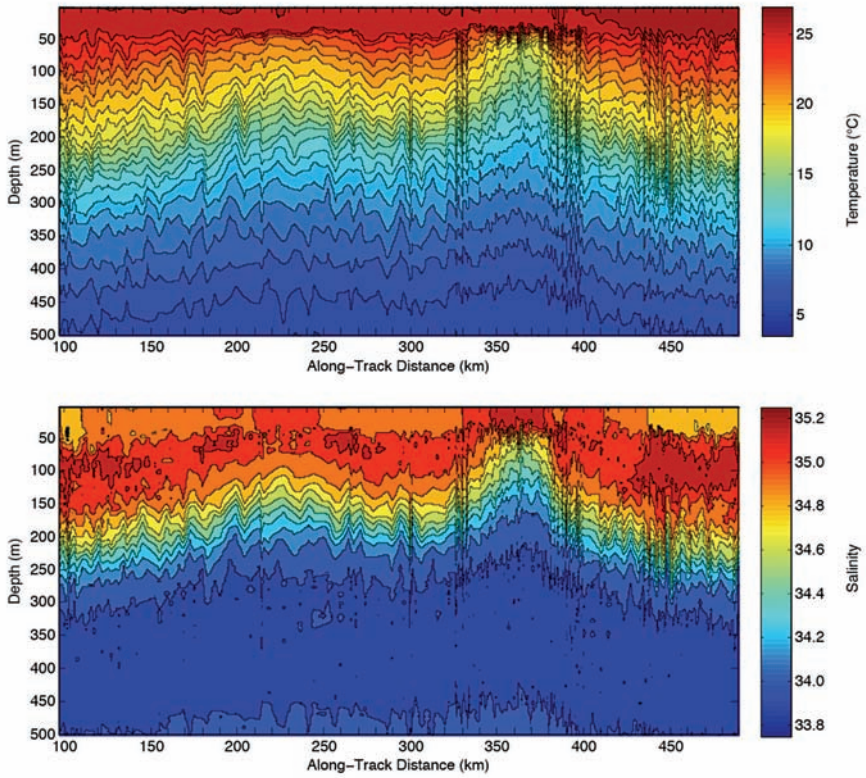


Figure 1. Glider measured temperature (top) and salinity (bottom) verses depth along the glider track measured as distance traveled. The glider crossed the northern side of the cyclonic eddy at 200-250 km into its track then later returned and went through the eddy center at 350-400 km into its track.

Progress during FY 2011

In June 2010, JIMAR worked in collaboration with Dr. Bruce Howe, UH-SOEST, and Dr. Erin Oleson (NOAA/PIFSC) to deploy a seaglider to collect acoustic and oceanographic data at and away from a cyclonic eddy off O'ahu. Unfortunately, the acoustic recorder failed early into the deployment so no appreciable acoustic data was collected, but we did collect temperature and salinity data. These have been analyzed to describe the structure of the cyclonic eddy. In July 2011, we will deploy another glider off Kona, in collaboration with the JIMAR effort in the Kona Integrated Ecosystem Assessment project.

Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Southwest Fisheries Science Center

NOAA Sponsor: Franklin B. Schwing, Steven J. Bograd

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
- To understand climate variability and change to enhance society's ability to plan and respond
- To serve society's needs for weather and water information

Purpose of the Project

The project's purpose is to: 1) describe the characteristic modes of variability in the North Pacific Ocean over interannual to decadal time scales, from analysis of historical data and numerical ocean model output, and conduct research related to the application of *in situ* and satellite remote sensing data products for marine fisheries and other ocean users requirements; and 2) conduct research and provide satellite data in support of the emerging west coast regional associations (RAs) of the Integrated Ocean Observing System (IOOS). These research efforts are being undertaken to: a) improve understanding of marine environmental variability and its impacts on living marine resources; b) develop improved living marine resource assessment models; and c) apply satellite remote sensing technology to improve the management of economically and ecologically important marine resources.

Progress during FY 2011

In addition to maintaining the existing data services, the project made progress in several areas in FY 2011.

- *West Coast Regional Node CoastWatch Program*. During FY 2011, the West Coast Regional Node (WCRN) of the NOAA CoastWatch program expanded its product suite to include useful parameters such as sea surface temperature fronts and eddy kinetic energy. Significant outreach events included four satellite application training workshops and participation in the Science and Math Investigative Learning Experience at Oregon State University.

The satellite application training courses were provided at a number of levels:

- Training for Community College Instructors, at Monterey Peninsula College
- Training for NOAA Scientists, at Monterey Peninsula College
- Training for Climate Investigations, Jakarta, Indonesia
- Training for Applications to Living Marine Resources, Oregon State University

- *Blue whale movements and behavior in the eastern North Pacific.* The project continued to build habitat models for predicting movement behavior for satellite-tracked blue whales in the Northeast Pacific. Because they depend exclusively on dense krill aggregations for food and appear to forage year-round, the predictive models being developed are based on environmental variables that are proxies for krill aggregation through a simple 'upwelling-diatoms-krill' food chain, a pathway with predictable forcing mechanisms throughout the range. Our preliminary results indicate that blue whales increase their 'area restricted search' behavior (an indicator of foraging) in the California Current in Summer-Autumn while it is lowest and to the Baja California coast in Winter-Spring. At this time the behavior is highest in the eastern tropical Pacific in an area just west of the Costa Rica Dome. The environmental predictability of this offshore area as potentially important for foraging during the low-latitude phase of their migration has conservation implications for blue whales in the high seas.

• *Climate change and top predator habitat in the Pacific.* Habitat models for several species of marine top predators were developed based on the tracking data set from the Tagging of Pacific Predators (TOPP) project, combined with a suite of remote-sensed environmental data. These analyses contributed to a synthesis of the TOPP program, and identified a number of biodiversity hot spots in the eastern North Pacific. In addition, habitat models have been run in predictive mode using output from climate models. These analyses provided predictions of large-scale habitat changes over the next century for cetacean, pinniped, shark, tuna, sea turtle, and seabird guilds.
• *Applications of hierarchical Bayesian methods in marine sciences.* Hierarchical Bayesian methods were applied to a number of projects examining environmental and ecosystem variability, including: (a) an analysis of environmental forcing of bluefin tuna abundance in the northeast Atlantic; (b) an analysis of albatross distribution in relation to competition, fisheries activity, and interannual environmental variability; and (c) development of a method to examine depth and temperature records from Humboldt squids tagged in the California Current. In addition

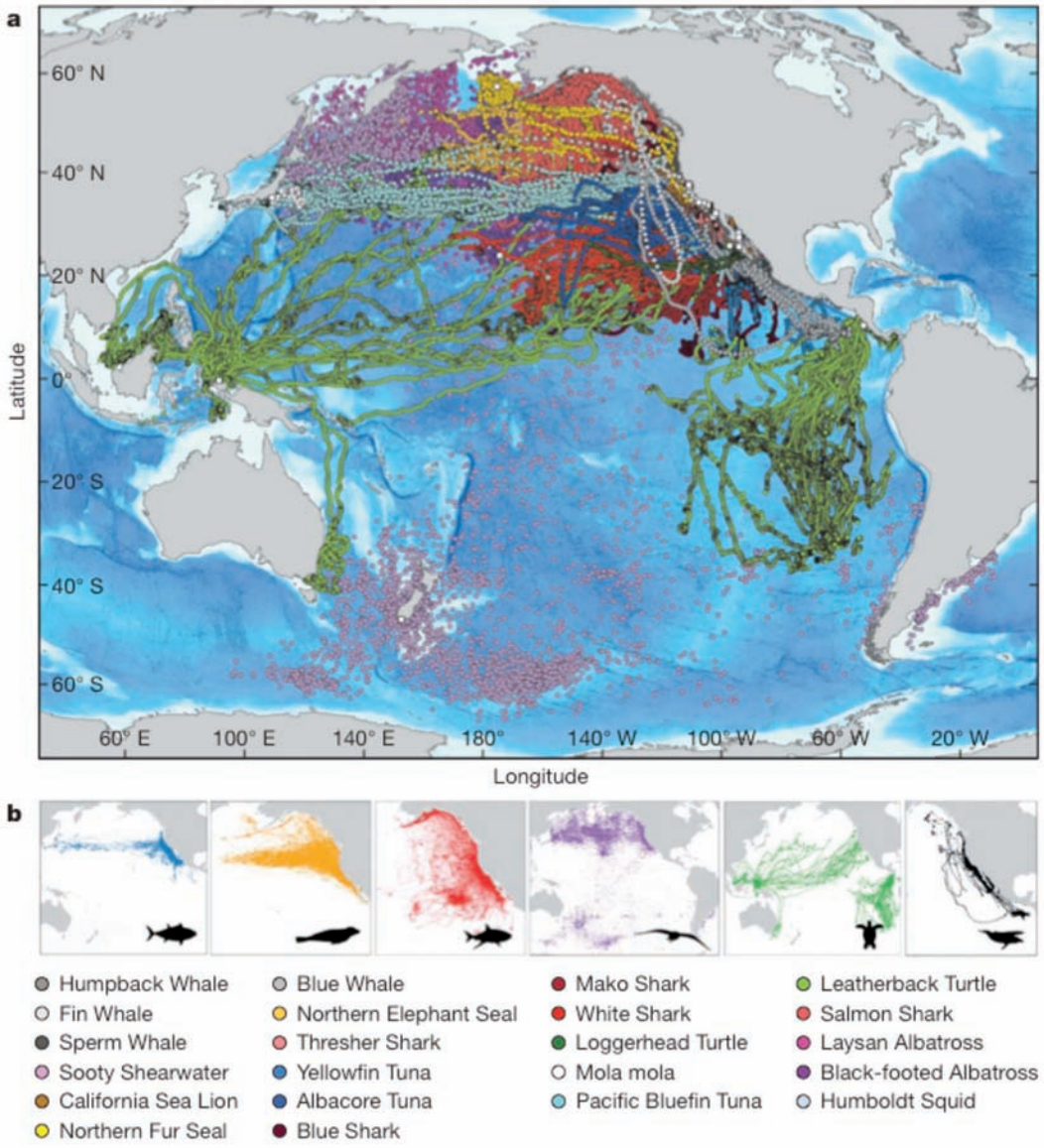


Figure 1. All TOPP species state-space position estimates and distribution from electronic tagging. (a) Daily mean position estimates (circles) and annual median deployment locations (white squares) of all tagged species. (b) Daily mean position estimates of the major TOPP guilds (from left): tunas (yellowfin, bluefin, and albacore), pinnipeds (northern elephant seals, California sea lions, and northern fur seals), sharks (salmon, white, blue, common thresher, and mako), seabirds (Laysan and black-footed albatrosses and sooty shearwaters), sea turtles (leatherback and loggerhead), and cetaceans (blue, fin, sperm, and humpback whales).

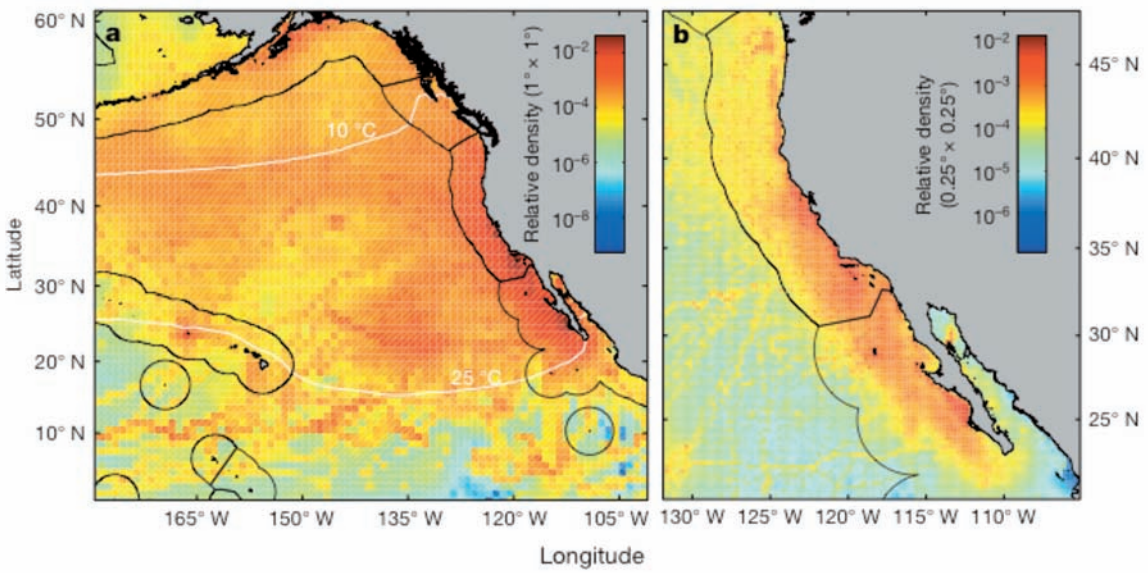


Figure 2. Predator density maps and residency patterns. (a) Density of large marine predators within the eastern North Pacific. Densities of the time-weighted and species-normalized position estimates of all tagged individuals were summed within 1° X 1° grid cells. (b) Density of large marine predators within the CCLME at a 0.25° X 0.25° resolution. SST contours in (a) are denoted by solid white lines. Exclusive economic zones are delineated by solid black lines.

to this core research a hierarchical ocean model for extended reconstructions and software for Bayesian kriging using multiple processors, multiple CPU threads, and/or multiple GPU (graphics processing unit) threads were developed.

• *California Current Integrated Ecosystem Assessment*. Work was applied to the development of the pilot California Current Integrated Ecosystem Assessment (IEA), in collaboration with other scientists at the SWFSC and NWFSC. A California Current ecosystem status report, describing recent physical and biological conditions and trends, was developed as a chapter of the IEA and several leading ecosystem indicators were developed.

Contribution, Linkages, and Impacts of the Fisheries Sector to the Economies of Hawai'i and other U.S. Affiliated Pacific Islands: An Extended Input-Output Analysis

P.I.: PingSun Leung

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Minling Pan

NOAA Goal(s)

• To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The goal of this research program was to quantitatively assess the contribution, linkages and impacts of the fisheries sector to the State of Hawai'i and other U.S. Affiliated Pacific Islands with a Social Accounting Matrix (SAM). Economic impact models on commercial fisheries are typically based on input-output (I-O) tables that focus exclusively on economic linkages among production sectors. However, managers of the fishery have to grapple with not only how much economic activity can be generated but also who are the primary beneficiaries of the fishery. A SAM makes it possible to identify the distributional characteristics of the economic impact from the fishery industry and is a useful tool to engage with fishery policy implications. The Hawai'i SAM Fishery Model was designed to: 1) provide necessary information on the backward and forward linkages of the fishery sectors to the other sectors of the economy and the household sector; and 2) examine the distributional linkages of Hawai'i's production sectors to household income.

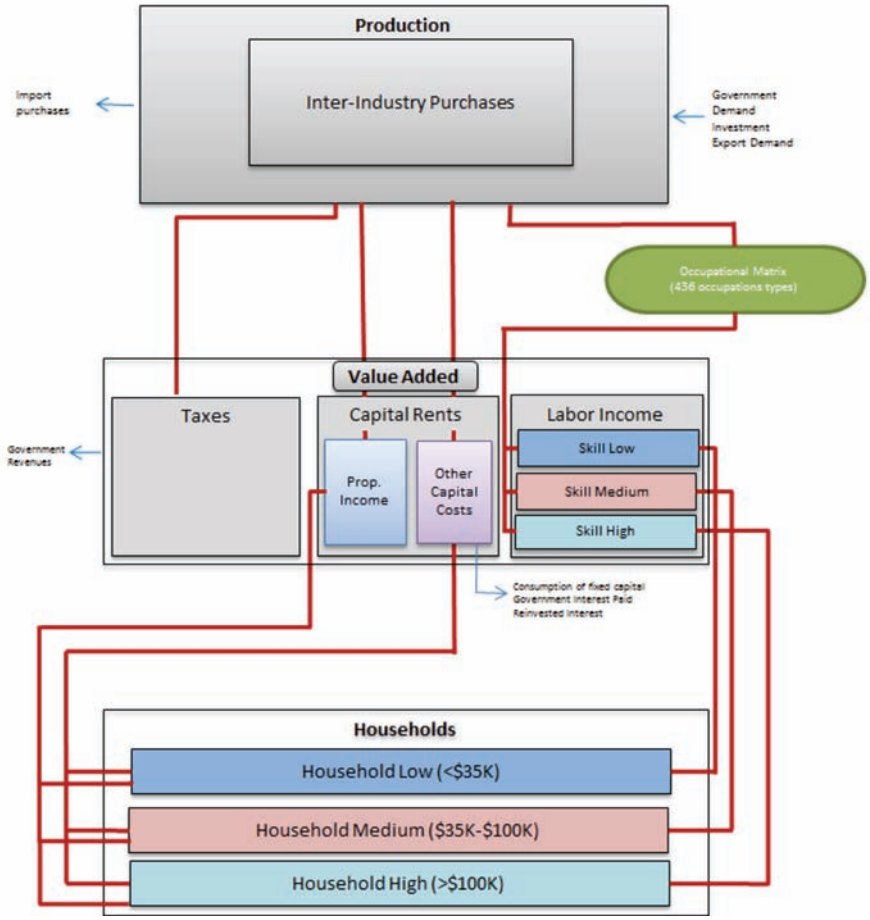


Figure 1. The construction of a SAM depends on the intended purpose of the model. In the assembly of the Hawaii Fishery SAM, special attention was given to decomposing the factor payments so that production activities could be reasonably linked towards households. We used the State's occupational matrix to disaggregate the industry-household linkage according to the composition of skill levels employed by each industry. The mechanism of income flows can be seen more clearly in Fig. 2. Here the production sector's labor payments are identified by individual occupations. With the occupation matrix, the inputs are then mapped into appropriately defined skill levels based on the average salary of the occupation. The labor income is then mapped into the household sector, where the distribution of skill levels is appropriately mapped to follow the distribution of household socioeconomic groups. Total labor compensation is then combined with capital income to give us total household income. Overall this mapping gives us a high level of precision in identifying skill intensive industries versus unskilled intensive industries. Our approach provides explicit linkages between the distributions of income from the production sector to the household.

Progress during FY 2011

In the previous fiscal year the project updated the economic I-O analysis on Hawai'i's fisheries and extended the I-O analysis to a SAM framework. In this fiscal year the primary objectives were to: 1) apply this model using SAM multiplier analysis to examine fisheries' economic contribution, linkages and impacts in Hawai'i; 2) disseminate and share the results of our model with the academic community; and 3) provide policy analysis for fishery management

• *Objective 1 SAM multiplier analysis of Hawai'i's fishery sector*. The project applied the model to measure SAM industry, value-added, and household multipliers for the five fishery sectors and 67 non-fishery sectors. Compared to previous studies on Hawai'i's fishery, the SAM industry multipliers were slightly higher than the traditional I-O multipliers. This was explained by both structural changes in the industry and the greater preciseness of the SAM approach relative to the I-O approach. Using an industry-occupation linked setup, SAM was able to deliver a rich analysis of household income and distributional linkages. Researchers found that the fishery sectors had

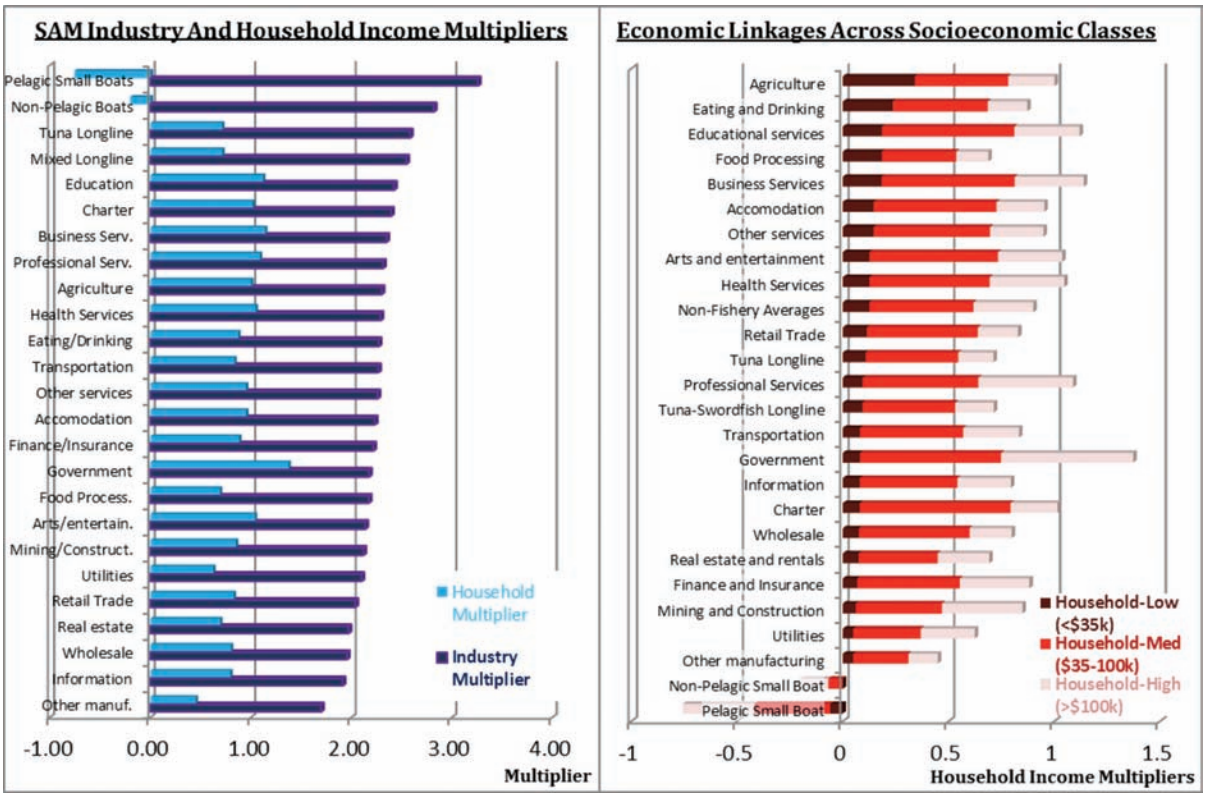


Figure 2. The SAM allows researchers to trace industry impacts (left figure) and also income flows across different socioeconomic groups. The figure on the right presents the distributional impacts on high (above $100,000), medium ($35,000-$100,000), and low (below $35,000) income households. Comparing the linkages across sectors, it is possible to assess which sectors have higher linkages across different socio-economic groups. The multipliers indicate that the professional services and government sectors are linked to the high income groups. This is reflected by the skill intensive nature of these sectors as well as, possibly, their low level of input usage. The data shows that the agriculture and eating and drinking sectors have the strongest linkages to the low-income groups reflecting the relatively low skill nature of the occupations employed by the sectors.

relatively weak income linkages to the households that were primarily concentrated on the lower and middle income groups.

• *Objective 2 Dissemination and sharing of findings.* The project presented its findings at two academic venues for FY 2011. The preliminary findings were first presented at the PFRP PI meeting in Dec. 2010, and updated findings were presented at the NAAFE meeting in May 2011.

• *Objective 3 Provide policy analysis for fishery management.* The project was asked by the Western Pacific Regional Fishery Management Council to estimate the economic and social impacts of the recent bigeye closure that occurred at the end of 2010. Using the SAM model, project researchers ex-post ran some of the direct and indirect impacts of the closure and presented these estimates at the June 2011 SSC meeting.

Data Administration of Pelagic Fisheries Data

P.I.: Thomas A. Schroeder [JIMAR Project Lead: William Walsh]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Karen Sender

NOAA Goal(s)

• To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This JIMAR project provides continued data administration support for PIFSC and PIRO scientists and data managers. The Hawai'i Longline Observer Data System (LODS), is a complete suite of tools designed to collect, process, and manage quality fisheries data and information. Guided by the principles of the NOAA Data Quality Act, LODS is the result of the collaboration and cooperation of scientists, data collectors, and information management experts across the NOAA Fisheries Pacific Islands Region. This project also supports the development of the Hawai'i Longline Logbook Data System (LLDS) leveraging tools and software modules designed and built for the LODS. On-going data administration support of LODS and the development of LLDS ensure efficient response to changing data collection requirements, consistent and documented data processing and data management, and secure and high quality data that is accessible to fisheries scientists and managers.

Progress during FY 2011

The LODS was upgraded successfully in FY 2011 and the project team worked closely with the LODS data manager and steering committee to identify new system requirements. Project team members utilized the NMFS JIRA issues management (trouble ticket) tool to track all system defects and enhancement requests and to ensure rigorous development, testing, and migration to production requirements. Database and application server upgrades and patching were supported to meet NOAA security and maintenance requirements.

In FY 2011, work on LLDS enabled integration of LLDS, LODS, and catch landings data in support of research for catch statistics reporting requirements and catch allocation scenarios. Development of data validation and integration routines greatly improved the timeliness of fisheries statistics and reports, and a major upgrade of the fisheries data access tool, Data Trawler, provided greater ease of use and an improved user experience for accessing data from the PIFSC enterprise database.

DeepWater Horizon Response

P.I.: Thomas A. Schroeder [JIMAR Project Leads: Amy Comer, Marie Ferguson, Donald Hawn, T. Todd Jones, Karen Underkoffler, John Wang]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Michael Seki

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

In a coordinated response to the 2010 Deepwater Horizon incident, NOAA developed an effort to assess the scope and severity of oil impacts on ecosystems of the Gulf of Mexico (GOM). JIMAR research staff with a wide range of critical skills and experience were organized and dispatched to the Gulf to provide key support. Their tasks included observation, monitoring and sampling, recording, and reporting on impacts. These were utilized by NOAA and other agency leadership. JIMAR staff helped with response planning and coordination; surveyed Gulf beaches and coastal waters to recover stranded and injured sea turtles; conducted oceanographic surveys of the water column and sea floor from research vessels; operated small boats involved in ecological assessment work; monitored seafood safety; and more. The JIMAR researchers set aside their normal research activities, and even expanded their workload, to ensure that NOAA's and partners' responses to the oil spill were timely and effective.

Progress during FY 2011

Amy Comer, a JIMAR Research Associate from the PIFSC Ecosystems and Oceanography Division was deployed to Mississippi from mid-August until September 1st. She was deployed to the GOM to assist a team in the Turtle Rescue Program for the state of Mississippi. Her duties consisted of taking phone calls with coordinates as to locations of dead or distressed sea turtles and the subsequent retrieval of the turtles onshore, off shore, or on the barrier islands. If necessary, the team embarked on a recruited vessel of opportunity (VOO) stationed at three ports along the Mississippi coast. If the turtles were on land, they deployed by truck. In addition to locating each

Figure 1. (top right) Dip netting a juvenile green turtle. During the NOAA response to the GOM oil spill, researchers searched convergent zones for juvenile turtles. This required luck, really good eyes, and a captain with incredible boating skills.

Figure 2. (bottom right) Green turtle recovered from gulf—A juvenile green turtle recovered from the Gulf of Mexico oil spill. Once aboard, oil samples from the carapace and skin where carefully collected. The turtle was heavily fouled and showed signs of oil ingestion, it was brought back to shore for further rehabilitation.

turtle, they identified the species, swabbed for oil, took down detailed notes of the area, noted the exact GPS coordinates, and took pictures of the turtle. If the turtle was dead, they bagged it and took it back to the lab for further analysis.

Marie Ferguson, who is a Marine Ecology Specialist with the PIFSC Coral Reef Ecosystem Division, reported to the Gulf in July to assist the NOAA/NMFS Mississippi Laboratory in Pascagoula with the sea turtle stranding response program. Response activities included answering the Mississippi sea turtle hotline, responding to calls on dead/injured sea turtles in nearshore regions and retrieving, transporting, and processing dead sea turtles. Collaboration with several institutions and the local community, and utilization of VOOs were essential for successful response efforts. Upon completion of response activities subsequent to the Deepwater Horizon incident, Marie assisted with presentations on Gulf experiences by Shawn Murakawa and T. Todd Jones at PIFSC.

Fish Biologist Donald Hawn of the PIFSC Fish Research and Monitoring Division (FRMD) was deployed to the Mississippi Gulf area as a member of the NOAA Fisheries Service team from late-July 29 to mid-August. His primary duties were to respond to sea turtle sightings and recoveries, and process seafood samples from various commercial fisheries and, in some cases from local concerned individuals. The processing of seafood samples were conducted at the National Seafood Inspection Laboratory in Pascagoula, MS. This work included the processing and analysis of fish and shellfish freshly harvested throughout the affected Gulf region.

Karen Underkoffler, a JIMAR Fisheries Technician with the PIFSC FRMD, performed sea turtle recovery service during her three week deployment. This included collecting and documenting dead or distressed sea turtles found and reported along the Mississippi Gulf coast or afloat in coastal waters. She worked alone on the coastline or with contracted VOOs to accomplish the near shore recoveries. Skin tissue swabs were taken from the turtles to confirm the presence of oil, or lack thereof. Photographs and carapace measurements were taken,

GIS Coordinates were documented, and species and sex were determined on-site before collecting the turtles and delivering them to the Institute for Marine Mammal Studies (IMMS). The data collected, tissue samples, and turtles were then transferred to IMMS through a chain of custody procedure. Carcasses and tissue samples were kept frozen for further evaluation. Live turtles were examined by IMMS staff and rehabilitated at the center. Daily reports were called into the field operations office.

During the Deepwater Horizon response, Dr. T. Todd Jones, a JIMAR Assistant Fisheries Researcher in FRMD, and Dr. John Wang, a JIMAR Fisheries Researcher, were deployed to the GOM region from May through June. Working with NOAA scientists and other researchers they helped operate a sea turtle stranding network that covered the Mississippi coastline stretching from Alabama and Louisiana. This network initially responded to 20-30 sea turtles stranding events each day. The network also initiated an in-water stranding project using the VOOs to locate and collect stranded sea turtles in offshore coastal waters. As stranding events in Mississippi stabilized, both Todd and John were moved out of Mississippi to work with the In-Water Sea Turtle Survey Team (IWSTST) in collecting juvenile animals affected by the oil spill. Operating from Venice, LA, the IWSTST sailed daily down the Mississippi into the GOM where they located convergent lines of oil, Sargasso weed, and other debris. Following these lines, they set transects and captured juvenile sea turtles. This work was conducted in coordination with personnel from the Southwest Fisheries Science Center, Southeast Fisheries Science Center, and scientists from the Riverhead Foundation for Marine Research. The captured sea turtles were assessed with regard to the amount of oil found on the animals. Heavily fouled turtles were cleaned and transported back to shore where they were taken to rehabilitation facilities. The team helped record, log, and rehabilitate over 200 Kemp's ridley, loggerhead, and green sea turtles. In addition, Todd escorted 11 juvenile Kemp's ridley turtles to Orlando where custody was handed over to Disney Animal Kingdom and Sea World for continued rehabilitation. This event was covered by the Orlando Sentinel and U.S.A. Today as well as other media outlets. Todd later published an account of these activities in the article "Gulf Diaries 2: On the Events, People, and Turtles of the Mississippi Shoreline" (State of the World's Sea Turtles, 6, 20-21, 2011). A PDF of this paper is available online at http://www.seaturtlestatus.org/sites/swot/files/report/033111_SWOT6_p16-21_Disaster Strikes.pdf.

Fisheries Oceanography: Ecosystem Observations & Research Program

P.I.: Thomas A. Schroeder [JIMAR Project Leads: Meagan Sundberg, Karen Underkoffler, Haiying Wang]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Michael P. Seki

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This JIMAR project monitors and conducts research on ecosystems that involve marine species and resources of concern to the Pacific Islands Region. The project activities enable scientists to provide scientific advice to those charged with management of the resources as mandated by legislation (e.g., Reauthorized Magnuson Stevens Act, Marine Mammals Protection Act, Endangered Species Act, etc.). Current specific activities include support for data management of the various ocean observing system inputs, biological and ecological sampling of species for use in studies to advance population assessment efforts, and support for advancing public awareness of marine ecosystems observations

Progress during FY 2011

- *Life history*. This component of the project provides fundamental biological and ecological research on Federally managed species to allow for improved understanding of the mechanisms influencing resource distribution and abundance by conducting field surveys using a variety of sampling gears, performing laboratory studies of biological specimens as well as organizing, analyzing, and managing all collected and archived data in an efficient manner. The project conducts biological studies aimed at improving knowledge of life history parameters (e.g., age and growth, and reproduction) with specific intentions to complement and improve ongoing population assessments of fishery resources. To this end, two fisheries associates are supported to collect life history information of commercially

important bottomfish species and biological samples for age, growth, and reproduction studies. Routine sampling at the United Fishing Agency, a commercial fish auction, has been conducted to support the size- and age-based monitoring of the landed catches; a toughbook computer with bar-code scanning capabilities was implemented to optimize data collection; and small-boat fishing operations were conducted to supplement maturation studies. Life history data is formatted then uploaded into Oracle, and Life History program data sets were inventoried then entered into InPort.

JIMAR associates in the Life History group also studied opah (*Lampris guttatus*) and its cryptic siblings for confirmation of genetic variations—differences in species morphology and distribution patterns. An opah specimen from European waters was designated as a neotype after it was found that no type specimen exists in the archives to substantiate findings. This specimen is being used for a re-description of opah and as a reference for the new species descriptions (see Fig. 2).

Figure 1. Fisheries associate sampling pelagic fish species at the UFA fish auction using the toughbook barcoding system designed specifically for the Life History program.

• *Fisheries Habitat Geospatial Database Management*. This aspect of the project enables or promotes ready access to most data collected or archived by the PIFSC. JIMAR staff collate, manage, and provide access to all types of spatial fishery habitat data through enterprise geodatabase management methods and network-based dynamic data access applications. Activities include the collection of essential fish habitat studies of bottomfish, precious corals, and pelagic fish. This year's efforts include a base map geodatabase creation for management boundaries, bathymetries, physical oceanography layers, and benthic habitat classifications. The Habitat staff built a Hawaiian bottomfish geo-database for spatial resource management and critical habitat assessments. They also developed a customized web-based application using ArcGIS for the display and distribution of the spatial information repository to support project managers and scientists. Finally, JIMAR built a fishery longline logbook geo-database to support fisheries spatial resource assessment and international fishery reporting.

Figure 2. Opah (Lampris guttatus) *neotype specimen studied at the Museum Oceanographic in Monaco, France.*

Fisheries Oceanography: Ecosystem Observations & Research Program: Analyses of Catch Data for Marlins

P.I.: Thomas A. Schroeder [JIMAR Project Lead: William A. Walsh]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Gerard DiNardo

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This project pertains to two large istiophorid billfish species that are relatively common in the catch of the Hawai'i-based pelagic longline fishery—blue marlin (*Makaira nigricans*) and striped marlin (*Kajikia audax*). The intentions are to provide updated, corrected catch histories and indices of relative abundance that correspond to the current management regime of the fishery (i.e., two sectors). Such indices are useful to the Stock Assessment Group at the Pacific Islands Fisheries Science Center.

Progress during FY 2011

Two working papers were completed and presented at a meeting of the Billfish Working Group (BILLWG) of the International Scientific Committee for Tunas and Tuna-like Species in the North Pacific Ocean (ISC), which was held in Honolulu in January 2011. The first paper presented a corrected catch history for striped marlin from 1948–2009; the second described the nominal and standardized catch rate trends in the Hawai'i-based longline fishery from 1995–2009. Both working papers are available on the ISC website.

The 62-year corrected catch history for striped marlin in Hawaiian waters was developed by gathering, cross-checking, and compiling data from numerous sources of varying accuracy. These various data sources were then evaluated using both circumstantial (i.e., implausibly low reported catches) and direct evidence (i.e., misidentifications and other biases that were definitively identified with auction records). The report describes these evaluations and relevant caveats concerning accuracy in detail, so this corrected catch history can be considered "transparent".

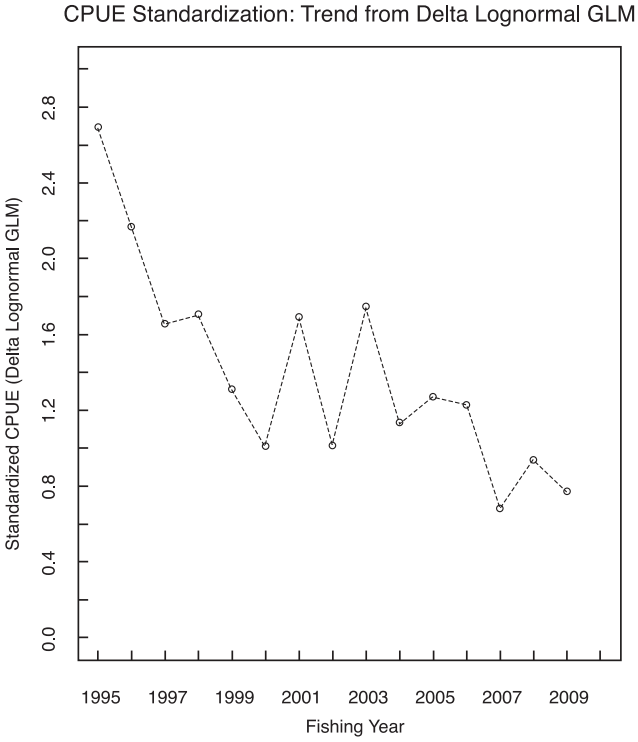


*Figure 1. Annual trend of observed striped marlin (*Kajikia audax*) CPUE as standardized with a delta-lognormal GLM.*

This work is noteworthy for inclusion of an adjustment for discarded striped marlin. Discarding of istiophorid billfishes (i.e., striped marlin, blue marlin, and shortbill spearfish *Tetrapturus angustirostris*) in this fishery generally involves small fish during years with high recruitment, and although the rates are usually low (*ca*. 5–10%), mortality associated with discarding has been documented. The availability of observer data from 1995–2009 permitted calculation of an average discard rate to account for this reporting bias. Application of this correction (+6.2%) to the entire time series was considered appropriate because the apparent motivation for discarding (i.e., an excess of small fish of low economic value) has probably not changed over time. Although use of a constant as a correction is an oversimplification, it was deemed acceptable in order to include this catch component. The majority of discards were dead at release and some post-release mortality can also be expected. Therefore, categorization of discards as dead removals was deemed justifiable.

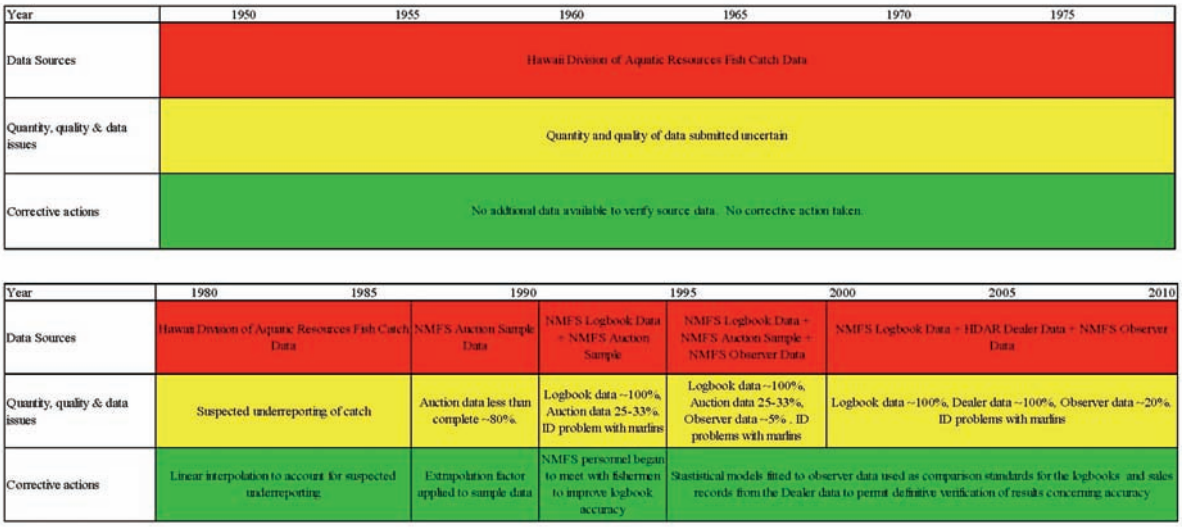


*Figure 2. Timeline presenting the sources of striped marlin (*Kajikia audax*) catch data used to develop a corrected catch history for 1948–2009, with important characteristics of these sources and corrective actions taken with respect to known or suspected problems.*

It was concluded that the corrected 62-year catch history was more accurate than the likely alternative—an uncorrected time series with known and suspected biases that would introduce uncertainty into the stock assessment. Use of this corrected catch history in the stock assessment for striped marlin in Hawaiian waters was recommended, and the recommendation was accepted by the Working Group.

The second working paper presented catch-per-unit-effort standardizations for striped marlin in the Hawai'i-based pelagic longline fishery from 1995–2009. Catch and operational data were gathered by NOAA Fisheries Pacific Islands Regional Observer Program (PIROP) personnel. The standardizations were conducted by fitting generalized linear models (Poisson GLM; delta-lognormal GLM). Explanatory variables used as factors were the fishing year, quarter of the year, and fishing region. Sea surface temperature, hooks per float, and hooks per longline set were used as continuous explanatory variables. Results include descriptive catch statistics, an analysis of deviance for each model with residuals plots and a table summarizing the residuals, and graphical presentations of the nominal and GLM-standardized rates.

The results indicate that striped marlin catch rates decreased significantly from 1995–2009 in the Hawai'i-based pelagic longline fishery. These standardized results were reasonable in relation to the nominal data, in which CPUE decreased by 87.2% and the frequency of sets with positive catches decreased by 61.4%. Because both CPUE and the frequency of catch decreased, it appears likely that these findings reflect changes in relative abundance and not just changes in the fishery.

Fisheries Oceanography: Ecosystem Observations & Research Program: Methods to Reduce Marlin Catch and to Estimate Post-release Mortality

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Michael K. Musyl]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Keith A. Bigelow

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Pop-up satellite archival tags (PSATs) are being used to determine post-release survival and the vertical and horizontal movement patterns in commercially and ecologically important tuna, billfish, and shark species. This

JIMAR research is intended for incorporation into population assessments, addressing fisheries interactions, and improving the overall management and conservation of commercially and recreationally important species. Management strategies for mitigating effects on the bycatch of large-scale commercial fisheries require accurate estimates of post-release survival in captured pelagic species. High mortality from industrial fishing has the potential to reduce parental biomass and ultimately the ability of the stock to rebound. The uncertainty about post-release survival in many pelagic species is challenging for management but this information is absolutely critical to improve stock assessments and to develop conservation measures. For catch-and-release to be a viable management bycatch mitigation strategy there must be a high likelihood of post-release survival. Marlin and other pelagic bycatch species are released from fishing gear but it is largely unknown whether animals survive long term and what population-level effects might encompass. Effective strategies to mitigate bycatch also requires knowledge of species-specific horizontal and, more importantly, vertical movement patterns. Knowledge of these vertical movement patterns may allow fishing crews to target the opportunity of mismatch between hook depth and species' vertical distributions and thus possibly minimize bycatch. The project objectives are as follows.

- Determine the post-release survival of large Pacific blue marlin (*Makaira nigricans*) and other istiophorid billfish (striped marlin, *Kajikia audax*; shortbill spearfish, *Tetrapturus angustirostris)* released from pelagic longline gear using PSATs.
- Develop biochemical techniques that are portable and applicable to the rapid analyses of post-release survivorship in many pelagic species. Blood and muscle samples will be collected from marlin and subjected to a comprehensive set of analyses to measure the levels of critical ions, metabolites, and proteins to create a physiological profile for each fish. The long term goals are to identify a model that can predict the likelihood of survival of bycatch and to develop analytical kits that could be distributed in the commercial fishery to allow rapid analysis of fish on site.
- To fill in gaps on migration within Pacific Islands, a pilot study was conducted to determine the vertical and horizontal movement patterns in commercially important wahoo (*Acanthocybium solandri*) around Niue.

Progress during FY 2011

For the analysis of post-release survival, JIMAR project personnel produced a sampling manual to describe the proper acquisition and storage of biochemical samples from the field. Laboratory equipment to collect and store biochemical samples in the field was procured and assembled into field kits. To carry out the bulk of the field sampling on the project, two fisheries observers were trained and equipped to acquire marlin samples from the Hawai'i-based commercial longline fishery. The observers, who started work in October, have already provided samples to the project and deployed PSATs. The project purchased 15 PSATs and PIFSC will provide, in-kind, additional PSATs to supplement the project in FY 2012. To supplement observer sampling and PSAT deployments, a commercial longline vessel was contracted to complete a total of ~75 longline sets. It is expected that sampling and deployment of PSATs on blue marlin will continue in FY 2012. Over the past six months, blood plasma samples has been analyzed for parameters including ions (Na^+, Cl^-, Ca^{2+}, K^+, Mg^{2+}), metabolites (glucose, lactate), enzymes (alkaline phosphatase, alanine transaminase, aspartate aminotransferase, creatine phosphokinase, lactate dehydrogenase) and hormones (cortisol). To date, analyses on 37 billfish, including 22 pacific striped marlin, four pacific blue marlin, and 11 shortbill spearfish have been completed. Overall, ions do not show much variation between individuals of each species, whereas metabolites and proteins can vary up to 1000-fold—mostly due to the condition of the fish during sampling. It is expected that these will be more sensitive indicators of biological stress. Researchers prepared mRNA and cDNA from most of the samples, analyzing for mRNA encoding a stress-sensitive gene product (heat shock protein 70, HSP70) and its constitutively expressed partner (HSC70), as well as a housekeeping gene that serves as an internal control (β-actin). For this marker, analyses on 87 billfish, including 63 pacific striped marlin, four pacific blue marlin, and 20 shortbill spearfish have been completed. Expressing HSP70 over HSC70, shortbill spearfish varied up to 4-fold, pacific striped marlin 2.5-fold, and pacific blue marlin does not show any variation at all so far. Six marlin (four striped, two blue) sampled for tissues have also been tagged with PSATs.

To improve the information on potential fisheries interaction within Pacific Islands, Michael Musyl was requested to instruct members of the Niue Department of Agriculture, Fisheries and Forests (DAFF) in tagging wahoo with PSATs to learn about their horizontal and vertical movement patterns. Musyl briefed the Minister of Fisheries on the goals of the project, was interviewed by the Broadcast Corporation of Niue (BCN) for local television (copies of the interview available upon request), and presented a public seminar given on September 29. Wahoo is a highly

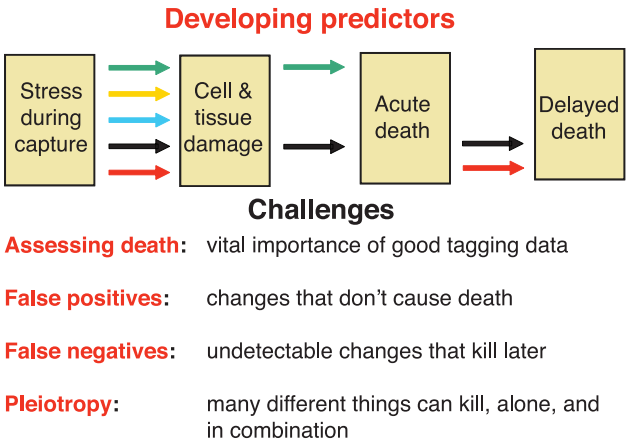


Figure 1. Developing predictors to determine the post-release survival in released fish.

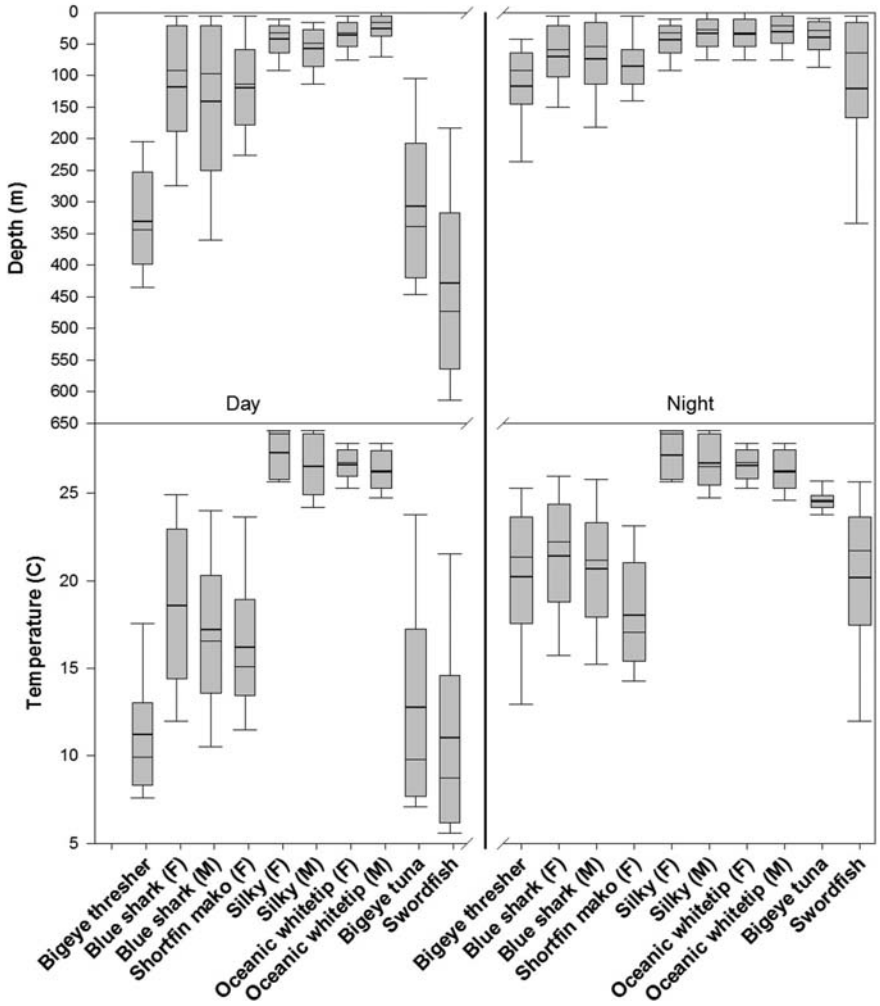


*Figure 2. Daytime and nighttime depth and thermal ranges for pelagic shark species: bigeye thresher (*Alopias superciliosus*); blue shark (*Prionace glauca*); shortfin mako (*Isurus oxyrinchus*); silky shark (*Carcharhinus falciformis*); oceanic whitetip shark (*C. longimanus*); bigeye tuna (*Thunnus obesus*); and swordfish (*Xiphias gladius*). The box represents the interquartile range. The position of the mean (light horizontal line) and median (bold horizontal line) are indicated and the "whiskers" represent the 10–90th deciles. M = male and F = female. From Musyl et al., 2011.*

migratory pelagic scombroid fish distributed worldwide throughout tropical and warm temperate seas. Despite its economic importance to many coastal nations, assessments of wahoo are hampered by a lack of basic life history information. After the onset of the wet season (commencing ~September/October), catch rates of wahoo drop precipitously around Niue. It was not known whether wahoo transited to other locations, altered their vertical dive patterns to track prey or if lower catch rates could be attributable to fisheries interactions. In late September, 2010, seven wahoo (avg. size ~20 kg, range, 17 to 25 kg) were tagged and released (avg. capture-tag-release episode was ~2 to 3 minutes) in Niue. Samples were also double-tagged with conventional plastic tags. Of the 7 PSATs deployed, one appears to be a failure (i.e. the PSAT did not report on its programmed eight month pop-up date after deployment) and researchers are waiting on one tag to report in September 2011. Five tags attached to wahoo reported data and indicated two wahoo made directed movements to the east coast of Australia and averaged about 34 km/day linear speeds en route after 112 and 133 days-at-liberty. For the other three tags that reported data, these fish probably remained around the vicinity of Niue after 59, 77, and 98 days-at-liberty. Lastly, project personnel completed page proofs on two manuscripts relating to PSAT performance and analysis of post-release survival in pelagic sharks.

Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear

P.I.: Thomas A. Schroeder [JIMAR Project Lead: John Wang]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Yonat Swimmer

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This JIMAR project conducts research in the area of sea turtle bycatch reduction through experimental longline, gillnet, and coastal poundnet field trials. Specifically, this work aims to provide the logistical, scientific, and/or the financial support to collaborators to conduct at-sea trials of experimental longline fishing gear to test capture rates of both target (fish) species and incidentally caught bycatch species such as sea turtles. In addition, the work

*Figure 1. ETP green sea turtles (*Chelonia mydas*) captured in Baja California, Mexico, during experiments developing methods to reduce sea turtle interactions with coastal gillnets.*

Figure 2. Loggerhead sea turtle caught in longline fishing gear in Spain.

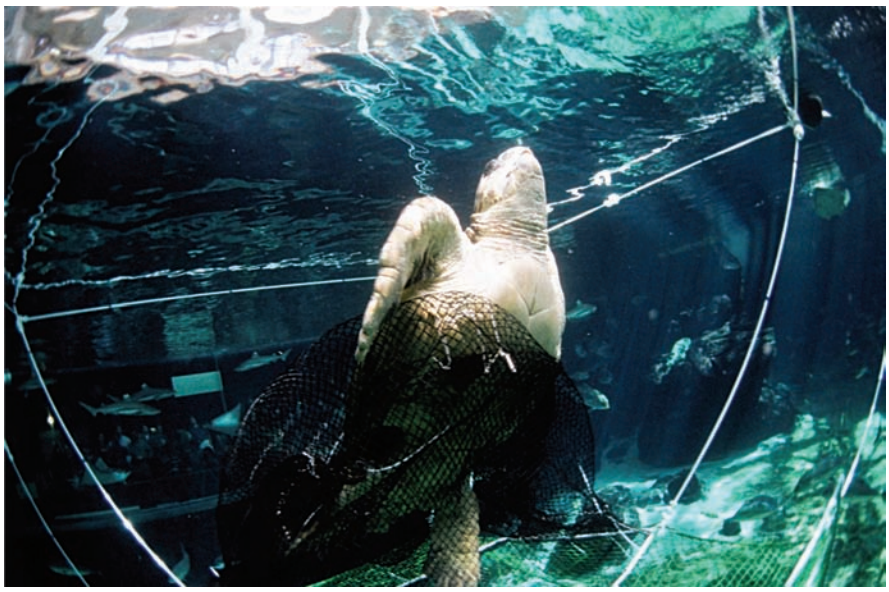


Figure 3. Sea turtle escaping from a pound net escape device (PED) during experiments conducted at the Suma Aquarium in Kobe, Japan.

aims to develop strategies useful in reducing sea turtle interactions with coastal gillnet fisheries as well as coastal poundnet fisheries.

Progress during FY 2011

To date, field trials have compared over 1 million traditional vs. experimental hooks in Italy, Brazil, Uruguay, Costa Rica, Spain, Vietnam, and Indonesia. In each location, the project has shown that use of relatively large circle hooks reduces (by varying degrees) the incidental capture of sea turtles in fisheries. Furthermore, their use has also been shown to significantly increase capture rates of tuna (*Thunnus* spp.). Capture of billfish, primarily swordfish, has been shown to be slightly reduced on circle hooks compared to traditional hooks and this may reduce the

economic viability of this hook in certain fisheries. The data also suggest that the capture of pelagic rays is also greatly diminished by the use of circle hooks in relation to traditional J hooks, which has been instrumental in encouraging local fishers to adopt use of circle hooks in the fisheries. There is some concern, however, that use of circle hooks results in higher capture rate of sharks, and this is a concern that will be addressed in the near future. In the past year, field trials of circle hooks were initiated in Vietnam. Additionally, trials of a "release" hook began in Costa Rica and researchers look forward to evaluating these data in the near future to determine their potential use to promote safe release of turtles in longline gear.

The work has involved contracting a statistician to help with a metadata analysis that will allow for robust sample size enabling the potential to differentiate the relative influences of variables such as hook shape and size on rates of capture of sea turtles, sharks, as well as target species. All of the data has been entered into an Access Database that is publicly available and posted on the NOAA bycatch website.

In addition, field trials in coastal gillnet fisheries have shown that using visual cues such as illuminated nets can reduce sea turtle interactions with gillnets by 40-60%. When tested in a commercial bottom-set gillnet fishery, target catch rates were not affected nor was the overall value of the catch. This suggests that simply illuminating gillnets with LED lightsticks or chemical lightsticks can be one method to reducing sea turtle interaction rates.

The project also initiated collaborations with NOAA-PIRO (Protected Resources Division), the Sea Turtle Association of Japan (STAJ), Tokyo University of Marine Science and Technology, and ProPensinula to identify mitigation measures useful in reducing sea turtle bycatch in mid-water pound net fisheries deployed off the coast of Japan. Recent reports suggest a very high interaction rate between sea turtles and these fisheries and, in particular, high mortalities in mid-water pound nets. To date, 17 designs based on gear observations from pound net and other fisheries were developed. By testing these designs, a protocol to handle turtles and characterize turtle escape behavior was established.

Fisheries Oceanography: Protected Species Investigation: Marine Turtle Research Program

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Tyler Bogardus]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The purpose of this JIMAR project includes eleven discrete elements that consist of: 1) research to reduce or mitigate high-seas and coastal fishery bycatch of sea turtles; 2) research on the general biology, life history, and ecology of sea turtles in coastal marine habitats and on nesting beaches; 3) monitoring of sea turtle population trends for stock assessments; 4) simulation modeling of long term sea turtle datasets to better understand population dynamics; 5) health assessments and disease investigations with focus on sea turtle fibropapilloma tumor disease; 6) administration of a sea turtle stranding and salvage network for research and live turtle rehabilitation; 7) training, capacity building, and sea turtle information exchange with other Pacific islands; 8) educational outreach to the public focused on sea turtle research results; 9) experimentation with remote viewing digital imagery for sea turtle monitoring and research; 10) maintenance of efficient and secure computerized storage, management, and retrieval of sea turtle research data; and 11) administration of observer training in the collection of sea turtle data aboard commercial longline fishing vessels.

Progress during FY 2011

In the FY 2010 annual report, JIMAR's MTRP contribution identified the following goals for FY 2011: 1) continue research of the pelagic ecology and movements of sea turtles to develop management strategies to reduce bycatch; 2) continue captive care and rehabilitation of captive-reared and stranded turtles; 3) conduct necropsies on stranded turtles and collect and manage biological samples; 4) conduct Longline Observer training; 5) participate in field captures of marine turtles in the main Hawaiian Islands, and 6) hire and train JIMAR

MTRP research associate and stranding associate. The project's progress toward these goals is discussed below.

JIMAR Marine Turtle Specialist, Denise Parker, manages a Pacific-wide satellite-tracking database, prepares maps, analyses satellite-tracking data, and provides data for publication in peer-reviewed journals. Data has been managed and maps produced for 67 turtles from eight projects throughout the Pacific during FY 2011.

JIMAR employees Shandell Brunson, Tyler Bogardus, and Wendy Marks, along with NMFS MTRP staff, were responsible for the care and rehabilitation of six stranded sea turtles and two captive-bred and captive-reared green turtles at the NMFS Kewalo Research Facility. Wendy Marks, along with NMFS MTRP staff, was responsible for overseeing the daily care of all sea turtles under MTRP care. Daily care involved feeding, cleaning tanks, administering medication, and conducting external visual exams.

JIMAR employees Shandell Brunson, Tyler Bogardus, Wendy Marks, and Tiffany Hooper (July to October 2010) along with NMFS MTRP staff were responsible for conducting necropsies on stranded marine turtles. Salvaged carcasses are examined externally and a gross necropsy is performed to ascertain a cause of stranding. Biological samples such as skin for genetic analysis, food items for diet analysis, tumor tissue for disease studies, and gonads for sex and maturation analysis are collected and managed by JIMAR MTRP Biological Technicians.

JIMAR MTRP employees and NMFS MTRP staff conducted three Longline Observer training sessions in FY 2011 (9/20/10, 1/21/11, and 6/16/11). Shandell Brunson led the training and Tyler Bogardus, Wendy Marks, and Tiffany Hooper (9/20/10) assisted with the hands-on training. Ms. Brunson gave a 30 minute presentation on sea turtle biology and then demonstrated proper techniques for tagging and taking a skin biopsy for genetic analysis.

JIMAR MTRP employees participated in field captures of marine turtles on several occasions in FY 2011 at the Hanauma Bay and Kailua Bay study sites. Wendy Marks also participated in field captures from a boat at the Kaneohe Bay study site. Juvenile green turtles were captured by hand/snorkel or by scoop net and were then tagged, measured, weighed, and examined. Additionally, JIMAR staff, Tyler Bogardus and Wendy Marks, participated in field captures of marine turtles on the Island of Hawai'i in FY 2011.

JIMAR MTRP research associate Tyler Bogardus and stranding associate Wendy Marks began employment in September 2010. Both have excelled in their responsibilities.

Figure 1. MTRP JIMAR research associate Tyler Bogardus (left), and JIMAR administrative assistant Shandell Brunson (right) carefully transport a captured green turtle for tagging and measuring.

Figure 2. MTRP JIMAR stranding associate Wendy Marks transporting a turtle for release.

Fisheries Oceanography: Protected Species Research Program

P.I.: Thomas A. Schroeder [JIMAR Project Leads: Marie Hill, Liz Kashinsky]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Erin Oleson, Charles Littnan, Frank Parrish

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The JIMAR Protected Species Research Program is comprised of two components: the Cetacean Research Program and the Hawaiian Monk Seal Research Program.

- *Cetacean Research Program.* The Cetacean Research Program (CRP) is charged with assessing the status of cetacean stocks within the U.S. Exclusive Economic Zone (EEZ) waters of the Pacific Islands Region (PIR). Assessment of cetacean stocks includes conducting inventories of species within each PIR EEZ, followed by evaluation of the structure of the stocks within each EEZ, the population status of each stock, and evaluation and mitigation of human impacts on cetacean stocks.
- *Hawaiian Monk Seal Research Program.* The Hawaiian Monk Seal Research Program (HMSRP) works to develop mortality mitigation strategies and to enhance the recovery of the monk seal.

Progress during FY 2011

- *Cetacean Research Program.* The PIR includes the entire Hawaiian archipelago, Johnston Atoll, Kingman Reef and Palmyra Atoll, Baker and Howland Islands, Jarvis Island, American Samoa, Wake Island, Guam, and the Commonwealth of the Northern Mariana Islands. At least 34 cetacean stocks occur in the Hawaiian EEZ alone, and many more exist in the other PIR EEZs, though most are largely unstudied. Assessment of cetacean stocks includes conducting inventories of species within each PIR EEZ, followed by evaluation of the structure of the stocks within each EEZ, the population status of each stock, and evaluation and mitigation of human impacts on cetacean stocks.

During FY 2011 JIMAR's work in the CRP included large vessel surveys within the Hawaiian EEZ. The Hawaiian Islands Cetacean Ecosystem Assessment Survey (HICEAS) was a collaborative effort with the Southwest Fisheries Science Center that was accomplished over a period of four months (August 14-December 7) using two ships that visually and acoustically surveyed approximately 10,000 nmi of transect lines. There were over 400 sightings of 21 confirmed cetacean species, more than 20,000 photos taken, approximately 200 biopsy samples collected, and over 600 acoustic detections that included identifiable vocalizations from 15 species. In addition, oceanographic data were collected along the transect lines, with over 160 Conductivity Temperature Depth (CTD) casts, approximately 400 Expendable Bathythermograph (XBT) casts, and over 400 surface chlorophyll samples. The data from this survey will be used to update the abundance estimates for the National Marine Fisheries (NMFS) stock assessment reports.

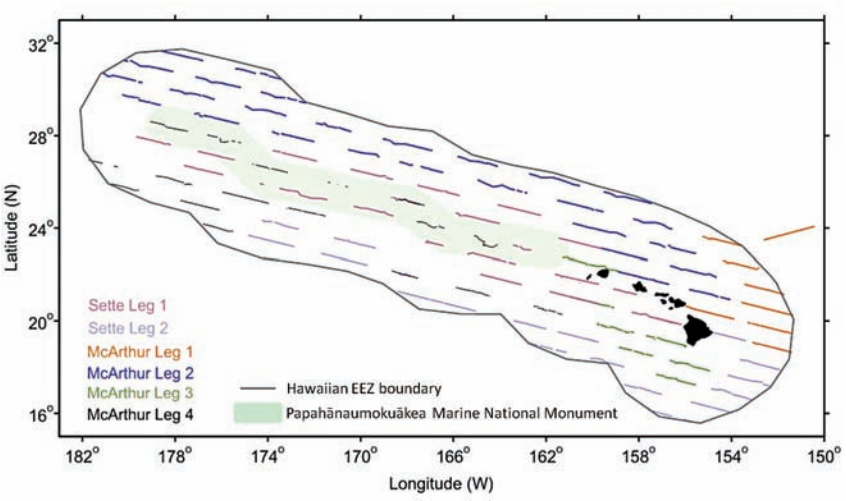


Figure 1. On-effort tracklines surveyed during the 2010 HICEAS.

JIMAR participated in small boat surveys during the 2011

fiscal year, including photo-identification and behavioral surveys for spinner dolphins off of the Kona coast of the Big Island (December 1-14) and photo-identification and biopsy surveys for cetaceans around Palmyra Atoll (April 29-May 9).

The CRP has been maintaining High-Frequency Acoustic Recording Packages (HARPs) for long-term continuous recording of cetacean occurrence off the Kona coast of the Island of Hawai'i, Kaua'i, Pearl and Hermes Reef in the Northwestern Hawaiian Islands, Wake Island, Tinian, and Saipan. The results of these monitoring efforts will provide detailed accounts of the seasonal and diel behavior of cetaceans in these locations.

Figure 2. Bryde's whale.

Small boat surveys for cetaceans in American Samoa that were planned for the 2011 fiscal year were not conducted due to budgetary delays.

• *Hawaiian Monk Seal Research Program*. Activities undertaken by the HMSRP during FY 2011 included population monitoring and assessment, characterization of foraging ecology, evaluation of health and disease, survival enhancement activities, and behavioral research. Winter and summer field camps staffed by JIMAR employees were established in the Northwestern Hawaiian Islands (NWHI). Field personnel collected valuable population information, tagged seals for long-term identification, assisted in marine debris collection, documented and mitigated mortality by aggressive males, and mitigated shark predation on pre-weaned pups. A trial study to determine the efficacy of both an injectable and topical antihelminthic for treating young seals for parasites took place at Laysan Island. Shark predation monitoring and mitigation were undertaken to prevent monk seal pup mortality at French Frigate Shoals (FFS). This included the translocation of nine weaned pups from areas of higher to lower predation risk within the atoll. A trial of aversive conditioning techniques was conducted at Kure Atoll to determine their efficacy in halting ongoing attacks and to dissuade aggressive male seals from seeking out and harassing pups and other young seals. A JIMAR employee served as primary point of contact between deployed field camps (Laysan Island and Kure Atoll) and Honolulu during the tsunami generated by the March 2011 Japan earthquake, coordinated the field camp evacuation after the tsunami passed, and participated in the U.S. Coastguard C-130 flyover to assess tsunami damage in the NWHI. JIMAR staff compiled data for manuscripts on past efforts to rehabilitate and relocate HMSs and on large scale movements of HMSs. A new integrated monk seal population database was designed and deployed in the field in April 2011. Directed studies of MHI seal abundance and distribution were also carried out.

Figure 3. Newborn pup and mom at French Frigate Shoals (Photo by Mark Sullivan. Photo courtesy of NOAA Fisheries, Pacific Islands Fisheries Science Center, taken under Marine Mammal Permit #10137-05).

The foraging ecology program reached a major milestone in their MHI dietary studies with the completion of the first assessment of monk seal diet and feeding behavior in the MHI; a manuscript detailing the diet of MHI seals is being prepared for submission. Scat analysis and work to further develop a prey photo identification database continue. Telemetry equipment was deployed on 11 seals and biomedical samples were collected from 13 for disease surveys in the MHI. An external review of the Health and Disease program was conducted September 8-10, 2010. Full-time JIMAR staff trained field staff in sample collection techniques and managed the disposition of a large number of biomedical samples accumulated during population assessment activities, the de-worming study, and MHI epidemiological sampling. JIMAR personnel also provided support and participated in stranding responses and began utilizing a new database to manage HMS specimens. A project to reorganize and barcode hundreds of archived frozen HMS specimens began in Fall 2010. Blubber and serum samples collected from

Figure 4. Surveying seals at Sand Island, Kure Atoll (Photo courtesy of NOAA Fisheries, Pacific Islands Fisheries Science Center, taken under Marine Mammal Permit # 848-1695-01).

MHI seals were analyzed for persistent organic pollutants in August 2010, and the data were analyzed and a manuscript is in development. JIMAR staff assisted with researching and designing effective techniques to modify behavior of Hawaiian monk seals. They also assisted with the preparation of a publication documenting the presence of ciguatoxins in monk seal tissue and blood specimens.

Human Dimensions of Fishing and Marine Ecosystems in the Western Pacific/ Sociocultural Profiles of Pacific Islands Regions Fishing Ports

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Dawn Kotowicz]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Stewart Allen

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The need for information on the human dimensions of marine ecosystems is becoming more important not only in assessing the effects of management on individuals, households, and communities but also in identifying possible management alternatives and accompanying social, cultural, and economic objectives. Establishment of new Marine National Monuments (MNMs) near Guam, the Commonwealth of the Northern Marianas, and American Samoa raises a number of sociocultural issues relevant to management of the MNMs. Required annual catch limits for managed marine species present another critical need for social research to study the social, economic, and cultural implications of allocation of catch for consideration by mangers. JIMAR researchers collect valuable sociocultural information by facilitating coastal use mapping with the NOAA Pacific Islands Fisheries Science Center's project to develop an integrated ecosystem assessment for the Kona Coast of the Big Island. Researchers assist PIFSC with refinement of the Fishing Ecosystem Analysis Tool (FEAT) to link and spatially display fishing and socioeconomic information in Hawai'i. Exploring the sociocultural aspects of adapting to climate change impacts will be increasingly valuable as American Samoa communities consider management actions to increase resiliency. Updating fishing community profiles developed by JIMAR and PIFSC provides communities and others with the capability to update information on their own social science information needs.

JIMAR researcher Laurie Richmond speaks with a fish buyer at the Honolulu Fish Auction about the impacts of the bigeye closure for the Hawaiian fishing fleet on his business of buying and selling ahi to world markets.

Progress during FY 2011

As of July 2010, the JIMAR project entitled Sociocultural Profiles of Pacific Islands Regions Fishing Ports has been incorporated into, and will be reported under, the larger Human Dimensions of Fishing and Marine Ecosystems in the Western Pacific project. The project is comprised of several subprojects described below.

• *Sociocultural aspects of Mariana Trench Marine National Monument.* Existing materials and information sources have been reviewed and integrated with information collected from conversations with MNM managers and stakeholders in the CNMI and Guam regarding sociocultural aspects of the management plan and development for the Marianas Trench MNM. The survey instrument has been developed and reviewed by JIMAR researchers and other survey research specialists and is now in the approval process with the Office of Management and Budget.

• *Social considerations for adopting catch share programs in the Western Pacific.* Last year JIMAR researchers took advantage of an important opportunity to examine the impacts of catch limits on Hawai'i's fishing communities and to consider what kinds of catch share plans might be appropriate when the Hawaiian bigeye fishery reached its limit and was closed in November 2010. Conversations and interviews with fishermen, fish buyers, and others associated with the fishery revealed social, cultural, and economic impacts experienced during the closure. These findings were presented at the Scientific and Statistical Committee of the Western Pacific Regional Fishery Management Council (Council) and the Council meetings to inform managers as they consider catch share options for fisheries management.

• *Developing new ways to analyze and display existing fisheries and socioeconomic information through FEAT.* The JIMAR staff supports the refinements to FEAT that have been undertaken by contractor Makai Ocean Engineering. Refinements to date include upgrading the ability to mask confidential data, adding new parameters to allow query by fishing grid (location of fishing activity), refining the display and interpretability of information resulting from queries, adding the capability to analyze recreational fishing data, and enabling FEAT to run on PIFSC servers and thus be accessible over the intranet (and eventually the internet).

In FY 2011, JIMAR staff assisted in reviewing FEAT with stakeholders and suggested possible refinements. In particular, JIMAR staff Laurie Richmond presented FEAT to NOAA Fisheries Regional Office Assistant Regional Administrators during their meeting on Maui in March, 2011. JIMAR staff also assisted with the presentation of FEAT to fishermen at the Western Pacific Regional Fishery Management Council's Fishermen's Forum in Honolulu, February 2011.

• *Mapping coastal uses in the Puako-Kalaoa area, Island of Hawai'i.* JIMAR researchers worked to develop and complete a coastal-use mapping workshop in the Puako region of the Kona Coast. The workshops were held at the Kaupulehu Interpretive Center from September 22-24. Over 50 users of the coastlines from Kawaihae to Keahole Point on the Kona Coast of Hawai'i Island worked to develop maps of the location and spatial extent of 16 uses in the region. GIS professionals from NOAA's Office of Coastal Resource Management (OCRM) worked to collate information from the workshop into a series of GIS layers for each coastal use. The use maps and GIS layers have been completed and a report is forthcoming. JIMAR employees contributed by planning and organizing the workshop (including inviting stakeholders from the region to participate) and helping to facilitate the workshop.

• *Establishing climate resilient communities in American Samoa.* This project is a partnership among JIMAR, PIFSC, PIRO, the National Ocean Service's Pacific Services Center, and the University of Hawai'i's Coastal Geography Group. JIMAR activity during FY 2011 was limited due to the departure from JIMAR of project manager Arielle Levine, who is continuing work on the project as a PIRO contractor. Fieldwork was completed during late FY 2010 and UH partners are still analyzing and compiling data collected in Amouli village. As a result, the Participatory Learning Assessment workshops have not yet been conducted.

• *Fishing community profiles*. JIMAR researchers support the PIFSC Federal staff to develop profiles of each fishing community in the Western Pacific Region. These profiles have either been published or exist in draft form ready for publication. The JIMAR staff participated in discussions with NOAA Fisheries social scientists from all regions regarding updates of existing fishing community profiles. Currently there is a question of whether updates should consist of regularly-published profiles, addendums to existing profiles, or development of community-specific databases that would have broader application. JIMAR staff members have also suggested inserts to the profiles based on other ongoing projects.

Kona Integrated Ecosystem Assessment

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Melanie Abecassis]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Jeffrey Polovina

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Develop an Integrated Ecosystem Assessment (IEA) of the Kona coast off the Island of Hawai'i to provide scientific advice to local and regional managers.

Progress during FY 2011

The purpose of this JIMAR project is to: 1) cover the preparation of data for the Integrated Ecosystem Assessment (IEA) data portal; 2) begin development of a circulation model for the Kona region; 3) begin development of socioeconomic indicators; and 4) deploy an observing system to measure physical and biological characteristics of the Kona region. During FY 2011, a University of Hawai'i student employee collated information from various partners to help build a data inventory of GIS layers for the Kona region. Select layers were then processed and provided to the company contracted to construct an IEA data portal. These data layers are available on the preliminary data portal website at http://www.hanloncreative.net/noaa/coords. Additionally the student successfully built an internal inventory of historic PIFSC cruise data in the Kona region. This data has been validated, reprocessed, and stored in a common oceanographic format to facilitate incorporation to the data portal. Work began in FY 2011 to develop a circulation model to better understand the role of oceanography in the pelagic early life history (egg and larval stages) of resident organisms around the Kona coastline of the island of Hawai'i. This circulation model is a subset of the high-resolution ocean circulation model HYCOM for the Kona region and drives a larval transport model under development for the IEA. In FY 2011, a complete set of daily model runs were provided to the transport modeling team, and a system was set up to facilitate the delivery of current daily HYCOM model runs as well as 28-day forecasts.

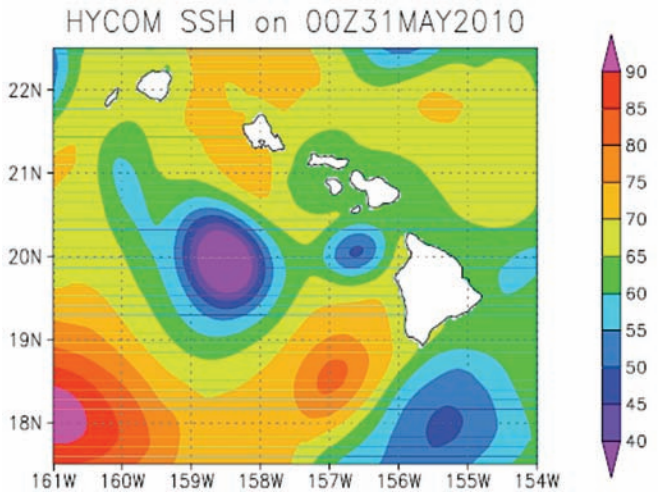


Figure 1. Example HYCOM sea surface height model output for May 31, 2010.

Figure 2. Sea glider recovery from small boat platform.

In FY 2011, a social sciences researcher was hired to help compile available socioeconomic data in the Kona region as well as facilitate a management session of a September 2011 Kona IEA symposium. Preliminary work was completed to consolidate available human dimension

information in the Kona region. These data will be used in FY 2012 to form human dimension "indicators" that can be used to track ecosystem societal "health" in a discrete time series. When complete, these will be made publicly available through the data portal.

A project was started in FY 2011 to deploy a sea glider off the Kona coast to better understand eddy dynamics in the Kona region as well as to validate the unassimilated HYCOM circulation model output. The sea glider was prepped and modified in FY 2011 to accommodate the oceanographic sensors and hydrophone necessary to capture the physical and biological data of interest in this study.

Marine Resource Dynamics & Assessment Program (MARDAP): Economics of Fisheries Initiative

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Kelly Davidson]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Minling Pan

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The purpose of this JIMAR project is to conduct economic assessments of commercial and recreational fisheries and the seafood market in the Pacific Islands Region.

Progress during FY 2011

The project has successfully continued data collection and monitoring activities in the Hawai'i longline and American Samoa longline fisheries. Economic data forms were revised and translated into Vietnamese and Korean to accommodate foreign boat captains. The database is constantly updated with additional observations and summaries of key economic indicators are periodically presented at Western Pacific Fishery Management Council meetings. Seafood market research was conducted through a survey of consumer preferences for wild capture and aquaculture fish products. A total of 1241 survey responses were collected online and in-person in Hawai'i and Kentucky to evaluate local and national consumer perspectives. The results from the survey were presented at fisheries-related academic conferences and a publication of the economic analysis is currently under peer-review.

The project hosted two major fishery management workshops: the Pacific Islands Region Catch Shares Workshop in Honolulu, HI; and The Workshop on Global Tuna Demand and Fisheries Dynamics in the Eastern Pacific Ocean in La Jolla, CA. The national catch shares workshop investigated potential applications for catch share management systems to the Pacific Islands areas through discussions of existing catch-share programs and the objectives of management in the Pacific Islands Region. An administrative report detailing outcomes of the workshop is currently under review and a collection of relevant papers for a special issue of *Marine Policy* is in progress.

Marine Resource Dynamics & Assessment Program (MARDAP): Research Support

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Nathan Chan]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Jerry Wetherall, Susan K. Kamei

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This JIMAR project provides information services and administrative and facilities support for JIMAR research

activities conducted at the Pacific Islands Fisheries Science Center, Dole Street campus, University of Hawai'i campus, Aiea Heights research facility, and the Kewalo Research Facility.

Progress during FY 2011

The JIMAR Scientific Information Specialist continued to provide technical support to the PIFSC Scientific Information Services (SIS) group on various aspects of data services, including support of PIFSC affiliated JIMAR scientists. JIMAR performed quality control on and managed the timely data entry of fisheries and research data for input into an Oracle database. Work included recruitment, training, and guidance for University of Hawai'i students who conducted reviews and entered and verified the fishery statistics. JIMAR continued online training to develop skills in Drupal CMS (content management system), and these skills were utilized to begin co-development of a new SIS Fisheries Data Catalog, which is a Web-based listing of PIFSC data holdings that includes summaries of essential metadata and related literature such as code lists, forms and log sheets, and field specifications. The new catalog will replace the current static HTML catalog. It will provide users with a cleaner and more interactive interface. It will also significantly reduce the time and effort required for updates, maintenance, and new entries. In addition, JIMAR staff facilitated research activities by providing facilities and maintenance support. Tasks included reconfiguration of work spaces, installation of equipment for research interests, and general assistance to JIMAR staff and work areas. Documentation was developed to assist in tracking of facilities requests.

Marine Resource Dynamics & Assessment Program (MARDAP): Research Support—Fisheries Data Monitoring

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Walter Machado]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fishery Science Center

NOAA Sponsor: Samuel G. Pooley, Kurt Kawamoto, David Hamm

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This JIMAR project provides PIFSC with timely and accurate Fishery Management Plan (FMP) logbook data and other fishery information for use in research and management. The main focus is the daily monitoring of Hawai'i's pelagic longline fleet, which is currently and increasingly subject to international management at the species level. The project provides PIFSC and the fishing industry with a JIMAR contact point for feedback and information exchange with fishery scientists and managers.

Progress during FY 2011

The JIMAR Fisheries Specialist and Bigeye Tuna Database Assistant continue to provide timely high-level support to fishery monitoring activities by providing high quality data to JIMAR and NMFS. The daily burden of quality control and processing logbook data have increased due to fast tracking procedures that were implemented to track Hawai'i's bigeye tuna (BET) landings for use in forecasting prior to implementing a Hawai'i longline BET fishery closure if/when the WCPFC and IATTC annual U.S. longline caught BET quota is predicted to be reached. These additional monitoring requirements increase the daily workload and are compiled weekly or as necessary as the quota gets taken. Additional quality control procedures and cross checks of relevant databases have been implemented as needed to continually improve the results and timeliness of the product. For example, a matching program comparing the longline logbook tuna counts to sales records at United Fishing Agency auction was developed and is now used to improve the quality of the data. The general Hawai'i longline fleet wide quarterly reports are completed 45 days after the quarter.

A continuously updated photo database of Hawai'i's pelagic longline fishing fleet was created to document and monitor permitted vessels in the fleet. The logbook scanning project has successfully archived 12 years of the Hawai'i longline logbooks with nine more years of logbooks yet to be scanned.

Figure 1. United Fishing Agency (fish auction).

Figure 2. F/V Princess K, *a mid-size longline vessel.*

Marine Resource Dynamics & Assessment Program (MARDAP): Research Support—Main Hawaiian Islands Deep 7 Bottomfish Fast Track Project

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Jessica Phelps]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Michael M. Quach

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

JIMAR's Main Hawaiian Islands (MHI) Deep 7 Bottomfish Fast Track Project is an ongoing project that began September 2007. The Total Allowable Catch (TAC) rule was implemented by NOAA Fisheries in the State of Hawai'i to manage the "Deep 7" bottomfish species caught near the main Hawaiian Islands. The Deep 7 complex is comprised of six eteline snappers and an endemic grouper, known locally as onaga (*Etelis coruscans*), ehu (*Etelis carbunculus*), opakapaka (*Pristipomoides filamentosus*), kalekale (*Pristipomoides sieboldii*), gindai (*Pristipomoides zonatus*), lehi (*Aphareus rutilans*), and hapu'upu'u (*Hyporthodus quernus*). Hawai'i State law requires commercial fishers to submit their monthly fishing reports 10 days after the following month in which marine life was taken. JIMAR staff work in collaboration with the Department of Land and Natural Resources-Division of Aquatic Resources (DLNR-DAR) to fast-track Deep 7 bottomfish fishing and dealer data in order to successfully monitor the fishery. The fishing year for the Deep 7 Bottomfish fishery opens on September 1, and closes when the total landings are predicted to reach the TAC or on August 31, whichever occurs first. Near real-time monitoring is needed to close the fishery when the TAC is near attainment, so data collection and processing must be fast-tracked to provide timely and accurate landing information to assist in the monitoring and management of this fishery.

Progress during FY 2011

Through accurate and timely data collection and entry, JIMAR staff members continue to successfully manage the MHI Deep 7 bottomfish fishery. In order to facilitate timely submittal, monthly reminder letters are mailed to Deep 7 fishers and dealers, and JIMAR staff enter the commercial fishing and dealer data within two days of

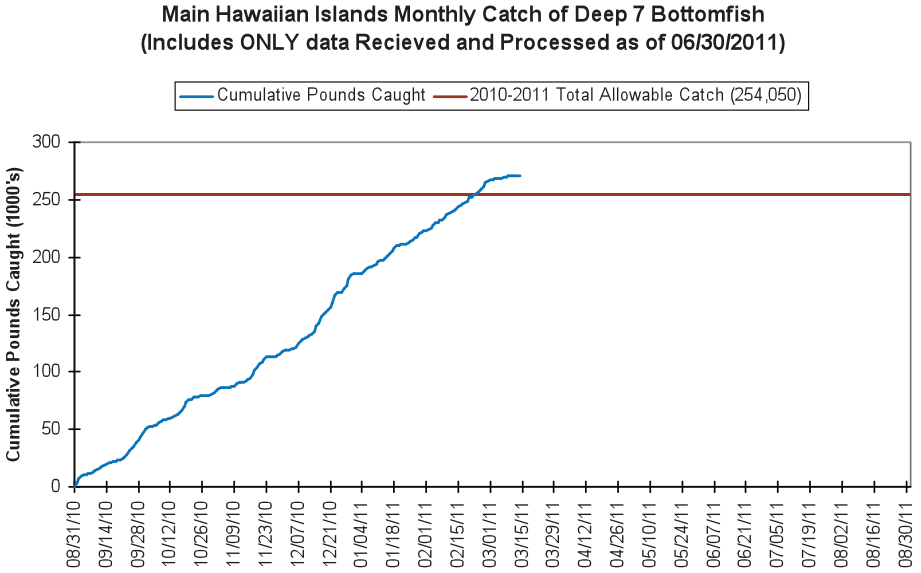


Figure 1. Graph showing the accumulation of the TAC for the 2010-2011 MHI Deep 7 bottomfish fishing year. The fishery closed on 3/12/11.

receiving the report. Follow-up interviews with fishers and dealers are conducted to correct any questionable or incorrect data. Using a computer program, fisheries data are error checked on a daily basis and weekly updates are sent to fishery managers beginning in October 2010. The Deep 7 bottomfish fishery opened on September 1, 2010 with a TAC of 254,050 pounds. Based on weekly data updates, fishery managers met in early February 2011 and decided to close the MHI Deep 7 Bottomfish fishery effective March 12, 2011. As of July 1, 2011 commercial fishers have reported catching 270,863 pounds of Deep 7 bottomfish, 6.6% over the 254,050 pound TAC. This overage may be due to the difficulty of predicting the date the TAC is reached because the fishing reports are due 10 days after the following month in which the fish are caught and weather has a strong influence on fishing effort in the bottomfish fishery.

Month	Deep 7	Fishing Report			Dealer Report				
		no. fishers	pieces	lbs	no. fishers	no. dealers	pieces	lbs. sold	value
TOTAL	Opakapaka	380	41,332	146,455	287	55	35,626	122,848	$709,844.65
	Onaga	257	12,626	67,491	203	42	10,690	57,080	$397,691.90
	Ehu	309	11,004	24,270	207	36	7,522	16,289	$88,564.06
	Lehi	127	1,150	11,586	105	26	1,019	8,743	$36,233.16
	Hapuupuu	181	749	8,052	133	25	673	6,599	$36,212.30
	Kalekale	218	5,429	9,923	168	34	4,429	6,910	$25,210.16
	Gindai	179	1,338	3,087	107	21	860	1,769	$8,089.43
	SUM	**471**	**73,628**	**270,863**	**350**	**64**	**60,819**	**220,237**	**$1,301,845.66**

Figure 2. Table showing the number of Deep 7 reported landed and reported sold between September 1, 2010 and March 12, 2011 as of 6/30/2011.

Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program

P.I: Thomas A. Schroeder [JIMAR Project Lead: Hui-Hua Lee]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Gerard DiNardo

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The goals of this Stock Assessment Research Program are to: 1) assess the status of pelagic stocks in the Pacific Ocean; 2) assess the status of insular resources in the Pacific Islands Region (e.g., bottomfish); and 3) assess the impact of fishing on these stocks. During a technical review of the Pacific Islands Region (PIR) lobster and bottomfish assessment procedures, it was recommended that collaborative research programs with industry, the Pacific Islands Fisheries Science Center, and the University of Hawai'i be developed to: 1) provide independent estimates of population size; 2) generate updated estimates of population dynamics; and 3) advance insular stock assessment methodologies in the PIR. In addition, the establishment of the Western and Central Pacific Fisheries Commission (WCPFC) and International Scientific Committee (ISC) has emphasized the need for pelagic stock assessments in the Western and Central Pacific Ocean (WCPO), and recommended that arrangements to facilitate assessments move forward. Currently, PIFSC conducts assessments of pelagic fish stocks in the Pacific Ocean collaboratively with scientists from Japan, Taiwan, Korea, China, Mexico, and the Inter-American-Tropical-Tuna-Commission (IATTC) under the auspices of the ISC. Priority is given to billfish and oceanic shark species in the Pacific Ocean, including marlin and swordfish, as well as blue, oceanic whitetip, silky, and thresher sharks.

Progress during FY 2011

Four goals were outlined by JIMAR for the reporting year, including: 1) implementation of a continuous fishery independent pilot survey, and biological data collection and tagging programs for bottomfish in the MHI; 2) conducting the NWHI lobster resource survey in May 2011; 3) planning and participation in two ISC Billfish Working Group workshops and the 11th meeting of the ISC Plenary in July 2011; and 4) advancing stock assessment methodologies for pelagic species in the North Pacific Ocean and insular species in the PIR. Of the goals articulated, the following were accomplished.

• *Implementation of a fishery independent pilot survey for bottomfish stocks in the MHI.* The development of a PIR fishery independent survey for bottomfish is recognized as a high priority among regional fishery managers and scientists. This is a multiyear project, and data from the survey will be used to determine optimal gear(s), sample sizes, and number of vessels needed to implement fishery independent surveys in the Hawaiian Archipelago, Guam, CNMI, and American Samoa. Results to date include the completion of a dozen fishing trips aboard local fishing vessels to collect requisite data for assessing the feasibility of a fishery independent bottomfish survey, collection of 70 biological samples to advance bottomfish age and growth research, and completion of 3 outreach sessions with local constituents. In addition, 12 fishermen were contracted to conduct tagging operations in the MHI, and 1500 bottomfish (snappers) were tagged and released; a total of 23 fish were recaptured. A final report describing the results of year 1 will be completed by September 2011. In addition, a MHI bottomfish fishery-independent calibration survey was implemented in waters surrounding Maui and O'ahu in February 2011. The goal of this research was to conduct provisional gear calibration studies between existing commercial fishing gear and non-extractive sampling gear including the Simrad EK60 echosounder system and baited underwater video cameras (BotCam). The NOAA Ship Oscar *Elton Sette* conducted a total of nine continuous acoustic survey transects including five days of daytime acoustic survey over a BotCam unit and five evenings of acoustic surveys in conjunction with targeted fishing operations. The University of Hawai'i contracted vessel, *F/V Hukipono*, completed 98 standardized BotCam drops. Additionally, partner fishing vessels completed 111 daytime fishing stations and 43 nighttime fishing stations in conjunction with BotCam drops and the acoustic transects.

Figure 1. Participants at the January 2011 ISC Billfish Working Group Workshop.

Figure 2. Participants at the May 2011 ISC Billfish Working Group Workshop.

• *NWHI lobster resource survey*. The NWHI lobster resource survey was not conducted in FY 2010 due to scheduling conflicts with the NOAA Ship *Oscar Elton Sette*.

• *Planning and participation in two ISC Billfish Working Group workshops, International Tagging Symposium, and the 11th meeting of the ISC Plenery*. Two workshops of the ISC Billfish Working Group and one international tagging symposium were convened in FY 2011 with significant support from JIMAR staff. The main goal of the January 19-27, 2011 workshop was to review available North Pacific striped marlin fishery-dependent and fishery-independent data for possible inclusion in the stock assessment, including region specific Category I, II, & III data, CPUE time series, and life history parameters. At the May 24-June 1, 2011 workshop the goals were to: 1) finalize North Pacific striped marlin data and stock assessment work plan; 2) conduct collaborative sensitivity analyses of Eastern Pacific Ocean striped marlin stock assessment with the IATTC; and 3) develop a work plan for completing blue marlin assessment. Both workshop reports have been finalized and submitted to the ISC Plenary for review and adoption. An International Tagging Symposium was convened in Taitung, Taiwan in November 2010 with participants from 20 countries. The goal of this symposium was to communicate research findings to scientists conducting tagging research and advance tagging methodologies. The 11th meeting of the ISC Plenary and ISC working group meetings will be held in San Francisco, CA, U.S.A on July 14-25, 2011.

• *Advancing stock assessment methodologies for pelagic species in the North Pacific Ocean and insular species in the PIR*. Numerous stock assessments were completed with assistance from JIMAR staff, and significant progress on population model development also occurred in FY 2010. To facilitate other pelagic species stock assessments, two workshops of the ISC Albacore Working Group were convened to complete the albacore assessment in June 2011, and an ISC Shark Working Group meeting was convened in April 2011 to develop a stock assessment work plan for blue shark and shortfin mako shark in the North Pacific Ocean. An updated stock assessment was conducted for deep-slope bottomfish stocks in the MHI. JIMAR project participants Eric Fletcher and Lyn Wagatsuma provided analytical support for the bottomfish assessment.

Marine Turtle Conservation and Management Initiative

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Regional Office

NOAA Sponsor: Charles Karnella

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

In many Pacific coastal and island communities, marine turtles have long been a food source and play important cultural roles in the lives of inhabitants. Six marine turtles species—green, hawksbill, olive ridley, leatherback, loggerhead, and flatback turtles inhabit the Pacific, especially marine areas of Melanesia. Additionally, this is an area of growing commercial fishing fleets, specifically using longline and purse seine gear. The purpose of this project is to introduce fishermen, fishery administrators, policy makers and other stakeholders to information and materials designed to increase opportunities for survival by marine turtles that might be captured during pelagic fishing operations in exclusive economic zones of New Caledonia (this action will augment NOAA Fisheries supported marine turtle conservation activities already underway in Papua New Guinea, Indonesia and future activities possibly in Solomon Islands).

Progress during FY 2011

Awareness activities for the general public and sea turtle encounter activities at Aquarium des Lagons included 20 minute long shows, turtle encounter, and question and answer sessions scheduled once to twice a week and led by the Program Officer. It is estimated that approximately 1,000 people were reached during FY 2011. Several workshops were organized for school children 5 to 12 years old. Each activity lasted 30 minutes to 1 hour in the aquarium's education room. These activities included a movie and a quiz about sea turtle biology and threats, tailored to specific age groups. During this fiscal year, 355 children participated, a significant increase over last year. The workshop on turtles represented 18% of the outreach activities of the aquarium during calendar year 2010. In addition, 50 children attended workshops during school holidays between July 2010 and June 2011. The aquarium also cared for two injured sea turtles (a green and a hawksbill turtle) that were later tagged then released in March 2011.

An important part of this program is outreach and education efforts at community functions outside the aquarium. In this manner, the message of sea turtle biology and threats including feral dog predation of turtle eggs and the problem of plastic pollution is more far reaching than being presented at the aquarium facility alone. The Program Officer attended ten county fairs reaching approximately 900 people during FY 2011. Considering the calendar year 2010, this is a 47% increase over 2009. To enhance outreach efforts, two sets of seven posters (80 x 100 cm) were produced to use for scholar groups and for awareness activities done outside of the aquarium. Also, the sea turtle exhibit presented at the aquarium in early 2010 (January-May) was adapted to become a travelling exhibition. Included were 11 panels containing turtle life history and threats information and four screens with videos or slide shows. From October 1 through June 23, 2011, it was loaned to the villages of Bourail, Koné, La Foa and Mont Dore for different occasions. At Bourail alone, 232 people visited the exhibition.

Mesophotic Reef Ecosystems of Hawai'i's Au'au Channel

P.I.: Thomas A. Schroeder [JIMAR Project Lead: John Rooney]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Frank Parrish, Jeffrey J. Polovina

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Funding for this JIMAR project originated in 2007 for a multi-agency proposal titled, "CRES 2007: Investigating the Deep (50-100 m) Coral Reefs of Hawai'i," to study a complex of what are now referred to as "meso-photic" coral reefs in the Au'au Channel between the islands of Maui and Lanai. Benthic communities of scleractinian corals, other invertebrates, macroalgae and fishes are studied, along with the physical oceanography of the area, to develop a better understanding of the structure, composition, ecological dynamics, and management needs of mesophotic coral ecosystems.

Figure 1. Scientists using closed circuit rebreathers and mixed gas measure work in combination with the Hawaii Undersea Research Laboratory's Pisces V submersible to photograph, measure, and stain a coral colony for growth rate studies. The use of combined technical scuba and research submersible dives was pioneered during cruise KOK11-02. (Photo: John Rooney)

Progress during FY 2011

During FY 2011, JIMAR personnel participated in two research cruises for this project. Cruise SE10-06 on the NOAA Ship *O.E. Sette* was conducted July 6-15, 2010 and included: recovery, downloading, servicing, and re-deployment of two 30 m physical oceanographic instrument moorings; the recovery of a mooring with a Vemco acoustic receiver and deployment of another; four mixed gas scuba dives to conduct paired benthic video and fish count surveys and collect samples; 33 camera sled dives to record the type and location of mesophotic communities; daily water column profiling with a CTD and light meter; and EK60 sonar calibration and surveying for water column communities and their diel movements.

Figure 2. A school of *Aphareus rutilans* (ironjaw snappers or Lehe) over a reef of *Leptoseris hawaiiensis* in the Au'au Channel off Maui. (Photo: Hawaii Undersea Research Laboratory)

From February 26 to March 10, 2011, JIMAR personnel participated in another cruise aboard the University of Hawai'i vessel *R/V Ka'imikai-o-Kanaloa*. During the cruise ten research submersible dives were completed, seven of which included combined technical scuba and submersible operations. To the best of our knowledge, this is the first time that combined technical scuba and submersible dives were conducted to complete scientific research missions; the combined operations were successful in leveraging the advantages of each method to enhance scientific results. A total of 11 ROV dives were also completed, to continue the mapping and characterization of mesophotic communities.

Oceanography Initiative

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Melanie Abecassis]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Jeffrey Polovina

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Research is conducted under this initiative to advance our understanding of oceanography and its link to the insular and pelagic ecosystems within the newly created Pacific Monuments. On research cruises, JIMAR collects in-situ measurements of key oceanographic and ecosystem variables including temperature, salinity, chlorophyll, and acoustically sampled indices of the sound scattering layers. During March and April 2010, a 28-day oceanographic cruise was conducted in the waters around the Marianas Archipelago including within the Mariana Trench Marine National Monument. The first task of this project is to analyze data from this cruise. In 2012, an oceanographic cruise around American Samoa will be conducted including the waters of the Rose Atoll Marine National Monument.

Progress during FY 2011

During the March to April 2010 Marianas cruise, Conductivity-Temperature-Depth (CTD), oxygen, and fluorometer measurements were taken by JIMAR staff from the ocean surface down to 1,000 meters at stations along three meridional transects west ("Western Transect"), south ("Central Transect"), and east ("Eastern Transect") of the island chain (Fig. 1). Water samples were collected at each full degree for nutrients and chlorophyll-a, and at every 0.5° for chloropigments. Discrete chlorophyll-a samples were filtered at sea, and chloropigment samples were stored in liquid nitrogen for later laboratory HPLC analysis. Bioacoustic backscatter and currents were continuously monitored as well to tie together any observed spatiotemporal changes with changes in oceanography. To examine the composition of organisms below the trophic level of micronekton, the main component of the scattering layers, zooplanktonic organisms were sampled every 1° along the three meridional transects using an Isaacs Kidd Mid-water Trawl (IKMT). All samples were collected in the upper 200 m during night time, when zooplankton (and micronekton) biomass is high, as diel migrators move to near-surface waters to feed. To supplement the in situ data, JIMAR staff utilized satellite altimetry and ocean color products to gain an understanding of eddy structure and productivity levels in the area.

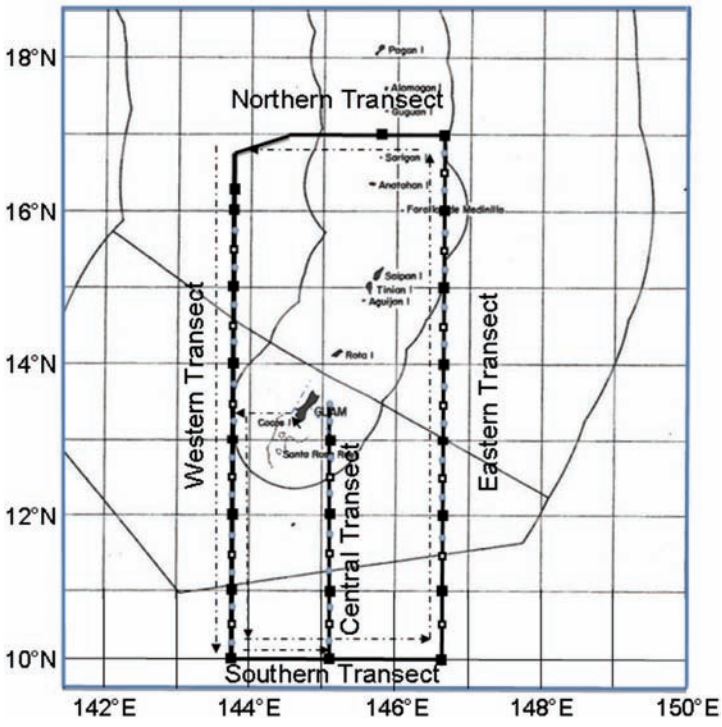


Figure 1. Survey transects for the in situ observations. Filled and unfilled squares indicate full (nutrients, chloropigments, and chlorophyll-a) and bottled (chloropigment determinations only) CTD stations, with gray circles denoting CTD stations with no bottle samples. One daytime and two nighttime acoustic transects and IKMT trawls were also conducted at each full and bottled CTD stations, respectively.

JIMAR analysis of data obtained from the CTD casts show a general shallowing of

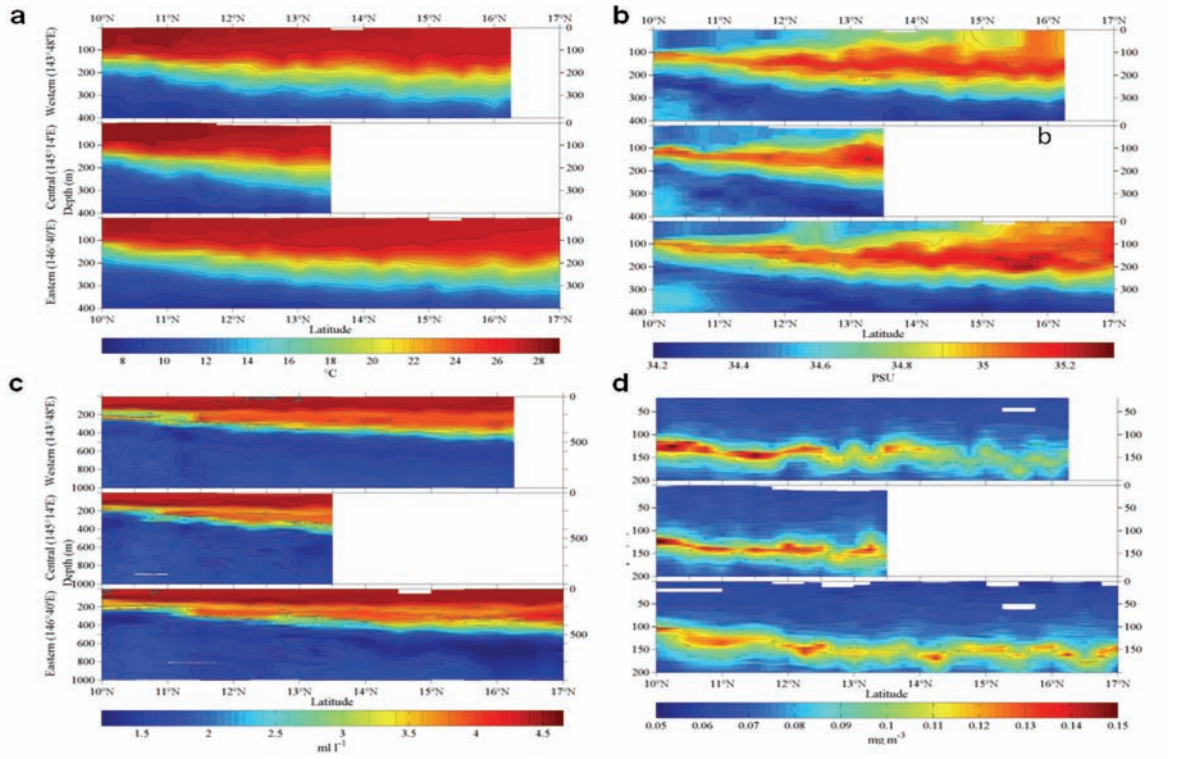


Figure 2. Figure 2. (a) Temperature, (b) salinity, (c) dissolved oxygen, and (d) chloropigment concentrations along the three meridional transects, shown down to 400, 400, 1000, and 200 m in depth.

the mixed layer to the south, and a salinity maximum and minimum at 100-250 m and 300-600 m, respectively (Figs. 2a, b). The salinity minimum shallows and becomes vertically thinner from south to north. The salinity maximum reaches the surface and is wider in its vertical extent to the north. It becomes a subsurface feature to the south, caused by North Equatorial Current dynamics. This salinity maximum represents North Pacific Tropical Water that is formed to the north and advected southward along isopycnals and westward by the North Equatorial Current (NEC). Dissolved oxygen concentrations (DO) were relatively high in the upper 100-150 m with a strong gradient from 150-250 m on the south to 400-450 m on the north, deeper along the Eastern than along the Western Transect (Fig. 2c). Below these depths, DO minimums were at 350-450 and 650 m at the south and north, respectively. Fluorometry results show very low background concentration (< 0.05 mg m^{-3}) apart from a subsurface deep chlorophyll-a (Chl-a) maximum, which is situated around 150 m in depth shoaling to the south (Fig. 2d).

Pacific Islands Monitoring and Sampling Program

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Eric Cruz]

NOAA Office (of the primary technical contact): National Marine Fisheries Services/ Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, David Hamm

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This project is one in a series of the Commercial Fisheries Biosampling (CFBS) program that was established to assist fisheries resource managers in producing improved stock assessments for federally managed species. The

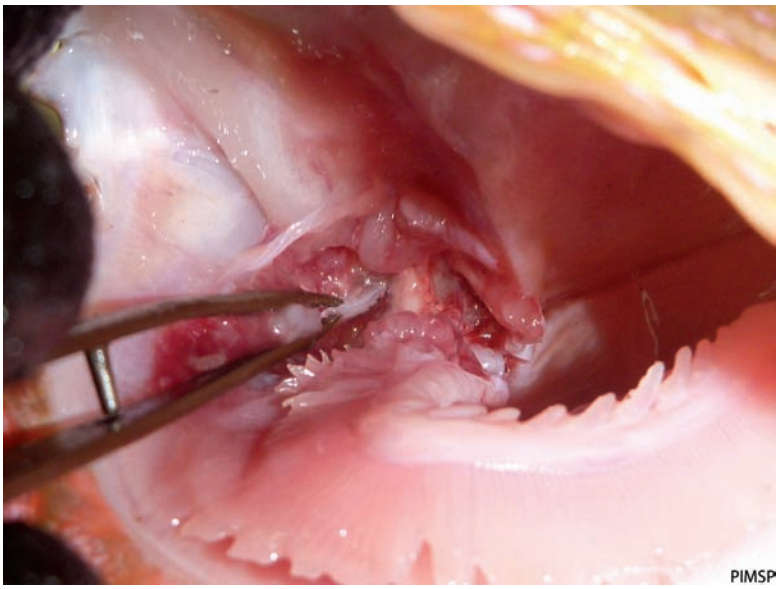


Figure 1. Removing the otolith of Variola louti through the operculum.

CFBS was established to assist fisheries resource managers in producing improved stock assessments for federally managed species and to provide more robust species level harvest data for development of ACLs required by the Magnuson-Stevens Act. A major goal of JIMAR's Pacific Islands Monitoring and Sampling Program (PIMSP) is to obtain species identification, size frequency, age, growth, fecundity, length at maturity, and length at age information on all reef and bottom fishes from key fisheries in Guam, the Commonwealth of the Northern Mariana Islands (CNMI), and American Samoa and to provide the data to the Pacific Islands Fisheries Science Center (PIFSC), local agencies, and the Western Pacific Regional Fisheries Management Council.

Progress during FY 2011

Much progress has been made in each of the three island areas. A biosampling database program was created and is in use in all three island areas to efficiently enter and maintain all data collected through the CFBS. The most robust biosampling program is on Guam and is supported primarily by JIMAR. The program includes size frequency sampling performed 3-5 times a week at the Guam Fishermen's Co-operative Association (Co-op), the biggest fish market on Guam. Eric Cruz has been working with the Co-op since November 2009 and has built strong personal and professional relations with the Co-op and many of their fishermen. This relationship enables more complete and accurate data to be collected from all reef and bottomfish catches. Currently, there are over 25,000 individuals measured from 185 species. The sampling programs in the CNMI and American Samoa are developing through grants to local fisheries agencies and contracts with consultants, fish vendors, or fishermen.

Figure 2. Size frequency sampling of Scarus spp. and Epinephelus spp. at the Guam Fishermen's Cooperative Association.

Life History sample collection on Guam has expanded to include five targeted species (*Hipposcarus longiceps*, *Monotaxis grandoculis*, *Variola louti*, *Cheilinus undulatus*, and *Etelis coruscans*) and any "rare event" individuals of other species. Sampling is no longer only opportunistic as JIMAR was able to negotiate agreements with the Co-op to "borrow" fish, unobtrusively remove otoliths and gonads, and return the fish to the Co-op to be sold. Due to changes in the targeted species list and complications with the contractor initially selected to process the otoliths, the life histories of the first set of 5 species has not been completed. JIMAR contracts are now in place to prepare histological slides for gonadal tissues to support the life history work. Currently, there are 530 life history samples from 28 species, 400 whole voucher specimens and DNA tissue samples have been obtained for 115 species, and 50 additional finclips for mahimahi DNA sampling were also collected. Three hundred gonad samples were provided to PIFSC for

preparation. In the CNMI and American Samoa, life history sample collection is still in its early stages. However, training was provided to 7 staff from these two island areas at a workshop held at the PIFSC Aiea laboratory by Cruz, David Hamm, and Robert Humphreys. At this workshop, standardized methodologies were established and how to adapt these methods to each island area were discussed.

Pacific Islands Regional Observer Program

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Regional Office

NOAA Sponsor: John Kelly, Kevin Busscher

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The Pacific Islands Regional Observer Program is managed through a fishery Management Plan developed by the Western Pacific Regional Fishery Management Council and approved by the National Marine Fisheries Service with the authority of the Magnuson-Stevens Fishery Conservation and Management Act, and the Endangered Species Act. The observer program provides high quality data on protected species interactions (sea turtles, marine mammals, and sea birds), catch composition, fishing effort, and selected fisheries research projects from commercial longline vessels based in Hawai'i and American Samoa. The data are collected at sea by fisheries observers. Fishery debriefers' primary purpose is to train observers and ensure the quality and integrity of data collected by observers through the debriefing process.

Figure 1. John Peschon participating at a debriefing conference in Cairns, Australia.

Progress during FY 2011

From July 2010 through June 2011 (reporting period), 409 observer trips were debriefed with 75 trips from the previous year also completed. Program staff members were placed on four research cruises to test different hook types. These tests were initiated as a result of the False killer whale Take Reduction Team recommendations. During the 2011 reporting period the program also participated and developed training modules for observer trainings and trained new observer trainers in the Republic of the Marshall Islands, Soloman Islands, Republic of Vanuatu, and the Republic of Kiribati. The program worked with the Forum Fisheries Agency (FFA) and the South Pacific Communities (SPC) in cooperation to develop and enhance these at sea fisheries monitoring programs and help with the development of observer data bases. In addition, the program hosted an observer debriefing workshop in Cairns, Australia to work with observer program managers from the emerging observer program in order to begin the process of observer debriefing and to begin establishing an observer debriefing corps. Program staff also presented papers at several American Fisheries Society meetings regarding sea birds interactions with commercial longline fishing vessels.

Figure 2. Cheree Smith teaching sea turtle identification during observer training in Vanuatu.

Pelagic Fisheries Research Program (PFRP): Program Management

P.I: Kevin Weng

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Manage the activities of the Pelagic Fisheries Research Program (PFRP), solicit and implement new research proposals, and promote science-based management of fisheries for highly migratory fisheries in the western Pacific Ocean.

Progress during FY 2011

- *Request for proposals*. No RFP was issued during 2011 because the funding was reduced such that the PFRP had no funds available.
- *Multi-year projects*. The PFRP was unable to fulfill its commitments to multi-year projects funded in prior cycles due to inadequate funding.
- *International collaboration in research on pelagic fisheries*. The PFRP continues to work with the SPCs Pacific Tuna Tagging Program (PTTP) to unify the analysis of data between PTTP and the Hawai'i Tuna Tagging Project 2.

The PFRP continues to support the ADMB Project, an international effort to ensure that the AD Model Builder software will be maintained in the future. (This software is used in over 200 fisheries management agencies for statistical modeling and assessment of fish population around the world; see http://admb-project.org/.

- *PFRP program manager*. The PFRP program manager contributed to: the Regional Ecosystem Advisory Panel (WesPac), April 2011; the Pelagics Plan Team (WesPac), April 2011; and a workshop on the interactions between tunas and seabirds (MCBI), Honolulu, May 2011. The PFRP program manager also gave a presentation on PFRP accomplishments to the NOAA office of Science and Technology in Silver Spring, MD, January 2011.
- *Visiting scientist program*. PFRP postdoctoral researcher Tim Sippel contributed to a number of stock assessment and other meetings including: Geostat 2010, Spain (geostatistical analysis using opensource software); International Scientific Committee Billfish Working Group, Honolulu, January 2011; International Scientific Committee Billfish Working Group, Taiwan, May-June 2011; WesPac, Honolulu, September 2010; and International Tuna Conference, Lake Arrowhead, May, 2011.

PFRP: ADMB Open Source Project

P.I.: John Sibert

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The general purpose of the ADMB Open Source Project is to assist the transition of the ADModel Builder software package from proprietary to free, open-source software. ADMB is currently used by all NOAA Fishery Science Centers to create stock assessment tools. The long term goal is to enable the long term support of this software through an active and committed group of user/developers located in laboratories and universities around the Nation and around the world.

Progress during FY 2011

The complete ADMB source code, Version 10.1, was publicly released. The source code and compiled binary objects for 12 different combinations of operating systems and compilers are currently available at http://admb-project.org/downloads. The ADMB Subversion repository is publicly accessible at http://www.admb-project.org/svn/. Work was begun on a programmer's reference guide that documents many of the numerous functions and specialized classifications in ADMB. The Reference Guide is available on-line at http://admb-project.org/documentation/api. The first ever ADMB Developers workshop was convened and produced many useful improvements to the source code. A second outcome of the workshop was to enlarge the base of active user/programmers committed to maintaining ADMB.

PFRP: Age and Growth of Striped Marlin, Kajikia audax Caught in the Hawai'i-based Longline Fishery

P.I.: Kevin Weng [Richard Keller Kopf]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Robert Humphreys

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Striped marlin are an important component of commercial longline fisheries in the Indian and Pacific Oceans and are a vital ecological resource as a top predator in the open ocean ecosystem. Approximately 4000 mt are harvested each year from the U.S. Western and Central Pacific Ocean but the sustainability of these catches are uncertain due to a lack of biological information pertaining to this species. This project proposes a study of the key age and growth characteristics of the population of striped marlin caught in the Hawaiian-based longline fishery in order to support stock assessment in this region. This research aims to develop a sex-specific age and growth model for striped marlin in the north-central Pacific Ocean based on previously developed and validated aging methods. The study will take advantage of previous collections of biological hardparts (dorsal fin spines and sagittal otoliths) provided by a collaboration with the Pacific Islands Fishery Science Center as well as current and on-going collections of these hardparts through Pacific Island Regional Observer programs. The expected outcomes this research are intended to provide length-at-age and growth rate information which are required to develop a stock assessment model for striped marlin in the north Pacific Ocean.

Progress during FY 2011

Progress against milestones are as follows.

- July 2010—Arrange import permits for shipment of samples to Australia and start monthly observer sampling regime. An important permit has been granted and dorsal fin spine and otolith samples have been imported. An observer sampling regime was initiated in January 2010 to collect dorsal fin spine 4, length, sex, and head sections from striped marlin caught in the Hawai'i based longline fishery.
- August 2010—Mail first shipment of fin spines and otoliths to Australia to begin processing and preliminary age estimation. The first shipment of samples was received in 2010 and processed in 2011.
- November 2010—Kopf and Humphreys meeting in Hawai'i to finalize aging methodology, project scope, sampling requirements, and attend annual meeting of PFRP. Meeting attended and presentation given in December 2010. Project scope agreed on with Humphreys and discussion held with NOAA stock assessment scientists.
- March 2011—Finish processing samples collected through December 2010. Completed (see below).
- April 2011—Undertake first reading and measurement of samples collected through December 2010. Dorsal fin-spines examined and measured of which 137 were suitable for age and growth analysis. Sub-sample of otoliths collected from head sections and preliminary age estimated conducted. Results presented in a preliminary von Bertalanffy growth curve in the July 2011 progress report submitted to the PFRP and NOAA stock assessment scientists.

• May 2011—Progress report due to PFRP and budget request for second year funding. Progress report submitted to PFRP in January 2011and July according to JIMAR timeline.

PFRP: Analyses of Catch Data for Billfishes (Istiophoridae)

P.I: Kevin Weng [JIMAR Project Lead: William A. Walsh]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Jon Brodziak

NOAA Goal(s)

• To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The goals of this project are to provide updated corrected catch histories and indices of relative abundance for istiophorid billfishes that correspond to the current management regime of the fishery (i.e., two sectors). Such indices should prove useful to the Stock Assessment Division at the PIFSC in billfish stock assessments.

Results with striped marlin should be available for use at the meeting of international scientists planned for December 2011 in Honolulu to develop a stock assessment, and a blue marlin stock assessment will also be initiated in the near future. Whereas previous work with marlins (Walsh et al., 2005; 2007) relied upon use of generalized additive models (GAMs), this project will include methodological improvements because both GAM and generalized linear model (GLM) analyses will be conducted with a longer time series to provide the relative abundance indices.

Analyses of catch data for both striped and blue marlins are predicated upon integrated use of fishery observer reports, longline logbooks, and commercial sales data. The observer records represent the data source previously used to fit GAMs according to methods described in Walsh et al. (2005; 2007). The logbooks represent the data to which fitted model coefficients are applied and the sales records are used to verify inferences regarding apparent qualitative or quantitative discrepancies between predicted and observed catches.

Progress during FY 2011

PFRP work done under this project in the last year consisted of standardizations of catch rates (catch per unit effort: CPUE) for oceanic whitetip and silky sharks. These data were collected by the Pacific Islands Regional Observer Program in 1995-2010. Although these are not billfishes, the statistical aspects of the analyses should prove similar. Specifically, both the billfishes and all sharks taken by this fishery, except blue sharks, comprise very small fractions of the catch. It was therefore deemed appropriate to evaluate the use of "zero-inflated" models, which are suitable for analysis of data with many zeroes. These zero-inflated models were compared to the more standard method, known as a delta-lognormal analysis. The following

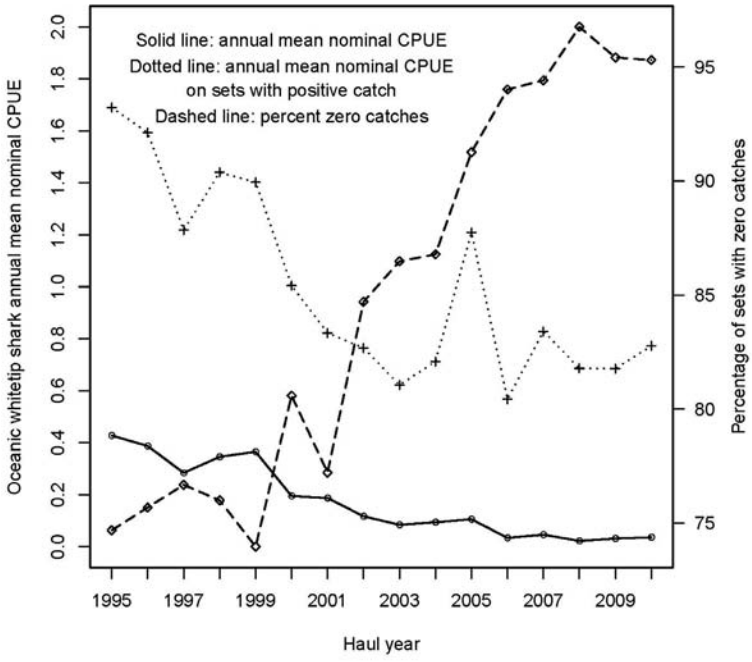


Figure 1. Oceanic whitetip shark nominal CPUE and percentages of sets with zero catches in the Hawaii-based pelagic longline fishery in 1995-2010. The solid line represents the annual mean nominal CPUE. The dotted line represents the mean annual nominal CPUE on sets with positive catch. The dashed line represents annual percentages of zero oceanic whitetip shark catches.

paragraph summarizes the results of this work.

This report presents descriptive statistical summaries and GLM analyses of catch data for oceanic whitetip shark *Carcharhinus longimanus* and silky shark *C. falciformis* in the Hawai'i-based pelagic longline fishery. This paper is a collaborative effort begun at the Secretariat of the Pacific Community (SPC) in New Caledonia and completed at the NOAA Fisheries PIFSC in Hawai'i. The data were collected by fishery observers aboard commercial vessels in 1995–2010. Oceanic whitetip shark mean annual nominal CPUE decreased significantly from 0.428/1,000 hooks in 1995 to 0.036/1,000 hooks in 2010. This reflected a significant decrease in nominal CPUE on longline sets with positive catch from 1.690/1,000 hooks to 0.773/1,000 hooks, and a significant increase in longline sets with zero catches from 74.7% in 1995 to 95.3% in 2010. Oceanic whitetip shark CPUE was standardized by delta-lognormal and zero-inflated Poisson GLM methods. The latter method was employed because 90.1% of the longline sets caught zero oceanic whitetip sharks. Four factors (16 haul years; calendar quarters; deep- and shallow-set fishery sectors; eight fishing regions) were significant explanatory variables in these analyses. Sea surface temperature was a significant continuous explanatory variable in a binomial GLM of the presence or absence of oceanic whitetip shark catches. The haul year effect coefficients from these models were used to compute indices of relative abundance. These time series were highly correlated, and each was also highly correlated with the time series of nominal CPUE. The silky shark catch data differed from the oceanic whitetip shark data in four major respects. The first was that nearly all silky sharks were caught on deep sets. The second was that most (62.5%) of the silky shark catch was taken from 0-10°N, although only 3.4% of the observed fishing occurred in those latitudes. The third difference was that sample sizes were very small before 2000. Finally, although 46.3% of the longline sets from 0-10°N caught zero silky sharks, 54.5% of the silky shark catch in these waters was taken on 11.5% of the longline sets, which caught ≥ 5 silky sharks. These differences led to use of the data from 0-10°N in the deep sector from 2000–2010 in the GLM analyses, which were fitted by delta-lognormal and quasi-Poisson (i.e., overdispersed) methods. These GLM analyses had low explanatory power. Silky shark CPUE has ranged from 0.034/1,000 hooks to 1.840/1,000 hooks, but with no significant trend. Therefore, it is concluded that the relative abundance of silky shark in tropical waters exploited by this fishery, particularly near the Line Islands, has remained fairly stable since 2000. This was not the case with oceanic whitetip shark, which has apparently undergone a highly significant decline in relative abundance in this fishery since 1995.

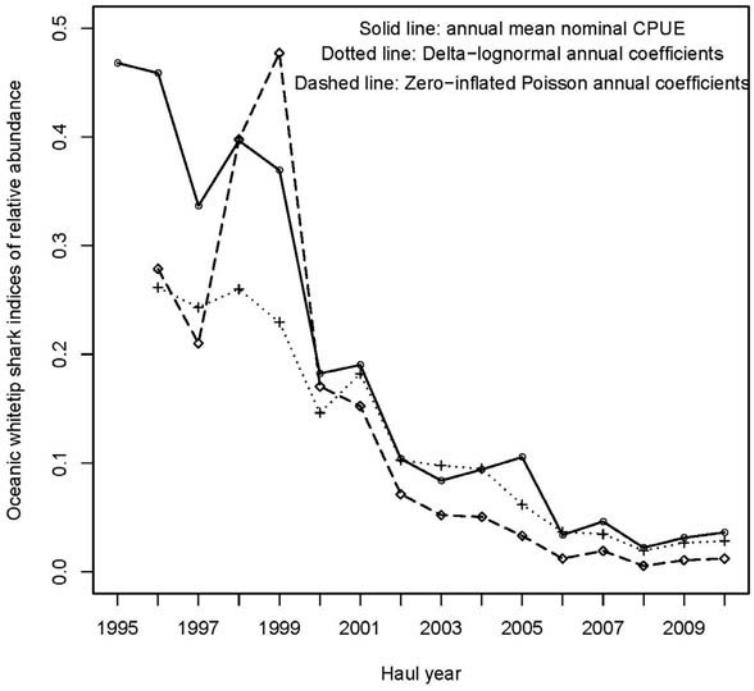


Figure 2. Annual indices of relative abundance from the delta-lognormal (dotted line) and zero-inflated Poisson analyses (dashed line) of oceanic whitetip shark CPUE in the Hawaii-based pelagic longline fishery in 1995-2010. The nominal CPUE trend (solid line) is included for comparison.

PFRP: Assimilating in situ Bioacoustic Data in a Mid-trophic Level Model and its Impact on Predicted Albacore Feeding Habitat in the American Samoa Waters

P.I.: Kevin Weng [Patrick Lehodey]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Réka Domokos

NOAA Goal(s):

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Pacific tuna stocks are facing increasing fishing pressure while also under the influence of natural variability and climate change. Nevertheless, the management of these species is still based on annual statistical stock assessment analyses—ignoring environmental and climate variability. There is a need for new complementary approaches for management that relies on the development of ecosystem end-to-end models integrating both natural and anthropological effects. Such models, which describe the spatial population dynamics of tuna in relation to their bio-physical environment (e.g., SEAPODYM, a basin-scale ocean model), require key information and parameterization of the forage for tuna, the Mid-Trophic Level (MTL) micronekton, which is one of the less known components of the ocean ecosystem. To optimize the parameters of the basin-scale SEAPODYM MTL sub-model, in situ micronekton biomass should be incorporated at all representative regions within an ocean basin. Therefore, this project undertakes the task of incorporating in situ multi-frequency bioacoustic data from four different regions of the Pacific Ocean into SEAPODYM-MTL with a rigorous mathematical method of data assimilation. The incorporation of data from these first four regions is instrumental in the development of SEAPODYM and will lead to massive improvements of the model in the future. Further, the impact of this new parameterization will be tested on the prediction of the feeding habitat and population dynamics of south Pacific albacore tuna in the Samoa region by comparison of model results to in situ data.

Progress during FY 2011

Shipboard surveys were conducted in March 2011 along the 158°W meridional from 22°45'N to 36°N and along the 161°W meridional from 31°30'N to 35°N to study the oceanography of the transition zone (TZ) between the subarctic and the subtropical gyres and the associated chlorophyll front (CF). Bioacoustics and current data (from an acoustic Doppler current profiler, ADCP) were collected continuously down to 1200 and 800 m, respectively, along with data from conductivity-temperature-depth (CTD) casts down to 1000 m depth, spaced at every 0.25°. Bioacoustics and CTD data have been processed and some preliminary analyses conducted. Results indicate that the TZ and the CF were very closely positioned along 161°W at approximately 32°N. However, further to the east (along 158°W) the TZ and CF split with the TZ moving to 31°N and the CF to 33°45'N. Interestingly, changes in micronekton characteristics along 158°W seemed to correspond to the CF, which is opposite from observations conducted in March 2009. Along 161°W, changes in micronekton characteristics, which were obtained from the acoustic backscatter, occurred at around 33°N, north of the TZCF. Along both meridional, micronekton backscatter decreased in intensity from south to north, while Chl-a, both from in situ and satellite measurements, increased. The depth of both the shallow and deep scattering layers decreased from 0-200 to 0-150 m and from 450-800 to 350-600 m from south to north.

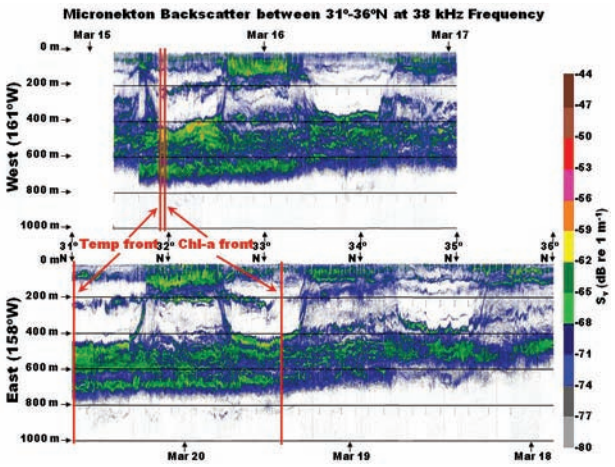
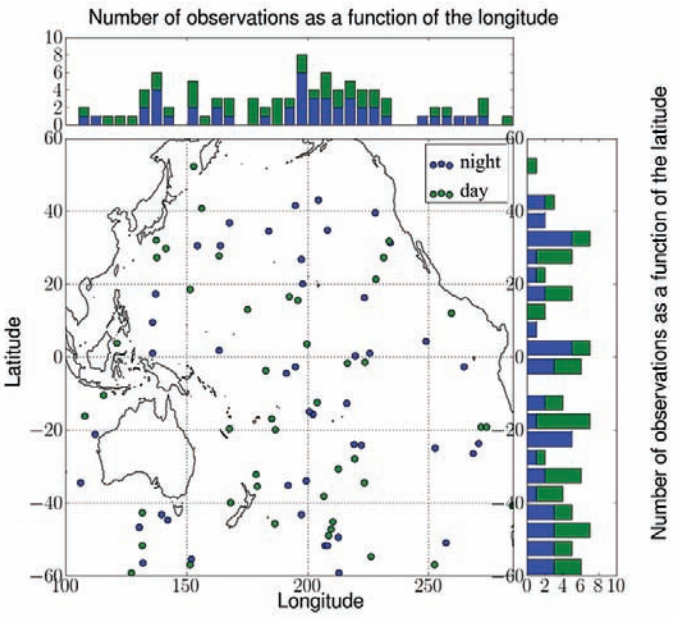


Figure 1. Micronekton backscatter between 31°N and 36°N at 36 kHz frequency.

Bioacoustics data from the March 2009 cruise to the TZCF are provided for model assimilation. Additional data are provided from colleagues of the CSIRO (Australia) for the Tasman Sea region. The 38 kHz full resolution acoustic data was converted for assimilation into NASC values proportional to fish biomass (MacLennan et al., 2002). Because the 38 kHz frequency signal is dominated by micronektonic organisms, the integration of NASC is believed to be representative of the total biomass of the six functional groups of the model. The energy transfer coefficients are optimized to fit the relative ratios of micronekton biomass (or NASC) between layers changing during day and night periods. These ratios are computed by integrating the NASC in space (in each cell grid of the model and in each layer) and time (during night-time and day-time, excluding transition periods). Then the values are scaled by the integrated value from the surface to the bottom boundary of the deepest layer of the model. The adjoint technique was used to optimize the model as described in Senina et al. (2008). Further modifications included a restart option in the optimization to avoid the spin-up at each evaluation of the cost function, and the options to compute sensibility analysis (using model predictions or likelihood), profiling (projection of the cost function in 2D), or the Hessian matrix. The code was validated by a derivative check, which is an approximation between analytical gradient and finite difference stay very low for at least two consecutive step sizes for all parameter, and twin experiments.

In a twin experiment, the initial parameterization of the model is considered as the truth. A set of pseudo-observations is extracted from these simulation outputs (Fig. 2). Then values of parameters are changed and optimization experiments run to check that the model converges towards the "true" (i.e., initial) parameter values (Fig. 2).



	"True" value	Twin experiment 1		Twin experiment 2	
		start	convergence	start	convergence
Epi	0.17	0.16	**0.17**	0.418	**0.17**
Meso	0.10	0.16	**0.0999998**	0.178	**0.10**
Mmeso	0.22	0.17	**0.22**	0.048	**0.22**
Bathy	0.18	0.17	**0.18**	0.116	**0.18**
Mbathy	0.13	0.17	**0.13**	0.076	**0.13**
Hmbathy	0.20	0.17	**0.20**	0.164	**0.20**
Calculation time (hour)			20.10		31.40
Maximal relative error			$2.0\ 10^{-6}$		0.00

Figure 2. Twin experiments to check the MTL parameters optimization approach using acoustic data assimilation. The map shows the random selection of pseudo-observations and the table gives the results after convergence of parameter values.

PFRP: Biological, Economic, and Management Drivers of Fishery Performance: A Global Meta-analysis of Tuna and Billfish Stocks

P.I.: Kevin Weng [Trevor A. Branch]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The purpose of this project is to: 1) describe the current status and trends in biomass and fishing mortality of tunas and billfishes around the world; 2) evaluate the association between biological, economic, and management characteristics and differences in current stock status; 3) measure the impact of different management actions on fishing mortality rates for stocks experiencing overfishing (Fmsy, the fishing mortality greater than that which would produce maximum sustainable yield); and 3) publish the results in the scientific literature.

Progress during FY 2011

This FY stock assessments for all available stocks of tunas and billfishes were compiled (20 stocks, eight species); biomass relative to biomass producing maximum sustainable yield was calculated (Bmsy); economic data on ex-vessel prices, and biological data on natural mortality, trophic level, generation length, regional fisheries

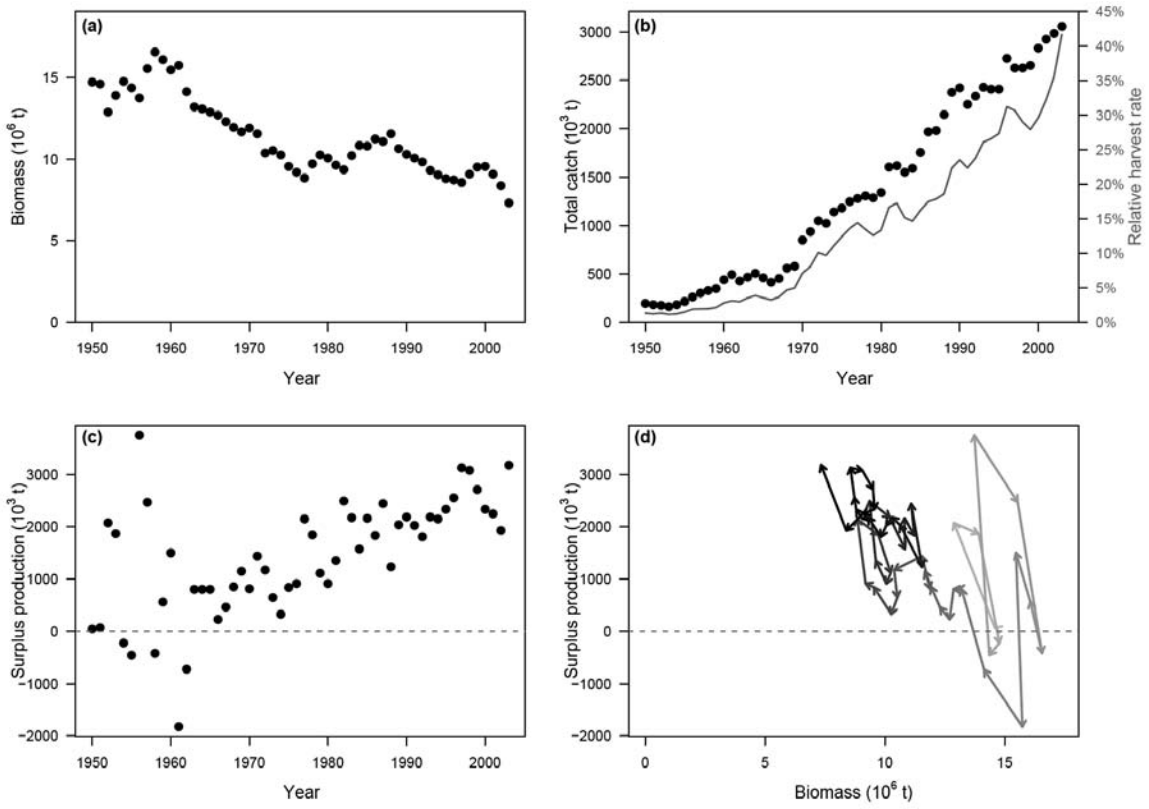


Figure 1. (a) Trends in biomass of all tunas and billfishes compiled; (b) total catch (circles) and relative harvest rate (gray line, catch relative to biomass index); (c) aggregate surplus production by year; (d) relationship between surplus production and biomass (light gray = earliest years). Note: all relations are draft and subject to change; "biomass" in this figure is a mixture of total biomass and spawning biomass, which needs revision.

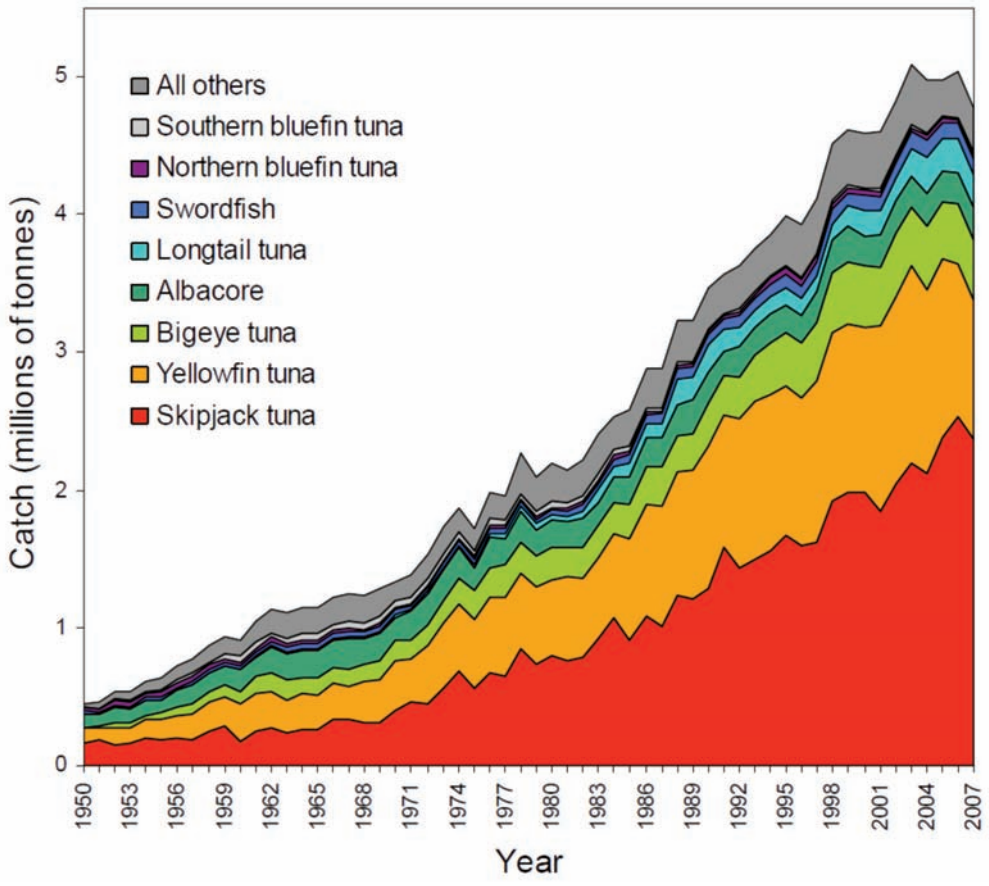


Figure 2. Catches of open ocean tunas and billfishes from the FAO catch database. Similar results are seen when catches in our stock assessment database are plotted.

management organization, maximum length, and other potential explanatory factors were compiled. The project is conducting analyses and checking with RFMO partners to make sure that all of the information is up to date, and preparing analyses.

There has been some slippage in the timeline for completion because two other research groups have projects similar to these proposed projects (one published as Collette et al., 2011, Science, doi: 10.1126/science.1208730). Therefore the plan is to expand this project beyond the initial proposal to include additional and more advanced analyses, including the estimation of lost yield due to underfishing and overfishing.

PFRP: Biology and Habitat Use of Monchong (*Eumegistis illustris*) at Cross Seamount, Hawai'i

P.I: Kevin Weng

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Monchong is a generic local name given to two deep water pomfret species—the sickle pomfret, *Taractichthys steindachneri*, and the lustrous pomfret, *Eumegistis illustris*. The sickle pomfret is a common incidental catch in

pelagic longline fisheries throughout the North Pacific. The lustrous pomfret exhibits fidelity towards deep slope or seamount habitats and are generally caught by short-line or handline. Both monchong species are valued by Hawai'i seafood wholesale and processing firms who have successfully promoted it in the fresh market and restaurant trade. These species have become an increasingly important component of local Hawai'i fisheries in terms of commercial fishery landings and sales in recent years. In the case of the lustrous pomfret, most of the catch occurs at Cross Seamount, a smallish seamount 8 km in diameter at the summit located 290 km south of Honolulu. Concerns over the sustainability of current pomfret removal rates with respect to recruitment from this limiting habitat have prompted the Western Pacific Regional Fishery Management Council, in coordination with PIFSC, to launch an investigation into expanding knowledge of pomfret life history and ecology. This monchong study will occur in conjunction with the Hawai'i Tuna Tagging Project 2, a PFRP-funded project that is an integrated component of a Pacific wide tuna tagging and assessment program being implemented by the Secretariat of the Pacific Community, Pacific Tuna Tagging Project (PTTP). Tagging programs are widely recognized as important tools for understanding the population dynamics, dispersal patterns, and fisheries interactions of fish populations and produce additional data inputs necessary to improve stock assessments and predictive models.

Progress during FY 2011

Cruise to Cross Seamount conducted aboard *F/V Hoku*, Captain Bruce Fukuda, April 2011. During this cruise the project recovered the acoustic listening stations, downloaded data, replaced batteries, and redeployed them. In addition, 19 monchong were tagged using acoustic transmitters. During the same cruise, 500 bigeye tuna were tagged with plastic dart tags, contributing to the Hawai'i Tuna Tagging Project 2.

During three cruises in 2010, 15 monchong were tagged with acoustic transmitters. Twelve of these fish were recorded on the listening array (downloaded April 2011). Three fish showed a large number of detections (between 6000 and 55000 detections), revealing greatest residency in the center of the seamount plateau, with the greatest number of movements between stations on the eastern half of the plateau. Fish tended to move in a clockwise direction around the plateau.

PFRP: Biotelemetry Tag Retention in Pelagic Tuna

P.I: Kevin Weng [Todd Jones, Michael Musyl, John Wang]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The purpose of the project is to study the drag, lift, and torsion of pop-off satellite tags (PSATs) in order to increase retention times of the tags in large pelagic fish. The median retention time for PSATs in bigeye tuna is nine days (range: 1-36). PSATs cost upward of several thousand dollars with battery life intended for year deployments. Using force transducers and a tow tank capable of speeds greater than 5 m s^{-1} and accelerations up to 9 m s^{-2} we will determine the forces involved in unseating the anchor head, which is typically inserted into the base of the dorsal fin between the pterygiophores. The unseating of the anchor head leads to premature ejection of the tag and possibly to misinterpretation of the data.

Progress during FY 2011

Several different tags from Microwave telemetry, Wildlife Computers, and Desert Star have been tested to date. Mock tags of differing shapes were also tested to look at drag reducing measures. The tags have been tested through speeds of 0.5 m s^{-1} to 8.5 m s^{-1} and at accelerations ranging from 1.6 to 9 m s^{-2}. The present data suggest that the burst speed and quick acceleration of pelagic fish may be leading to the early ejection of PSAT tags. A preliminary report on two types of PSAT tags (MK10 and X-tag) has been submitted to PFRP.

PFRP: Descriptive Assessment of Traditional and Small-Scale Fisheries in the Western Pacific

P.I.: Kevin Weng [Edward D. Glazier]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This project involves the collection, compilation, synthesis, analysis, and reporting of existing and new information regarding small-scale and traditional fishing fleets and activities across Hawai'i, the Commonwealth of the Northern Marianas, Guam, and American Samoa. The project will result in an empirically based descriptive assessment of those small-scale fisheries in the study region that are not clearly or entirely commercial or recreational in nature. The ultimate intent of the work is to improve the quality and quantity of data available for purposes of fishery management and as potentially needed for determination of equitable annual catch limits or other small boat fishery management strategies across the region.

Progress during FY 2011

Fieldwork in the Northern Marianas and Guam was completed during the first two quarters of FY 2011 as projected in the project proposal. Samoa fieldwork is in progress. Hawai'i fieldwork is in progress.

Figure 1. (top right) Scene at the Guam Lunar Festival 2010.
Figure 2. (bottom right) Day's End, Saipan 2010.

PFRP: Early Life Stage Dispersal of Yellowfin Tuna (*Thunnus albacares*) in the Central North Pacific

P.I.: Kelvin Richards [Claire Paris]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The purpose of this project is to understand larval dispersal patterns of yellowfin tuna (*Thunnus albacares*) in the Hawaiian Region. The project is investigating the early life stage movement of yellowfin tuna—quantifying

the degree of larval self-retention in the Hawaiian region and export to or from other tropical regions of the Pacific—and thus providing supplemental information on the origin of yellowfin tuna to Hawai'i fisheries that is vital for local-scale management. This is accomplished by incorporating the output from a three-dimensional model that simulates ocean circulation (HYCOM) into a biological model (BOLTS) that depicts adult spawning strategies, larval development, behavior, and dispersal (Paris et al., 2007). This allows the characterization of larval dispersal pathways in the Hawaiian archipelago, and we are investigating how these patterns vary across years and over ecological time scales relevant to the management of pelagic resources. In summary, this project fills a gap in the understanding of marine population dynamics in the study area, while having the potential to improve stock assessment and fisheries management.

Progress during FY 2011

During FY 2011 the project set up, ran, and performed sensitivity analysis with BOLTS, using both velocities from the global and regional implementations of HYCOM. The following parameters were tested: a) number of released larvae; b) interval of release; c) mortality; d) diffusion coefficient; e) pelagic larval duration; f) time of release; and g) depth of spawning (considering 2D displacement). Such tests were fundamental to verify if the model reached stability and is capturing the scales of flow variability. Hydrodynamic outputs from the regional and global HYCOM were linked to observations. Researchers also investigated how changes to the physical environment can affect larval dispersal and connectivity patterns around the Hawaiian Islands. They did this by comparing the connectivity patterns for the Main Hawaiian Islands given by the global HYCOM and the regional

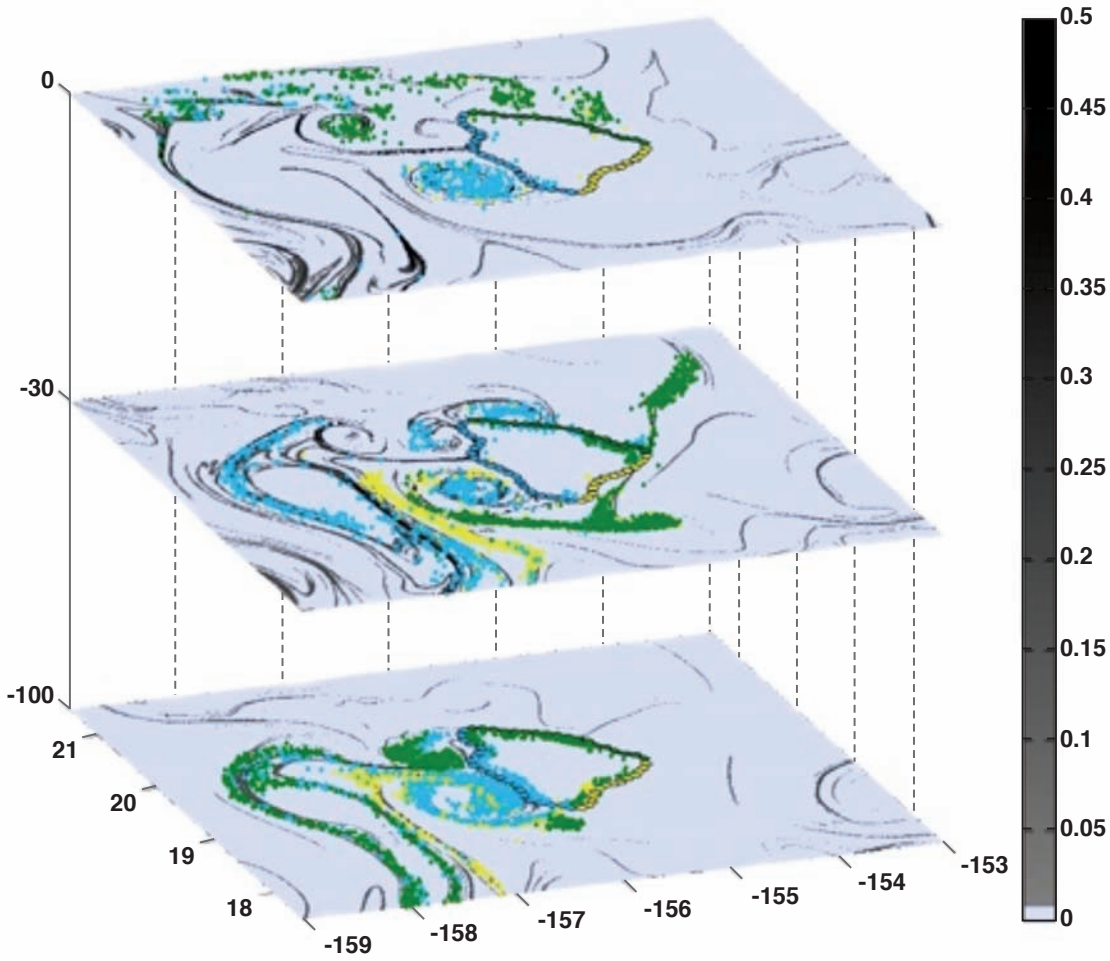


Figure 1. Finite Size Lyapunov Exponents (days-1) and larvae positions for surface, 30, and 100 meters from the regional HYCOM for August 9. FSLEs were calculated backwards for 30 days. Larvae were released on July 18 and advected for 23 days.

Figure 2. Connectivity for the Big Island from June 2009 to May 2010, showing the major flows observed for each region for the global (faded color) and regional (stronger color) HYCOM at surface.

HYCOM forced with local winds, for the period from May 2009 to December 2010. The differences indicated the importance of local wind forcing in producing variable flow conditions that affect the dispersion properties of larvae.

The project also characterized the Lagrangian Coherent Structures in the flow for May 2009 to March 2010. The locations of the unstable and stable manifolds were estimated by computing the Finite Size Lyapunov Exponents (FSLE). This was done to understand the underlying mechanisms that provide pathways as well as barriers to the transport of larvae. The results of these experiments resulted in two symposium presentations and researchers are finalizing a manuscript with the major findings for publication. This analysis allowed them to address the following outcomes. 1) Using the regional HYCOM the project determined the non-persistence of transport barriers, and their seasonal variability (Hypothesis H1). 2) The comparison of connectivity matrices and larval dispersal pathways with the location of LCSs verified that barriers can influence the larval transport between spawning and retention sites of yellowfin (Hypothesis H2).

PFRP: Examining Pelagic Food Webs using Multiple Chemical Tracers

P.I.: Jeffrey C. Drazen, Brian Popp [Peter Nichols, Charles Phleger]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Middle trophic level organisms (namely macroplankton and micronekton) are the decisive link between primary producers and top predators as well as food items of many commercially important pelagic predators. However, the trophic dynamics of many macroplankton and micronekton are poorly known. Consequently, fishery models and ecosystem-based management decisions would benefit greatly from detailed information on the trophic dynamics of these organisms in the pelagic environment. The project uses multiple chemical analyses (bulk stable isotopes, compound specific isotopes, lipid biomarkers, and mercury concentrations) in conjunction with supplementary stomach content analyses to characterize the pelagic food web, incorporating organisms from primary producers to top predators in waters surrounding the Hawaiian Islands. The specific objectives are: 1) to evaluate variation in diet amongst commercially important top predators and amongst major taxonomic and ecological groups of middle trophic level pelagic animals; and 2) to determine major trophic connections between epipelagic, mesopelagic, and bathypelagic habitats and communities.

Results from this project will increase our understanding of trophic connectivity between the forage base and top predators and further elucidate the structure and variability of pelagic food webs, which is necessary information for ecosystem-based managers and ecosystem modelers.

Progress during FY 2011

The project has met all of the target goals for this second year of the project, which principally included additional sample collection and laboratory analysis of the collected samples. To improve sample collection efficiency a $10m^2$ Tucker trawl was purchased and researchers fished this net off of Oʻahu to collect over 400 individual small fishes, shrimps, cephalopods, and gelatinous plankton representing 98 pelagic species. In addition to mid-trophic

level animals, size fractionated zooplankton and samples of particulate organic matter were collected at different depths. Many top predator samples (tunas, billfish, sharks, opah, escolar, etc.) have been collected through the Hawai'i Longline Observer program and opportunistically from local fisherman. Laboratory work has included stomach content analysis of large predators, stable isotope (including amino acid specific) analysis of top predators and small micronektonic fishes, and fatty acid profile analysis of a suite of top pelagic predators.

Stomach content analysis of deep living predators including opah, lancetfish, escolar, and snake mackerels has described the diet of three of these species for the first time. Opah consume many more cephalopods than the lancet fish, which predominantly eat hatchetfishes, salps, and hyperiid amphipods (which live inside the salps). The lancetfish diet is a surprise given their enormous gape and large dagger-like teeth. The snake mackerel and escolar stomachs analyzed only contained bait and a few cephalopod beaks. These samples are treated as the other species and there are no signs of regurgitation in whole specimens. Thus it appears that these animals either feed infrequently and/or have much greater digestive rates. Particularly interesting was that lancetfish and opah both consume a large amount of plastic. Based on lab tests the plastic is positively buoyant suggesting that these fishes feed in part at or very near the surface. Tagging studies of opah suggests a minimum depth of 50m, in contrast to this suggestion. It may also be possible that biofouling causes the plastic to sink and hence enters deep water food webs, which has not previously been described.

The larger mesopelagic predators including lancetfish, snake mackerals, esoclar, bigeye and yellowfin tuna, swordfish, and mahimahi have been analyzed for fatty acid (FA) biomarkers. These results suggest that the deeper foraging species have a distinct FA profile and diet compared to more shallow feeding species, as expected. Another trip to work with our collaborators in Australia will provide FA profiles of prey which will help to more specifically identify which prey types are most important to each predator.

In a collaborative project with scientists at five other institutions worldwide the project examined the trophic positions of abundant and common mesopelagic micronekton globally. The goal was to elucidate the biochemical and ecological mechanisms responsible for bulk tissue nitrogen isotopic variability in two groups of important mesopelagic fishes (lanternfishes—Family Myctophidae, and dragonfishes—Family Stomiidae) sampled from five geographically widespread oceanographic regimes. Using stable nitrogen isotopic compositions of individual amino acids, the trophic position (TP) of these fishes was quantified and showed that despite great nitrogen isotopic variability in bulk tissue, TPs are consistent for both groups of fishes across all oceanographic regimes. Differences in the nitrogen isotopic values of phenylalanine ($\delta^{15}N_{phe}$) and bulk tissue $\delta^{13}C$ values confirmed that bulk tissue $\delta^{15}N$ values were the result of region-specific biogeochemistry controlling isotopic values at the base of the food web. This isotopic variability in phytoplankton is inherited by the fish consumers and can lead to confounded interpretation of TP derived from bulk tissue $d^{15}N$ values and create difficulty in making regional comparisons. Calculated lanternfish TPs aligned with previous expectations from stomach content (SC) studies, which describe these fishes as strict zooplanktivores (TP ~3). However, dragonfish TPs estimated based on amino acid isotopic analysis in this study were lower than previous ecological expectations based on SC studies. These SC studies suggest that dragonfishes are piscivorous across all regimes. In contrast, the project's TP estimates suggested that dragonfishes are more similar to lanternfishes and are not strict piscivores. These results suggest that diet studies have overestimated the TP of these fishes with implications for food-web structure and function. The results also provide a clear method to intercalibrate bulk isotope results across ecosystems for global comparisons.

PFRP: Hawai'i Tuna Tagging Project 2

P.I.: Kim N. Holland [David Itano, Kevin Weng]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

To elucidate the movement patterns, fisheries (harvest) patterns, and biology (growth rates, mortality rates, etc.) of the three primary tuna species (yellowfin, skipjack, and bigeye) that underpin coastal fisheries in the

Main Hawaiian Islands. The project is an official "Sub-Regional Project" of the ongoing tagging program of the WCPFMC and data will be shared with this agency.

Progress during FY 2011

A modest level of tagging activity was achieved during the reporting period, although access to the main tagging platform, the pole and line vessel Nisei, has proved problematic due primarily to low fishing activity by this vessel and the reluctance of the captain (n.b., not the owner) to accommodate scientific personnel during periods of slow fishing. Recent negotiations indicate that the situation will improve considerably in the very near future (see below). Tagging was conducted on an opportunistic basis from the *R/V Opah* around Oʻahu FADs and from the *F/V Hoku* during acoustic tagging excursions to the Cross Seamount. In the reporting period, 455 bigeye tuna, 167 yellowfin, and 75 skipjack were tagged around Oʻahu and at Cross Seamount. The recapture "hotline" is monitored daily and recaptures are being reported, which indicates that the program's infrastructure is working as intended.

Limited access to the pole and line vessel Nisei has made a significant negative impact on the number of fish released around Oʻahu. Unfortunately, Nisei is the only remaining pole-and line vessel on Oʻahu. However, recent four-way negotiations involving the vessel owners, the vessel captain, United fishing Agency representatives, and this project's scientific personnel indicate that access to the vessel will be facilitated in the future and it is reasonable to expect that tagging activity will greatly increase over the next few months.

PFRP: Impacts of Fishing on Vulnerable Non-target Species at Seamounts

P.I.: Kevin Weng

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Seamounts have extraordinary levels of endemism and exert a powerful aggregating effect on species, attracting fishes, cetaceans, seabirds, and turtles. Only a few of the world's 100,000 seamounts have been explored, leaving us with a minimal understanding of the biology of seamount organisms. Despite this, seamounts experience intensive fisheries, and interviews of commercial fishermen in Hawaiʻi reveal frequent catches of bentho-pelagic sharks. As a result, the Western Pacific Fishery Management Council and NOAA are responsible for the management of species that are potentially endemic, highly vulnerable to fishing, so poorly understood that they cannot be assessed, and for which no definitions of essential fish habitat (EFH) exist. While seamounts have been hypothesized as stepping-stones, it is unclear if seamount sharks are isolated populations or if they move between seamounts and landmasses. Deep set longline fishing will be conducted at Cross Seamount to characterize the elasmobranch community. Detailed studies will be conducted for the three highest trophic level bentho-pelagic elasmobranchs: the Cooke shark (*Echinorhinus cookei*); the sixgill shark (*Hexanchus griseus*); and the sleeper shark (*Somniosus pacificus*). A combination of acoustic, satellite, and accelerometry technologies will be used to characterize their behavior, habitat use, and connectivity with other seamounts and islands. The resulting data will allow definitions of EFH and determination of appropriate management units. The proposal includes a low risk-high reward component, using established methods on new species; as well as a high risk-high reward component, that aims to develop a novel method to study these deep water animals.

Progress during FY 2011

- *Characterization of bentho-pelagic elasmobranchs.* During project cruises to Cross Seamount researchers have been unable to capture bentho-pelagic sharks. Additional cruises and increased targeting of these animals will be conducted in the future. In order to refine their techniques researchers have been testing fishing, tagging, and sampling methods in waters near Oʻahu. They have sampled tissues from a number of bluntnose sixgill

sharks and deployed one popup satellite tag. This popup satellite tag did not report. They plan to continue this testing program and deploy miniPAT satellite tags.

- *Determination of fine-scale habitat use.* During 2011 the acoustic monitoring array was downloaded. Because researchers had been unable to place acoustic transmitters in sharks on prior cruises, the array did not contain data for these species, though it did collect data on other species in related research programs.
- *Determination of connectivity and long-range movements.* VR2 listening arrays on the Main Hawai'i Islands and North West Hawaiian Islands continue to be maintained by University of Hawai'i researchers, such that inter-island movements might be detected. Satellite tagging is planned for upcoming cruises.
- *Studying foraging behavior to reduce by-catch.* The Daily Diary accelerometer was to have been housed for use in deep water by the developers at Swansea University, UK. They have been unable to develop a deep water version of the daily diary tag. In the interim, the project is exploring the possibility of developing a small accelerometer that could withstand the depths occupied by deep water elasmobranchs.

PFRP: Improved effectiveness of WCPFC through better informed fishery decision maker

P.I.: Kevin Weng [Simon Hoyle, Fabrice Bouye, Shelton Harley]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

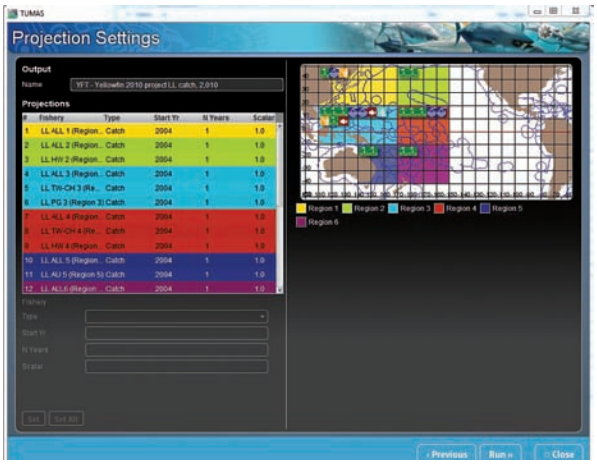
The purpose of this project is to develop a tool that will allow WCPFC decision makers to interact directly with stock assessments, and observe how alternative management strategies may affect both them and other interested parties. This application will: a) help decision makers to become familiar and comfortable with the stock assessment's predictions; b) allow decision-makers to explore a greater range of management options than they can at present, including those they see as more relevant to them; c) allow decision makers to discuss potential outcomes, and compare alternative strategies, with their industry representatives; and d) allow each group to see how the various options they are considering may affect them and the parties they negotiate with by providing a greater and more relevant range of outputs.

Figure 1. The project web page at http://www.tumas-project.org, where TUMAS can be downloaded.

Progress during FY 2011

Work on this project continued in FY 2011. The project is due to finish in February 2012. The following objectives have been met this year.

- Trained and supported participants, or demonstrated application, and obtained feedback from SPC-GEF stock assessment training workshops in 2010, December PFRP meeting, FFA management options meetings, and the Western Pacific Fisheries Management Council. Application used by WPFMC in early 2011 to examine management options.
- Developed installation wizard.
- Developed automatic update features, via website.
- New features allowed the user to choose the species and model run.



(left) Figure 2. The welcome screen for the TUMAS software. (right) Figure 3. The projection settings screen TUMAS software, where the future catch and effort can be adjusted.

- Update provided options for exporting graphs and tables to excel, pdf, and image formats.
- Set up web-based support, e.g., Frequently Asked Questions and e-mail technical support.
- Produced user manual, which is available online.
- Released application via website http://www.tumas-project.org, and publicized in March 2011.
- Trained and supported participants at 2011 SPC-GEF stock assessment training workshops. TUMAS was placed at the center of the advanced workshop and used over three days for training exercises.

PFRP: Integrating Conventional and Electronic Tagging Data into the Spatial Ecosystem and Population Model SEAPODYM

P.I.: Kevin Weng [Inna Senina, Francois Royer, Patrick Lehodey]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
- To understand climate variability and change to enhance society's ability to plan and respond

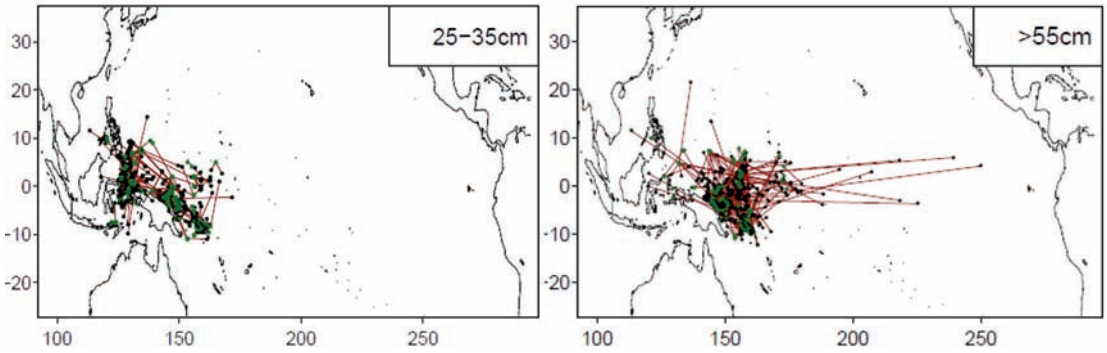
Purpose of the Project

The purpose of the project is to integrate conventional and electronic tagging data within SEAPODYM habitat-based population dynamics model. It is proposed to develop a fully operational model allowing assimilation of both fishing and tagging data, and to validate it by performing two case studies, with a focus on Pacific skipjack and yellowfin tuna populations.

Progress during FY 2011

The tasks and planned activities for Year 1 of the project were as follows.

• *Compilation of tagging datasets for skipjack and yellowfin tunas and preparation of the data in the format for SEAPODYM.* NIFSF provided two datasets. The first contained detailed fishing data from pole-and-line vessels, aggregated in 0.25 degree and one week resolution. The second contained conventional tagging data. SPC collaborators also provided us with conventional tagging data collected from campaigns covering the 2006-2011 time period. Yellowfin data are available for longer period starting from 1998 and larger spatial domain including releases in the Eastern Pacific ocean. Some detailed fishing data are available, and a complete dataset containing high resolution fishing data is under preparation.



Example of skipjack conventional tagging data (2006-2011) aggregated into cohorts by size for the use in SEAPODYM. Note that for the cohort of smaller tunas (25-35cm) the time at liberty not greater that 120 days was set to show only the tags, which belong to the cohort. The number of tagged tuna of 25-35cm and larger than 55cm are 563 and 640, respectively. The mean displacements are 170nmi and 300nmi and standard deviations are 238 and 525, respectively.

All tagging data were first compiled into a single dataset in the format required by SEAPODYM. This format allows easy extraction of tagging records by size cohorts and by season. Aggregation into size (mapped into age) cohorts is necessary for incorporation of tagging data in age-structured SEAPODYM so that the information about movement at size shown by the tags can be directly used for estimation of habitat parameters (see Fig. 1).

• *Development and implementation of the method for assimilation of tagging data, both electronic and conventional.* Two different methods for estimating SEAPODYM parameters from tagging data were implemented and successfully tested with electronic and/or conventional tagging data: 1) tagged cohort simulator (based on both electronic and conventional tags); 2) predicting preferred habitat from residence time computed directly from electronic tagging data. Both methods were validated with actual (not artificial) datasets on smaller domains. A third method, consisting in estimation of movement fields from conventional tagging data, is still under development. The project plans to publish a manuscript that describes and compares all three methods used with SEAPODYM.

• *Preparing physical and biogeochemical forcing, MTL outputs and overall model configuration.* High-resolution data—biogeochemical (VGPM), physical, and biological forcing (MERCATOR-SEAPODYM)—were prepared for the entire Pacific Ocean domain on a resolution of ¼° x 7 day and the period 1998-2010. Extensive comparisons with other forcing datasets and available observations (climatology) were done in order to validate environmental data.

PFRP: Integrating Electronic and Conventional Tagging Data into Modern Stock Assessment Models

P.I.: Kevin Weng [Simon Nicol, Mark Maunder]

NOAA Office (of the primary technical contact): National Marine Fisheries/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Pierre Kleiber

NOAA Goal(s)

• To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Extensive electronic and conventional tagging data sets exist for tuna species; however, the information available is not fully utilized in the tuna stock assessment models. The project aims to maximize the utilization of movement information contained in tagging data. It is based on the four key elements of the tagging data that could directly or indirectly inform stock assessment and management advice: analysis of horizontal movements for estimation of movement parameters (both conventional and electronic tags); direct estimation of movement parameters from other models; conversion of movement parameters estimates into block-transfer rates that are used in

Multifan-CL and Stock Synthesis; and incorporation into stock assessment models through one or more priors. Stock assessments undertaken in 2012 are expected to benefit from this development thereby assisting Regional Fisheries Management Organizations with the sustainable management of tuna resources.

Progress during FY 2011

The contracts between the University of Hawai'i and the Secretariat of the Pacific Community were finalized in February 2011. Since finalization the project Principal Investigators have undertaken the necessary project planning and are preparing for a workshop on the topic in October 2011.

PFRP: Integrative Modeling in Support of the Pelagic Fisheries Research Program: Spatially Disaggregated Population Dynamics Models for Pelagic Fisheries (PFRP Modeling Project)

P.I.: Kevin Weng

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The general objective of this research is to integrate the results of different components of the Pelagic Fisheries Research Program (PFRP) into a consistent framework that integrates knowledge of fish movement and population dynamics, the fishing process, economics and oceanography. The primary focus is the development of spatial models of pelagic fish population dynamics that explicitly include movement, mortality, and fisheries. The work emphasizes collaboration with other PFRP projects. The specific objectives were to continue, improve and maintain the movemod diffusion and advection modeling software, and run the movemod model with new and existing data sets.

Progress during FY 2011

Dr. Tim Sippel has been working on utilization of a database to standardize electronic tagging data storage and formats, which was developed by colleagues in California (www.tagbase.org). The purpose is to facilitate more efficient data analysis that has broad appeal, including for projects like the PFRP Modeling Project. Johnoel Anchetta from PFRP plans to contribute to the database framework as well.

Dr. John Sibert worked with Drs. Inna Senina and Patrick Lehodey (CLS, France) to apply the PFRP-sponsored SEAPODYM spatial ecosystem model of tuna population dynamics to the evaluation of space-based policies for conservation of bigeye tuna in the equatorial purse seine fishery. PFRP graduate student Eun Jung Kim (University of Hawai'i, Oceanography Department) continued development of a model to quantitatively capture the effects of fish aggregating devices (FADs) on the movement of skipjack tuna population. This model had been successfully tested in simulation. Additional work by Kim is underway to compute estimates of drifting FAD density in the WCPO using particle tracking software.

Skipjack, yellowfin, and bigeye tagging and fishing effort data from the Secretariat of the Pacific Community were updated through 2010. The new data are aggregated at both 1° and 0.5° resolution.

The current movemod source code is available on the PFRP subversion repository. Plans for creating an open-source project to maintain the movemod software were put on hold for want of financial support.

PFRP: Ocean Acidification Impacts on Tropical Tuna Populations

P.I.: Kevin Weng [Simon Nicol, Dan Margulies, Vernon Scholey]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The unaccounted impacts of ocean acidification (and warming) upon tuna stocks in the Pacific (and globally) represent a serious risk to the achievement of sustainability based management objectives for both Regional Fisheries Management Organizations and for the policies of sovereign states responsible for tuna fisheries management in the Pacific region. Research has demonstrated that the early life history stages of some fish species (and numerous other marine organisms) are sensitive to ocean acidification levels that are projected to occur by the end of this century. Those findings have significant implications for future recruitment success and population levels for those species. This project aims to elucidate the impacts of projected ocean acidification levels upon processes and life history stages of yellowfin tuna (Thunnus albacores) that are considered critical to recruitment success: sperm motility; fertilization rates; embryonic development; hatching rates; condition; development; growth; and survival in pre- and post-feeding larvae. The outputs from this project will reduce uncertainty regarding future stock trends as provided to tuna Regional Fisheries Management Organizations in the Pacific, increasing the likelihood that these organizations can make decisions that ultimately achieve sustainability based management objectives.

Progress during FY 2011

The contracts between the University of Hawai'i and the Secretariat of the Pacific Community were finalized in February 2011. Since finalization the project Principal Investigators have undertaken the necessary project planning and are preparing for laboratory trials to commence in the Achotines Laboratory of the Inter American Tropical Tuna Commission in September 2011. All equipment necessary for these trials has been purchased.

PFRP: The Role of Social Networks on Fishermen Economic Performance in Hawai'i's Longline Fishery

P.I.: PingSun Leung [Shawn Arita]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley [Stewart Allen]

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This project seeks to examine the role of social network capital on vessel economic performance in the Hawai'i longline fishery (HLF). With an ethnically fragmented participation structure, the HLF offers an interesting case to examine social network capital effects. The research framework combines two methodological tools—social network analysis (SNA) and stochastic production frontier/econometric analysis. Researchers intend to collect detailed information on social linkages in the HLF and perform a SNA on the HLF. After constructing appropriate sociometric measures of Social Network Capital, they will then estimate its economic returns for longliners. The project may be outlined by the following three phases: 1) data collection of social linkages in the HLF/fishermen interviews; 2) mapping of SNA data and analysis of individual and group level measures of social network capital; and 3) econometric estimation of the return to social network capital on vessel economic performance.

Progress during FY 2011

It should be noted that the project officially began in October 2010. The goal of FY 2011 was then to make progress on the first stage of data collection for the social linkages in the HLF. This includes the development of a SNA survey instrument and commencement of administration of fishermen interviews.

• *Objective 1—Development of SNA survey instrument.* The project successfully developed a survey instrument that could be used to measure the social linkages for members of HLF and their individual social capital. Three separate surveys were designed for vessel owners, vessel captains, and owner-operators. The surveys were carefully tailored to ensure that they would collect the data required by the project's social network analysis and subsequent econometric exercise. A pilot test was also conducted to make sure the questions could be well administered to the fishermen.

• *Objective 2—Commencement of fishermen interview administration.* A field team was assembled to handle the fishermen interview administration. A graduate student at the University of Hawai'i, Manoa was selected to manage the team of one native Vietnamese speaker and one native Korean speaker, who were both contracted as enumerators for the ethnically diverse HLF. The interviewing exercise is currently ongoing and initial responses look very promising. The field team immersed themselves well in the HLF and has received positive feedback from the fishermen. Up until this point project researchers have successfully interviewed the following breakdown of HLF vessels: 30 Caucasian (non-Korean/Vietnamese) vessels; 9 Korean vessels; and 12 Vietnamese vessels. They intend to complete the remaining targeted interviews by September 2011.

Protected Resources Environmental Compliance Initiative

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Regional Office

NOAA Sponsor: Michael Tosatto, Alecia VanAtta

NOAA Goal(s)

• To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The goals of the project are to: develop and implement strategies to further recover marine species protected under the Endangered Species Act (ESA) and /or the Marine Mammal Protection Act (MMPA); conduct section 7 consultations under the ESA; revise and maintain the marine mammal stranding program to fulfill mandates of the MMPA; assist in the analysis and procedural requirements to manage federal fisheries in compliance with the ESA and the MMPA; and develop and deliver outreach and education campaigns for the public concerning protected resources issues.

Progress during FY 2011

The objectives established for this period included: 1) sea turtle conservation, management and fisheries related mitigation activities within the PRECI; 2) coordinating and building capacity for Hawaiian monk seal and stranded cetacean response on Maui; 3) coordinating and building capacity for Hawaiian monk seal and stranded cetacean response in the Pacific Islands Region; 4) and assisting in outreach and education missions by managing and developing outreach programs, materials and activities, and creating partnerships with other federal and state agencies and non-profit organizations

JIMAR Protected Resources Division (PRD) International Turtle Conservation and Management Liaison, Karen Frutchey, served through mid-September 2010 as Logistics Coordinator for marine turtle egg relocation response efforts resulting from the Deepwater Horizon oil spill. Karen trained several Florida permit holders on egg relocation techniques and assisted with relocation of several marine turtle nests and supervised work of many contractors, government employees, and volunteers. As U.S. territory lead, Karen participated in the Mariana Archipelago Green Turtle Workshop. While attending this meeting, she discussed progression of turtle conservation and management concerns with PIRO funded project stakeholders from the Commonwealth of the Northern Marianas (CNMI), Guam, and American Samoa. Karen participated in the 31st Symposium on Sea Turtle Biology and Conservation

where she co-chaired the Pacific Islands Regional meeting, served as an evaluator for student paper presentations, and networked with Pacific islands regional stakeholders and international partners to strategize ways to promote turtle conservation in small communities. As the point of contact for western and central Pacific marine turtle conservation and management projects, Karen continues as liaison between marine turtle conservation and management project principal investigators and project staff internationally. This year she served as technical monitor for marine turtle projects in Vietnam, New Caledonia, Vanuatu, Federated States of Micronesia, and French Polynesia. Technical support for a marine turtle genetic sampling project is provided by Karen, working with NOAA Southwest Fisheries Science Center (SWFSC) scientists, to characterize western Pacific green turtle nesting stocks by assisting countries and territories with sample organization and serving in a supporting role in analysis of green turtle skin samples. As part of this genetics project, Karen traveled to the French Polynesia in October-December 2010 as technical lead on an expedition to Mopelia Atoll to collect small skin samples from post nesting green turtles and build the capacity of French Polynesia scientists and residents to continue nesting beach monitoring and research beyond the time of her visit. She has also reviewed sample datasets from several regional partners before samples are shipped to and incorporated in the SWFSC archive. Karen also reviewed and commented on internal NOAA documents including marine turtle grant applications, PIRO turtle management plan drafts, grant progress reports, and annual reports.

Figure 1. Dera Look using a "crowding board" during a Hawaiian monk seal response.

JIMAR PRD Sea Turtle Biologist, Kim Maison served as technical monitor for two grant funded projects including Hawai'i hawksbill monitoring and conservation and research on sea turtles at Palmyra Atoll. She served as PIRO's representative on the working group for the implementation of the new ESA sea turtle observer rule. In addition, Kim led the completion of a biological opinion on new regulations for the American Samoa-based long line fishery. She completed research and analysis on the effectiveness of global efforts to reduce greenhouse gas emissions as a contribution to evaluating a listing petition for 82 species of corals. Kim completed numerous mapping projects using GIS software, creating products including range maps for the petitioned Bumphead parrotfish, petitioned coral species, and various maps depicting action areas and extent of various impacts (mainly acoustic) on protected species and habitats for ESA Section 7 consultations. She reviewed six project progress reports, two scientific research permits applications, and completed two informal Section 7 consultations and one technical assistance request. Kim has begun a joint project with the U.S.FWS to assess the impacts of anthropogenic lighting on sea turtles in the Main Hawaiian Islands. She also continued to maintain a Sea Turtle Reference database for PRD and served as a supporting team member on Section 7 consultations, providing technical assistance to the regulatory team on numerous projects and consultations. In particular, she continues to periodically update language for agency documents to incorporate the impacts of climate change into analyses. She attended two professional conferences (in Hawai'i and San Diego) and contributed to the drafting of a Sea Turtle Recovery management plan for the Pacific Islands Region. Kim was designated as the Climate Change Point of Contact and as such provides information and guidance on incorporating the effects of climate change into management analyses and identifying gaps in climate science where information would be useful for marine resource management.

JIMAR PRD Outreach and Education Specialist, Jen Metz, continued to provide assistance and guidance with the various outreach and education efforts for PRD. Jen worked closely with the PRD Assistant Hawaiian Monk Seal Coordinator on various outreach efforts aimed at promoting awareness and conservation of the Hawaiian monk seal. These programs included developing a short, animated video to educate the public about responsible wildlife viewing of the Hawaiian monk seal. Working with a contractor, Jen helped to develop the script and storyboard for this video and is the lead on the project. The video will be completed by August 2011 and be distributed to partners and volunteer groups to use with the public. Jen also worked closely with the PIRO PRD Sea Turtle Team Lead, as well as partners at the Department of Land and Natural Resources and U.S. Fish and Wildlife Service, to

use information gained in the previous year's Outreach and Education Assessment of Hawaiian Green Sea Turtles in the development of a "Fishing Around Sea Turtles" program that included a website, informational tackle box sticker, and advertisement in the October 2010 Hawai'i Fishing News. Jen is currently awaiting approval of a survey to distribute to the fishing store owners that offered the free tackle box stickers to their customers as a method to evaluate the "Fishing Around Sea Turtles" sticker and website. Jen initiated and leads a Green Team at the NOAA Fisheries Pacific Islands Regional Office and continued to represent PRD interests at various outreach events including the Hawai'i Nature Center Earth Day, Malama Maunalua Heritage Festival, Honolulu Zoo Endangered Species Day, the North Shore Jr. Lifeguard program, and Malama Aina Festival.

Shelley Steele is the JIMAR Outreach and Education Coordinator for the Pacific Islands Region. Shelley assists in the implementation of a variety of outreach and education projects and programs for both the Pacific Islands Regional Office and the Pacific Islands Fisheries Science Center. This year Shelley has performed numerous career day presentations and represented NOAA Fisheries Service at community events such as the 4th Annual Seafood and Fishing Festival, Marine Life Discovery Day, Sustainability Fair, Science Symposiums, 3rd Annual Ocean Expo, Sette Kid's Day, and Endangered Species Day where she promoted NOAA Fisheries Service to wide ranging audiences. Shelley maintains outreach and education equipment and works with the Communications Officer and Graphics Specialist to design and develop displays and activities for use at outreach and education events. Her general tasks include completing monthly reports, coordinating logistics for events and presentations, procuring supplies and material for the Communications Team, and proofing copy for publications. Shelley coordinated the purchase of life size Hawaiian monk seal models—the stars in Monk Seals in Your Neighborhood events, which proactively brought monk seals to the community in an effort to gain acceptance for regulatory actions being unveiled later this year.

Figure 2. Shelley Steele engaging a young member of the public in a Hawaiian monk seal activity.

JIMAR Marine Mammal Response Network Specialist (Maui), Nicole Davis, resigned from JIMAR to become a federal employee with NOAA Fisheries Protected Resources in mid-August 2010. However, in her final month and a half as a JIMAR employee, Nicole continued to manage the Maui Seal Sighting Hotline phone and coordinate marine mammal responses on Maui, and within Maui County. This included a two-week long response to a molting seal, excavating monk seal bones on the island of Lanai, and providing a training for volunteer marine mammal responders. At the end of July, Nicole went to Midway Atoll for two weeks to assist NOAA PIFSC with monk seal research. Upon her return from Midway, she attended a COSEE Educators 2-day workshop. The knowledge and experience gained from these events ultimately strengthen the effort in building capacity and the network for marine mammal response in Maui County.

In July and August 2010, JIMAR Assistant Marine Mammal Response Network Coordinator, Dera Look, served as the on-site coordinator for a Hawaiian monk seal pupping event on the North Shore of O'ahu. She managed volunteers on a daily basis and worked with Turtle Bay Resort staff to minimize human disturbance to a Hawaiian monk seal mother and pup. During this time Dera also coordinated logistics in response to two live hooked Hawaiian monk seals. On August 16, 2010, Dera worked with the Hawai'i Cetacean Rehabilitation Facility to care for a live Blaineville's beaked whale that was stranded in Kihei, Maui. She assisted with daily feedings, drug administration, medical examinations, and volunteer supervision. Dera also assisted with the collection of the first hearing test on a beaked whale, using the Auditory Evoked Potential method, collected by the Hawai'i Institute of Marine Biology. This research resulted in a paper recently published in the Journal of Experimental Biology.

Reducing Shark Bycatch with Electropositive Metals in Hawai'i-based Fisheries

P.I.: Thomas A. Schroeder [JIMAR Project Lead: John Wang]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Keith Bigelow, Yonat Swimmer

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The incidental capture of sharks is estimated at over 300,000 metric tons annually and often comprises a large proportion of the total catch (Fig. 1). NOAA Fisheries has recognized shark bycatch as a management priority fisheries challenge and indicated that, "Management entities should invest in elasmobranch research, fishery monitoring, reduction of bycatch and bycatch mortality, minimization of waste, and enforcement". This JIMAR project examines potential deterrents that may be useful in reducing shark interactions with fishing gear. Specifically, we conducted at-sea field trials to compare catch rates of sharks caught on hooks with and without an electropositive metal, specifically Nd-Pr. This specific alloy has been identified to repel sharks from approaching baited gear and our research aims to identify the alloy's potential use as an effective bycatch mitigation method to reduce the unwanted capture of sharks in fishing gear.

Progress during FY 2011

- *Completed inshore longline trials examining the effects of Nd/Pr alloys on scalloped hammerhead sharks* (Sphyrna lewini). In cooperation with University of Hawai'i's Hawai'i Institute of Marine Biology (HIMB), the project conducted fishing experiments in Kaneohe Bay with bottom-set longline gear targeting juvenile scalloped hammerhead sharks (*Sphyrna lewini*). Bottom longline gear contained branchlines that alternated with control 45g lead weight and 45g Nd-Pr weight. Results from 22 bottoms longlines have yielded a total of 60 scalloped hammerhead sharks with 18 sharks caught on treatment hooks (CPUE= 0.008 sharks/hook-hour) vs. 42 sharks caught on control hooks (CPUE=0.019 sharks/hook-hour), suggesting a greater than 50% reduction on capture rates of sharks on hooks with Nd-Pr weights (Fig. 1).
- *Completed longline trials examining the effects of Nd/Pr alloys on blue sharks and mako sharks.* In collaboration with HIMB and NOAA Southwest Fisheries Science Center (SWFSC), the project conducted longline field trials off the coast of Southern California. Longlines were composed of 200 branchlines in which branchlines with lead weight were alternated with branchlines with Nd/Pr metal weight for a total of 39 longlines set. The catch was composed of primarily Mako sharks (*Isurus oxyrinchus*) (n=128) and blue sharks (*Prionace glauca*) (n=156). Analysis indicates no difference in the catch rates of Mako sharks and Blue sharks between control and treatment branchlines.
- *Completed trials in Ecuadorian longline fisheries examining effects on mixed shark species.* In collaboration with the Ecuadorian governmental and non-governmental agencies and NOAA Southwest Fisheries Regional Office (SFRO), the project conducted a study in the Ecuadorian artisanal longline fisheries targeting tunas, billfish, and sharks. Longlines were composed of 300 branchlines

Figure 1. Sharks caught in artisanal fishery in Baja, Mexico.

and we alternated branchlines with lead (control) vs. Nd/Pr (treatment) metal weights. Eleven sets were deployed. Catch was low due to poor conditions and competition from other longline fishing boats in the area. Nonetheless, researchers caught 23 sharks comprised of Pelagic thresher sharks (*Alopias pelagicus*), silky sharks (*Carcharhinus falciformis*), and scalloped hammer head sharks.

• *Completed behavioral studies examining feeding behaviors of captive sharks to Nd/Pr alloys.* In collaboration with HIMB the project conducted behavioral experiments with juvenile scalloped hammerhead sharks examining feeding and swim behavior in response to electropositive metals.

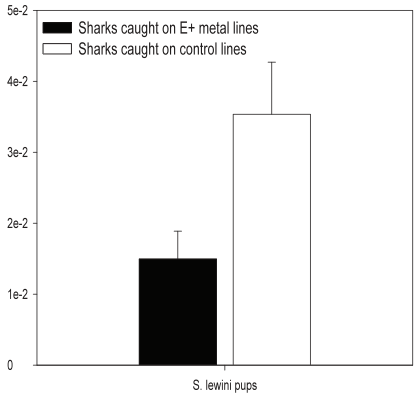


Figure 2. Catch data from at-sea field trials testing catch rates of sharks on lines with and without electropositive metals.

Review and Possible Refinements to Essential Fish Habitat and HAPC Designations All Federal Management Unit Species in the Western Pacific Region, Excluding Hawaiian Bottomfish Management Unit Species

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Adrian Ramirez]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Michael Parke

NOAA Goal(s)

• To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

This JIMAR project involves a comprehensive review of the following: 1) essential fish habitats (EFH) and habitat areas of particular concern (HAPC) definition requirements; 2) current EFH/HAPC definitions for the federal management unit species (MUS) in the Western Pacific Region (WPR), except for the MHI Bottomfish Management Unit Species (BMUS); and 3) new information relevant to federal MUS in the WPR. Most of the efforts are focused on identifying and summarizing new scientific literature, unpublished reports, unpublished data, and any other sources of information regarding critical life history stages, reproductive cycles, preferred habitats and movement patterns. The information will be provided to PIRO and the Western Pacific Region Fishery Management Council (WPRFMC) in detail for potential inclusion as addendums in the fishery ecosystem management plans.

Progress during FY 2011

JIMAR has compiled a variety of studies pertaining to habitat use by pelagic and seamount species in the WPR and provided a brief summary of the findings. JIMAR will complete a draft summary of the research to present to the WPRFMC.

Social and Economic Analysis of Western Pacific Fisheries

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Dawn Kotowicz]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Justin Hospital

NOAA Goal(s)

• To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The overarching purpose of this JIMAR project is to monitor economic conditions within Hawai'i's fisheries and seafood markets. These analyses will provide essential baseline information that will allow managers to better understand the economic implications of future fisheries management in Hawai'i. This includes both how future regulations will affect the greater economy of the State of Hawai'i as well as the economic well being of fishery participants, consumers, and stakeholders that interact with fishery resources. Additionally, in light of increased domestic regulations, this project strives to investigate the global implications of U.S. fisheries management. We explore the global market for snapper and grouper species to examine how domestic regulations and consumer purchasing decisions contribute to, or challenge, global sustainability.

Progress during FY 2011

Using existing secondary data from an annual cost survey for the Hawai'i bottomfish fishery, JIMAR staff developed descriptions of the operational aspects of this fishery including: fishing effort; variable trip costs; annual fishing expenditures; levels of investment; and attitudes and perceptions of fishermen towards management of the fishery. A series of papers (two in press and one in draft form) have been developed that will contribute to the understanding of economic aspects of the fishery given the substantial institutional and recent regulatory changes.

Data collection for the Hawai'i fresh fish retail market monitoring program continues to be an ongoing effort. JIMAR researchers have been collecting weekly retail market prices for fish species prevalent in Hawai'i's seafood markets, entering and organizing data, and producing data summaries to inform managing agencies and the general public. The project developed a draft report detailing three years (2007-2010) summary of data. The data collected through the retail price monitoring program is also being used by JIMAR staff to explore price transmission in Hawai'i's retail tuna market. A database of retail and wholesale prices and margins has been collected and analyzed statistically using econometric models. This research contributes information about how price fluctuations at the ex-vessel level (prices that fishermen receive) are passed on to consumers.

While investigating the global demand for snapper, JIMAR staff members developed a database of global snapper supply in order to research the increased market reliance on fresh snapper imports from the South Pacific in light of increased regulations for the Hawai'i bottomfish fishery. An overview of the existing regulatory frameworks for major players in the global snapper market has been incorporated into the working paper.

One project outlined in the proposal was not completed. The reason for this setback was primarily logistical and was the result of extended (and unexpected) efforts by other members of Hawai'i's fisheries research community. The project decided not to pursue the dealer/wholesaler research because recent efforts by other researchers with this sector proved unsuccessful, although they continued to engage the community, making the success of our proposed research doubtful.

Sustainable Fisheries Initiative

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Regional Office

NOAA Sponsor: Michael Tosatto, Alvin Z. Katekaru

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The Sustainable Fisheries Initiative fosters the optimal and sustained commercial and non-commercial harvest of marine fishery resources and the conservation and protection of protected species in the Pacific Islands region. Initiative activities are authorized under the Magnuson-Stevens Fishery Conservation and Management Act. The project uses the best scientific information available on coastal and marine resources, collects/analyzes socio-economic data, disseminates research information, and communicates fisheries regulatory guidelines and announcements. A major undertaking is to conduct socio-economic studies in collaboration with the NMFS PIFSC on the impacts of management actions on the human environment, communities, and fishery sectors.

The desired outcome is to: enhance the region's economy; maintain and foster island ocean cultures; maximize recreational, subsistence, and customary exchange fishing opportunities; prevent overfishing; rebuild overfished stocks; mitigate adverse impacts to protected resources; and educate constituents and public consistent with NOAA's strategic plan in ecosystem-based management.

Progress during FY 2011

- Human dimensions projects
  - Reviewed and commented on draft Fishery Ecosystem Plan amendments with particular emphasis on the quality of social and economic data.
  - Prepared the Sustainable Fisheries Division's (SFD's) Human Dimensions Research Agenda that will continue through 2011-12.
  - Assisted in the completion of SFD's Fish Dealer information project.
  - Reviewed and provided guidance to PIFSC staff and others (e.g., Pacific Islands Fisheries Group) on survey design and implementation as well as other areas of social science expertise.
  - Researched and compile information on determining commercial fishery failure due to the 2006 tsunami that hit American Samoa based on economic impacts.
  - Participated in the Western Pacific Fishery Management Council's Social Economic, Ecological, and Management Uncertainty (SEEM) Working Group.
  - Developed, and continue to improve, a regional recreational fishing profile.
  - Worked with outreach and education specialist to improve and expand SFD's recreational fishery web pages.
  - Organized and participated in charter fishery scoping meetings in Kona, on Maui and Oʻahu.
  - Participated in the Pacific Islands Recreational Fisheries Working Group activities.
  - Provided comments to substantially revise the existing support contract with SRGII for marine spatial planning services to PIRO.
  - Mentored two college students in the NOAA's Hollings Scholarship Program.
- Sustainable fisheries outreach and educational projects
  - Designed a 25-page educational booklet, "Sharks of the Marianas Archipelago", covering 18 shark species.
  - Redesigned a brochure for local fishermen, "Protected Species Handling Guide", that highlights protected species identification, handling, and release.
  - Prepared an educational brochure, "Sea Turtle Identification in Guam and the Northern Mariana Islands", and a poster that were distributed at the annual Chamorro Lunar Calendar Festival in Guam.
  - Redesigned the entire Sustainable Fisheries section of the website to work with the new NOAA Fisheries Service template. Created image banners with quality photos, a seabird identification gallery, and functional webpage layouts.

Western Pacific Fisheries Information Network Project

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Diosdado Gonzales]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Michael M. Quach

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The Western Pacific Fisheries Information Network Project (WPacFIN) is an ongoing JIMAR project that supports the primary functions of the Western Pacific Fisheries Information Network Program at the PIFSC. WPacFIN-JIMAR focuses on improving data collection in the Pacific Islands Region to address data needs to protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management. The Project supports this goal at various levels by improving the quality of data input to fisheries modeling and research, as well as improving the accuracy of forecasting to help decision makers develop and ensure compliance with established catch limits.

The mission is to: provide technical support to help participating fisheries agencies in American Samoa, Hawai'i, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) develop and implement their fishery-dependent data collection programs; and provide data needed to support these clients' monitoring of established total allowable catch (TAC), quotas, data requests, and fisheries ecosystem management plans and reports.

Progress during FY 2011

JIMAR continued to make significant progress in supporting the WPacFIN program at PIFSC. Project staff worked on programming, creating databases, processing data, writing administrative reports and system documentation, and creating summary reports and data summaries to address data needs. Many other products and support jobs provided by the WPacFIN JIMAR staff are recurrent. Specific FY 2011 accomplishments include the following.

- Produced and submitted to NOAA HQ the 2010 Fisheries of the United States (FU.S.) fisheries data summary for American Samoa, CNMI, Guam, and Hawai'i.
- Updated and maintained the WPacFIN data website.
- Developed software applications and provided technical support to fisheries agencies in American Samoa, Hawai'i, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI).
- Upgraded the American Samoa Data System application to make it more robust, user friendly, and portable.
- Designed and implemented a Fisherman Reporting System (FRS) module that imports and validates data from the Hawai'i Division of Aquatic Resources (DAR) online data system.
- WPacFIN staff designed bio-sampling databases and is in the final process of implementing these programs for American Samoa, Guam, and CNMI.
- WPacFIN staff has started migrating existing programs to C#.
- Successfully migrated data from the existing database formats to Oracle or MySQL databases.
- Improved existing programs that produce data summary tables and charts for islanders to complete their Fisheries Management Plan Team reports.
- Greatly improved documentation of existing applications to better serve and support clients. For example, staff analyzed and documented the American Samoa expansion and Plan Team reports in great detail.

The project accomplished most of the proposed activities during the past year. The intranet web-based system for data requests and summaries project was cancelled due to internet security issues. The American Samoa Tutuila-based creel survey project and the Coral Reef Ecosystem Plan Team reporting module are on hold because this project lacks a plan team standard format.

Coastal Research

The JIMAR Administrative Board approved the addition of Coastal Research as the sixth JIMAR research theme at its November 2000 meeting. Subsequent to this decision, two initiatives have focused further attention on this emerging research area. NOAA has established a Coastal Services node in Honolulu and President Clinton designated the Northwest Hawaiian Island as a national refuge. To date, JIMAR research has been directed at issues related to coral reefs, a major component of the coastal zones of Hawai'i and U.S.-affiliated Pacific Islands.

Applications of Satellite Ocean Remote Sensing to Living Marine Resources (Ocean Remote Sensing)

P.I.: Thomas A. Schroeder [JIMAR Project Lead: Lucas Moxey]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Jeffrey J. Polovina

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The NOAA OceanWatch-Central Pacific node supplies near-real time, remotely sensed oceanographic and environmental data for the entire Pacific-based communities, including resource managers, researchers, educators and the general public; JIMAR staff play a key role in this work. The satellite-derived products include ocean surface temperature, ocean color, ocean surface topography, ocean surface wind fields, environmental indicators (Empirical Orthogonal Functions, EOFs), and high-resolution (1.1 km) thermal infrared High Resolution Picture Transmission (HRPT) imagery from the NOAA AVHRR satellites. The HRPT data is collected daily by the AVHRR receiving station located in Ewa Beach, O'ahu (Hawai'i).

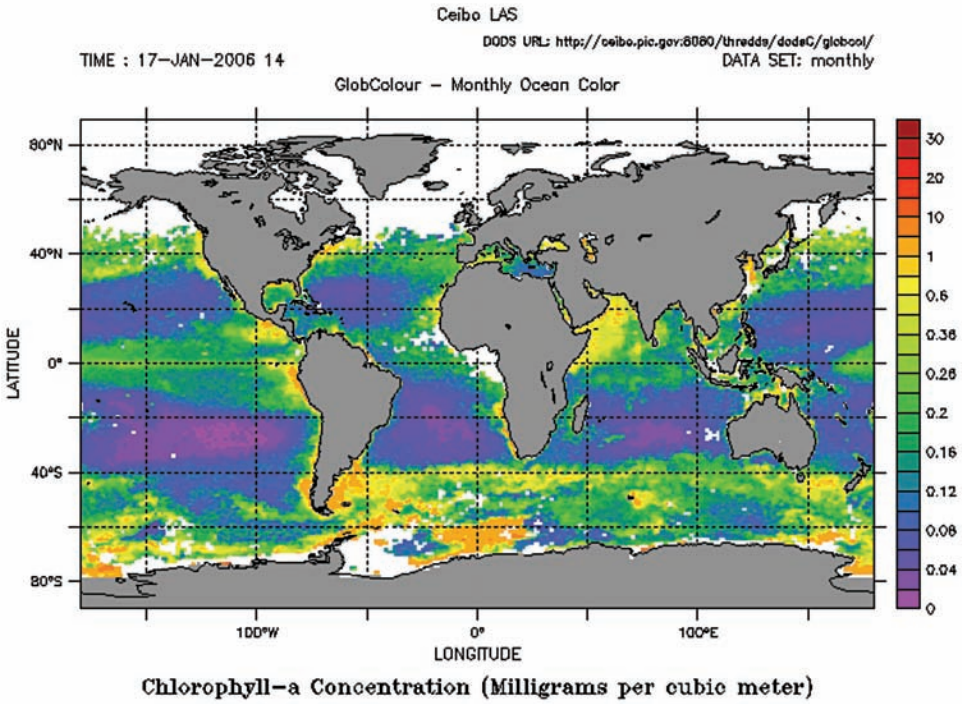


Figure 1. Sample of GlobColour global model data.

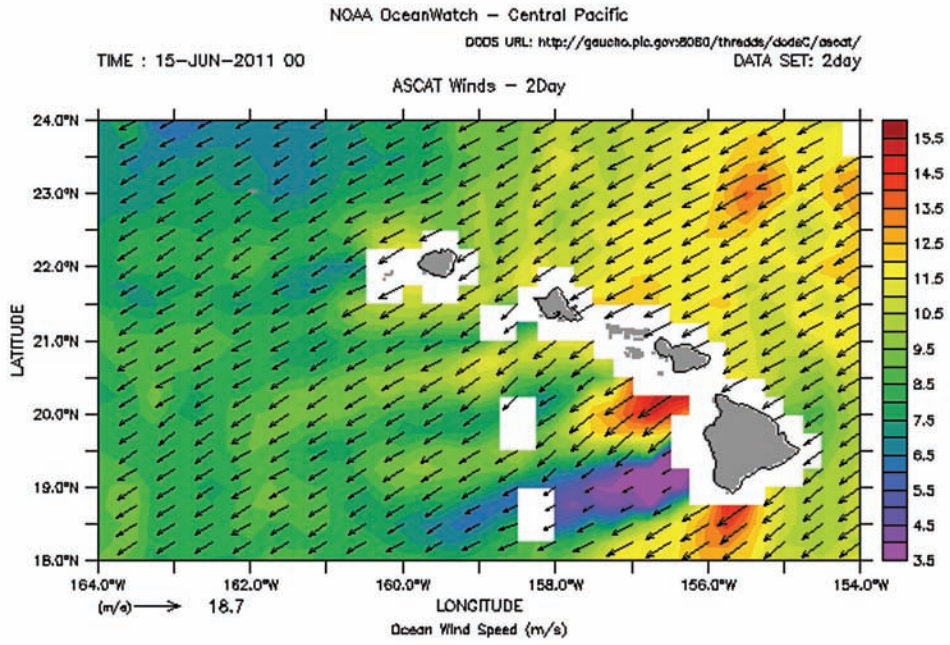


Figure 2. Sample of ASCAT 2-day ocean wind surface wind data for Hawai'i.

Progress during FY 2011

During FY 2011, the Ocean Remote Sensing (ORS) project supported users from Hawai'i, the Pacific-rim, and around the globe by providing satellite remotely-sensed data and products. During this period, JIMAR staff in ORS also developed and served additional remotely sensed ecosystem datasets and indicators, including the assimilation of the GlobColour model data (Fig. 1) and the blended day-night Pathfinder v5.1 sea-surface temperature product. In addition, ORS provided customized daily satellite data support to the newly established Kona Integrated Ecosystem Assessment (IEA), while also providing near-real time sea-surface height information to assist in the development and navigation of an underwater glider for surveying eddies off the Kona coast. All these accomplishments were completed in accordance to the plans established in FY 2010.

Additional accomplishments attained throughout FY 2011 include the establishment of a near-real time data processing stream of ASCAT ocean surface wind data (Fig. 2), the establishment of a developmental live access server and THREDDS data server, continuation of reciprocal collaboration efforts with NOAA National Weather Service-Honolulu Office, serving as liaison for amendments to projected NWS data transfer protocols, and participation and collaboration in various outreach events with NOAA and the Western Pacific Regional Fishery Management Council.

Coral Reef Management Initiative

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Marine Fisheries Service/ Pacific Island Regional Office

NOAA Sponsor: Michael Tosatto, Alan Everson

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

The purpose of this project is to enhance the management of coral reef habitat throughout the U.S. Pacific Islands. The goal of Coral Reef Management Initiative (CRMI) is to establish an enhanced coral reef management

presence within the existing NMFS, PIRO, and Habitat Conservation Division (HCD). The CRMI relates directly to the JIMAR Coastal Research theme of achieving sustainable balance between the forces of coastal development and preservation. Information obtained as a result of CRMI assists resource managers in attaining this goal. It also enhances interagency cooperation and information exchange, and develops new technologies for coastal resource management. A major focus of this initiative is to investigate approaches to develop appropriate compensatory mitigation for coastal construction related loss of coral reef habitat including, but not limited to, conducting follow-up studies of several coral reef mitigation projects. A coral reef classification system will be developed for use in habitat management decisions made by the HCD. The initiative will enhance our capacity to address coral reef conservation issues in Guam, CNMI, and American Samoa as well as aid in the development of an integrated GIS-based system to evaluate anthropogenic impacts to corals reef.

Progress during FY 2011

In 2010-2011, the Senior Coral Reef Ecologist in PIRO HCD contributed significantly to the regulation of impacts to coral reefs in the U.S. pacific Islands via: 1) continued implementation of various federal mandates including conducting Essential Fish Habitat consultations and Fish and Wildlife Coordination Act biological assessments, and providing technical advice on a range of monitoring protocols and mitigation plans for proposed Army Corps projects such as harbor improvements, beach restorations, and waterway modifications; 2) continued building of PIRO HCD capacity to manage nearshore water quality by membership in the Land- Based-Sources of Pollution local action strategy steering committee, review of National Pollution Discharge Elimination System permits, and attendance of an Environmental Protection Agency water quality standards training and the Pacific Islands Watershed institute workshop; 3) participation in the development of the National Coral Reef Monitoring Plan; 4) continued development of a guidance document on management needs for soft sediment by identifying the ecological function and value of this habitat type; and 5) building of outreach and education capacity on coral conservation and management by attendance at a media workshop, presentation at the Hawai'i Conservation Conference and at the Hawai'i Pacific University Marine Seminar Series, and coordination of the participation of science and management exhibitors in the Maunalua Bay outreach and education event.

National Environmental Policy Act (NEPA) Initiative

P.I.: Thomas A. Schroeder

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Regional Office

NOAA Sponsor: Michael Tosatto, Charles Karnella

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management

Purpose of the Project

Under the Federal National Environmental Policy Act (NEPA), federal agencies must insure that environmental information is made available to public officials and citizens before decisions are made and actions taken. The purpose is to promote management and policy decisions that will prevent or eliminate damage to the environment, stimulate health and welfare of man, and enrich understanding of ecological systems and natural resources important to the Nation. The major focus of this initiative is to obtain technical assistance on an activity- and project-specific basis to ensure timely and legally sufficient agency compliance with applicable NEPA requirements. The initiative addresses NOAA Fisheries Service's NEPA compliance with international treaties in addition to fostering international marine resource conservation measures. While NOAA Fisheries Service has addressed NEPA compliance associated with Federal activities (i.e., development of fishery management plans) in the past, this NEPA Initiative represents a holistic effort to foster compliance with NEPA in international projects. Information and lessons learned from this NEPA Initiative will be evaluated and applied to future NEPA actions. NEPA-focused hires under this initiative will closely coordinate and collaborate with several existing organizations with marine resource protection mandates. These include, but are not limited to: NOAA Pacific Islands Region Fisheries Science Center; NOAA National Ocean Service; NOAA and NOAA Fisheries Service headquarters components; and the Western Pacific Fishery Management Council.

The primary purpose of the NEPA Initiative is the development of NEPA analyses for the promulgation of regulations to implement the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention) and decisions made by the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC), pursuant to the authority of the Western and Central Pacific Fisheries Convention Implementation Act (WCPFCIA; 16 U.S.C. § 6901 et. seq.). The initiative also supports NEPA analyses for the promulgation of regulations to implement the South Pacific Tuna Treaty (SPTT), pursuant to the authority of the South Pacific Tuna Act (SPTA; 16 U.S.C. §§ 973-973r).

Progress during FY 2011

Promulgation of regulations under the authority of the WCPFCIA or SPTA and the associated NEPA analyses involves complexities related to, among other things, whether and how to analyze environmental effects abroad, determinations of whether the agency has any discretion in the needed actions, the range of alternatives to be analyzed, and the scope of the analyses required. These factors have resulted in the need for extensive research and strategy development, which have been incorporated into NEPA documents.

In the last fiscal year, preparation began on two EAs for the implementation of the decisions of the Sixth Regular Annual Session of the WCPFC. These EAs have been expanded to include implementation of the decisions of the Seventh Regular Annual Session of the WCPFC. It is anticipated that these EAs will be completed in the next fiscal year. Preliminary research regarding appropriate NEPA analysis is also being conducted to prepare for the implementation of the anticipated decisions of the Eighth Regular Annual Session of the WCPFC, which will be held in December 2011.

NEPA training activities for JIMAR staff included attendance at the Advanced NEPA Topics course sponsored by the National Conservation Training Center, as well as attendance at two webinars on NEPA topics sponsored by the National Association of Environmental Professionals.

Sustaining Healthy Coastal Ecosystems

P.I.: Thomas A. Schroeder [JIMAR Project Leads: Annette DesRochers, Kyle Koyanagi, Joyce Miller, John Rooney, Bernardo Vargas-Angel, Ivor Williams]

NOAA Office (of the primary technical contact): National Marine Fisheries Service/Pacific Islands Fisheries Science Center

NOAA Sponsor: Samuel G. Pooley, Russell Brainard

NOAA Goal(s)

- To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
- To understand climate variability and change to enhance society's ability to plan and respond

Purpose of the Project

The JIMAR Sustaining Healthy Coastal Ecosystems project's mission is to provide sound science to enable informed and effective implementation of ecosystem-based management and conservation strategies for coral reef ecosystems of the U.S Pacific Islands Region. To accomplish this mission, JIMAR project scientists lead and participate in a multi-partner, integrated, interdisciplinary program of ecosystem assessment and long-term monitoring, benthic habitat mapping, and applied research on the coral reef ecosystems of 50 primary islands and atolls in the Hawaiian Archipelago, the Mariana Archipelago (Guam and the Commonwealth of the Northern Mariana Islands), American Samoa, and the Pacific Remote Islands Marine National Monument. This work supports NOAA and other agencies in meeting mandates of the Coral Reef Conservation Act of 2000 and various executive orders issued to ensure conservation and protection of the nation's coral reef ecosystems.

Progress during FY 2011

• *Pacific RAMP*. In a continuation of decade-long monitoring of coral reef ecosystem health in the U.S. Pacific Islands, four interdisciplinary Pacific Reef Assessment and Monitoring Program (Pacific RAMP) cruises (http://noaacred.blogspot.com; http://www.pifsc.noaa.gov/library/hiialakai.php) were conducted aboard the NOAA Ship

Hi'ialakai around the islands and banks of the Northwestern Hawaiian Islands (NWHI), the main Hawaiian Islands (MHI), Wake Atoll, and the Mariana Archipelago. Scientists from the Coral Reef Ecosystem Division (CRED) of the NOAA PIFSC, JIMAR, and partner agencies conducted integrated assessments and monitoring of fishes, corals, algae, and other invertebrates and collected a variety of oceanographic and water-quality observations. Because a bleaching watch for the area was in effect, during the September 2010 cruise scientists carefully monitored the reefs of the NWHI for signs of bleaching, damage, and disease; JIMAR scientists observed bleaching primarily at the northern atolls (Pearl and Hermes, Midway, and Kure), in shallow backreef and lagoon environments, with up to 20% of colonies affected. Based upon monitoring data collected during Pacific RAMP cruises over the past decade, JIMAR, NOAA, and the U.S. Fish and Wildlife Service (USFWS) developed a coral bleaching response plan for the NWHI in March 2011. At Kure Atoll, blooms of the alga *Boodlea composita* were much reduced compared to results from a 2009 survey. Around the MHI, the majority of benthic surveys conducted there during the Pacific RAMP cruise in October and November 2010 revealed reef conditions similar to those reported during surveys in previous years.

On March 10, 2011, one day before a severe earthquake and tsunami struck Japan, the *Hi'ialakai* left Honolulu for Wake Atoll. The ship was diverted from its transit to Wake to evacuate USFWS and NOAA personnel from Laysan Island and Kure Atoll and drop them off at Midway Atoll. At Wake Atoll the bumphead parrotfish (*Bolbometopon muricatum*) was observed in small schools (~10-20 individuals) along the east coast or as individuals at REA sites on the southern and southeastern forereefs. Although not seen in large aggregations (200+), as they were observed during previous RAMP cruises, the bumphead parrotfish, which is listed as "vulnerable" by the International Union for Conservation of Nature and is a "species of concern" under the Endangered Species Act (ESA) was still seen during towed-diver fish surveys far more commonly at Wake than at other islands and atolls surveyed by CRED. Personnel from partner agencies in Guam and

*Figure 1. A bumphead parrotfish (*Bolbometopon muricatum*) observed at Wake Atoll during the Pacific RAMP cruise there in 2011. (NOAA photo: K. Osada)*

Figure 2. A JIMAR staff member removes derelict fishing gear from corals at Midway Atoll. (NOAA photo)

the CNMI participated in the Pacific RAMP operations around the Mariana Archipelago and more than 250 people visited the *Hi'ialakai* in Guam and Saipan for education and outreach activities. No serious bleaching or decline in the health of the coral reef ecosystems of the Mariana Archipelago was observed during that 2011 Pacific RAMP cruise.

Results from previous Pacific RAMP surveys in the Mariana Archipelago were summarized in a booklet ("Coral Reef Ecosystems of the Mariana Archipelago: A 2003-2007 Overview"; http://www.pifsc.noaa.gov/cred/mariana_overview.php) that was presented at the U.S. Coral Reef Task Force meeting in Guam and CNMI in September 2010, and the full report is scheduled for publication in late 2011. Another important publication resulting from Pacific RAMP data, "Differences in reef fish assemblages between populated and remote reefs spanning multiple archipelagos across the central and western Pacific", was published in a 2011 special issue of the Journal of Marine Biology, themed "Ecosystem-Based Management of Pacific Islands" (doi:10.1155/2011/826234). Another major paper that describes and documents the types, prevalence, and distribution of coralline algal diseases in the U.S. Pacific States and Affiliated Territories was published in December 2010 in the journal Coral Reefs (doi:10.1007/s0038-010-0646-x).

*Figure 3. A school of manini or convict tang (*Acanthurus triostegus*) observed at Wake Atoll during the Pacific RAMP cruise there in 2011. (NOAA photo: K. Osada)*

Figure 4. Tissue loss lesion on a colony of Porites lobata *at Honolua Bay, Maui. (NOAA photo: B. Vargas-Ángel)*

• *Expanded benthic and fish surveys.* In partnership with the Division of Aquatic Resources (DAR) of the Hawai'i Department of Land and Natural Resources (DLNR), Hawai'i Institute of Marine Biology of the University of Hawai'i, The Nature Conservancy, and Cornell University, JIMAR scientists are conducting focused benthic and fish surveys in areas of special interest around the MHI. Benthic surveys designed to develop tools for assessment of coral bleaching and disease risks in the Hawaiian Islands were conducted in April, July, and September 2010 at 11 Maui sites and in April 2011 at four Maui sites. These surveys are intended to provide a better understanding of the annual and seasonal patterns of bleaching and disease prevalence at selected sites across the state. JIMAR fisheries scientists are working with the DAR in West Maui to monitor the impacts of the closure of the Kahekili Herbivore Fisheries Management Area (KHFMA) to take care of herbivorous fishes and sea urchins. Surveys at ~100 transects were completed in the KHFMA in September 2010. Experience from this protected area demonstrated that herbivore closure areas can win substantial public support in Hawai'i and, therefore, clear and scientifically strong monitoring of the effects of herbivore protection at Kahekili has the potential to lead to wider adoption of this form of marine managed areas and improved management of herbivores in general. By conducting shore-based surveys in addition to the biennial ship-based Pacific RAMP surveys, the number of fish survey sites was increased by 30 around O'ahu and by ~80 around Guam in collaboration with scientists from the University of Guam and Guam's Division of Aquatic and Wildlife Resources. This increase in fish survey sites will assist scientists and managers in assessing population status of reef fishes around the more heavily populated islands and will improve scope for developing appropriate annual catch limits (ACLs) for coral reef fisheries as mandated by the Magnuson-Stevens Reauthorization Act.

• *Marine debris.* JIMAR staff chaired two sessions at the International Marine Debris conference held March 20–25, 2011, in Honolulu and organized by NOAA and the United Nations Environmental Program. An international

assembly of marine debris researchers, natural resource managers, policymakers, and representatives from industry and non-government organizations highlighted research advances and shared strategies and best practices to assess, reduce, and prevent the effects of marine debris. As part of ongoing efforts to identify and remove marine debris in the Papahanaumokuakea Marine National Monument in the NWHI, JIMAR staff from CRED in March and April 2011 completed a 23-day mission, first based from Midway Atoll and then aboard the NOAA Ship *Oscar Elton Sette*. The original and primary mission of that cruise was to resupply and transport personnel from JIMAR and the PIFSC Protected Species Division at field camps in the NWHI, and the "piggyback" marine debris mission was organized in less than six weeks before that cruise. More than 15 metric tons of marine debris, primarily derelict fishing gear, was removed during efforts at Midway, Pearl and Hermes, and Kure Atolls, Lisianski and Laysan Islands, and French Frigate Shoals. More than 704 metric tons of marine debris have been removed from the NWHI since 1996.

• *Benthic habitat mapping projects*. In FY 2011, JIMAR staff completed a project that included multibeam mapping around Oʻahu and autonomous underwater vehicle (AUV) development. Multibeam surveys were conducted in Kaneohe Bay, around the north and eastern shores of Oʻahu, and near the reef runway. Kaneohe Bay, one of the only well-protected bays in Hawaiʻi with rich coral resources and the home of the University of Hawaiʻi's Hawaiʻi Institute of Marine Biology (HIMB), had only sparse high-resolution bathymetric coverage from airborne light detection and ranging (LiDAR) surveys, because of lack of light penetration in much of the deeper (15 m) bay waters. JIMAR scientists using the *R/V Ahi* conducted sonar surveys in October 2010 and combined the multibeam data with available LiDAR and deeper multibeam surveys outside of the bay to provide almost complete bottom coverage. At the request of the DLNR, JIMAR scientists also completed a survey of a site near the Honolulu Reef Runway to determine the bottom condition 18 months after a Navy ship grounding there in 2009. JIMAR personnel also participated on a multiagency cruise about the NOAA Ship *Oscar Elton Sette* in July 2010 and on the *R/V Kaiʻmikai-o-Kanaloa* in February and March 2011 to the Auʻau Channel off Maui to study a complex of mesophotic coral reefs there. CRED owns and operates a SeaBED AUV in collaboration with the NOAA Northwest Fisheries Science Center (NWFSC) and Deep Submergence Laboratory at the Woods Hole Oceanographic Institution. During FY 2011, JIMAR personnel participated in two NWFSC cruises off the Pacific Northwest conducting AUV surveys for sponge reefs, deep corals, and rock fishes. A cruise to survey benthic habitats off the south and west coasts of Oʻahu using the SeaBED was conducted in March 2011 off the *M/V Huki Pono*.

• *ESA 82 corals*. In response to an October 2009 petition to protect 83 coral species under the Endangered Species Act, the NOAA National Marine Fisheries Service formed a Biological Review Team to conduct a Status Review for 82 of the 83 petitioned species. Federal scientists, aided by JIMAR Subject Matter Experts and technical support personnel, have worked to complete the Status Review document that is under review at PIFSC (as of June 2011). This unanticipated project and the extensive Status Report required caused delay of other milestones, such as publication of the full, multi-volume Monitoring Report for the Mariana Archipelago.

• *Census of Marine Life celebrates a decade of discovery*. Findings from the decade-long Census of Marine Life (CoML) project were presented at the Decade of Discovery events in London, England, in October 2010. For the Census of Coral Reef Ecosystems (CReefs), a CoML project that began in 2006, JIMAR scientists from CRED led efforts to deploy more than 600 autonomous reef monitoring structures (ARMS) throughout the world's oceans. Other CReefs work led by partner institutions included thorough censuses of lesser studied coral reef organisms and advances in genomics that will aid in monitoring changes to ecosystems that are caused by ocean warming and acidification. As a result of CoML, more than 1200 new species have been described in the world's oceans, 5,000+ possible new species have been collected and not yet described, 35,000+ species identified with DNA barcodes, 18 million+ microbial DNA species catalogued, and 2,600+ peer-reviewed scientific papers published.

• *Humpback whale song reveals wintering activity in the Northwestern Hawaiian Islands*. Scientists from JIMAR, HIMB, and CRED discovered that the wintering grounds of the humpback whale (*Metaptera novaeangliae*) extend to the NWHI. The MHI are the principal breeding grounds for the humpback in the north Pacific, and population recovery over the last three decades has resulted in a geographic expansion of the species. Ecological acoustic recorders (EARs), microprocessor-based autonomous recorders originally developed at HIMB that sample the ambient sound field on a programmable cycle, were deployed at nine sites throughout the Hawaiian Archipelago to better understand the distribution of humpback whales. The timing and abundance of whale song at each site provides evidence that humpback whales were common in the NWHI from December to mid-May, closely following trends observed in the MHI.

JIMAR Publications

Author(s) Names	Publication Date	Title	Published In (Journal Name, volume and page number)	Type of Publication	Citation No. or hyperlink	Project Title
Abecassis, M., J. Polovina, H. Dewar	12/15/2010	Modeling swordfish daytime vertical habitat in the North Pacific Ocean from pop-up archival tags	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	Oceanography Initiative
Abecassis, M., J. Polovina, H. Dewar	3/18/2011	Modeling swordfish daytime vertical habitat in the North Pacific Ocean from pop-up archival tags	Fourth International Science Symposium on Bio-logging: Hobart, Australia	Presentation		Oceanography Initiative
Annamalai, H., S. Kida and J. Hafner	7/15/2010	Potential impact of the tropical Indian Ocean-Indonesian Seas on El Nino characteristics	J. Climate, 23, 3933–3952	Journal Article	doi:10.1175/2010JCLI3834.1	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Arita, S.		The distributive economic impacts of Hawaii's fishery	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	PFRP: The Role of Social Networks on Fishermen Economic Performance in Hawaii's Longline Fishery
Arita, S., M. Pan, J. Hospital, P.S. Leung	May, 2011	Contribution, linkages and impacts of the fisheries sector to Hawaii's economy: A social accounting matrix analysis	JIMAR Contribution Report 11-373	Technical Report		Contribution, linkages and impacts of the fisheries sector to the economies of Hawaii and other U.S.-Affiliated Pacific Islands: an extended input-output analysis
Ayotte, P., K. McCoy, I. Williams, J. Zamzow	In press	Coral Reef Ecosystem Division standard operating procedures: data collection for rapid ecological assessment fish surveys	U.S. Dept. of Commerce, NOAA Technical Memorandum	Technical Report		Sustaining Healthy Coastal Ecosystems
Banobi, J.A., T.A. Branch, R. Hilborn	3/30/2011	Do rebuttals affect future science	Ecosphere, 2, article 37	Journal Article	http://www.esajournals.org/doi/pdf/10.1890/ES10-00142.1	PFRP: Biological, Economic & Management Drivers of Fishery Performance: A Global Meta-analysis of Tuna & Billfish Stocks
Becker, E.A, K.A. Forney, M.C. Ferguson, D.G. Foley, R.C. Smith, J. Barlow, J.V. Redfern	8/26/2010	Comparing California Current cetacean–habitat models developed using in situ and remotely sensed sea surface temperature data	Marine Ecology Progress Series, 413, 163-183	Journal Article	doi:10.3354/meps08696	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations

Black, B.A., I.D. Schroeder, W.J. Sydeman, S.J. Bograd, B. Wells, F.B. Schwing	2010	Winter and summer upwelling modes and their biological importance in the California Current Ecosystem	Global Change Biology, 17, 2536-2545	Journal Article	doi:10.1111/j.1365-2486.2011.02422.x	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Block, B.A., I. Jonsen, A. Winship, S. Jorgensen, S. Shaffer, S.J. Bograd, E.L. Hazen, D.G. Foley, G. Breed, A.L. Harrison, J. Ganong, A. Swithenbank, H. Dewar, B. Mate, D.P. Costa, M. Castleton, G. Shillinger, K. Schaefer, S. Benson, M. Weise, R. Henry	7/7/2011	Tracking apex marine predator movements in a dynamic ocean	Nature, 475, 86-90	Journal Article	doi:10.1038/nature10082	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Blyth-Skyrme, V.	2/9/2011	Current application and future needs of the NOAA Pacific Islands Fisheries Science Center's Coral Reef Ecosystem Division seabed mapping program	Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division, Honolulu. 21 p.	Technical Report	http://www.soest.hawaii.edu/pibhmc/pibhmc_documentation.htm#other_pubs	Sustaining Healthy Coastal Ecosystems
Branch, T.A., O.P. Jensen, D. Ricard, Y. Ye, R. Hilborn	4/28/2011	Contrasting global trends in marine fishery status obtained from catches and from stock assessments	Conservation Biology (online)	Journal Article	http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2011.01687.x/pdf	PFRP: Biological, Economic & Management Drivers of Fishery Performance: A Global Meta-analysis of Tuna & Billfish Stocks
Brodziak, J., C.-L. Sun, L. Wagatsuma	6/1/2011	Report of the ISC Meeting of the Pacific Billfish Working Group	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean: Taipei, Taiwan. May 24-June 1, 2011	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Brodziak, J., D. Courtney, L. Wagatsuma, J.M. O'Malley, H.H. Lee, W. Walsh, A. Andrews, R. Humphreys, G. DiNardo	2/24/2011	Stock assessment of the main Hawaiian Islands Deep7 bottomfish complex through 2010	106th Meeting of the Scientific and Statistical Committee: Honolulu, HI. February 22-24, 2011	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Brodziak, J., H.H. Lee, M. Mangel	6/11/2011	Probable values of stock-recruitment steepness for North Pacific albacore tuna	The ISC Albacore Working Group: June 4-11, 2011. ISC/11/ALBWG/11	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Chiang, W.-C., M.K. Musyl, S.-C. Fu, T.-L. Huang, C.-L. Sun, W.-Y. Chen, D.-C. Liu, W.-C. Su, S.-Z. Yeh	2011	Electronic tagging studies of sailfish (Istiophorus platypterus) in eastern Taiwan to examine movement patterns, habitat preferences and fisheries interaction	Journal of Experimental Marine Biology and Ecology, 397, 129-135	Journal Article		Fisheries Oceanography: Ecosystem Observations & Research Program: Methods to Reduce Marlin Catch and to Estimate Post-release Mortality

Chowdary, J. S., S.-P. Xie, J.-Y. Lee, Y. Kosaka, and B. Wang	11/30/2010	Predictability of summer Northwest Pacific climate in 11 coupled model hindcasts: Local and remote forcing	J. Geophys. Res.-Atmos., 115, D22121	Journal Article	doi:10.1029/2010JD014595	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Chowdhury M.R., A.G. Barnston, C. Guard, S. Duncan, T. Schroeder, and P.-S. Chu	10/1/2010	Sea-level variability and change in the U.S-Affiliated Pacific Islands: Understanding the high sea levels during 2006-08	Weather, 65, 263-268	Journal Article		Pacific ENSO Applications Center
Chowdhury, M. R., T. Schroeder	5/26/2011	Rising sea level and the vulnerable coastal communities in the USAPI	Climate Information for Managing Risks (Conference): Orlando, FL. May 25-27, 2011	Presentation	http://conference.ifas.ufl.edu/CIMR/Presentations/Thursday/130%20pm/Session%2011-Boca%20111/0130%20(1)%20-%20Chowdhury.pdf	Pacific ENSO Applications Center
Chowdhury, M.R.	Spring 2011	Likelihood of high sea levels in the Hawaiian Islands	Hawai'i Planning: A Publication of the Hawaii Chapter of the American Planning Association, Spring 2011, 1-6	Newsletter	http://www.hawaiiapa.org/pdf/2011Spring Newsletter/Sea-level.pdf	Pacific ENSO Applications Center
Choy, C.A, B. Popp, J. Drazen, E. Gier, P. Davison, A. Flynn, J. Hoffman, J. McClain, T. Miller, S. Ross, T. Sutton	12/15/2010	AA-CSIA-derived regional comparison of the trophic positions of midwater fishes	PFRP meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/choy.pdf	PFRP: Examining Pelagic Food Webs using Multiple Chemical Tracers
Choy, C.A., P. Nichols, R. Phleger, B. Popp, J. Drazen	5/16/2011	Fat-scinating pelagic fishes: comparing fatty acid biomarker profiles in Hawaiian surface- and deep-dwelling predators	62nd Tuna Conference: Lake Arrowhead, CA. May 16-19, 2011	Presentation	http://www.tunaconference.org/PDFfiles/62nd Meeting/62nd-Tuna-Conference-Proceedings.pdf	PFRP: Examining Pelagic Food Webs using Multiple Chemical Tracers
Clarke, M.E., C. Whitmire, E. Fruh, J. Anderson, J. Taylor, J. Rooney, S. Ferguson, H. Singh	5/27/2011	Developing the SeaBED AUV as a tool for conducting routine surveys of fish and their habitat in the Pacific	In: Autonomous Underwater Vehicles, 2010 IEEE/OES, p. 1–5. Autonomous Underwater Vehicles 2010, Monterey, CA, September 1–3. NOAA Northwest Fisheries Science Center, Seattle, WA	Conference Proceedings	doi:10.1109/AUV.2010.5779665	Sustaining Healthy Coastal Ecosystems
Criddle, K., M. Pan, and K. Davidson	In press	A summary of the Pacific Islands Region Catch Share Workshop, Honolulu, HI March 9-12, 2010	NOAA PIFSC Administrative Report	Workshop Proceedings		MARDAP: Economics of Fisheries Initiative
Davidson, K., M. Pan, W. Hu, and D. Poerwanto	6/7/2011	A survey of demand preferences for aquaculture across geographically distinct markets	National Aquaculture Extension Conference: Memphis, TN. June 5-7	Presentation		MARDAP: Economics of Fisheries Initiative
Davidson, K., M. Pan, W. Hu, and D. Poerwanto	5/27/2010	Consumer preferences for wild caught and farm raised seafood: a comparison across species and consumer residence states	3rd National Forum on Socioeconomic Research in Coastal Systems, Center for Natural Resource Economics and Policy: New Orleans, Louisiana. May 26-28	Presentation		MARDAP: Economics of Fisheries Initiative

Davidson, K., M. Pan, W. Hu, and D. Poerwanto	In press	Consumers' willingness to pay for aquculture fish products vs. wild caught seafood—A case study in Hawaii	Aquaculture Economics and Management	Journal Article		MARDAP: Economics of Fisheries Initiative
Davidson, K., M. Pan, W. Hu, and D. Poerwanto	10/26/2010	Consumers' willingness to pay for aquculture fish products vs. wild caught seafood- A Case Study in Hawaii	Annual PICES Meeting, North Pacific Marine Science Organization: Portland, OR. October 22-31.	Presentation		MARDAP: Economics of Fisheries Initiative
Davidson, K., M. Pan, W. Hu, and D. Poerwanto	4/23/2011	Measuring the effect of socioeconomic factors on consumer preferences for seafood: A case study in Hawaii	4th International Symposia on Stock Enhancement and Sea Ranching: Shanghai, China. April 21-23	Presentation		MARDAP: Economics of Fisheries Initiative
De La Beaujardiere, J., R. Mendelssohn, C. Ortiz, R. Signell	11/1/2010	Building the IOOS data management subsystem	Marine Technology Society Journal, 44, 73-83	Journal Article	doi:10.4031/MTSJ.44.6.10	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
DesRochers, A.		IOOS biological observations project: Data integration	Integrated Ocean Observing System (IOOS) Biological Observations Workshop 2: Honolulu, HI. May 18-19, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
DesRochers, A.		Managing data from an integrated ecosystem monitoring program	PIFSC 2010 External Program Review: Scientific Data Management Systems and Capabilities, IMIN Conference Center, East-West Center: Honolulu, HI. July 20-22, 2010	Presentation	https://www.st.nmfs.noaa.gov/confluence/display/PIFSCrev/PIFSC+2010+External+Program+Review	Sustaining Healthy Coastal Ecosystems
Dewar, H., E.D. Prince, M.K. Musyl, R.W. Brill, C. Sepulveda, J. Luo, D. Foley, E.S. Orbesen, M.L. Domeier, N. Nasby-Lucas, D. Snodgrass, R.M. Laurs, J.P. Hoolihan, B.A. Block, L.M. McNaughton	May, 2011	Movements and behaviors of swordfish in the Atlantic and Pacific Oceans examined using pop-up satellite archival tags	Fisheries Oceanography, 20, 219-241	Journal Article	doi:10.1111/j.1365-2419.2011.00581.x	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
DiNardo, G., D. Courtney, L. Wagatsuma	4/21/2011	Report of the ISC Meeting of the Shark Working Group.	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean: Keelung, Taiwan. April 19-21, 2011	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
DiNardo, G., L. Wagatsuma	7/13/2010	Report of the ISC Meeting of the Pacific Billfish Working Group	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean: Victoria, BC, Canada. July 12-13, 2010	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program

DiNardo, G., L. Wagatsuma	1/27/2011	Report of the ISC Meeting of the Pacific Billfish Working Group	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean: Honolulu, HI. January 19-27, 2011	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Domokos, R.	12/16/2010	Oceanographic Investigation of Pelagic Habitat around the Mariana Islands	PFRP PI meeting at the lmin conference center (EWC): Honolulu, HI. Dec 15-16, 2011	Presentation		PFRP: Assimilating in situ Bioacoustic Data in a Mid-trophic Level Model and its Impact on Predicted Albacore Feeding Habitat in the American Samoa Waters
Donovan, M., P. Fisher-Pool, M. Lammers, K. Wong	2010	Northwestern Hawaiian Islands, passive acoustic monitoring site FFS1, French Frigate Shoals, Ecological Acoustic Recorder (EAR), 06-September-2006 to 24-September-2007, Level 1 analysis of passive acoustic observations	Pacific Islands Fisheries Science Center, PIFSC Internal Report IR-10-029	Technical Report		Sustaining Healthy Coastal Ecosystems
Donovan, M.K.		Demographic variability in an introduced Hawaiian reef fish	Western Society of Naturalists: San Diego, CA. November 11-14, 2010	Presentation		Sustaining Healthy Coastal Ecosystems
Donovan, M.K.		Demographic variability in an introduced Hawaiian reef fish	36th Tester's Symposium, University of Hawaii: Honolulu, HI. March 17, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Donovan, M.K.		Multi-scale demographic trends in an introduced Hawaiian reef fish: implications for population modeling	2nd International Marine Conservation Congress: Victoria, BC, Canada. May 14-18, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Donovan, M.K., I.D. Williams, A.M. Friedlander, K. Longnecker, J.P. Beets, B.W. Bowen, E.C. Franklin	In press	Catalog of coral reef fish life history specimens for the Hawaiian Islands	NOAA Pacific Islands Fisheries Science Center, PIFSC Internal Report	Technical Report		Sustaining Healthy Coastal Ecosystems
Dorman, J. G., T.M. Powell, W.J. Sydeman, and S.J. Bograd	2/17/2011	Advection and starvation cause krill (*Euphausia pacifica*) decreases in 2005 northern California coastal populations: Implications from a model study	Geophysical Research Letters, 38, L04605	Journal Article	doi:10.1029/2010GL046245	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Drazen, J., L. De Forest, R. Domokos	2011	Micronekton abundance and biomass in Hawaiian waters as influenced by seamounts, eddies, and the moon	Deep-Sea Research I 58, 557-566	Journal Article		PFRP: Examining Pelagic Food Webs using Multiple Chemical Tracers
Elison Timm, O., H. F. Diaz, T .W. Giambelluca, M. Takahashi	2/23/2011	Projection of changes in the frequency of heavy rain events over Hawaii based on leading pacific climate modes	J. Geophys. Res.-Atmos., 116, D041	Journal Article	doi:10.1029/2010JD014923.	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center

Felix, F., D.M. Palacios, S.K. Salazar, S. Caballero, B. Haase, J. Falconi	In press	The 2005 Humpback Whale Expedition: A first attempt to assess and characterize the population in the archipelago	Journal of Cetacean Research and Management	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Ferguson, M., K. Koyanagi		Aerial surveys and derelict fishing gear removal along main Hawaiian Islands nearshore environments: a case study	Fifth International Marine Debris Conference, Honolulu, HI. March 20–25, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Fisher-Pool, P.		The effects of vessel engine noise on acoustic behavior of the Hawaiian dascyllus (Dascyllus albisella)	Second International Conference on Effects of Noise in Aquatic Life: Cork, Ireland. August 15-20, 2010	Presentation		Sustaining Healthy Coastal Ecosystems
Fisher-Pool, P., M. Lammers, K. Wong	2011	American Samoa passive acoustic monitoring site ROSE, Rose Atoll, American Samoa, ecological acoustic recorder (EAR), 14-March-2008 to 16-July-2009. Level 1 analysis of passive acoustic observations.	Pacific Islands Fisheries Science Center, PIFSC Internal Report IR-11-001	Technical Report		Sustaining Healthy Coastal Ecosystems
Fournier, D.A., H. Skaug, J. Ancheta, J. Ianelli, A.Magnusson, M. Maunder, A. Nielsen, and J. Sibert	In press	AD Model Builder: using automatic differentiation for statistical inference of highly parameterized complex nonlinear models	Optimization Methods & Software	Journal Article	doi:10.1080/10556788.2011.597854	ADMB Open Source Project
Fu, X. H., B. Wang, J.-Y. Lee, W.Wang, L. Gao	In press	Sensitivity of dynamical intra-seasonal prediction skills to different initial conditions.	Monthly Weather Review	Journal Article		Multi-Model Ensemble Forecast of MJO
Fudeyasu, H., Y. Wang, M. Satoh, T. Nasuno, H. Miura, W. Yanase	12/1/2010	Multiscale interactions in the lifecycle of a tropical cyclone simulated in a Global Cloud-System-Resolving Model: Part I: Large-scale and storm-scale evolutions	Mon. Wea. Rev., 138, 4285–4304	Journal Article	doi:10.1175/2010MWR3475.1	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Fudeyasu, H., Y. Wang, M. Satoh, T. Nasuno, H. Miura, W. Yanase	12/1/2010	Multiscale interactions in the lifecycle of a tropical cyclone simulated in a Global Cloud-System-Resolving Model: Part II: System-scale and mesoscale processes	Mon. Wea. Rev., 138, 4305–4327	Journal Article	doi:10.1175/2010MWR3474.1	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
G. Wang, S.-P. Xie, T. Qu, and R. X. Huang	3/1/2011	Deep South China Sea circulation	Geophys. Res. Lett., 38, L05601	Journal Article	doi:10.1029/2010GL046626	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Hall, M., Y. Swimmer, M. Parga	In press	No "Silver bullets" but plenty of options: working with the Eastern Pacfic artisinal fishers to reduce sea turtle mortality in fisheries.	Marine Turtles of the Eastern Pacific: Conservation Challenges and Signs of Success.	Book Chapter		Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear

Hazen, E.L., D.P. Nowacek, L. St. Laurent, D. Moretti, P. Halpin	4/27/2011	The relationship among oceanography, prey fields, and beaked whale foraging habitat in the tongue of the ocean.	PLoS ONE, 6, e19269	Journal Article	doi:10.1371/journal.pone.0019269	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Hazen, E.L., D.W. Johnston	November, 2010	Meridional patterns in the deep scattering layers and top predator distribution in the central equatorial Pacific	Fisheries Oceanography, 19, 427-433	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Hazen, E.L., L.B. Crowder	In press	Fisheries ecology	Sourcebook for Theoretical Ecology: University of California Press	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Holland, K., D. Itano, L. Dagorn, and T. Lindstrom		Data from double-tagged animals elucidates the impact of FADs on behavior and feeding ecology of Yellowfin tuna	Proceedings of the 62nd Tuna Conference: Lake Arrowhead, CA. May 16-19, 2011	Conference Proceedings	http://www.tunaconference.org/Proceedings.htm	PFRP: Hawaii Tuna Tagging Project 2
Hoolihan, J.P., J. Luo, F.J. Abascal, S.E. Campana, G. De Metrio, H. Dewar, M.L. Domeier, L.A. Howey, M.E. Lutcavage, M.K. Musyl, J.D. Neilson, E.S. Orbesen, E.D Prince, J.R. Rooker	2011	Evaluating irregular post-release behaviour of large pelagic fishes deployed with pop-up satellite archival tags	ICES Journal of Marine Science, 68, 880-889	Journal Article		Fisheries Oceanography: Ecosystem Observations & Research Program: Methods to Reduce Marlin Catch and to Estimate Post-release Mortality
Houbcharaun, A., J. Hospital	5/11/2011	An empirical look at retail pricing behavior: The case of ahi in Hawaii	North American Association of Fisheries Economists (NAAFE) Forum	Presentation		Social and Economic Analysis of Western Pacific Fisheries
Howell, E.A., S.J. Bograd, C. Morishige, M.P. Seki, and J.J. Polovina	2011	On the North Pacific circulation and associated marine debris concentration	Marine Pollution Bulletin	Journal Article	doi:10.1016/j.marpolbul.2011.04.034	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Hoyle, S.		TUMAS - A management options simulation tool for the WCPFC	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	PFRP: Improved effectiveness of WCPFC through better informed fishery decision maker
Hsu, P.-C., and T. Li	2/1/2011	Interactions between boreal summer Intraseasonal oscillations and synoptic-scale disturbances over the western North Pacific. Part II: Apparent heat and moisture sources and eddy momentum transport	J. Climate, 24, 942-961	Journal Article	doi:10.1175/2010JCLI3834.1	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center

Hsu, P.-C., T. Li, and B. Wang	4/19/2011	Trends in global monsoon area and precipitation over the past 30 years	Geophys. Res. Lett., 38, L08701	Journal Article	doi:10.1029/2011GL046893	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Hsu, P.-C., T. Li, and C.-H. Tsou	2/1/2011	Interactions between boreal summer Intraseasonal oscillations and synoptic-scale disturbances over the western North Pacific. Part I: Energetics diagnosis	J. Climate, 24, 927-941	Journal Article	doi:10.1175/2010JCLI 3833.1	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Humphries, N.E., J.R.M. Dyer, N. Queiroz, N.G. Pade, M.K. Musyl, K. Schaefer, J.M. Brunnschweiler, T.K. Doyle, J.D.R Houghton, G.C. Hays, C.S. Jones, L.R. Noble, V.J. Wearmouth, E.J. Southall, D.W. Sims	6/24/2010	Environmental context explains Lévy and Brownian movement patterns of marine predators	Nature, 465, 1066-1069	Journal Article		Fisheries Oceanography: Ecosystem Observations & Research Program: Methods to Reduce Marlin Catch and to Estimate Post-release Mortality
Hutchings, J.A., C. Minto, D. Ricard, J.K. Baum, O.P. Jensen	7/15/2010	Trends in the abundance of marine fishes	Canadian Journal of Fisheries and Aquatic Sciences, 67, 1205-1210	Journal Article	http://www.nrcresearch press.com/doi/pdf/10.1139/F10-081	PFRP: Biological, Economic & Management Drivers of Fishery Performance: A Global Meta-analysis of Tuna & Billfish Stocks
Ishihara, T., Y. Matsuzawa, H. Peckham, J. Wang	In press	Meeting report: 2nd International workshop to mitigate bycatch of sea turtles in Japanese pound nets.	Marine Turtle Newsletter	Journal Article		Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear
Itano, D., K. Holland, J. Rooker, and R.J. Wells		Tuna management at sub-regional scales: Scientific, ecological and socio-economic aspects of an old debate	Proceedings of the 62nd Tuna Conference: Lake Arrowhead, CA. May 16-19, 2011	Conference Proceedings	http://www.tunaconference.org/Proceedings.htm	PFRP: Hawaii Tuna Tagging Project 2
Jayewardene, D.	2010	Experimental determination of the cost of lesion heling on Porites compressa growth	Coral Reefs, 29, 131-135	Journal Article	doi:10.1007/s00338-009-0560-2	Coral Reef Management Initiative
Johnson, G.C., and J.M. Lyman	6/1/2011	Global oceans: Sea surface salinity [in "State of the Climate in 2010"]	Bulletin of the American Meteorological Society, 92, S86-S88	Journal Article	doi:10.1175/BAMS-92-6-StateoftheClimate	Profiling CTD Float Array Implementation and Ocean Climate Research
Johnson, G.C., and J.M. Lyman	7/1/2010	Sea surface salinity [in "State of the Clilmate in 2009"]	Bulletin of the American Meteorological Society, 91, S63-S64	Journal Article	doi:10.1175/BAMS-91-7-StateoftheClimate	Profiling CTD Float Array Implementation and Ocean Climate Research
Johnson, G.C., J. M. Lyman, J.K. Willis, S. Levitus, T. Boyer, J. Antonov, M.D. Palmer, and S.A. Good	7/1/2010	Ocean heat content [in "State of the Clilmate in 2009"]	Bulletin of the American Meteorological Society, 91, S56-S59	Journal Article	doi:10.1175/BAMS-91-7-StateoftheClimate	Profiling CTD Float Array Implementation and Ocean Climate Research

Johnson, G.C., J.M. Lyman, J.K. Willis, S. Levitus, T. Boyer, J. Antonov, M.D. Palmer, and S.A. Good	6/1/2011	Ocean heat content [in "State of the Climate in 2010"]	Bulletin of the American Meteorological Society, 92, S81-S84	Journal Article	doi:10.1175/BAMS-92-6-StateoftheClimate	Profiling CTD Float Array Implementation and Ocean Climate Research
Johnson, N.C., and S.-P. Xie	11/7/2010	Changes in the sea surface temperature threshold tropical convection	Nature Geoscience, 3, 842-845	Journal Article	doi:10.1038/ngeo1008	Remote Versus Local Focing of Intraseasonal Variability in the IAS Region: Consequences for Prediction
Jones, T.T., K. Thielman, P. Baron, M. Elfstrom, R. Stephens	4/1/2011	Preliminary report	Preliminary Report/ JIMAR Annual Report	Technical Report		PFRP: Biotelemetry Tag Retention in Pelagic Tuna
Kenyon, J., J. Maragos, P. Vroom		The distribution and abundance in the Northwestern Hawaiian Islands of corals petitioned for listing under the U.S. Endangered Species Act	2011 Northwestern Hawaiian Islands Research Symposium, IMIN Conference Center, East-West Center: Honolulu, HI. February 25–26, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Kikiuchi, K., B. Wang, and Y. Kajikawa	In press	Bimodal representation of the Tropical intraseasonal oscillation.	Climate dynamics	Journal Article		Multi-Model Ensemble Forecast of MJO
Kikuchi, K., and B. Wang	6/1/2010	Formation of tropical cyclones in the northern Indian Ocean associated with two types of tropical intraseasonal oscillation modes	J. Meteor. Soc. Japan, 88, 475–496	Journal Article	doi:10.2151/jmsj.2010-313	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Kikuchi, K., and B. Wang	7/1/2010	Spatio-temporal wavelet transform and the multiscale behavior of the Madden-Julian Oscillation	J. Climate, 23, 3814–3834	Journal Article	doi:10.1175/2010JCLI2693.1	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Kim, E., and J. Sibert		The distribution of FADs and its influence on Skipjack tuna movement in the Western and Central Pacific Ocean	Proceedings of the 62nd Tuna Conference: Lake Arrowhead, CA. May 16-19, 2011	Conference Proceedings	http://www.tunaconference.org/Proceedings.htm	Pelagic Fisheries Research Program (PFRP): Program Management
Kittinger, J.		Characterization of small-scale and traditional fisheries of the U.S. Pacific Islands - Introduction to a new PFRP sociocultural research project	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	PFRP: Descriptive Assessment of Traditional and Small-Scale Fisheries in the Western Pacific
Knowlton, N., R.E. Brainard, R. Fisher, M. Moews, L. Plaisance, M.J. Caley	11/23/2010	Coral reef biodiversity	In: McIntyre AD (ed.). Life in the world's oceans: diversity, distribution, and abundance, p. 65–77 (Chapter 4). Blackwell Publishing Ltd., Oxford, UK	Book Chapter	doi:10.1002/9781444325508.ch4	Sustaining Healthy Coastal Ecosystems

Kobayashi, D., I. Cheng, D. Parker, J. Polovina, N. Kamezaki, G. Balazs	1/7/2011	Loggerhead Turtle (*Caretta caretta*)movement off the coast of Taiwan: characteristics of a hotspot in the East China Sea and investigation of mesoscale eddies	ICES Journal of Marine Science, 68, 707-718	Journal Article	http://icesjms.oxfordjournals.org/content/68/4/707.short	Fisheries Oceanography: Marine Turtle Research Program
Kopf, K.		Life history of striped marlin (*Kajikia audax*) and the value of biological information for stock assessment of pelagic fishes	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	PFRP: Age and Growth of Striped Marlin, Kajikia audax Caught in the Hawaii-based Longline Fishery
Koyanagi, K., R. Boland		Derelict fishing gear removal in the Papahʻnaumokuʻkea Marine National Monument	Fifth International Marine Debris Conference, Honolulu, HI. March 20–25, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Kurapov, A.L., D. Foley, P.T. Strub, G.D. Egbert, and J.S. Allen	5/14/2011	Variational assimilation of satellite observations in a coastal ocean model off Oregon	Journal of Geophysical Research, 116, C05006	Journal Article	doi:10.1029/2010JC006909	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Lammers, M.		Passive acoustic monitoring of biological trends in the NWHI	2011 Northwestern Hawaiian Islands Research Symposium, IMIN Conference Center, East-West Center: Honolulu, HI. February 25–26, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Law, K.L., S. Morét-Ferguson, N.A. Maximenko, G. Proskurowski, E.E. Peacock, J. Hafner, and C.M. Reddy	9/3/2010	Plastic accumulation in the North Atlantic Subtropical Gyre	Science, 329, 1185–1188	Journal Article	doi:10.1126/science.1192321	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center
Lee, H.H.	10/19/2010	Estimating input sample size for length-frequency data in Stock Synthesis: US longline and US troll fisheries	The ISC Albacore Working Group: La Jolla, CA. October 12-19, 2010. ISC/10/ALBWG-03/03	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Lee, H.H., J. Brodziak	2/24/2011	Investigation of the association between Hawaii deep slope bottomfish CPUE and environmental variables	106th Meeting of the Scientific and Statistical Committee: Honolulu, HI. February 22-24, 2011	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Lee, H.H., L.H. Teo, S. Kohin, J. Ianelli, I.Taylor	6/11/2011	Preliminary population analysis of North Pacific albacore based on the Stock Assessment Program Stock Synthesis 3	The ISC Albacore Working Group: June 4-11, 2011. ISC/11/ALBWG/03.	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Lee, H.H., M. Maunder, K.P. Piner, R. Methot	4/1/2011	Estimating natural mortality within a fisheries stock assessment model: an evaluation using simulation analysis based on twelve stock assessments	Fisheries Research, 109, 89-94	Journal Article	http://www.sciencedirect.com/science/article/pii/S0165783611000403	Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program

Lehodey, P.	9/24/2010	Towards operational management of pelagic ecosystems	ICES CM Documents	Conference Proceedings	ISBN 978-87-7482-085-7	PFRP: Assimilating in situ Bioacoustic Data in a Mid-trophic Level Model and its Impact on Predicted Albacore Feeding Habitat in the American Samoa Waters
Lemos, R.T., B. Sansó	2010	Conditionally Linear Models for Non-Homogeneous Spatial Random Fields	AMS Tech Report	Journal Article	doi:10.1016/j.stamet.2011.02.001	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Lemos, R.T., B. Sansó	In press	Conditionally linear models for non-homogeneous spatial random fields	Statistical Methodology	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Lemos, R.T., B. Sansó, F.D. Santos	July, 2010	Hierarchical Bayesian modelling of wind and sea surface temperature from the Portuguese coast	International Journal of Climatology, 30, 1423-1430	Journal Article	doi:10.1002/joc.1981	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Levin, P.S., F.B. Schwing, Eds.	2011	Technical background for an IEA of the California Current: Ecosystem health, salmon, groundfish, and green sturgeon	NOAA Techincal Memorandum	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Li, Y.H.	2/19/2011	Partition of elements between solid and liquid phases in aqueous environment	Aquatic Geochemistry	Journal article	doi 10.1007/s10498-011-9121-8	Penetration of Anthropogenic CO2 in the Oceans Based on Analysis of Recent WOCE/JGOFS/OACES Carbon Data Using the Remineralization Ratios Obtained by the New Three-End-Member Mixing Model
Li, Y.H., Y. Sohrin, T. Takamatsu	4/1/2011	Lake Biwa and the ocean: Geochemical similarity and difference	Limnology 12, 89-101	Journal article		Penetration of Anthropogenic CO2 in the Oceans Based on Analysis of Recent WOCE/JGOFS/OACES Carbon Data Using the Remineralization Ratios Obtained by the New Three-End-Member Mixing Model

Looney, E., B. Vargas-Ángel		Relationships between temperature, bleaching, and coral disease in the Northwestern Hawaiian Islands	2011 Northwestern Hawaiian Islands Research Symposium, IMIN Conference Center, East-West Center: Honolulu, HI. February 25–26, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Maison, K.A., I. Kinan-Kelly, K. Frutchey	9/1/2010	Green turtle nesting sites and sea turtle legislation throughout Oceania	U.S. Dep. Commerce, NOAA Technical Memorandum. NMFS-F/SPO-110, 52 pp.	Memorandum	http://www.fpir.noaa.gov/Library/PUBDOCs/tech_memo/GreenTurtle_TechMemoFINAL2.pdf	Protected Resources Environmental Compliance Initiative
Manuel, M.E., K. Koyanagi		In-water surveys and removal of marine debris following a tsunami in American Samoa	Fifth International Marine Debris Conference, Honolulu, HI. March 20–25, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
McGregor, A., A. Timmermann, N. Schneider, M.F. Stuecker, M.H. England	submitted in 2011	The effect of the South Pacific Convergence Zone on the termination of El Nino events and the meridional asymmetry of ENSO	J. Climate	Journal Article		Changes in the Tropical Pacific Climate Variability During the Last Millennium: External Forcing Versus Internal Variability
McGregor, S., A. Timmermann	4/1/2011	The effect of explosive tropical volcanism on ENSO	J. Climate, 24, 2178-2191	Journal Article	doi:10.1175/2010JCLI3990.1	Changes in the Tropical Pacific Climate Variability During the Last Millennium: External Forcing Versus Internal Variability
Mendelssohn, R.	May, 2011	The STAMP software for state-space models	Journal of Statistical Software, 41	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Miller, J., T. Battista, A. Pritchett, S. Rohmann, J. Rooney	3/14/2011	Coral Reef Conservation Program mapping achievements and unmet needs	NOAA Coral Reef Conservation Program, Silver Spring, MD. 68 p.	Technical Report	http://data.nodc.noaa.gov/coris/library/NOAA/CRCP/other/other_crcp_publications/CRCP_Mapping_Achievements_and_Unmet_Needs_March142011.pdf	Sustaining Healthy Coastal Ecosystems
Mon, J.-Y., B. Wang, and K.-J. Ha	In press	Modulation on 2009/10 winter snowstorms in the United States	J. Climate	Journal Article		Multi-Model Ensemble Forecast of MJO
Moore, A.M., H.G. Arango, G. Broquet, C. Edwards, M. Veneziani, B. Powell, D. Foley, J.D. Doyle, D. Costa, P. Robinson	2011	The Regional Ocean Modeling System (ROMS) 4-dimensional variational data assimilation systems: Part II	Progress in Oceanography	Journal Article	doi:10.1016/j.pocean.2011.05.003	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations

Moore, A.M., H.G. Arango, G. Broquet, C. Edwards, M. Veneziani, B. Powell, D. Foley, J.D. Doyle, D. Costa, P. Robinson	2011	The Regional Ocean Modeling System (ROMS) 4-dimensional variational data assimilation systems: Part III	Progress in Oceanography	Journal Article	doi:10.1016/j.pocean.2011.05.005	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Musyl, M.K., M. Domeier, N. Nasby-Lucas, R.W. Brill, L.M. McNaughton, J.Y. Swimmer, M. Lutcavage, S.G. Wilson, B. Galuardi, J.B. Liddle	In press	Performance of pop-up satellite archival tags	Marine Ecology Progress Series	Journal Article		Fisheries Oceanography: Ecosystem Observations & Research Program: Methods to Reduce Marlin Catch and to Estimate Post-release Mortality
Musyl, M.K., R.W. Brill, D.S. Curran, L.M. McNaughton, B. Kikkawa, N. Fragoso, C.D Moyes	In press	Post-release survival, vertical movements and thermal niche partitioning in five species pelagic sharks released from longline fishing gear in the central Pacific Ocean	Fishery Bulletin	Journal Article		Fisheries Oceanography: Ecosystem Observations & Research Program: Methods to Reduce Marlin Catch and to Estimate Post-release Mortality
Nadon, M., I. Williams, J.S. Ault, B. Zgliczynski		Towards using underwater visual surveys and benthic habitat information for population/stock assessment of coral reef fish: examples from Hawaii	2011 Northwestern Hawaiian Islands Research Symposium, IMIN Conference Center, East-West Center: Honolulu, HI. February 25–26, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Nowacek, D.P., A.S. Friedlaender, P.N. Halpin, E.L. Hazen, D.W. Johnston, A.J. Read, M. Zhou, Y. Zhu	4/27/2011	Super-Aggregations of krill and humpback whales in Wilhelmina Bay, Antarctic Peninsula	PLoS ONE, 6, e19173	Journal Article	doi:10.1371/journal.pone.0019173	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
O'Malley, J.M.	In press	Spatiotemporal variation in the population ecology of scaly slipper lobsters Scyllarides squammosus in the Northwestern Hawaiian Islands	Marine Biology	Journal Article	http://www.springerlink.com/content/k4hw0100440w8314/	Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Pacific Islands Fisheries Science Center	9/15/2010	Coral reef ecosystems of the Mariana Archipelago: a 2003-2007 overview	NOAA Pacific Islands Fisheries Science Center, PIFSC Special Publication, SP-10-002, 38 p.	Technical Report	http://www.pifsc.noaa.gov/cred/mariana_overview.php	Sustaining Healthy Coastal Ecosystems
Pacific Islands Fisheries Science Center	2/14/2011	Cruise report, NOAA Ship Hi`ialakai, cruise HA-10-01, Leg I, 21 January–14 February 2010, Johnston Atoll, Howland Island, and Baker Island of the Pacific Remote Islands Marine National Monument	Pacific Islands Fisheries Science Center, PIFSC Cruise Report, CR-10-009, 61 p.	Technical Report	http://www.pifsc.noaa.gov/library/hiialakai.php	Sustaining Healthy Coastal Ecosystems

Pacific Islands Fisheries Science Center	2/14/2011	Cruise report, NOAA Ship Hi`ialakai, cruise HA-10-01, Leg II, 17 February–23 March 2010, American Samoa: Tutuila Island, Aunu`u Island, Rose Atoll, South Bank, Ofu Island, Olosega Island, Ta`u Island, Swains Island	Pacific Islands Fisheries Science Center, PIFSC Cruise Report, CR-10-011, 87 p.	Technical Report	http://www.pifsc.noaa.gov/library/hiialakai.php	Sustaining Healthy Coastal Ecosystems
Pacific Islands Fisheries Science Center	2/14/2011	Cruise report, NOAA Ship Hi`ialakai, cruise HA-10-01, Leg III, 27 March–24 April 2010, Jarvis Island, Palmyra Atoll, and Kingman Reef of the Pacific Remote Islands Marine National Monument	Pacific Islands Fisheries Science Center, PIFSC Cruise Report, CR-10-010, 69 p.	Technical Report	http://www.pifsc.noaa.gov/library/hiialakai.php	Sustaining Healthy Coastal Ecosystems
Pacific Islands Fisheries Science Center	4/15/2011	Cruise report, NOAA Ship Hi`ialakai, cruise HA-10-07, 4–29 September 2010, Northwestern Hawaiian Islands (NWHI): French Frigate Shoals, Pearl and Hermes Atoll, Kure Atoll, and Lisianski Island and Neva Shoal. Main Hawaiian Islands: Five Fathom Pinnacle	Pacific Islands Fisheries Science Center, PIFSC Cruise Report, CR-11-002, 64 p.	Technical Report	http://www.pifsc.noaa.gov/library/hiialakai.php	Sustaining Healthy Coastal Ecosystems
Pacific Islands Fisheries Science Center	2/21/2011	Cruise report, NOAA Ship Hi`ialakai, cruise HA-10-08, 7 October–5 November 2010, Main Hawaiian Islands: Hawai`i Island, Maui Island, Lana`i Island, Kaua`i Island, Ni`ihau Island, Lehua Rock, O`ahu Island, and Moloka`I Island	Pacific Islands Fisheries Science Center, PIFSC Cruise Report, CR-11-001, 85 p.	Technical Report	http://www.pifsc.noaa.gov/library/hiialakai.php	Sustaining Healthy Coastal Ecosystems
Pacific Islands Fisheries Science Center	5/13/2011	Cruise report, NOAA Ship Hi`ialakai, cruise HA-11-01, Leg I, 10 March–2 April 2011, Wake Atoll	Pacific Islands Fisheries Science Center, PIFSC Cruise Report, CR-11-004, 35 p.	Technical Report	http://www.pifsc.noaa.gov/library/hiialakai.php	Sustaining Healthy Coastal Ecosystems
Pacini, A.F., P.E. Nachtigall, C.T. Quintos, D. Schofield, D.A. Look, G.A. Levine, J.P. Turner	6/22/2011	Audiogram of a stranded Blainville's beaked whale (Mesoplodon densirostris) measured using auditory evoked potentials	J. Exp. Biol. 214, 2409-2415	Journal Article		Protected Resources Environmental Compliance Initiative
Palacios, D.M., Salazar, S.K., and F.H. Vargas	2010	Galápagos marine vertebrates: responses to environmental variability and potential impacts of climate change	Climate Change Vulnerability Assessment of the Galápagos Islands	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations

Palmer, M. D., J. Antonov, P. Barker, N. Bindoff, T. Boyer, M. Carson, C.M. Domingues, S. Gille, P. Gleckler, S. Good, V. Gouretski, S. Guinehut, K. Haines, D.E. Harrison, M. Ishii, G.C. Johnson, S. Levitus, M.S. Lozier, J.M. Lyman, A. Meijers, K. von Shuckmann, D. Smith, S. Wijffels, and J. Willis	12/1/2010	Future observations for monitoring global ocean heat content	In Proceedings of the "OceanObs'09: Sustained Ocean Observations and Information for Society" Conference (Vol. 2), September 21-25, 2009, Venice, Italy. Hall, J., D.E. Harrison, and D. Stammer, Eds., ESA Publication WPP-306	Conference Proceedings	doi:10.5270/OceanObs09.cwp.68	Profiling CTD Float Array Implementation and Ocean Climate Research
Palmer, M.D., K. Haines, and J. M. Lyman	7/1/2010	Recent advances in our understanding of Global ocean heat [in "State of the Clilmate in 2009"]	Bulletin of the American Meteorological Society, 91, S63-S64	Journal Article	doi:10.1175/BAMS-91-7-StateoftheClimate	Profiling CTD Float Array Implementation and Ocean Climate Research
Pan, M., K. Davidson, W. Hu, and D. Poerwanto	4/22/2011	Preference between wild capture and marine aquaculture fish in relation to geographical differences	9th Asian Fisheries and Aqauculture Forum: Shanghai, China. April 21-23	Presentation		MARDAP: Economics of Fisheries Initiative
Perry, T., N. Pomeroy, K. Lino, K. O'Brien	12/1/2010	2008 Main Hawaiian Islands derelict fishing gear survey	NOAA Pacific Islands Fisheries Science Center, PIFSC Special Publication, SP-10-003. 36 p.	Technical Report	http://www.pifsc.noaa.gov/library/pubs/SP-10-003.pdf	Sustaining Healthy Coastal Ecosystems
Piner, K., H.H. Lee	2/24/2011	Estimation of bottomfish CPUE using the delta method and HDAR logbooks 1948-2010	106th Meeting of the Scientific and Statistical Committee: Honolulu, HI. February 22-24, 2011	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Piner, K.P., H.H. Lee	1/27/2011	Meta-analysis of striped marlin natural mortality	The ISC Billfish Working Group: Honolulu, HI. January 19-27, 2011. ISC/11/BILLWG-1/10.	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Piner, K.P., H.H. Lee, M. Maunder, R. Methot	In press	A simulation-based method to determine model misspecification: examples using natural mortality and population dynamics models	Marine and Coastal Science	Journal Article		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Popp, B., K. Arthur, C. Bradley, C.A. Choy, E. Gier, N. Wallsgrove	5/16/2011	Compound specific nitrogen isotope analysis of amino acids: a new tool for studying the trophic ecology of marine animals	63rd Tuna Conference: Lake Arrowhead, CA. May 16-19, 2011	Presentation	http://www.tunaconference.org/PDFfiles/62ndMeeting/62nd-Tuna-Conference-Proceedings.pdf	PFRP: Examining Pelagic Food Webs using Multiple Chemical Tracers
Qu, T., S. Gao, and I. Fukumori	4/7/2011	What governs the North Atlantic salinity maximum in a global GCM?	Geophys. Res. Lett., 38, L07602	Journal Article	doi:10.1029/2011GL046757	Enhancement of Data and Research Activities for Climate Studies at the International Pacific Research Center

Richards, B.L., I.D. Williams, M.O. Nadon, B.J. Zgliczynski	1/1/2011	A towed-diver survey method for mesoscale fishery-independent assessment of large-bodied reef fishes	Bulletin of Marine Science, 87(1), 55-74	Journal Article	doi:10.5343/bms.2010.1019	Sustaining Healthy Coastal Ecosystems
Richmond, L.	4/1/2011	Narrating geographic knowledge: Telling stories, writing the world	Association of American Geographers Annual Meeting: Seattle, WA.	Presentation		Human Dimensions of Fishing and Marine Ecosystems in the Western Pacific/ Sociocultural Profiles of Pacific Islands Regions Fishing Ports
Richmond, L.	5/1/2011	Confronting the colonial legacy of fisheries management: Policy challenges and possibilities	Native American and Indigenous Studies Association Conference: Sacramento, CA.	Presentation		Human Dimensions of Fishing and Marine Ecosystems in the Western Pacific/ Sociocultural Profiles of Pacific Islands Regions Fishing Ports
Richmond, L.	Submitted on 4/01/2011	Culture, property, and catch shares: Lessons from Alaska	Marine Policy Special Issue: Catch Share Workshop: Pacific Islands Fisheries	Workshop Proceedings		Human Dimensions of Fishing and Marine Ecosystems in the Western Pacific/ Sociocultural Profiles of Pacific Islands Regions Fishing Ports
Richter, I., S.-P. Xie, A.T. Witternberg, and Y. Masumoto	3/4/2011 online	Tropical Atlantic biases and their relation to surface wind stress and terrestrial precipitation	Climate Dynamics, ONLINE	Journal Article	doi:10.1007/s00382-011-1038-9	Roles of Ocean-Atmosphere-Land Interaction in Shaping Tropical Atlantic Variability and Toward Reducing Climate Model Biases in the Equatorial Atlantic and Adjacent Continetns
Robel, A.A., S.F. Gary, M.S. Lozier, G.L. Shillinger, H. Bailey, S.J. Bograd	In press	Projecting uncertainty onto marine megafauna trajectories	Deep-Sea Research	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Roeber, V., Y. Yamazaki, K.F. Cheung	2010	Resonance and impact of the 2009 Samoa tsunami around Tutuila, American Samoa.	Geophysical Research Letters, 37, L21604	Journal Article	doi:10.1029/2010GL044419	Three-dimensional Model of Tsunami Generation and Near-field Characteristics
Rooney, J., E. Donham, T. Montgomery, H. Spalding, F. Parrish, R. Boland		Mesophotic coral ecosystems (MCEs) in the Hawaiian Archipelago	ASLO Aquatic Sciences Meeting, San Juan, Puerto Rico. February 13–18, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Rudershausen, P.A., W.A. Mitchell, J.A. Buckel, E.H. Williams, E.L. Hazen	2010	Developing a two-step fishery-independent design to estimate the relative abundance of deepwater reef fish: application to a marine protected area of the southeastern United States coast	Fisheries Research, 105, 254-260	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations

Ruttenberg, B.I., S.L. Hamilton, S.M. Walsh, M.K. Donovan, A. Friedlander, E. DeMartini, E. Sala, S.A. Sandin	6/16/2011	Predator-induced demographic shifts in coral reef fish assemblages	PLoS ONE, 6(6), e21062	Journal Article	doi:10.1371/journal.pone.0021062	Sustaining Healthy Coastal Ecosystems
Sales, G., B. Guffoni, Y. Swimmer, N. Marcovaldi, L. Bugoni	12/1/2010	Circle hook effectiveness for the mitigation of sea turtle bycatch and capture of target species in a Brazilian pelagic longline fishery.	Aquatic Conserv: Mar. Freshw. Ecosyst., 20, 428–436	Journal Article		Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear
Schopmeyer, S.S., P.S. Vroom, J.C. Kenyon	In press	Spatial and temporal comparisons of benthic composition at Necker Island, Northwestern Hawaiian Islands	Pacific Science	Journal Article		Sustaining Healthy Coastal Ecosystems
Schultz, J.K., J.M. O'Malley, E.E. Kehn, J.J. Polovina, F.A. Parrish, R.K. Kosaki	5/1/2011	Tempering expectations of recovery for previously exploited populations in a fully protected marine reserve	Journal of Marine Biology, 2011, article ID 749131	Journal Article	http://www.hindawi.com/journals/jmb/2011/749131/	Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Senina, I.		Progress in spatially explicit modeling of tuna population dynamics	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	PFRP: Integrating Conventional and Electronic Tagging Data into the Spatial Ecosystem and Population Model SEAPODYM
Seo, H., and S.-P. Xie	3/25/2011	Response and impact of equatorial ocean dynamics and tropical instability waves in the tropical Atlantic under global warming: A regional coupled downscaling study	Journal of Geophysical Research-Oceans., 116, 18	Journal Article	doi:10.1029/2010JC006670	Roles of Ocean-Atmosphere-Land Interaction in Shaping Tropical Atlantic Variability and Toward Reducing Climate Model Biases in the Equatorial Atlantic and Adjacent Continetns
Shillinger, G.L., A.M. Swithenbank, H. Bailey, S.J. Bograd, M.R. Castleton, B.P Wallace, J.R. Spotila, F.V. Paladino, R. Piedra, and B.A. Block	2011	Vertical and horizontal habitat preferences of leatherback turtle post-nesting habitats in the South Pacific Ocean	Marine Ecology Progress Series, 422, 275-278	Journal Article		Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Sippel, T.		Behavioural and environmental influences on the distribution of striped marlin (*Kajikia audax*) in the Southwest Pacific Ocean: Results from behavioural modelling of individual movements	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	JIMAR Visiting Scientist
Sippel, T., and S. Teo		Recruitment habitat of Pacific tunas and billfish: Meta-analysis, predictions and needs	Proceedings of the 62nd Tuna Conference: Lake Arrowhead, CA. May 16-19, 2011	Conference Proceedings	http://www.tunaconference.org/Proceedings.htm	JIMAR Visiting Scientist

Small, R.J., S.-P. Xie, E.D. Maloney, S.P. deSzoeke, and T. Miyama	3/25/2010 online	Intraseasonal variability in the far-east Pacific: investigation of the role of air-sea coupling in a regional coupled model	Climate Dynamics, 36, 867-890	Journal Article	doi:10.1007/s00382-010-0786-2	Remote Versus Local Focing of Intraseasonal Variability in the IAS Region: Consequences for Prediction
Sooraj, K.P., H. Annamalai, A. Kumar, H. Wang	submitted in 2011	A comprehensive assessment of CFS over the tropics	Weather and Forecasting (revised)	Journal Article		Development of an Extended and Long-range Precipitation Prediction System over the Pacific Islands
Sudnovsky, M.		Tackling marine debris in the Northwestern Hawaiian Islands	Presentation made to the general public at Hanauma Bay: Honolulu, HI. March 31	Presentation		Sustaining Healthy Coastal Ecosystems
Sudnovsky, M., K. O'Brien		Derelict fishing gear removals from the Northwestern Hawaiian Islands	Fifth International Marine Debris Conference, Honolulu, HI. March 20–25, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Sundberg, M., K. Underkoffler	2011	Size composition and length-weight data for bottomfish and pelagic species collected at the United Fishing Agency Fish Auction in Honolulu, Hawaii from October 2007 to December 2009	PIFSC Administrative Report H-11-02	Technical Report		Fisheries Oceanography: Ecosystem Observations & Research Program
Suntsov, A., R. Domokos	8/5/2010	Vertically migrating micronekton and macrozooplancton communities around Guam and the Northern Mariana Islands	PIFSC seminar series (Dole Street): Honolulu, HI	Presentation		PFRP: Assimilating in situ Bioacoustic Data in a Mid-trophic Level Model and its Impact on Predicted Albacore Feeding Habitat in the American Samoa Waters
Swimmer, Y., J. Suter, R. Arauz, K. Bigelow, J. Wang, C. Boggs	12/1/2010	Sustainable fishing gear: the case of modified circle hooks in a Costa Rican longline fishery.	Marine Biology, 158, 757-767	Journal Article		Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear
Swimmer, Y., J. Wang, R. Arauz, M. McCracken	12/1/2010	Effects of hook offsets on target species catch rates and sea turtle bycatch in a shallow Costa Rican longline fishery.	Aquatic Conserv: Mar. Freshw. Ecosyst., 20, 445 – 451	Journal Article		Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear
Swimmer, Y., L. McNaughton, D. Foley, L. Moxey, A. Nielsen	12/1/2010	Movements of olive Ridley sea turtles (L. olivacea) and associated oceanographic features as determined by improved light-based geolocation.	Endangered Species Research Journal, 10, 245–254	Journal Article		Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear

Swimmer, Y., R. Arauz, J. Wang, J. Suter, M. Musyl, A. Bolanos, A. Lopez	3/26/2010 online	Comparing the effects of offset and non-offset circle hooks on catch rates of fish and sea turtles in a shallow longline fishery	Aquatic Conservation: Marine and Freshwater Ecosystems	Journal Article	doi:10.1002/aqc.1108	Fisheries Oceanography: Ecosystem Observations & Research Program: Methods to Reduce Marlin Catch and to Estimate Post-release Mortality
Sydeman, W.J., S.A. Thompson, J.C. Field, W.T. Peterson, R.W. Tanasichuk, H.J. Freeland, S.J. Bograd, and R.R. Rykaczewski	6/24/2011	Does positioning of the North Pacific Current affect downstream ecosystem productivity?	Geophysical Research Letters, 38, L12606	Journal Article	doi:10.1029/2011GL047212	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Teo, L.H., H.H. Lee, S. Kohin	10/19/2010	Time series associated with albacore fisheries based in the Northeast Pacific Ocean	The ISC Albacore Working Group: La Jolla, CA. October 12-19, 2010. ISC/10/ALBWG-03/02.	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Timmers, M.A., K.R. Andrews, C.E. Bird, M.J. deMaintenton, R.E. Brainard, R.J. Toonen	1/1/2011	Widespread dispersal of the crown-of-thorns sea star, Acanthaster planci, across the Hawaiian Archipelago and Johnston Atoll. Journal of Marine Biology	Journal of Marine Biology, 2011, Article ID 934269	Journal Article	doi:10.1155/2011/934269	Sustaining Healthy Coastal Ecosystems
Tokinaga, H., and S.-P. Xie	1/12/2011	Wave and Anemometer-based Sea-surface Wind (WASWind) for climate change analysis	J. Climate, 24, 267-285	Journal Article	doi:10.1175/2010JCLI3789.1	Roles of Ocean-Atmosphere-Land Interaction in Shaping Tropical Atlantic Variability and Toward Reducing Climate Model Biases in the Equatorial Atlantic and Adjacent Continetns
Tokinaga, H., and S.-P. Xie	2/6/2011 online	Weakening of the equatorial Atlantic cold tongue over the past six decades	Nature Geosci., 4, 222-226	Journal Article	doi:10.1038/ngeo1078	Roles of Ocean-Atmosphere-Land Interaction in Shaping Tropical Atlantic Variability and Toward Reducing Climate Model Biases in the Equatorial Atlantic and Adjacent Continetns
Tribollet, A.D., T. Schils, P.S. Vroom	11/1/2010	Spatial-temporal variability in macroalgal assemblages of American Samoa	Phycologia, 49, 574-591	Journal Article		Sustaining Healthy Coastal Ecosystems
Tsuda, R.T., I.A. Abbott, P.S. Vroom, J.R. Fisher	10/1/2010	Marine benthic algae from Johnston Atoll: new species records, spatial distribution, and taxonomic affinities with neighboring islands	Pacific Science, 64, 581-601	Journal Article	doi:10.2984/64.4.585	Sustaining Healthy Coastal Ecosystems
Tsuda, R.T., J.R. Fisher, P.S. Vroom	In press	First floristic account of the marine benthic algae from Jarvis Island and Kingman Reef, Line Islands, central Pacific	Australian Journal of Systematic Botany	Journal Article		Sustaining Healthy Coastal Ecosystems

Tsuda, R.T., J.R. Fisher, P.S. Vroom	In press	First records of marine benthic algae from Swains Island, American Samoa	Cryptogamie Algologie	Journal Article		Sustaining Healthy Coastal Ecosystems
Vargas-Ángel, B.		Predicting temperature-related disease in the Great Barrier Reef and Hawaiian Islands	Coral Bleaching Response Workshop for Papahʻnaumokuʻkea Marine National Monument: Honolulu, HI. March 8–10, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Vargas-Ángel, B.	12/1/2010	Crustose coralline algal diseases in the U.S.-Affiliated Pacific Islands	Coral Reefs, 29, 943-956	Journal Article	doi:10.1007/s0038-010-0646-x	Sustaining Healthy Coastal Ecosystems
Vargas-Ángel, B., E.E. Looney, O.J. Vetter, E.F. Coccagna	In press	Severe, widespread El Niño-associated coral bleaching in the US Phoenix Islands	Bulletin of Marine Science	Journal Article		Sustaining Healthy Coastal Ecosystems
Vargas-Ángel, B., et al.		Spatial, temporal and taxonomic patterns of coral bleaching in the Northwestern Hawaiian Islands.	2011 Northwestern Hawaiian Islands Research Symposium, IMIN Conference Center, East-West Center: Honolulu, HI. February 25–26, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Vargas-Ángel, B., J. Kenyon		Bleaching through time in the Northwestern Hawaiian Islands	Coral Bleaching Response Workshop for Papahʻnaumokuʻkea Marine National Monument: Honolulu, HI. March 8–10, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Vaz, A.C., K. Richards, C. Paris, Y. Jia	3/17/2011	Effects of local wind forcing on larval dispersion and connectivity in the main Hawaiian Islands	36th Albert L. Tester Memorial Symposium	Conference Proceedings	http://www.hawaii.edu/zoology/tester/Tester_Webprogram.pdf	PFRP: Early Life Stage Dispersal of Yellowfin Tuna (Thunnus albacares) in the Central North Pacific
Vaz, A.C., K. Richards, C. Paris, Y. Jia	Submitted	Flow variability and its impact on connectivity for the Kona coast of the Hawai'i Island	PIFSC Kona Symposium 2011	Workshop Proceedings		PFRP: Early Life Stage Dispersal of Yellowfin Tuna (Thunnus albacares) in the Central North Pacific
Vetter, O., R. Brainard		In situ and satellite oceanography: coral bleaching in Papahʻnaumokuʻkea	Coral Bleaching Response Workshop for Papahʻnaumokuʻkea Marine National Monument: Honolulu, HI. March 8–10, 2011	Presentation		Sustaining Healthy Coastal Ecosystems

Vroom, P.		A tribute to Isabella A. Abbott—a leader in phycological and ethnobotanical research in Hawai`i and across the Pacific	2011 Northwestern Hawaiian Islands Research Symposium, IMIN Conference Center, East-West Center: Honolulu, HI. February 25–26, 2011	Presentation		Sustaining Healthy Coastal Ecosystems
Vroom, P.S.	1/1/2011	"Coral dominance:" A dangerous ecosystem misnomer?	Journal of Marine Biology, 2011, Article ID 164127	Journal Article	doi:10.1155/2011/164127	Sustaining Healthy Coastal Ecosystems
Vroom, P.S., B.J. Zgliczynski	In press	Effects of volcanic ash deposits on coral reef communities: a study of Anatahan, Commonwealth of the Northern Mariana Islands	Coral Reefs	Journal Article		Sustaining Healthy Coastal Ecosystems
Walsh, W., H.H. Lee	1/27/2011	Standardization of striped marlin, *Kajikia audax*, CPUE with generalized linear models fitted to pelagic longline observer data from the Hawaii-based fishery: 1995-2009	The ISC Billfish Working Group: Honolulu, HI. January 19-27, 2011. ISC/11/BILLWG-1/08.	Workshop Proceedings		Marine Resource Dynamics & Assessment Program (MARDAP): Stock Assessment Research Program
Walsh, W.A. and H.-H. Lee	1/1/2011	Standardization of striped marlin Kajikia audax with Generalized Linear Models fitted to Fishery Observer Data. ISC/11/BILLWG1/08		Technical Report		Fisheries Oceanography: Ecosystem Observations & Research Program: Analyses of Catch Data for Marlins
Walsh, W.A.	7/28/2011	Analysis of catch data for Oceanic Whitetip and Silky sharks reported by fishery observers in the Hawaii-based longline fishery in 1995-2010	PIFSC Working Paper WP-11-010	Technical Report		Fisheries Oceanography: Ecosystem Observations & Research Program: Analyses of Catch Data for Marlins
Walsh, W.A. and R.Y. Ito	1/1/2011	A long-term corrected catch history for striped marlin (Kajikia audax). ISC/11/BILLWG1/03		Technical Report		Fisheries Oceanography: Ecosystem Observations & Research Program: Analyses of Catch Data for Marlins
Wang, J., Y. Swimmer, S. Fisler	12/1/2010	Developing visual deterrents to reduce sea turtle bycatch in gill net fisheries.	MEPS, 408, 241–250	Journal Article		Fisheries Oceanography: Methods Aimed to Reduce Sea Turtle-Longline Interactions: Tests of Modified Baits and Fishing Gear
Wang, J.H., M. Hutchinson, L.. McNaughton, K. Holland, Y. Swimmer	2010	The effects of Nd/Pr alloy on feeding and catch rates in coastal and pelagic shark species	IATTC Technical meeting on Sharks	Conference Proceedings		Reducing Shark Bycatch with Electropositive Metals in Hawaii-based Fisheries
Wiener, C.S., M.O. Lammers	8/1/2010	Sound & observation: listening for clues using real-life acoustic recorders	The American Biology Teacher, 72, 365-368	Journal Article	doi:10.1525/abt.2010.72.6.10	Sustaining Healthy Coastal Ecosystems

Williams, I.	2010	U.S. Pacific reef fish biomass estimates based on visual survey data	NOAA Pacific Islands Fisheries Science Center, PIFSC Internal Report, IR-10-024, 18 p.	Technical Report		Sustaining Healthy Coastal Ecosystems
Williams, I.D., B.L. Richards, S.A. Sandin, J.K. Baum, R.E. Schroeder, M.O. Nadon, B. Zyliczynski, P. Craig, J.L. McIlwain, R.E. Brainard	1/1/2011	Differences in reef fish assemblages between populated and remote reefs spanning multiple archipelagos across the central and western Pacific	Journal of Marine Biology, 2011, Article ID 826234	Journal Article	doi:10.1155/2011/826234	Sustaining Healthy Coastal Ecosystems
Young, H.S., S.A. Shaffer, D.J. McCauley, D.G. Foley, R. Dirzo, B.A. Block	2010	Resource partitioning by species but not sex in sympatric boobies in the central Pacific Ocean	Marine Ecology Progress Series, 403, 291-301	Journal Article	doi:10.3354/meps08478	Climate Change and Ecosystem Variability in the North Pacific Ocean and the Dynamics of Marine Resource Populations
Young, J.		A qualitative analysis of Pacific Ocean food webs: Final report	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	PFRP: Examining Latitudinal Variation in Food Webs Leading to Top Predators in the Pacific Ocean
Young, J.		Can latitude be used as a proxy for the effects of climate change on oceanic food webs?	PFRP Principal Investigators Meeting: Honolulu, HI. December 15-16, 2010	Presentation	http://www.soest.hawaii.edu/PFRP/dec10mtg/dec10mtg_presentations.htm	PFRP: Examining Latitudinal Variation in Food Webs Leading to Top Predators in the Pacific Ocean
Zamzow, J.		CRED fish data, its acquisition and applications	Integrated Ocean Observing System (IOOS) Biological Observations Workshop	Presentation		Sustaining Healthy Coastal Ecosystems

JIMAR Publications—Deep Water Horizon

Project #	PI Name/Author Names	Publication Date	Publication Title	Published In (Journal Name, volume and page number)	Type of Publication	Citation No. or hyperlink
661261	Jones, T.T.	2011	Gulf diaries 2: On the events, people, and turtles of the Mississippi shoreline	State of the World's Sea Turtles (SWOT), 6, 20-21	Magazine Article	www.seaturtle status.org/sites/swot/files/report/033111_SWOT6_p16-21_Disaster Strikes.pdf
658543	MacPherson, S., R. Trindell, B. Schroeder, L. Patrick, D. Ingram, K. Frutchey, J. Provancha, A. Lauritsen, B. Porter, A. Foley, A. Meylan, B. Witherington, M. Pico	4/12/2011 (submitted)	Sea turtle nest translocation effort in the Florida panhandle and Alabama, USA, in response to the Deepwater Horizon (mc-252) oil spill in the Gulf of Mexico	Proceedings of the 31st Annual Symposium on Sea Turtle Biology and Conservation, San Diego, California, USA, 12 - 15 April 2011	Conference Proceedings	

Appendix I List of Acronyms

ACC	Anomaly Correlation Coefficient
ACL	Annual Catch Limit
ACLs	Allowable Catch Limits
ACT	Annual Catch Target
ADCP	Acoustic Doppler Current Profiler
ADMB	Automatic Differentiation Model Builder
ALOHA	A Long-term Oligotrophic Habitat Assesment
AMIP	Atmospheric Model Intercomparison Project
APDRC	Asia-Pacific Data Research Center
ARL	Air Resources Laboratories
ARMS	Autonomous Reef Monitoring Structures
ARSHSL	Archive of Rapidly-Sampled Hawaiian Sea Level
ASCAT	Advanced Scatterometer
AUV	Autonomous Underwater Vehicle
AVHRR	Advanced Very High Resolution Radiometer
AVISO	Archiving, Validation and Interpretation of Satellite Observations
BAMS	Bulletin of the American Meteorological Society
BCN	Broadcast Corporation of Niue
BET	Big Eye Tuna
BILLWG	Billfish Working Group
BOLTS	Biophysical Offline Larval Tracking System
Bmsy	Biomass producing Maximum Sustainable Yield
BMUS	Bottomfish Management Unit Species
BotCam	Baited underwater video camera
CAMEO	Comparative Analysis of Marine Ecosystem Organization
CCA	Canonical Correlation Analysis
CCLME	California Current Large Marine Ecosystem
CF	Chlorophyll Front
CFBS	Commercial Fisheries Biosampling
CFS	Climate Forecast System
CIRES	Cooperative Institute for Research in Environmental Sciences
CLIDDS	Climate Information Delivery and Decision Support System
CLiPAS	Climate Prediction and its Application to Society
CLIVAR	Climate Variability and Predictability Research Program
CM2.1	Climate Model 2.1
CMAP	CPC Merged Analysis of Precipitation dataset
CMIP3	Coupled Model Intercomparison Phase 3
CMS	Content Management System
CNMI	Commonwealth of the Northern Mariana Islands

CoML	Census of Marine Life
COSEE	Centers for Ocean Sciences Education Excellence
COSMOS	Community Earth System Models
CPC	Climate Prediction Center
CPU	Central Processing Unit
CPUE	Catch Per Unit Effort
CRED	Coral Reef Ecosystem Division
CReefs	Census of Coral Reef Ecosystems
CRES	Coral Reef Ecosystem Studies
CRMI	Coral Reef Management Initiative
CRP	Cetacean Research Program
CSIRO	Commonwealth Scientific and Industrial Research Organization
CTD	Conductivity-Temperature-Depth
DAFF	Department of Agriculture, Fisheries and Forests
DAR	Division of Aquatic Resources (Hawaii)
DLNR	Department of Land and Natural Resources
DO	Dissolved Oxygen
EA	Enterprise Architecture
EAR	Ecological Acoustic Recorder
ECMWF	European Centre for Medium-Range Weather Forecasts
EEIO	Eastern Equatorial Indian Ocean
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ENSO	El Niño Southern Oscillation
EOF	Empirical Orthogonal Function
EPA	Environmental Protection Agency
ERA-40	ECMWF ReAnalysis project
ERD	Environmental Research Division
ESA	Endangered Species Act
ETP	Eastern Tropical Pacific ocean
F/V	Fishing Vessel
FA	Fatty Acid
FAD	Fish Aggregating Devices
FAO	Food and Agriculture Organization of the United Nations
FATE	Fisheries and the Environment
FEAT	Fishing Ecosystem Analysis Tool
FFA	Forum Fisheries Agency
FFS	French Frigate Shoals
FMP	Fishery Management Plan
Fmsy	Fishing mortality producing Maximum Sustainable Yield
FRMD	Fish Research and Monitoring Division

FRS	Fisherman Reporting System
FSLE	Finite Size Lyapunov Exponents
FUS	Fisheries of the United States
FY	Fiscal Year
GAM	Generalized Additive Model
GASEX	Gas Exchange Experiment
GCOS	Global Climate Observing System
GEF	Global Environment Facility
GFDL	Geophysical Fluid Dynamics Laboratory
GIS	Geographic Information System
GLM	Generalized Linear Model
GLOSS	Global Sea Level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GOM	Gulf of Mexico
GPU	Graphics Processing Unit
HAPC	Habitat Areas of Particular Concern
HARPs	High-frequency Acoustic Recording Packages
HCD	Habitat Conservation Division
Hg^0	Elemental Mercury
Hg^P	Particulate Mercury
HICEAS	Hawaiian Islands Cetacean Ecosystem Assessment Survey
HIMB	Hawaii Institute of Marine Biology
HiOOS	Hawaii Ocean Observing System
HLF	Hawaii Longline Fishery
HMS	Hawaiian Monk Seal
HMSRP	Hawaiian Monk Seal Research Program
HPLC	High Performance Liquid Chromatography
HQ	Head Quarters
HRPT	High Resolution Picture Transmission
HSC70	Heat Shock Cognate 70
HSP70	Heat Shock Protein 70
HSS	Heidke Skill Score
HTML	HyperText Markup Language
HYCOM	HYbrid Coordinate Ocean Model
IAS	Inter-American Seas
IATTC	Inter-American Tropical Tuna Commission
ICOADS	International Comprehensive Ocean-Atmosphere Data Set
IEA	Integrated Ecosystem Assessment
IKMT	Isaacs Kidd Mid-water Trawl
IMMS	Institute for Marine Mammal Studies
I-O	Input-Output

IODZM	Indian Ocean Dipole/Zonal Mode
IOOS	Integrated Ocean Observing System
IPCC	Intergovernmental Panel on Climate Change
IPRC	International Pacific Research Center
iRAM	IPRC Regional Atmospheric Model
ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ISC	International Science Committee
ISO	Intraseasonal Oscillation
ISVHE	IntraSeasonal Variability Hindcast Experiment
IWSTST	In-Water Sea Turtle Survey Team
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JASADCP	Joint Archive for Shipboard ADCP
JASL	Joint Archive for Sea Level
JGOFS	Joint Global Ocean Flux Study
JIMAR	Joint Institute for Marine and Atmospheric Research
JJA	June-July-August
KHFMA	Kahekili Herbivore Fisheries Management Area
KRF	Kewalo Research Facility
LED	Light-Emitting Diode
LiDAR	Light Detection and Ranging
LLDS	Longline Logbook Data System
LODS	Longline Observer Data System
MAM	March-April-May
MCBI	Marine Conservation Biology Institute
MHI	Main Hawaiian Islands
miniPAT	Mini Pop-up Archival Transmitting tag
MJJ	March-June-July
MJO	Madden-Julian Oscillation
MLO	Mauna Loa Observatory
MLRM	Multiple Linear Regression Model
MME	Multi-Model Ensemble
MMPA	Marine Mammal Protection Act
MNM	Marine National Monument
MPI-OM1	Max Planck Institute – Ocean Model 1
MTL	Mid-Trophic Level
MTRP	Marine Turtle Research Program
MUS	Management Unit Species
NAAFE	North American Association of Fisheries Economists
NASC	Nautical Area Scattering Coefficient
NCAR	National Center for Atmospheric Research
NCEP	National Center for Environmental Prediction

Nd/Pr	Neodynium/Praseodymium alloy
NEC	North Equatorial Current
NEPA	National Environmental Policy Act
NIFSF	National Research Institute of Far Seas Fisheries, Shimizu, Japan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NORPAX	North Pacific Experiment
NOS	National Ocean Service
NSF	National Science Foundation
NWFSC	NorthWest Fisheries Science Center
NWHI	Northwestern Hawaiian Islands
NWS	National Weather Service
OACES	Ocean Atmosphere Carbon Dioxide Exchange Study
OceanSITES	Ocean Sustained Interdisciplinary Time-series Environment observation System
OCO	Office of Climate Observation
OFES	Ocean model For Earth Simulator
ORA	Ocean Reanalysis/Analysis System
ORCM	Office of Coastal Resrouce Management
ORS	Ocean Remote Sensing
PC	Principle Component
PED	Pound net Escape Device
PFEL	Pacific Fisheries Environmental Laboratory
PFRP	Pelagic Fisheries Research Program
PIFSC	Pacific Islands Fisheries Science Center
PIMSP	Pacific Islands Monitoring and Sampling Program
PIR	Pacific Islands Region
PIRO	Pacific Islands Regional Office
PIROP	Pacific Islands Regional Observer Program
PLA	Participatory Learning Assessment
PMEL	Pacific Marine Environmental Laboratory
PRD	Protected Resources Division
PRECI	Protected Resources Environment Compliance Initiative
PRSN	Puerto Rico Seismic Network
PSATs	Pop-up Satellite Archival Tags
PSMSL	Permanent Service for Mean Sea Level
PTTP	Pacific Tuna Tagging Project
PTWC	Pacific Tsunami Warning Center
PTWS	Pacific Tsunami Warning System
R/V	Research Vessel
RAMP	Reef Assessment and Monitoring Program

REA	Rapid Ecological Assessment
RFMO	Regional Fisheries Management Organization
RFP	Request for Proposal
RGM	Reactive Gaseous Mercury
RISA	Regional Integrated Climate and Assessment
ROV	Remotely Operated Vehicle
RPSS	Rank Probability Skill Score
RSMAS	Rosenstiel School of Marine and Atmospheric Science
SAM	Social Accounting Matrix
SC	Stomach Content
SEAPODYM	Spatial Ecosystem And Populations Dynamics Model
SEEM	Social Economic, Ecological, and Management
SFD	Sustainable Fisheries Division
SFRO	Southwest Fisheries Regional Office
SIS	Scientific Information Services
SNA	Social Network Analysis
SPC	Secretariat of the Pacific Community
SPC	South Pacific Communities
SPCZ	South Pacific Convergence Zone
SPTA	South Pacific Tuna Act
SPTT	South Pacific Tuna Treaty
SSC	Scientific and Statistical Committee
SST	Sea Surface Temperature
STAJ	Sea Turtle Association of Japan
SWFSC	SouthWest Fisheries Science Center
SWIO	SouthWest Indian Ocean
SWOT	State of the World's Sea Turtles
TAC	Total Allowable Catch
TAO	Tropical Atmosphere Ocean project
TB	Terrabyte
TBO	Tropospheric Biennial Oscillation
THREDDS	Thematic Real-time Environmental Distributed Data Services
TOGA	Tropical Ocean Circulation Experiment
TOPP	Tagging of Pacific Predators
TP	Trophic Position
TUMAS	Tuna Management Simulator
TZ	Transition Zone
UFA	United Fishing Agency
UHDAS	UH Data Acquisition System
UHSLC	University of Hawaii Sea Level Center
UH-SOEST	University of Hawaii-School of Ocean and Earth Science and Technology

USAPI	U.S. Affiliated Pacific Islands
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
VGPM	Vertically Generalized Production Model
VOO	Vessel of Opportunity
WASWind	Wave and Anemometer-based Sea-surface Wind dataset
WCPFC	Western and Central Pacific Fisheries Commission
WCPFCIA	Western and Central Pacific Fisheries Convention Implementation Act
WCPFMC	Western and Central Pacific Fisheries Management Commission
WCPO	Western and Central Pacific Ocean
WCRN	West Coast Regional Node
WesPac	Western Pacific Regional Fishery Management Council
WHOI	Woods Hole Oceanographic Institution
WHOTS	WHOI Hawaii Ocean Time-series Station
WOCE	World Ocean Circulation Experiment
WPacFIN	Western Pacific Fisheries Information Network
WPFMC	Western Pacific Fisheries Management Council
WPR	Western Pacific Region
WPRFMC	Western Pacific Region Fishery Management Council
XBT	Expendable Bathythermograph

Appendix II Visiting Scientists

DATE	NAME/AFFILIATION	PURPOSE OF VISIT
07/09/10	Keith Criddle Professor University of Alaska, School of Fisheries & Ocean Sciences Juneau, AK	Participate in Review Panel for the FY2010 PFRP Request for Proposals.
07/09/10-07/10/10	John Graves Professor Virginia Institute of Marine Science Gloucester Point, VA	Participate in Review Panel for the FY2010 PFRP Request for Proposals. Visit and tour the Kewalo Research Lab.
07/16/10-07/21/10	Laurie Richmond Instructor University of Minnesota, Department of Fisheries, Wildlife & Conservation Biology St. Paul, MN	Present analysis of the Fishing Ecosystem Assessment Tool to the external review panel (in collaboration with Dr. Stewart Allan).
07/20/10-07/22/10	David Colpo Senior Program Manager Pacific States Marine Fisheries Commission Portland, OR	Review and evaluate the scientific data management regime at NOAA PIFSC.
07/20/10-07/22/10	Steven Smith Research Scientist University of Miami RSMAS Miami, FL	Review and evaluate the scientific data management regime at NOAA PIFSC.
07/29/10	Linda Fernandez Associate Professor UC Riverside Riverside, CA	Present current research. Explore collaborative opportunities for marine resource economics research in the Central and Western Pacific.
08/09/10-08/11/10	Loren McClenachan Instructor UC San Diego La Jolla, CA	Collaborate on the historical sea turtle population project.
09/08/10-09/11/10	Paul Calle Veterinarian Wildlife Conservation Society Bronx, NY	Participate in the Hawaiian Monk Seal Research Program External Review Workshop. Collaborate with Dr. Charles Littnan (program lead).
09/08/10-09/10/10	Ailsa Hall Deputy Director Sea Mammal Research Unit Fife, UK	Participate in the Hawaiian Monk Seal Research Program External Review Workshop.

09/08/10-09/10/10	Joseph Gaydos Veterinarian UC Davis, School of Veterinary Medicine Eastsound, WA	Participate in the Hawaiian Monk Seal Research Program External Review Workshop.
09/08/10-09/10/10	Kirsten Gilardi Veterinarian UC Davis, Wildlife Health Center Davis, CA	Participate in the Hawaiian Monk Seal Research Program External Review Workshop.
09/13/10-10/01/10	Bruno Giffoni Technical Coordinator of the Sea Turtle Program Projeto TAMAR-ICMBio/Fundação Pró-TAMAR São Paolo, Brazil	Participate in the PIRO-led Fisheries Observer Training Course.
10/04/10-10/08/10	Dawn Kotowicz Research Assistant Costal Resources Center, University of Rhode Island Narragansett, RI	Present findings on community resiliency in Thailand pre- and post- Tsunami at WPFMC's Science and Statistical Committee. Provide consultation to PIFSC and JIMAR regarding the CAMEO coral reef project.
11/15/10-11/19/10	Amanda Bradford PhD candidate University of Washington Seattle, WA	Collaborate with colleagues from the PIFSC Cetacean Research Program, SWFSC, and NMFS regarding current cetacean stock assessment research and future improvements to research protocols.
11/15/10-11/19/10	Cynthia McCaskey Independent Contractor Christiansted, U.S. Virgin Islands	Provide consultation to PIFSC and JIMAR regarding the CAMEO coral reef project.
12/09/10-12/17/10	Robert Olson Senior Scientist Inter-American Tropical Tuna Commission La Jolla, CA	Deliver keynote speech and participate in the PFRP Principle Investigators Meeting. Collaborate with Dr. Brian Popp and Dr. Jock Young.
12/17/10	Gerald Meehl Scientist NCAR Boulder, CO	Visit IPRC and consult with members. Present seminar entitled "Decadal variability of Asian-Australian monsoon-ENSO-TBO relationships."
01/14/11-02/15/11	In-Sik Kang Professor Seoul National University Seoul, Korea	Visit the IPRC. Discuss the CliPAS project.
01/19/11-01/27/11	Jae-Bong Lee Scientist National Fisheries Research and Development Institute of Korea Busan, South Korea	Participate in the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific, Billfish Working Group Workshop.

02/08/11-02/10/11	William Bowen Research Scientist Department of Fisheries and Oceans Canada Halifax, Canada	Participate in the annual Hawaiian monk seal recovery team meeting. Provide consultation regarding Hawaiian monk seal research and programs.
02/08/11-02/10/11	William Gilmartin Director of Research Hawaii Wildlife Fund Volcano, HI	Participate in the annual Hawaiian monk seal recovery team meeting. Provide consultation regarding Hawaiian monk seal research and programs.
02/08/11-02/11/11	Frances Gulland Senior Scientist The Marine Mammal Center Sausalito, CA	Participate in the annual Hawaiian monk seal recovery team meeting. Provide consultation regarding Hawaiian monk seal research and programs.
02/08/11-02/10/11	Lloyd Lowry Hawaiian Monk Seal Recovery Team Kailua Kona, Hawaii	Chair the annual Hawaiian monk seal recovery team meeting. Provide consultation regarding Hawaiian monk seal research and programs.
02/08/11-02/10/11	Donald Siniff Professor University of Minnesota St. Paul, MN	Participate in the annual Hawaiian monk seal recovery team meeting. Provide consultation regarding Hawaiian monk seal research and programs.
02/13/11-02/17/11	Julia Blanchard Research Fellow Imperial College London Berkshire, UK	Collaborate with PIFSC staff to build a coupled size-based ecosystem model driven with output from a climate-ocean model. Assist staff in running simulations.
02/28/11-03/04/11	Yong-Rock An Researcher Cetacean Research Institute Ulsan, South Korea	Visit the NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary site in Kihei, Maui. Discuss research of, and management approaches to protect, species such as monk seals, turtles, and whales.
03/09/11-03/11/11	Richard Carbone Science Advisor Earth Observing Laboratory, NCAR Boulder, CO	Continue research with Dr. Yangping Li, NSF planning with Dr. Steven Businger and Dr. Roger Lukas, and Encyclopedia writing with Dr. Steven Businger.
03/22/11-03/24/11	Richard Carbone Science Advisor Earth Observing Laboratory, NCAR Boulder, CO	Continue research with Dr. Yangping Li, NSF planning with Dr. Steven Businger and Dr. Roger Lukas, and Encyclopedia writing with Dr. Steven Businger.
04/25/11-04/30/11	Richard Carbone Science Advisor Earth Observing Laboratory, NCAR Boulder, CO	Continue research with Dr. Yangping Li, research collaboration with Gary Barnes and Dr. Roger Lukas, and Encyclopedia writing with Dr. Steven Businger.

4/27/11-05/09/11	David Burdick Biologist Bureau of Statistics & Plans Hagåtña, Guam	Participate in the Marianas RAMP cruise as a subject-matter expert of the Guam region.
05/09/11-05/13/11	Ann Shriver Executive Director North American Association of Fisheries Economists Corvallis, OR	Co-organize the North American Association of Fisheries Economists 2011 Forum with Dr. Minling Pan.
05/10/11-05/13/11	Daniel Huppert Professor University of Washington Seattle, WA	Participate in the North American Association of Fisheries Economists 2011 Forum. Chair conference sessions.
06/20/11-06/23/11	John Sibert Professor Emeritus University of Hawaii, SOEST Honolulu, HI	Participate in ADMB Developer's Workshop in Santa Barbara, CA.

Appendix III Workshops and Meetings Hosted by JIMAR

PFRP Principal Investigators Meeting and TUMAS Software Workshop
December 15-16, 2010
Asia Room Imin Conference Center, UH-Manoa

Melanie Abecassis
Shawn Arita
Karen Arthur
Keith Bigelow
Fabrice Bouye
Anela Choy
Abe Coughlin
Dean Courtney
Jonathan Dale
Reka Domokos
Mary Donovan
Jeff Drazen
Andrew Gray
Don Hawn
Kim Holland
Melinda Holland
Evan Howell
Simon Hoyle
Bob Humphreys
David Itano
T. Todd Jones
Sam Kahng
EunJung Kim
Jack Kittinger
Pierre Kleiber
Keller Kopf
PingSun Leung
Jeff Muir
Mike Musyl
Robert Olson
Minling Pan
Jeff Polovina
Sam Pooley
Jim Potemra
Kelvin Richards
Derek Seiple
Mike Seki
Inna Senina
Noriko Shoji
John Sibert
Tim Sippel
Lennon Thomas
Matthew Vandersande
William Walsh
John Wang
Phoebe Woodworth
Jock Young
Johnoel Ancheta
Dodie Lau

TUMAS Software Demonstration
Dec. 16, 2010
Kamehameha Room

(Approximately 15 attendees.)

Appendix IV JIMAR Personnel

Information as of June 30, 2011

Category	Number	Unknown	High School	Associates	Bachelors	Masters	Ph.D.
Research Scientist	20	0	0	0	0	0	20
Visiting Scientist	0	0	0	0	0	0	0
Postdoctoral Fellow	3	0	0	0	0	0	3
Research Support Staff	138	0	3	4	87	37	7
Administrative	12	0	0	0	9	2	1
Undergraduate Students	28	0	28	0	0	0	0
Graduate Students	13	0	0	0	12	1	0
Received less than 50% NOAA support	2	0	0	0	0	0	2
Total	**216**	**0**	**31**	**4**	**108**	**40**	**33**
Located at Lab (include name of lab)	PMEL: 2 PFEL: 5 PIRO: 12 PIFSC: 128 ESRL: 5						
Obtained NOAA employment within the last year	10						
Postdoctoral Fellows and Students from Subgrantees	Postdocs: 4 Students: 7						

Appendix V Awards

Tomoko Acoba
- NOAA-NMFS Team Member of the Month for May

Shandell Brunson
- Nominated for 2009 RCUH Outstanding Employee of the Year

Annette DesRochers
- Nominated for 2009 RCUH Outstanding Employee of the Year

Karen Frutchey
- Certificate of Appreciation from USFWS for service during Deepwater Horizon Response Effort, September 15th, 2010
- Certificate of Appreciation from NOAA Fisheries Service, Pacific Islands Regional Office for service during Deepwater Horizon Response Effort, September 20th, 2010

Christopher Hawkins
- NOAA Certificate of Appreciation for work on a series of Hawaii charter fishery meetings held across the state by the PIRO Sustainable Fisheries Division

Melanie Jordan
- 2010 NOAA Fisheries Service Team Member of the Year Award

Dr. Ricardo Lemos
- 2010 Savage Award in Applied Methodology for PhD thesis entitled "Hierarchical Bayesian methods for the marine sciences: analysis of climate variability and fish abundance"

Molly Timmers
- Nominated for 2009 RCUH Outstanding Employee of the Year

Karen Underkoffler
- NOAA Certificate of Appreciation and Challenge Coin for supporting the Deepwater Horizon Oil Spill, August 2010

John Wang
- PIFSC Team Member of the Year

Group Awards

Trevor Branch, Ray Hilborn, Olaf Jensen
- Jointly received the Ecological Society of America "2011 Sustainability Science Award" for the paper Worm et al. (2009) "Rebuilding Global Fisheries" published in *Science*. This award is presented to the authors of the peer reviewed paper (published in the past five years) that makes the greatest contribution to the emerging science of ecosystem and regional sustainability through the integration of ecological and social sciences.

Paper Awards

Best Conference Scientific Paper Award
- Lehodey, P., I. Senina, B. Calmettes, F. Royer, P. Gaspar, M. Abécassis, J. Polovina, D. Parker, R. **Domokos**, O. Hernandez, M. Dessert, R. Kloser, J. Young, M. Lutcavage, N.O. Handegard, J. John Hampton, 2010: Towards operational management of pelagic ecosystems. ICES (International Council for the Exploration of the Sea) CM Documents, 2010, 20-24 September, Nantes, France, 13 pp. ISBN 978-87-7482-085-7.

Feature Article Status in *Marine Ecology Progress Series*
- **Musyl, M.K.**, M. Domeier, N. Nasby-Lucas, R.W. Brill, L.M. McNaughton, J.Y. Swimmer, M. Lutcavage, S.G. Wilson, B. Galuardi, J.B. Liddle, 2011: Performance of pop-up satellite archival tags. *Marine Ecology Progress Series*. Feature Article Status is awarded to articles of exceptional significance; these articles are then published by open access on the journal's website.

Appendix VI Graduates

Maire Cahoon, MS
"The Foraging Ecology of Monk Seals in the Main Hawaiian Islands"

Christopher Hawkins, PhD
"Finding Blame for Environmental Outcomes: A Cognitive Style Approach to Understanding Stakeholder Attributions, Attitudes, and Values"

Ron Hoeke, PhD
"An investigation of wave-dominated coral reef hydrodynamics"

Joseph M. O'Malley, PhD
"Population dynamics of Northwestern Hawaiian Islands spiny lobster and slipper lobsters: spatial heterogeneity and drivers of somatic growth"

Benjamin Richards, PhD
"Where the wild things are: environmental factors affecting the distribution of large-bodied reef fishes"

Yoshiki Yamazaki, PhD
"Depth-integrated, Non-hydrostatic Model with Grid Nesting for Tsunami Generation, Propagation, and Runup"

Appendix VII Publication Summary

The table below shows the total count of publications for the reporting period and previous periods categorized by JIMAR Lead Author, NOAA Lead Author, or Other Lead Author and whether it was peer-reviewed or non-peer reviewed.

		FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
Peer-Reviewed	**JIMAR Lead Author**	18	36	50	36	32	31	47	40	46
	NOAA Lead Author	33	22	26	20	26	25	22	17	15
	Other Lead Author	20	30	26	28	43	51	42	68	41
Non-Peer-Reviewed	**JIMAR Lead Author**	16	39	31	24	11	18	18	24	67
	NOAA Lead Author	10	17	14	16	18	8	18	9	19
	Other Lead Author	14	21	17	17	20	17	9	9	15