

annual report



pacific islands fisheries science center
NOAA
honolulu, hawaii

2008

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PIFSC Mission

To conduct high-quality, timely research to support the stewardship of fisheries resources, protected species, and ecosystems in the central and western Pacific Ocean.

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An online version is available at
<http://www.pifsc.noaa.gov/do/index.php>

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foreword

We are happy to provide you the 2008 Annual Report of NOAA Fisheries' Pacific Islands Fisheries Science Center. The Center's research covers a wide range of scientific issues and topics requiring expertise in many disciplines. Our principal areas of research include coral reef ecosystems; marine ecosystem analysis and oceanography; fisheries biology; bycatch mitigation; fisheries monitoring and socioeconomics; and protected species population monitoring and research. Support programs within the Center ensure success of our science endeavors by providing help in administration and infrastructure, information technology and communications, and scientific information.

In 2008 we conducted our second external review of the Center's research, this time focused on our ecosystem research. The review provided critical insights into areas where we need to improve and where we can develop more fully. Information on this year's review, as well as the 2007 review, can be found on our Web site at: <http://www.pifsc.noaa.gov/do/pifscreports.php>. In 2009 we will be holding a similar review focused on our pelagic research.

We have a diverse and energetic staff from a broad range of scientific and technical specialties. We engage in research expeditions year-around throughout the central and western Pacific, including American Samoa, Hawaii, the Mariana Archipelago, and remote island areas in the mid-Pacific, and maintain extensive temporary field camps at remote islands and atolls in the Northwestern Hawaiian Islands. We are committed to the highest standards of scientific research and timely conservation and management advice.

We welcome your comments and thank you for your support.



A handwritten signature in black ink that reads "Sam Pooley".

Samuel G. Pooley, Ph. D.
Science Director



A handwritten signature in black ink that reads "Michael P. Seki".

Michael P. Seki, Ph. D.
Deputy Science Director



The Dole Street office building remains the primary administrative and research facility of the Pacific Islands Fisheries Science Center and has served the Center and its predecessor agencies since its completion in 1950.

overview of the center

Function and Mission

The Pacific Islands Fisheries Science Center (PIFSC) is one of six NOAA Fisheries Science Centers. It was established in 2003 with the creation of the Pacific Islands Region (PIR) within NOAA Fisheries, and is headquartered in Honolulu, Hawaii. The Center is responsible for research on Federally managed marine fisheries, protected species such as the endangered Hawaiian monk seal, and ecosystems in the entire western and central Pacific Ocean, in both insular (near island) habitats and pelagic (open ocean) environments.

The Center's mission is to conduct timely, high quality applied science—monitoring, reporting, and analysis—to support conservation and management of living marine resources in the central and western Pacific Ocean. The PIFSC mission is linked directly to the NOAA Strategic Plan and, in particular, NOAA's Ecosystem Mission Goal:

“To protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management.”

In providing science to support an ecosystems approach to the conservation, management and recovery of living marine resources, PIFSC has adopted a multidisciplinary strategy. The strategy involves integrated data collection and monitoring of marine resources and their environment, including an extensive ecosystem observation system; scientific research programs with activities focused on nearshore and pelagic fisheries, coral reef species

and habitats, marine mammals and sea turtles, marine ecosystems and oceanography; and conservation and management advice directly related to domestic and international conservation and management mandates.

The Center's fisheries-oriented research programs monitor U.S. fisheries in the Pacific and conduct biological, ecological, and economic research in support of five Fishery Management Plans and four emerging Fishery Ecosystem Plans developed by the Western Pacific Regional Fishery Management Council (WPFMC). Similar scientific contributions are made toward international management of fisheries for tuna and other highly migratory species by the Western and Central Pacific Fisheries Commission and the Inter-American Tropical Tuna Commission. In both domestic and international fisheries management arenas, PIFSC provides scientific support and advice to the NOAA Fisheries Pacific Islands Regional Office (PIRO).

The Center's coral reef ecosystem research focuses on comprehensive surveys of reef ecosystems in the archipelagoes of the Pacific Islands Region. Protected species research and recovery programs monitor the status of the Hawaiian monk seal and sea turtles in the Pacific and identify the factors affecting their population, health, and recovery. A newer component of the Protected Species program is focused on surveys of cetacean populations in the central Pacific. Other PIFSC research investigates the structure and dynamics of central North Pacific marine ecosystems and how marine populations are affected by changes in their predators, prey, and habitat, and by ocean climate.

History

Known previously as the Honolulu Laboratory, PIFSC was established as an independent science center of the National Marine Fisheries Service in 2003. The Center was founded on 55 years of federal marine fisheries research dating back to the founding of the Pacific Oceanic Fishery Investigations in 1948. In almost 6 decades of scientific studies, Center staff and their predecessors have engaged in oceanographic research, fishery resource exploration, fisheries development, fisheries biology and ecology, and protected species recovery research and conservation throughout the Pacific and as far away as the Indian Ocean. More recently, the Center has established extensive programs in coral reef ecology through collaboration with NOAA's Coral Reef Conservation Program.

Geographic Area of Responsibility

Bounded by the Hawaiian Archipelago in the north, American Samoa and U. S. Pacific Remote Island Areas in the south, and the Mariana Archipelago in the west, the Pacific Islands Region encompasses the largest geographical area within NOAA Fisheries' jurisdiction. The U.S. Exclusive Economic Zone (EEZ) within the Region includes more than 1.7 million square nautical miles of ocean, roughly equal to the total EEZ of the continental United States and Alaska. PIFSC is also responsible for research on living marine resources in the high-seas areas of the central and western Pacific.

Pacific Islands Fisheries Science Center FY 2008

Personnel		
Federal		92
JIMAR		111
Other		15
Total		218

Budget by NOAA Program	\$ M	%
Corals	6.2	68
Ecosystem Observation	16.9	25
Protected Species	1.6	7
Total	\$ 24.7	

Budget and Staffing History

In fiscal year (FY) 2008, the PIFSC budget was \$24.7 M and supported a staff of 218 researchers, technical personnel, and administrative employees. Almost all of the Science Center's budget supports the NOAA ecosystems "mission," and its activities generally fall within the Ecosystems Observation Program and Corals Program. In addition to federal employees, Center programs include a large number of scientists and seasonal technical staff employed by the University of Hawaii (UH) Joint Institute for Marine and Atmospheric Research (JIMAR) and by private contractors. Several UH students also work at the Center or are engaged in graduate research with Center projects, and about 10 Center scientists serve as affiliate faculty and are on graduate committees within the university.

Facilities and Vessels

The Center is located at five sites in Honolulu: the main office complex is located on Dole Street, adjacent to the University of Hawaii at Manoa campus. A smaller seawater research facility is located at

Kewalo Basin on the Honolulu waterfront enabling research on live, large pelagic fishes, monk seals, and sea turtles. This location is also the site of most of the Center's coral reef ecosystem monitoring staff. Another research facility, with offices and a wet laboratory supporting fish biology work, is leased in Aiea near Pearl Harbor. Additionally, some PIFSC marine mammal and coral reef researchers are located in offices adjoining the PIRO headquarters on Kapiolani Blvd in downtown Honolulu, and PIFSC has an advanced mapping facility on the UH campus. The seawater research functions are expected to move to a new NOAA facility on Ford Island next fiscal year.

The NOAA Ship *Oscar Elton Sette*, homeported at Ford Island in Honolulu, is the primary research vessel supporting the Science Center's extensive field activities.



Kewalo Research Facility



Aiea Heights Research Facility (leased space)

Research Focus

PIFSC research currently focuses on several areas of high priority:

- ❑ Identifying and understanding the effects of ecosystem linkages and environmental processes on fish stocks, protected species, and other marine life and developing the scientific basis for ecosystem-oriented management
- ❑ Monitoring and reducing fishery interactions with protected species
- ❑ Monitoring the status of Hawaiian monk seals and finding ways to increase their survival and population sustainability
- ❑ Assessing the populations of deepwater snappers, groupers and jacks (bottomfish) in the main Hawaiian Islands
- ❑ Monitoring the status of marine turtle populations in the Pacific
- ❑ Assessing cetacean populations and the effects of human activity on them
- ❑ Mitigating fisheries bycatch, particularly in multinational pelagic longline fisheries
- ❑ Assessing the stocks of tunas, billfishes, sharks, and ecologically related pelagic species and providing scientific advice in support of international and domestic management of fisheries that catch these species
- ❑ Researching the use of barbless hooks by recreational fishers to reduce post-release fish mortality and risks of injury to protected species
- ❑ Expanding the understanding of socioeconomic and cultural aspects of living marine resource use and appreciation throughout the region
- ❑ Assessing the physical and biological structure, dynamics, and health of coral reef ecosystems
- ❑ Monitoring and removing derelict fishing gear and other marine debris from reefs and near-shore waters of the Hawaiian Archipelago
- ❑ Extending our fisheries and ecosystems monitoring and research to the waters of American Samoa, Guam, and the Northern Mariana Islands in cooperation with these jurisdictions



NOAA Ship Oscar Elton Sette

Science Center Organization

The PIFSC is organized into five research divisions:

- ❑ Coral Reef Ecosystem Division (CRED)
- ❑ Ecosystems and Oceanography Division (EOD)
- ❑ Fisheries Monitoring and Socioeconomics Division (FMSD)
- ❑ Fishery Biology and Stock Assessment Division (FBSAD)
- ❑ Protected Species Division (PSD)

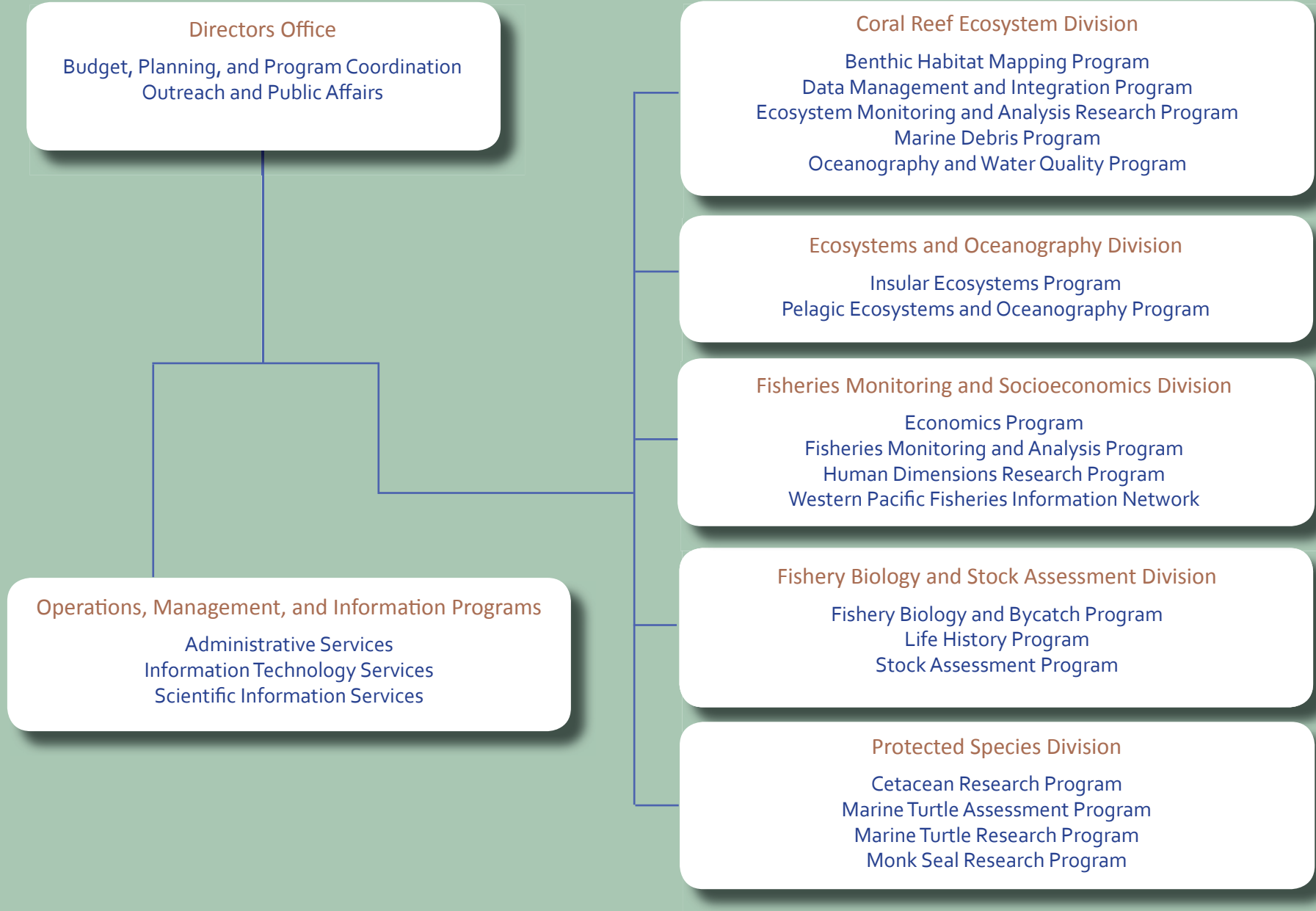
The Operations, Management, and Information (OMI) Division has three programs providing essential support:

- ❑ Administrative Services
- ❑ Information Technology Services
- ❑ Scientific Information Services



Kapiolani Boulevard Offices (leased space)

Pacific Islands Fisheries Science Center



the directors office

The Directors Office provides overall scientific leadership, strategic guidance, research direction, program management, and operational policy for the Science Center. In addition, the office is responsible for liaison with our many partnering agencies and offices, including the Pacific Islands Regional Office and other NOAA offices locally and nationally; the Western Pacific Fishery Management Council; resource management agencies of American Samoa, Guam, Hawaii, and the Northern Mariana Islands; the University of Hawaii and the University of Guam; the U.S. Fish and Wildlife Service; fishing industry members and organizations; recreational fishers; nongovernmental conservation organizations; other groups and the general public. The Directors Office provides coordination and leadership for U.S. participation in international scientific committees and commissions in the Pacific. The Center Director serves on the NOAA Fisheries Science Board and is the U.S. delegate to PICES (the six-nation North Pacific Marine Science Organization). The Directors Office also manages the Center's planning and budget functions as well as outreach and public affairs.

Budget, Planning, and Program Coordination

Many Center-wide budget, planning, and program coordination activities are implemented from the Budget and Planning Office to ensure responsiveness to and consistency with the NOAA and NOAA Fisheries Strategic Plans. These activities include:

- ❑ Generation of current and projected program operating and spending plans
- ❑ Center-wide budget formulation, execution, and requests
- ❑ Development of guidelines and policies governing maintenance of the budget
- ❑ Research program oversight, coordination, and integration
- ❑ Strategic planning and input to the NOAA Program Planning and Budget Execution System
- ❑ Establishment and tracking of performance measures and milestones
- ❑ Ensuring National Environmental Policy Act compliance for PIFSC research
- ❑ Coordination of PIFSC efforts to support the Integrated Ocean Observing System (IOOS)
- ❑ Scheduling and coordination of NOAA research vessel and aircraft operations
- ❑ Establishing PIFSC as a scientific information resource for the community and networking with community groups, schools, and other organizations
- ❑ Teaching young people to become stewards of the environment
- ❑ Promoting careers in ocean sciences
- ❑ Helping teachers develop a science and conservation curriculum that supports the objectives of PIFSC. The program also designs educational resources and implements strategies to increase communications and understanding between the agency, our constituents, and the general public

Outreach and Public Affairs

The community outreach program serves as the focus for the communication of scientific programs with the public. The objective of the program is to seek and create opportunities to inform and educate constituents about the Center's programs. This is accomplished by:



Employee award ceremony and barbecue

Science Outreach Helps Build Community Support

Public education is an important aspect of the Center's work. Outreach activities not only let people learn about the Center's research and monitoring activities, but they spark interest in ocean science among young people and cultivate attitudes and practices of marine resource conservation and stewardship within the community.

Center scientists frequently interact with the public and media during the course of their field work on the waterfront, beaches, and in nearshore environments. In addition, members of all research divisions and administrative support groups take advantage of numerous community events to inform public constituents about NOAA's mission in marine ecosystem science and the beneficial impacts of our work on the economy and environment in the Pacific. During 2008, Center staff members were active in a wide range of outreach activities, including career fairs at schools, ocean-related festivals, public meetings, educational seminars, recreational fishing tournaments, visits to hospitals, and other events.



operations, management, and information programs

Administrative Services

The Office of Administration provides a comprehensive range of services in support of the Pacific Islands Fisheries Science Center's mission and staff. The office manages Center hiring and personnel issues, grants, procurement and property, safety, facilities, small boats, and staff training.

Administration staff specialists help PIFSC announce and fill federal job vacancies in Center programs, manage the orderly entry and exit of personnel from Center programs, ensure accurate and timely accounting of staff work time and attendance, and handle other personnel issues in cooperation with NOAA's Workforce Management Office. In 2008 the Center posted 18 recruitment actions which resulted in 6 selections in 2008, with several other selections to be made in the first quarter of 2009.

Members of the Administration staff manage several grants and cooperative agreements supporting research and related activities for protected species, coral reefs, fisheries, oceanography, aquaculture, and other areas of scientific research critical to the NOAA mission. In 2008, the Center submitted, processed and ensured obligation of all grants, totaling more than \$10 million, ahead of schedule. The Center played an active role in the Pacific Region Grants Cooperative group which sponsored Grants Online Training and grant writing training, and participated with the Council for Native Hawaiian Advancement to staff a booth at a Grantee Forum Outreach activity on Maui.

Our procurement specialists help Center staff obtain services, supplies, and equipment they need to meet program requirements and achieve operational goals. We strive to process invoices quickly, so contractors and vendors are paid promptly, and to record transaction accounting data accurately. We monitor the Center's equipment inventory to ensure accurate and timely accounting of all property. In 2008, the Center executed 265 procurement actions totaling \$4.7 million.

The Facilities Program is responsible for maintaining Center facilities in good order and recording and reporting material deficiencies to NOAA Fisheries facility program managers. The Administration staff actively monitors the status of PIFSC facilities and coordinates with the Center's Safety Officer and Executive Officer to identify needed repairs or improvements, determine costs, and ensure proper completion of work orders. In 2008, we accomplished several notable improvements at the Dole Street facility, including installation of a generator to serve the IT server room and warehouse; repair of gutters on Annex I; and the reengineering of drainage around Annex I.

The Safety and Environmental Compliance Program is responsible for ensuring that PIFSC research programs and activities abide by federal rules and regulations designed to prevent injury to employees and adverse effects to the environment. The program manages facility compliance inspections and training and promotes behavioral changes in Center staff to reduce injuries and adverse environmental impacts. In 2008, a monthly safety newsletter was developed for dissemination to Cen-

ter staff. The Center also completed a Remote Area Evacuation protocol intended to guide all NOAA offices in the Pacific in the event of emergency.

The Small Boat Program is responsible for ensuring PIFSC compliance with NOAA policies related to boats and skiffs. The program maintains an up-to-date PIFSC vessel policy, conducts boat and water safety training for Center staff, and manages the PIFSC small boat fleet. The program coordinates with Center research divisions conducting boating operations and provides assistance and guidance to them on boating and safety issues. The Center continues to be a leader in the NOAA Small Boat training program, with the Center's Small Boat Coordinator serving as the west coast representative on the NOAA Small Boat Safety Board. In 2008 the Coordinator secured funding and worked with a contractor to develop and deliver the NOAA component training course. The Coordinator also conducted Surf Rescue Boat training, Advanced Coxswain training, and Motorboat Operator Certification Course training.

The PIFSC Office of Administration also coordinates and tracks training and professional development activities for Center managers and staff, including guidance and training on equal employment opportunity matters. The Office of Administration sponsored several activities during 2008 to encourage diversity in the workplace, including participation by 18 staff members in the International Women's Conference and participation in college job fairs. In 2008, PIFSC conducted training sessions on a range of topics including contract management, travel management, property manage-

ment, and ethics. The Center served as a focal point for coordination of shared training opportunities with other NOAA components.

Key Activities/Issues

PIFSC continues to deal with the problems of maintaining aging facilities and providing adequate work space to accommodate a growing staff.

With a lengthy Continuing Resolution in 2009, the Center is faced with the challenge of executing grants and contracts in a very compressed time frame and obligating most funds in the latter half of the year.

Planning for the NOAA Pacific Regional Center continued in 2008. During 2009, our staff will continue to actively participate in the planning to ensure that PIFSC requirements are met during the initial building design phase of the project.

The Center is committed to ensuring that all PIFSC boat operators complete NOAA Component training by the end of March 2009. The training covers NOAA boat policy, risk assessment and team coordination.



Safety is top priority at the Center.

Information Technology Services

The Information Technology Services (ITS) group is composed of a team of System Administrators and a team of Systems Design specialists. The System Administrators are responsible for providing core IT support to PIFSC staff at the Dole Street facility and all satellite work sites. ITS system administrators maintain, monitor, and upgrade computer hardware, software, networking, communications, and related infrastructure and ensure compliance with growing IT security requirements. The ITS system design team is responsible for leading or assisting in the design and development of data systems to meet needs of users in all Center divisions and programs.

System Administrators

During 2008, IT administrators maintained and enhanced information and technology support for Center staff in the face of significant logistical challenges, including the continuing dispersal of scientists to work centers away from the Dole Street facility. The addition of new PIFSC offices at the Kapiolani Boulevard work site required expansion of networking capability and other onsite IT support there. In addition, IT staff spent significant effort identifying future IT requirements for NOAA's new Pacific Regional Center at Ford Island. Several accomplishments of IT administrators in 2008 are noteworthy:

- ❑ Procured and installed a backup generator for the computer room at Dole Street to reduce downtime and better protect critical server and network equipment during power interruptions.
- ❑ Upgraded the Center's Oracle database servers and storage devices to provide increased storage and reliability of servers.

- ❑ Procured a new backup tape system with increased capability and speed to enable quicker backup operations.
- ❑ Completed comprehensive certification and accreditation of the PIFSC local area network in collaboration with NOAA Fisheries CIO staff and contractors. Adjusted and enhanced network to correct deficiencies identified in the audit.
- ❑ Implemented the Federal Desktop Core Configuration on all laptops and workstations and encrypted Blackberry devices to comply with new security mandates.

Systems Design Team

The ITS Systems Design Team (SDT) helps PIFSC and the Pacific Islands Regional Office scientists, data managers and administrators complete their missions by designing and building cost-effective, time-saving information management solutions. The SDT provides database design and management expertise, application development services, and project management support both within the Pacific Islands Region and on a cross-regional basis through partnerships with NOAA Fisheries' national Fisheries Information System.

In 2008, SDT staff made good progress on several key projects to improve scientific and administrative information systems at the Center. Among the notable accomplishments were the following:

- ❑ Designed, developed, and implemented a comprehensive database and Web application to manage Center personnel data. The application enables creation and maintenance of staff lists and related administrative information for all personnel (employer,

workgroup, phone, emergency contacts, training data, and more). It features system auditing, security, and report generation for authorized administrative staff.

- ❑ Migrated a PIFSC software/hardware database from Microsoft-Access to Oracle to facilitate data entry and access from remote work sites and enable integration with the Center's property and purchasing systems. The Oracle database provides ITS with timely system security information. Other enhancements improved Center management of property inventories and the custody and usage of equipment and software.
- ❑ Working with other NOAA Fisheries staff, established guidelines for certifying electronic reporting software developed by vendors. Delivered guidelines and data requirements for the Hawaii longline fishery logbook to PIRO for review and publication in the Federal Register.
- ❑ Continued to provide support for the Longline Observer Data System (LODS) used by PIRO for critical monitoring of the Hawaii longline fishery. In 2008, SDT developed, tested, and implemented several requested enhancements, including database administration functions in the LODS marine mammal module.
- ❑ Continued the Hawaii Longline Logbook Data System modernization project which seeks to integrate multiple fisheries-dependent data sources.
- ❑ Worked with Center and WPacFIN staff to develop an enhanced data set that integrates nonconfidential longline logbook fishery data from Hawaii, American Samoa, and California and corresponding information on longline landings. This "enhanced" longline logbook database is the basis for U.S. reports to regional fishery management organizations.
- ❑ Developed database reporting routines that integrate longline logbook and longline observer data, enabling the Center to respond to user requests for nonconfidential observer data in support of stock assessments.
- ❑ Continued to develop and support the InPort Metadata Catalog, the software tool now being used by NOAA Fisheries to inventory and document the agency's data holdings. InPort currently contains more than 3000 information assets cataloged by 10 NOAA Fisheries components and partner organizations.



Network servers require regular maintenance by ITS systems staff.

Scientific Information Services

The Scientific Information Services (SIS) group provides comprehensive support to the Pacific Islands Fisheries Science Center in the management and dissemination of scientific information collected, acquired or produced by Center programs. SIS handles many kinds of information, including fisheries data, scientific publications, educational materials, graphics, and library resources, and also manages the Center's Web presence.

SIS data services staff carefully screen, validate, and archive catch statistics and other information provided to NOAA Fisheries by commercial fishing vessel captains or collected by the Center's fisheries research programs. SIS strives to provide full access to the data for statistical analyses, stock assessment studies, and fishery reports while meeting legal requirements to protect the confidentiality of commercial fishing enterprises. In 2008, SIS made significant progress in its PIFSC Metadata Project to compile, organize, and publish information describing all data holdings of the Center, including data reported to NOAA Fisheries by fishers and data collected by PIFSC research programs. SIS staff helped metadata managers in other Center programs register key metadata and created templates for topic-specific data catalogs. SIS staff also developed and implemented DARTS, a new Web-based tool for managing requests by SIS clients for data access and other data services.

SIS publications specialists carefully examine and edit reports, manuscripts, and other documents prepared by Center scientists to ensure they meet NOAA information quality standards before they are released to the public or submitted for publication in peer-reviewed journals. In addition to editing journal articles, SIS publications staff manage the editing, review and approval of operating plans

and cruise reports for PIFSC expeditions on the NOAA Ships *Oscar Elton Sette* and *Hi'ialakai* and chartered commercial research vessels. They also edit numerous PIFSC internal reports, working papers, conference abstracts, and other documents. In 2008, SIS publications staff designed DOCMAN, a Web-based application for managing the in-house editing, review and approval of journal manuscripts and other documents prior to their dissemination by the Center or submission for publication in scientific journals. Work on the project continues with completion expected in 2009.

SIS helps Center staff at all work sites with graphical design and layout, photography, digital image processing, and other graphics needs. In 2008, SIS continued to meet needs of Center scientists for posters, banners, leaflets and other materials for presentation at conferences. Our SIS graphics specialist also provided key support for NOAA outreach events and public educational activities.

SIS manages a NOAA reference library for use by Center scientists and the public. The library has

extensive up-to-date collections of scientific journals and technical books on fisheries science, oceanography, marine ecology, conservation biology, and other subjects with an emphasis on Pacific Island insular and oceanic ecosystems. In 2008, the SIS librarian completed a comprehensive Operations Manual for the library and continued to develop a comprehensive Oracle database of PIFSC documents enabling ready public access to the Center's publications via the PIFSC Web site. The librarian also completed a special project to scan documents from research vessel cruises conducted during 1949–1990 by the Center's predecessor organization, the Honolulu Laboratory, including historic expeditions in the 1950s under the Pacific Oceanic Fishery Investigations. The librarian built a Web-based portal providing ready access to this valuable electronic document archive with links to actual data collected during the cruises.

SIS is responsible for developing and maintaining the PIFSC Web site. The PIFSC webmaster disseminates the Center's scientific reports, public data products, news about current research activities and other information over the Internet. Web content is produced



The PIFSC library serves Center scientists and the public.

by subject matter experts in the Center's research divisions. In 2008, we made several improvements in our Web presence, including enhanced Web page design and expanded contents. New contents include the online PIFSC Quarterly Research Bulletin. A new home page design is in the works for release in 2009.

SIS also manages the PIFSC Intranet, providing Center staff with comprehensive information about administrative support resources; policies and procedures; reports of current Center research activities; NOAA Fisheries news; announcements of upcoming meetings, seminars, and other events; current cruise schedules; and more. In 2008, priority was given to regular updating of Intranet contents, including in-house administrative procedures, policy directives, cruise documents, and announcements of Center events and new staff publications. An online Center staff directory was added to the Intranet to help newcomers and old-timers get better acquainted.

As a diverse information support group, SIS aims to ensure that marine resource managers, research colleagues, and the public have ready and timely access to important data products and the research findings of Center scientists.

SIS has established several milestones for completion in 2009:

- ❑ Complete development of DOCMAN, the Web-based manuscript processing system
- ❑ Develop best practices and a plan for archiving and securing the Center's data assets
- ❑ Design templates for Web publication of the Center's in-house technical reports
- ❑ Create a template for Web publication of the Barbless Circle Hook Newsletter, a key outreach product of the Center's Fisheries Monitoring and Socioeconomics Division

Document Rescue Project Ensures Access to Historic Cruise Records

As NOAA has turned more attention toward changes in marine ecosystems, older survey data have become more valuable. Early observations of fish stock abundance and species composition help us interpret changes over time and measure the effects of fishing and other factors. To enable ready access to such data, PIFSC Librarian Ani Au rescued cruise reports and other documents from research cruises conducted during the 1949–1990 period by the Honolulu Laboratory, the predecessor of PIFSC. She scanned them into digital format, collected metadata about the cruises, and made all the valuable information available to PIFSC scientists on the Center's Intranet. Now, with nothing more than a Web browser, researchers can view detailed records of historic expeditions to the equatorial Pacific and other areas visited by the *Henry O'Malley* (1949-1951), *Hugh M. Smith* (1949-1959), *John R. Manning* (1950-1957), *Charles H. Gilbert* (1952-1973), *Townsend Cromwell* (1964-2002), and several other vessels chartered for scientific work. Early voyages of the Pacific Oceanic Fishery Investigations (POFI), as the Honolulu Laboratory was first known, provided new knowledge of pelagic fisheries resources and oceanography in the mid-Pacific. Some led to profound discoveries, like the 1952 expedition of the *Hugh M. Smith*, during which POFI oceanographer Townsend Cromwell and his colleagues found and described the Equatorial Undercurrent (later named the Cromwell Current), a key feature of the Pacific equatorial circulation. Users of the Web site can browse through metadata stored in an Oracle database created by Au and view all available documents for an expedition, including cruise instructions, summary reports, narrative reports, maps, and correspondence related to cruise planning and execution. During 2009, links to a SIS Fisheries Research Data Catalog will be added to the Web entries for each cruise, enabling users to also find detailed descriptions of the cruise's scientific databases.



POFI scientists on early longline surveys of the *John R. Manning* studied tuna and marlin in the equatorial Pacific.



Orangefin anemonefish (*Amphiprion chrysopterus*) swimming over a sea anemone (*Heteractis crispa*).

coral reef ecosystem division

In support of NOAA's Coral Reef Conservation Program, the Coral Reef Ecosystem Division (CRED) conducts extensive research to support management and conservation of coral reef ecosystems in the U.S.-affiliated Pacific Islands. Research activities include interdisciplinary Integrated Ecosystem Assessments (IEAs) and long-term monitoring, benthic habitat mapping, oceanographic observations, and more. In leading the Pacific Reef Assessment and Monitoring Program (RAMP), CRED collaborates with federal, state, and territorial agencies, nongovernmental organizations, and academic partners to conduct biennial surveys of coral reefs throughout the main Hawaiian Islands (MHI), Northwestern Hawaiian Islands (NWHI), the Territories of Guam and American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), and Pacific Remote Island Areas (PRIA). Using standardized methods for IEAs at more than 50 islands and atolls across diverse gradients of biogeography, environmental conditions, and human activity, Pacific RAMP enables comparative analysis that improves understanding of the complex processes influencing the health of coral reef ecosystems throughout the region. IEAs provide essential baseline information by which to assess, predict, and mitigate impacts of climate change, fishing, pollution, and other stressors on coral reef ecosystems. The knowledge gained is shared with local, regional, national, and international resource managers and stakeholders to improve decision making for the long-term conservation and management of coral reef resources. CRED also conducts research to better assess and predict accumulations of marine debris affecting coral reef ecosystems and leads multiagency projects to remove debris from reefs and shorelines.

The CRED is organized into five thematic program areas:

- ❑ *The Oceanography and Water Quality Program* observes and monitors key oceanographic processes, environmental parameters, and water quality conditions using: in situ observations collected from ships and small boats, surface and subsurface moored instrument arrays, and satellite-tracked drifter buoys; data from satellite-borne remote sensors; and oceanographic models. The program also develops tools and instruments to improve IEAs, including Ecological Acoustic Recorders (EARs) to monitor activities of marine biota and vessels through the sounds they produce, Autonomous Reef Monitoring Structures (ARMS) to assess and monitor invertebrate biodiversity, and Bottom Camera (BotCam) bait stations to assess relative abundance of bottomfish.
- ❑ *The Ecosystem Monitoring and Analysis Research Program* conducts Rapid Ecological Assessments (REAs) and towed-diver surveys to quantitatively and qualitatively document the spatial distribution, density, species composition, size structure, and condition of corals, other macroinvertebrates, fish, and algae during biennial Pacific RAMP surveys. REAs involve stationary point counts of organisms, roving diver surveys, belt transects, photoquadrats, video transects, and specimen sample collection. Towed-diver surveys using digital video or still cameras provide broad spatial coverage of benthic composition and provide detailed information on the abundance and distribution of ecologically important fish and macroinverte-

brate taxa. EARs are used to document biological changes over shorter time scales than are possible to study during biennial Pacific RAMP cruises. ARMS are used to assess spatial patterns and temporal trends of indices of invertebrate biodiversity, contributing to the International Census of Marine Life's Census of Coral Reef Ecosystems (CReefs) project.

- ❑ *The Benthic Habitat Program* uses multibeam echo sounders, towed cameras, autonomous underwater vehicles, and other tools to create benthic habitat maps describing the depth, character, and composition of the seafloor and associated biota in and around coral reefs.
- ❑ *The Marine Debris Program*, with support from the NOAA Marine Debris Program, uses towed-diver and swim surveys to assess distributions and accumulations of derelict fishing gear and other marine debris in the MHI and NWHI and unmanned aerial systems to locate marine debris at sea. CRED divers manually remove marine debris from reefs and shorelines and collect data on the type, distribution, and density of debris. The Program also conducts research to better understand impacts of marine debris and develop cost-effective means to locate and remove marine debris at sea.
- ❑ *The Data Management and Integration Program* formats, documents, synthesizes, integrates, distributes, and archives data collected by CRED and its partners. The program applies quality controls to data, enters the data into an Oracle database and/or ArcSDE geodatabase, and produces metadata compliant with NOAA's Coral Reef Information System. The databases facilitate access to the data and enable spatial and

temporal analyses and integration of CRED's multidisciplinary ecosystem observations.

CRED has 67 staff members, including 9 federal employees, 56 employees of the University of Hawaii's Joint Institute for Marine and Atmospheric Research (JIMAR), and other staff. Grants—primarily to JIMAR—accounted for the largest CRED expenditures in FY 2008.

Key 2008 Accomplishments

- ❑ Issued the *Coral Reef Ecosystem Monitoring Report for American Samoa: 2002–2006* as a PIFSC Special Publication, a culmination of reef surveys during American Samoa RAMP cruises in 2002, 2004, and 2006. The report is available online at <http://www.pifsc.noaa.gov/cred/hmapping/amsareport.php>.
- ❑ The Marine Debris Program removed 31 tons of derelict fishing gear from the NWHI and 6.5 tons from the MHI. The Program and its partners have removed nearly 660 tons of marine debris from the NWHI since 1996.

Coral Reef Ecosystem Division FY 2008

Personnel		
Federal		9
JIMAR		56
Other		2
Total		67
Budget		
	\$	%
Salaries and benefits	909,149	16
Grants	3,500,000	61
Equipment, supplies, travel	1,320,340	23
Total	\$5,729,489	

- ❑ Conducted multibeam mapping of seafloor around French Frigate Shoals (3300 km²) using the NOAA Ship *Hi'iialakai* and around Brooks Bank (145 km²) using the R/V *AHI*. Recorded extensive underwater video using camera sled and drop camera. Multibeam bathymetry and backscatter data, optical validation data, and high-resolution benthic habitat mapping products are available at <http://www.soest.hawaii.edu/pibhmc>.
- ❑ In partnership with EOD, University of Hawaii, Hawaii Division of Aquatic Resources (DAR), and Bishop Museum, CRED contributed to mapping and interpretation of mesophotic coral ecosystems in the Auau Channel, main Hawaiian Islands, using a towed camera.
- ❑ Used video data from an underwater camera sled to estimate fish biomass in the 35–130 m depth range at Pearl and Hermes Atoll. Products from the survey will soon be available at <http://www.soest.hawaii.edu/pibhmc>.
- ❑ Led Pacific RAMP cruises on the NOAA Ships *Hi'iialakai* and *Oscar Elton Sette* to American Samoa, MHI, NWHI, and the PRIA to continue long-term integrated ecosystem monitoring. Partners included the U.S. Fish and Wildlife Service, National Park Service, the American Samoa Department of Commerce, American Samoa Department of Marine and Wildlife Resources, the Hawaii Governor's Office, DAR, Papahānaumokuākea Marine National Monument, University of Hawaii, Hawaii Institute of Marine Biology (HIMB), Bishop Museum, and National Geographic.
- ❑ CRED continued monitoring oceanographic conditions and water quality at 54 islands, atolls, and banks in the U.S. Pacific Islands using 24 moored surface-telemetered buoys and 237 subsurface oceanographic moorings.
- ❑ In partnership with NOAA's Pacific Marine Environmental Laboratory and NOAA's Coral

Reef Watch program, CRED collected water samples in American Samoa, MHI, NWHI, and the PRIA to establish baseline observations of carbonate chemistry in diverse reef habitats as part of a broader effort to understand potential long-term impacts of climate change-induced ocean acidification on coral reef ecosystems.

- ❑ In partnership with HIMB, CRED deployed 18 EARs to monitor biological sounds and motorized vessel traffic at sites in American Samoa, Guam, Hawaiian Archipelago, Saipan, and the PRIA. A manuscript on use of EARs to understand ecological processes was published.
- ❑ Analyzed data from 12 ARMS deployed at French Frigate Shoals in late 2007 to document the presence of three alien species not previously reported for the NWHI. In collaboration with CReefs partners, CRED deployed 195 ARMS throughout American Samoa, MHI, NWHI, and the PRIA to establish baseline indices of cryptic invertebrate biodiversity across the region. CReefs colleagues also deployed 54 ARMS at sites in Australia and Brazil. CRED hosted an international workshop to develop protocols for molecular processing and analysis of ARMS samples.

Challenges, Problems, and Limitations

The primary challenge for CRED is to provide timely, unbiased scientific information on the condition of coral reef ecosystems in the Pacific Islands Region and processes influencing them. The information must be easily interpreted and presented in a manner useful to resource managers, policy makers, and other key stakeholders. To meet the challenge, CRED needs to continue long-term reef monitoring, integration of ecosystem observations, and studies of reef resources and processes across the Pacific Islands. These tasks will require a sustained commitment of funding and extensive access to NOAA

research vessels. The Division is also challenged to improve methods used to identify, understand, and explain complex spatial and temporal patterns and relationships across multidisciplinary biological and environmental data sets.

Future Focus and Direction

In response to a new Roadmap for the NOAA Coral Reef Conservation Program, CRED will focus on improving responsiveness to local management needs for scientific information to address impacts of climate change, fishing, land-based pollution, and other forces. To help facilitate better

communication, CRED will assign scientific liaisons at the Center to work closely with resource managers in each of the six areas (MHI, NWHI, American Samoa, Guam, CNMI, and the PRIA) and investigate the detailing of CRED staff to work on location with management agencies in American Samoa, Guam, and CNMI.

CRED will produce coral reef ecosystem monitoring reports for the Mariana Archipelago, the Hawaiian Archipelago, and the PRIA over the next 3 years, using the recently completed American Samoa report as a template. CRED will continue to organize Pacific-wide integrated ecosystem observa-

tions into relational geospatial databases to enable comparative spatial and temporal analyses of marine ecosystems across the Pacific Islands Region. CRED will also investigate the role of ecosystem biodiversity in maintaining ecosystem resiliency.

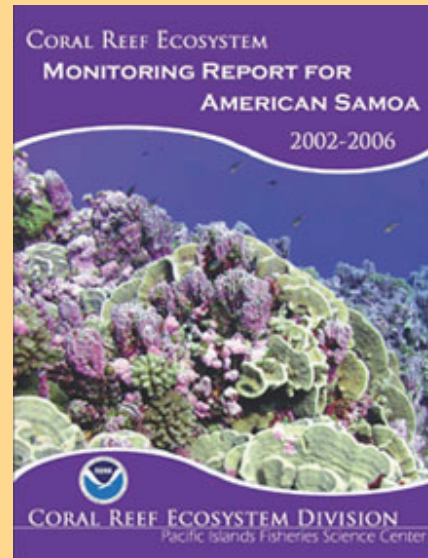
Specifically, in 2009 CRED will:

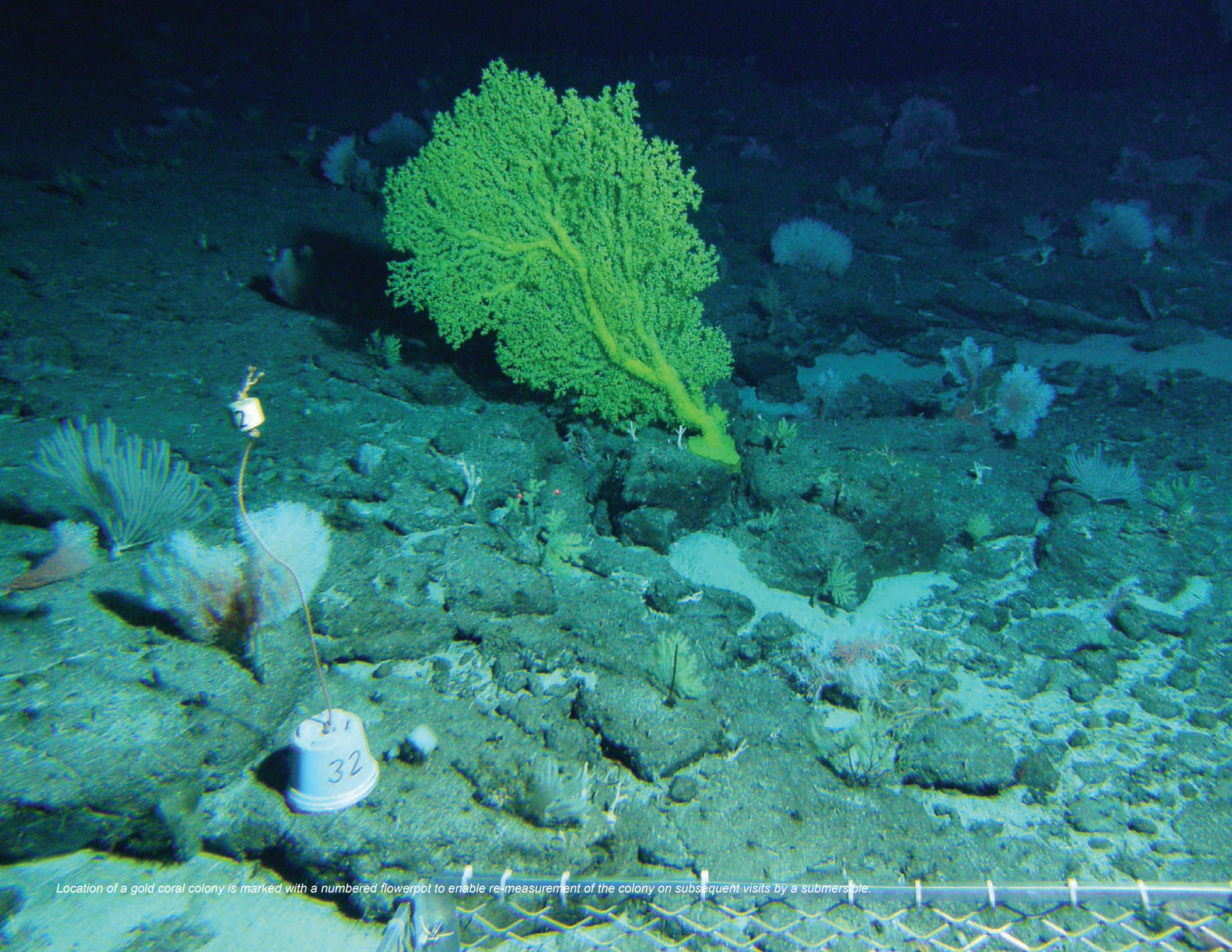
- ❑ Assign scientific liaisons at the Center to work closely with resource managers across the Pacific Islands Region
- ❑ Lead interdisciplinary Pacific RAMP cruises to Guam, CNMI, and Wake Atoll.
- ❑ Produce a draft Coral Reef Ecosystem Monitoring Report for the Mariana Archipelago: 2003-2007.
- ❑ Complete production of benthic habitat maps showing areas of hard and soft substrate for the Mariana Archipelago.
- ❑ Conduct initial testing of the SeaBED autonomous underwater vehicle for efficient collection of optical data to ground-truth moderate depth habitat mapping.
- ❑ Continue development of protocols for processing and analyzing ARMS data as part of the CReefs biodiversity project.
- ❑ Work to establish a baseline understanding of carbonate chemistry processes in Pacific Island reef environments and develop tools to monitor impacts of ocean acidification on reef ecosystems.
- ❑ Create ocean circulation maps of American Samoa, the Mariana Archipelago, and Hawaiian Archipelago for studies of larval transport and recruitment.

Report Documents Surveys of Reef Ecosystems in American Samoa

Since 2002, CRED scientists have worked with partners in American Samoa to survey coral reefs in the archipelago. The studies have resulted in enormous improvements in knowledge of the benthic habitats, oceanography, and biological communities of American Samoa coral reef ecosystems. In 2008, CRED assembled an extensive final report describing the surveys around Tutuila and Aunu'u Islands, Ofu and Olosega Islands, Ta'u Island, Rose Atoll, and Swains Island. The 500-page document summarizes data collected during a series of Reef Assessment and Monitoring Program expeditions to American Samoa in 2002, 2004, and 2006. Chapters for each area of American Samoa describe survey methods and instrumentation, habitat mapping, oceanography and water quality, corals and coral disease, algae, benthic macro-invertebrates, and reef fishes. Release of the report was announced in July 2008 by the NOAA Administrator, Vice Admiral Conrad Lautenbacher, during his address at the 11th International Coral Reef Symposium in Florida. The report is available online at:

<http://www.pifsc.noaa.gov/cred/hmapping/amsareport.php>.





Location of a gold coral colony is marked with a numbered flowerpot to enable re-measurement of the colony on subsequent visits by a submersible.

ecosystems and oceanography division

The Ecosystems and Oceanography Division (EOD) conducts research to advance our understanding of the structure and dynamics of Pacific basin marine ecosystems. In particular, EOD seeks to understand how marine populations change directly in response to changes in their predators and prey and indirectly as a result of broader habitat-based changes in the ocean climate, including El Niño, La Niña, and other interannual or decadal events.

EOD research covers topics on many different spatial scales ranging from fine-scale habitat characterization to basin-scale oceanography, and various temporal scales from short-term individual foraging behavior to long-term ecosystem changes and population trends. Accordingly, a variety of approaches are necessary, including collaborations with scientists in other PIFSC divisions, other government agencies, academic departments, industry, nongovernmental organizations, and foreign institutions.

The EOD has three major research themes:

- ❑ Insular Habitat and Ecology focuses on understanding the dynamics of island-associated species and processes.
- ❑ Pelagic Habitat and Ecology considers the ocean from the perspective of large pelagic animals.
- ❑ Ecosystem Oceanography identifies changes in the ocean that may affect the marine ecosystem.

EOD provides scientific advice in support of improved stock assessment and fisheries management, develops indicators of ecosystem changes,

and publishes scientific findings related to effects of habitat and environment on individuals, populations, ecosystems, and fisheries. To accomplish these goals, EOD researchers use a variety of platforms including deep diving submersibles, remotely operated vehicles, and SCUBA, both small and large research vessels and commercial vessels. EOD employs a broad spectrum of advanced technologies and tools, including pop-up satellite archival tags, animal-borne instruments such as CRITTERCAM, shipboard and moored echo sounders, satellite remotely sensed oceanographic and atmospheric data products, ocean circulation models, and ecosystem models.

EOD has 12 staff, including 6 federal employees and 6 JIMAR employees. Salaries and benefits made up the largest share of expenditures in the EOD budget. The EOD Chief also serves as Principal Investigator for the NESDIS-funded Central Pacific

Ecosystems and Oceanography Division FY 2008

Personnel		
Federal		6
JIMAR		6
Total		12
Budget		
	\$	%
Salaries and benefits	729,649	58
Grants	200,556	16
Equipment, supplies, travel	324,888	26
Total	\$1,225,093	

OceanWatch Node (<http://oceanwatch.pifsc.noaa.gov/>) managed by a JIMAR oceanographer. This program archives and distributes a suite of satellite remotely sensed oceanographic data to a diverse group of users in government agencies and the private sector.

Key 2008 Accomplishments

- ❑ Completed a paper on bigeye tuna habitat using pop-up tag data.
- ❑ Completed a paper describing TurtleWatch—a near real-time map product that combines data on sea surface temperature and currents to identify areas in the fishing grounds for Hawaii longline vessels where encounters with loggerhead sea turtles are most likely, enabling fishers to avoid interactions with this protected species.
- ❑ Completed a paper on effects of the ocean environment on longline fishery performance around American Samoa.
- ❑ Completed a paper on temporal patterns in the acoustic signals of beaked whales at Cross Seamount, near the main Hawaiian Islands, derived from a High-frequency Acoustic Recording Package anchored on the seamount.
- ❑ Conducted a research cruise to study deepwater coral habitats in the main Hawaiian Islands.
- ❑ Conducted a research cruise to Cross Seamount to estimate biomass of tuna using shipboard acoustic instruments.

Challenges, Problems, and Limitations

Noise contamination in the acoustic data collected by the NOAA Ship *Oscar Elton Sette* continues to be a problem for research surveys of tunas and their forage. Due to funding limitations at the Pacific Marine Center (NOAA), the problem has yet to be resolved. Storage and handling of the massive data sets produced by passive and active acoustic recorders, satellite-borne sensors, and coupled physical-biological ocean models remain significant challenges.

Future Focus and Direction

In collaboration with the Protected Species Division, EOD is continuing to deploy passive acoustic recorders on the seafloor to collect information on the occurrence of cetaceans at various locations in the central North Pacific. The Division also plans to expand studies to describe climate-induced changes in the subtropical gyre marine ecosystem using remotely sensed oceanographic data, fishery statistics, observer data, and ecosystem models.



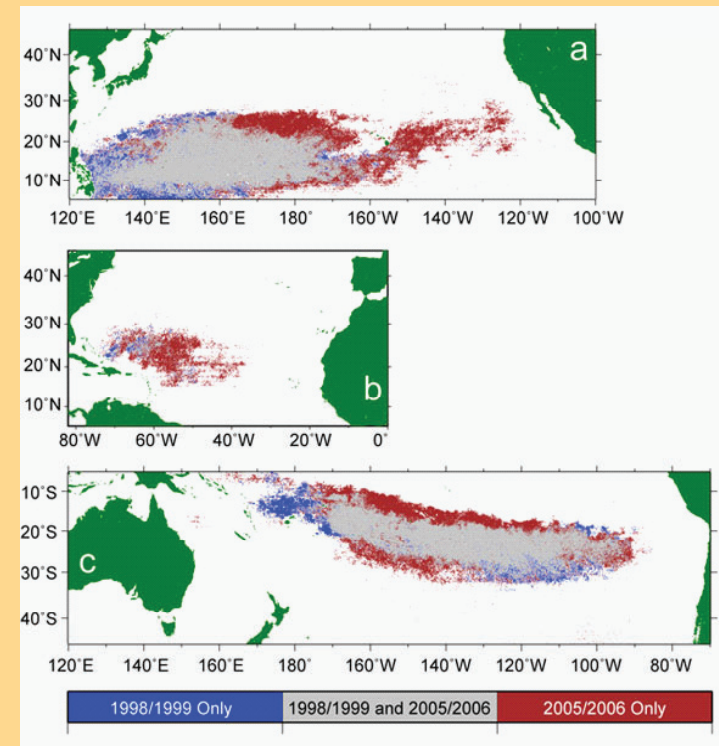
A trawl net is used to collect specimens of micronektonic organisms in midwater depths as part of research on the habitat and prey of bigeye tuna.

Low-productivity Regions in Mid-ocean Gyres Expand as Oceans Warm

EOD scientists confirmed that regions of low biological production within the world's subtropical gyres have been expanding in concert with rising sea surface temperatures. The phenomenon, appearing to varying degrees in subtropical gyres of the northern and southern hemispheres, was discovered by analyzing and mapping chlorophyll concentration and temperature in surface waters and comparing the results for two periods, 1998-1999 and the more recent and warmer period 2005-2006. The EOD study was built on earlier work by NASA scientist Charles McClain and others.

Chlorophyll levels in the ocean's surface waters, measured by the SeaWiFS "ocean color" sensor on the Seastar satellite, indicate the amount of phytoplankton present, and hence the level of primary production. The expansion of low-chlorophyll (low productivity or oligotrophic) surface waters in the subtropical gyres appears to be directly linked to increasing temperatures. Warming of the gyres, whether induced by natural processes or human activities, strengthens vertical stratification of the open-ocean regions, reducing the likelihood that nutrient-rich deep waters will be transported into the sunlit surface layer where photosynthesis occurs. The expected result is lower rates of primary production (and reduced levels of the pigment chlorophyll) in these waters, with cascading effects through higher levels of the marine food chain. Ocean models and other observations show warming and increased vertical stratification are occurring in all oceans; thus, continued expansion of oligotrophic regions within the gyres is predicted.

Results of the study were published in *Geophysical Research Letters* by EOD staffers Jeffrey Polovina and Evan Howell and JIMAR researcher Melanie Abecassis.



In the North Pacific subtropical gyre (Panel a), most areas that were oligotrophic (i.e., had low levels of chlorophyll) in 1998/1999 also were oligotrophic in 2005/2006 (gray region). A few areas were oligotrophic in 1998/1999 but not in 2005/2006 (blue region). And many areas not oligotrophic in 1998/1999 had become so by 2005/2006 (red region). Similar results were calculated for the North Atlantic gyre (Panel b) and the South Pacific gyre (Panel c).

Reference: Polovina, J. J., E. A. Howell, and M. Abecassis (2008). Ocean's least productive waters are expanding. *Geophys. Res. Lett.*, 35(3), L03618. <http://dx.doi.org/10.1029/2007GL031745>



PIFSC scientist configures an acoustic doppler current meter for deployment.



Northwestern Hawaiian Islands catch of bottomfish waiting to be weighed in and placed on pallets for auctioning.

fisheries monitoring and socioeconomics division

The Fisheries Monitoring and Socioeconomics Division (FMSD) specializes in the collection, management, and analysis of data from U.S. fisheries in the Pacific Islands Region. The FMSD monitors and reports on U.S. fisheries; provides technical support to the PIFSC partner agencies in Hawaii, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) in developing and administering local fisheries monitoring programs; and conducts social and economic research on marine resource use. Fishery-dependent data are collected, processed, and analyzed by FMSD. Products derived from the data comprise most of the information requests received by FMSD from fisheries scientists and managers. They support fishery monitoring and fish stock assessment and are the foundation of many fisheries management decisions. Socioeconomic data collection and research provide valuable insights into the effects of those decisions on fishery participants. FMSD provides fisheries statistics to fulfill U.S. obligations for data exchange and reporting under several international agreements.

The FMSD is organized into four programs:

- ❑ *The Western Pacific Fisheries Information Network (WPacFIN)* is a cooperative program involving a central office at PIFSC and fisheries agencies in American Samoa, CNMI, Guam, and Hawaii. The WPacFIN central office compiles fisheries information collected by these agencies and provides technical expertise and tools to help them collect fishery-dependent data needed to make local, federal, and international fisheries management decisions.

- ❑ *The Fisheries Monitoring and Analysis Program (FMAP)* collects, processes, compiles, interprets, and disseminates federally mandated logbook data. FMAP also provides information on federally regulated fisheries to fishers and industry constituents and makes nonconfidential data available to fishers and other clients to improve PIFSC communication and working relationships with them.
- ❑ *The Economics Program (EP)* contributes to Pacific Islands Region fisheries management by assessing the economic health and capacity of fishing fleets, monitoring costs and earnings, studying fish prices and markets, developing models to examine economic impacts of fisheries regulations, and evaluating direct-use and indirect-use values of living marine resources.
- ❑ *The Human Dimensions Research Program (HDRP)* studies the “people” side of fishing and other uses of marine ecosystems in the Pacific Islands Region. HDRP research complements biophysical and economic studies by exploring social and cultural benefits and values associated with marine resources.

FMSD has a staff of 30, including 13 federal employees, 14 JIMAR employees, and others. Personnel and grants made up the largest fractions of expenditures in FY 2008.

Key 2008 Accomplishments

Many products provided by FMSD are recurrent. Examples are quarterly and annual summaries of logbook statistics for longline fisheries in Hawaii

and American Samoa, sections of annual reports for Fishery Management Plans, and annual inputs to Fisheries of the United States. Some of the Division’s new initiatives and accomplishments in 2008 included the following:

- ❑ Provided technical support to fishery offices in American Samoa, CNMI, Guam, and Hawaii to improve data collection and reporting.
- ❑ Provided support for U.S. fishery reports and data submissions to Regional Fisheries Management Organizations, such as the Inter-American Tropical Tuna Commission, International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean and Western and Central Pacific Fisheries Commission.

Fisheries Monitoring and Socioeconomics Division FY 2008

Personnel		
Federal		13
JIMAR		14
Other		3
Total		30
Budget		
	\$	%
Salaries and benefits	1,202,266	41
Grants	1,181,576	40
Equipment, supplies, travel	556,094	19
Total	\$2,939,936	

- ❑ Compiled up-to-date statistics for U.S. fisheries of the Pacific Islands Region and made them available on the WPacFIN Web site for all viewers.
- ❑ In collaboration with the Hawaii Division of Aquatic Resources (HDAR), Pacific Islands Regional Office, and WPFMC, provided support for management of the bottomfish fishery in the main Hawaiian Islands, including delivery of public outreach and fisher education, development of field guides and training for bottomfish identification, and implementation of procedures for fast-track catch monitoring.
- ❑ Expanded the outreach and education program for use of barbless circle hooks in Hawaii's shoreline recreational fishery by creating a special "Keiki Barbless" component for school age anglers.
- ❑ Estimated impacts of time-area closure management alternatives for the Hawaii swordfish longline fishery on sea turtle interactions and economic returns.
- ❑ Monitored fishing costs of the Hawaii and American Samoa longline fleets and retail prices in the Honolulu fresh fish market as part of a continuous economic data collection program.
- ❑ Conducted comprehensive interviews of 78 elder fishermen in American Samoa to document traditional knowledge of local marine resource use and management and chronicle changes in practices over time. Completed a report on Historic Fishing Methods in American Samoa.
- ❑ Contributed to the Socioeconomic Monitoring Pasifika Guidelines for socioeconomic assessment and monitoring in the Pacific Islands and coordinated associated training for people from seven Pacific Islands territories and freely associated states.
- ❑ Completed a report on how agencies can measure public values, beliefs, and attitudes and apply them to marine resource management.
- ❑ Conducted a national training for public resource management agencies on social and economic aspects of management planning and development of guidelines for community self-evaluation and measurement of community social capital.



In Guam and the Commonwealth of the Northern Mariana Islands, bottomfish are hauled in using combination manual/hydraulic powered reels.

Challenges, Problems, and Limitations

The FMSD must meet increasing demands for improved fisheries data collection, management, and reporting to enable agency compliance with federal statutes and regulations. FMSD will continue to help the WPFMC in providing monitoring and scientific information for amending Fishery Management Plans and developing Fishery Ecosystem Plans. New mandates under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) with respect to permits, reporting, and management of total allowable catch will provide challenges in the Pacific Islands where regulations governing such management measures are mostly absent. Chal-

lenges in fisheries data collection are anticipated as the agency implements annual catch limits and meets new mandates for catch monitoring in domestic and international arenas, including domestic recreational fisheries. Accordingly, the FMSD must ensure sufficient PIFSC staffing levels, invest in technical training, build greater technical capacity of WPacFIN partners, increase the efficiency of data operations, and improve the timeliness of reporting. The importance of economics and human dimensions research will continue to grow as broader, ecosystem-based approaches to fisheries management are developed, requiring FMSD to seek new partnerships and sources of funding. In all programs, FMSD staff will need to maintain comprehensive metadata and documentation of data collections, procedures, reports, and data products.

Future Focus and Direction

WPacFIN will continue to improve long-term data collection programs and address new developments. Our staff will work closely with partner offices throughout the Pacific Islands Region to identify ways to improve data collection and coverage and help local fishery offices implement new monitoring programs. WPacFIN will continue to develop database applications to support several projects, including integration of HDAR fish catch data with fish dealer sales data, improvement of recreational fisheries monitoring, and collection of data on local fishing fleets and fish imports in CNMI and American Samoa. WPacFIN also plans to improve its Web site content, data request service protocols, and documentation for data collection programs and database applications.

FMAP will provide technical assistance for ongoing efforts to develop simpler and more efficient alternatives for reporting of catch and effort by fishers. In particular, FMAP will assist with development

of electronic logbooks and electronic transmission of logbook reports which will enable secure, efficient, and timely compliance with federal reporting requirements and quicker and more accurate fishery monitoring. FMAP will also develop software applications that integrate data from different data sets, perform fishery analysis and monitoring functions, and generate the summary statistics needed to meet the agency's domestic and international reporting requirements. FMAP will also continue to improve its section of the PIFSC Web site and enable ready online access to current, nonconfidential fishery statistics, fishery reports, and other information. EP will continue to seek support for expanded research in American Samoa, Guam, and the CNMI. EP intends to expand its research on the economics of coral reef resources, protected species, and ecotourism.

HDRP plans to complete profiles of fishing communities in Hawaii and American Samoa as required by the MSA, complete a framework for long-term monitoring of the human dimensions of coral reef ecosystems in the main Hawaiian Islands, and further develop its geographic information systems to support analysis of fishing impacts at the sub-island scale in the main Hawaiian Islands.

HDRP will continue research and training activities in support of the WPFMC and other clients, including expansion of programs begun in 2008. HDRP will continue to work with other PIFSC divisions toward a better mutual understanding of the human dimensions of challenges facing the region. HDRP will also continue to provide social science assistance and advice to partners in the Pacific and U.S. mainland.

Elders Provide Insights on American Samoa Traditional Fisheries Practices

In American Samoa, use and management of marine resources has traditionally been based on conservation ethics exercised at the local village level. Rapid changes in American Samoa culture and economics, however, have increased the risk that traditional conservation knowledge, held primarily by village elders, may be lost. To preserve such knowledge, Arielle Levine of the PIFSC Human Dimensions Program led a project to consult elders in several American Samoa fishing communities and build an aural and written record of traditional practices.

A team of American Samoa researchers including Fialoa Maiava and Bert Fuiava of the American Samoa Department of Marine and Wildlife Resources, Fatima Sauafea-Leau of the NOAA Fisheries Pacific Islands Regional Office, and Fale Tuilagi of the National Park Service conducted in-depth interviews of 78 fishermen from 28 villages on Tutuila and the Manu'a Islands of American Samoa. They asked the elders, aged 40 to 86, to describe marine resource use and changes in management practices over time. Information was collected on historical changes in fishing frequency, catch and fish abundance, fishing areas, local harvest restrictions, traditional methods of management, importance of marine resources to the Samoan way of life, and other elements of traditional knowledge.

Transcripts of the interviews and translations from Samoan to English will be produced using funds from a 2008 Mia J. Tegner Memorial Research Grant in Marine Environmental History and Historical Marine Ecology, provided by the Marine Conservation Biology Institute. The work will be completed in cooperation with the Samoan Studies Institute of American Samoan Community College, allowing for more detailed analysis of interview results in the future. Digital audio recordings and written transcriptions and translations of the elder interviews will be provided to the NOAA Fisheries Voices from the Fisheries Oral History Project, making them available to a national audience.



Elder fisherman provides traditional knowledge on methods of fishing and managing marine resources in American Samoa.



During the 1970s, trawlers from Japan and the former Soviet Union made large catches of armorhead on mid-Pacific seamounts. PIFSC is providing scientific expertise in support of an intergovernmental effort to ensure the recovery and sustainability of fish stocks and ecosystems on seamounts of the northwest Pacific Ocean.

fishery biology and stock assessment division

The Fishery Biology and Stock Assessment Division (FBSAD) conducts fundamental biological and ecological research on fish, sea turtles, and crustaceans caught in federally managed fisheries to enable improved understanding of the mechanisms that influence their distribution and abundance. Life history studies on age and growth, reproduction and fecundity, migration and movement, and mortality are conducted to provide estimates of vital rates for stock assessments and ecosystem-based management. Research is focused on tunas, billfishes, sea turtles, and other pelagic species; bottomfish; and the Northwestern Hawaiian Islands lobster. Attention is also being directed toward coral reef and seamount species.

The research involves field surveys using a variety of sampling gears, laboratory studies of biological specimens, and analysis of data from experiments using conventional and electronic tags and other tracking methods. Geochemical techniques are used to investigate trophic levels and population connectivity. New fishing technologies are developed, tested, and promoted internationally to reduce fisheries bycatch and effects of pelagic longline and other fisheries on populations of sea turtles, seabirds, sharks, and other species caught incidentally. The ecology of exploited stocks and effects of stock levels, harvests, bycatch, and conservation measures on the broader ecosystem are explored through food web analyses and ecosystem models.

Stock assessments are currently conducted for tunas, billfishes, pelagic sharks, bottomfishes and lobsters. These assessments, along with estimates of the bycatch of sea turtles, seabirds, and marine

mammals are provided to support informed decisions by the NOAA Fisheries Pacific Islands Regional Office (PIRO), the Western Pacific Regional Fishery Management Council (WPFMC), and international organizations such as the Western and Central Pacific Fisheries Commission (WCPFC), the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC), and the Inter-American Tropical Tuna Commission (IATTC).

The FBSAD is organized into three programs:

- ❑ *The Fishery Biology and Bycatch Program* focuses on identifying methods to minimize incidental capture of sea turtles and other bycatch species in pelagic longline and other fisheries, including modifications to fishing gear and bait, and promotes adoption of such methods through outreach and education programs. The program also conducts research on habitats, movements, distribution, and post-release survivorship of fishes, sharks and sea turtles released from pelagic fishing gear. Other research is conducted to model the effects of various factors on the vulnerability of pelagic fishes to capture in longline and other fisheries and to use the results in standardizing catch-per-unit-effort (CPUE) data for pelagic stock assessments. Staff in this program also lead the WPFMC Pelagic Fishery Management Plan (FMP) Team.
- ❑ *The Life History Program* conducts basic research on the age, growth, and reproductive strategies of managed fish species and bycatch species. The program also collaborates in studies of coral reef

fish community structure and responses of reef fish populations to anthropogenic factors.

- ❑ *The Stock Assessment Program* conducts population assessments of pelagic species, including yellowfin and bigeye tuna in the western and central Pacific and swordfish, striped marlin, and blue shark in the North Pacific. Assessments are also produced for insular species including bottomfish in the Hawaiian Archipelago, Guam, and Mariana Archipelago and lobster in the Northwestern Hawaiian Islands. Top priority is given to the multispecies complex of bottomfish in the main Hawaiian Islands, which is subject to excessive fishing pressure. The program estimates incidental takes of sea turtles, seabirds, and marine mammals, and the bycatch of fish species (mostly sharks) in the Hawaii longline fishery. The program also develops and implements international collaborative research agreements with foreign scientific institutions and organizations and provides leadership to the WPFMC Hawaiian Archipelago Ecosystem Team and Western Pacific Stock Assessment Review process.

In addition to directing research activities of the Division, the FBSAD Chief serves as International Science Advisor to the Directors Office, providing critical support and counsel on scientific issues arising with respect to tunas, billfishes, and ecologically associated species in the Pacific. The International Science Advisor is responsible for: providing scientific advice, technical reports, and informed opinion on scientific matters at meetings of the WCPFC, ISC, and other regional fisheries organizations; pro-

viding similar scientific support to PIRO, the U.S. State Department, and other members of official U.S. delegations to such meetings; and leading the U.S. delegation at meetings of the WCPFC Scientific Committee. The International Science Advisor also oversees the compilation of official fishery statistics for U.S. fishing fleets harvesting tunas and billfishes in the Pacific Islands Region and, as the U.S. data correspondent, submits such statistics to the WCPFC and other regional field offices.

FBSAD staff provide expertise, advice and leadership within scientific working groups of international fishery organizations including WCPFC and ISC, and in support of multilateral efforts to establish a regional fisheries management organization for the northwest Pacific.

FBSAD staff members also help the Directors Office in overseeing NOAA Grants to the Oceanic Institute, advise the State of Hawaii on matters related to introduced and invasive species, and organize and maintain the PIFSC schedule of research cruises on the NOAA Ship *Oscar Elton Sette*.

Fishery Biology and Stock Assessment Division FY 2008

Personnel		
Federal		19
JIMAR		9
Total		28
Budget		
	\$	%
Salaries and benefits	2,037,025	55
Grants	524,944	14
Equipment, supplies, travel	1,173,505	31
Total	\$3,735,474	

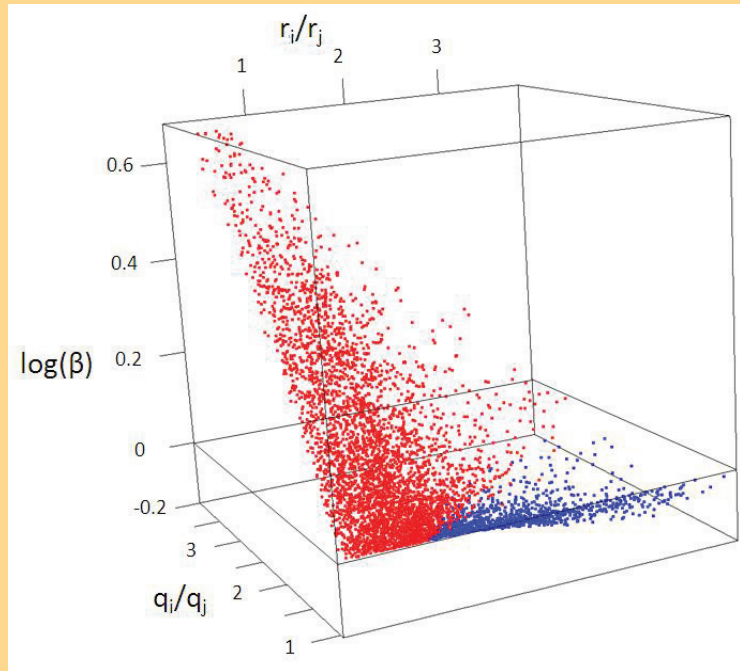
FBSAD has a staff of 28 people including 19 federal employees and 9 employees of JIMAR. Staff salaries and benefits made up the largest share of expenditures in FY 2008.

Key 2008 Accomplishments

- ❑ Completed a manuscript reporting preliminary results of an experiment in the Hawaii tuna longline fishery showing that use of deep-set gear without shallow hooks (no hooks down to 100 m depth) results in greatly reduced catches of marlins and other incidental species compared with unmodified deep-set gear, while maintaining catch rates of the target species, bigeye tuna.
- ❑ Completed a draft Programmatic Environmental Assessment for Elasmobranch Bycatch Reduction in Domestic and International Fisheries.
- ❑ Participated in a NOAA Vulnerability Evaluation Working Group to provide technical guidance for determining the vulnerability of managed fish stocks and setting Annual Catch Limits.
- ❑ Convened and cochaired the annual meeting of the WCPFC Scientific Committee; reports are posted on the the WCPFC Web site at: <http://www.wcpfc.int/>.
- ❑ Convened and chaired meetings of the ISC Bycatch Working Group and Billfish Working Group. Meeting reports are posted on the ISC Web site at: <http://isc.ac.affrc.go.jp>.
- ❑ Established a cooperative program with Hawaiian Archipelago bottomfish fishermen to collect specimens of snapper and grouper for studies of age, growth, maturity, trophic level, and population structure. The data are critical for improved stock assessment.
- ❑ Estimated incidental takes of sea turtles, seabirds, and marine mammals in the 2007 Hawaii longline fishery.
- ❑ Collaborated in updating stock assessments of bigeye tuna in the western and central Pacific, albacore in the South Pacific, blue shark in the North Pacific, and bottomfish in the Hawaiian Archipelago.
- ❑ Contributed scientific inputs to the WCPFC, ISC, and WPFMC on a range of topics including status of stocks, CPUE standardization, bycatch mitigation, and post-release mortality of sea turtles.
- ❑ Through cooperative research agreements with industry, conducted lobster tagging research at Necker Island, Maro Reef, Gardner Pinnacles, and Laysan Island in the NWHI. Presented results at scientific meetings and conferences.
- ❑ Reported results of a preliminary growth curve based on an otolith-derived age and growth study of the Hawaiian grouper.
- ❑ Prepared a plan for billfish biological research that emphasizes the need for improved international collaboration in the acquisition of data and biological samples.
- ❑ Reestablished a program to periodically collect biological data on commercial catches of pelagic and bottomfish species available for sampling at the United Fishing Agency fish auction.
- ❑ Contributed scientific expertise on biology and fisheries of the Emperor-Northern Hawaiian Ridge seamounts at multilateral meetings to establish a northwest Pacific regional fisheries management organization.
- ❑ Developed a cooperative research agreement with the Fisheries Research Institute, Taiwan, on a suite of biological and ecological research topics and initiated discussions toward a similar agreement with Shanghai Ocean University, Shanghai, China.

Study Highlights Problems in Using Aggregate CPUE to Infer Changes in Abundance of MultiSpecies Stocks

Many fish stock assessments rely on changes in catch per unit of fishing effort (CPUE) to characterize changes in the abundance of the exploited stock. In cases where the catch is made up of several species, analysts often compute an aggregate CPUE, based on the combined catch, to measure overall abundance of the stock complex. Recent research by PIFSC scientist Pierre Kleiber and colleague Mark Maunder (Inter-American Tropical Tuna Commission) strongly argues against this approach, showing that it is prone to serious bias. In particular, it is very likely that a decline in aggregate CPUE will exaggerate the actual decline in abundance of the stock complex (so-called “hyper-depletion”). In a small but unlikely set of cases, a decline of aggregate CPUE would understate the true overall stock decline (“hyper-stability”). Kleiber and Maunder published their results in Fisheries Research. They concluded that aggregate CPUE, while perhaps useful as a quick and rough indicator of mixed-stock abundance, is not a reliable index of aggregate abundance and tends to exaggerate fishery-caused fluctuations in abundance. It is not a substitute for careful stock assessment of a multispecies complex, which should consider each species individually or take into account differences among the species and their interactions.



Kleiber and Maunder simulated changes in total stock abundance and aggregate CPUE over 30 time steps for 5000 hypothetical pairs of exploited stocks governed by Schaefer population dynamics and randomly assigned catchability and productivity. For each of the 5000 cases, they computed a measure of bias (β , slope of regression between \log (abundance) and \log (CPUE)), with positive values of β indicating hyperdepletion, and negative ones hyperstability. A plot of $\log(\beta)$ against ratios of productivity (r) and catchability (q) shows that bias is most apt to involve hyperdepletion (red) rather than hyperstability (blue).

Reference: Kleiber P., and Maunder M. N. (2008). Inherent bias in using aggregate CPUE to characterize abundance of fish species assemblages. *Fish. Res.* 93(1): 140-145. <http://dx.doi.org/10.1016/j.fishres.2008.03.013>

Challenges, Problems, and Limitations

Increasing FBSAD staff to meet new mandates continues to be difficult due to limited funding and lack of office space. While adequate funding of sea turtle bycatch studies will likely continue, the budget for fish bycatch research has dwindled, and funding for other fish and ecosystem research is very limited. Core fish stock assessment tasks are substantially funded, but mandates to assess additional species and meet new requirements of the Magnuson-Stevens Fishery Conservation and Management Act, particularly establishment of annual catch limits for all fisheries, are unfunded.

Although the Division Chief serves as International Science Advisor for the U.S. delegation to WCPFC and FBSAD staff members contribute significantly to scientific work of the WCPFC, ISC, and other regional international fisheries agreements, PIFSC has not received funding to provide such scientific support for international fisheries.

On the international front, many nations participating in the WCPFC have strongly resisted U.S.-recommended methods for reducing sea turtle bycatch, methods largely tested and widely promoted by FBSAD.

Within the Center, challenges remain with developing and coordinating integrated research programs needed to support ecosystem approaches to management of living marine resources. One of the challenges for FBSAD scientists is to improve stock assessments through greater use of oceanographic data products developed by EOD.

Among other challenges, FBSAD has been asked to help assess coral reef fisheries and provide scientific advice to the State of Hawaii on management of fisheries in the main Hawaiian Islands through

closed areas and other means. Information is often lacking to adequately address these issues, which have traditionally been outside Federal jurisdiction.

Future Focus and Direction

Collaborative testing of improved fishing gear to reduce longline bycatch will continue, with a return to studies of longline–seabird interactions, continued collaboration with other nations on sea turtles and increased research on sharks. Recommendations for international fisheries conservation measures on bycatch will be actively promoted. Bycatch work will include completion of a new National Bycatch Report with coverage of all fish species and protected species.

New research will be focused on Hawaiian bottomfish life history, distribution, and stock dynamics, using results of the major new sampling projects funded by the Fisheries Disaster Relief Program. Work will be conducted on standardizing bottomfish CPUE data to account for previous changes in the fisheries, so that trends in stock abundance over time can be more accurately described and future assessments can be improved. A total allowable catch risk analysis model for MHI bottomfish will be provided to the WPFMC and other stakeholders for their use in scenario analyses. This will satisfy technical requirements for setting annual catch limits for MHI bottomfish, which recent stock assessments indicate have been experiencing excessive fishing mortality.

Review and improvement of stock assessments for tunas, billfishes, and sharks will continue under the auspices of the WCPFC and ISC. Work will be published describing the influence of fish habitat, fishing gear configuration, and other variables on indices of abundance for large pelagic species and the vulnerability of these species to fishing gear. Results will be used in CPUE standardization to improve stock assessments. In addition to stock assessment research, significant effort will be devoted to standardizing and documenting methods of fishery data processing and reporting to meet increasing demands of international agreements for information and advice. Production schedules and report formats will be improved and more detailed and comprehensive fisheries statistics will be reported than in previous years.



Juvenile bigeye tuna



Longline hook bin showing the snaps that attach to the mainline and circle hooks that are required for swordfishing.



Field camp on Lisianski Island used by researchers to study and observe endangered Hawaiian monk seals.

protected species division

The Protected Species Division (PSD) conducts research supporting the recovery and sustainability of marine mammals and sea turtles in the Pacific Islands Region. Marine mammal studies involve the highly endangered Hawaiian monk seal population and cetaceans. Marine turtle studies involve primarily the threatened Hawaiian green turtle population, but also address other species including hawksbill, loggerhead, olive ridley, and leatherback turtles. PSD research covers a broad range of topics in life history, ecology, health and disease, and demography.

The research employs several advanced technologies. Passive acoustic monitoring systems are used to detect underwater sounds produced by cetaceans and by vessels and other anthropogenic sources. Other instruments deployed concurrently record oceanographic features. Satellite-linked Geographic Positioning System tags are attached to monk seals and turtles to track their movements and describe dive patterns. Archival electronic tags are used to obtain fine-scale dive pattern information. Fatty acid profile analysis is used to determine the diet of monk seals. Mathematical and statistical methods are used to model population dynamics and analyze data from field studies and surveys.

The PSD is organized into four programs:

- ❑ *The Monk Seal Research Program* conducts research on the Hawaiian monk seal population with the goal of enhancing its recovery. The program's work extends the length of the archipelago and includes an annual census of seal abundance and other field studies to assess population trends and demographics at the main

breeding sites in the Northwestern Hawaiian Islands (NWHI); investigations of foraging ecology; monitoring and assessment of health and disease parameters; identification of natural and human factors that may be limiting monk seal recovery; and research on methods to enhance recovery of the species.

- ❑ *The Cetacean Research Program* studies populations of whales and dolphins in the central and western Pacific Ocean and involves a range of topics, including surveys of cetacean distribution, abundance and stock structure; studies of habitat use, reproduction, and mortality; and assessment of natural and anthropogenic threats. The cetacean group's research includes ship-based visual and acoustic line transect surveys, photo-identification studies, passive acoustic surveys using High-Frequency Acoustic Recording Packages, habitat modeling, and ecosystem studies.

- ❑ *The Marine Turtle Research Program* is responsible for research on the threatened Hawaii green turtle population. The research agenda is comprehensive: field studies of growth rates, mortality, and movements; long-term monitoring of abundance trends, including annual surveys of the primary nesting colony at East Island, French Frigate Shoals, in the NWHI; and the biology, etiology, and effects of fibropapilloma disease. The group also trains Pacific islanders and fishery observers in sea turtle biology and handling, collects data on fishery interactions with sea turtles, and studies the pelagic biology of sea turtles in the Pacific.

- ❑ *The Marine Turtle Assessment Program* studies marine turtle population biology and stock status across the U.S. Pacific Islands Region, with a focus on areas outside the Hawaiian Archipelago. Research is conducted on a wide range of topics, including: turtle demography and population dynamics; assessment of natural and anthropogenic factors affecting turtle populations; evaluation of management strategies influencing marine turtle recovery; development of simulation models to identify data gaps, study demographic trends and design and evaluate management strategies; and a variety of other marine turtle studies. This program has begun working with biologists in Guam and the Commonwealth of the Northern Mariana Islands (CNMI) to help develop monitoring programs in these areas to assess abundance and stock structure of marine turtle populations.

Protected Species Division FY 2008

Personnel		
Federal		13
JIMAR		17
Other		6
Total		36
Budget		
	\$	%
Salaries and benefits	971,257	26
Grants	888,700	24
Equipment, supplies, travel	1,866,746	50
Total	\$3,746,703	

The PSD staff of 36 includes 13 federal employees, 17 JIMAR staff, and others.

Key 2008 Accomplishments

- ❑ Conducted annual NWHI monk seal population assessment using modified methods necessitated by decreased funding levels.
- ❑ Conducted multiagency research on the NOAA Ship *Oscar Elton Sette* to investigate cetacean movement patterns and determine if cetacean behavior changes during U.S. Navy ship operations.
- ❑ Completed a 10-year Captive Care Research Plan for Hawaiian Monk Seals to evaluate efficacy of captive care in improving seal survival.
- ❑ Initiated a study to examine the foraging ecology and relative foraging success of juvenile monk seals at Lisianski Island.
- ❑ Completed field collections of Hawaiian monk seal health and disease information in the NWHI.
- ❑ Conducted a workshop of monk seal researchers, shark experts, and key stakeholders to discuss and develop strategies for mitigation of shark-related mortality of young seals at French Frigate Shoals.
- ❑ Estimated the number of green turtles nesting at East Island, French Frigate Shoals, during the 2008 nesting season.
- ❑ Successfully relocated 6 weaned monk seal pups from French Frigate Shoals to Nihoa with objective of improving their chances of survival.
- ❑ Conducted aerial survey of monk seals in the main Hawaiian Islands (except Ni'ihau) in collaboration with CRED.
- ❑ Completed a study of foraging interactions between monk seals and large predatory fish in the

Northwestern Hawaiian Islands in collaboration with EOD.

- ❑ Completed a study of organochlorine contaminants in Hawaiian monk seals from four subpopulations in the Northwestern Hawaiian Islands.
- ❑ Released satellite-tagged juvenile loggerhead turtles in pelagic waters of the South Pacific as part of an ecological study in collaboration with international partners.
- ❑ Reported on temporal patterns in the acoustic signals of beaked whales at Cross Seamount.
- ❑ Evaluated effect of variable oceanic productivity on the Hawaiian monk seal in collaboration with EOD.
- ❑ Completed a study using Bayesian state-space modeling to assess the recovery and harvest potential of the Hawaiian green sea turtle stock.
- ❑ Completed a study with Southwest Fisheries Science Center on population structure of Hawaiian green turtle foraging aggregations.
- ❑ Coauthored paper on “TurtleWatch” as a tool to reduce bycatch of loggerhead turtles in the Hawaii longline fishery.
- ❑ Published paper on relationship between offspring size and survival, providing insight into causes of mortality in Hawaiian monk seals.

Challenges, Problems, and Limitations

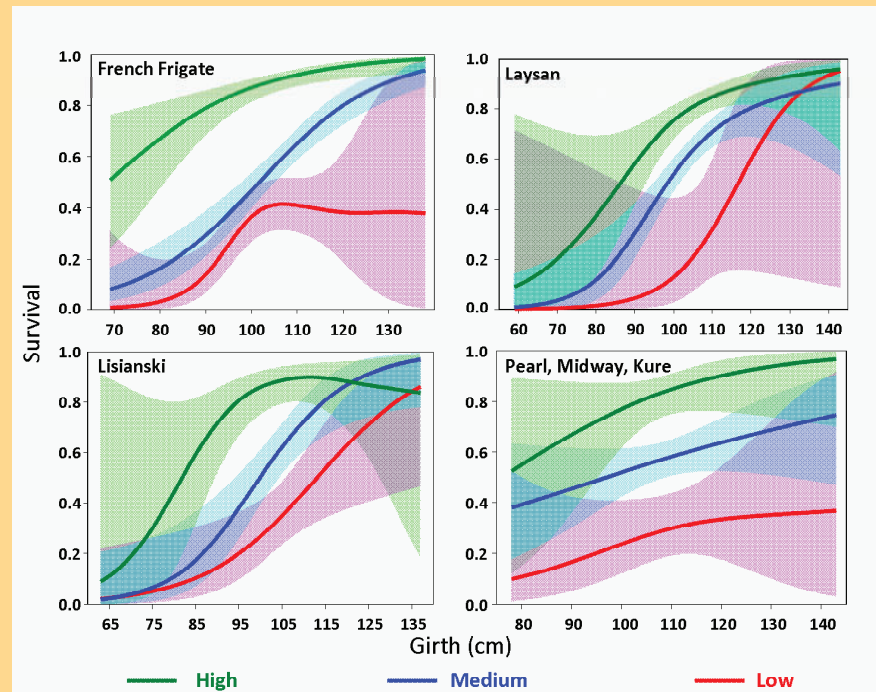
Through comprehensive efforts to monitor Hawaiian monk seals in the NWHI, we continue to document a persistent population decline in this imperiled species. An ongoing challenge is to diagnose the root causes of the decline and develop tools and strategies for enhancing the species' recovery. In the sea turtle and cetacean programs, we have broadened research agendas and identified research priorities, but we lack adequate funding and other resources to carry out new mandates.

Future Focus and Direction

During 2009, we will continue to place emphasis on characterizing the ecological factors influencing the decline of Hawaiian monk seals, in part by studying the habitat needs and foraging behavior of juvenile seals, a segment of the population that suffers high mortality. At the same time, PSD will build partnerships with other agencies and nongovernmental organizations to develop methods for increasing survival of juvenile seals. PSD will continue field camps in the NWHI to collect demographic data for long-term monitoring, mitigate mortality (e.g., by disentangling seals from debris and reducing shark predation), and collect specimens for foraging and health studies. PSD also hopes to expand monk seal monitoring and assessment in the MHI, where the monk seal population is increasing and human contact with seals is becoming more frequent. Another PSD goal will be to further develop and implement the cetacean stock assessment research program. This will include analyzing cetacean sound data from acoustic recorders, modeling characteristics of spinner dolphin resting habitat, and expanding the community-based photographic identification catalog for Hawaiian spinner dolphins. PSD scientists will continue research on the foraging ecology of the Hawaiian green sea turtle, place increased emphasis on the endangered hawksbill sea turtle, and address stock assessments of marine turtles in Hawaii, American Samoa, Guam, and the CNMI. PSD will also continue to assess the status of marine turtle populations that forage in the central North Pacific but nest outside the United States, including leatherbacks, loggerheads, and olive ridleys.

Relationship Between Size of Monk Seal Pups and Their First-year Survival Indicates Causes of Mortality

The endangered Hawaiian monk seal population is declining at 4% per year, largely due to low survival in pups. Understanding pup survival and factors affecting it are critical to NOAA's efforts to reverse the decline and recover the species. PIFSC biologist Jason Baker hypothesized that causes of mortality in wildlife populations could be inferred from variation in the relationship between offspring size and survival during their first year. He tested the hypothesis by studying the relationship between the girth of weaned monk seal pups and their survival. He found that the pups' probability of surviving their first year was positively related to their girth at weaning (a measure of condition). Pup survival also varied by subpopulation and year. Further, when he compared the size-survival relationships amongst years with high, medium, and low first-year survival, Baker found that poor survival of pups after weaning was generally associated with an intensification of size-dependent mortality, probably related to limitation of their food supply. This result was consistent with many other observations pointing to food shortage as the main cause of poor pup survival and population decline in Northwestern Hawaiian Islands monk seals. An exception was noted at French Frigate Shoals, where data indicated that low pup survival was associated with size-independent mortality, likely resulting from a known high incidence of shark predation. Baker's novel approach, analyzing the relationship between first year survival and offspring size, should be useful in many other wildlife population studies. It was published in the journal *Endangered Species Research*.



Analysis of monk seal data showed that the relationship between first-year survival and pup girth at weaning varied between years with low, medium, or high survival (solid colored lines) and between subpopulations (separate panels). Colored bands indicate 95% confidence intervals.



On the starboard bridge deck of the NOAA Ship Oscar Elton Sette.

notable milestones

- Conducted an external panel review of the Center's ecosystem science activities.
- Completed a draft agreement for coordination between the Center and staff of the Papahānaumokuākea Marine National Monument.
- Developed emergency evacuation protocols for Center scientists and contractors working in remote areas of the Pacific Islands Region.
- Prepared and implemented a Pandemic Influenza Plan for the Center.
- Completed transfer of the InPort Metadata Catalog System to the NOAA Fisheries Office of Science and Technology.
- Completed upgrade of the Longline Observer Data System for Hawaii and American Samoa.
- Coordinated comprehensive registration and publication of metadata on the Center's data holdings using InPort.
- Collaborated with scientists at the Secretariat of the Pacific Community to update stock assessment of bigeye tuna in the western central Pacific Ocean.
- Convened working group meetings of the International Scientific Committee on Tuna and Tuna-like Species in the North Pacific Ocean to advance stock assessment of striped marlin and swordfish in the North Pacific.
- Developed a main Hawaii Islands bottomfish risk analysis model to estimate the probability of overfishing given a specified total allowable catch.
- Estimated the bycatch of sea turtles and other protected species in the Hawaii longline fishery for 2007.
- Published research describing expansion of low productivity regions in subtropical gyres linked to ocean warming.
- Published the Hawaii Archipelago Marine Ecosystem Research (HAMER) Plan, describing a multiagency research approach to ecosystem research in the Hawaiian Archipelago.

notable milestones (continued)

- Developed a framework for monitoring human dimensions of coral reef ecosystems in the main Hawaiian Islands.
- Completed research report documenting traditional knowledge of marine use and resource management in American Samoa.
- Completed final report on case studies of successful bycatch reduction strategies in the Hawaii-based longline fleet.
- Completed 1-yr study of supply and prices in the Hawaii retail market for bottomfish.
- Produced estimates of fish catch in the Pacific Islands Region for Fisheries of the United States and reported quarterly catch and effort for longline fisheries in Hawaii and American Samoa.
- Developed and implemented “fast-track” data processing and reporting systems for monitoring Hawaii bottomfish total allowable catch.
- Conducted workshop of invited experts to develop strategies for mitigation of shark predation on Hawaiian monk seals.
- Completed report of multiyear trends in strandings of marine turtles in the Hawaiian Islands.
- Produced 60-m bathymetric grids of the Mariana Archipelago for online dissemination to Center clients.
- Completed annual marine debris removal operations in the Northwestern Hawaiian Islands.
- Processed and disseminated databases of high-resolution oceanographic data collected from instruments in Guam and the Northern Mariana Islands.

2008 publications



Articles in Peer-Reviewed Journals

Arthur, K., Limpus, C., Balazs, G., Capper, A., Udy, J., Shaw, G., Keuper-Bennett, U., Bennet, P.

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