



NOAA FISHERIES

PACIFIC ISLANDS FISHERIES SCIENCE CENTER

The Pacific Islands Fisheries Science Center (PIFSC) conducts research in a wide variety of programs that may be of interest to the Western Pacific Fishery Management Council (Council). This report is organized around the research divisions of the PIFSC as a series of highlights.

Report to the Western Pacific Fishery Management Council

September 2014

FISHERIES RESEARCH AND MONITORING DIVISION (FRMD)

NOAA Expedition to the Northern Mariana Islands Focused on Insular Fisheries Research Interests of CNMI Agencies and Scientists

Recently scientists from PIFSC joined colleagues from the Commonwealth of the Northern Mariana Islands (CNMI) to conduct joint studies of marine fish populations, ecosystems and habitat in waters of the CNMI. CNMI participants included researchers from the Division of Fish and Wildlife (DFW), Bureau of Environmental & Coastal Quality (BECQ), Northern Marianas Mayor's Office (NMMO), Northern Marianas College (NMC), and the CNMI Bio-Sampling team. The expedition was conducted using the NOAA Ship *Oscar Elton Sette* in waters of Uracas, Maug, and Asuncion within the Marianas Trench Marine National Monument (MTMNM) from June 19 to July 3 and in waters around Pagan, Alamagan, Guguan, Sarigan, and Anatahan in the Northern Mariana Islands (NMI) from July 7 to July 21. The primary objective of the mission was to support fisheries research proposals and interests of CNMI agency colleagues.

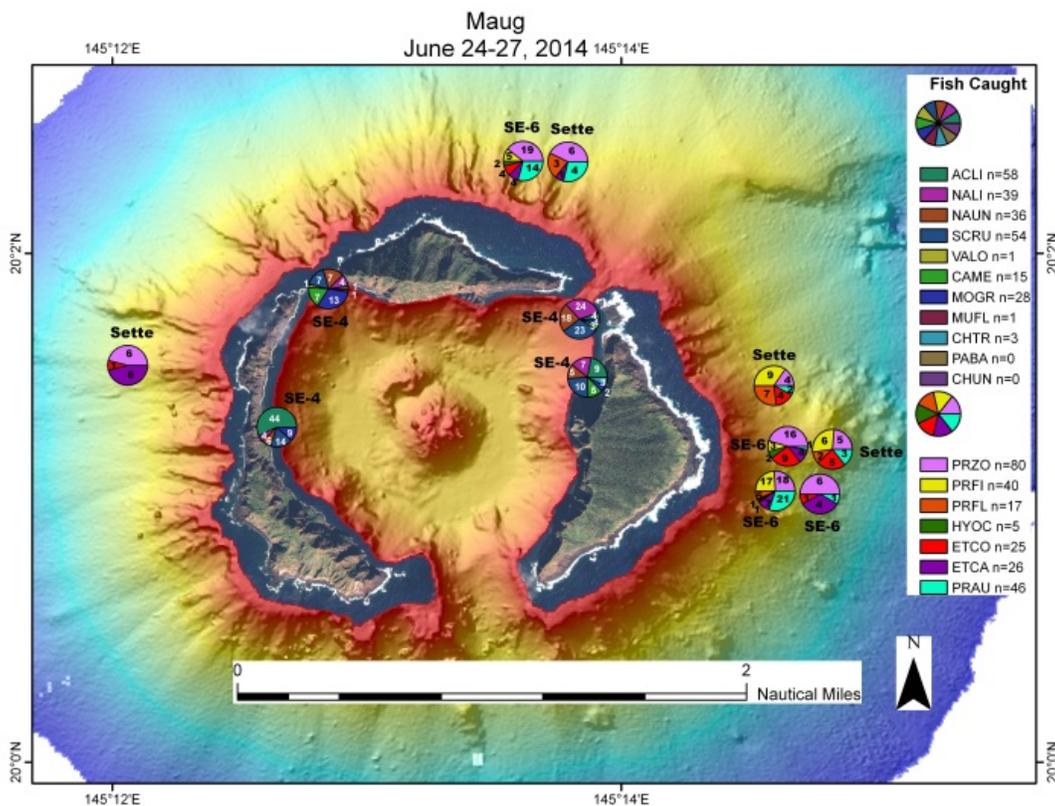


Figure 1. Bathymetry maps of Maug. Pie diagrams show location of fishing operations by the NOAA Ship *Oscar Elton Sette* and species composition of fish catch at each site. Legend identifies each species by color and code name (combined first 2 letters of genus and species names) and indicates the total number of fish caught at the island. Reef fish species are identified in the top portion, and bottomfish species in the lower portion. Map courtesy of PIFSC Coral Reef Ecosystem Division.

Science activities aboard the *Sette* included “bio-sampling” of deep-slope bottomfish and shallow reef fish species, that is, collecting information and tissue samples of selected specimens of fish to support a variety of life history studies (to be conducted by PIFSC and DFW) and research on important ecosystem topics including latitudinal trophic shifts and genetic connectivity within the Mariana Archipelago (DFW). Using small boats launched from the *Sette*, BECQ scientists conducted a variety of field work including a survey of the benthos and investigation of water quality of the intertidal habitat around each island. Additional research included fishing for bottomfish and, when opportunities arose, photo-documenting any shark depredation interactions during the bottomfishing operations (NMC project). Other operations included conductivity-temperature-depth (CTD) casts to 1,000 meter depths to characterize oceanographic conditions in the water column and deployment of Isaacs-Kidd midwater trawls and drifting night-lights to sample early life stages of fish.

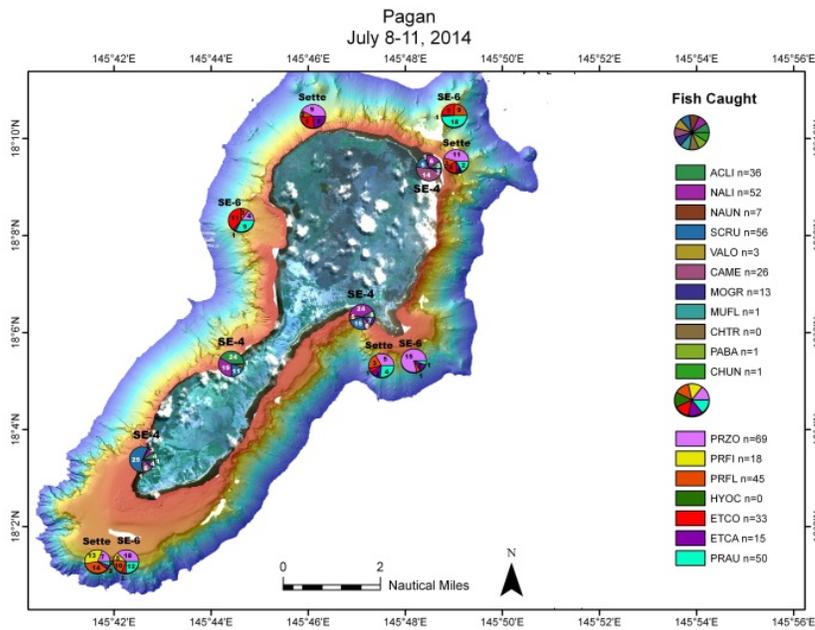


Figure 2. Bathymetry maps of Pagan. Pie diagrams show location of fishing operations by the NOAA Ship *Oscar Elton Sette* and species composition of fish catch at each site. See caption of Figure 1 for further explanation.

Deep-slope bottomfish sampling targeted eteline snappers in the 200-350 meter depth range around each of the islands. Bottomfish sampling using hydraulic fishing reels onboard the *Sette* and electric reels onboard a NOAA small boat caught primarily six eteline snapper species (gindai *Pristipomoides zonatus*; opakapaka *P.*

filamentosus; yelloweye opakapaka: *P. flavipinnis*; yellowtail kalekale *P. auricilla*; ehu *Etelis carbunculus*; and onaga *E. coruscans*) and one grouper species (eightbar grouper *Hyporthodus octofasciatus*). Gindai and yellowtail kalekale dominated the catch of deep-slope bottomfish at virtually all the islands surveyed. Other species such as opakapaka, onaga, and yelloweye opakapaka were abundant in the catch at particular islands while ehu was less abundant. Large specimens of the eightbar grouper were caught only at the three northernmost islands surveyed within the MTMNM. Highest catches of eteline snappers occurred at Maug within the MTMNM and at Pagan within the NMI (Figs 1 and 2).

All eteline snapper and grouper specimens were sampled for otoliths, gonads, and muscle/fin tissues.

Using snorkel-spearfishing gear, staff from DFW, NMMO, and the CNMI Bio-Sampling team sampled fish populations, primarily targeting six shallow reef fish species (blue-lined surgeonfish *Acanthurus lineatus*; orange-spine unicornfish *Naso literatus*; blue-spine unicornfish *N. unicornis*; redlip parrotfish *Scarus rubroviolaceus*; bluefin trevally *Caranx melampygus*; and bigeye emperor *Monotaxis grandoculis*). These species constitute the most common components of the landed catch in CNMI and Guam. All collected specimens of these species were sampled for otoliths, gonads, and muscle/fin tissues.

Intertidal benthic surveys and water quality sampling were conducted by BECQ scientists at representative sites at all of the islands. Survey activities included fish counts, benthic photography, and observations of benthic species present. Water samples were also collected to test for physical properties and bacterial count.

Additional scientific operations completed were 16 CTD casts to depths of 1,000 meters, 14 Isaacs-Kidd tows that sampled both surface and midwater (~100 meters depth) habitats, and 6 drifting night-light stations. During leg 1, two archeologists were disembarked on the island of Alamagan to conduct 11 days of fieldwork prior to being retrieved by the *Sette*.



A diverse team of scientists, deck crew, and officers carried out the *Sette* expedition, representing NOAA, JIMAR, and marine resource agencies of CNMI and Guam.

14th Meeting of the ISC Convened in Taipei to Review Research and Stock Status of Tunas, Billfishes and Sharks in the North Pacific Ocean



The 14th meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was held in Taipei, Taiwan from 16-21 July 2014. Attending were ISC members from Canada, Chinese-Taipei, Japan, Korea, and the United States and representatives of the Western and Central Pacific Fisheries Commission and the North Pacific Marine Science Organization. Observers from Pew Charitable Trust, International Seafood Sustainability Foundation and World Wildlife Fund also attended. Chaired by Gerard DiNardo, the Plenary reviewed information prepared by ISC scientific working groups for billfish, albacore, shark and Pacific bluefin tuna, including new data, updated analyses that support stock assessments, and key results and conclusions. A special seminar on the impacts of climate change on fish and fisheries was held.

The Plenary endorsed working group findings that stocks of albacore tuna and blue shark in the North Pacific, and swordfish in the Western and Central North Pacific are not overfished or experiencing overfishing, and that the Eastern Pacific Ocean swordfish stock is not overfished but likely is experiencing overfishing. The Plenary re-iterated earlier findings that the Pacific bluefin tuna and striped marlin stocks are overfished and experiencing overfishing and that the Pacific blue marlin stock is not overfished or experiencing overfishing. The committee was provided information on biological reference points for North Pacific albacore tuna and the probability of that stock achieving specific biomass levels. The committee also reviewed information on the historic range of

recruitment for Pacific bluefin tuna and catch and effort data that managers could consider in crafting management measures for that stock.

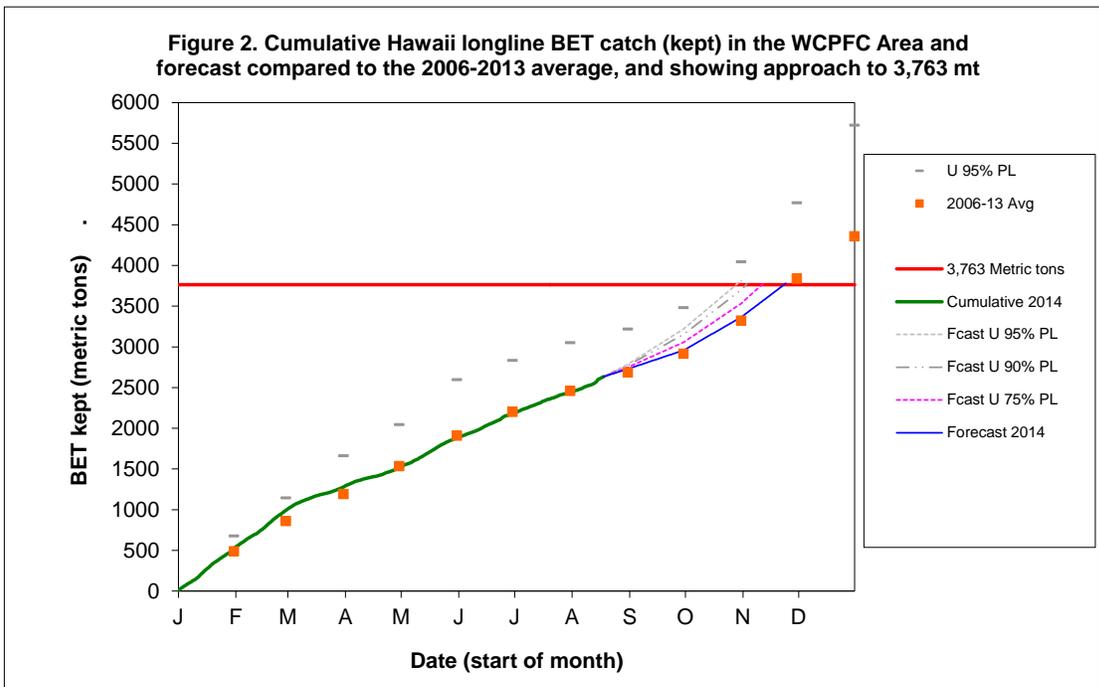
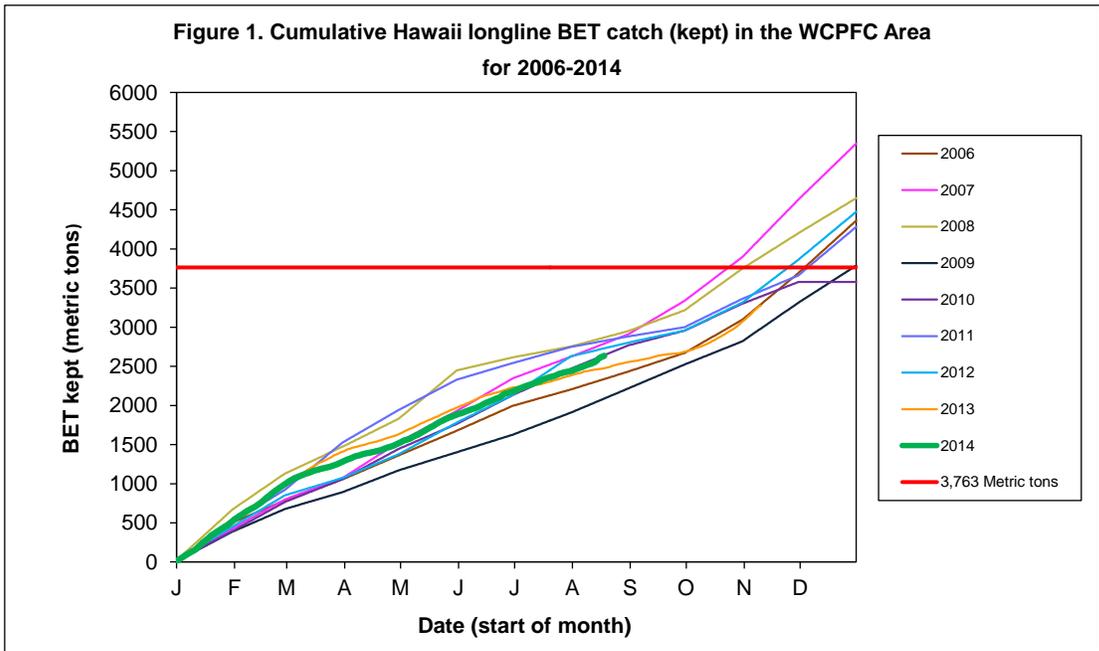
The Plenary discussed formalizing the ISC structure and administration and agreed to continue researching means of doing both. The Plenary also noted the strides ISC Working Groups had made in several areas, including incorporating best available scientific information (BASI) into stock assessment work, enhancement of stock assessment reports, and increased transparency in Working Group activities. The ISC workplan for 2014-2015 includes completing a new assessment of North Pacific striped marlin, a first assessment of shortfin mako shark, and enhanced management of the ISC database and website. The Plenary re-elected Chi-Lu Sun for a second term as ISC Vice-Chair, and the following working group Chairs: Suzanne Kohin for the Shark Working Group, Ren-Fen Wu for the Statistics Working Group, and Jon Brodziak for the Billfish Working Group. The next Plenary will be held in the United States in July 2015.

U.S. Longline Bigeye Tuna Catch Monitored and 2014 Forecast Issued

To provide fishery managers and fishermen with early and actionable information on longline catches subject to catch limits, PIFSC estimates and forecasts longline bigeye tuna catch in the Pacific. The catch statistics are computed by coupling longline logbook catch data that are provided by Hawaii longline vessels with estimates of average weights per fish from Hawaii fish sales data. Catch summaries for U.S. longline fishing in the western and central Pacific (WCPFC Area) and the eastern Pacific Ocean are provided as a PIFSC Internal Report entitled "Advice on U.S. Longline Bigeye Tuna Catch in Relation to Limits in Effect for 2014" (IR-14-025) to US fishery managers .

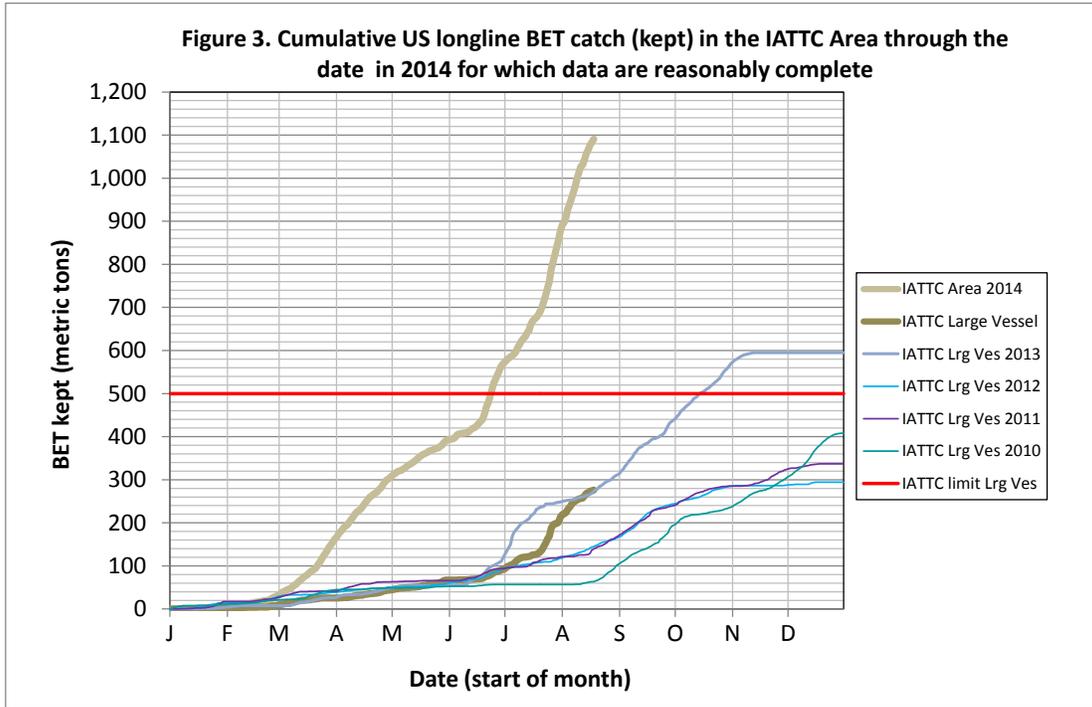
The first (preliminary) 2014 catch estimate and forecast were provided July 11, with updates on July 24, Aug 27, and Sept 9. By Sept 9 the cumulative catch was estimated to have reached 2,798 metric tons, a little more than in 2013, less than in 2012, and about average for the cumulative catch at this point in the year (Figure 1, below).

Forecasts of when the U.S. catch limit in the WCPFC Area will likely be reached are made assuming that additional catches in 2014 will continue based on the average catch patterns during 2006-2013. The 2014 catch was a little higher than average in February, but since then the cumulative catch has been average, and all of the forecasts so far have projected the catch as reaching the U.S. limit of 3,763 metric tons in late November (Figure 2, below), as is typical of most years.



Cumulative bigeye tuna (BET) catch by U.S. longline vessels in the WCPFC area during 2006-2014 compared with the annual 3,763 mt catch limit (Figure 1) and forecasts of when the catch limit is likely to be reached in 2014 within various statistical prediction limits (PL) (Figure 2). The blue line corresponds to a 50% PL and predicts the limit will be reached in late November.

The total catch of bigeye tuna in the Inter-America Tropical Tuna Commission (IATTC) area in the eastern Pacific Ocean has not been unusual this year, but the most recent update indicates that catches by large U.S. longline vessels (greater than or equal to 24 m overall length) had already reached the record high level seen in 2013 (Figure 3).



Cumulative bigeye tuna (BET) catch in the IATTC Area of the eastern Pacific Ocean during 2014 by all U.S. longline vessels and annually (2010-2014) for large vessels (24 m or longer) in the U.S. fleet. The annual BET catch limit for large U.S. vessels in the IATTC Area is 500 mt. As of late August 2014, the BET catch for large vessels had reached the same level as in 2013, when the catch limit was reached in mid-October.

A description of the 3,763 metric ton (mt) bigeye tuna catch limit for U.S. longline vessels in the WCPFC Area and a link to the Compliance Guide that describes what catches are subject to the catch limit are available at http://www.fpir.noaa.gov/SFD/SFD_regs_6.html. Note that U.S. longline catches do not include fish landed in the U.S. Territories, or fish caught outside the Hawaii EEZ by vessels permitted to fish in the U.S. Territories. Information on the current status of the catch limit is updated regularly (http://www.fpir.noaa.gov/SFD/SFD_regs_3.html). Similar information on the 500 mt U.S. longline bigeye catch limit in the IATTC Area (i.e., eastern Pacific) for vessels greater than or equal to 24 m in length is also available (http://www.fpir.noaa.gov/SFD/SFD_regs_4.html).

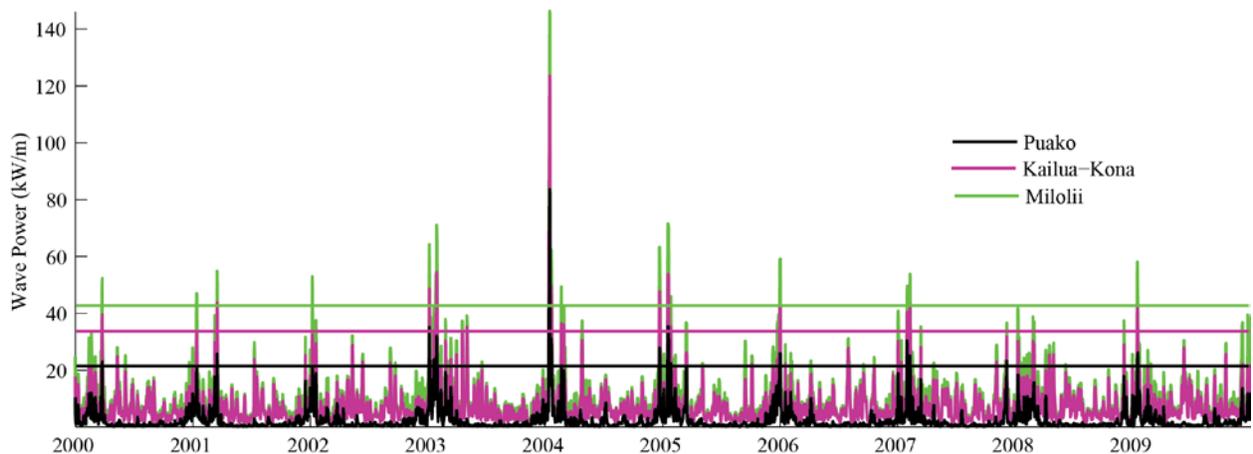
ECOSYSTEMS AND OCEANOGRAPHY DIVISION (EOD)

Kona IEA Science Symposium Highlights Status and Trends in Kona's Marine Ecosystem

The *Symposium on Kona's Marine Ecosystem: Status and Trends* was held September 4 - 5 in Kailua-Kona. The event featured 44 presentations covering topics ranging from satellite tools, observational and GIS products, distributions and spatial patterns of marine mammals, mesophotic reefs, aquaculture, and spatial and temporal patterns in coral and nearshore fish communities. There were also presentations on community-based efforts to quantify local fishing effort and assess fish spawning with a view to producing educational tools to promote best-fishing practices. Over 180 individuals participated and represented a broad spectrum of federal and state agencies, non-governmental organizations and the local community.

Some major research findings presented in the symposium include (but certainly are not limited to):

1: Large spatial differences in climatological wave forcing are apparent along West Hawai'i, with more than a doubling in upper climatological limits observed from Puako to Milolii (see figure). Wave forcing is an important driver of coral reef benthic community structure and can serve as an indicator for understanding temporal changes in reef ecosystems along West Hawai'i.



Wave power (kW/m) at three sites located north to south along West Hawai'i: Puako (black line), Kailua-Kona (magenta line) and Milolii (green line). Horizontal bars are the corresponding upper climatological limits of wave power for each geographic area. Wave forcing increases towards the southern end of West Hawai'i, as evidenced in both the higher upper climatological limits and greater magnitude of peak wave events in that region.

2: Since 1978, the total abundance of reef-associated fish has declined by 52% (range of 43 - 61% across all habitats) in the South Kohala region. Similar changes in the benthic community have also been documented, including a 28% decline (21 - 35%) in overall coral cover.

3: Sedimentation severely limits coral recruitment and is potentially a major driver of coral community changes observed along the Kohala coastline. Sediments in the water column near Pelekane Bay were driven by both re-suspension of sediments by waves and wind and new input generated by precipitation and subsequent land runoff. The largest sedimentation event over a 12-month time period was associated with the 2011 Tohoku Tsunami in Japan, which increased suspended sediment 7 fold compared to all other events observed during the study period.

4: Simulations of larval retention across the main Hawaiian Islands show that West Hawai'i potentially retains approximately 80% of larval propagules, nearly twice the proportion of any other location.

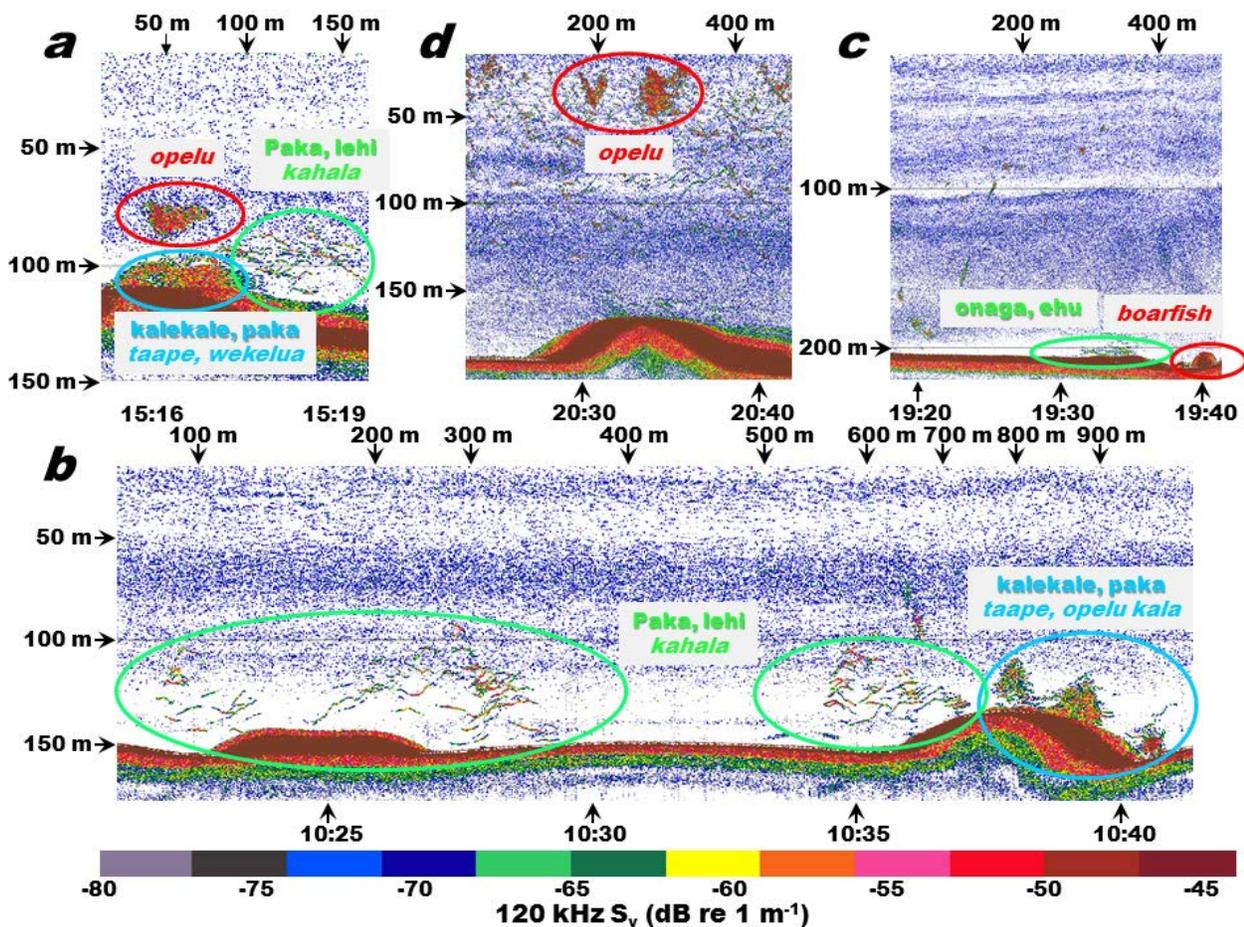
Recent Progress and Challenges in Identifying Deep-7 Hawaii Bottomfish from Acoustic Data

Presently, only fisheries- dependent methods are used to derive the estimates of biomass and abundance needed for stock assessment of “Deep-7” Hawaii bottomfish (6 snapper species and an endemic grouper). To improve the quality of biomass and abundance estimates, three fisheries-independent approaches — acoustic, optical, and experimental fishing — are being studied and compared to arrive at a single approach or a combination of methodologies that provides the most accurate estimates. As part of this joint project between EOD and FRMD, acoustic descriptors are being developed to distinguish Deep-7 from other demersal and semi-demersal species and, if possible, to identify Deep-7 bottomfish to the species level.

The application of acoustics methods to assess these fish is challenging due to the high rugosity of bottomfish habitats and the frequent intermixing and association of Deep-7 bottomfish with each other and other species. The task involves improving our capability to separate echoes generated by the target species from those of other species, and, using this capability, estimating biomass and abundance of Deep-7 bottomfish. To fulfill the above objectives, acoustic data were collected on board the *Oscar Elton Sette* in the area of the “Maui Complex”. The acoustic data were analyzed and compared to species and size information obtained simultaneously from experimental bottomfish fishing operations and stereo-video cameras attached to various sampling platforms (e.g., Botcam, Toad, CTD frame, AUV, and ROV). Of the camera platforms used, the AUV seemed to provide the most useful data. The slowly-moving AUV could be kept within the transducers’ beams far more frequently than Botcam or

ROV, giving it a higher potential for effectiveness in future data collection. However, so far, most of the data points for validating the acoustic method have come from synchronous fishing operations, which have high uncertainty due to difficulties in accurately estimating locations of fish catch from time of catch, depth of the hook, and drift of the vessel. More observations from simultaneous acoustics and optical sampling, ideally with reliable cameras mounted on an AUV, are needed to improve the accuracy of acoustic descriptors developed thus far for Deep-7 species. In addition to optical data, the experience of fishermen using acoustic “fish finders” was a valuable source of information for distinguishing fish on echograms.

The separation of Deep-7 species has been partially achieved. The accompanying graphic shows examples of species as they appear on echograms at the shallow (echogram a), mid-depth (b), and deep (c) ranges of Deep-7 habitat. In the shallower habitat (~100 m), smaller opakapaka and kalekale form thick aggregations on the ocean floor and they can be intermixed with each other



Echograms depicting examples of aggregated and loosely-associated fish identified during simultaneous observation using acoustics and alternative methods, such as video cameras or hook-and line fishing. Examples of backscatter from Deep-7 bottomfish and other fish species intermixed with them are shown at shallow (a), mid-depth (b), and deep (c) ranges of Deep-7 bottomfish habitat. The middle-top echogram (d) shows an example of a near-surface school of opelu.

and with taape and/or wekeula. Lehi and larger opakapaka swim close to the bottom as non-aggregated individuals. Opelu typically form vertically elongated or “V” shaped aggregations and are located farther up in the water column (echograms a and d). However, smaller opakapaka and kalekale can also migrate up in the water column and are hard to separate from opelu and taape. There are some indications that dB differencing (comparing acoustic signals between different frequencies) could be used to separate taape and opelu from Deep-7 species, but more *in situ* data are needed to verify this hypothesis.

In mid-depth range (echogram b), smaller kalekale and opakapaka form thick aggregations on the bottom with shapes that taper off with decreasing depth. Larger opakapaka and lehi swim individually. At the shallower and mid-ranges, these Deep-7 species mix with kahala, another species that cannot be distinguished from Deep-7 at this time. In the deeper ranges of Deep-7 habitat (below 200 m, echogram c), onaga and ehu swim close to the bottom and do not form aggregations. They do not seem to intermix with other species that cannot be separated on the echogram. In addition to dB differencing methods, non-Deep-7 species might be separated using their size range if more data were available. Species that could not be separated from Deep-7 at this point are either at the lowest (e.g., taape) or highest (e.g., kahala) end of Deep-7 size range.

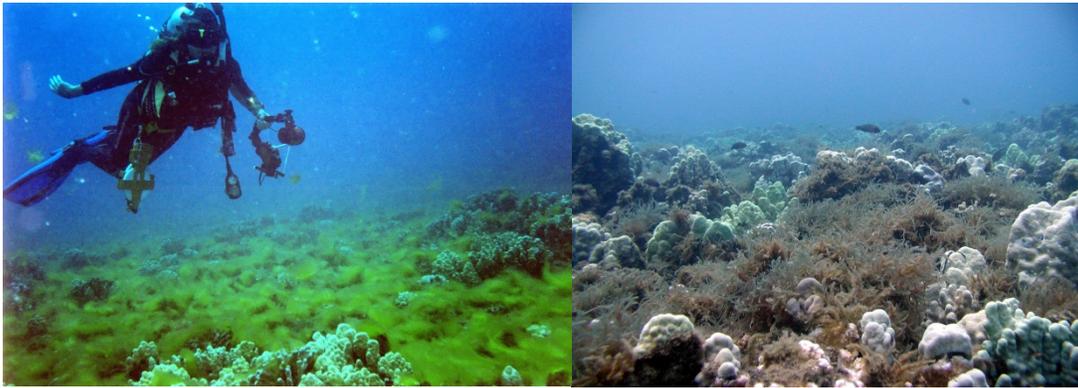
CORAL REEF ECOSYSTEM DIVISION (CRED)

Monitoring in Kahekili Herbivore Fisheries Management Area Indicates Increase in Fish Biomass and Improved Conditions for Corals

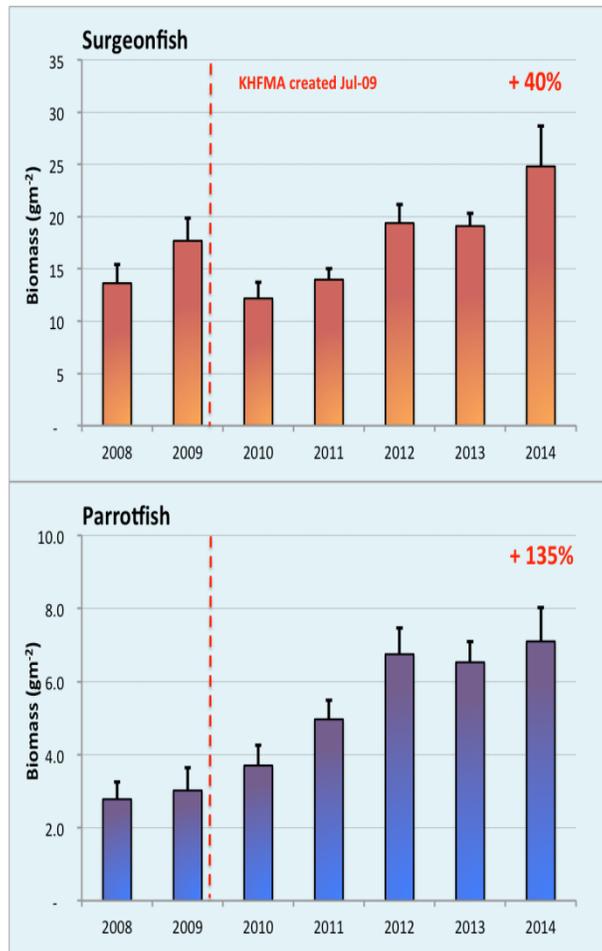
Five years after the Kahekili Herbivore Fisheries Management Area was established in West Maui, monitoring indicates an increase of herbivorous fish biomass there and early signs of improved conditions for corals.

The Kahekili Herbivore Fishery Management Area (KHFMA) in Ka’anapali, West Maui, was established by the state of Hawaii in July 2009. It involves a form of management unique within the state, namely protection of coral reef herbivores (i.e., surgeonfishes, parrotfishes, chubs, and sea urchins), which may not be killed, injured, or harvested within the boundaries of this fisheries management area. The goal of the KHFMA is to restore natural grazing processes and thereby increase the local reef’s ability to resist and recover from excessive algal growth that had occurred repeatedly on local reefs through the 1990s and early part of the 2000s.

Since 2009, CRED has partnered with the Division of Aquatic Resources (DAR) of the Hawaii Department of Land and Natural Resources to conduct twice-annual surveys of fishes and benthos within the KHFMA.



Algal blooms occurred at Kehekili in 2001 (left) and 2005 (right). NOAA photos.



Semi-annual surveys indicate that mean biomass densities of surgeonfishes and parrotfishes at the Kahekili Herbivore Fishery Management Area have increased since the conservation area was created. Error bar shows 1 standard error of the mean.

Thus far, the KHFMA has restricted harvesting of reef herbivores for 5 years, a period that is considerably shorter than the lifespan of many of the herbivorous fish species that are protected inside the KHFMA. Therefore, full effects of protection on those fish species and on slow-growing corals will not be clear for several more years. Here are some highlights from the survey results to date (the most recent surveys were March 31–April 3, 2014):

- Surgeonfish biomass has increased by 40% since establishment of the KHFMA (comparing average of 2013–2014 estimates with average of 2008–2009 estimates).
- Over the same time period, parrotfish biomass has increased by 135%. Additionally, the number of large individuals (>30 cm in total length) of the dominant parrotfish species, the Bettlehead Parrot (*Chlorurus spilurus*), has greatly increased since closure, consistent with increased survivorship of medium-to-large individuals.
- Since closure, mean cover of crustose coralline algae (CCA), which is a benign algal form favorable to coral recruitment and growth, has increased from 2% to 9% (comparing 2008–2009 to 2013–2014). A strong positive correlation between parrotfish biomass and CCA cover suggests that recovery of those key herbivores inside the KHFMA is leading to improved conditions for corals.
- Following recent relative stability over recent years at a level of ~32%, mean coral cover marginally increased to 34.6% over the last year.

CRED staff and DAR partners will conduct the next round of monitoring in late September 2014.

Remote Video Technology Allows Survey of Jacks and Sharks in Deeper Coral Reef Habitat at French Frigate Shoals in the Northwestern Hawaiian Islands

During a recent research mission to the Northwestern Hawaiian Islands, scientists in the PIFSC Coral Reef Ecosystem Division (CRED) used video cameras to observe and quantify fish populations in coral reef habitat previously unexplored, waters too deep for the usual scuba diver surveys. During May 19–31, 2014, a team led by CRED scientist Jacob Asher of the University of Hawaii Joint Institute for Marine and Atmospheric Research surveyed reefs at French Frigate Shoals using baited and unbaited remote underwater video systems (BRUVs) in waters up to 100 m in depth, well below depths comfortably reached by scuba divers (<30 m). Also involved in the BRUV operations were Biological Science Tech Jamie Barlow of PIFSC and Fishery Policy Analyst Emily Crigler from the NOAA Fisheries Pacific Islands Regional Office.

A BRUV is a rudimentary metal frame placed on the seafloor and enclosing two stereo video cameras that simultaneously film fishes as they swim in front of the

cameras' lenses. By synchronizing the images from each camera and using special software, the scientists can accurately identify and enumerate fishes that pass in front of the BRUV and estimate their size and position. The BRUV was deployed from a small rigid inflatable boat launched from the Honolulu-based research vessel *Searcher*.



JIMAR scientist Jake Asher (left) and PIRO policy analyst Emily Crigler (right) prepare to deploy BRUV underwater video camera systems on the seafloor at French Frigate Shoals in the Northwestern Hawaiian Islands. NOAA photo.

Data collected during this mission and from another NHWI survey planned for September 2014 will be used to assess the abundance and distribution of roving piscivores, particularly sharks and jacks. Data from the NHWI will be compared with BRUV data gathered in the main Hawaiian Islands in recent years. A core goal of CRED's work with diver-independent BRUV technology is to augment the findings from CRED's routine coral reef surveys—conducted by scuba divers in waters of depths <30 m. By combining results of the two survey methods, we can achieve a better understanding of coral reef fish communities over a much broader depth range, from shallow reefs down to depths of 100m.

Coral Reef Ecosystems of Wake Island and the Mariana Islands Monitored during 2014 Pacific RAMP Expedition

The 2014 Pacific Reef Assessment and Monitoring Program (Pacific RAMP) expedition aboard the NOAA Ship *Hi'ialakai* conducted scientific monitoring of coral reef ecosystems in waters of Wake Island, Guam, and the Commonwealth of the Northern Mariana Islands. Mission HA-14-01 took place between March 5 and June 2 under leadership of the PIFSC Coral Reef Ecosystem Division (CRED). Data gathered during the 2014 mission augment information gathered on earlier biennial (and now triennial) surveys which began at these locations in 2003.



Farallon de Pajaros, northernmost island in the Northern Mariana Islands chain, exuding steam and volcanic gases. NOAA photo.

Pacific RAMP missions are carried out as part of the National Coral Reef Monitoring Plan of NOAA's Coral Reef Conservation Program.

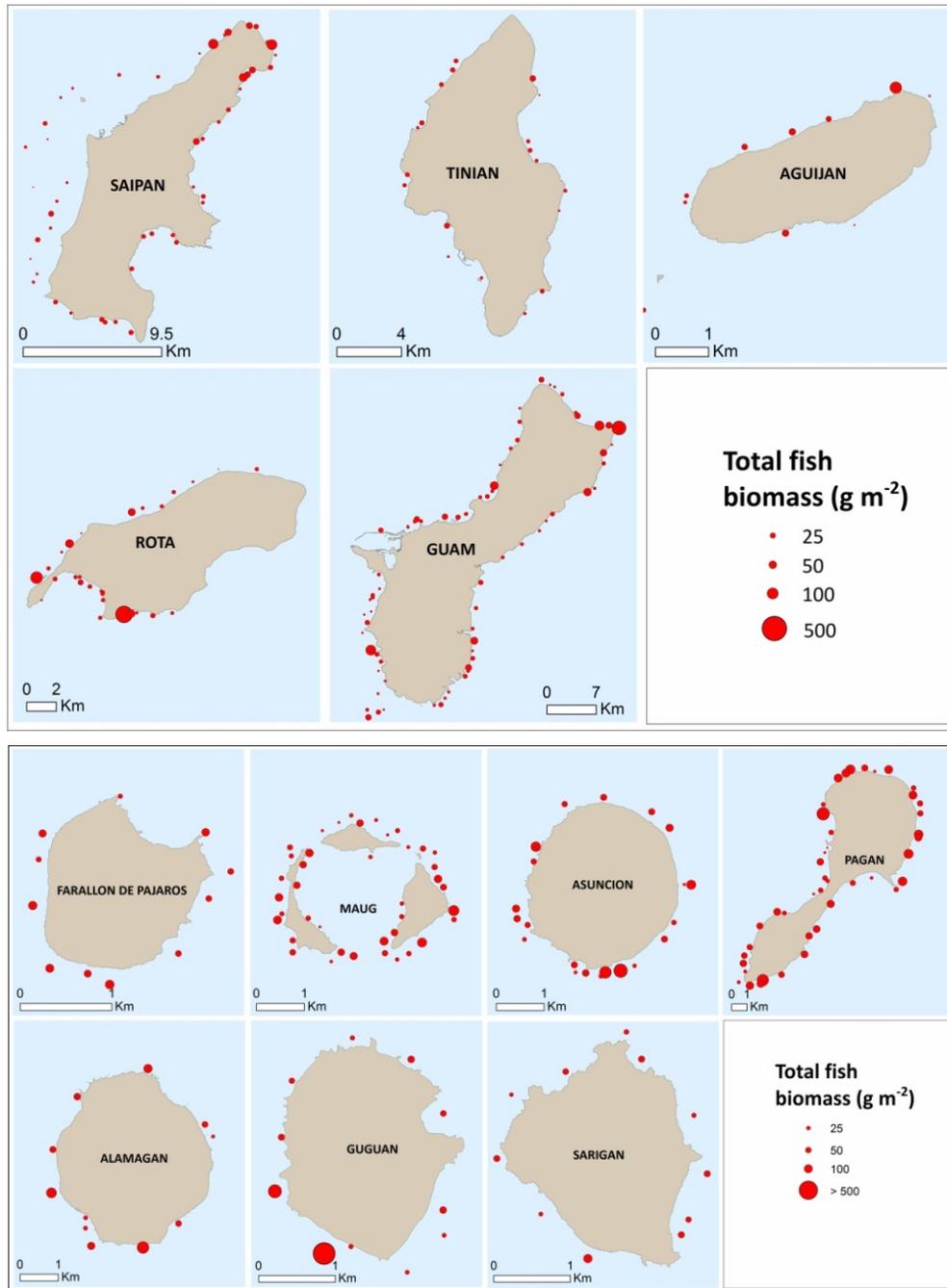
Researchers conduct biological surveys of the coral reef using a stratified random sampling design that covers all types of hardbottom habitat in water depths <30 m.

Additionally, during the surveys, CRED oceanographers and partners collect

data on ocean temperature, chemical composition of the sea water, benthic cover, calcification, bioerosion, and biodiversity. A key objective of the data collection is to enable assessment and monitoring of the effects of climate change on coral reefs, including changes in ocean acidification.

During the 2014 expedition, researchers conducted ecological surveys, collected water samples, and deployed monitoring instruments and platforms at Wake Island and in the Mariana Archipelago. Members of the CRED Climate and Ocean Change Team installed climate monitoring stations around Wake and at Guam, Saipan, Pagan, and Maug in the Marianas. They deployed 87 subsurface temperature recorders, 176 calcification accretion units, 57 autonomous reef monitoring structures, and 96 bioerosion monitoring units. CRED scientists and partners completed 111 broad-scale towed-diver surveys on the coral reefs,

covering more than 240 km of coastline, surveyed fishes at 374 Rapid Ecological Assessment (REA) sites, and surveyed the benthos at 178 REA sites. The accompanying graphic shows estimates of reef fish biomass in the Marianas derived from the REA surveys. Analysis of other data will be carried out and published in the coming months.



Estimates of total reef fish biomass density (g/m^2) at Rapid Ecological Assessment sites in the Mariana Archipelago surveyed from March 25 to May 7, 2014, as part of PIFSC mission HA-14-01.

PROTECTED SPECIES DIVISION (PSD)

Hawaiian Monk Seal Research: 2014 Field Season Nears End in NWHI

During the 2014 field season in the Northwestern Hawaiian Islands (NWHI), the PIFSC Hawaiian Monk Seal Research Program (HMSRP) collected seal population data and conducted recovery actions at all six major Hawaiian monk seal breeding locations within the NWHI. Due to budget cuts, field studies were severely curtailed in 2012–2013 which resulted in greater uncertainty in estimates of seal abundance and other demographic parameters and fewer interventions by PIFSC field staff to increase seal survival. In 2014, longer field seasons were planned for 5 of the 6 breeding sites but effort was truncated at some sites where field researchers had to be evacuated due to the threat of hurricanes Iselle, Julio, and Genevieve.

Prior to the 2014 summer field season, HMSRP staff facilitated monk seal data collection by cooperating research partners. At Midway Atoll, colleagues from the State of Hawaii and the U.S. Fish and Wildlife Service began periodic data collection in March. At Kure Atoll, State of Hawaii biologists conducted weekly seal surveys from October 2013 until NMFS field staff arrived in July.



Disentangling Hawaiian monk seals from derelict fishing gear and other marine debris is one of the ways researchers intervene to enhance monk seal survival in the NWHI.

NWHI field camps were deployed at French Frigate Shoals (FFS), Laysan Island, Lisianski Island, Pearl and Hermes Reef (PHR), and Kure Atoll from June 19 to July 1, 2014, during an expedition of the NOAA Ship *Hi'ialakai*. As the hurricanes threatened, field researchers at Laysan Island, Lisianski Island, and PHR were evacuated by the Navy and taken to Midway Atoll on August 8. Midway field work was stepped up with the arrival of the evacuated field staff. The NOAA Ship *Oscar Elton Sette* was scheduled to redeploy the Laysan camp on September 5 and recover personnel and field gear from all 6 sites during September 8-15. Surveys of Nihoa and Mokumanamana (Necker) Islands were conducted during the *Hi'ialakai* deployment mission and scheduled to be repeated during the *Sette* pick-up mission and/or during a separate expedition to Nihoa on the R/V *Searcher* in September.



Seasonal field camps are established at major pupping sites, like this one at Pearl and Hermes Reef, to support research and recovery of Hawaiian monk seals in the Northwestern Hawaiian Islands.

Throughout the 2014 field season researchers collected demographic information on seals, conducted recovery actions, and documented the birth of at least 121 pups. Recovery actions included disentangling seals from marine debris; camping and shark fishing at FFS pupping sites to detect, deter, and document shark predation; relocating at least 18 weaned pups within FFS to lower their risk of predation; deterring adult male aggression towards weaned pups; and removing entanglement hazards from all breeding sites. At FFS, a black pipe was removed from the beach berm; the pipe was an entrapment hazard and necessitated the rescue of 43 entrapped green turtles during the season. The

opening of Ke Kai Ola, the Marine Mammal Center's monk seal hospital in Kailua-Kona created an opportunity to help seals in the NWHI that otherwise probably would have died in the wild. A total of 4 immature seals (two thin/emaciated juveniles and 2 prematurely weaned pups) were collected during the deployment voyage and transported to Ke Kai Ola where they gained up to 25% of their body weight after arrival. These seals are to be released back to the NWHI during the September expedition. In addition, during that mission, a number of weaned pups will be translocated within the NWHI from areas of lower survival to areas of higher survival, and thin/emaciated seals may be collected for treatment at the Kona facility.

China/USA Sea Turtle Workshop Convened in Hawaii

An invitational China/USA Sea Turtle Workshop was convened in Honolulu August 25-29, 2014 under the auspices of the NMFS Bilateral Living Marine Resources initiative and the Chinese Academy of Fishery Science in Beijing. Official hosts and organizers for the workshop were George Balazs (PIFSC), Jeffery Seminoff (SWFSC) and Thierry Work (USGS). They were assisted by John Wang (PIFSC), Shandell Brunson (PIFSC), and Denise Parker (JIMAR). Nine scientists from various regions of China participated in the workshop, including participants from Hainan Island, Hong Kong, Taiwan, and mainland China. Four of the participants were university professors, three were government biologists, one was a graduate student, and one represented an NGO involved in research.



Participants in the 2014 China/USA Sea Turtle Workshop, Honolulu, 25-29 August 2014.

Workshop activities consisted of seminar presentations, informal discussions, and exchange of information to foster further cooperation and actions, including collaborative research. There was also hands-on field work with Hawaiian sea turtles. Participants agreed on several 'ways forward' for further cooperation including a follow-up workshop in mainland China in 2015, and a program of reciprocal China/USA visiting scientists for 1-2 month periods.

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