JIMAR Plans for FY 2021

Douglas S. Luther, PhD

Director

Joint Institute for Marine and Atmospheric Research
University of Hawaii at Manoa
1000 Pope Road, MSB 312
Honolulu, HI 96822
http://www.soest.hawaii.edu/jimar

JIMAR Plans for FY 2021

Ecosystem Forecasting

Open Source ADMB Project

P.I.: Erik Franklin

During the next fiscal year, the project plans to distribute another release of ADMB in December 2020. The release will include bug fixes, function documentation, software testing, and improvements to ADMB runtime. In addition to developing multi-processor support into ADMB, the other development plans are to reduce resources used by temporary variables, use multiple files instead of a single subnamespace (tpl) file, provide better access to hessian computations from tpl, and investigate an ADMB to TMB tool. The location for the Developers Workshop 2020 was changed from Massachusetts, USA, to Copenhagen, Denmark and will be hosted by ICES to coincide with the September 2020 ICES Annual Science Conference. The workshop objectives will be similar to previous workshops where developers will discuss new ideas, test new features including the multi-processor changes and work in small groups to resolve software issues.

Ecosystem Monitoring

Ecosystem Structure and Function

P.I.: Douglas S. Luther [JIMAR Project Lead: Jeffrey Hare]

During the next year, JIMAR will maintain full-time laboratory technical staff to analyze a range of samples (lancetfish stomachs, zooplankton and micronekton) from previous and upcoming cruises, to continue assessing patterns in the biomass and distribution of mid-trophic level organisms in the Hawaii longline fishing ground and in Hawaii waters.

In addition, a graduate assistant from the University of Hawaii at Manoa Department of Oceanography will be employed by the project to investigate the sensitivities and future projections of the North Pacific subtropical gyre due to the effects of climate change. The Eastern North Pacific (ENP) is a productive marine region that exhibits high levels of spatiotemporal variability in physical conditions with implications for living marine resources. The sensitivity of the ENP to future climate change is dependent on the large-scale structure of the North Pacific (e.g., mixing and ventilation of the subtropical and subarctic water masses) as well as on local processes (e.g., stratification and local wind stress). This work seeks to contribute to the oceanographic community's understanding of the future ecological state of the region by characterizing its lateral boundary conditions, tracing the origin of its source waters beyond the regional domain, and describing the influence of North Pacific basin-scale processes on these source-water properties.

Ecosystems Observations and Research Program: Research Support Project

P.I.: Douglas S. Luther [JIMAR Project Lead: Jeffrey Hare]

Aquaculture System Management. For the coming year, JIMAR staff (led by Aaron Moriwake) will continue to provide system management support for the SWS facility, including coordinating activities, maintaining and repairing equipment, training staff on system operations, modifying the facility to best accommodate staff needs and providing support for incoming animals.

Pacific Islands Region Fisheries Science Outreach and Education. Led by Ali Bayless, this project will support outreach and education activities such as community events, career fairs, and school programs on a quarterly basis representing PIFSC in partnership with JIMAR. Project staff will continue utilizing virtual efforts to support multiple virtual internship programs through interactive webinars and workshops. JIMAR will also continue to develop and post online outreach products focused on current research and Science Center priorities, such as

Feature Stories, Science Blogs, and Story Maps coordinated with social media updates. In addition, the project plans to increase internship opportunities for students in the Marine Option Program at the University of Hawaii at Mānoa.

Large Marine Ecosystem/Ecosystem-Based Fisheries Management Coordination. As information continues to be collated, project efforts (led by Megan Asher) will be shared with key partners in the Marianas region, PIRO, WPRFMC, and PIFSC. Partner inputs will be appropriately integrated throughout the document. Given the value tied to stakeholder engagement in the Marianas, the project will reach out to additional stakeholders in the region as the document is further developed. It is anticipated that the inputs from these partners will help fill information gaps and shape efforts to create a more valuable resource for the stakeholders. In addition to incorporating management, scientific and other stakeholder inputs into the document during FY 2021, the LME team will also seek formal designation of the Marianas as an LME and work toward publication of the effort.

Ecosystems Observations and Research Program: Science Operations Project

P.I.: Douglas S. Luther [JIMAR Project Lead: Kyle Koyanagi]

Analysis and Evaluation of Fishery Independent Data and Collection Methods for Insular Fish Stocks in the Pacific Islands Region. Over the next year, the Analysis and Evaluation Team will complete video analysis for fish abundance and lengths for the 2020 insular bottomfish survey, deliver the new data set products to the FRMD Stock Assessment program, and continue annual reporting on MOUSS camera errors. Testing and training of the Video and Image Analytics for a Marine Environment (VIAME) automated image analysis toolkit will continue using a new Windows-based operating system and web-based graphical user interface software enhancements for creating annotation training data. Video analysis and evaluation of bench and field testing videos which use an artificial LED light prototype will also be conducted.

Operations and Logistics Services to Support Pacific Islands Fisheries Science Center Research Missions and Projects. The SOD Field Operations Team will continue to provide high quality, effective logistical, operational, and small boat research support services while striving to 'lead the standard' in safety for PIFSC research activities.

Advanced Survey and Sampling Technology Development. Next year, JIMAR staff will continue to develop and field test artificial lighting systems with the current MOUSS units to determine their effectiveness for future studies that will survey Main Hawaiian Islands Deep 7 Stock in the 250 to 400 meter depth range. While maintaining current MOUSS stereo camera units, the Advance Survey and Sampling Technology Development Team will continue its efforts to research and develop the next generation stereo camera system that will be used to further MHI Bottomfish Fishery Independent Surveys.

SOD JIMAR staff will also continue to work closely with PIFSC researchers to carefully outline their survey and sampling requirements so that equipment and instruments to collect repeatable and reliable data can be designed and fabricated.

Environmental Data Management to Support Fisheries and Ecosystem Research. The project will continue to build on the progress that was made this year. There will be one or more occasions in the upcoming year to provide data management or development support and guidance to a PIFSC data project. Staff will form an additional functional data group to meet on a regular basis to discuss PIFSC data management issues and needs. The project will identify two or more data sets as feasible for direct integration. The project will provide a formal assessment of the state of data management within one additional PIFSC division in collaboration with the division's data staff. One or more standards and best practices to improve the quality of PIFSC data management will be developed. The project will develop one or more data tools or procedures that can be used to address a formal phase of the data life cycle.

Geospatial Products and Marine National Monuments of the Pacific. Due to staff vacancies, progress on these projects is on hold pending new recruitment action.

National Ocean Acidification Observing Network—Oahu NCRMP Class III

P.I.: Christopher Sabine

With increased funding from NOAA/OAP and NSF, the project will expand the CRIMP2 and Kaneohe mooring sensor suite to include a newly developed autonomous pH and TA sensor. This will add a new parameter, TA, to the high-frequency observations that are very relevant to understanding the calcification and coral reef dynamics of this region. Depending on sensor performance, this new sensor package may become standard for NOAA OA sites. Project researchers will use the moorings, along with the drifters also instrumented with this new sensor package to further study the effects of OA on coral reef health in Kaneohe Bay.

NCRMP Pacific Reef Assessment and Monitoring Program (RAMP)

P.I.: Douglas S. Luther [JIMAR Project Lead: Brittany Huntington]

During the coming project year, the major objective is to plan and execute the Marianas Archipelago RAMP cruise in spring 2021 aboard the NOAA R/V *Rainier*. Since this vessel is a new platform for RAMP cruise execution, the project anticipates additional planning time to determine the feasible scope and scale of the field mission, as well as how to best leverage the fewer number of small boats available on the *Rainier* for survey execution. Following the mission, staff will complete data quality control checks and data cleaning and then submit datasets to the archive for public access.

Ocean Remote Sensing

P.I.: Douglas S. Luther [JIMAR Project Lead: Jeffrey Hare]

In addition to maintaining operations and providing user support, during the next fiscal year the OWCP plans to: adapt the satellite training course to be conducted 100% remotely; continue to contribute to the SAFE reports; evaluate the feasibility of incorporating sea surface temperature (SST) gradients into the TurtleWatch product; and set up an automated process to analyze server logs to better understand data usage statistics within OWCP.

On-site Support for OA Mooring Test-beds: Evaluating and Expanding New Carbon Technologies to Subsurface Habitats

P.I.: Christopher Sabine

With increased funding from NOAA/OAP and NSF, the project will expand the CRIMP2 and Kaneohe mooring sensor suite to include a newly improved Briggs autonomous pH and TA sensor for an extended period (ideally for a full year). This will add a new parameter, TA, to the high-frequency observations that are very relevant to understanding the calcification and coral reef dynamics of this region. Depending on sensor performance, this new sensor package may become standard for NOAA OA sites. The project will also continue to test the SAMI-alk system with a preliminary one-month deployment anticipated before the end of the calendar year.

Pacific Fisheries Monitoring Program

P.I.: Douglas S. Luther [JIMAR Project Lead: Frances Tong]

The project will continue to monitor Hawaii's pelagic longline fishery at the same high level to allow completion of quarterly and annual reports within the allotted time. JIMAR staff will complete daily bigeye and striped marlin catch updates for entry into the fast track system. This system allows for timely and accurate forecasting of fishery closures in compliance with annual WCPFC and IATTC requirements. Additionally, as international and local management continues evolving to include tracking of more species of concern, the project will explore options for inclusion of these species.

The ER team will continue distributing tablets to the longline fleet and training captains in submitting electronic logs. The team will also continue working with the application developer to implement new features, simplify equipment and deployment, and address software issues.

The JIMAR EM staff will begin examining data gaps discovered during the initial investigation of EM efficacy and will also explore the creation of catch handling requirements. Fishers will bring catch typically discarded to a designated spot within the camera field of view; this increases the accuracy of EM while decreasing cost of review. Results of the research will be important towards establishing regulatory frameworks to implement EM. Staff are planning to further investigate how EM can be used to determine post interaction mortality rates on protected species. These data are used to ensure the fishery does not exceed the number of allowable protected species interactions and are currently only collected on trips that have at-sea observers. If these determinations can be successfully performed using EM, then these data could be collected for any protected species interactions in the Hawaii-based longline fisheries. In addition, project staff are still participating in the electronic technologies steering committee to ensure all stakeholders have a voice in planning EM implementation.

The logbook archival scanning project will continue working on the American Samoa longline logbooks and scanning the Hawaii logbooks as they are submitted. The team will continue to foster positive and cooperative relationships among PIFSC, the fishing industry, and other interested parties through its daily onsite monitoring activities. The team will also continue to enter data for the Pacific tuna fishery purse seine fleet.

Pacific Islands Territorial Science Initiative (PITSI)

P.I.: Douglas S. Luther [JIMAR Project Lead: Frances Tong]

For the next report period, JIMAR staff will complete the Bayesian data integration model and a more complex multi-species neutral landscape model. Two manuscripts will be completed: 1) using the single-species neutral landscape model to compare the theoretical performance of three fishery and ecosystem surveys; and 2) using the Bayesian data integration model to understand the potential benefits of multi-survey monitoring programs over single-survey designs. A data specialist will also assist in completing the code and documentation needed for the creel survey expansion external review.

Pacific Tuna Fishery Data Management

P.I.: Douglas S. Luther [JIMAR Project Lead: Frances Tong]

This project will end soon after the start of the new report period and operations will consist mainly of data entry, data assessment and quality control, and data access of the purse seine tuna information provided from the fishing fleet.

Sustaining Healthy Coastal Ecosystems

P.I.: Douglas S. Luther [JIMAR Project Lead: Brittany Huntington]

The focus for the next year includes leveraging existing ESD monitoring and other available data to provide analyses to support activities of jurisdictional and federal management agencies and serve as a resource on best practices, methods development, and analyses as applied to coral reef ecosystem research to inform management actions. In FY 2021, the project will focus on: 1) developing a Center of Excellence to advance structure from motion applications and artificial intelligence technology; 2) analyzing the resiliency of coral reefs across the Pacific Islands Region; and 3) expanding its portfolio of research focused on Essential Fish Habitat (EFH). Many of these information products, services, and analyses are aimed at responding to specific requests (i.e. EFH, coral reef restoration, assessment of specific management actions, etc.) received during on-going collaborative discussions with local and jurisdictional partners in Hawaii, American Samoa, Guam, CNMI, as well as NOAA and other Federal partners.

Territorial Biosampling

PI: Douglas S. Luther [JIMAR Project Lead: Melanie Hutchinson]

The life history research for two Management Unit Species (MUS) is underway and will be completed in the next year. The age, growth and maturation research for the blue trevally, *Caranx melampygus*, for CNMI is expected

to be completed in the following year. Additionally, the life history research of gindai, *Pristipomoides zonatus*, for Guam is underway and expected to be completed during FY 2021. A LHP team trip to American Samoa is being planned and will develop relationships with local partners and fishers, collect life history samples for MUS, and examine options for re-establishment of the Commercial Fisheries Biosampling Program in American Samoa. Project staff are also planning to start a new project on a U.S. territories bottomfish species to provide life history information based off of U.S. mandates for information on management unit species.

West Hawaii Integrated Ecosystem Assessment

P.I.: Douglas S. Luther [JIMAR Project Lead: Jeffrey Hare]

For the next fiscal year, the West Hawai'i IEA project will continue to conduct novel and interdisciplinary research to help elucidate key socioeconomic factors, oceanographic processes, and ecological interactions that drive nearshore and pelagic marine food-web dynamics. The project continues to process and analyze the extensive amounts of biological samples and physical data collected during historical PIFSC expeditions to the region. These efforts will be synthesized into a number of reports, peer-reviewed journal articles and outreach material, highlighting novel findings and key insights on food-web dynamics necessary to support ecosystem-based management in the region.

In particular, JIMAR researchers uncovered new and ecologically important findings related to ocean slicks, including the biodiversity of organisms found in surface slicks and the underlying mechanisms that drive slick formation. The project expects to publish multiple publications and subsequent news and media engagement from these efforts.

The West Hawaii IEA JIMAR project will also support a two-day science symposium in Kailua-Kona (Hawai'i Island). This event provides a forum for scientists, managers, and the local community to learn and engage in efforts and research related to the coastal marine ecosystem of West Hawaii. This symposium will build upon the most recent event in December 2017 and will strengthen partnerships in the region and provide important exposure for relevant JIMAR and PIFSC research.

Western Pacific Fisheries Information Network (WPacFIN)

P.I.: Douglas S. Luther [JIMAR Project Lead: Frances Tong]

The project will continue converting VFP database applications to MySQL and C# for WPacFIN Central and partner agencies. The database redesign project for Hawaii data has a shortlist of post-go live items that need to be completed. Then the focus will shift to transitioning the U.S. territory (American Samoa, CNMI and Guam) VFP databases to MySQL.

The full conversion of the obsolete Visual FoxPro-based database to a MySQL database for the territory databases is expected to begin September 2020 and finish sometime in 2021. Work includes creating new databases based on commonly accepted database design principles, data cleanup (including fixing typographical errors, removing duplicates and marking invalid data), data validation, consolidation of datasets, and migration and import. As the project commences, decisions will be made on whether to include the conversion of territory applications from Visual FoxPro to something more modern, or to make the territory application work a separate WPacFIN project.

The Fisher Reporting and Dealer System (FRDS) will be updated because it requires substantial programming modifications to use the new MySQL database. Additionally, HDAR will need a set of canned reports which will require programming since the reports will be more complex than what can be produced easily in Metabase.

JIMAR project staff will be expanded to include a web programmer with database programming skills, and recruitment is expected to open sometime June 2020 with an expected start date in September 2020. All project work will be done by Western Pacific Fisheries Information Network (WPacFIN).

Ecosystem-Based Management

Marine Debris Mitigation Project

P.I.: Douglas S. Luther [JIMAR Project Lead: Brittany Huntington]

In the next project year, the JIMAR Marine Debris Mitigation Project will: 1) provide staff and assets to support a Fall 2020 State of Hawaii Division of Forestry and Wildlife-led chartered mission to remove shoreline debris from the Northwestern Hawaiian Islands; 2) collect, enter, quality assess, and archive data from the mission; and 3) prepare for the Fall 2021 JIMAR-led chartered mission to remove derelict fishing gear and other marine debris from the NWHI.

Preparation includes the following.

• develop the three-year (2022-2024) strategic plan to pool resources for the next large-scale mission;
• develop new partnerships and collaborations to generate additional funding sources to supplement the ongoing support from the current stakeholders;
• continue to develop research projects, including the Structure-from-Motion project that measures impacts of derelict fishing gear on shallow coral reef ecosystems, and the Unmanned Aerial Surveys to better detect and survey for derelict fishing gear;
• expand data analysis to shoreline and in-water debris data to better understand the characteristics and spatial accumulation patterns of marine debris in the NWHI, and
• continue opportunistic outreach and education for the project.

Socioeconomics of Western Pacific Fisheries

P.I.: Douglas S. Luther [JIMAR Project Lead: Hing Ling Chan]

During the coming year, the project will continue providing support for the ongoing economic data collection programs for the American Samoa, Guam, and CNMI small-boat fisheries and the database management for the cost data collected from the Hawaii and American Samoa longline fisheries. JIMAR staff will update the data summaries on the website and seek publications in various outlets. In addition, twelve project elements are planned for FY 2021. These include: 1) provide assistance to the National Community Social Vulnerability Indicators work plan; 2) conduct socioeconomic monitoring for resilient communities in the Pacific; 3) conduct a cost-earnings study of Hawaii longline fleet; 4) conduct a cost-earnings study of Hawaii small-boat fisheries; 5) predict the impact of climate change on the economic viability of the Hawaii longline fleet; 6) provide assistance to model location choice in the deep-set and shallow-set fisheries; 7) provide assistance to model observer effects on fishing behaviors; 8) incorporate socioeconomic data throughout stock assessments process; 9) analyze governance processes, institutions, and compliance to improve Western Pacific fisheries management; 10) examine climate change impacts to Hawaii fisheries and fishing community adaptive capacity; 11) integrate social, economic, and cultural components into submodule for Main Hawaiian Islands Atlantis Ecosystem Model; and 12) incorporate spatially explicit sociocultural values in the west Hawaii IEA.

Stock Assessment Research Program

P.I.: Douglas S. Luther [JIMAR Project Lead: Melanie Hutchinson]

In the next reporting year, JIMAR researchers within the PIFSC Stock Assessment Program will be involved in investigations of insular and pelagic fisheries. The primary focus of the insular team will be to work on new approaches to territorial bottomfish assessments (American Samoa, Guam, and the CNMI). The team will seek to implement new data-limited approaches focused on size composition data. This is a critical project that will span multiple years.

A JIMAR effort to extend a data-limited approach to estimate life history parameters is currently being submitted for publication and should be completed in the next year. The software tools for the automation of bycatch estimation for the America Samoa longline fishery will be created in FY 2021 and a similar tool will be created to automate the generation of the internal bycatch reports and the National Bycatch Report. Other SAP toolkits including AGEPRO and the SAP GitHub site require consistent updates and this is ongoing. The spawning guide

and smartphone application will be completed at the end of 2020 and handed over to the Kohala Center for further enhancements to the app.

Protection and Restoration of Resources

Cetacean Research Program

P.I.: Douglas S. Luther [JIMAR Project Lead: Marie Hill]

The Pacific Marine Assessment Program for Protected Species (PacMAPPS) is a partnership among the federal agencies Bureau of Ocean Energy Management (BOEM), NOAA Fisheries (Alaska, Northwest, Pacific Islands, and Southwest Fisheries Science Centers), U.S. Navy, and U.S. Fish and Wildlife Service (USFWS), to conduct surveys to assess the abundance of multiple species and their ecosystem. Ship-based surveys within the Guam/CNMI EEZ to be conducted in summer of 2021 are the next effort as part of the PacMAPPS plan. The data collected during the survey will complement ongoing NOAA efforts to conduct comprehensive marine mammal, seabird, and ecosystem surveys in U.S. waters in the Pacific every 3–6 years to estimate the abundance of protected species populations, develop spatial models of species distributions, and monitor status and trends. The survey data will also provide updated density estimates that will augment Navy's acoustic effects analysis required for environmental planning documents and consultations under the Marine Mammal Protection Act and Endangered Species Act.

The project will also continue with HARP maintenance at all of the existing sites during the next fiscal year.

Effects of Nitrogen Sources and Plankton Food-Web Dynamics on Habitat Quality for the Larvae of Atlantic Bluefin Tuna in the Gulf of Mexico

P.I.: Karen E. Selph

Although funding for this project has ended, the project is in the process of preparing manuscripts for a special issue of *Journal of Plankton Research*. The journal's submission deadline is 1 August 2020.

Fishing Impacts on Non-target Species

P.I.: Douglas S. Luther [JIMAR Project Lead: Melanie Hutchinson]

The post release mortality rates from sharks tagged in longline fleets are currently being analyzed and written up as a peer review manuscript with a submission target of early fall 2020. A recent project effort to begin a tagging experiment in an experimental fishery in California will start in late summer 2020. JIMAR program staff will transfer lessons learned and protocols to the observer program associated with this fishery and conduct tagging training in San Diego, with two trips scheduled for the remainder of the calendar year. The gear configuration and hook dissolution experiment data are also ready for analysis and manuscript preparation. JIMAR program staff will continue to work with the Hawaii Community Tagging Community (HCTP) participants and partners on tag deployments, photo identification, and outreach and education. The project has two trips to Kona scheduled to service the receiver array and train fishers in tagging techniques and distribute tags.

Hawaiian Monk Seal Northwestern Hawaiian Islands Research Seasonal Support

P.I.: Douglas S. Luther [JIMAR Project Lead: Lizabeth Kashinsky]

Over the coming year, to the degree possible given the uncertainty of the impacts of program activities due to the COVID-19 pandemic shutdown, JIMAR HMSRP staff will continue to collaborate with NMFS scientists to collect monk seal survey and life history data and conduct enhancement activities primarily in the NWHI. JIMAR staff will perform field studies, tag and mark animals for identification, collect specimens for genetic studies, conduct boating operations, collect non-invasive samples for foraging studies, and monitor for health and disease

opportunistically through necropsies and non-invasive sampling techniques. Non-invasive specimens will also be collected for ongoing foraging studies. Ongoing survival enhancement activities may include collection of dangerous debris off beaches, disentanglement of seals, translocation of weaned pups within the French Frigate Shoals (FFS), and reuniting mother-pup pairs. Special enhancement projects may include continuation of shark monitoring and removal, vaccinating seals against morbillivirus, and translocation of pups between breeding sites. Advanced technologies (remote cameras, rovers, Unmanned Aircraft Systems, etc.) may also be utilized to monitor the population. Field personnel may also perform vocalization studies and assist other programs and agencies with activities such as establishing and maintaining marine debris plots, mitigating wildlife entrapments (particularly at FFS), conducting insect, plant, and Laysan duck surveys, monitoring for invasive species at field sites, and collecting sea turtle nesting data.

Hawaiian Monk Seal Research Program

P.I.: Douglas S. Luther [JIMAR Project Lead: Lizabeth Kashinsky]

Over the next reporting year, to the degree possible given the uncertainty of the impacts of program activities due to the COVID-19 pandemic shutdown, the JIMAR HMSRP plans to continue collecting survey and life history data on monk seals and conduct enhancement activities primarily in the MHI. JIMAR staff will collaborate with National Marine Fisheries Service scientists to conduct HMS field studies, analyze data and perform daily maintenance, operations, and training for field camps. JIMAR staff expect to coordinate and respond to stranded seals, conduct boating operations, train and lead field personnel, and continue to update and maintain existing databases. Foraging and dietary studies are planned in the MHI, and health and disease monitoring will occur opportunistically through necropsies and non-invasive sampling techniques in conjunction with foraging studies or via directed studies. Vaccination of wild seals against morbillivirus is expected to continue. Ongoing survival enhancement activities may include collection of dangerous debris off beaches, disentanglement of seals, translocation of weaned pups, and reuniting mother-pup pairs. Special enhancement projects may include continuation of shark monitoring and removal, collection of undersized seals for rehabilitation, and translocation of pups between breeding sites. The program plans to continue to advance behavioral research as well as continue with vocalization studies. Unmanned Aerial System activities and fish pen research may also be conducted.

Marine Turtle Recovery in the Pacific Islands Region

P.I.: Douglas S. Luther [JIMAR Project Lead: Camryn Allen]

The JIMAR Marine Ecological Researcher will continue studies on the ecology of hawksbill sea turtles in the MHI, plans to participate in a genetics workshop to be held in Philippines to standardize genetics work in the West Pacific, travel to Indonesia to mitigate leatherback fishing, and continue leading the nesting research in the Solomon Islands. The JIMAR field researchers at FFS will continue to monitor the nesting abundance of green sea turtles during a rapid-assessment survey in August 2020. JIMAR staff will participate in field captures of marine turtles on Oahu and periodically on the neighbor islands and will continue the utilization of the newly developed sea turtle endocrinology laboratory for research projects investigating sex, sex ratio, capture stress, and age of sexual maturity. JIMAR will conduct studies on age and growth of sea turtles within the MHI as well as high seas populations through the Pacific Islands Regional Office (PIRO) observer program.

Pacific Islands Deep Sea Coral and Sponge Initiative

P.I.: Douglas S. Luther [JIMAR Project Lead: Virginia Moriwake]

During the next project year, JIMAR staff will continue working to gather information on deep-sea coral and sponge communities. Annotation of animal observations from prioritized 2019 ROV dives, including cruises to American Samoa and the Emperor Seamount chain, will be completed and the records will be submitted to the DSCRTP for inclusion in its national database. Images, and if possible short video clips, that characterize the animal communities and habitats observed in each of the Sanctuary Units surveyed in American Samoa will be provided to the National Marine Sanctuary of American Samoa Office. Summary tables of animal observations, high density coral and sponge communities identified, and dive information will be produced. Also, the Benthic

Deepwater Animal Identification Guide will be updated with images from recent E/V *Nautilus* cruises and, if desired and approved, with images from the R/V *Falkor* cruise.

Papahānaumokuākea Marine National Monument Monitoring and Research

P.I.: Douglas S. Luther [JIMAR Project Lead: Brian Hauk]

For the next project year, JIMAR staff are currently planning for a charter cruise to PMNM to look more closely at invasive algae, buoy damage, hurricane effects and bleaching recovery. Project staff plan to coordinate advanced survey training for student intern divers who will participate in the charter cruise. Project staff will also continue coordinating logistics and planning for a multi-year mesophotic research project in American Samoa slated to begin early in 2021 and last for four years. Staff will continue processing 3D models and analyzing data from previous expeditions as well as preparing manuscripts. The Resource Protection Program will continue to participate in activities to protect the marine ecosystems of the NWHI, including hull inspections, marine debris removal planning, and coordinating efforts to remove grounded National Weather Service buoys and assess damage caused by them.

Equatorial Oceanography

Observation and dynamics of oceanic variability in the Solomon Sea

P.I. William Kessler

For the next fiscal year, the project's objective is to focus on the characterization of the low-latitude western boundary current (LLWBC) of the South Pacific. Project goals are to: 1) develop advanced products for the Solomon Sea and its LLWBC in slightly delayed mode incorporating outside information including Argo and altimetry; 2) relate the transport changes through the Solomon Sea to basin-scale and local winds; and 3) explain how these changes affect the tropical strip as a whole.

Optimizing Routine Ocean Current Measurements by the NOAA Fleet 2017-2021

P.I.: Eric Firing

The project plans to continue its work along the same lines as during previous years. The *Thomas Jefferson* and the *Oregon II* might become ready for UHDAS installations during the coming year. Project researchers anticipate moving the N2N data pipeline to operational status.

University of Hawaii Sea Level Center

P.I.: Philip Thompson

Modernization of the UHSLC's data acquisition, quality control, and archiving software will continue to be a priority focus during FY 2021, including an overhaul of the database to transition from text files to a modern database infrastructure with an improved data acquisition interface for users. The website content will continue to be updated and staff will continue to focus on developing content with real-world uses for stakeholders and researchers. At this point, it is unclear how the COVID-19 pandemic shutdown will affect international travel in the coming fiscal year. If restrictions are lifted soon, the project proposes to visit at least 14 UHSLC core project stations (a standard objective during a typical year), but they hope to visit a greater number in order to partially make up for visits not made due to the pandemic shutdown. The exact number of maintenance visits will depend on logistics, as well as the timing and location of travel restrictions. UHSLC research in the coming year will consist of a variety of ongoing and new projects. The project will continue to investigate the skill and usefulness of seasonal sea level forecasts around the United States, the frequency and statistics of future high-tide flooding across

U.S. coastlines, compound flooding risks associated with co-occurring high sea levels and weather extremes, and the dynamics and statistics of wave-driven and tidal flooding in American Samoa and the Puʻuhonua O Hōnaunau National Historical Park on the Island of Hawaiʻi.

University of Hawaii Sea Level Center cGPS

P.I.: Philip Thompson, James Foster

The project will complete the reconfiguration of the BHMA replacement site to bring it into full operation. The HNLC site will also be brought back online. A new GNSS site will be installed at an existing UHSLC tide gauge installation in the Pacific region; the project hopes there will be an opportunity to get its installation crew on a ship visiting Johnston Atoll allowing them to add GNSS to that tide-gauge. Researchers will designate the equipment currently in Mexico for installation at a different tide-gauge site; they are exploring the possibility of moving it to the Isla Soccorro site. Maintenance visits are planned to the GNSS sites in the Cape Verde Islands (site TGCV), and the Maldives (sites HULE and ADDU). Data from existing sites will be received, archived locally, and transmitted to the international data archives for global public access.

Climate Research and Impacts

Analysis of Vulnerability of Military Installations in the Pacific Basin to Coastal Flooding

P.I.: Mark A. Merrifield

For the next fiscal year, the project anticipates completing the mixed distribution analysis, the Level 1 impacts analysis, and GIS-related tabular/graphic products in the fall of 2020. The uncertainty assessment will be the final analysis, followed by writing and submitting the final report in February-March 2021.

Atmospheric Gases in the Remote Pacific Marine Free Troposphere Measured in Hawaii

P.I: Douglas S. Luther [Brian Vasel, Darryl T. Kuniyuki]

Due to limitations in funding, only routine monitoring of atmospheric mercury species is planned for FY 2021.

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

P.I.: Niklas Schneider

This was a one-year grant, but a proposal was submitted to continue the APDRC data services for an additional year. If funded, the new grant will provide resources to fully develop the WMO RA-V Climate Monitoring Node.

Profiling CTD Float Array Implementation and Ocean Climate Research

P.I.: Douglas S. Luther [Gregory C. Johnson]

In the next fiscal year, JIMAR collaboration with PMEL and other Argo partners will continue with testing, deployment, and performance monitoring for more core and Deep Argo floats (as the Covid-19 pandemic shutdown allows). Ocean climate studies will continue using Argo data, including analysis of global ocean heat content and sea surface salinity variations, with more work on delayed-mode quality control for the PMEL Argo floats.

Transferal of Pacific ENSO Applications Climate (PEAC) Center Products and Services to Weather Forecast Office (WFO) Honolulu

P.I.: James Potemra

In the next and final year, the transition plan will be finalized and PEAC will train the NWS staff in the various activities so that the NWS can incorporate these into their work plan.

Tsunamis and Other Long-Period Ocean Waves

Archive of Rapidly-Sampled Hawaiian Sea Level

P.I.: Douglas S. Luther

The ongoing application of the rapidly-sampled sea level records in PacIOOS efforts to diagnose the causes of harbor sea level variations and coastal inundation events, demonstrates that the collection, processing, archiving, concatenation, and dissemination (through ARSHSL) of rapidly-sampled Hawaiian sea level are important activities that will therefore be continued. The project will continue to store both the 1-min and 6-min data from Hawaii sea level stations. They will upgrade the quality control (QC) application so that it can load any previous year's raw data and make QC changes as needed; then it can be uploaded to the ARSHSL website. Project researchers will develop a simple catalogue for the raw data so that it is in one year chunks and can be easily accessed by the QC application. As funding permits, the project will continue to move forward with the re-establishment of the full ARSHSL archiving activities. Along with JIMAR funding, PacIOOS resources will be used to accomplish the resumption of real-time data acquisition from several PTWC gauges for archiving in ARSHSL. However, the low priority and light funding of ARSHSL means this will be a multi-year activity.

Tsunami Research and Modeling

P.I.: Douglas S. Luther

Plans for the next fiscal year include finalizing and publishing Dr. Sannikova's manuscript and collaboration with other NOAA Center for Tsunami Research scientists in conducting a tsunami hazard assessment for selected Department of State overseas facilities. The conclusions of Dr. Sannikova's investigation may expedite the work of identifying hazardous tsunami scenarios for the locations under investigation.

The University of Hawaii Sea Level Center—Tsunami Research

P.I.: Philip Thompson

During FY 2021, the project plans to meet project objectives by servicing five Pacific Tsunami gauges and five Caribbean Tsunami gauges.

List of Acronyms

ACL	Annual Catch Limit
ADMB	Automatic Differentiation Model Builder
AGEPRO	Age Structured Projection Model
APDRC	Asia-Pacific Data Research Center
ARL	Air Resources Laboratories
ARSHSL	Archive of Rapidly-Sampled Hawaiian Sea Level
ASRAMP	American Samoa Reef Assessment and Monitoring Program
AUV	Autonomous Underwater Vehicle
BOEM	Bureau of Ocean Energy Management
CNMI	Commonwealth of the Northern Mariana Islands
COVID-19	Corona Virus Disease 2019
CPU	Central Processing Unit
CRIMP-2	Coral reef instrumented platform-2
CRP	Cetacean Research Program
CTE	Cold Tongue El Niño
DAR	Hawaii State Division of Aquatic Resources
DAWR	Division of Aquatic and Wildlife Resources (Guam)
DoD	Department of Defense
DSCRTP	Deep Sea Coral Research and Technology Program
DVR	Digital Video Recorder
E/V	Exploration Vessel
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EM	Electronic Monitoring
ENP	Eastern Northern Pacific
ENSO	El Niño Southern Oscillation
ER	Electronic Recording
ESA OC CCI	European Space Agency Ocean Color Climate Change Initiative
ESD	Ecosystem Sciences Division
EVA	Extreme Value Analyses
FAD	Fish Aggregating Device
FFS	French Frigate Shoals
FRDS	Fisher Reporting and Dealer System
FRMD	Fisheries Research and Monitoring Division
FY	Fiscal Year
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
HARP	High-frequency Acoustic Recording Packages
HCTP	Hawaii Community Tagging Program
HDAR	Hawaii Department of Aquatic Resources

HMS	Hawaiian Monk Seal
HMSRP	Hawaiian Monk Seal Research Program
IATTC	Inter-American Tropical Tuna Commission
IEA	Integrated Ecosystem Assessment
ISO/IEC	International Organization for Standardization/International Electrotechnical Commission
JIMAR	Joint Institute for Marine and Atmospheric Research
LED	Light Emitting Diode
LHP	Life History Program
LLWBC	Low-latitude western boundary current
LME	Large Marine Ecosystem
MARAMP	Marianas Archipelago Reef Assessment and Monitoring Program
ME	Mixed El Niño
MHI	Main Hawaiian Islands
MLO	Mauna Loa Observatory
MOUSS	Modular Underwater Stereoscopic System
MUS	Management Unit Species
N2N	NOAA to NOAA
NABC	Naval Amphibious Base - Coronado
NCRMP	National Coral Reef Monitoring Program
NIES	National Institute for Environmental Studies
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
NWHI	Northwestern Hawaiian Islands
NWS	National Weather Service
OA	Ocean acidification
OAP	Ocean Acidification Program (NOAA office)
OC CCI	Ocean Colour Climate Change Initiative
ODRS	Online Commercial Marine Dealer Reporting System
OWCP	Ocean Watch – Central Pacific
PacIOOS	Pacific Islands Ocean Observing System
PacMAPPS	Pacific Marine Assessment Program for Protected Species
PEAC	Pacific ENSO Application Climate (Center)
PIFSC	Pacific Islands Fisheries Science Center
PIR	Pacific Islands Region
PIRO	Pacific Islands Regional Office
PMEL	Pacific Marine Environmental Laboratory
PMNM	Papahānaumokuākea Marine National Monument
PRIMNM	Pacific Remote Islands Marine National Monument
PSD	Protected Species Division
PTWC	Pacific Tsunami Warning Center

PYSO	PIFSC Young Scientist Opportunity
QC	Quality Control
R/V	Research Vessel
RAMNM	Rose Atoll Marine National Monument
RAMP	Reef Assessment and Monitoring Program
RFA	Regional Frequency Analysis
ROV	Remotely operated underwater Vehicle
SAFE	Stock Assessment and Fisheries Evaluation
SAP	Stock Assessment Program
SMAP	Soil Moisture Active Passive
SMOS	Soil Moisture and Ocean Salinity
SOD	Science Operations Division
SOEST	School of Ocean and Earth Science and Technology
SPTT	South Pacific Tuna Treaty
SST	Sea Surface Temperature
SSTP	Survey and Sampling Technologies Program
SWS	Seawater System
TA	Total alkalinity
TB	Terabyte
TMB	Template Model Builder
tpl	subnamespace
U.S.	United States
UHDAS	University of Hawaii Data Acquisition System
UHSLC	University of Hawaii Sea Level Center
USAPI	United States Affiliated Pacific Islands
USFWS	United States Fish and Wildlife Service
VFP	Visual FoxPro
VIAME	Video and Image Analytics for a Marine Environment
WCPFC	Western and Central Pacific Fisheries Commission
WMO RA-V	World Meteorological Office Regional Alliance Five (Pacific Islands)
WPacFIN	Western Pacific Fisheries Information Network
WPE	Warm pool El Niño
WPRFMC	Western Pacific Regional Fishery Management Council