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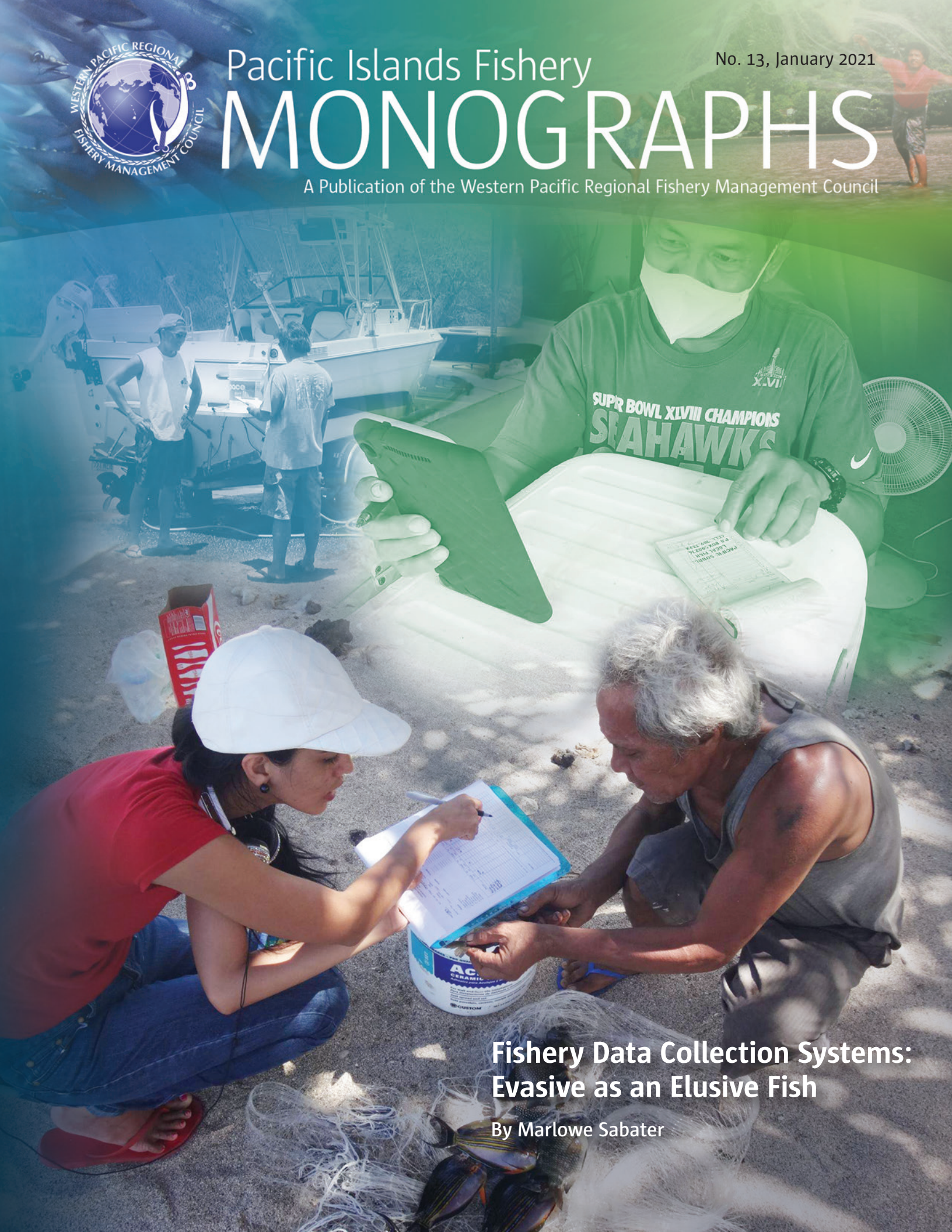

Fishery Data Collection Systems: Evasive as an Elusive Fish

By Marlowe Sabater

ABOUT THE AUTHOR

Marlowe Sabater is the marine ecosystem scientist at the Western Pacific Regional Fishery Management Council and the former chief fisheries biologist at the American Samoa Department of Marine and Wildlife Resources.

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COVER: (*top left*) Hawai'i data collection; (*bottom left*) Priti Smith conducting a shore-based creel interview with Terry Lam-Yuen to capture rare-event fishing in American Samoa; (*top right*) Jim Cabanese of Pacific Source Fish Mart reporting fish purchase from CNMI fishermen on Catchit Logit.

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LIST OF ACRONYMS

ACL	annual catch limit
AM	accountability measure
CML	commercial marine license
CNMI	Commonwealth of the Northern Mariana Islands
CPRS	Commercial Purchase Reporting System
CPUE	catch per unit effort
CRCP	Coral Reef Conservation Program
DAR	Division of Aquatic Resources (Hawai'i)
DAWR	Division of Aquatic and Wildlife Resources (Guam)
DFW	Division of Fish and Wildlife (CNMI)
DMWR	Department of Marine and Wildlife Resources (American Samoa)
EEZ	exclusive economic zone
EPAP	Ecosystem Principles Advisory Committee
FDCC	Fisheries Data Coordinating Committee
FDCRC	Fishery Data Collection and Research Committee
FEP	Fishery ecosystem plan
FIN	Fishery Information Network
EPAP	Ecosystem Principles Advisory Panel
FMP	fishery management plan
HMRFS	Hawai'i Marine Recreational Fishing Survey
MRIP	Marine Recreational Information Program
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	maximum sustainable yield
nm	nautical mile
NMFS	National Marine Fisheries Service
NWHI	Northwestern Hawaiian Islands
PacFIN	Pacific Fishery Information Network
PIFMAPS	Pacific Island Fisheries Monitoring and Assessment Planning Summit
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office
PIROP	Pacific Islands Regional Observer Program
PMT	Plan Management Team
PRIAs	Pacific Remote Island Areas
RFMC	Regional Fishery Management Council
SAFE	Stock Assessment and Fishery Evaluation
SFA	Sustainable Fisheries Act
SSC	Scientific and Statistical Committee
SFF	Sustainable Fisheries Fund
SWFSC	Southwest Fisheries Science Center
TAC	total allowable catch
TSI	Territory Science Initiative
USFWS	U.S. Fish and Wildlife Service
WPacFIN	Western Pacific Fishery Information Network
WPDGC	Western Pacific Data Goals Committee
WPR	Western Pacific Region
WPRFMC	Western Pacific Regional Fishery Management Council
WSFR	Wildlife and Sport Fish Restoration

1. INTRODUCTION

"**Math does not just describe the universe** but makes the universe." "The universe is a mathematical structure." "Everything in the universe is made of math." These are some of the quotes that are circulating in the popular media about math and numbers. If you ponder upon them, you'll find that they contain some truth. The smallest atom has a weight; our age is a number; everything has a dimension; and the universe is quantified by its age (13.8 billion years) and rate of expansion (72 kilometers per mega parsec).

When you come to fish and fisheries, numbers abound. Fish have weight, age and length. The catch of fisheries has a weight. Fishing effort has a duration. Each fisherman has a rate at which he or she catches fish. All these are numbers.

When fishery agencies collect these numbers, fishery managers can use them to make decisions that are equitable to the stakeholders and help sustain the stocks. Data are the lifeblood of fishery science and management. Stock assessments are driven by numbers. Monitoring of fishery performance relies heavily on data. The evaluation of regulatory impacts and the effectiveness of management measures all need accurate and diverse sets of data.

Then why, despite knowing this and having decades of management history, has the Western Pacific Regional Fishery Management Council (WPRFMC, or Council) struggled to acquire fishery information that is critically needed to properly manage the fisheries in the region? This monograph attempts to answer that question by documenting the attempts that have been to improve fishery data collection in the Western Pacific Region (WPR). Some efforts reached their goals; some failed. It seems that a robust data collection system that has been long sought after is as elusive as a wily fish.

2. SETTING THE STAGE

2.1 Regional Fisheries Management

In 1976, the enactment of the Fishery Conservation and Management Act (subsequently known as the Magnuson-Stevens Act, or MSA) established the nation's fishery conservation zone (now known as the exclusive economic zone, or EEZ), which extends 200 nautical miles (nm) offshore. The MSA also established eight Regional Fishery Management Councils (RFMCs) mandated to develop, monitor and amend fishery management plans (FMPs) for fisheries in federal waters (generally, 3 to 200 nm offshore). The FMPs are required to have conservation and management objectives and measures to prevent overfishing, rebuild overfished stocks and ensure a safe, sustainable supply of seafood and long-term economic and social benefits of fisheries to the nation.

In partnership with the National Marine Fisheries Service (NMFS), the Council manages the federal fisheries and the species throughout their range. The Council and NMFS coordinate with state and territory fishery agencies in the management of shared fishery resources. The coordination among the Council and federal, state and territory agencies includes monitoring and tracking catch. Tracking of the catch is a crucial part of fishery management to monitor fishery performance, production, catch per unit effort (CPUE) and, more recently, to meet annual catch limit (ACL) requirements of the 2006 reauthorized MSA.

2.2 Regional Fisheries

Island and pelagic fisheries are the major categories of fisheries managed by the Council in the WPR. The island fisheries are located in waters surrounding Hawai'i (including the Northwestern Hawaiian Islands, or NWHI), American Samoa, Mariana Archipelago (Guam and the Commonwealth of the Northern Mariana Islands, or CNMI) and the Pacific Remote Island Areas (PRIAs). The pelagic fisheries occur both within the U.S. EEZ waters surrounding each of these island areas and in international waters.

The island fisheries are more diverse than the pelagic fisheries in terms of the species and the gear used to catch the species. The bottomfish, crustaceans, precious coral and coral reef ecosystem fisheries constitute the majority of the island fisheries. These fishermen use small boats for most commercial operations and also other watercraft, like canoes and kayaks, for the noncommercial sector. There are the bottomfishing headboat type noncommercial charters in the Marianas. The noncommercial fisheries are conducted along the shoreline using such gear as nets, hook-and-line and spear and include recreational, subsistence, sustenance, cultural and traditional fishing.

The pelagic fishery is subdivided into large vessels, such as longliners and purse-seiners, and small boat commercial, noncommercial and charter troll fisheries. These fisheries principally target tuna, blue marlin and other billfishes.

2.3 Regional Data Collection Systems

For the island and small-boat pelagic (i.e., nonlongline) fisheries, fishery-dependent data are captured by state and territorial agencies: the Division of Aquatic Resources (DAR) in Hawai‘i, the Department of Marine and Wildlife Resources (DMWR) in American Samoa, Division of Aquatic and Wildlife Resources (DAWR) in Guam, and Division of Fish and Wildlife (DFW) in the CNMI.

Hawai‘i noncommercial island and small-boat pelagic fisheries data are collected through the Fisher Reporting System, as a requirement for those holding a Hawai‘i Commercial Marine License (CML), and is supplemented by Dealer Reports, which fish retailers must provide on the amount of fish bought from fishermen. The requirements for the fishermen reports range from trip level (for Deep 7 bottomfish[1]) to monthly (for the rest of the species).

Hawai‘i noncommercial island and small-boat pelagic fisheries data are collected by the Hawai‘i Marine Recreational Fishing Survey (HMRFS). The HMRFS system includes a mail survey, which estimates fishing effort, and a shoreline roving interview (i.e., Access Point Angler Intercept Survey at predetermined ports, marinas and ramps) to estimate catch.

In the territories, the standard data collection system for the island and small-boat pelagic fisheries includes boat- and shore-based creel surveys (fig. 1). These surveys are comprised of a Participation Run, where data collectors randomly survey stratified locations and periods to gauge fishing participation, and a Catch Interview Run, where data collectors intercept fishermen for interviews of their specific effort and to measure their catch.

Commercial data for the island and small-boat pelagic fisheries in the territories are supplemented by the Commercial Purchase Reporting System (CPRS) (fig. 2). Fish retailers submit logbooks on the type and amount of fish they have purchased from the commercial fishermen. The CPRS is voluntary in Guam and mandatory for American Samoa, CNMI and Hawai‘i.

The noncommercial data for the island and small-boat pelagic fisheries in the territories are assumed to be that gathered from the shore-based creel survey and the not-sold portion of the catch from the boat-based catch interview.

For the commercial longline fisheries, the Pacific Islands Regional Observer Program (PIROP) and NMFS logbook programs are utilized to record catch by species and effort of U.S. longline fisheries based in Hawai‘i and American Samoa. The PIROP uses observers on board longline vessels to collect additional information such as size frequencies of catch by species with geolocation information on longline sets. Submitting reports electronically has been an option for the longline fisheries. In September 2020, the Council took final action on a regulatory amendment for mandatory electronic reporting for vessels operating under the Hawai‘i longline limited entry permit and vessels larger than 50 feet in length (i.e., size classes C and D) operating under the American Samoa longline limited entry permit. Under the amendment, vessel operators must record and submit logbook data within 24 hours after completion of each fishing day using an electronic logbook application certified by NMFS. In the event of technology malfunction, vessel operators would be required to submit the logbook data by paper or electronically within 72 hours of the end of each fishing trip. The recommended date for implementing mandatory electronic reporting is by July 1, 2021. This regulatory amendment is pending approval by the Secretary of Commerce. There are no noncommercial longline fisheries; therefore, no corresponding data collection mechanisms.

Fig. 1. Boat-based creel survey technicians in American Samoa recording catch information from a trolling trip (2001). *Dave Hamm photo.*

Fig. 2. WPacFIN staff Mike Quach training DLNR staff on Rota, CNMI, to use the Commercial Purchase Reporting System data processing app. *Dave Hamm photo.*

1. Comprised of six species of deep-water snapper and one deep-water grouper.

3. EARLY DATA COLLECTION HISTORY

3.1 Boxes of Receipts

In the 1970s, the Council began work to develop the FMPs for the WPR as mandated by the MSA. These efforts included coordinating fishery data collection systems with the State of Hawai'i and establishing such systems in the territories.

The State of Hawai'i had been collecting fisheries information since the 1940s, including dealer information which was not inputted in a computerized database system. The Council saw an opportunity to capture the dealer information at the United Fishing Agency (Honolulu fish auction), which was and continues to be the biggest dealer in Hawai'i. After fishermen dropped off their catch at the auction, copies of the receipts they were issued were kept in shoeboxes. The Council contracted Kurt Kawamoto, assisted by Hawai'i DAR staff Jo-Anne Kushima, to collect the information from the auction receipts and log landings (fig. 3). The receipt boxes were transported to the Honolulu

Fig. 3. Council contractor Kurt Kawamoto and DAR staff member Jo-Anne Kushima collect fish purchase information at the Honolulu fish auction. *WPRFMC photo.*

Laboratory, then a part of the NMFS Southwest Fisheries Science Center (SWFSC), to be sorted. A standardized coding system was established for the fishermen, species and other information on the receipts. This was the start of the Hawai'i dealer database. The Honolulu Lab subsequently hired

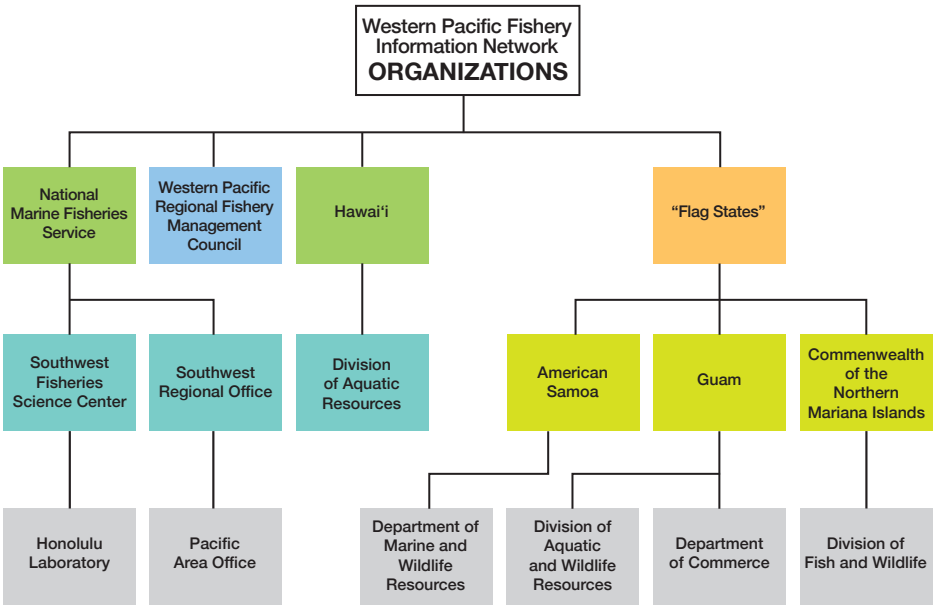


Fig. 4. Organizations participating in the Western Pacific Fisheries Information Network. *Source: Hamm 1993.*

the Council contractor to continue the data collection at the auction and also from dealers on the islands of Kaua'i, Maui and Hawai'i (the Big Island), where the second largest seafood auction (Suisan) was located.

For the territories, the Council initiated the Historical Data Compilation Project, which identified and described the fishery data available in American Samoa, Guam and CNMI.

3.2 Western Pacific Fisheries Information Network

In 1981, the SWFSC established the Fishery Information Network (FIN) to "provide a central source of regionwide fishery data" in the Pacific area so as to meet the increasing demand for readily accessible, quality fisheries data needed for the development of FMPs and other management purposes (Hamm 1982). The FIN included the Pacific FIN (PacFIN) for the Western coastal states and Idaho and the Western Pacific FIN (WPacFIN) for Hawai'i and the U.S. Pacific Island territories. NMFS, WPR state/territorial fishery agencies and the Council comprised WPacFIN (fig. 4) and participated in the design and implementation of WPacFIN. Alaska FIN deals with the northwest region fisheries.

WPacFIN provides technical support, including hardware and software support, and governs the data storage and data sharing through various agreements. The WPacFIN system provides each island area with its unique and independent data system and brought about the standardization of data sets to allow for inter-jurisdictional comparisons. The WPacFIN developed the data entry softwares, computational capabilities and automated summarization of the data collected by each territory fishery agencies. These summarizations are used to generate the Council's annual monit oring reports as well as the the reporting for the *Fisheries of the United States*.[2]

Starting in December 1981 into 1982, 64K Apple II+ computer systems were installed in all four island fishery agencies. Relational database systems were created and numerous staff trained to support the generation of

2. *Fisheries of the United States* is the annual NMFS yearbook of fishery statistics for the United States published from 1999 to 2018. The report provides data on U.S. recreational catch and commercial fisheries landings and value as well as other aspects of U.S. commercial fishing.

a territory-wide information to monitor fishery performance. As technology changed and microcomputers systems improved over the last 40 years of support, WPacFIN Central has provided about 80 Microsoft-based computers covering five to six processor generations and provided many training at all main fishery offices and field offices.

The WPacFIN developed database processing, quality control and reporting systems that spanned about seven database and four programming languages. The technical support at the backend of the data collection process is meant to support the on-the-ground collection conducted by the territorial fishery agencies.

3.3 Fishery Data Coordinating Committee

The establishment of WPacFIN required a coordinating body to recommend priorities and identify the regional data collection program's needs. By mid-1982, the Western Pacific Data Goals Committee (WPDGC) was created for this purpose and included the same agencies comprising WPacFIN. This Committee determined the specific projects and data collection systems that should be undertaken in each island area. A Technical Subcommittee was formed to support the technical and operational aspects of WPacFIN and to ensure that the information needs were met.

The WPDGC restructured into the WPacFIN Fisheries Data Coordinating Committee (FDCC) in 1985 (figs. 5a–g). The FDCC was the governance body that guided implementation of WPacFIN and the forum for communicating data collection issues and proposing solutions. It included heads of the WPRFMC, SWFSC, SWFSC Honolulu Lab, American Samoa Office of Marine Resources (precursor to the DMWR), Guam Department of Agriculture, Hawai'i Board of Land and Natural Resources and CNMI Department of Natural Resources. The purposes of FDCC were 1) to serve as the forum for information exchange related to fisheries data and to oversee WPacFIN operations and progress review; 2) to establish WPacFIN implementation activities and priorities; 3) to coordinate and recommend improvements to the implementation plan; 4) to promote development and implementation of data collection; and 5) to designate membership of a Technical Subcommittee (Hamm 1985). The glory days of the FDCC were in the late 80s to the early 2000s, when it took the fight to the Pacific States Marine Fisheries Commission to get its fair share of data collection funding. At this time, WPacFIN budget was under PacFIN budget line item since the Honolulu Lab was under the SWFSC.

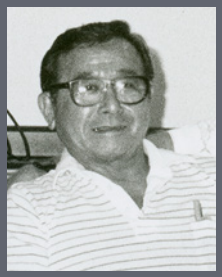
3.4 Funding: A Continuing Challenge

The Council has had a historic involvement in financially supporting WPacFIN. The coordinated data collection system for the WPR was established and initially implemented from PacFIN funds committed by the SWFSC. The Council helped by providing $40,000 in seed funding and by working with the SWFSC's Honolulu Lab to transition the Council's existing Historical Data Compilation Project to WPacFIN (Hamm 1982).

Keeping the regional system funded has been challenging. In 1987, Congressman Daniel Akaka (D-Hawai'i) informed Council Chair Wadsworth Yee that neither the Senate nor the House provided funding for the 6-year-old program (fig. 6). Undeterred, the Council sought funding through the Pacific Marine Fisheries Commission and assisted state/territorial agency directors with the preparation of letters supporting the PacFIN budget request for $1.9 million, of which 18% ($350,000) would be used to continue supporting WPacFIN.

In a memo dated Dec. 9, 1987, Council Executive Director Kitty M. Simonds reported to Council Chair Bill Paty (incumbent Hawai'i Board of Land and Natural Resources chair) that the Council provided programmatic funds for each territory member of the FDCC, purchased four IBM

WPacFIN Fisheries Data Coordinating Committee



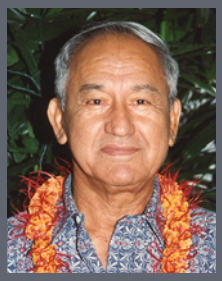



Fig 5. Original members of the FDCC included (*top row, left to right*) Committee Chair Kitty M. Simonds (WPRFMC), Richard Shomura (SWFSC Honolulu Lab), Henry Sesepasara (American Samoa), Harry Kami (Guam); (*bottom row left to right*) Henry Sakuda (Hawai'i), Nick Leon Guerrero (CNMI) and Doyle Gates (SWFSC).

Personal System/2 machines for Hawai'i fishery offices on the neighbor islands to replace the Apple II computers provided initially by the SWFSC Honolulu Lab (Table 1) (figs. 7a and 7b) and provided computer training for DAR staff.

According to a 1989 Council summary document titled "PacFIN," the federal share of the PacFIN consisted of programmatic grants to the RFMCs and some ad-hoc monies from the West Coast offices of NMFS. This document was used to justify the increased and stable funding for WPacFIN for the fiscal year 1990 (WPRFMC 1989). During this period, the Council requested $400,000 that would go to Hawai'i and the territories (an order of magnitude larger than the initial seed funding of $40,000) and $200,000 to support the WPacFIN Data Systems.

The Council also supported the region's data collection system by funding the Boating Fishing Survey Design Project to scope the extent of recreational fisheries in Hawai'i; purchasing computer systems for American Samoa and Guam; and continually monitoring the status of data collection in the region.

In 2004, the Pacific Islands became its own NMFS region separate from the NMFS Southwest Region, and the Pacific Islands Fisheries Science Center (PIFSC) was established. This led to some supplemental funding for WPacFIN and Council projects (fig. 8).

Figs. 8. David Hamm, WPacFIN program manager (circa 1980s). *David Hamm photo.*

DANIEL K. AKAKA
SECOND DISTRICT, HAWAII

COMMITTEE:
APPROPRIATIONS
SUBCOMMITTEES:
AGRICULTURE, RURAL DEVELOPMENT
TREASURY, POSTAL SERVICE
TOURISM CAUCUS

WASHINGTON OFFICE:
2301 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
TELEPHONE: (202) 225-4906

DISTRICT OFFICE:
5104 PRINCE JONAH KUHIO KALANIANAOLE FEDERAL BUILDING
P.O. BOX 50144
HONOLULU, HI 96850
TELEPHONE: (808) 541-1986

Congress of the United States
House of Representatives
Washington, DC 20515

October 26, 1987

RECEIVED
OCT 29 1987
Western Pacific Fishery Management Council

Mr. Wadsworth W. Yee
Chairman
Western Pacific Regional Fishery
Management Council
1164 Bishop St., #1405
Honolulu, Hawaii 96813

Dear Wads:

This is in response to your correspondence concerning the Western Pacific Fishery Information Network (WesPacFIN). Please excuse my delay in responding to your concerns.

The idea of a sport fishing license program has been proposed by the Administration as a means of generating revenue. However, Congress has opposed such efforts in the past, and I am unaware of any legislation to implement a fishing license program moving forward in the House.

Unfortunately, neither the House nor the Senate provided an alternative source of funding for WesPacFIN. H.R. 2763, the FY88 Departments of Commerce, Justice, State, and the Judiciary Appropriations Bill, included no funds for this program. In an effort to reduce the budget deficit, Congress has to make difficult fiscal decisions often to the detriment of many worthwhile and deserving programs.

Thank you for your correspondence. Please do not hesitate to contact me whenever I may be of service.

Aloha pumehana,

Daniel K. Akaka

DANIEL K. AKAKA
Member of Congress

DKA:lkb

Fig. 6. Letter from Congressman Daniel Akaka informing the Council that there is no funding to support WPacFIN in the Fiscal Year 1988 Appropriation Bill, which is indicative of the continuous struggle to fund the regional data collection program.

Table 1: Technical specifications of the IBM PS/2 and Apple II used to collect fishery data in the Western Pacific Region.

Parameters	IBM PS/2 (Upgraded computers provided by the Council)	Apple II+ & Apple IIe (Initial computers provided by SWFSC Honolulu Lab)
Microprocessor	Intel 8088	MOS Technology 6502
Central Processing Unit Speed	4,772,726 Hz (2x)	1,022,727 MHz
Random Access Memory	64 kilobytes	64 kilobytes
Graphics	320 x 200 resolution (Color Graphics Adapter)	280 x 192 resolution (National Television System Committee)

Figs. 7a. and **7b**. The Council provided IBM Personal System/2 computers (*left*) to fishery agencies in Hawai'i neighbor islands to replace aging Apple II computers (*above right*) that had been previously provided to them by the Honolulu Lab.

4. MONITORING FISHERY PERFORMANCE

Between the enactment of the MSA in 1976 and its reauthorization in 1996, the Council developed and implemented four FMPs: the Crustacean FMP (1983), Precious Coral FMP (1983), Bottomfish and Seamount Groundfish FMP (1986) and Pelagic FMP (1987). While the impetus for implementing and coordinating the region's data collection programs was development of the FMPs, once most of them were completed (the Coral Reef Ecosystem FMP would be implemented in 2004), the attention refocused to monitoring performance of the fisheries and developing the assessments to manage the stocks in compliance with the FMPs and MSA National Standards 1 and 2. National Standard 1 requires conservation and management measures that prevent overfishing while achieving optimum yield. National Standard 2 requires these measures to be based on the best scientific information available. Each FMP requires an annual report to monitor the fishery performance and a set of indicators to evaluate whether the FMP objectives are achieved.

While the original goal of establishing a coordinated data collection program through out the region is to monitor the broad fishery performance, the changes in the management requirements both in the local and federal waters triggered the evolution of the data collection needs. At this period, the annual reports and annual reviews of the FMP objectives drove the changes in the data collection and reporting from the regional data collection systems in Hawai'i and the territories.

The early annual reports for the FMP focused on descriptions of fishery performance and characteristics of the fisheries that met the basic FMP requirements. But as information requirements and the complexity of the management increased, basic descriptions were no longer adequate and there was general dissatisfaction with the process used to generate the Bottomfish and Pelagic FMP Annual Reports. Too much effort was expended on producing descriptive statistics of fishery performance and not enough effort was given to rigorous analyses. The module and report generation was overemphasized, and trends, changes and fishery issues received less emphasis. Additionally, the Council's annual reports and NMFS's Stock Assessment and Fishery Evaluation (SAFE) report were potentially duplicative.

4.1 Fishery Management Plan Monitoring and Assessment Workshop (1989)

Nearly a decade after establishment of WPacFIN and FDCC, the Council, in collaboration with the SWFSC Honolulu Lab, convened the FMP Monitoring and Assessment Workshop on Nov. 6–9, 1989. Representatives from each of the region's state and territory fishery agencies participated in the workshop to define and discuss the analyses needed to monitor and assess the status of the bottomfish and pelagic fisheries in each island region. Data, analytical processing systems and human resources were identified for each method of analysis.

The workshop generated three products: 1) a report that documented the workshop discussion and recommendations; 2) a "plan of attack" that followed up on the workshop discussions and suggestions for organizing available data and analytical resources to improve FMP monitoring procedures; and 3) a document that compiled the data collection needs to address the requirements of the annual and SAFE reports.

The first workshop product (Pooley 1990) reported a protocol for the development of the Pelagic and Bottomfish Annual Reports. Each state and territory agency would be responsible for generating the report module for its island area ahead of the Council's annual Plan Management Team (PMT) meetings. Ample time should be given for the PMT members to review the reports and for the reports to be revised and finalized. The report also documented several indicators generated by the workshop to evaluate the performance of the fisheries and status of the stocks. Indicators for the bottomfish fishery were biological (e.g., average length at first maturity, the ratio of fishing mortality to natural mortality and CPUE <50% that at maximum sustainable yield (MSY) or 20% of that at virgin biomass); economic (e.g., harvest capacity at MSY, decline in long-term revenue, and annual vessel operating cost > ex-vessel revenue); operational (e.g., increase in catch per gear, increase in proportion of frozen products, change in species composition, and substantial increase or decrease in total landings compared to the long-term average); and expert-based (e.g., interaction with protected species begins to occur). Some of the ranked pelagic fisheries indicators included size statistics, index of localized catchability, ratio of CPUE per gear, index of species-gear-season CPUE, recreational CPUE trends, price trends and index of effort by area and gear.

The second workshop product (Bartram 1990a) created the actions by which issues identified in the annual report generation process would be addressed. These actions included 1) streamlining the FMP monitoring procedures by focusing on the priority indicators of fishery condition and urgent fishery issues; 2) publishing the basic fishery data from the annual data review only in the NMFS WPacFIN's "Fishery Statistics of the Western Pacific"[3] and incorporating only portions of their summary statistics and other research information by reference

3. Between 1986 and 2016, WPacFIN published 31 PIFSC administrative reports summarizing the fishery data collected throughout the WPR.

in the annual reports; 3) incorporating more rigorous analysis focusing on the key fisheries indicators that are related to the management objectives; 4) treating annual report suggestions as the PMT's best judgment about fishery conditions based on the individual member's expertise and familiarity with the fisheries; 5) providing the Council with brief annual summaries of the status of the FMP fisheries and popularizing the annual reports for distribution to fishery participants; and 6) including the SAFE report requirements in the annual data review.

In response to the workshop, WPacFIN Central created automated Plan Team Report generation software that produced Word documents embedded with updated graphs and tables required by the FMPs. This enabled island fishery agency Plan Team members to focus on writing the interpretation of the trends in the data and developing recommendations.

The third workshop product, the WPacFIN data plan (Bartram 1990b), provided the data and research needed to develop and improve on the indicators and descriptors that would help managers monitor the FMPs and make informed decisions about them. Each indicator and descriptor depends on the types and quantities of data collected and analyzed. The workshop identified data collection steps and research that would improve the data that feeds into each indicator and descriptor for the Bottomfish and Pelagic Annual Reports. The data plan covered improvements to the fishery-dependent data collection; identified mandatory record-keeping and reporting as a primary need to improve the fishery's commercial segment; and described the support for the technical work conducted by WPacFIN central, island agency systems, monitoring system upgrades, and special fishery information projects and research to fill in information gaps for assessments.

In response to the workshop, the American Samoa Office of Marine Resources would require mandatory commercial fishery permit and dealer reports in its regulations.

In 2012, CNMI would enact Public Law 17–89, establishing a mandatory catch recording and reporting system, but the implementing regulations would not be approved until February 2019. In Guam, data submission continues to be voluntary.

4.2 WPacFIN Next Generation Computer Training Workshop Workshop (1989)

The SWFSC Honolulu Lab convened the WPacFIN Next Generation Computer Training Workshop on Nov. 13–24, 1989. This workshop aimed to provide technical capabilities for the member agencies to utilize new hardware and software environments as part of the technical upgrading effort. While this built upon the local capacity for data transcription and management, it did not address the operational issues associated with on-the-ground data collection.

Reviews conducted by the Center for Independent Consultants and Barry Vittor on the survey design of the creel surveys resulted in minor tweaks to the design.[4]

That's so 80s Trivia

How long does it take to run a single year summary the Hawai'i Pelagic Fisheries Module in a micro-computer?

A Council memo (Rutka 1989) reported that NMFS scientist and PMT member Robert Skillman said DAR PMT members could reserve the State of Hawai'i mainframe to run the data for the module or use the University of Hawai'i mainframe and pay for the time of usage. Or they could use the micro-computer [which we now call a desktop computer], but it would take one to two days to complete one-year of a 10-year time series. Today, that task would take a couple of minutes on an ordinary desktop computer.

TOMY Dingbot, 1987. Source: Pinterest.com.

4. Dave Hamm, in discussion with the author, 2020 Dec. 14.

5. COMPLYING WITH THE SUSTAINABLE FISHERIES ACT

The 1996 reauthorization of the MSA, the Sustainable Fisheries Act (SFA), strengthened the requirements to prevent overfishing and rebuild overfished fisheries. It ushered in the use of biomass-based reference points, i.e., MSYs, and reduced the use of the spawning potential ratios, the primary reference points prior to the SFA. It set the standard for FMPs to specify measurable criteria for determining stock status, which drove the development of status determination criteria for each management unit species or complex and made stock assessments a requirement. The SFA also introduced another key FMP component—fish habitat, requiring designations of essential fish habitats and habitat areas of particular concern.

The 1996 SFA also called for NMFS to create an Ecosystem Principles Advisory Panel (EPAP). The EPAP developed recommendations to expand the use of ecosystem principles in fisheries management (16 USC §1882) (EPAP 1999). The Council jumped on this opportunity and developed the Coral Reef Ecosystem FMP, the first ecosystem-based FMP in the nation, which incorporated the eight EPAP recommendations. Four Councils (North Pacific, Pacific, South Atlantic and Western Pacific) first responded to the call for the development of Fishery Ecosystem Plans (FEPs) and mostly addressed the EPAP recommendations (Wilkinson and Abrams 2015).

The new regulations in the SFA and the EPAP recommendations elevated the significant and crucial role of data in fisheries science and management and led to the convening of several additional data workshops.

5.1 Data 2000 Workshop—Developing Stock Assessments (1997)

In February 1997, the Council hosted a workshop to prepare WPacFIN for the demands of the amendments to the FMPs brought about by the SFA requirements. The Data 2000 Workshop goal was to address the gaps in the regional data collection systems to ensure that the data could be used to generate stock assessments.

The workshop generated 54 recommendations for the data collections systems of Hawai'i, American Samoa, Guam and the CNMI and eight recommendations for WPacFIN central. They included additional components for the annual reports (e.g., socioeconomic, protected species, fishery-independent information), partner access to data, database characteristics, data documentation and standards, and capabilities to generate the reports.

The common recommendations across the region were to 1) develop regulations to require licensing and reporting; 2) expand the data collection systems; 3) improve communication and outreach; 4) refine data collection goals and objectives; 5) enhance collaboration among agencies to deal with data collection issues; 6) upgrade the technology and automate the reports; 7) integrate multiple data collection and database systems; 8) enhance research on management unit species; and 9) increase the resolution of the existing data collection system for the commercial and recreational fisheries.

5.2 Ecosystem Science and Management Planning Workshop (2005)

In the early 2000s, the Council began restructuring its five species-based FMPs into place-based FEPs. To assist in this work, it convened three workshops between 2005 and 2007. The Ecosystem Science and Management Planning Workshop (or Biophysical Workshop) in April 2005 brought together 60 experts to address the data that would be needed for the new FEPs. The workshop noted that the shift toward the ecosystem approach to fisheries management would require the collection of oceanographic, fishery-independent biomass, social and economic, and protected species information. It would also require the use of ecosystem models and development of indicators useful for gauging ecosystem processes and the effects of management on species and the ecosystem (Glazier 2011).

The workshop participants identified a range of interim requirements for new data needed to support the ecosystem-approach to management in the region. Of primary interest was improving the commercial, recreational, subsistence landings and effort data; 2) information on bycatch and fishery interactions; and 3) data regarding life-history. The participants recognized that the ecosystems (biophysical, social and economic) are different between archipelagos and that research priorities should cater to the needs of each archipelago.

Workshop recommendations included the formation of a Data Needs Working Group to address the collection of fishery-dependent information to support ecosystem-based fisheries management and to monitor the fisheries through the annual and SAFE reports for the WPR.

5.3 Data and Monitoring Workshop (2006)

In response to the recommendation from the 2005 Ecosystem Science and Management Planning Workshop recommendation to form a Data Needs Working Group, the Council convened the Data and Monitoring Workshop in October 2006 (fig. 9). The workshop's goal was to identify the data and research needs to develop stock assessments and ecosystem models to support the implementation of the FEPs. Improvements in the data and research priorities would trigger changes to the annual and SAFE reports, which would be redesigned from species-based to place-based to match the structure of the FEPs.

The workshop covered the different data collection systems in the domestic (commercial and recreational) and

international fisheries. Participants also reviewed the statutory requirements of the 1996 SFA for FEPs and associated reports, including the SAFE Reports. The workshop discussed the inclusion of habitat data in the reports and identified habitat and ecosystem parameters to be monitored, including the human component. The workshop covered stock assessments that could be generated given the available data.

The workshop concluded with recommendations to restructure the annual reports and to include within them the elements needed for the annual reports to mutually serve as the SAFE reports. In particular, this included compliance with the National Standard 2 requirement to be based upon the best scientific information available. Several ecosystem and socioeconomic indicators would also be included to support development of the FEPs, which would be finalized in 2009.

Federal management measures that required additional data increased the burden on the state and territorial data collection systems. Without a significant increase in the NMFS funding support for basic fishery data collection, the territory fishery agencies adapted by reprogramming their Sportfish Restoration Program, Interjuridictional Fisheries Act, and WPacFIN cooperative agreement to accommodate the collection of additional fishery information. These changes in turn altered the programming codes of the data input, the databases and the reporting softwares at WPacFIN Central.

Fig. 9. Council senior scientist Paul Dalzell presents a recap of the purpose and nature of the 2006 Data and Monitoring Workshop to the attendees. *WPRFMC photo.*

6. COMPLYING WITH THE 2007 REAUTHORIZED ACT—ANNUAL CATCH LIMITS FOR ALL

In 2007, the MSA was reauthorized with an overarching goal to end overfishing and rebuild overfished stocks. The focus of federal fisheries management shifted to stock sustainability and required ACLs and accountability measures (AMs) for all federally managed fisheries. This obligation put the onus on data collection systems to be robust to meet the scientific standards for stock assessments and real-time management measures to prevent and end overfishing.

The 2007 reauthorization also made sweeping changes to the role of science in fisheries management. Scientific products were subject to peer-review, and the responsibilities of the Council's Scientific and Statistical Committee (SSC) were enhanced to include this, including the review of data.

The 2007 reauthorized MSA also reflected renewed interest in recreational fisheries through the establishment of the Marine Recreational Information Program (MRIP) to provide statistical estimates of the recreational catch in the nation. Another big program introduced in the 2007 reauthorization was catch shares, which is a market-based management system that allocates the catch limit to fishery participants.

The management needs for fishery data had increased significantly from enactment of the MSA in 1976 to its reauthorization 31 years later in 2007. The rate of change in the information requirements for federal fishery management outpaced the slow evolution of the data collection due to lack of support. The efforts to improve the data collection system had still not satisfactorily produced fishery-dependent data to satisfy the management needs for the region. The status quo seemed to be, as the old adage says, "The more things change, the more things stay the same."

> "The more things change, the more things stay the same."

Without significant investment in improving the data collection systems to keep up with the increasing sophistication of the federal fishery management system, the region was left with making the most of what it had, not only in funding but also in the capacity of the local agencies to do the work. Constant staff turn-overs and the need for WPacFIN Central to train new staff kept the system at status quo. During this time, more federal interventions through short- and medium-term fixes started to come into fruition.

6.1 Pacific Island Biosampling Workshop (2009)

At the 144th meeting of the Council in March in American Samoa, the Council's Bottomfish Plan Team reported the need to conduct life history work on bottomfish. In response, the Council asked PIFSC to establish a program to collect otoliths from bottomfish around American Samoa to get basic age and growth information. PIFSC, through WPacFIN Central and the PIFSC Life History Program lab,[5] worked with the Council to organize the Pacific Island Biosampling Workshop. The workshop plan was presented to the FDCC at its July 2009 meeting in Kona. It was noted that the biosampling contract with the Richard Seman in collaboration with the Guam Fishermen's Cooperative Association would end in 2009 and that the hope was for a regional biosampling program to continue that effort. While CNMI DFW and American Samoa DMWR each had its own life history program geared towards processing samples, neither could procure the needed samples. A regional biosampling program could bridge that gap as well.

The workshop was held at the Guam Fisherman's Cooperative Association in August 2009 and included biologists from the American Samoa, Guam, CNMI and Hawai'i fishery management agencies and local fishing community members (figs. 10a–g). Led by Megan Sundberg and Karen Underkoffler of the PIFSC Aiea Lab, the workshop provided training in otolith and gonad extraction, sampling protocols, processing and handling biosamples, and data logging.

The regional biosampling workshop provided PIFSC with the impetus to create a coordinated biosampling program, the Pacific Island Commercial Fishery Biosampling Program, utilizing Enhanced Stock Assessment Program funds.

The Commercial Fishery BioSampling Program has two components. The first is sampling for fishery dependent data led by WPacFIN Central. This collected length and weight information to generate conversion coefficients. WPacFIN developed the data entry and data summarization software for the territory agencies and third-party contractors. The second component is the life history sampling by the

5. Prior to PIFSC, NMFS life history work was undertaken by Ed DeMartini through the Honolulu Lab's Insular Ecology Program.

Regional BioSampling Workshop August 11–12, 2009, Guam

Figs. 10. **a)** A workshop participant is trained to properly log life history data; **b)** Megan Sundberg demonstrates otolith extraction from an onaga; **c)** Workshop participants extract otoliths from fish heads; **d)** Karen Underkoffler shows otolith rings against the sunlight; **e)** Close-up of otolith removal from a fish sample; **f)** Gonad sample from opakapaka; and **g)** Participants of the Pacific Island Biosampling Workshop held August 2009 in Guam.

PIFSC Life History Program, run by Robert Humphreys Jr. During his involvement with the Council's high school summer course, which has run annually since 2006, Humphreys demonstrated otolith extraction and ring counting and the sampling of seamount groundfish, which exposed the need to expand the life history sampling to other federally managed species. The species' biological information is one of the three legs of stock assessments along with catch from fishery-dependent data collection and abundance from fishery-independent surveys.

In 2011, PIFSC began hiring staff and implementing contracts in each territory to collect, measure and ship biosamples to Hawai'i. The Council provided additional funding support to fill in the manpower gaps in Guam and the CNMI.

6.2 Regional Fishery Data Workshop (2009)

In November 2009, the Council convened the Western Pacific Region Fishery Data Workshop. Its primary objective was to examine data gaps that could prevent the Council from meeting the mandates of the 2007 reauthorized MSA, particularly ACLs and AMs, and to consider catch shares. The workshop developed an inventory of the different monitoring and research conducted in the WPR. Participants gauged whether the quality of the data collected was robust enough to generate MSY and identified data gaps in catch, effort, life history and assessments (WPRFMC 2009).

The regional workshop highlighted the research conducted by the territorial agencies to provide information for stock assessments and defined priority species for ACL management. Many of the data gaps identified in the workshop could be traced back to the earlier workshops, indicating that the on-the-ground data collection had not evolved much. The technology for data entry and reporting may have evolved, but the basic data collection remained antiquated.

Altogether 28 recommendations emerged from the workshop. The overarching theme was the need for additional human and funding resources in the region if the Council were to address the ACL mandates by 2011 and to consider catch shares in future management.

6.3 Workshop on Establishing Annual Catch Limits for Coral Reef Fisheries (2011)

The coral reef ecosystem fisheries are the classic example of a data-limited situation. The fisheries are as diverse as the species harvested. Species-level catch and effort information is available for only a very few species. Life history data is scarce, and abundance data is available only from 0 to 30 meters. These shortcomings presented significant challenges for developing assessments on thousands of species in the Council's FEPs. The data-limited nature of coral reef fisheries was not unique to the WPR; it also occurred and continues to occur in the Caribbean, Gulf of Mexico and South Atlantic regions.

The Council convened the Coral Reef Fisheries ACL Workshop in February 2011. Participants included representatives from fishery management agencies, NMFS, researchers from the Universities of Miami and Puerto Rico, and staff members from the Caribbean, Gulf of Mexico and South Atlantic Councils.

The workshop's goal was to determine the underlying issues in implementing ACLs and AMs for data limited coral reef fisheries. Given the lack of available data, the workshop was to provide advice to the RFMCs on what types of assessments could be used and the control rules that could be applied to specify ACLs.

The workshop served as an information exchange among the regions on how each planned to implement ACLs and AMs. The data-limited situation constrained the ability to develop CPUE-based assessments. Many of the acceptable biological catch control rules used were from data limited methods and average catch approaches. The workshop advised 1) using a simplistic approach for data-limited fisheries; 2) conducting an inventory of data and life history information; 3) utilizing existing management measures to augment ACLs, and 4) considering the removal of rare species and those predominantly caught in state/territorial waters a management unit species. More importantly, the workshop advised the Councils to improve data collection and life history data (WPRFMC 2011).

> "Use simplistic approach for data limited situation."

The Council was under pressure to complete the ACL specification for all of the management unit species in the four FEPs by 2012. The main Hawaiian Island Deep 7 bottomfish complex was the only non-pelagic fishery to have a stock assessment. Since there was no stock assessment for coral reef species, the Council worked with its SSC and coordinated with PIFSC to apply the average catch approach to family-level groupings to set acceptable biological catches. The Council, through the Cooperative Agreement with the Coral Reef Conservation Program (CRCP), partnered with Hawaii Pacific University to develop stock assessments for federally managed coral reef species, to address data methodologies and to explore the utility of the data-limited methods to specifying harvest limits for ACL specification purposes (Table 2).

As the Council progressed on developing stock assessments and methodologies for the data-limited fisheries, the PIFSC Stock Assessment Program ramped up its assessments, expanding beyond the Deep 7 bottomfish. Between 2015 and 2017, PIFSC generated species-level reef fish stock assessments for 27 main Hawaiian Island species (Nadon 2017) and 12 Guam species (Nadon 2019) using the length-based spawning potential ratio approach (Nadon et al. 2015).

6.4 Hawai'i Non-Commercial Data Workshop (2011)

The 2007 reauthorization included establishment of a National Saltwater Angler Registry and improvements to the Marine Recreational Fishery Statistics Survey. To facilitate these improvements recommended by the

Table 2: List of stock assessment work to acquire information needed for ACL management.

REFERENCE	PROJECT
Thomas 2011	Kona Crab Assessment
Walker et al. 2012	Estimation of the Noncommercial Catch in the WPR
Thomas 2013	Guam Reef Fish Productivity and Susceptibility Analysis
Pardee 2014a	Hawai'i Parrotfish Assessment
Pardee 2014b	CNMI Reef Fish Productivity and Susceptibility Analysis
Maciasz 2014	Hawai'i Kumu Assessment
Sabater and Kleiber 2014	Augmented Catch-MSY Approach to Fishery Management in Coral-Associated Fisheries
Pardee 2015a	Am. Samoa Reef Fish Productivity and Susceptibility Analysis
Pardee 2015b	Estimating Sustainable Yields for Data Limited Coral Reef Fishery in CNMI
Pardee 2016a	Feasibility Study for Age-based Stock Assessment for the Main Hawaiian Island Deep 7 Bottomfish
Martell 2015	An Integrated Catch-MSY Model for Data-Poor Stocks
Rudd and Martell 2016	Updates to the Age-Structured, Integrated Catch-MSY Assessment Approach
Remington and Field 2016	Evaluating Biological Reference Points and Data-Limited Methods in Western Pacific Reef Fisheries
Remington 2018	Evaluating Biological Reference Points and Data-Limited Methods in Commercial Reef Fisheries of the Main Hawaiian Islands
Kent 2017	Testing the Feasibility of a Catch Projection Methodology and Enhancement of Monitoring of the Coral Reef Fisheries of the WPR
Pardee 2016b	Data Limited Assessments of American Samoa Coral Reef Fishery
Pardee 2017a	Initial Stock Assessment of the Hawai'i Palani (*Acanthurus dussumieri*) Fishery
Pardee 2017b	Assessment of the Hawai'i White Ulua Fishery
Rudd 2019	Evaluating Options for Assessment and Management of Coral Reef Fish

National Research Council, NMFS established MRIP to provide national estimates of recreational catch.

On Dec. 7, 2011, the Council convened the Hawai'i Noncommercial Data Collection Workshop. The objectives of this workshop were to 1) develop regional priorities and proposals for funding (through MRIP and other sources) to ascertain the noncommercial universe; 2) determine the noncommercial component of Hawai'i fisheries, and 3) collect data from noncommercial fisheries in Hawai'i.

Participants presented their agency's efforts in collecting and reporting on noncommercial fisheries estimates. Some projects, like HMRFS, were conducted regularly with support from both the State and MRIP. Federal regulations required noncommercial permit and reporting for bottomfish. Other projects were intermittent depending on funding, such as Hawai'i socio-economic surveys and pilot projects to estimate the noncommercial participants in Hawai'i.

The workshop had three recommendations: 1) develop a regionally based survey to qualify for an exemption to the National Saltwater Angler Registry; 2) determine the weakness of HMRFS and determine what is needed to fix the issue; and 3) determine the primary goal of the noncommercial data collection.

Subsequently, the State of Hawai'i opted to not seek an exemption from the national registry and instead to pursue improving the HMRFS survey and conducting MRIP pilot projects for a possible fisherman certification program. Hawai'i is still struggling with getting a good handle on the noncommercial universe.

6.5 Data Collection Improvement Workshop

The Coral Reef Fisheries ACL Workshop highlighted the lack of data to support proper implementation of the MSA ACL requirement and the need for action to address those gaps. There was a general recognition that WPR fisheries remained in a data-limited situation despite numerous attempts to improve the region's data collection system. On Dec. 13–15, 2011, the Council convened the Workshop on Improving Fishery Data Collection in the Western Pacific to address the root issues and challenges that caused the data limited situation to persist. This workshop recognized the lack of concrete steps to attain data collection improvements (WPRFMC 2012). While needs were identified in previous workshops, the resulting plans did not specify tangible steps to address the needs.

The December workshop would rectify this by identifying agencies to commit to specified tasks and the grants that would fund the activities. Problems were categorized as institutional, community, sampling, regulatory and interagency relationships. The prioritized issues were examined in detail, and solutions with appropriate on-the-ground steps to attain them were identified. The cost and timeline of the solutions were estimated. Identified issues were prioritized according to importance, impact on data quality and quantity, and attainability of the potential solutions. Leaders of the local fishery management agencies who participated in the workshop expressed their commitment and support to improving the data collection in their respective jurisdictions. The federal partners—the Council, PIFSC and U.S. Fish and Wildlife Service (USFWS)—also expressed their intent

Fig. 11. The Technical Subcommittee that worked on the Fishery Data Collection and Research Committee Strategic Plan.

to support the data collection improvement effort in the best way possible (WPRFMC 2012).

The workshop generated several tangible outcomes: 1) a base document to gauge how much has been accomplished since the workshop; 2) restructuring of the data collection governance body that provides data collection improvement updates; 3) commitments to work on the actions by individual agencies and coordination with the data collection governance body; 4) a regular funding stream to support agreed-upon improvement projects; 5) an omnibus proposal covering multiple data collection improvement projects to be partitioned to whatever funding mechanism became available; and 6) an agreement to share data.

6.5.1 Governance Body Restructuring

The commitments expressed by the agency participants at the 2011 Data Collection Improvement Workshop was the impetus behind the restructuring of the data collection governance body. The FDCC had devolved over the years to annual meetings to address budget allocations. In 2013, the Council at its 158th meeting recommended formation of the Fishery Data Collection and Research Committee (FDCRC) to replace the FDCC, which has become dormant. The FDCRC followed the same FDCC membership except that USFWS Wildlife and Sport Fish Restoration (WSFR) was included in the membership because it provides the most significant share in funding the territorial data collection. The NMFS Pacific Islands Regional Office (PIRO) was invited to become a member of the FDCRC but deferred to PIFSC for representation. The FDCRC broadened its scope to not only collection of data but also coordination and monitoring of research in the region to address the discovery at the 2009 workshop that the parties are unaware of the extent of research occurring in the territories.

The FDCRC Technical Subcommittee developed a strategic plan (FDCRC 2014) that was approved by the FDCRC members (fig. 11). The plan attempted to enhance the fishery data collection programs in the territories and Hawai'i to address the data-limited situation and improve the local and federal data quality standards. It identified how each agency pursues each task specified in the plan. The directors of the fishery management agencies and federal partners signed the plan. Annual updates are provided during FDCRC meetings to monitor progress in addressing the tasks. To date, the Council and federal partners have actively pursuing the tasks described in the plan, and the territories have addressed some of the priorities by developing project proposals.

6.5.2 Funding Stream for Projects

In March 2012, at the Council's 153rd meeting in Saipan, CNMI, staff presented the 2011 Data Collection Improvement Workshop summary and recommendations and highlights of the region's data-limited situation and the creel survey evaluation conducted by InfoDesign Hawaii. The meeting became a pivotal moment in the region's data collection history due to the attendance of NMFS Deputy Assistant Administrator for Regulatory Programs Samuel Rauch III, who is in charge of the proper implementation of ACLs (fig. 12). The Council generated several recommendations to NMFS to provide funding for several data collection improvement projects. An omnibus proposal for data collection improvement pilot projects was drafted and reviewed by WPacFIN prior to submission to NMFS.

In June 2013, NMFS created the Territorial Science Initiative (TSI) as a direct result of the 153rd Council meeting's unveiling of the region's long history of data collection challenges and the lack of funding support for fishery-dependent data collection over the years. Funding has been from a patchwork of sources including the USFWS–WSFR for the on-the-ground collection (but limited to the recreational fisheries mostly through the shore-based survey), the Interjurisdictional Fisheries Act funding from PIRO for the boat-based commercial fisheries, WPacFIN for the data

Fig. 12. Pictured at the 153rd Council meeting in Saipan are (*seated l to r*) then CNMI Gov. Benigno Fitial and Council Executive Director Kitty M. Simonds and (*standing l to r*) Council Members Ray Tulafono and Arnold Palacios, Council Chair Manny Duenas and NMFS Deputy Assistant Administrator for Regulatory Programs Samuel Rauch III.

Table 3: Pilot projects and their funding sources.

YEAR	PROJECT	FUNDING SOURCE
2013	Supplemental support for the DMWR boat-based creel survey	SFF3
2014	Pilot creel surveys at unsampled ports and shoreline to calibrate adjustment factors in the expansion of catch, effort, and CPUE from the existing creel survey in the Commonwealth of Northern Mariana Islands: data collection in Tinian	SFF3
2015	Determining coverage requirements and statistically-valid minimum sample size for all fisheries in the Western Pacific region	CRCP (Phase 1) SFF5 (Phase 2)
2015–2018	Fishermen and vendor incentive and outreach programs to enhance participation in creel surveys and vendor reporting	TSI
2016	Review and optimization of existing 30-year creel survey data using statistical models to attain standardized catch, effort and CPUE for stock assessments	CRCP
2016	Developing biological reference points for priority species or species groups using fishery-dependent and fishery-independent data to facilitate species status determination	CRCP
2016	Survey of the Guam naval base not covered by the DAWR survey	MRIP
2017	Developing a survey methodology to capture rare fishing events and methods	MRIP
2018	Developing automated annual fishery status report modules, online status reporting, and ACL monitoring reports	CRCP
2018	Alternative estimation methods for the annual catch of federally managed species in the Western Pacific	SFF4
2018	Estimating the noncommercial catch in the Marianas spear fishery through club-based reporting	MRIP
2019–2020	Development of a territorial electronic reporting system	TSI

processing and supplemental funds from the Council to fill in the gaps.

TSI's purpose is to increase locally based science, build local scientific and monitoring capabilities and enhance fisheries science capacities in the territories. This initiative would provide much-needed support to bolster the ability of the territories to gather accurate and timely fishery information for management. TSI became a temporary line item folded into the permanent Expanded Annual Stock Assessment budget, which is dedicated to supporting the territories in enhancing data collection and research to support ACL implementation. The funding is piped through PIFSC to support additional manpower in the territories for the collection of data. In 2015, the Council began receiving a portion of the TSI to augment the on-the-ground data collection, and, in 2017-2018, TSI became a category under the Saltonstall-Kennedy grant reserved for the territories.

As it became clear that no single source would fund all of the recommended data collection improvement projects, the Council pursued several grant opportunities, including the CRCP, Sustainable Fisheries Fund (SFF), TSI and MRIP (Table 3).

6.6 Pacific Island Fisheries Monitoring and Assessment Planning Summit (2019)

Decades of data workshops and attempts to find the holy grail of data collection systems yielded mediocre returns. Even after years of ACL implementation, the region continued to suffer from a data-limited situation. The release of the 2019 Territorial Bottomfish Management Unit Species Benchmark Stock Assessment by PIFSC was the latest blow. It found the American Samoa fishery to be subject to overfishing and the American Samoa and Guam stocks to be overfished.

Despite the lack of a data workshop to involve the communities before development of the assessment, the assessment passed the peer-review process and the SSC accepted it as the best scientific information available because it was an improvement from the previous assessment. However, the same could not be said for the data used in the assessment, which came from the territories' creel surveys that had undergone numerous unsuccessful attempts at data collection improvement. The territories were victim to the adage: "It is the best scientific information available because it's the only information available." This was a serious wakeup call to improve the data; otherwise, the fishing communities would suffer. The Council and NMFS agreed that the review of the territorial data collection elements was paramount. NMFS had conducted programmatic reviews of WPacFIN but not of the on-the-ground data collection.

> "It is the best scientific information available because it's the only information available."

A review had been conducted in 1992 by Joseph Powers from the SWFSC, who was coincidentally the Center for Independent Expert reviewer of the Territory Bottomfish Management Unit Species Benchmark Stock Assessment. Unfortunately, the Council has not been able to find or gain access to the 1992 review.

Another review to evaluate the implementation of the current data collection system in the territories was conducted by an independent Council contractor, InfoDesign Hawaii, in 2012.

The contractor shadowed the data collectors in American Samoa, Guam and CNMI over several shifts and conducted interviews with the data collectors and program managers on the program's historical implementation, issues and challenges. The creel surveys were design-based, and strictly following the design was crucial.

The surveys were conducted based on random-stratified selection of location and survey period. The participation and catch interviews were conducted only for the selected location and survey period. Data were then expanded on an annual level. The evaluation's conclusion indicated that the fishery data collection programs as implemented were not adequate to provide statistically valid estimates for the ACL implementation (Bak 2012). The surveys were originally designed to provide only a general sense of fishery performance and were not designed to capture the complex dynamics of the fisheries. The evaluation results showed that sources of errors and bias were introduced at multiple levels, thereby violating the survey design's assumptions. Moreover, the expansion algorithm used unverified assumptions and imputation methods that introduce an unknown level of uncertainty in the estimates.

The results of the creel survey evaluation surprised the territorial programs but not WPacFIN Central, which had highlighted issues of uncertainty in the estimation method as a need that the evaluation could address. These issues had also been noted in previous data workshops, which triggered a series of events that changed the data governance structure in the region. Internally, WPacFIN contracted InfoDesign Hawaii LLC to conduct a comprehensive data analysis of the territorial creel survey data set to get a handle on the extent of the variability and sources of errors and bias.

To fill the gap in the data collection review, the Council and NMFS convened the Pacific Island Fisheries Monitoring and Assessment Planning Summit (PIFMAPS) on Aug. 19–23, 2019, in Honolulu. Participants included the heads of the territorial fishery management agencies that implement the data collection programs with support from a technical staff and federal partners such as NMFS Pacific Island Regional Office and the USFWS–WSFR Program Grant, which provide federal funds for data collection (fig. 13). A panel of reviewers from the Pacific States Marine Fisheries Commission–PacFIN (Robert Ryznar and Jenny Sutter) and the SWFSC (Steve Turner) was commissioned to evaluate the data collection programs and provide recommendations on how to move forward.

The PIFMAPS review provided the following general recommendations: 1) optimize the creel survey design to meet the territorial and federal scientific and management needs; 2) engage MRIP for a review of the surveys; 3) require mandatory reporting for all fisheries, prioritizing the bottomfish fishery and mandatory licensing for fishermen and vendors; 4) promote electronic reporting; 5) increase timeliness of data submission; 6) link catch reports with dealer reports on a real-time basis; and 7) conduct a three-year calibration of the creel data with the commercial receipt books (Turner et al. 2019).

Additional recommendations addressed biosampling, organization and execution, communication and outreach, and electronic technologies. Overall, this workshop turned the tide for the region because all of the agencies that participated agreed to the recommendations and committed to follow through with them.

Fig. 14. Catchit and Logit logo.

Fig. 15. The owner of MJ Fishing in Saipan transcribes daily purchase receipts into the Catchit Logit app.

The Council and PIFSC have been working together to address the recommendations from the PIFMAPS workshop. To address the recommendations regarding mandatory and electronic reporting, the Council committed in 2019–2020 to support fishermen and fish vendors with their reporting needs. In collaboration with PIFSC and the territory fishery agencies, the Council developed the Catchit Logit Progressive Web Application (figs. 14 and 15). Catchit Logit users are able to provide accurate and timely data to fishery science and management agencies for real-time information to track catch against ACLs. Each account keeps a log of the fishery-dependent data and follows federal data confidentiality standards. Users immediately receive a summary of their individual data allowing them to monitor their fishery and sales performance.

Fig. 13. Regional participants of the Pacific Island Fisheries Monitoring and Assessment Planning Summit held in Honolulu in August 2019.

7. WHAT DOES THE FUTURE HOLD?

Fishery management has evolved considerably since promulgation of the MSA in 1976. Reauthorizations of the Act have increased the need for more fishery data, but the evolution of the data collection systems in the WPR has not kept up to meet the continually increasing federal requirements. More than four decades of trying different approaches to improve the fishery data collection have yielded minimal returns, and, as a result, the insular fisheries are still in a data-limited situation.

Yet, there are some positive signs for the future. WPacFIN has evolved its antiquated DBase4 to Microsoft Visual FoxPro system, which has been the main database system for several decades before it advanced to the MySQL database. WPacFIN has also undergone restructuring. PIFSC made the decision during the 173rd Council meeting in June 2018, attended by NOAA Assistant Administrator for Fisheries Chris Oliver. This internal restructuring is a fresh wind. For decades, WPacFIN has overseen the data submission and followups of the territorial data collection through various cooperative agreements. The current FDCRC and WPacFIN aim to increase the accountability of the territories in terms of their cooperative agreements and transparency in terms of priorities and direction. Two of the major grantors, the NMFS PRIO–Federal Programs and the USFWS–WSFR Programs, are members of the FDCRC, which creates an oversight of the regional data collection programs that could be used to leverage accountability.

Improving the WPR data collection situation has been a constant battle in which you win some and lose some due to various reasons intrinsic to the nature of the region and the working relationships of the agencies involved. The following case studies highlight one fishery where a cooperative working relationship has led to timely data and another fishery for which gathering data continues to be problematic.

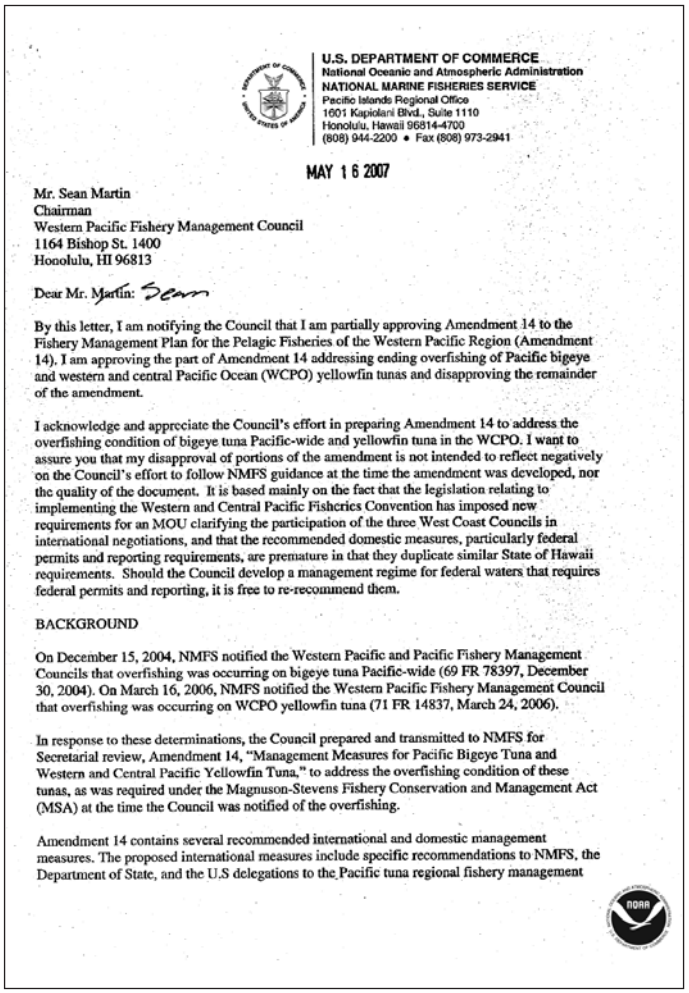
7.1 Deep-7 Bottomfish in the Main Hawaiian Islands

In 2003, Deep 7 bottomfish in the main Hawaiian Islands was declared to be subject to overfishing. Working together, the state and federal management of the fishery moved to a total allowable catch system (TAC) in 2007. However, monthly reports submitted by the bottomfish fishermen created uncertainty in the ability to close the fishery in federal waters without exceeding the TAC, especially in years when the TAC was low (e.g., 178,000 pounds in fishing year 2007–08). In partnership with DAR, the Council conducted 42 community meetings to address the management of the main Hawaiian Island bottomfish resources, which included scoping for moving reporting from a monthly to a trip level. In February 2010, DAR implemented its Online Fishing Report website, and, in September 2011, the State of Hawai'i replaced its requirement for monthly reports for main Hawaiian Islands Deep 7 botttomfish with a trip report requirement. Fishermen must report within five days of the trip end date. In this coordinated state-federal management of the fishery, managers exerted a significant amount of effort to plan, coordinate and provide outreach to engage all the parties involved and to get fishermen to report correctly at a level that will improve data, science, assessment and management.

7.2 Small-Boat Pelagic Fishery

Through the years, the Council and its SSC have recommended reporting requirements for all managed fisheries. In 2007, the Council attempted to require federal permit and reporting for the Hawai'i commercial small-boat (i.e., nonlongline) pelagic fishery as part of Amendment 14 to the Pelagic FMP to address domestic and international overfishing of Pacific bigeye and Western and Central Pacific yellowfin tunas. NMFS Pacific Islands Regional Administrator Bill Robinson informed the Council that the conservation and management measures for bigeye and yellowfin tunas in the amendment were approved while the federal permit and reporting measures were rejected, indicating they were premature and duplicative of the State of Hawai'i data collection (fig. 16; Robinson 2007). In response, the Council expressed its disappointment with the disapproval of the permit and reporting measures (fig. 17; WPRFMC 2007). The constant underreporting and lack of detailed information to implement a limited access privilege program and ACLs could have been resolved had these measures been approved.

Hawai'i continues to struggle to acquire data from the small-boat pelagic fishery. In 2020, as part of its review of the Pelagic FEP (formerly, FMP), the Council held a series of public meetings and a Fishers Forum that included discussion on the need for better data from this fishery, especially from the noncommercial sector. The Council, at its 183rd meeting in September 2020, noted the overall need for collaborative management with the State of Hawai'i in order for any regulation to be successful. The Council met in October 2020 with PIRO, PIFSC and the State of Hawai'i during which the parties agreed to work together to address data gaps and misaligned regulations.



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 944-2200 • Fax (808) 973-2941

MAY 16 2007

Mr. Sean Martin
Chairman
Western Pacific Fishery Management Council
1164 Bishop St. 1400
Honolulu, HI 96813

Dear Mr. Martin: Sean

By this letter, I am notifying the Council that I am partially approving Amendment 14 to the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (Amendment 14). I am approving the part of Amendment 14 addressing ending overfishing of Pacific bigeye and western and central Pacific Ocean (WCPO) yellowfin tunas and disapproving the remainder of the amendment.

I acknowledge and appreciate the Council's effort in preparing Amendment 14 to address the overfishing condition of bigeye tuna Pacific-wide and yellowfin tuna in the WCPO. I want to assure you that my disapproval of portions of the amendment is not intended to reflect negatively on the Council's effort to follow NMFS guidance at the time the amendment was developed, nor the quality of the document. It is based mainly on the fact that the legislation relating to implementing the Western and Central Pacific Fisheries Convention has imposed new requirements for an MOU clarifying the participation of the three West Coast Councils in international negotiations, and that the recommended domestic measures, particularly federal permits and reporting requirements, are premature in that they duplicate similar State of Hawaii requirements. Should the Council develop a management regime for federal waters that requires federal permits and reporting, it is free to re-recommend them.

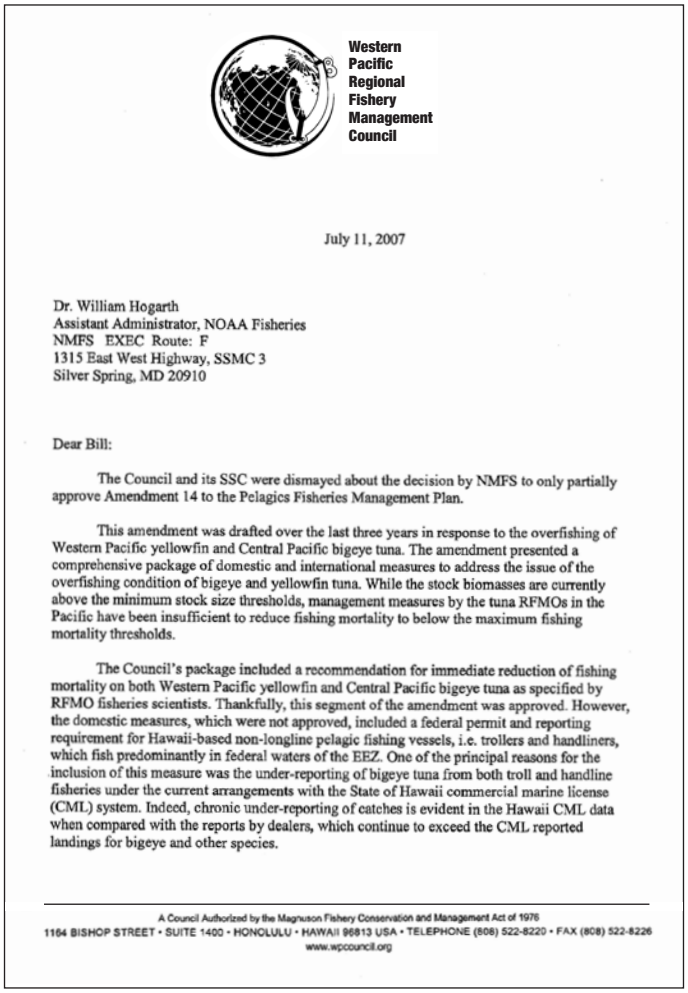
BACKGROUND

On December 15, 2004, NMFS notified the Western Pacific and Pacific Fishery Management Councils that overfishing was occurring on bigeye tuna Pacific-wide (69 FR 78397, December 30, 2004). On March 16, 2006, NMFS notified the Western Pacific Fishery Management Council that overfishing was occurring on WCPO yellowfin tuna (71 FR 14837, March 24, 2006).

In response to these determinations, the Council prepared and transmitted to NMFS for Secretarial review, Amendment 14, "Management Measures for Pacific Bigeye Tuna and Western and Central Pacific Yellowfin Tuna," to address the overfishing condition of these tunas, as was required under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) at the time the Council was notified of the overfishing.

Amendment 14 contains several recommended international and domestic management measures. The proposed international measures include specific recommendations to NMFS, the Department of State, and the U.S delegations to the Pacific tuna regional fishery management

Fig. 16. Official correspondence on the rejection of the federal permit and reporting measures in Amendment 14 to the Pelagic FMP.



Western Pacific Regional Fishery Management Council

July 11, 2007

Dr. William Hogarth
Assistant Administrator, NOAA Fisheries
NMFS EXEC Route: F
1315 East West Highway, SSMC 3
Silver Spring, MD 20910

Dear Bill:

The Council and its SSC were dismayed about the decision by NMFS to only partially approve Amendment 14 to the Pelagics Fisheries Management Plan.

This amendment was drafted over the last three years in response to the overfishing of Western Pacific yellowfin and Central Pacific bigeye tuna. The amendment presented a comprehensive package of domestic and international measures to address the issue of the overfishing condition of bigeye and yellowfin tuna. While the stock biomasses are currently above the minimum stock size thresholds, management measures by the tuna RFMOs in the Pacific have been insufficient to reduce fishing mortality to below the maximum fishing mortality thresholds.

The Council's package included a recommendation for immediate reduction of fishing mortality on both Western Pacific yellowfin and Central Pacific bigeye tuna as specified by RFMO fisheries scientists. Thankfully, this segment of the amendment was approved. However, the domestic measures, which were not approved, included a federal permit and reporting requirement for Hawaii-based non-longline pelagic fishing vessels, i.e. trollers and handliners, which fish predominantly in federal waters of the EEZ. One of the principal reasons for the inclusion of this measure was the under-reporting of bigeye tuna from both troll and handline fisheries under the current arrangements with the State of Hawaii commercial marine license (CML) system. Indeed, chronic under-reporting of catches is evident in the Hawaii CML data when compared with the reports by dealers, which continue to exceed the CML reported landings for bigeye and other species.

A Council Authorized by the Magnuson Fishery Conservation and Management Act of 1976
1164 BISHOP STREET • SUITE 1400 • HONOLULU • HAWAII 96813 USA • TELEPHONE (808) 522-8220 • FAX (808) 522-8226
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Fig. 17. Council response expressing dissatisfaction with the NMFS rejection of the Amendment 14 permit and reporting measures.

7.3 Funding the Future

Aside from the State of Hawai'i, funding support from the local governments for fishery data collection is minimal to nonexistent. Territorial data collection is almost 100% federally funded. And yet, the federal grantors do not have a strong voice in terms of influencing on-the-ground implementation of fishery data collection and ensuring the grantees are accountable and generate quality data.

Attempts to increase the funding for data collection has yielded variable results over the past four decades. PIFSC's attempt to increase funding for data collection in the territories (i.e., TSI) to $1 million dollars, to be shared with the Southeast Fisheries Science Center through the Expanded Annual Stock Assessment line item, did not fully materialize.[6]

One option on the table is to federalize the system. Federal permit and reporting could facilitate additional funding to support data collection. This would require cooperation between the federal and local fishery agencies to jointly implement the program. The cooperative agreements could include data sharing with the territory agencies.

There is a general agreement that the data available in their current state do not meet the federal mandate in managing the stocks under ACLs. Upgrading data collection to meet the higher federal standard would benefit the state and territories and fulfill their local fishery management needs. Stronger collaboration and partnership among the parties involved in the FDCRC would result in better data, better science and better management.

6. T. Todd Jones, director, PIFSC Fisheries Research and Monitoring Division, in discussion with the author, Nov. 19, 2020.

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Western Pacific Regional
Fishery Management Council
1164 Bishop Street, Suite 1400
Honolulu, Hawaii 96813
Tel: 808-522-8220
Fax: 808-522-8226
info.wpcouncil@noaa.gov
www.wpcouncil.org

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