

# Developing Certified Surveys for the Hawaii Marine Recreational Fishing Survey

## MRIP Workshop Summary Report

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## **Executive Summary**

A workshop was held at the NOAA Inouye Regional Center in Honolulu, Hawaii (May 28–30, 2019) to help develop certified surveys for the Hawaii Marine Recreational Fishing Survey (HMRFS). Currently, the intercept catch survey conducted by HMRFS is not MRIP-certified. Several past pilot projects (funded by MRIP) were conducted to design and test alternative survey methods for recreational fishing in Hawaii. The recent workshop in May 2019 provided an opportunity for all partners to review the pros and cons of the different pilot surveys. Staff members from NOAA Fisheries Office of Science and Technology presented the certified surveys currently used in the Atlantic and Gulf of Mexico States. In addition, there were presentations on creel surveys from the territories of the Pacific Islands Region (PIR; Guam, Commonwealth of the Northern Mariana Islands, and American Samoa), including recent pilot projects. During the workshop discussion, it was recommended that the survey for private boats adapt the MRIP-certified Fishing Effort Survey (FES) and the MRIP-certified Access Point Angler Intercept Survey (APAIS) for HMRFS certification. For the shore-based catch survey, it was suggested that the Pacific Islands Region (including Hawaii Division of Aquatic Resources, Western Pacific Regional Fishery Management Council, and NOAA Fisheries in the region) request MRIP certification of a roving survey design that can potentially be used for HMRFS. As the next step, a regional MRIP task team will be created to prepare the survey design documentation for the certification request.

## Background

A NOAA MRIP (Marine Recreational Information Program) project was funded in 2012 to review the current Hawaii Marine Recreational Fishing Survey (HMRFS) methodologies and evaluate improvement options. It was recommended that survey design improvements should focus on the private boat and shore-based modes only since the charter boat mode is covered by the State's commercial reporting system (Breidt et al. 2012; Ma et al. 2013).

An onsite roving survey, mail survey, and aerial survey were designed and tested for shore fishing in Hawaii as FY2013 and FY2014 MRIP projects (Ma et al., 2014; Ma et al., 2017a). Fishing effort and catch estimates were produced from the pilot roving and mail surveys and the estimates were compared with those from existing surveys (Ma et al., 2017a; Ma et al., 2018). For the private-boat mode, the survey design developed by MRIP and currently used in the Atlantic and Gulf of Mexico States was modified and tested in Hawaii (Ma et al., 2017b). The study indicated that implementation of a fixed time-block sampling design is feasible, at least on Oahu (Ma et al., 2017b; Ma et al., 2018). In 2018, it was proposed to host a workshop to develop a certified survey program for HMRFS. The proposal was based on the results of surveys tested in Hawaii and the US Pacific Islands Region (PIR), including recent MRIP projects and territorial creel studies in Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands (CNMI).

The proposed workshop was held in Honolulu at the NOAA's Inouye Regional Center on May 28–30, 2019 (see Appendix 1 for the workshop agenda). The workshop participants included scientists, managers, and survey statisticians from NMFS (Office of Science and Technology (OST), Pacific Islands Fisheries Science Center (PIFSC), Pacific Islands Regional Office (PIRO), and Southeast Regional Office), Hawaii Division of Aquatic Resources (HDAR), Western Pacific Regional Fishery Management Council (WPRFMC), and the US PIR territories (American Samoa, Guam, and CNMI). MRIP consultants with expertise in survey statistics also participated in the workshop and provided advice.

## Workshop Summary

The intent of this summary is to document the discussions and salient points of the workshop.

### *Day 1 (May 28)*

In the welcome and introduction session, Dr. Joseph O'Malley represented the PIFSC leadership to welcome the workshop participants and outlined the workshop objectives. During the morning session, Dr. Dave Van Voorhees (OST) provided an overview of the MRIP certification and transition planning process (Appendix 2). Overall, the transition approach includes:

1. Review/evaluation of the current survey design
2. Developments of improved survey designs
3. Pilot testing
4. Peer review of the improved survey designs
5. Transition to implementation

The proposed survey designs can be certified if they are statistically valid and key assumptions of the designs are reasonable. The MRIP Transition Team develops and executes appropriate transition plans for implementing new certified survey designs selected for implementation by a Regional Implementation Team.

Dr. Tom Sminkey (OST) presented the new design of the Access Point Angler Intercept Survey (APAIS), which has been certified and implemented in the Atlantic and Gulf of Mexico States (Appendix 3). The new survey is based on a fully formalized probability sampling design. There are several improvements over the previous Marine Recreational Fisheries Statistics Survey (MRFSS) APAIS, including improved temporal stratification (6-hour time intervals) and increased geographic stratification (state sub-regions). The MRIP Fishing Effort Survey (FES) replaced the previous Coastal Household Telephone Survey (CHTS) in 2018. The new FES is a self-administered mail survey utilizing angler registries (Appendix 4). The USPS database of mailing addresses is the sample frame and the addresses from the National Saltwater Angler Registry (NSAR) are auxiliary. Addresses drawn from USPS that are matched to NSAR are all retained as well as a random subsample of the unmatched addresses. The FES sampling is also stratified by geographic proximity to the coast.

During the morning session, Marlowe Sabater (WPRFMC) also described the main contents of the Pacific Islands Regional MRIP Implementation Plan (PIR MRIP Ad-hoc Steering Committee, 2017).

In the afternoon, Tom Ogawa (HDAR) provided an overview of HMRFS. HMRFS was part of MRFSS when it started in the late 1970s (Appendix 5). The initial HMRFS only lasted for a short period of time and was then reestablished in 2001. The current HMRFS includes shore fishing and private boat fishing. The Fishing Effort Survey (mail survey) follows the national MRIP design even though there are only a limited number of anglers currently registered with NSW in Hawaii. The new APAIS design has not been used by HMRFS. There have been several MRIP projects in Hawaii which addressed potential improvements of the current recreational fishing data collection design. Dr. Hongguang Ma (PIFSC) presented results from

these projects, including the pilot roving survey for shore fishing and pilot survey for private boat fishing (Appendix 6). Catch and effort estimates from the roving survey, pilot private-boat survey, and mail survey were produced and compared with current surveys in HMRFS. There were limitations in the spatial coverage of the aerial survey tested on Oahu due to the restrictions from airports and military bases. Tom Ogawa provided comparisons of the surveys tested and listed major limitations in the current HMRFS survey methodologies (Appendix 7). He then presented some initial ideas about potential survey design changes.

Following the presentations, initial discussions on various survey options available for HMRFS were considered. The options included:

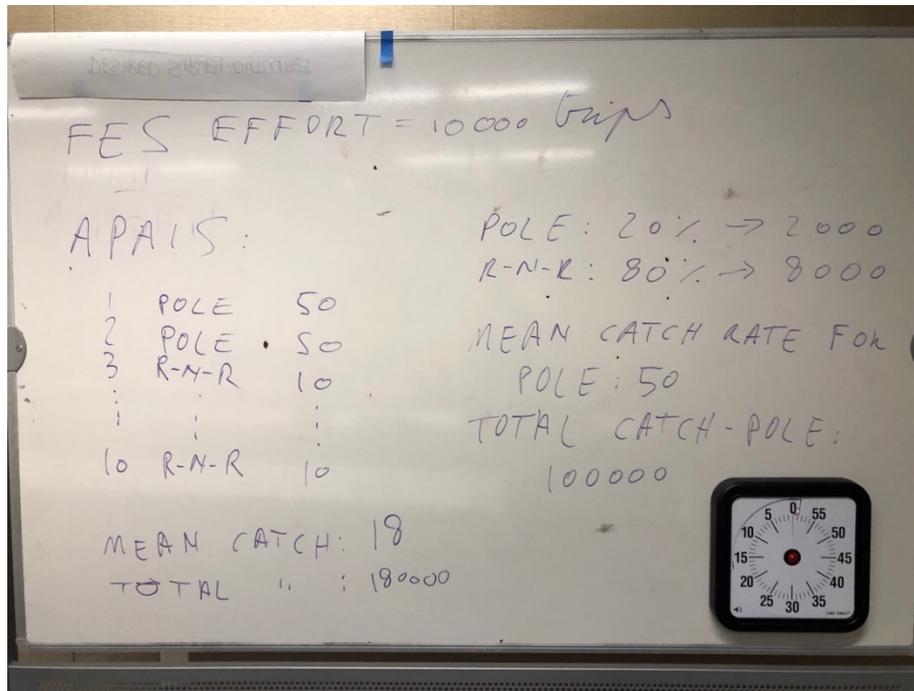
1. Access point angler intercept survey (APAIS) certified by MRIP for private boat and shoreline fishing
2. Fishing effort survey (FES, mail survey) certified by MRIP for private boat and shoreline fishing
3. Roving shoreline catch survey, tested by MRIP (Hawaii project study)
4. Roving shoreline effort survey, tested by MRIP (Hawaii project study)
5. Mail survey for shoreline fishing effort, tested by MRIP (Hawaii project study)
6. Mail survey for boat-based fishing effort, tested by MRIP (Hawaii project study)
7. Aerial survey for shoreline fishing effort, tested by MRIP (Hawaii project study)
8. Private boat intercept survey, tested by MRIP (Hawaii project study)

Options 1 (APAIS) and 2 (FES) have already been implemented in the US Atlantic and Gulf of Mexico States. The FES has been implemented in Hawaii as well. The pilot-tested private boat survey (option 8) was modified from the MRIP-certified APAIS (option 1). Catch for the entire boat (instead of individual catch) was collected for the pilot study. The pilot mail surveys for shoreline fishing (option 5) and private-boat fishing (option 6) used all household addresses on Oahu and addresses in the state vessel registry (registered with the Hawaii Division of Boating and Ocean Recreation) as sample frames, respectively. The mail survey for shore fishing effort on Oahu had reasonable coverage of night fishing and fishing from private and restricted areas.

The roving effort survey for shore fishing (option 4) did not cover remote and private/restricted areas nor night fishing activities. Thus, using roving survey alone to estimate total fishing effort in Hawaii would produce incomplete estimates mainly due to access limitations and limited temporal coverage. The aerial survey (option 7) tested on Oahu was not able to provide precise estimates for the proportion of fishing activity missed by the ground-based roving surveys. The average effort (effort per segment) and trip characteristics (such as proportion of trips using different gear types) may be estimated from the roving survey. The roving catch survey also has some advantages over the traditional access point intercept survey. For instance, interviews can be conducted during incomplete fishing trips and a surveyor can cover a broader area to obtain catch interviews.

Day 2 (May 29)

At the beginning of the morning session, MRIP statistical consultant, Dr. Jean Opsomer (Westat), demonstrated how catch from different gear types can be estimated even when gear-type information is not collected in the fishing effort survey (Figure 1). Assuming the proportion of trips from different gear types based on the onsite intercept survey represents the true trip characteristics, the total expanded fishing effort can be partitioned into fishing effort of different gear types. The product of gear-specific catch rate (estimated from the onsite intercept survey) and fishing effort by gear provides the catch estimates for different gear types.



**Figure 1. Dr. Opsomer's notes showing how gear-specific catch can be estimated with a domain estimation method. A domain is any subpopulation of interest for producing estimates. An estimation domain may or may not be a stratum, which is a subpopulation that is identified prior to sampling (Breidt et al., 2012). Fishing gear types are usually not used for stratification because the gears used by fishers are often unknown until the survey is conducted.**

The morning session also included presentations on current surveys and pilot surveys (funded by MRIP and the Territorial Science Initiative) in Guam, CNMI, and American Samoa. Dr. Kimberly Lowe (PIFSC) provided an overview of the surveys currently conducted in the US PIR territories. The surveys are administrated by the Guam Division of Aquatic and Wildlife Resources (DAWR, Department of Agriculture), the CNMI Division of Fish and Wildlife (DFW, Department of Lands and Natural Resources), and the American Samoa Department of Marine and Wildlife Resources (DMWR). The shore-based effort and catch surveys used by these territories utilize a roving survey design to collect fishing effort and catch information. The boat-based survey is mainly an access point survey by design. Michael Quach (PIFSC) used Guam as an example to demonstrate how the shore-based and boat-based surveys are scheduled and implemented. Toby Matthews (University of Hawaii) showed how survey data are used to estimate fishing effort and catch in Guam. For the boat-based survey, fishing effort and catch are

estimated by fishing method (e.g., trolling, bottom fishing, spearfishing etc.), type of day (week day vs weekend), port, and charter/non-charter. For shore-based surveys, the estimates are separated by fishing method (e.g., hook & line, cast net, gillnet, spear, etc.), type of day, region (for hook & line only, which is the dominant fishing method), and time of day (day or night). The boat fishing effort is measured as the number of vessel trips and catch rate is measured as catch per vessel trip. For the shore-based survey, fishing effort is measured as gear hours and catch rate as catch per gear hour. Catch is estimated as the product of fishing effort and catch rate in each estimation domain.

Brent Tibbatts (Guam DAWR) presented the results of two Guam creel pilot studies. For the boat-based survey in Guam, expert-informed adjustment factors are used to account for fishing activities missed by the effort surveys, which do not cover the full 24 hours of a survey day. For the pilot studies, surveys were conducted during “additional” shift times to complement regular shift times, together covering all 24 hours. At most, 15% of the vessel trips were missed during the regular shift times and there were no indications that the expert-informed adjustment factors are not appropriate. In Guam, an aerial survey is used to estimate fishing effort in inaccessible areas that are not visited by the ground-based roving effort survey. The aerial survey data analysis indicated that an average of 90% of gear counts occurred within the region covered by the roving effort survey. The coverage rate of the ground-based roving survey was rather consistent (SD = 3.2%) over the years.

Marlowe Sabater (WPRFMC) then presented three pilot projects (in the US PIR territories) funded by MRIP including 1) estimating catches from non-surveyed areas, 2) documenting rare event fisheries (seasonal fisheries or rare fishing methods), and 3) investigating how self-reporting of catch and effort for the non-commercial spear fishery could work.

In the afternoon a discussion session was facilitated by Dr. Kirsten Leong (PIFSC). The strengths and limitations of various survey methods were discussed. It was noted that the current HMRFS intercept surveys do not include invertebrate catch. The estimated non-commercial catch of octopus, opihi, kona crab, and other invertebrates is of interest to Hawaii’s fisheries management and for stock assessments. It was suggested that invertebrate catch could be included in the HMRFS intercept survey, since trips catching finfish and invertebrates overlap. In the effort survey (FES), the number of finfish trips and invertebrate fishing trips can be specifically asked. To properly estimate total catch of invertebrates, the sample frame for APAIS would need to include sites where fishing for invertebrates and finfish occur. The state of Hawaii is particularly interested in area-specific shoreline fishing information, which is not adequately captured by the current HMRFS APAIS. The aerial survey tested on Oahu in 2015 was conducted in an attempted to account for the under-coverage of the ground-based roving survey. Russell Sparks (aquatic biologist in Maui, HDAR) suggested that data from aerial surveys may help guide local fisheries management.

Results from the pilot mail survey on Oahu (in 2015) for shore-fishing effort indicated that night fishing accounted for more than one third of the total trips for rod and reel (the major gear type). Currently, HMRFS catch interviews are only conducted during daylight hours. Dr. Lesser (Oregon State University), an MRIP statistical consultant, indicated that night-time catch interviews were needed to compare the catch rate and composition between day and night time fishing activities. Even though it is challenging, obtaining catch interviews from remote locations

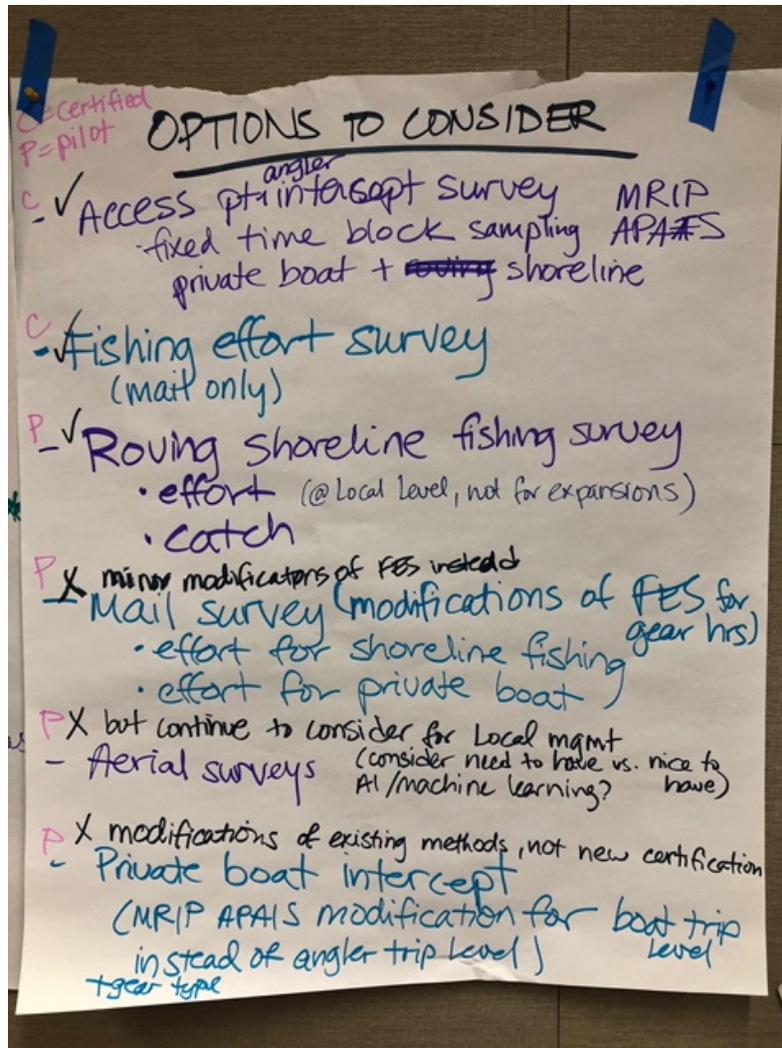
or private/restricted areas are needed to evaluate whether catch rate and catch composition from these un-sampled areas are similar to these covered by the current onsite catch survey.

Charter boat captains and operators in Hawaii are required to have a commercial marine license and submit monthly fishing reports to HDAR. According to Dr. Van Voorhees, MRIP is currently exploring a survey design that combines mandatory reporting with dockside intercepts. The survey design employs a capture-recapture method (logbook reporting as capture and dockside intercepts as recapture) to account for unreported trips and misreported catch in the logbook. This approach could be used to adjust the charter fishing trip and catch information from the State of Hawaii's commercial fishing report system.

For the shoreline catch survey in Hawaii, it was recommended that the Pacific Islands Region (including partners from the state, regional council, and PIFSC/PIRO) request MRIP to certify a roving survey design that could be used in Hawaii as well as other similar areas in the region or other regions. Once the roving survey is certified by MRIP, it will then be eligible for MRIP funding. The certified survey design can then be included in the regional MRIP implementation plan to justify funding and implementation.

#### *Day 3 (May 30)*

On the third day, the discussion of options for replacement of the existing HMRFS private boat surveys continued, focusing on potential modifications to the intercept interview questionnaire (Figure 2). In the proposed modified APAIS, catch data would be collected from a vessel trip rather than from individual anglers. Catch rate can still be estimated as catch per angler trip (when the number of fishers on the vessel is known) to be consistent with the effort unit from the FES. The MRIP-certified FES that is currently used in Hawaii could also be modified to include trips for invertebrate fishing. The proposed modifications will need to be documented in the transition plan and submitted to MRIP for review/approval prior to their implementation.



**Figure 2. Flip-chart discussion notes regarding the survey options that can be used for HMRFS.**

Also discussed was the formation of a regional implementation/transition subgroup, which will be tasked with preparing the certification documents. The first step of the preparation will be to formalize the roving survey methodology with detailed descriptions of the survey design, pilot test results, and feasibility assessment. Also included in the description will be how the sampling is executed, the estimates are produced, and how the QA/QC is accomplished. The State’s objectives will be included so that the reviewers have a better understanding of what the State wants to accomplish with the survey data. For MRIP estimation at a national level, gear information is not used to produce standard estimates of total catch by species, in domains defined by fishing mode (shore fishing or private boat fishing) and primary area of fishing (inland, ocean 3 miles or less from shore, and ocean more than 3 miles from shore). However, the State indicated that gear-specific catch is useful for fisheries management at a local level (state or regions within the state). Dr. Opsomer noted that gear-specific effort information would be difficult to collect from the mail survey (effort survey) but data from the APAIS could be used to estimate gear-specific effort and catch. Identifying the data elements needed for this

purpose would be helpful. The certification request document will then be peer reviewed and revised as needed before being presented to NMFS leadership for final approval.

Transition planning for the implementation of the certified survey designs will need to consider the importance of benchmarking new survey designs against legacy survey designs. Also, calibration methods may need to be developed to convert legacy catch estimates so that they are comparable to those produced by the new surveys. However, calibrations will be needed only if the estimates of effort and/or catch per unit effort are significantly different between the two surveys. For the roving survey design, if the design tested in the pilot study is proposed for certification, the results from the pilot study could potentially be used for evaluation purposes. The transition team will have partners from HDAR, NMFS, and WPRFMC.

At the end of the workshop, there was some discussion on a potential review of territorial surveys by MRIP. The MRIP statistical consultants indicated that they would focus on reviewing whether the current survey design is statistically valid and if there are problems with implementing of the survey design. Issues related to basic operations (e.g., purchasing, staffing, and transportation) but not related to the survey design can also be included in the document as additional information.

In summary, the workshop participants encouraged the region to quickly form the regional MRIP task team. This team will prepare the documents to be submitted to MRIP proposing new methodologies for data collections (i.e., a roving survey design) or/and modifications to currently certified survey designs, for consideration of certification/approval. For the modification of the MRIP-certified FES and APAIS, it was recommended that the OST staff responsible for these survey components provide input to the modified survey questionnaires. Progress from the working group(s) can then be reported to a larger group to get additional input. Some members of the PIR MRIP Ad-hoc Steering Committee will meet in late August 2019 and plan on the initial steps.

## **Acknowledgements**

The list of workshop participants in Appendix 1 only included those who were invited and were in attendance the workshop. Annie Yau (previously with PIFSC) helped with the workshop planning. Dave Hamm (PIFSC retiree) and many staff members of the Western Pacific Fishery Information Network (WPacFIN, PIFSC) attended part of the workshop and contributed to the discussion on the roving surveys conducted in the US PIR territories. Kirsten Leong, Stefanie Dukes, and Sarah Stephenson shared the notes taken at the workshop. Felipe Carvalho (PIFSC) reviewed an early version of the report and provided helpful comments.

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## Appendix 1—Develop Certified Surveys for HMRFS (Workshop Agenda)

NOAA Inouye Regional Center  
(May 28-30, 2019)

Primary Objective: Identify/develop survey options for the Hawaii Marine Recreational Fishing Survey (HMRFS) that can be certified under NOAA Fisheries Marine Recreational Information Program (MRIP). The intercept survey in Hawaii has currently not been certified by MRIP. The certification process can include identifying components of HMRFS that are currently certifiable, incorporating other certified survey methods from other regions, incorporating uncertified methods pending MRIP approval, and exploring areas that may require more analysis or testing to become certifiable. This workshop is the continuation of previous MRIP workshops held in Hawaii.

Secondary Objective (as time permits): Provide an opportunity for Territorial participants to meet with MRIP staff and MRIP statistical consultants to discuss the Territorial surveys.

### May 28 (Tuesday)

**Welcome and introduction: 8:45-9:00**

**Morning Session: 9:00-12:00**

*In addition to introducing the context of this workshop with respect to MRIP and the Pacific Islands regional planning process, this section provides an over view of survey methods that have been certified and implemented by MRIP in the Atlantic and Gulf of Mexico States, for consideration as to whether or not these should be adopted by HMRFS.*

- MRIP – National overview and description of the certification process (presenter: Dave Van Voorhees)
- Pacific Islands Region MRIP Regional Implementation Plan (Marlowe Sabater)
- MRIP intercept surveys: Certified survey methods in Gulf and Atlantic areas (Tom Sminkey)
- MRIP fishing effort survey and other certified surveys (Dave Van Voorhees/Rob Andrews)
- Discussion on the applicability of the presented surveys for Pacific Islands Region (HMRFS and MRIP participants)

### **Afternoon Session: 13:00–16:30**

*This section will provide an overview of current HMRFS methods, and survey methods pilot tested in Hawaii to solicit feedback from MRIP staff on current HMRFS operations.*

- HMRFS overview (Tom Ogawa)
- MRIP pilot project studies in Hawaii (shore roving catch/effort survey, aerial survey, mail survey, and private boat intercept survey) (Hongguang Ma/Tom Ogawa)
- Discussion on the designs and lessons learned from the pilot studies in Hawaii (led by MRIP statistical consultants)

*Alternative survey options for HMRFS*

- Discussion to agree on an initial recommendation as to what survey options that are certifiable by MRIP can be considered for adoption by HMRFS. Options include surveys already certified in other regions, surveys recently pilot tested in the Pacific Islands region, and others. Factors to be considered include survey designs and scalable costs. The recommendations will be revisited and updated with more details on Day 2.

### **May 29 (Wednesday)**

(Agenda items not completed from the previous day will be continued)

### **Morning Session: 9:00–12:00**

*This section will provide information presentations on pilot projects in Guam, CNMI, and American Samoa. The purpose is to present participants with additional survey options for consideration as they recommend next steps for HMRFS certification.*

- Fishing surveys in Guam, CNMI, and American Samoa—overview and survey expansion (Kimberly Lowe/Michael Quach/Toby Matthews)
- Territorial Science Initiative (TSI) projects for territorial surveys (24-hour fishing effort survey and analysis of aerial survey data) (Brent Tibbatts/Toby Matthews)
- Territorial MRIP projects including a) pilot surveys at un-sampled ports and shoreline of Guam, b) developing specialized surveys for rare fishing methods/events (pulse fishery, seasonal runs), and c) spear fishing registry and reporting system ( Marlowe Sabater)

### **Afternoon Session: 13:00–16:30**

*Continued discussion on identifying paths to certify HMRFS under MRIP. The goal is to develop final recommendations on how to move forward with certifying HMRFS under MRIP.*

- Enumeration and discussion of lessons learned (facilitated written listing)
  - a. Strengths/limitations of various survey methods tested (MRIP projects, pilot studies)
  - b. Are there territorial survey methods useful for HMRFS to consider?

- Planning the step-wise certification process for the selected HMRFS surveys
  - a. Are there current components of HMRFS that are certifiable by MRIP?
  - b. Are there certified survey methods around the country that would be useful for HMRFS to consider implementing?
  - c. Are there survey methods currently being used/tested by HMRFS or the territories that may be certifiable in the future, and if so what specific steps need to be taken to ensure these methods can be certified in the future?

## May 30 (Thursday)

Agenda items not completed the previous day will be continued

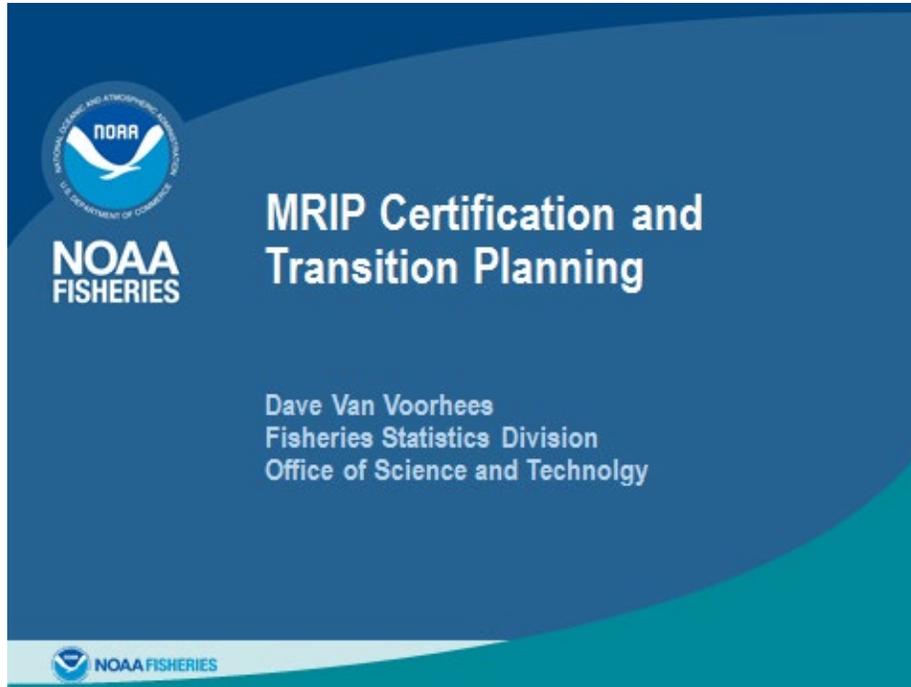
*Once the primary objective has been completed, this section will provide an opportunity for Territorial participants to meet with MRIP staff and statistical consultants to discuss the Territorial surveys.*

## List of participants

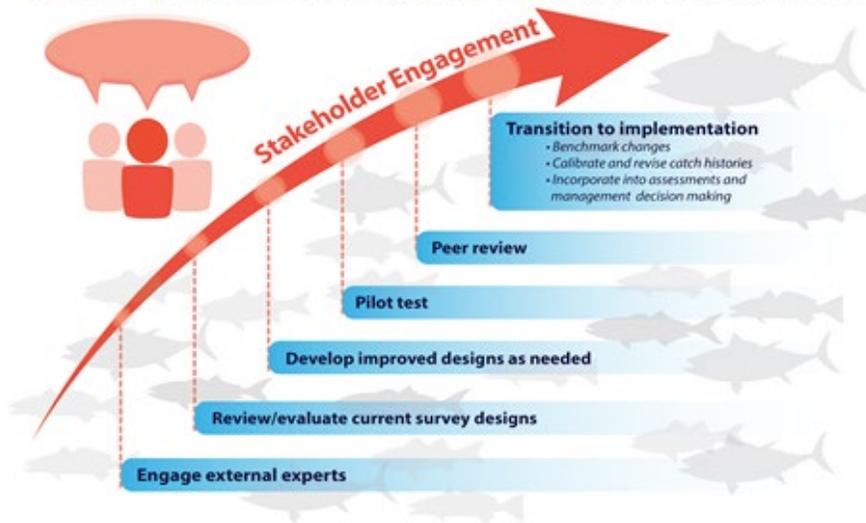
HMRFS/MRIP Creel Review Workshop: Organizers and Participants			
Organization, location	Name	Position/ title	Role for the workshop
Division of Aquatic Resources (DAR), Hawaii	Brian Neilson	Administrator	MRIP grant administered through DAR
	Ryan Okano	Aquatic Biologist Oahu	DAR representative
	Russell Sparks	Aquatic Biologist Maui	DAR representative
DAR/Research Corp University Hawaii	Hal Koike	Biometrician, Hawaiian Islands	DAR contractor, analysis creel and other types of data
	Tom Ogawa	HMRFS Project Manager	Presenter and organizer
	Matthew Dill	Creel Surveyor, HMRFS	Background info HMRFS Hawaii (Hilo, Puna, Kohala)
	Kekai Edens	Creel Surveyor, HMRFS	Background info HMRFS Hawaii (Hilo, Puna, Kohala)
	Genesis Enos	Creel Surveyor, HMRFS	Background info HMRFS Hawaii (Ka'ū, Kona, Kohala)
	Byron Hardwick	Creel Surveyor, HMRFS	Background info HMRFS Hawaii (Ka'ū, Kona, Kohala)
	Steve Kaneko	Data Analyst, HMRFS	Background info HMRFS Analysis
	Richard Beebe	Creel Surveyor, HMRFS	Background info HMRFS Oahu (Ewa, Wai'anae, North Shore)
NMFS, Office of Science & Technology (OST), Silver Spgs. MD	Patrick Conley	Creel Surveyor, HMRFS	Background info HMRFS Kauai
	Dave Van Voorhees	NMFS-OS&T, Division Chief	Presenter and organizer (MRIP implementation and certification)
NMFS, PIFSC, Honolulu	Tom Sminkey	NMFS-OS&T, MRIP Statistician	Presenter and organizer (MRIP implementation)
	Hongguang Ma	PIFSC-FRMD, MRIP Statistician	Presenter and organizer
	Joe O'Malley	PIFSC-FRMD, Stock Assessment Program Mgr.	PIFSC leadership support
	Michael Quach	PIFSC-FRMD, WPacFIN IT Specialist	Presenter and background information territorial surveys
	Stefanie Dukes	PIFSC-FRMD, Fisheries Mgmt. Specialist	Facilitation
	Kimberly Lowe	PIFSC-SOD, Research Operations Analyst	Presenter, organizer & facilitation support (former WPacFIN)
	Beth Lumsden	PIFSC-FRMD, Division Deputy Director	PIFSC leadership support
MRIP Statistical Consultants	Kirsten Leong	PIFSC-ESD, Social Scientist	Facilitation
	Ginny Lesser	Professor (Oregon State), Statistician	Lead discussion/evaluation of survey options for HMRFS
NMFS/PIRO, Honolulu	Jean Opsomer	Professor (Colorado State/Weslat), Statistician	Lead discussion/evaluation of survey options for HMRFS
	Andrew Torres	PIRO, Recreational Fisheries Specialist	Facilitation
NMFS, Southeast Regional Office (SERO), St Petersburg, FL	Walter Ikehara	PIRO, Fishery Information Specialist	Facilitation
	Sarah Stephenson	SERO, Caribbean Branch, Fishery Biologist	Observing (for Caribbean surveys)
PIFSC/JIMAR, Guam	Christine Laurent	TSI Data Associate, Guam Creel Surveyor	Background information (recent Guam surveys)
PIFSC/University of Hawaii, Honolulu	Toby Matthews	Former TSI Supervisor & Data Analyst	Presenter, statistician (territorial creel surveys)
Council, Honolulu	Marlowe Sabater	Ecosystem scientist	Presenter (MRIP projects in territories)
Division Aquatic & Wildlife Resources (DANR), Guam	Brent Tibbatts	Aquatic Biologist & Creel Survey Mgr. (Boat/Shore)	Presenter and background (historical & recent Guam surveys)
Division Fish & Wildlife (DFW), CNMI	Michael Tenorio	Aquatic Biologist, Manager creel (Boat/Shore)	Background information (historical CNMI surveys)
	Edward Ogo	Creel Surveyor	Background information recent CNMI surveys
Dept. Marine & Wildlife Resources (DMWR), American Samoa	Tepora Toliniu Lavata'i	Boat-based Creel Survey Mgr.	Background information (American Samoa Boat-based surveys)
	Yvonne Mika	Shore-based Creel Survey Mgr.	Background information (American Samoa Shore-based surveys)
* JIMAR - Joint Institute for Marine & Atmospheric Research			
† TSI = PIFSC-JIMAR, Territorial Science Initiative			

## Appendices 2–7: Selected presentations on MRIP certified surveys and the Hawaii Marine Recreational Fishing Surveys (HMRFS).

### Appendix 2: MRIP certification and transition planning



## OVERALL TRANSITION APPROACH



## MRIP Organizational Chart

Effective November 2018



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### *Appendix 3: MRIP intercept surveys*

**NOAA**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
U.S. DEPARTMENT OF COMMERCE

**NOAA**  
FISHERIES  
Office of  
Science and  
Technology

# MRIP: A New Design of the Access Point Angler Intercept Survey

Tom Sminkey  
NOAA Fisheries, ST1

HMRFS Design Workshop | Honolulu, HI | May 28, 2019

## What is an Access Point Intercept Survey?

- **On-site survey** to collect catch data (access point)
- **Sampling** of completed angler fishing trips (intercept)
- **Spatiotemporal sampling frame:** matrix of fishing access sites and time intervals
- **Multi-stage cluster sampling** (survey)



### National Research Council Review (2006)

Recommendations for Improvements and Revisions to Access Point Intercept Survey

**Need to eliminate “alternate” sites –**  
unknown and inconsistent selection probabilities

**Need to get accurate counts of all completed trips on site –**  
needed for sample weighting

**Should consider approach to cover trips throughout the day –**  
peak fishing period has been focus, need to cover all time periods



## New APAIS Sampling Design



### Project Team started in 2009

- Develop new intercept design

### 2010 North Carolina pilot study:

- Conducted side-by-side with old design (MRFSS – current HMRFS)
- Final Report (Breidt, et al., 2012):
  - Recommended wide implementation
  - Recommended possible further enhancements
- Independent peer reviews endorsed implementation



## 2013 Design Overview

### Complex Stratified Multi-stage with Clustering

#### Strata

- Sub region, State, Mode, Month, Kind-of-Day, Interval

#### Primary Stage Units

- Site cluster-day-interval
- A: 2am-8am, B: 8am-2pm, C: 2pm-8pm, D: 8pm-2am

#### PPS Selection

- Estimated MOS defined as expected fishing activity or "pressure" (counts of angler-trips per time period)

#### SRS at lower stages



## What's Different in the New Design?

### Maximize number of site-days observed

- **Not the number of angler interviews!**
- Precision of multi-stage survey estimators depends almost exclusively on number of primary sampling units (site-days) observed

### Improved sample frame:

- Spatial component consists of single-site and multi-site clusters
- Increased temporal stratification: 6-hour time intervals
- Increased geographic stratification: state sub-regions (=islands)



## What's Different in the New Design?

### Fully formalized probability sampling:

- Probability-proportional-to-size sampling of site-time units (PSUs)
- Attempt to intercept all completed angler trips on site

### Samplers do not decide when/where to conduct interviews

- Fixed time interval for each site assignment
- Fixed order of sites for multi-site assignments
- Alternate mode sampling eliminated (2013)

### No limit on number of interviews per assignment



---

## What's Different in the New Design?

### Accurate counting of all trips within sampled site/time unit

- Sampling fractions at each stage known
- Important for proper weighting of data

### Emphasis on completing all assignments

- "Controlled selection"
  - Draws thousands of possible sets of assignments
  - Eliminates sets that don't match constraints
  - Selects one of remaining sets at random
- No canceling or re-scheduling of assignments
- Fixed sampling provides known work schedule for staff!



---

## What else changed?

**Revised Site Register**  
was implemented in 2012  
for use in 2013 sampling

**Incorporates changes**  
to accommodate the  
new survey design,  
improve data management  
and data access



---

## What is the Site Register?

**A database and website** with information on public access fishing sites where interviews for the APAIS can be conducted, i.e. **the sample frame**.

### Contains data on:

- Site location
- Site contacts
- Site description
- Fishing activity
- Change tracking
- Cluster group (shore, charter, private)



## Core Changes (MRFSS to MRIP)

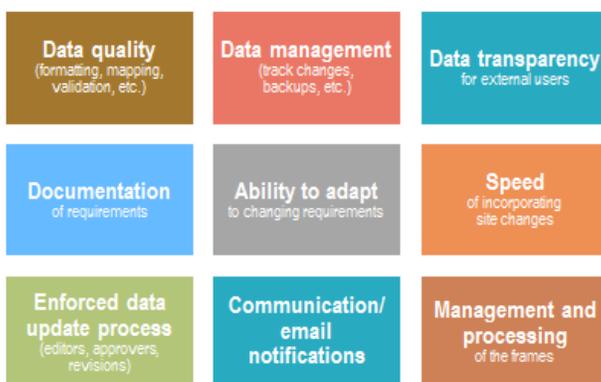
**Format:** NMFS managed relational database with web-accessible user interface

**Site data:** Geographic data, enforced data requirements, new descriptive data (local resources, site details)

**Fishing activity:** Fishing pressures tracked in 6-hour intervals rather than previous single "peak" pressure



## Resulting Survey Improvements:

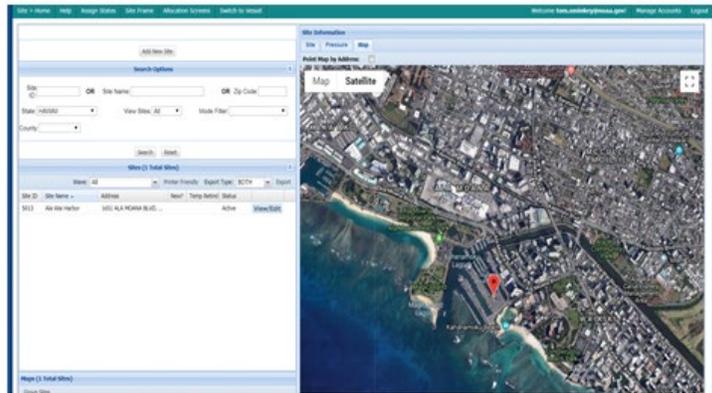


## Stakeholders Uses

	NMFS	Partners	Public
Frame management	✓		
User account management	✓		
Monitor site status	✓	✓	
Add & edit sites	✓	✓	
Search sites	✓	✓	✓
View sites	✓	✓	✓
Download site data	✓	✓	✓







ID	Frame Type	Frame Name	Created	Modified	Status
9248	SITE REGISTERS	2013 Wave 5, October - Sept13 (mon_julst+2)	20-Aug-2013	20-Sep-2013	Generated
9392	SITE REGISTERS	2013 Wave 5, October - Sept13 (mon_julst+2)	18-Sep-2013	22-Sep-2013	Generated
8710	SITE REGISTERS	2013 Wave 5, September - Aug13 (mon_julst+2)	02-Aug-2013	03-Aug-2013	Generated
8730	SITE REGISTERS	2013 Wave 5, September - Aug13 (mon_julst+2)	02-Aug-2013	04-Aug-2013	Generated
10472	SITE REGISTERS	2013 Wave 5, December - Nov13 (mon_julst+2)	03-Nov-2013	12-Nov-2013	Generated
10510	SITE REGISTERS	2013 Wave 5, December - Nov13 (mon_julst+2)	03-Nov-2013	03-Nov-2013	Generated
10402	SITE REGISTERS	2013 Wave 6, November - Sept13 (mon_julst+2)	27-Sep-2013	01-Oct-2013	Generated
10322	SITE REGISTERS	2013 Wave 6, November - Sept13 (mon_julst+2)	27-Sep-2013	27-Sep-2013	Generated
10370	SITE REGISTERS	2013 Wave 5, February - Jan14 (mon_julst+2)	03-Jan-2014	13-Jan-2014	Generated
10376	SITE REGISTERS	2013 Wave 5, February - Jan14 (mon_julst+2)	03-Jan-2014	07-Jan-2014	Generated
10382	SITE REGISTERS	2013 Wave 5, February - Jan14 (mon_julst+2)	03-Jan-2014	07-Jan-2014	Generated
10382	SITE REGISTERS	2013 Wave 5, February - Jan14 (mon_julst+2)	03-Jan-2014	07-Jan-2014	Generated
10382	SITE REGISTERS	2013 Wave 5, January - Dec13 (mon_julst+2)	30-Nov-2013	30-Nov-2013	Generated
10388	SITE REGISTERS	2013 Wave 5, January - Dec13 (mon_julst+2)	30-Nov-2013	30-Nov-2013	Generated

State	# of Counties	# of Sites
<input checked="" type="checkbox"/> PUERTO RICO	1	118
<input checked="" type="checkbox"/> RHODE ISLAND	5	172
<input checked="" type="checkbox"/> SOUTH CAROLINA	8	130
<input checked="" type="checkbox"/> VIRGINIA	24	207

Stratum	Min Distance	Max Sites	Min Pressure for Single Site Clusters
0-1000-1400	60	2	2
0-1400-2000	60	2	2
0-2000-0200	60	2	2
0-1300-0700	60	2	2
0-1000-0800	60	2	2

## 2013 Design Adjustments

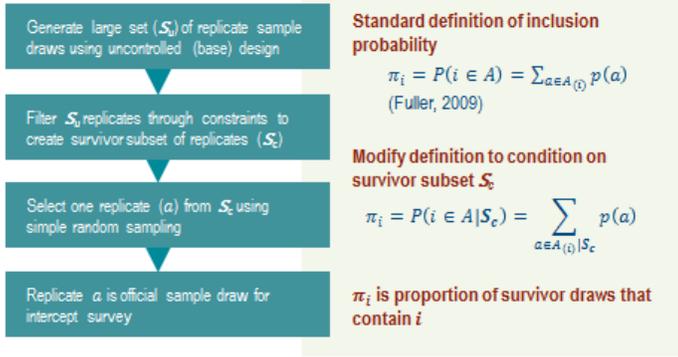
### Goals

- Accommodate field staff constraints
- Improve interviewing productivity
- Improve spatial and temporal sample distribution
- Maintain same temporal and spatial coverage

### How

- Adjustments to site/cluster pressures & clustering rules
- Adjustments to sampling strata and allocation of sample to strata
- Addition of temporal and spatial sorting variables to assignment draw

## New replication-based draw program



## 2013 Design Adjustments - Conclusions

### Effectiveness of 2013 Changes

- Substantive improvements in interviewing productivity
- Improvements to Charter mode not satisfactory

### Additional changes warranted in 2014

- How can we better target sample to productive times of day but still maintain full temporal coverage?
- What else can be done for Charter mode?



## AP AIS 2014 Design



### 2 Primary changes

- **Peak interval** – Period of day with highest fishing activity
- **Mixed boat sampling** – both Private/Rental and Charter Boat modes sampled on each assigned day/site-cluster/time



## APAIS 2014 Design: Peak Interval

### Create a new sample interval

that more closely corresponds to peak fishing activity

### Minimize disruption to existing design

#### P:11AM-5PM

- 6-hour interval
- Covers 2nd half of B interval and 1st half of C interval

B:8AM-11AM	B:11AM-2PM	C:2PM-5PM	C:5PM-8PM
	P:11AM-2PM	P:2PM-5PM	



## APAIS 2014 Design: Peak Interval

### Keep existing B and C intervals

- Maintain full coverage 8AM-8PM

### Overlapping Intervals

- Possible to draw same site/3-hr time block/date in two intervals
- Requires adjustments to inclusion probabilities, strata definitions

$$\pi_{BP} = \pi_B + \pi_P - (\pi_B * \pi_P)$$

$$\pi_{CP} = \pi_C + \pi_P - (\pi_C * \pi_P)$$

- Requires special field procedures

B:8AM-11AM	B:11AM-2PM	C:2PM-5PM	C:5PM-8PM
	P:11AM-2PM	P:2PM-5PM	



## APAIS 2014 Design: Mixed Boat Sampling

Improve Charter mode  
efficiency and productivity

Allow samplers to interview  
both Private boat and  
Charter boat anglers  
during the same assignment

Treat mode of fishing  
as domain variable  
instead of stratification variable

Replace mode  
with site group stratification  
in sample frame



---

## APAIS 2014: Mixed Boat Sampling

### Existing PR and CH mode strata replaced with site groups

- **Site groups are exclusive** – a site can only belong to one group
- **Site groups are still related to mode**
  - CH sites (only CH, primarily CH, or high CH activity)
  - PR sites (only PR, all other sites not in CH site group)

**Site groups** have separate clustering, sample allocation, draws

### Led to improved productivity

particularly for smaller guide boats in Charter sector

## Approach extended to Shore mode in 2016



## APAIS: Mixed Mode Sampling in Hawaii

### Existing PR and SH mode strata replaced with site groups

- **Site groups are exclusive** – a site can only belong to one group
- **Site groups are still related to mode**
  - PR sites (only PR, primarily PR with some SH fishing)
  - SH sites (only SH, primarily SH)

**Site groups** have separate clustering, sample allocation, draws

### Many 'clusters' will only be single site

- time/distance between sites to be determined

**Allows Interviewing either SH or PR anglers**

**Provide opportunity for improved productivity**



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## APAIS: across the islands

- Counties continue to have separate sample allocations
- Day/Interval assignments = sample unit drawn
- Pool all islands' data to produce weighted estimates for Hawaii
- Domain estimation for county or island specific estimates
- Sample sizes to be determined (#site-days)



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<p><b>OST-MRIP:</b></p>	<ul style="list-style-type: none"> <li>• Lauren Dolinger-Few, John Foster, Dave Van Voorhees, Patty Zielinski, Anjel Lewis</li> </ul>
	
<p><b>Consultants:</b></p>	<ul style="list-style-type: none"> <li>• F. Jay Breidt, Colorado State University</li> <li>• Jean D. Opsomer, Westat Inc. (formerly CSU)</li> <li>• James R. Chromy, RTI International</li> <li>• Breda Muñoz, RTI International</li> </ul>



*Appendix 4: MRIP Fishing Effort Survey (FES)*



## MRIP Fishing Effort Survey

Rob Andrews  
Dave Van Voorhees  
Fisheries Statistics Division  
Office of Science and Technology



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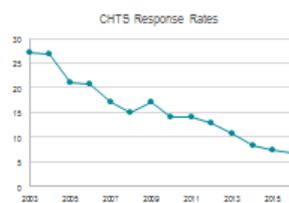
## Coastal Household Telephone Survey

- Implemented in 1981
- Bi-monthly survey of shore and private boat fishing effort (trips) in Atlantic, Gulf of Mexico, Puerto Rico and Hawaii
- Landline, random digit dial (RDD) telephone survey
- Limited to coastal counties

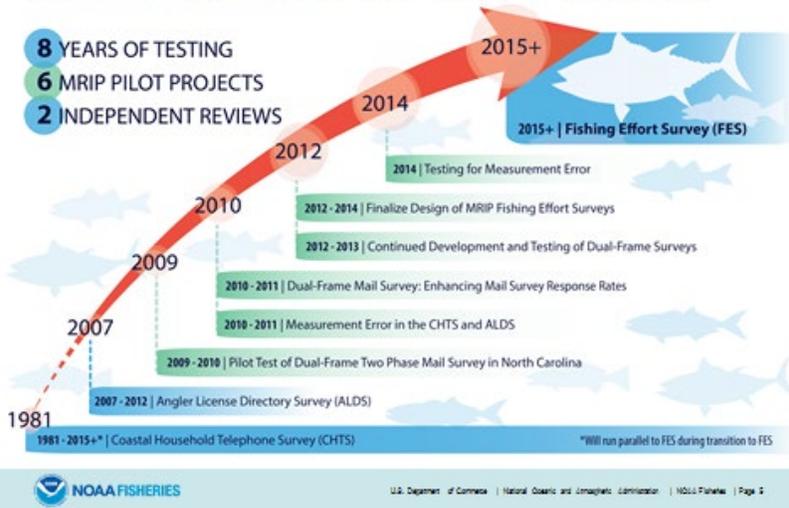
## Coastal Household Telephone Survey

- Susceptible to non-sampling errors
  - Non-coverage of cell-only households
  - Declining response rates
  - Inaccurate reporting of fishing activity
- Inefficient for sampling anglers

## CHTS - Non-Sampling Error



# EVOLUTION OF THE EFFORT SURVEY



## Survey Designs Considered

- License Frame Telephone Survey
- Dual-Frame Telephone Survey
  - License frame + RDD landline frame
  - RDD landline frame + RDD cell frame
- Dual-Frame Mail Survey
  - Postal address frame + License address frame
- Panel Surveys

## MRIP Fishing Effort Survey

- Culmination of several pilot studies
- Samples from comprehensive address frame - Computerized Delivery Sequence (CDS) frame
- Cross-sectional, self-administered mail survey
- Monitors private boat and shore fishing effort
- Tested in MA, NY, NC and FL (2012-2013)
- Implemented for Atl. and Gulf states in 2015 – conducted concurrently with CHTS (2015-2017)

---

## MRIP Fishing Effort Survey

- Self-administered mail survey utilizing angler registries
- Less complicated than typical dual-frame survey:
  - One sample frame: USPS database of mailing addresses
  - Auxiliary list: National Saltwater Angler Registry addresses
- Sample drawn from USPS and matched to NSAR
  - All (or most) of matched addresses retained
  - Fraction of unmatched addresses retained
  - Stratifies sample and allows optimization of sample allocation

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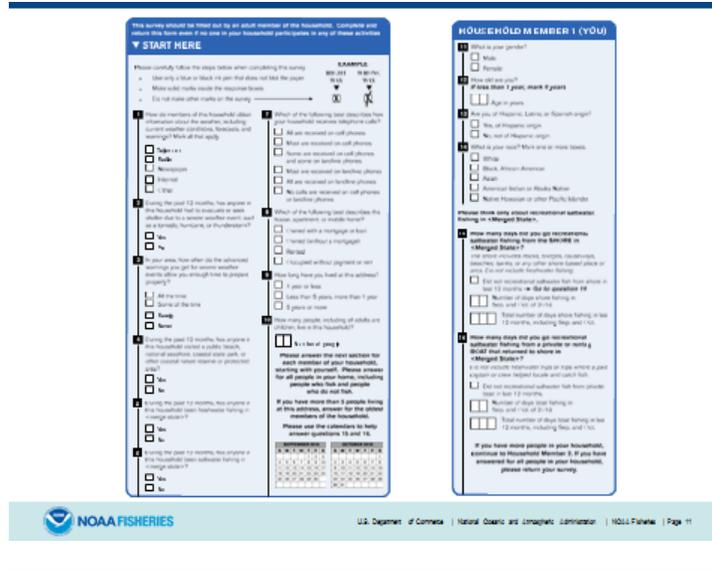
## FES - Sampling

- Bi-monthly sampling from CDS address frame
- Stratified sampling design
  - Coastal state
  - Geographic proximity to coast (coastal/coastal)
  - Address matching to license databases
- Optimized sampling among strata

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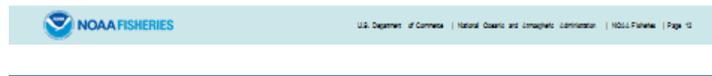
## FES – Data collection design

- Administered for six, two-month reference waves
- Self-administered household mail questionnaire
  - Household demographics and warmup (non-fishing Q's)
  - Trips by mode and demographics for up to 5 household residents
- Two questionnaire mailings plus telephone and postcard reminder
- \$2 prepaid cash incentive
- Currently testing web push design



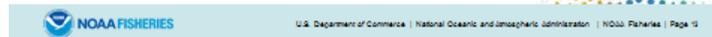
## FES Benefits

- Mail survey less susceptible to non-sampling error than CHTS
  - Greater coverage
  - Higher response rates
  - "Data-rich" sample frame
  - Sufficient time to consider responses
- Using license lists to stratify ABS can increase efficiency and helps target sampling toward fishing households



## Recent NAS Review of MRIP

**“The [Fishing Effort Survey] methodologies, including the address-based sampling survey design, are major improvements.”**



## Pilot Study Comparisons - Response Rates

State	Fishing Effort Survey (Mail Survey)		Coastal Household Telephone Survey	
	%	N	%	N
Florida	45.4	7,460	14.5	2,588,115
Massachusetts	40.6	6,279	13.1	275,967
New York	32.0	4,908	11.6	421,636
North Carolina	41.7	6,203	16.4	332,934
TOTAL	40.4	24,850	14.1	3,618,652

## Pilot Study Comparisons - Estimates

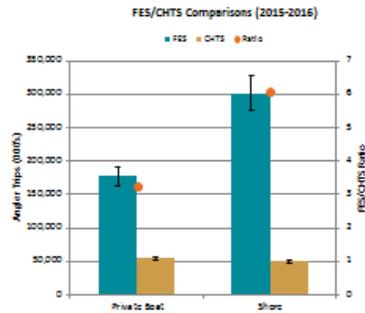
State	Survey	%FHHs	A/HH	T/HH	Trips	SH Trips	PR Trips
FL	FES	16.3	1.8	11.3	39,244	25,973	13,271
	CHTS	6.2	1.8	9.0	9,730	4,042	5,688
MA	FES	9.2	1.6	10.3	5,152	3,090	2,062
	CHTS	3.2	1.6	9.5	1,403	525	879
NY	FES	7.9	1.7	11.2	11,784	6,807	4,977
	CHTS	2.4	1.6	9.7	2,319	1,131	1,188
NC	FES	14.5	1.6	11.4	6,903	4,555	2,348
	CHTS	6.7	1.8	8.3	2,058	944	1,114
TOTAL	FES	12.8	1.7	11.2	63,082	40,425	22,658
	CHTS	4.8	1.7	9.0	15,510	6,642	8,868

## Results – Response Rates

- Overall, FES response rates nearly 5X higher than CHTS
- Differences in response rates ranged from factor of 3.1 (MS) to 6.2 (MD)
- Lower risk for nonresponse bias in FES
- HI response rates are highest among all states (40%)

## Results – Estimates

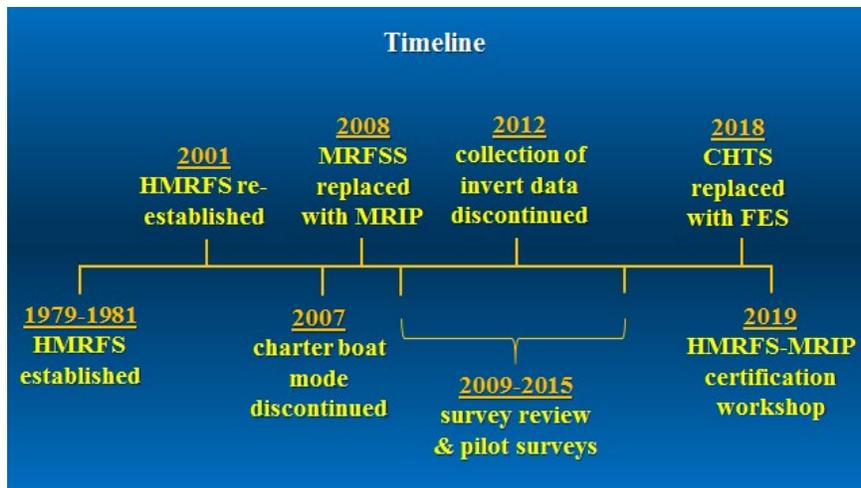
- FES estimates  
4.6 X larger than  
CHTS estimates
- Private boat (PR)  
– 3.3X
- Shore (SH) – 6.1X



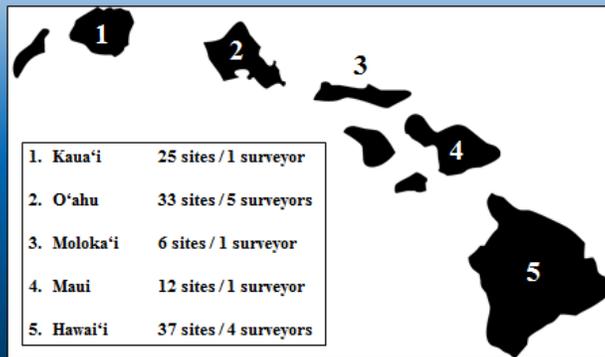
Appendix 5: HMRFS overview (presented by Tom Ogawa)

### Hawai'i Marine Recreational Fishing Survey (HMRFS) Overview

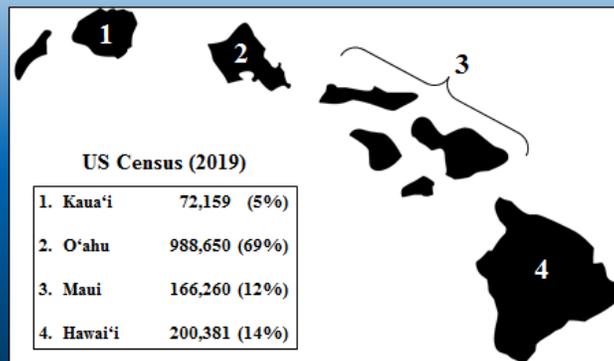
The overview slide includes four photographs: a sunset over the ocean with fishing gear, a map of the Hawaiian Islands with the HMRFS logo and 'GOT FISH?' text, a close-up of fishing gear on a boat, and a person handling a large fish on a boat. Logos for NOAA, Sport Fishing Restoration, and the HMRFS logo are displayed at the bottom.



### Current Number of Sites & Surveyors



### Population by County



### Survey Design (Catch Data)



#### Hawai'i Marine Recreational Fishing Survey (HMRFS):

- access point angler intercept survey, APAIS (catch / trip)
- sampling stratified by day type (weekend & week day) & mode (shore & private boat)
- surveys conducted at popular public boat ramps & shore fishing areas
- peak fishing hours targeted for sampling
- alternate site visits allowed
- generally cannot interview fishers until fishing trip is complete
- assignments randomly drawn but weighted according to site-specific fishing pressure estimates (i.e. higher pressure = more assignments)

## Survey Design (Catch Data)



- **fishing mode (shoreline or private boat)**
- **area fished (inland, state or federal waters)**
- **primary gear type & method**
- **hours fished**
- **target species**
- **days fished (past 2 months & 12 months)**
- **fisher category (non-commercial, part-time, full-time commercial)**
- **fisher demographics (state, county & zip code)**
- **catch (species, number caught, length, weight & catch disposition)**

## Survey Design (Effort Data)



### Fishing Effort Survey (FES):

- **mail survey (total number of fishers & trips per household)**
- **households sampled every wave (two-month period)**
- **unknown sampling universe (i.e. randomly drawn addresses)**

### Assignment Summary Form (ASF):

- **total onsite fisher counts tallied by surveyor for each site visited**
  - **complete & incomplete intercepts**
  - **refusals**
  - **language barrier**
  - **missed**
  - **not done fishing**

## Appendix







## Outline

HMRFS and pilot projects in Hawaii

Survey design and sampling/estimation for major pilot projects

Findings and recommendations



## Hawaii Marine Recreational Fishing Survey (HMRFS)

Re-initialization (2001)

Fully implementation in 2003

Charter boat survey eliminated in 2007

MRIP projects for survey improvement (2009-)



## Access Point Angler Intercept Survey (APAIS)

Targeted population is specified by wave (2 month) and mode (fishing from shoreline or private boats)

Sampling frame (matrix of sites registry and calendar month-days) is stratified by wave and fishing mode

Primary sampling unit is site-day and site-days are sampled with probability proportional to the expected # of angler trips





## Coastal Household Telephone Survey (CHTS) – Design and Data

Sampling frame (coastal full-time residential households with telephone) was not stratified by fishing mode

Household information (# of anglers)

Angler information (# of fishing trips)

Trip information (mode and date)



## Hawaii MRIP projects

Hawaii for-hire project (FY 2009, 2010)

Hawaii pilot study to improve intercept survey (2010)

HMRFS review (2012)

Survey of HI registered boaters (2012)

Design and pilot surveys for shoreline fishing (2013, 2014)

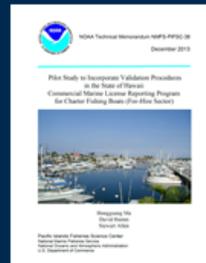
Test the new sampling design for private boat intercept survey (2015)



## Hawaii for-hire project (2009, 2010)

Trip report rate ranged from 50%-70% due to underreporting and no reporting. Fishing trips from likely charter boats were significant at two harbors. Recommendations included:

- Outreach for CML requirement for charter boats
- Avoiding name combination and including names of all boats fished
- Reporting all trips (including zero catch trips)





### HMRFS review (2012)

Hawaii is the only state where fishing license is not required for non-commercial saltwater fishing

HMRFS review recommendations included

- pilot study of shore fishing with hybrid methods (including onsite surveys)
- further development of mail survey for boats registered with DBOR
- improve existing system for charter fishing



### A survey of registered Hawaii boaters (FY 2012)

3000 randomly selected registered boaters were surveyed in 2013 (response rate 42%)

Advance notice, survey package, follow-up mailing to non-respondents

>70% of the boat owners fished from a boat at least once during the past 12 months



### Pilot surveys for shore fishing (tested in 2015 on Oahu)

Roving survey: ground-based counts of fishing gears and catch during daytime hours

Aerial survey: fishing gear counts including remote and private/restricted areas during daytime hours

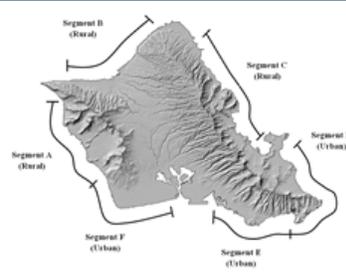
Mail survey: fishing gear counts from all areas during daytime and nighttime hours





### Design – roving survey (Jan - Apr, 2015)

- Stratification
  - by region (rural & urban)
  - by day type (weekday & weekend)
  - by shift (6:30-10:30, 10:30-14:30, 14:30-18:30)
- Effort (instantaneous gear counts)
- Catch rate (catch, gear, hrs fished)



### Design – aerial survey (Jan – Apr, 2015)

- One weekday and one weekend day per month (January skipped)
- Survey days coinciding with onsite roving effort surveys
- Coverage of fishing from remote & private/restricted areas



### Design – mail survey (Jan – Feb, 2015)

- Mail survey of Oahu residents
- 3000 samples drawn with SRS
- Pre-letter, two mailing of questionnaires, postcard reminder
- Coverage of fishing at night and from all areas

Hawaii Survey of Shore Fishing





## Pilot surveys for boat fishing (tested in 2016 on Oahu)

- Access point survey: catch (fish/vessel trip) and effort (vessel trips)
- Stratification: by day type (weekday or weekend) and time blocks (8:00-14:00, 14:00-20:00, and peak time 11:00-17:00)
- Six public boat ramps were sampled with unequal inclusion probabilities depending on sites, day types, and time blocks



## Recommendations and conclusions

- The aerial survey tested under its current design had limitations in spatial coverage.
- A mail survey could be an independent approach to estimate total fishing effort because of its broad coverage. More efficient sampling frames could be developed if the mail survey is used as an effort survey alone.
- The roving survey did not cover night fishing and fishing in remote and restricted areas. In order to incorporate the roving survey data with other surveys for total fishing effort estimation, a common domain shared by both surveys needs to be clearly defined.

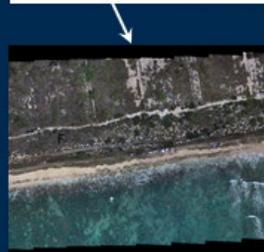


## Roving survey routes



Angler counts

Day	Time	Remote	Total	% Remote	Not covered
Feb 16 (WE)	12:00-13:15	10	157	6.4	E, EF
Feb 25 (WE)	8:30-10:00	4	63	6.3	C, CO, EF
Feb 19 (WD)	9:00-10:00	1	5	20	C, CO, D, E, EF
Feb 27 (WD)	8:40-10:18	6	31	19.2	CO, EF
Mar 23 (WD)	9:40-11:00	3	63	4.8	CO, EF
Mar 29 (WE)	10:00-11:30	1	110	0.9	AB, B, BC, C, EF
Apr 10 (WD)	11:20-12:41	14	99	14.1	CO, EF
Apr 11 (WE)	8:50-10:20	33	207	15.9	EF





## Recommendations and conclusions

- The aerial survey tested under its current design had limitations in spatial coverage.
- A mail survey could be an independent approach to estimate total fishing effort because of its broad coverage. More efficient sampling frames could be developed if the mail survey is used as an effort survey alone.
- The roving survey did not cover night fishing and fishing in remote and restricted areas. In order to incorporate the roving survey data with other surveys for total fishing effort estimation, a common domain shared by both surveys needs to be clearly defined.



## Recommendations and conclusions

- Implementation of a fixed time-block sampling design is feasible for private boats.
- A workshop has been planned to discuss the survey options to use/implement for HMRFS.



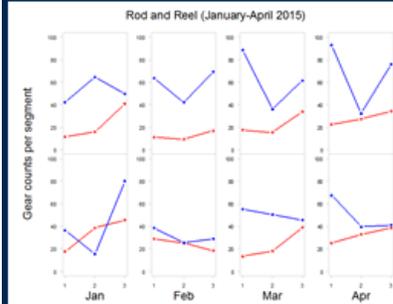
## Some result slides

- The following slides are included for discussion and Q&A

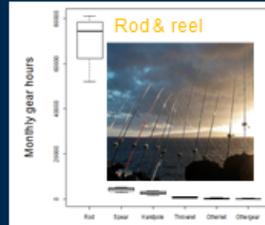
### Roving survey (Jan-Apr, 2015)



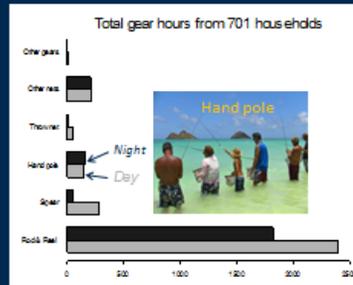
#### Effort Survey (Jan-Apr, 2015)



Rod and reel counts were higher during weekend (blue) and rod and reel was the major gear type.



### Mail Survey (Jan-Feb, 2015)



For rod & reel and hand pole, gear hours from night-time fishing accounted for more than 30% of total gear hours.

The proportion of fishing from private/restricted areas was:

- 23-29% at night
- 15-17% during the day

### Aerial Survey (Feb-Apr, 2015)



- Rod & Reel
- Spear
- Hand Pole
- Throw Net
- Gill Net

April 11, 2015

Gear	Gear Counts	Fisher Counts
Rod & Reel	481	169
Spear	37	37
Hand Pole	0	0
Throw Net	1	1
Other Net	0	0
Other Gear	0	0



The proportion of fishing from remote areas ranged from:

- 1-19% for angler counts
- 1-27% for rod and reel gear counts
- 2-23% for all gears combined



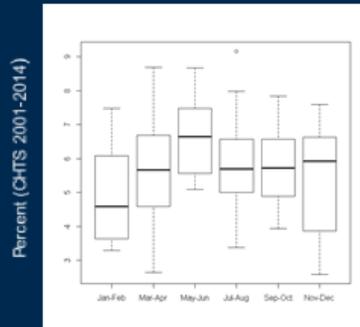
### Night-time fishing

- Rod & Reel: 187 nights vs 321 days (37%)
- Spear: 8 nights vs 71 days (10%)
- Hand pole: 21 nights vs 26 days (45%)
- Throw net: 1 nights vs 8 days (11%)



### Percentage of fishing households (Jan – Feb, 2015)

9.3% (fished in past two months) vs 2.9% (CHTS)



### Percentage of 2-month fishing households in CHTS 2001-2015 (Oahu)

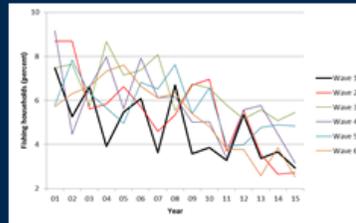
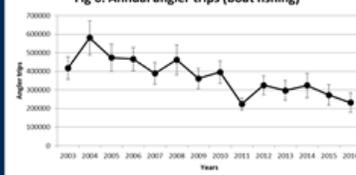


Fig 6. Annual angler trips (boat fishing)



*Appendix 7: Pros and cons of pilot surveys in Hawaii (presented by Tom Ogawa)*

**HMRFS Proposed Survey Design Changes for MRIP Certification**



The collage features several images: a boat with people, a map of Hawaii with the HMRFS logo and 'GOT FISH?' text, a person holding a large fish, a person on a boat, and a person holding a large fish. Logos for NOAA, SPORT FISH HAWAII, and another organization are at the bottom.

## Outline

### 1. pros & cons of pilot surveys

- mail survey
- aerial survey
- roving survey
- private boat intercept survey

### 2. HMRFS major limitations

### 3. proposed survey design changes



## Mail Survey Advantages

1. coverage of remote / private / restricted areas
2. coverage of night fishing
3. cost effective

## Mail Survey Disadvantages

1. recall bias – difficulty in remembering how many fishing trips taken; point estimates may be biased (inaccurate)
2. non-response bias – non-fishing households may be underestimated, assuming non-fishing households were less responsive to the survey; catch & effort may be overestimated

### Aerial Survey Advantages (digital pictures)

1. coverage of private & remote areas more complete than ground-based effort surveys
2. images can be referenced to verify target data &/or assess complementary info
3. images are geospatially referenced



### Aerial Survey Disadvantages (digital pictures)

1. image analyses are time consuming (may delay time-sensitive data needs)
2. sampling is weather-dependent
3. overcast days result in wider aperture (i.e. decreased resolution)
4. air traffic may delay/restrict sampling of certain areas (AM & weekdays generally less traffic than PM & weekends)
5. military bases limit air space access depending upon scheduled activities
6. certain gear types (e.g. hand pole vs. rod-&-reel) are hard to discern even at high resolution (all gears indiscernible at low resolution)
7. relatively narrow, high resolution image swaths (~ 200m) may not adequately capture certain gears & are difficult to validate unless entering/exiting water (e.g. spearfishers, gill netters, & fly fishers)

### Roving Survey Advantages (shore mode only)

- Effort: 1. eliminates recall bias (present in phone & mail surveys)
- Catch: 2. spatial coverage greatly expanded relative to APAIS
3. fixed time block sampling provides uniform temporal coverage
  4. incomplete fishing trips OK to sample

### Roving Survey Disadvantages (shore mode only)

1. cannot sample private / restricted areas
2. time limitations & logistical constraints inhibit sampling at remote areas
3. traffic & other unforeseen factors may delay or prohibit sampling certain areas & times
4. variable access & visibility of shoreline

## Private Boat Intercept Survey Advantages

1. **fixed time block sampling provides uniform temporal coverage (overlapping peak & non-peak hours)**
2. **boat-based catch (interview) minimizes survey fatigue**



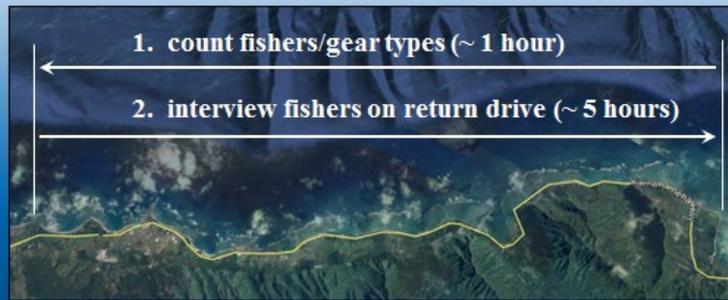
## HMRFS Major Limitations (Intercept Survey)

1. **sampling bias – creel survey targets periods of peak fishing productivity & allows alternate site visits**
2. **under-coverage – limited spatial coverage of shoreline (private boat mode OK)**
3. **pooled gears – differences in catch rate (rod-&-reel, spear & net)**
4. **pooled islands/counties – localized differences in target species, catch composition & gears/methods**
5. **night fishing – need for night sampling still unverified for both modes (pilot mail survey of shore fishing indicated night fishing may be significant)**
6. **invertebrate catch – starting Jan. 2012, invert catch no longer recorded**
7. **data processing – paper-based field data inefficient & time consuming**

## Proposed Survey Design Changes

- **replace APAIS with roving catch & effort survey (shore mode only)**
- **allow intercept sampling of incomplete trips (shore mode only)**
- **fixed time block sampling for both modes**
  - **regular time blocks: 7am – 1pm & 1pm – 7pm**
  - **peak time block: 11am – 5pm (private boat mode only)**
- **record gear-hours for both modes**
- **mode-specific FES survey (1 for shore & 1 for boat)**
- **replace individual catch with boat-based catch**
- **separate estimates for major gear types & counties**
- **electronic field forms (tablet) to streamline data processing & timeliness**
- **resume collecting invertebrate catch data**

### Combined Roving Effort-Catch Survey



- cost effective
- effort data directly corresponds with catch data
- surveyor can first identify “hot spots” then budget time on return leg to optimize intercept rate

### Future Pilot Studies?

- on-site night sampling to evaluate significance/need for both modes
- aerial survey using an observer to manually count fishers & gears
  - small plane or helicopter
  - drone?



### Appendix



survey forms



# Pilot Shoreline Mail Survey

Correct marks     Incorrect marks

• Please use #2 pencil or blue or black pens to complete this survey.  
 • Do not use red pencil or ink.  
 • Do not use X's or check marks to indicate your responses.  
 • Fill response circles completely with heavy, dark marks.

Did anyone in your household (including yourself) participate in any RECREATIONAL (non-commercial) subsistence shore fishing activities (includes rod & reel, spear fishing, fishing with nets, etc.) in Hawaii in the last year from March 1, 2014 to February 28, 2015? (Subsistence shore fishing includes activities from beaches, cliffs, piers, bridges, docks, jetties, roadsides, or other coastal areas. (After filling in a bubble, please follow the arrow.)

NO, did not fish recreationally from shore during this time → Please return survey  
 YES, some recreational subsistence shore fishing during this time → Please return survey

**FISHER 1:** The following questions pertain to participation in fishing activities by each fisher in the household. If you are the only fisher in your household, please return the completed survey in the envelope provided. Otherwise, please give the survey to the next fisher, after your completion.

1. Please fill the circle for ONE of the following categories that best represents your shore fishing activities:

- Fish primarily for pleasure (e.g. catch & release) and never sell any catch
- Fish primarily for food and never sell any catch
- Fish for other non-commercial purposes
- Fish primarily for commercial purposes

2. How many DAYS (from sunrise to sunset) and/or NIGHTS (from sunrise to sunset) during the past 12 MONTHS have you gone recreational subsistence shore fishing in Hawaii? →  DAYS and/or NIGHTS from March 1, 2014 to February 28, 2015

3. Did you participate in any recreational subsistence NIGHT FISHING activities from shore in Hawaii during the past TWO MONTHS from January 1, 2015 to February 28, 2015? (After filling in a bubble, please follow the arrow or the next question)

NO, did not fish at night from shore during this time → Go to Question 7  
 YES, some nighttime shore fishing during this time → Go to Question 7

4. The following question pertains only to recreational subsistence shore fishing trips that you took at NIGHT in Hawaii during the past TWO MONTHS (January 1, 2015 to February 28, 2015). For each of the following gear types listed, please enter (A) how many NIGHTS in total you went fishing, (B) how many HOURS you usually fished on a typical night fishing trip, and (C) the NUMBER of each gear type you usually used during a typical night fishing trip. (Please leave unused gear types blank)

Gear Type	Total Number		Based on a Typical Trip	
	(A) Nights	(B) Hours	(C) Hours	Number of Catches
Rod & Reel				
Spear (Shrimp, prawn, etc.)				
Beard Pole				
Throw Net				
Other Net (specify)				
Other Gear (specify)				

CH2B Coverd No. 0648-070  
Expiration Date: 9-30-2017

5. How many NIGHTS did you shore fish from a PRIVATE RESTRICTED area (e.g. military base, private land, private marina, etc.) during the past TWO MONTHS (January 1, 2015 to February 28, 2015)? →  NIGHTS from January 1, 2015 to February 28, 2015

6. Did you stay OVERNIGHT while fishing on any of these night fishing trips in Question 4 (e.g. in the past TWO MONTHS from January 1, 2015 to February 28, 2015)?

NO, did not stay overnight while shore fishing during this time → Go to Question 7  
 YES, some overnight shore fishing during this time → NIGHTS from January 1, 2015 to February 28, 2015  
 1. → IF YES, how many nights did you stay overnight? →  NIGHTS from January 1, 2015 to February 28, 2015 → Go to Question 7

7. Did you participate in any recreational subsistence DAYTIME FISHING activities from shore in Hawaii during the past TWO MONTHS from January 1, 2015 to February 28, 2015? (After filling in a bubble, please follow the arrow or the next question)

NO, did not fish during the day from shore during this time → Go to Question 10  
 YES, some daytime shore fishing during this time → Go to Question 10

8. The following question pertains only to recreational subsistence shore fishing trips that you took during the DAY in Hawaii during the past TWO MONTHS (January 1, 2015 to February 28, 2015). For each of the following gear types listed, please enter (A) how many DAYS in total you went fishing, (B) how many HOURS you usually fished on a typical day fishing trip, and (C) the NUMBER of each gear type you usually used during a typical day fishing trip. (Please leave unused gear types blank)

Gear Type	Total Number		Based on a Typical Trip	
	(A) Days	(B) Hours	(C) Hours	Number of Catches
Rod & Reel				
Spear (Shrimp, prawn, etc.)				
Beard Pole				
Throw Net				
Other Net (specify)				
Other Gear (specify)				

9. How many TOTAL DAYS did you shore fish from a PRIVATE RESTRICTED area (e.g. military base, private land, private marina, etc.) during the past TWO MONTHS (January 1, 2015 to February 28, 2015)? →  DAYS from January 1, 2015 to February 28, 2015

10. How old were you on your last birthday? →  YEARS

11. Are you male or female?

MALE  
 FEMALE

## DOBOR Vessel Registration Form (2016)

**VESSEL TYPE**

1-AIR BOAT     2-AUXILIARY SAIL     3-CABIN MOTORBOAT     4-HOUSEBOAT     5-INFLATABLE BOAT     6-OPEN MOTORBOAT  
 7-PADDLECRRAFT     8-PERSONAL WATERCRAFT     9-PONTOON BOAT     10-ROWBOAT     11-SAIL ONLY  
 12-OTHER

**PRIMARY OPERATION**

1-CHARTER FISHING     2-COMMERCIAL FISHING     3-COMMERCIAL PASSENGER CARRYING     4-DEALER DEMONSTRATION  
 5-MANUFACTURER DEMONSTRATION     6-OTHER COMMERCIAL OPERATION     7-PLEASURE     8-RENT OR LEASE (LIVERY)  
 9-FEE EXEMPT YOUTH GROUP     10-FEE EXEMPT GOVERNMENT     11-OTHER     12-NON-COMMERCIAL FISHING

**IF VESSEL REGISTERED AS PLEASURE -- ANSWER REQUIRED -- IF FISHING (OF ANY KIND) IS NOT YOUR PRIMARY OPERATION, DO YOU EVER USE YOUR VESSEL FOR NON-COMMERCIAL (RECREATIONAL, SUBSISTENCE) FISHING?**     YES     NO