

# MARINE RECREATIONAL INFORMATION PROGRAM

## **Addressing Recommendations from the MRIP Sponsored Review of Monitoring of Washington's Ocean Sampling Program – Evaluation of Electronic Data Capture Hardware and Application**

**Washington Department of Fish and Wildlife  
Ocean Sampling Program**

**December 23, 2014**

### **INTRODUCTION**

Comprehensive and sound management of recreational finfish fisheries in Washington State requires information on catch, effort, and stock-specific fishery impacts necessary to meet established conservation and allocation mandates. These data are federally required to open and manage recreational fisheries, especially considering the need to limit and monitor impacts to species of concern. For the Washington ocean Marine Catch Areas (Areas 1-4), these critical fishery information needs are met through the Washington Department of Fish and Wildlife (WDFW) Ocean Sampling Program (OSP).

To generate estimates of marine fish catch and effort in ocean Marine Catch Areas (for the “private boat” and “charter boat” modes), WDFW employs a procedure based on data collected by an access point intercept survey. The OSP survey is designed to provide both total effort and catch per unit effort (CPUE). These data are used to generate estimates of total catch and effort by Marine Catch Area, month, and fishing mode which are provided to the Recreational Fishery Information Network (RecFIN, [www.recfin.org](http://www.recfin.org)).

Currently, The OSP uses paper data cards to hand-record the information collected from each boat interview. In the past several years, the amount of information recorded per interview has increased significantly. Not only can the data cards not support incorporation of additional pieces of information (ie. the cards are completely full, front and back), field samplers are also having a difficult time remembering all the questions they are required to ask. Because of this, the OSP has become increasingly interested in the potential of electronic data collection where samplers could be prompted for data entry.

Further, the demands of in-season fishery management have become more rigorous. Data are required for in-season management decisions in a more timely fashion each season. Keying collected data is time-consuming, and data are frequently unavailable with less than a 2-3 week turnaround time. Potential exists to reduce this turnaround time with electronic data collection.

The Pacific States Marine Fisheries Commission (PSMFC) began development of electronic fishery

data collection applications through an MRIP pilot project in 2012. An application designed to meet Washington State's data collection needs was developed as part of that project; however, field testing of that application and the electronic data capture devices had not been performed.

This project allowed a full season of testing of the devices and the data collection application. The purpose of testing was to assess;

- (1) whether the units are capable of standing up to normal outdoor field use in the variety of conditions and surroundings in which sampling takes place,
- (2) the reliability of the devices and application,
- (3) the efficiency of electronic data capture versus current data collection methods,
- (4) the accuracy of data collected electronically versus data collected using current methods, and
- (5) improvements that could be incorporated into the application to increase efficiency, accuracy, or ease of use.

Exploring the use of electronic data capture was one of the recommendations suggested by the 2010 MRIP Consultant Review of the Washington Ocean Sampling Program.

## **METHODS**

Sampling design was identical to that currently used by the OSP during "peak" months (complete documentation is available on the RecFIN website, <http://www.recfin.org/documents/wa-osp-methods102008-0>).

During the months of March – September, WDFW hired one additional sampler in the ports of Ilwaco, Westport, and Neah Bay. Using the electronic data capture device (Apple Ipad Air tablet), that sampler accompanied another sampler using the program standard paper data collection method. The two samplers recorded identical data, including the duration of the interview using each method. During low effort time periods (mainly March – May), one sampler occasionally used both the Ipad and standard paper data cards for the same interview. All samplers throughout the season who used the electronic data collection devices were solicited for input on ease of use and ideas on possible improvements.

OSP field samplers used the electronic data capture devices in often severe environmental conditions including rain, wind (with salt water spray), and high heat. They were exposed to fish blood, slime, and ice. The ability of the data collection devices to withstand these conditions without interruption or failure was evaluated throughout the sampling season.

Field samplers typically work 8 hour shifts with minimal breaks. At times, considerably longer work shifts are required. We tested the ability of the data collection devices to accommodate these work shifts without interruption.

Dockside boat sampling is often very high paced, as field staff attempt to maintain a consistent sampling rate throughout the entire time period sampled. Speed and efficiency without jeopardizing accuracy are vital components of meeting sampling rate objectives. We compared the speed and efficiency of electronic data capture with that of conventional hand-recording methods. We also hoped to compare the accuracy of data collected electronically with that of data recorded conventionally.

Post-season, OSP permanent staff evaluated data records collected using each method. Duration of interview, accuracy, and efficiency of sample methods were compared and evaluated.

## RESULTS

Utilizing electronic sampling devices (Apple Ipad Air tablet) over a total of 857 hours of sampling activity during the months of March – September demonstrated that the devices are capable of withstanding normal outdoor field use and are sufficiently reliable to be considered for program-wide adoption. No devices were broken, damaged, lost, or stolen during testing. Only 1 instance of battery loss was recorded during a sampling shift. Device performance was negatively impacted by weather/ temperature on 21.2% of sampling shifts, while inability to collect data due to weather/ temperature resulting in data loss was experienced on 1.5% of sampling shifts (Table 1). Screen visibility was acceptable during various weather conditions and circumstances, rating positively (excellent/ good) on 68.1% of sampling shifts and poorly during 5.8%. The electronic sampling devices proved to be reliable under the field conditions encountered, rating positively (excellent/ good) on 76.1% of sampling shifts and poorly on 6.5% (Table 2).

The application used during testing (PSMFC-RECFIN-WA provided by Vitasys) presented significant difficulties in comparison to the standard paper data card collection. The reliability of the application rated positively (excellent/ good) 60.8% of sampling shifts and poorly during 12.3% of shifts (Table 3). When attempting to log into the application, samplers were successful 59.4% of sampling shifts and unsuccessful 40.6%; when attempting to create a new assignment, samplers were successful 90.2% of sampling shifts and unsuccessful 9.8%; when attempting to sync data, samplers were successful 46.4% of sampling shifts and unsuccessful 53.6%. The application was stable during 89.4% of sampling shifts, but the application crashed during 10.6% of shifts. Samplers were able to collect data during 94.4% of sampling shifts; 5.6% of sampling shifts were abandoned as a result of application failure (Table 4).

The Apple Ipad Air tablet equipped with the PSMFC-RECFIN-WA application was consistently less efficient in data capture than traditional paper data card collection methods. The average duration of interviews using the paper data card was 1.1 minutes per interview, while the average duration of interviews using the electronic sampling devices was 1.9 minutes per interview (Table 5). The efficiency of the electronic sampling method (Ipad Air tablet with PSMFC-RECFIN-WA application) received positive (excellent/ good) ratings during 29.4% of sampling shifts, and poor ratings on 27.1% of shifts (Table 6).

Issues with application development and data syncing precluded an accuracy analysis between the electronic sampling collection and the paper data card collection methods. Data collected electronically prior to May 10<sup>th</sup> was unusable. After May 10<sup>th</sup>, we were able to match and compare many lines of data that were collected and successfully synced using electronic devices with data recorded on paper data cards. Minor variations in catch values were found between the two databases. When comparing the successfully synced data, the anticipated quantity of electronically collected records were accounted for, but additional lines of data were present within the electronic sampling database that did not meet the established validity criteria of the application. Rules that had been established within the application were violated, causing boat type, trip type, and area fields to be missing values when associated angler and catch data fields contained values.

**Table 1.** 2014 device issues encountered during field testing of the Ipad Air device over the duration of the project (March – September), the number of sampling shifts the issue was encountered, the total number of sampling shifts the device could have experienced the issue, and the percentage of sampling shifts the issue was encountered.

| <b>Reliability of Ipad Air Device (Withstanding Field Conditions)</b> |               |                          |                                      |
|---|---------------|--------------------------|--------------------------------------|
| <b>Device Issues Encountered</b>                                      | <b>Shifts</b> | <b>Applicable Shifts</b> | <b>Percent of Shifts Encountered</b> |
| Damaged/ Broken   | 0             | 142                      | 0.0%                                 |
| Lost/ Stolen  | 0             | 142                      | 0.0%                                 |
| Battery Died  | 1             | 142                      | 0.7%                                 |
| Weather/ Temperature Performance Loss                                 | 28            | 137                      | 21.2%                                |
| Weather/ Temperature Data Loss  | 2             | 137                      | 1.5%                                 |

**Table 2.** 2014 sampler rating of the reliability of the Ipad Air device over the duration of the project (March – September), the number of sampling shifts the rating was given, the total number of sampling shifts the device could have received a rating, and the percentage of sampling shifts the rating was given, for screen visibility and durability.

| <b>Reliability of Ipad Air Device</b> |                          |                          |                |                   |                          |                |
|---------------------------------------|--------------------------|--------------------------|----------------|-------------------|--------------------------|----------------|
| <b>Performance Rating</b>             | <b>Screen Visibility</b> |                          |                | <b>Durability</b> |                          |                |
|                                       | <b>Shifts</b>            | <b>Applicable Shifts</b> | <b>Percent</b> | <b>Shifts</b>     | <b>Applicable Shifts</b> | <b>Percent</b> |
| Excellent                             | 25                       | 138                      | 18.1%          | 43                | 138                      | 31.2%          |
| Good                                  | 69                       | 138                      | 50.0%          | 62                | 138                      | 44.9%          |
| Okay                                  | 36                       | 138                      | 26.1%          | 24                | 138                      | 17.4%          |
| Poor                                  | 8                        | 138                      | 5.8%           | 9                 | 138                      | 6.5%           |

**Table 3.** 2014 sampler rating of the reliability of the PSMFC-RECFIN-WA application over the duration of the project (March – September), the number of sampling shifts the rating was given, the total number of sampling shifts the application could have received a rating, and the percentage of sampling shifts the rating was given.

| Reliability of Application |        |                   |         |
|----------------------------|--------|-------------------|---------|
| Performance Rating         | Shifts | Applicable Shifts | Percent |
| Excellent                  | 26     | 138               | 18.8%   |
| Good                       | 58     | 138               | 42.0%   |
| Okay                       | 37     | 138               | 26.8%   |
| Poor                       | 17     | 138               | 12.3%   |

**Table 4.** 2014 results for the functional reliability of the PSMFC-RECFIN-WA application over the duration of the project (March – September), the number of sampling shifts and the percentage of sampling shifts the result was experienced, for log in success, assignment creation, data syncing, application failure, and data collection.

| Reliability of Application |                |         |                           |         |                   |         |                     |         |                      |         |
|----------------------------|----------------|---------|---------------------------|---------|-------------------|---------|---------------------|---------|----------------------|---------|
| Results                    | Able to Log In |         | Able to Create Assignment |         | Able to Sync Data |         | Application Crashed |         | Able to Collect Data |         |
|                            | Shifts         | Percent | Shifts                    | Percent | Shifts            | Percent | Shifts              | Percent | Shifts               | Percent |
| Yes                        | 85             | 59.4%   | 129                       | 90.2%   | 64                | 46.4%   | 15                  | 10.6%   | 135                  | 94.4%   |
| No                         | 58             | 40.6%   | 14                        | 9.8%    | 74                | 53.6%   | 126                 | 89.4%   | 8                    | 5.6%    |
| Total                      | 143            | 100.0%  | 143                       | 100.0%  | 138               | 100.0%  | 141                 | 100.0%  | 143                  | 100.0%  |

**Table 5.** 2014 efficiency comparison between the Ipad Air device data capture and standard paper data card collection methods over the duration of the project (March – September), the seconds per interview, and the minutes per interview.

| Efficiency Comparison |                       |                       |
|-----------------------|-----------------------|-----------------------|
| Method                | Seconds Per Interview | Minutes Per Interview |
| Ipad                  | 111.84                | 1.9                   |
| Paper                 | 66.81                 | 1.1                   |

**Table 6.** 2014 sampler rating of the Ipad Air device and PSMFC-RECFIN-WA application data collection method over the duration of the project (March – September), the number of sampling shifts the rating was given, the total number of sampling shifts the device and application method could have received a rating, and the percentage of sampling shifts the rating was given.

| Efficiency of Ipad Data Collection |        |                   |         |
|------------------------------------|--------|-------------------|---------|
| Performance Rating                 | Shifts | Applicable Shifts | Percent |
| Excellent                          | 5      | 133               | 3.8%    |
| Good                               | 34     | 133               | 25.6%   |
| Okay                               | 58     | 133               | 43.6%   |
| Poor                               | 36     | 133               | 27.1%   |

## DISCUSSION

Testing the Ipad Air tablet as an electronic sampling device over the course of 857 sampling hours indicated that there is potential for the OSP to utilize electronic data capture technology in place of traditional paper form methods in the near future. Below, we discuss specific aspects of the 2014 testing results.

### *Equipment durability and reliability*

The Ipad Air device passed initial durability testing and performed well enough in the field conditions it was exposed to throughout the course of the sampling season to warrant further trials of the device. The capabilities of the device were greatly enhanced by the Lifeproof case, which provided the waterproof and shockproof capability to the devices that are essential to withstanding sampling conditions. Issues caused by field conditions that were encountered during the sampling time frame consisted mostly of screen glare due to sun, touch screen disruption from heavy rain, and overheating due to heat convection inside vehicles. The only two documented cases of weather related data loss or inability to collect data were the result of heavy rain causing prolonged touch screen malfunction, and warmth from a vehicle interior triggering the overheating protective shut down. Samplers were able to mitigate the effects of weather conditions by being conscious of the conditions the devices were subjected to, and by using their bodies to shield the touch screen from direct sun or rain. Battery life was not an issue even during prolonged overtime shifts of up to 11 hours. Potential battery issues could be overcome by distributing chargers for use in sampler vehicles.

### *Application reliability*

Reliability is a focal issue when contemplating a program wide movement from paper data card collection methods to electronic data collection. The OSP is designed to maintain a systematic random sample of boats, requiring a consistent data collection method. Data loss could jeopardize overall data quality and the accuracy of catch estimates used in fishery management and regulation planning. During the sampling season, a myriad of reliability issues were encountered with the application provided by Vitasys. There were too many issues related to opening the application,

logging in, creating new assignments, and syncing data to inspire confidence that the application would allow reliable data collection.

#### *Efficiency of electronic data collection*

To maintain sample rates and minimize biases during field sampling, it is vital that data is collected in an efficient manner. Efficient data collection ensures adequate sample size and promotes positive angler rapport for the OSP. During the trial season, the Ipad Air tablet equipped with the PSMFC-RECFIN-WA application was consistently less efficient than the standard paper data card collection method. This was to be expected to some extent. Samplers experienced a steep learning curve when using the Ipad Air tablet and application during the first few sampling shifts. The application itself proved to be cumbersome and several inefficiencies were attributed to form organizational issues and redundancies. Form corrections were made early in the sampling season, but application development was not available for the majority of the testing period. Consistent troubleshooting, operating system updates, and syncing issues also added significantly to office staff time required during the trial period.

#### *Accuracy*

Data accuracy of the electronic collection method is essential for the OSP to consider program wide adoption. Catch estimate and quota management precision are correlated with the accuracy of data collected by field sampling staff and populated in the database. Prior to May 10, there were existing issues with the electronic sampling database that caused the storage of nonexistent data values and caused data fields to be filled in with redundant, arbitrary values that were not representative of the data encountered in sample. The data were unable to be reconciled into a comprehensible format and we were unable to evaluate accuracy. Post May 10, the electronic sampling data were successfully synced to the electronic sampling database on an inconsistent basis. Accuracy analysis of the electronic data capture device was limited because data inconsistencies between electronic sampling data and paper card collection data could be attributed to multiple factors and error sources. Application glitches, syncing process failures, and database conversion issues were primary sources of data accuracy issues with the electronic data collection method, but it was impossible to pinpoint the specific source of each issue encountered. Sampler recording errors and angler interview variation issues were potential sources of inconsistencies between electronic sampling data values and paper card data values that could not be eliminated from consideration because of missing identifiers between the electronic data and paper card data. Overall, data collected during the project were not suitable for producing accurate ocean catch estimates and considerable accuracy improvements are a requirement for further consideration.

#### *Conclusions*

The OSP is optimistic that electronic sampling can replace paper data cards in the near future. The Ipad Air device performed well in a variety of weather and temperature conditions and withstood the slime and blood environments in which port samplers operate.

In order for the OSP to utilize electronic data capture methods as the sole means of data collection there would need to be significant changes to the design of the application. The reliability of the application would need to be increased so that data loss is at an acceptable level. Database rules need to be incorporated into the electronic form to eliminate obvious errors, increase data accuracy, and decrease data error checking requirements. The electronic form needs to be easier to use and read during sampling conditions, which could be accomplished with larger touch selection areas and different formatting. Electronic form flexibility should be improved to mimic the dynamic order of

interview questions and sampling, which would increase sampling efficiency. Changes to the data entry mechanics of the electronic form would eliminate data redundancies, and increase data entry efficiency.

Given the multitude of improvements necessary for the application to become viable for the OSP, we recommend developing a new application with more robust capabilities that would address the sampling complexities of the OSP with a higher degree of reliability and efficiency. We further recommend that the application be developed in-house by I.T. staff to allow better support and communication between developers and sampling program staff.

Ultimately, by utilizing a new application, new form design, and access to in-house I.T. support there is potential for future electronic data collection to approach the efficiency of paper data cards in the field, save office staff time by reducing data entry and error checking requirements, provide more accurate data, and minimize turn-around time for data analysis and estimates.