NOAA Technical Memorandum NMFS-SEFSC-758

Findings of the SEFSC Electronic Logbook Pilot Program

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February 2022

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February 2022

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This report should be cited as follows:

Pierce, Brett[a], Gross, Glenn[a], 2022. Findings of the SEFSC Electronic Logbook Pilot Program. NOAA Technical Memorandum NMFS-SEFSC-758, 33 p.

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Executive Summary

The Fisheries Statistics Division (FSD) of the Southeast Fisheries Science Center (SEFSC) ran a pilot between April-November of 2015 to test the feasibility electronic reporting (e-logbooks) in the Southeast for federal commercially permitted coastal and Highly Migratory Species (HMS) vessels. In addition to evaluating the software and hardware options for e-logbooks, the pilot program provided an opportunity to collect fishing effort data on a set based (fishing event) level. This is opposed to the trip level information collected currently on paper logbooks. By defining more specific spatial and temporal fishing events, logbook data can be used to inform advanced ecological models, single species stock assessments, and provide more detailed scientific data used in forming fisheries policy. Current reporting for coastal fisheries is on a trip level with HMS fisheries reporting on a set level using paper logbooks.

Eight laptops (15 inch Dell Latitude E6530) and three tablets (iPad2) were deployed on a total of 12 vessels and one vessel utilized an existing onboard PC. Three software vendors produced e-logbook versions for the pilot program. Of the 12 vessels, 9 vessels submitted data in some capacity. A total of 58 trips were completed with days at sea ranging from 1 to 17. Gears employed included bandit reel, hand line, longline (reef and pelagic), buoy, and trap (fish).

An important goal of the pilot project was to generate user feedback. The most frequent feedback from the pilot program participants concerned the hardware. They widely considered the laptops too cumbersome for many of the vessels in the pilot program. Although laptop and desktop versions of the e-logbook software may be adequate for some Southeast vessels, the SEFSC encourages vendors to develop additional tablet and mobile-based options of the software. A choice of several options will likely significantly reduce burden on fishers with hardware costs, data transmission rates, and ease of use. Fishers also provided feedback on the update to set-based fishing effort collection. Perceptions seem to correlate to the amount of time on the hardware and prior experience with set-based reporting. Participants using a gear type that can be naturally defined as a set were less likely to have issues with set-based reporting. The negative perceptions of set-based reporting were strongest with our hook-and-line/hand line (non-bandit) participants. It is important to note that not all feedback will go into the operational version.

The pilot study demonstrated the ability for e-logbooks to increase the spatial resolution of fishing effort. E-logbook reports showed vessels fishing in multiple areas during the same trip, information that is often not captured on the trip-based paper logbooks. One example from the pilot demonstrated a vessel fishing in three separate areas over a two-week trip. In this example, the current paper logbook would only require a single area reported, corresponding to the location where the majority of catches occurred. E-logbooks also have the

ability to use GPS coordinates (DDMM.0000) to log fishing locations. Under current reporting standards, a vessel fishing an area at 27 degrees latitude could be anywhere in a 4,246 square mile area. Using the pilot's GPS standards, the electronic logbook would decrease the uncertainty to around 31 square feet at the same latitude.

The e-logbooks tested during the pilot program also provided an opportunity to collect fishing effort on a set-based (fishing event) level for coastal gear types, in a similar fashion to the current HMS gear reporting requirements. Current reporting for coastal fisheries is on a trip level. More specific spatial and temporal fishing information can be used to inform ecological models, single-species stock assessments, and provide more detailed scientific data used in forming fisheries policy. Although set-based reporting will not be required initially for mandatory reporting, the SEFSC intends to continue discussions with industry members and the regional fishery councils to transition towards higher resolution fishing event definitions.

The pilot project demonstrated that electronic logbooks are a feasible platform to collect required logbook catch and effort information for federally permitted Southeast and HMS commercial fisheries. With an increased focus on improved data collection, e-logbooks have the ability to provide a significant improvement in data collection for the commercial sector that current paper logbooks cannot provide. Developing the data collection standards in coordination with the Atlantic Coastal Cooperative Statistics Program will lead to more standardized reporting interfaces along the East Coast and across fishing sectors, i.e., recreational-commercial and Northeast-Southeast dually permitted vessels. This meets a request from stakeholders to limit reporting burden (NMFS/GARFO 2019). Input from pilot participants has helped the SEFSC to integrate an electronic reporting option for a wide variety of vessel and gear types used for the numerous commercial fisheries of the Southeast and HMS.

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Introduction

The Fishery Monitoring Branch (FMB) of Southeast Fisheries Science Center (SEFSC) conducted a pilot program to test the feasibility of electronic reporting in the Southeast United States for all Southeast region federally permitted coastal commercial fishing vessels and those participating in the Atlantic Highly Migratory Species (HMS) fisheries. Federally permitted commercial coastal (hereafter, coastal) vessels, are vessels required to report commercial fishing trips and catch on Southeast Coastal Logbooks[1]. Federally Permitted vessels participating in the HMS fisheries are vessels required to report trips and catch on the HMS Trip summary and set form logbooks along with tally records (individual dressed weights).[2] Testing of electronic logbooks (e-logbook) began in April of 2015 and continued through November 30, 2015. The purpose of this report is to brief the various fishery management councils, the data collection committees, and the public on the findings of the e-logbook pilot program.

Installation

Installation of the e-logbook and the associated hardware occurred over several months beginning in April of 2015. Initially, the installation was to take 3 weeks. However, several factors prevented us from meeting the 3 week schedule. Volunteer recruitment began in the fall of 2014 and continued on an as-needed basis. Approaching the April installation date, there were 11 volunteers providing 15 vessels for the pilot program. The vessels consisted of nearly all major gear types, targeting a large variety of fisheries in the Southeast. The volunteers included 3 vessels from the HMS fishery. As the installation date approached, there were several vessel owners that informed the FMB they did not want to participate in the pilot program. Most notable were buoy gear fishers in the South Florida area. Also, a time-area closure in the Gulf of Mexico halted participation of a pelagic longline HMS vessel docked in Louisiana. All efforts were made to recruit participants using similar vessel and gear types, to replace the participants that left the pilot program.

Installation for the remaining vessels continued with mixed results. One goal of the pilot program was to evaluate the installation process of both the hardware and the software. There were a range of vessels that participated in the pilot program with varying cabin space and electrical capabilities. This provided the project with varying installation scenarios that are likely inclusive of the majority of vessels in the Southeast.

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[1] Snapper-Grouper/Reef Fish, Mackerel, Dolphin-Wahoo, and Coastal Shark Fisheries
[2] Swordfish, Tuna, Shark Fisheries

Vessel Information

Eight laptops and three tablets were deployed on a total of 12 vessels with one vessel utilizing an existing onboard Personal Computer. Of those 12, nine vessels submitted data in some capacity. A total of 58 trips were completed with days at sea ranging from 1 to 17. Gears employed included bandit reel, hand line, longline (reef and pelagic), buoy, and trap (fish). In addition to these vessels, hardware was deployed on 3 mixed gear vessels. Data file size for transmission ranged from 1 Kb for 1 day trips to 14Kb for 17 day trips. Further vessel and gear information can be found in **Appendix A.**

Participating Software Vendors

Three vendors produced e-logbook versions for the pilot program. These were OLSPS Marine, Electric Edge Systems Group Inc., and Harbor Light's Atlantic Coastal Cooperative Statistics Program (ACCSP) version. In this report, the OLSPS Marine software will be referred to the Olrac Dynamic Data Logger (OlracDDL). The Electric Edge Systems software is called Fishing Activity and Catch Tracking Systems (FACTS). The Harbor Lights version will be referred to as ACCSP. The FMB has been in touch with several other vendors who have expressed interest in producing operational software for the SEFSC. Periodic updates have been sent to these vendors. It is believed that once the data collection standards are finalized, more vendors will enter the market with approved data collection software.

Two different hardware platforms were used, an iPad2 and a 15-inch Dell Latitude E6530 laptop. Three iPads were deployed for the pilot program. The iPads only ran the ACCSP version of the e-logbook so the number deployed was limited. Some vessels in the pilot program utilized onboard computers and a version of the e-logbook was installed on those whenever possible. All other pilot program vessels were provided the Dell laptop. Both the FACTS and OLSPS e-logbook versions currently run exclusively on Windows operating systems.

Installation Process and Technical Information

Many vessels had very limited space, so power and data connections to the logbook were as flexible as possible to accommodate the space constraints. Turbulence under rough sea conditions was an additional concern. In some vessels, even those with enclosed wheelhouses, salt water intrusion was a possibility.

All fishing vessels have 12-volt battery power and some have DC to AC inverters providing 115VAC. Providing power from the vessels' 12-volt batteries was the only universal choice. 12-volt DC power was provided through maritime-quality sockets as is typical on fishing vessels. Fused circuit protection was implemented where practical.

The goals of the installation were to be minimally invasive, have flexibility of e-logbook location, and to be able to remove the e-logbook without a technician present. Any installation

hardware remaining after e-logbook hardware removal would have no negative effect on the vessels systems.

The primary source of data needed on the e-logbooks was manual data entry of fishing characteristics and real-time location via Global Positioning Systems (GPS). Location data were provided automatically by integrating the existing vessels GPS as a data input to the logbook or by providing the participant with an external USB-GPS receiver. On most vessels, shipboard GPS systems were manufactured by Garmin or Furuno. On some vessels, although functional GPS units were available, the necessary connecting cable from the GPS was absent. Knowledge of what GPS system was on board was not sufficient as it was discovered through experience that it is also imperative to know what connectors and cables were actually on board and available. When the correct connections for the GPS were not available, the proper cable needed to be ordered before installation could be completed.

GPS data coming from maritime GPS units is serial data as per the appropriate electrical standards of NMEA 0183 (National Marine Electronics Association) or NMEA 2000. Fortunately, integration of all GPS units required the use of NMEA 0183, which required less sophisticated interfacing hardware. As per the NMEA specifications, the GPS data comes out as standard serial data. This data stream feeds directly into any desktop legacy 9-pin connector serial port. The 9-pin connector serial port is no longer available on laptops so serial data must be transferred through a USB port. However, simple RS232 to USB converters are available and a Trendnet TU-S9 device was used to bring the serial GPS data into the laptops.

In addition to the hardware considerations of this Trendnet device, the laptop required the installation of the software driver for this device. The Windows “Device Manager” was used to determine which USB port the laptop assigned to the Trendnet and then this communication port, along with its baud rate (speed), had to be selected in the e-logbook software.

As the pilot program progressed, it was discovered that both FACTS and the OlracDDL version of the e-logbook worked well with some USB-GPS receivers, which we describe below. With the use of these receivers, installation can forgo the wiring of the on-board GPS to the hardware. These are very compact but very capable GPS receivers in a physically small package whose power and data input connection is through one Personal Computer compatible USB plug. This has numerous advantages as it makes the e-logbook more of a standalone system and therefore more portable. It also negates the problems encountered when one GPS signal is shared by multiple applications.

The two specific models used in the e-logbook pilot program were the GlobalSat BU-353-S4 USB GPS Receiver and the Garmin 18x USB GPS. Both are approximately 2” by 2” discs by 0.8”. The Dell laptops unfortunately seemed to be limited on the amount of current they

would feed from the USB ports and would not handle the electrical power requirements of the GlobalSat unit. Other laptops did not exhibit this current limitation. The Garmin worked with the Dell test-fleet laptops. Furthermore, USB-GPS receivers will need to have clear reception of satellite signals. As such, the use of an USB extension cable might need to be employed. It is possible such a USB extension cable might introduce a problem due to voltage drop. This will need some degree of experimentation. However, the USB-GPS is a very attractive option to meet the GPS needs of the e-logbook software.

As previously mentioned, there were several issues that were discovered during the installation process. Each issue can inform the Southeast fleet of areas of concern and provide best practices when installing the operational versions of the e-logbooks. Among the issues discovered, there were a few that stood out. Those issues are discussed in detail below.

Problems encountered:

1) Some vessels used the GPS data for other systems such as chart-plotter or navigation software. This sometimes caused interference between the e-logbook software and the chart-plotter software. One solution was to use virtual GPS port splitter software which is available as shareware or by license. Although this worked, it was not without its faults and required starting the two applications in the proper sequence. An alternate option is to use two separate GPS sources (such as a USB-GPS receiver) for the two systems.
2) The GPS system on board the pilot program vessels were adequate but the necessary serial data was already in use by another system, a chart plotter, and the addition of the e-logbook laptop added additional consumption of the serial data signal which resulted in a marginal signal level (voltage). The GPS data output is designed to go to only one device (computer). In the pilot program installation, it was desirable to minimize interference with the existing connection to the chart plotter. In a non-trial scenario, having the signal go to both the e-logbook and a chart plotter without interference could be handled numerous ways. Two such methods would be by adding a small “modem splitter” or by using a USB hub and have the data go to the chart plotter and to the e-logbook by separate USB ports. Note: USB is just a faster more universal version of the standard serial data.
3) In one installation, the needed GPS signal was already in use and going to another shipboard system. Fortunately the GPS had a redundant GPS port available on an unused connector, but it necessitated an additional unforeseen cable. This was purchased and the installation completed.

Fisher Feedback

The main objective of the pilot program was to test current versions of e-logbook software and then to use feedback from the pilot program participants to produce an e-logbook version that met the specific challenges of Southeast fisheries. Fishers provided regular feedback during the pilot program. That feedback was made available to the vendors so they could make any changes they felt were necessary to meet the fishers' requirements. It is important to note that not all feedback will go into the operational version. It has been the position of the Fishery Management Branch to allow vendors to develop a product, and then to market an approved product to fishers in the Southeast as long as data collection standards are met. Some suggestions by fishers and FMB staff may be too problematic to include in the initial operational version. We leave it to the discretion of the vendors to make changes as they see fit. Any software that is approved by the FMB will have to include data collection standards provided by the FMB.

Hardware

The most frequent feedback from the pilot program participants concerned the hardware. It was widely considered that the laptops provided were too cumbersome for many of the vessels in the pilot program. However, perception of the hardware depended on the cabin size, workspace, and the familiarity of the user with computers. Some vessels in the pilot program relied on already installed computers to run navigational software. The electronic logbook software installation occurred on these computers instead of a laptop or tablet provided by FMB. Feedback from vessels that used this set-up was more focused on the software aspects than the hardware.

Perception on the hardware also varied by the type of fishery and the gear used. For example, participants using buoy gear interacted with the laptop few times during a trip. The nature of a fishing set and the data collected allowed for the laptop to be stowed for the majority of the trip. In comparison, a vertical line fishers had to interact with the laptop frequently due to the definition of a set and the data required on the number of species caught. Fishers using bandit reel gear were often present in the wheelhouse while fishing was conducted, thus more attention can be paid to the e-logbook.

Many participants indicated that the e-logbook software should be on a tablet. Both vendors that were running primarily on laptops were informed early in the pilot program that fishers were asking for mobile versions of the software. Vendors are making the necessary shifts to produce e-logbooks on tablets as the technology continues to improve and become more available.

The data collection standards should guide the development of mobile versions of the e-logbook software. One vendor reported to the FMB that the current standards could be

developed into a mobile version somewhat quickly. We expect there to be continued dialogue with the vendors to address any issues that may arise while fitting current data standards into a mobile version.

It was noted earlier that the ACCSP mobile version of the e-logbook runs primarily on tablets, while an online version is available for vessels with an internet connection and PC. The mobile version has the capability to run on all three major mobile operating systems (Windows, iOS, and Android).

It is our belief that a laptop or desktop version of the e-logbook should be made available to the fleet with all consideration given to the development a mobile version of the e-logbook. The differences in using a laptop or PC versus using a mobile version can be found in **Appendices B and C**. It was evident in the pilot program that some vessels were capable of incorporating e-logbooks that run on traditional hardware like laptops and desktops. Some users may prefer this due to the familiarity with the hardware as well as the hardware already installed on-board. Some vessels in the pilot program use a computer to run navigational software. Integrating e-logbook use with these platforms would not be difficult to do. However, a large portion of the fleet may find it more convenient to run the e-logbook in a self-contained unit like a tablet that can be used at multiple locations on a vessel.

Software

Another priority of the electronic logbook pilot program was to field test the user interface of available versions specific to the Southeast fleet's needs. Fishers who used the three software versions provided feedback which was then passed along to the vendors. Feedback was provided on a regular basis and is being incorporated into the operational version. Specific fisher feedback included:

- More efficient navigation through software
- Ability to search quickly when looking through tables for data entry
- As many data entry fields as possible to 'roll over' between sets.
- Display settings to accommodate night fishing

There are some potential differences in the wants/needs of the fleet versus the needs of the SEFSC. Prior to the launch of the pilot, data collection standards were developed by the FMB staff and delivered to the vendors. Below are some areas of consideration that developed as a result of the experience fishers gained using the e-logbook over the course of the pilot program.

Set based collection

Other than the perceptions on the hardware, the feedback on the set based information has been the largest area discussed. Perceptions seem to correlate to the amount of time on the hardware and prior experience with set based reporting. For example, buoy gear fishers interact with the laptop very little and have prior set based reporting experience, therefore there was very little trouble with the information that was required.

Participants using a gear that can be deployed in a 'natural' set were less likely to have issues with set based reporting. The perceptions of set based reporting were strongest with our hook-and-line/hand line (non-electric rod-reel) participants. For the pilot project, we gave direction to participants defining what was considered a "set" for hook and line gear (**Table 1**). Our hook-and-line participants described their fishing activities at installation and the set based reporting was tailored to fit in the most logical process. However, recording data at the set level for some hook-and-line fishers proved to be problematic. Over the course of the pilot project, it was discovered that some vessels may make several test sets before initiating a significant fishing event. These sets may be only 5-10 minutes long. Furthermore, a fisher may employ a tactic of drifting over a reef several times, each time removing all gear from the water and returning to the initial location where the set began. Pilot participants indicated that recording a set every time the gear is removed from the water is simply too burdensome. With this is mind, the definition of a fishing event was scaled back to a sub-trip level for hook-and-line, hand line fisher **(Table 2).** Under the revised definition, a fishing event would be logged at least once every 24 hours. A fishing event would end when there is a significant stoppage of fishing or a new gear is deployed. This sub-trip level is an improvement spatially and temporally from the current, trip level reporting used in non-HMS paper logbooks.

For fishers using the bandit reel and vertical line gears, fishing was more suited to 'set' reporting. A typical bandit reel set in the pilot lasted 3-6 hours and a fisher would make 5-9 sets over a 4-day trip. Furthermore, no specific issues from set-based reporting within this gear type were reported.

Set-based effort data entry

Multispecies fisheries are unique in the Southeast. The ability to collect and apply more detailed catch and effort data to stock management can be an advantage when navigating the challenges facing Southeast fisheries. The more detailed the fishery-dependent data, the more a fishery can be disaggregated into fleet segments (Bastardie 2010). With increased detail required by the data collection, comes increased reporting burden on fishers. All versions of the pilot e-logbook had tools that limit the data entry burden on fishers. This includes quick access to commonly used gear, bait used, and species targeted. These are in addition to lists of favorites that enable fishers to quickly log catch or report on disposition of a discarded species.

Each e-logbook version, however, varied in which data entry fields can be 'rolled-over' and which have to be entered every set/trip. The pilot project participants expressed interest in rolling over nearly all of the effort data fields between sets. These fields include target species, hook size and type, bait type used, and gear type among others. However, discussions within the FMB suggest we may need to consider what specific fields fishers need to enter every time to ensure that the correct information is collected. For example, on the OlracDDL, the *Target Species* field is a field that rolls over with the information from the previous set. Even though this is a required field, it is very inconspicuous and can be overlooked. This was evident in the data that are submitted. For many of the reports submitted, the target species never changed and some reports did not indicate that the target species was even caught. Given that the target species in the Southeast can change between sets, we made the recommendation that the field must be selected for every set. A list of 'favorite' targeted species can be pre-loaded before a trip to limit time spent on this field. Increasing the number of required manual-entry fields will likely be at odds with what the users want. As indicated earlier, perceptions on the set based reporting vary and some fishers will likely not have preference either way once the operational version is released.

Hail weight vs. Logbook weight

Current coastal logbook reporting requires that the weight of all fish sold or kept-for-personal-use be reported on the logbook. The e-logbook requirements that for each set the fisher reports a hail weight for each species caught. This can potentially create differences in total landings that are sold versus what is reported by fishers. We expect there to be differences in this amount. There was no clear pattern in the pilot study of captains consistently exhibiting positive or negative bias in estimating hail weight, as both occurred regularly and varied between trips.

The data collected during the pilot project indicated that hail weights provided during the pilot were close to the landings reported in both the logbooks and in the dealer reports. Fishers routinely estimated catch within 10% of paper logbook reported catch[3]. The largest gap between hail weight and logbook weight during the pilot was 21%. Only 3 trips estimated hail weight with a difference of more than 15% of the paper logbook reported catch.

It is more beneficial, however, to look at the hail weight per set/effort than to focus solely on the landings totals of a trip. Current methods must assume that landings are uniform for the fishing time reported (Mion et al., 2015; Bastardie et al., 2010; Gerritsen et al., 2011). This can be further complicated by the differences in how effort is calculated between gear

[3] E-logbook hail weight was compared to paper logbooks and the dealer landings for the reported trip. Dealer reported landings were identical or nearly identical to paper logbooks for vessels reporting a trip during the pilot. Occasionally, a few pounds were reported on paper logbooks for catch that was not sold.

types. For example, reef long line fishing times are reported as the "average time in hours that the hooks were in the water" and for number of sets in the trip (2016 Southeast Coastal Fisheries Trip Report). Within fishing areas reported, landings must be averaged across these effort parameters, potentially reducing the ability to accurately collect any spatial variation that may be present (Mion et al., 2015; Hintzen et al., 2012). For gears that lack natural sets (thus more effort assumptions); this can be even more problematic.

Having fishers estimate hail weight for each set allows scientists to more accurately determine catch/effort information for a given location, providing the needed information to reduce uncertainty in the spatial variation of the catch. The set by set proportion of total catch from the hail weight can be then applied to the total weight sold (derived from dealer data) to estimate the amount landed from a given location. Given that each set's fishing time and location is also recorded, data sets will become more heterogeneous.

Set based Location

Coastal logbooks currently require commercial fishers to report one area fished on the trip level to be compliant with reporting requirements, even if multiple areas are fished. Current reporting areas are 1x1 degree grids. The use of onboard e-logbooks significantly increases the specificity of the spatial data collected and information on whether or not a vessel is fishing in multiple areas. Vessels often report fishing in only one area on logbooks regardless of whether or not fishing occurred in multiple areas. Analysis of e-logbook data showed vessels do fish in multiple areas. Electronic data collection would capture the spatial data that is currently not collected. One example from the pilot demonstrated that a vessel reported fishing in three separate areas over a two-week trip, but only reported one area on the paper logbook. Over the course of the pilot, there was no consistent pattern of vessels fishing in single or multiple areas on a trip. Vessels that fished over multiple areas for some trips may only fish in one area the next trip and vice versa.

HMS vessels already report on the set based level to indicate the start and location of a set. The additional requirements in the e-logbooks will be to indicate the time and location of end of the fishing event. Location of HMS pilot participant paper set forms were compared to the location reported and found to have a high degree of accuracy.

There is some indication that vessels fishing on longer trips have a higher likelihood of fishing in multiple areas. For the years 2014-2015, multi-day trips of four days or more represented 13% of all trips and 46% of days away for the coastal reef fisheries fleet. Trips of six days or more represented 7% of all trips and 33% of total days away. This information indicates that there is a potential for a significant increase in the amount of areas fished reported per trip when collecting spatial information electronically, when compared to the spatial information currently collected by coastal reef fisheries paper logbooks. Specific hotspot fishing locations

can be identified using GPS data in combination with the hail weight providing much more specific catch/effort information relative to location.

Overall, major improvements in the specificity of the spatial data would be one of the largest benefits from using electronic logbooks. Fishery-dependent data with concurrently recorded geo-spatial data present a novel opportunity to analysts and researchers (Gerritsen et al., 2011). Often, vessels travel large distances over a trip or even in a day in search of fish (Russo et al., 2015). Under current reporting standards, a vessel fishing an area at 27 degrees latitude could be anywhere in a 4,246 square mile area. That uncertainty increases if a vessel fishes in additional unreported areas over the duration of the trip. Using the pilot's GPS standards (DDMM.0000), the electronic logbook would decrease the uncertainty to around 31 square feet at the same latitude. Additionally, information provided by the e-logbooks will show the location of the beginning and end of each set for the majority of gears. Having this information decreases the uncertainty of biological models, ultimately improving stock assessment methods (Bastardie 2010).

Electronic logbooks will increase the specificity of spatio-temporal catch data. With the possible increase of 1700+ vessels in the Southeast providing detailed spatio-temporal data, comparisons between other data collection methods (i.e., embedded observers) can be assessed. The type of data collected by e-logbooks will be more aligned with those collected by observers, effectively increasing the frequency and the spatial extent of known data collection methods (Mion 2015). Another benefit of such detailed data is the identification of specific hotspot fishing locations and species interaction within broadly defined fishing areas which can aid in identifying essential fish habitat, spawning aggregations, and migration patterns of commercially important and endangered or threatened species. (C. Moore, 2016).

Apportionment

The apportionment section of the e-logbook had several rounds of discussion between the SEFSC staff and the vendors, with input from the pilot participants. Pilot participants were asked to apportion catch between dealers and if any was kept-for-personal-use. The data collected within the apportionment section were species landed, apportionment amount, disposition, grade, dealer sold to, and date and time sold (**Table 3**). The total of all landings reported was to equal the sum of pounds caught for every set, per species.

Ideally, fishers are to submit electronic reports before selling their fish. This led to confusion because it was not always known at that time to which dealer the catch will be sold, much less if any was to be kept-for-personal-use. This raised questions among the participants for two reasons. They had trouble understanding why they apportioned hail weight when it is

not the weight that is actually sold. Secondly, all of our participants sold to one dealer exclusively and expressed dissatisfaction of having to apportion the same amount landed when the grade and disposition did not change from the first time they entered it.

Discussions among the SEFSC staff, with input from the pilot fleet, resulted in an overhaul of the apportionment section, as well as the correlating catch and discards section (data entered at the end of each set). It was determined that final landings specific to a trip can be acquired from dealer reports. Furthermore, grade was not needed as a data entry field. As a result, for catch flagged 'for sale', fishers are required to enter the dealer they intend to sell to.

Cost of Electronic Logbooks to the Southeast Fleet

[4]*Fleet Revenue*

Using the latest complete data at the time of analysis, 2014, the Southeast coastal fleet[5] had 3,893 coastal permitted vessels. Of those, 2,127 did not report a logbook fishing trip, leaving 1,787 vessels for which we can estimate the varying levels of revenue. Estimated revenue was determined by calculating total landings by species for each vessel, and then multiplying those landings by the average price per pound by state. Landings information was derived from the coastal fisheries logbook program (CFLP) and the value of the landings from the Accumulated Landings System (ALS).

Results from the CFLP and ALS databases show a wide range of estimated revenues across the coastal commercial sector. Given the relatively small-scale nature of many Southeast commercial fisheries, this is to be expected. 55% of federally permitted vessels have revenues above $10,000 and slightly more than a quarter of vessels with at least one trip in 2014 and revenues of more than $50,000. 270 vessels (15%) had estimated revenues of more the $100,000.

Revenue figures seem to imply that not all permitted vessels participate in the commercial fisheries full-time or even every year. These data indicate that for a large percentage of vessels in the Southeast, income derived from commercial fishing is likely only a portion of annual income with another major component coming from for-hire fishing (over 20% of coastal logbook vessels have a federal for-hire permit. More specifically, a sample of the

[4] Summarized from analysis by Christopher Liese and Elizabeth Overstreet

[5] Federally permitted vessels required to report catch on federal "coastal logbook" forms. Estimated revenue for federally permitted vessels here does not include any income from participation in HMS, for-hire, or state managed fisheries etc.

commercial fleet showed that about a tenth of coastal commercial vessel owners derive more than half of reported income from charter fishing.

It should be noted that a large input into the operation comes from the owner in the form of labor. 85% of commercial fishing vessels comprising 86% of days-at-sea were operated by owner-operators, revealing an important labor component when it comes to operational costs. Ultimately, there is some degree of overlap in Southeast coastal fisheries between the commercial and charter sectors.

Southeast charter vessels will be adopting mandatory electronic reporting in 2021. As there is some overlap of participants in both for hire and commercial fisheries, the development of e-logbook software that can be used on a singular device needs to be explored. Data requirements between the e-logbook versions would differ, however a singular device with alternate interfaces depending on the type of fishery would reduce the cost and burden to fishers. Creating multiple interfaces on a singular device would best work by consolidating e-logbook submission protocols across the two fisheries. This has mostly been accomplished by consolidating reporting interfaces using the ACCSP API. There will be different reporting requirements between the sectors, but those requirements will not affect the data formats and structure.

Cost of e-logbook and Hardware

Implementing e-logbooks would shift a significant proportion of the data entry costs from the SEFSC to the industry. The exact cost to the industry will depend on several key factors, including the software version chosen, the cost of e-logbook platforms (tablets/PCs), and the supporting hardware. Costs differences in the hardware versions can differ because of the integrated features ('bells and whistles') that are provided above what is required by the SEFSC. These features may include spatial tracking of deployed gear, detailed access to catch histories and locations, and ease of use features that facilitate better e-logbook interactions.

Cost estimates are based on a range of variables that attempt to capture the variety of scenarios in which vessels in the Southeast may need to upgrade or include e-logbook licensing and hardware in order to submit logbooks electronically. One situation that is not easily calculated are instances in which a vessel owner may own multiple vessels, or a fish house or dealer covers the costs of licensing for its fleet vessels. Two of the pilot vendors have stated that discounts for bulk orders will be offered. Furthermore, the licensing costs are estimates based on the availability in other markets or disseminated to the SEFSC. Any estimates provided to the SEFSC were considered non-binding and subject to change. Licensing costs are not specific due to the proprietary nature of the information.

Hardware costs (**Tables 5, 6, 7**) are given in a range from mid/low-end to high-end costs and reflect an ordinary range of PC laptops, tablets, and supporting hardware (wires, USB-GPS receivers etc.) Costs of labor needed to install e-logbooks were based on installation costs during the pilot and can vary. Not included in the price are the costs of on-board GPS units, chart-plotters, or any other vessel electronics (i.e., VMS units and depth finders). All pilot vessels had existing onboard GPS units. Furthermore, it was stated earlier that USB-GPS receivers work well with pilot versions of the e-logbook and can significantly reduce the need for labor-intensive pairing to existing on-board GPS units. Finally, e-logbook versions that run on tablets will not need supporting hardware as the tablet is a self-contained unit capable of producing GPS locations.

Data Transmission

Transmitting logbooks electronically provides near real-time access to catch and effort data. As stated earlier, there are a number of ways in which logbooks can be submitted. In the pilot program, nearly all e-logbooks submitted were via at-dock or home Wi-Fi, or physically connecting the laptop to a network. However, advances in cellular coverage and technology and the ability to connect e-logbook devices to 4G/5G networks allows the data transmission through cellular networks. Sending data through a cellular network would require fishers to use personal or company data. However, the trip data files are packaged in a way to reduce the data size and would have a nearly negligible effect with respect to most current cellular data plans. The average file size sent during the pilot was 3.37 Kb. All single day trips were 1 Kb or less in data size. The average data size for a multi-day trip (2-17 days in pilot) was 5.31 Kb. When the coastal Southeast fleet trip frequency was analyzed, the average vessel makes 3.5 trips a month. Trips of 2 or more days away average just under 2 per vessel/month (1.96) with vessels trips of one days away averaging 4.25 per vessel/month. Ultimately, vessels on multi-day trips would be using 10.4 Kb a month with day trip vessels using 4.25 Kb of data a month submitting e-logbooks.

Some software versions have the ability to be integrated with vessel monitoring systems (VMS). No vessel in the pilot contained a compatible VMS models to be integrated with the e-logbook. Furthermore, some software versions, particularly tablet run versions, do not have the capability to connect to any VMS units. There are no plans to stipulate VMS compatibility as a requirement. The SEFSC recommends that fishing effort and hails weights be filled out at the time of landing for e-logbook users and submission of the full report within 7 days, which is consistent with paper logbook requirements. Expanding Wi-Fi options and increased cellular coverage and relatively small data file sizes should not hinder or put an undue burden in submitting e-logbooks in a timely manner. If no cellular service or at dock Wi-Fi is available, e-logbook devices or can be easily transported or data can be transferred to an external storage device to be submitted when conditions allow.

Feasibility of Electronic Logbooks in the Southeast and HMS Fisheries

Electronic logbooks are a feasible platform to collect catch and effort information in the Southeast and HMS fisheries, with a large potential to increase the value of this data for scientific purposes. The e-logbook pilot program also gave the FMB insight into circumstances specific to the fisheries and fleets of the Southeast that may diminish the value electronic reporting can offer. Circumstances such as cabin space and protection, familiarity with laptops and tablets, and the ability to integrate data entry into fishing activity were all tested. Furthermore, pilot participants were given the opportunity to provide input on the development of the operational version of the e-logbook interfaces. Over the course of the pilot, recommendations have been developed to guide the Regional Fishery Councils and to the public at-large on the feasibility of electronic reporting in the Southeast and HMS commercial fisheries.

e-logbook Platform (Hardware)

A large portion of the feedback received during the pilot pertained to the hardware. The majority of our participants used a government-issued 15.6-inch laptop. Although several vessels had the capacity to utilize laptops and PCs for electronic reporting, some participants viewed this as too bulky and expressed concern with not having enough space for a laptop. The feasibility of using this platform centers on a few key things. Vessels that had a relatively large, protected wheelhouse, and employ long set times are likely able to use this platform. It was noted above that GPS and power connections limits that portability of the laptop. Vessels that have a pilot that is continuously monitoring the wheel reported fewer issues with the laptops. Still, every vessel is different and the above characteristics may not facilitate the use of a PC or laptop.

For vessels where using a laptop is problematic, the use of mobile devices should be employed. Discussions with vendors indicate that current data collection standards can be developed in this platform. Mobile devices provide numerous advantages including longer battery life, portability, fully self-contained unit including GPS, and increased durability when used with a protective case. Vessels and gear types ideal for a mobile version include smaller vessels with a less-protected wheelhouse, small crews where all crew members actively fish, and fishing activities with relatively shorter sets. Drawbacks to using mobile devices possibly include reduced data editing capability from lack of physical keyboard and smaller screen sizes.

For both PC and mobile devices, a number of data transmission scenarios are possible. Hardware can be connected via Wi-Fi and reports can also be sent via cellular networks. Ensuring that hardware can connect to these networks should be a primary consideration. Furthermore, some future e-logbook versions may have the ability for submission via specific onboard VMS units.

Set-Based Data Collection

Given that HMS fisheries are already reporting on a set-based level, little is expected to change with the introduction of e-logbooks other than a more efficient way to submit required reports and more detailed information regarding disposition of discarded catch. Coastal fisheries, on the other hand, will have the opportunity to transition to the more spatially and temporally specific set-based data entry. During the pilot, the only gear type that proved problematic in terms of quality of data collected as well as excessive burden to fishers was for hook-and-line gear. From discussions with fishers and among FMB staff, it was determined that for this gear type, along with cast nests, reporting could be defined to a sub-trip level defined as a 24-hour period. Analysis from reports submitted during the pilot showed some fishers logging 60+ sets over a 3-day trip. A revised definition of a fishing event could gain support from the industry while still improving the quality of catch/effort data above current methods. A description of typical fishing events for pilot vessels, along with notes on hail weight vs. logbook accuracy can be found in **Appendix A**.

Reporting Electronically

Recording catch and effort electronically and then submitting the data improves upon the current paper-based collection. Electronic reporting is timelier and has the potential to contain fewer errors by using machine-generated variables like date, time, and location. Data entry errors can be reduced by allowing only valid entries based on look-up table using a standard code system. Currently, logbook reporters in HMS fisheries need multiple sheets of paper to report at the set level. Reporting electronically will remove this need as well as improve the timeliness of report submission. Future reporting requirements in highly regulated fisheries, such as increased reporting of discards and protected species interactions, can potentially be facilitated with the use of e-logbooks. Finally, using a device's memory storage, fishers can have easy access to their prior catch histories, locations, notes, and other significant trip information.

Developing the data collection standards in coordination with ACCSP, will lead to more standardized reporting interfaces along the East Coast and across fishing sectors, i.e., recreational-commercial and Northeast-Southeast dually permitted vessels. This meets requests from stakeholders to limit reporting burden (NMFS/GARFO 2019). Input from pilot participants allowed the SEFSC to make the necessary changes needed to integrate electronic reporting into the wide variety of vessel and gear types used for the numerous fisheries of the Southeast and HMS.

Implementation of Electronic Logbooks in the Southeast

Currently, paper versions of both coastal and HMS logbooks are received and opened daily. Logbooks are then organized and mailed off to be entered into the Unified Data Processing System (UDP). Logbooks with potential discrepancies are then flagged for further validation. Once validated, logbook data are accessible to staff and analysts.

A logbook containing no potential errors will be processed into UDP in around two weeks from the time it arrives at the FMB. Should the logbook need to be reviewed and then corrected by a vessel owner, the process can take between 4-6 weeks or longer. These types of back-end validations slow the process for getting accurate data into UDP. Further lengthening the process is the time it takes for a fisher to correct an erroneous logbook and send it back through the mail. E-logbooks can limit this time in three ways: 1) remove the length of time it takes to submit a logbook through the mail, 2) reduce the need for back-end validation by preventing invalid responses from being entered into the e-logbook, and 3) any potential errors can be validated and/or edited online by fishers. If fishers submit e-logbooks before landings are sold or offloaded, scientists and analysts will have near real-time access to catch and effort data.

It is believed that only a portion of the fleet will immediately convert to electronic reporting. Cost considerations as well as the familiarity with computers/tablets will likely prevent many vessels and captains from becoming early adopters. This creates a scenario where essential logbook data is being submitted in two formats with electronically generated reports being significantly more stratified than current logbooks. Current e-logbook data collection standards are designed in a way that facilitates the conversion of this highly stratified data into the current data standards and protocols. A rolling implementation of e-logbooks would not impact ongoing analyses or stock assessments.

E-logbook Data Submission and Access

All e-logbook reports will be submitted to and stored by the ACCSP in the Standard Atlantic Fisheries Information System (SAFIS) database. E-logbook data containing needed data fields will be pulled from a view created at ACCSP and placed in the UDP database. As stated earlier, the SEFSC expects the implementation of e-logbooks to be completed in stages until full or nearly full coverage in the Southeast Coastal and HMS fleets. Pilot participants submitted both paper and electronic reports. Once approved software is made available, e-logbook users will submit electronic reports in lieu of paper reports.

The development of final standards for the SEFSC e-logbook program is currently underway. The Southeast e-logbook will have an electronic signature component that will allow users to submit and correct completed reports. ACCSP assigns all valid SERO vessel owners participant ID. This ID used in combination with a user password will be the process by which a

fisher submits logbooks. It is believed that using this method will reduce burden on fishers and vessel owners by reducing the overall number of log-in and password requirements needed.

The final outstanding issue before the SEFSC e-logbook can be implemented is finalizing details involving Quality Assurance/Quality Control (QA/QC) protocols. As mentioned earlier, there is a greater ability of e-logbook software to reduce point-of-entry errors by providing a list of only valid responses. Furthermore, e-logbooks have the ability to query historical data for probability-based data checking by the user at the point of entry. The extent to which the SEFSC will incorporate this for the first round of implementation has yet to be finalized.

The full implementation of e-logbooks is likely to take several months. Many captains and owners have expressed interest in adopting e-logbook only reporting. Recruiting vessels to report electronically once all standards are finalized is expected to happen quickly. Implementation timelines remain tentative and are, in part, reliant upon outside partners. The SEFSC intends to move quickly to implement changes and additions as partners and vendors progress with their work.

Permit Compliance

All logbooks that are currently submitted count toward a fishers' compliance for renewing a permit. Fishers must be up to date to the day of their permit renewal. This is completed by submitting either a no-fishing report or a trip logbook. Both forms must be complete and free of errors or the fisher is held out of compliance. The same concept will apply for electronically submitted logbooks and no-fishing forms. ACCSP has entered into an information sharing agreement with SERO that will allow ACCSP Participant IDs to be linked to their corresponding permits. All electronic forms will be linked to fisher compliance and, provided forms are free of error, fishers will be given near real time credit for their submission. This will significantly reduce the time for a form submitted to the SEFSC, to be counted toward permit compliance.

Works Cited

2016 Southeast Coastal Logbook, Southeast Fisheries Science Center (SEFSC)

Bastardie, F., Nielsen, J. R., Ulrich, C., Egekvist, J., & Degel, H. (2010). Detailed mapping of fishing effort and landings by coupling fishing logbooks with satellite-recorded vessel geo-location. Fisheries Research, 106(1), 41-53.

Gerritsen, H., Lordan, C., Minto, C., & Kraak, S. (2012). Spatial patterns in the retained catch composition of Irish demersal otter trawlers: High-resolution fisheries data as a management tool. Fisheries Research, 129-130, 127-136

Hintzen, N. T., Bastardie, F., Beare, D., Piet, G. J., Ulrich, C., Deporte, N., . . . Degel, H. (2012). VMStools: Open-source software for the processing, analysis and visualisation of fisheries logbook and VMS data. Fisheries Research, 115-116, 31-43.

Mion, M., Piras, C., Fortibuoni, T., Celić, I., Franceschini, G., Giovanardi, O., . . . Raicevich, S. (2015). Collection and validation of self-sampled e-logbook data in a Mediterranean demersal trawl fishery. Regional Studies in Marine Science, 2, 76-86

Moore, C., Drazen, J. C., Radford, B. T., Kelley, C., & Newman, S. J. (2016). Improving essential fish habitat designation to support sustainable ecosystem-based fisheries management. Marine Policy, 69, 32-41.

NMFS/GARFO (2019). Fisherman's Perspective: Electronic Reporting Saves Time, Needs to Be Standardized Across Fisheries. https://www.fisheries.noaa.gov/feature-story/fishermans-perspective-electronic-reporting-saves-time-needs-be-standardized-across?utm_medium=email&utm_source=govdelivery accessed 12.30.2019

Russo, T., Pulcinella, J., Parisi, A., Martinelli, M., Belardinelli, A., Santojanni, A., . . . Anderlini, L. (2015). Modelling the strategy of mid-water trawlers targeting small pelagic fish in the Adriatic Sea and its drivers. Ecological Modelling, 300, 102-113.

Tables

Table 1. Pilot definition of fishing event for hook and line and cast net gears.

GEAR	SETR DEFINITION
HOOK AND LINE - OTHER	Fishing event begins when the first hook is placed in the water. Event ends when all lines are brought onboard and effort is moved to a new area of water or a different gear is deployed.
HOOK AND LINE - MANUAL (i.e. hand, rod and reel)	
HOOK AND LINE - POWERED (i.e. electric, hydraulic, bandit)	
HOOK AND LINE - BUOY	
TROLLING, GREENSTICK	
TROLLING, OTHER (i.e. rod & reel, hand, bandit, etc)	
CAST NETS	

Table 2. Revised List of Gears and Set Definitions. Revised Fishing Event Definitions are Highlighted

GEAR	SET DEFINITION
SEINE, PURSE	Fishing event is defined as a set. A set begins when gear is first placed in water and ends when gear has been completely removed from the water.
TRAWL, UNCLASSIFIED	
TRAWL, OTTER	
TRAWL, MIDWATER PAIR	
POTS, CRAB	Fishing event begins when the first trap is dropped and ends when all traps have been removed from the water.
TRAPS, FISH	
TRAPS, SPINY LOBSTER	
TRAPS, OTHER	
GILL NETS, OTHER	Fishing event is defined as a set. A set begins when gear is first placed in the water and ends when gear has been completely removed from the water.
GILL NETS, DRIFT	
GILL NETS, STRIKE	
GILL NETS, ANCHOR	
HOOK AND LINE - OTHER	Fishing event is on a Sub-trip level (24hours). An event begins when first hook is placed in the water. Event ends when there is a significant stoppage of fishing effort or new gear is deployed. At least one event must be recorded every 24 hours, if actively fishing.
HOOK AND LINE - MANUAL (i.e. hand, rod and reel)	
HOOK AND LINE - POWERED (i.e. electric, hydraulic, bandit)	Fishing event is defined as a set. A set begins when the first hook is placed in the water. Event ends when all
HOOK AND LINE - BUOY	
TROLLING, GREENSTICK	

TROLLING, OTHER (i.e. rod & reel, hand, bandit, etc.)	lines are brought onboard and effort is moved to a new area of water or a different gear is deployed.
LONGLINE, PELAGIC	Fishing event is defined as a set. A set begins when the first hook is placed in the water and ends when the last hook has been removed from the water.
LONGLINE, REEFFISH	
LONGLINE, SHARK	
LONGLINE, OTHER	
CAST NETS	Fishing event is on a Sub-trip level (24hours). Fishing event begins when the first cast is made. Event ends when there is a significant stoppage of fishing effort or new gear is deployed. At least one event must be recorded every 24 hours, if actively fishing.
HARPOONS, SWORDFISH	Fishing event begins when fisher(s) begin actively looking and ends when search ends.
SPEAR/GIG (NON-DIVING)	Fishing begins when diver(s) enter water and ends when last diver exits water.
DIVING, POWER DEVICE	
DIVING, NON-POWER DEVICE (NET, SPEAR, HAND)	
OTHER	

Table 3. Pilot Apportionment Section Data Fields

Species	Amount landed	Disposition	Grade	Dealer Info	Date Sold	Sold Time

Table 4. A. Post Pilot Apportionment Section Data Fields for Catch Sold

B. Final Apportionment Section Data Fields for Catch Not-Sold

A.

Species	Dealer Info	Date Sold

B.

Species	Amount Kept	Disposition	Date landed

Table 5. Cost of hardware and Installation per Pilot Vessel

Computer	Cost (time of purchase)	USB-GPS Receiver	Misc. Hardware	Installation Costs (3-4 hrs)	Total Hardware/Install
Dell Latitude	$1,100	$50	$30	$200	$1,380
iPad2	$629	$0	$50	$0	$679

Table 6. Mid/Low end Hardware First Year Cost to Fleet for Vessels with at least One Trip in 2014

Mid/Low End Hardware			
Yearly License	**Hardware & Install**	**Cost per Vessel**	**Total Active Fleet Cost**
$0	$400	$400	$714.80
$700	$400	$1,100	$1,965.70
$1,300	$400	$1,700	$3,037.90

Table 7. High end Hardware First Year Cost to Fleet for Vessels with at least One Trip in 2014

High End Hardware			
Yearly License	**Hardware & Install**	**Cost per Vessel**	**Total Active Fleet Cost**
$0	$1,380	$1,380	2,466.06
$700	$1,380	$2,080	3,716.96
$1,300	$1,380	$2,680	4,789.16

Appendices

Appendix A. Pilot Vessel Fishing Practices by Gear Type

Gear	Typical trip length (Days)	Average sets in a trip	Average length of sets	Notes on accuracy of e-logbook vs. Logbook
Powered Hook and line (Bandit)	3-5	5-10	2-6 hours	There was a decent level of accuracy between the e-logbook and Logbook. Occasionally a fish would end up being sold and reported on logbook that was not entered into the e-logbook. These instances would represent 3-5 fish out of thousands of pounds.
Reef Longline	9-17	10-35	3-5 hours	Reef longline produced similar results to the longline. Catch is harvested hook by hook and few (if any species) are not accounted for. Hail weight will vary by vessel, however, the pilot participant was fairly accurate at giving a hail.
Hand Line/Rod and Reel	2-5	12-60	0:10-1:00 hours	No issues reported. All species in e-logbook were accounted for in Logbook.
Buoy (HMS)	1	1	10-11 hours	This fishery yielded expected results when comparing e-logbook hail to logbook. The fishery currently reports on a set level and as such, no issues were mentioned. Volume of catch reduced compounded inaccuracy with hail weight.

Trap (Fish)	1-2	1-3	2-5 hours	Pilot participants tended to overestimated hail compared to logbook. All species in e-logbook we accounted for in Logbook.
Coastal Longline (shark)	1	2-3	2-3 hours	For this gear, participant only reported discards.

Appendix B. Comparison of hardware installation and use options

Hardware	GPS Integration	Fishing Integration	At Sea Viability
Laptop (PC)	Integrated with an on board GPS or with an external GPS receiver. Multiple software applications utilizing GPS will need multiple sources or virtual GPS splitter installed.	Use of a laptop or PC is relatively immobile. Some fishers will have to constantly enter the wheelhouse to log data. However, for captains who man the wheel during a set, this is less of an issue. Some vessels use PC's or laptops with navigational software. E-logbooks can run on the same computer and limit number of devices used.	Laptops generally require longer wiring as space may limit ideal placement. Many protected cabins still have considerable water infiltration that could degrade the laptop and wiring. Many vessels in the Southeast do not have room or provide adequate protection for laptops.
Tablet (mobile)	Fully contained unit. Most newer model tablets have an internal GPS chip. Other options include Bluetooth connection to on-board GPS. Some Windows based tablets can already use pilot versions of the e-logbook.	Mobile versions can more easily be moved around vessel. Provides a more versatile option for smaller vessels with relatively small crews. Crew members actively fishing can more easily fish and collect data.	There are a number of waterproof cases currently on the market that adequately protect tablets. Fully self-contained units require fewer connections and can be stowed easily when not in use. GPS signal can be acquired nearly anywhere on vessel.

Appendix C. Comparison of hardware data collection and feedback

Hardware	Data Collection Capabilities	Data Transmission	Pilot participants feedback
Laptop (PC)	Data collection is generally superior to tablets. The computing power and the ability to navigate through software is an advantage. Editing data entered, relatively larger screens, and the use of keyboard are advantages. Fishers have the ability to quickly change screens and use other software applications within the PC.	Data transmission can be completed through any internet connection or with some VMS units. There are a number of laptops on the market that have 4G capability allowing the transmission through the cellular network. Wi-Fi at dock or tethering a cell phone to the laptop also allow for data transmission.	Preference of laptop use varied among vessel type, gear type, and prior laptop experience. Vessels with enclosed wheelhouses with a pilot manning the wheel had few issues with a laptop if sufficient space available. If the above conditions were met with no room for a large laptop, a tablet was preferred. Furthermore, length of set influences preferences as well. The longer a fishing event, the less a fisher needed to interact with the laptop.
Tablet (mobile)	Presents specific challenges to data collection. Lack of a physical keyboard makes data editing more difficult, especially in tough conditions. Navigating through a tablet may be more difficult. Relatively smaller screens, especially if on a hand held device.	Tablets and mobile devices can submit data via Wi-Fi and through the cellular network if 3G/4G enabled.	Most fishers indicated that a mobile version of the e-logbook should be made available. Limited cabin space or non-enclosed wheelhouses limit the functionality of a laptop. Relatively smaller crews and fishing activities that require more interaction with the software tend to want a tablet over a laptop. Specific feedback for what they would like to see has been sent to vendors for their consideration.