MARINE RECREATIONAL INFORMATION PROGRAM

Implementation of Electronic Logbooks on Headboats Operating in the U.S. South Atlantic

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SUMMARY

The NOAA Fisheries Southeast Region Headboat Survey (SRHS) currently distributes paper logbook forms for vessel owners/operators to record trip-level catch and effort data (i.e., catch records). Historically, the time between in-season generation and delivery for paper form data is 3-5 months, and end-of-fishing-year estimates are subject to similar delays. Between October 2009 and October 2010, both paper and electronic logbook submissions were received voluntarily from seven (7) headboat vessels in North Carolina, South Carolina, Georgia, and Florida. Study participants were requested to submit two forms of identical data. Paper form reporting was executed per standard SRHS protocols. Electronic reporting was executed on computers owned by vessel owners/operators via a novel software application; data were transmitted to a secure digital storage facility via the Internet.

Electronic logbooks were effectively tested for a subset of headboats located along the southeastern U.S. Atlantic coast. A total of 4,859 species records were transmitted electronically, describing the fishing activity of 14,900 anglers on 719 trips. Electronic reporting methods were evaluated for potential advantages in reliability, accuracy, compliance, timeliness, and cost.

Electronic logbook methods and software developed for this project were reliable and functioned as expected. In a few cases (<5% of trips) electronic data were unreported for corresponding paper records; missing entries were attributed to random data-entry omissions by study participants, and not software errors. To assess reporting accuracy, biological samples (i.e., dockside samples) were examined from 77 trips where corresponding electronic logbook records were available. In 328 of 486 species-specific cases (67%), retained species sampled by

headboat port agents had also been reported via electronic logbooks. When summary statistics were restricted to species in the Snapper-Grouper Management Complex, reporting accuracy was higher (74%). To assess compliance, reported fishing dates were compared between the SHRS and electronic logbooks; vessel owners/operators reported 93% of the fishing activity documented by port agents. To assess timeliness, delays between fishing date and availability of electronic data were calculated. The average delay for electronic-form data was 20 days; the median was 9 days. For 2009, the programmatic cost of the current paper logbook system was $81K. If operated as a contract, the one-time cost of implementing a region-wide electronic logbook system (approximately 160 boats) is estimated to be $96K. Also, IT support and maintenance is estimated to be $36K annually.

Electronic logbooks improved the timeliness of data delivery and yielded inherent improvements over paper logbooks, including: better quality control, reduced data handling, and more secure data delivery. Time and effort by SRHS staff to develop annual catch summaries would be positively affected by increased efficiency of electronic logbooks. We estimated that annual data summaries would be available to managers approximately 2 months earlier than can be produced with the current paper-based system.

General recommendations: (1) Implement electronic logbooks for headboats in the entire southeastern U.S. (2) Fund support services during the transition from paper reporting to electronic reporting, with additional support into out-years. (3) Support development of an Internet-based software interface for electronic reporting. (4) Utilize the expertise of SRHS staff to provide a local level of training and quality control to vessel owner/operators to improve data quality. (5) Review and implement effective regulatory infrastructure for transitioning to electronic reporting, with further emphasis on electronic logbook reporting compliance.

Software recommendations: Vessel owner/operators, software designers, port agents and SRHS staff made numerous suggestions for improving the electronic logbook. Technical recommendations include: (1) An Internet-based portal to submit headboat data. (2) An expansion of visual aids for electronic logbook applications (e.g., maps of fishing area, species identification aids). (3) "Smart menus" which track users' past entries to adaptively simplify future data entry. (4) A query function allowing effort and catch to be summarized according to a user's needs. Based on input from stock assessment scientists and SRHS staff, future software versions should include a data field for fishing depth, more precise location data, and a field declaring target species.

INTRODUCTION

Project Background

The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) is required to collect statistics on marine recreational fishing. One of the oldest data collection programs in the southeastern United States is the Southeast Region Headboat Survey (SRHS). The headboat sector is considered a subset of recreational fishing, from which the collection of timely and accurate fisheries data has been historically challenging. The SRHS is the longest, continuous marine recreational fishing data collection program in the southeastern U.S. Since 1972, the Survey has relied upon paper logbook forms (i.e., catch records) completed by each vessel to record trip-level catch and fishing effort for individual fish species. In accordance with Code of Federal Regulations (CFR) Title 50, Part 622, logbook reporting for all headboats that fish in state and Federal waters of the Atlantic Ocean south of Virginia, has been mandatory since 1986. In March 2008, a letter was issued to all headboat permit holders indicating catch record submission would be monitored for compliance. In the U.S. South Atlantic, failure to submit a catch record for each trip can result in monetary civil penalties or non-renewal of federal fishing permits.

The SRHS is responsible for monitoring headboat fishing activity from Cape Hatteras to the Florida Keys in the South Atlantic (Figure 1), where approximately 80 headboats operate. A nearly equal number operate in the Gulf of Mexico (GOM). Over time, the SRHS has reported the catch or harvest of more than 350 fish species, and data from the SRHS are routinely provided to both the South Atlantic and Gulf of Mexico Fishery Management Councils. Data have also been used to address policy issues related to the Atlantic Coastal Fisheries Cooperative

Management Act, the reauthorized Magnuson-Stevens Fishery Conservation and Management Act, and the Endangered Species Act. Additionally, SRHS data have been cited in academic research and numerous scientific publications.

Self-reported paper logbook forms are currently submitted by vessel owners/operators to NOAA Fisheries headboat port agents on a mandated monthly schedule. Data are then centrally collected, shipped to a private contractor for key-entry, returned to SRHS staff in electronic form, and examined for quality control before use. Availability of data is variable due to several factors: submission delays, processing time, mailing time key-entry delays, all of which combined may take three to five months past a fishing trip. This information is therefore not immediately available for in-season fisheries management. Similarly, it requires three to five months past the end of the calendar year to calculate final annual estimates for use in stock assessments and quota monitoring. As fisheries managers continue to develop quota-based catch limits and accountability measures, it has become more critical to optimize data collection from the headboat sector. To reduce these delays, the use of electronic logbook methods is considered.

We initiated a one-year pilot project to assess the use and potential advantages of electronic logbook reporting vs. paper logbook forms for a subset of vessels in the U.S. South Atlantic headboat fishery, with resultant recommendations to be discussed in terms of whether or not to permanently extend the project coast-wide and into the GOM. Results are described from a test of simultaneous paper and electronic reporting. Potential improvements to methodology currently used to generate trip-specific catch and effort of recreational anglers were evaluated. Analyses compared reporting systems and quantified differences in reliability, accuracy, compliance, timeliness and cost.

Scope and Assumptions

Simultaneous paper and electronic catch records were requested from vessel owners/operators over a period of 13 months (October 2009 - October 2010, inclusive). Involving vessels from all states along the U.S. South Atlantic coast, the project period was assumed to generically reflect a year of headboat vessel operations in the fishery. The participation of vessel owners/operators in this study was voluntary. No incentives to participate in the project or computer equipment were provided to vessel owners/operators. We assumed that paper and electronic catch records would be identical for the same trip. We also assumed that participating vessel owners/operators would submit data in good faith and comply with electronic logbook reporting for the duration of the study period. Where vessel activity records and species identifications are considered, the observations of headboat port agents are assumed to be error free. Data are presented anonymously to comply with confidentiality requirements of the Magnuson-Stevenson Act.

Project Closure

Three products were developed:

(1) Effective field testing of electronic-form reporting, which included four software program updates incorporating user comments and software improvements.

(2) Comparative analyses to assess improvements in methodology currently used to collect effort and catch data for recreational anglers fishing on headboats.

(3) A report prepared by project coordinators summarizing the results and utility of the project (this report).

METHODS

Study participants were requested to submit two forms for each trip. On both paper and electronic logbook forms, vessel owners/operators fill out separate sections for trip-effort and catch data (Figures 2-4).

Trip-effort data consisted of two vessel identity fields, date of trip, departure and arrival time, fishing location, two fields accounting for angler numbers, declared trip type (e.g., ½ day, full day), fishing distance from shore, and pay type (e.g., per person, per group). Port agents retrieved paper logbook forms on a monthly schedule. Specifically, as defined by the Code of Federal Regulations, catch records are due ”no later than 7 days after the end of each month” (i.e., approximately 37 days can lapse before data from a trip on the first day of a month are collected). Port samplers then transcribed hand-written trip information by entering corresponding categorical codes into “AGENCY” fields on each paper catch record (Figure 2). For electronic logbook reporting, vessel owners/operators enter trip-effort data into the SE Logbook Application computer program in the top portion of the computer form (Figure 4).

Catch information is entered similarly on paper and electronic forms. Catch data requires no immediate transcription effort from port agents. For species encountered, vessel owners/operators entered the following information on both forms: species, number kept, an estimated total retained weight in pounds, and two fields reporting a count of live and dead released fish. Within summary data files, trip-effort and catch data are combined into unique species-specific rows (i.e., multiple rows describe a single trip).

As summarized above, paper catch records were collected monthly, sent by courier to Beaufort, NC, relayed in bulk to a commercial contractor for key-punch data entry services, and returned in digital and paper form by courier to the SRHS in Beaufort, NC (see Figure 5). Electronic catch records were available to transmit to the SRHS immediately following data entry. When a trip record was closed, data were saved to a personal computer. At the users' discretion, data were transmitted by Secure File Transfer Protocol (SFTP) to a data storage facility. For this study, electronic catch records were transmitted in bulk to the SRHS in Beaufort, NC on a monthly schedule, and arrived in the summary, species-specific row format described above.

Reliability

For the purpose of this report, "reliability" was strictly defined as the successful delivery of self-reported information to the SRHS by both paper and electronic methods. Reliability was assessed on a gross scale by summing the number of individual trips reported. Specifically, reliability was calculated as a percentage, dividing the sum of electronic form reported trips by the sum of paper form reported trips,

(# electronic form reported fishing trips / # paper form reported fishing trips) * 100,

where corresponding trips were examined individually to confirm that descriptive data matched (e.g., number of anglers were equal). Summed paper form records were the denominator, as it was assumed vessel owners/operators would appropriately adhere to legal reporting requirements more so than voluntary electronic submissions. Results were generated for each vessel and for all vessels. If data transmissions were reliable by both methods, differences should be explained

by negligible instances of random error. Data were also examined for any systematic pattern of error across all vessels to detect software-generated problems.

Accuracy

The accuracy of self-reported fish catches was assessed by examining species recorded in SRHS program dockside bioprofile samples to verify that species were also reported as caught and kept in electronic catch records. Since port agents are not required to sample all fish landed on a trip, comparisons of species abundance were not meaningful. Therefore, the term "accuracy" is restricted here to a comparison between species presence in both sets of records. If accurate, species encountered in a bioprofile sample would also be present in a vessel-reported catch record from the same trip. Accuracy of self-reported fish catches (BIO%) was calculated as the number of species present in electronic form data divided by the number of corresponding species present in the bioprofile sample,

(# electronic reported species / # of corresponding species present in a bioprofile) * 100.

Anomalous records were examined for patterns of inaccuracy. Calculations of accuracy were presented as a form of validation since bioprofile samples and vessel-reported catch record data were independent. Species-specific validations were tabulated to examine patterns common across multiple taxa. The published species list for the South Atlantic Fishery Management Council snapper grouper management complex (n = 73 species) was examined to determine a reporting accuracy for the complex, and collectively for species that fall outside of that complex (http://www.safmc.net/Portals/6/Library/FMP/SnapGroup/SnapperGrouperSpecies.pdf).

Compliance

"Compliance" was strictly defined to represent a validation of electronic logbook reporting. The self-reporting of fishing activity was assessed by examining headboat activity reports (HARs) recorded by port agents. Specifically, records were examined to verify that catch records were received on days when vessels were known to be fishing. Paper form data were not examined because port agents rectify HARs with available paper records before submission to the SRHS; thus, the presence of a paper record was used in creating a HAR. However, as standard practice port agents are additionally directed to report fishing activity detected outside of the paper catch records submitted by vessel owners/operators. For all fishing trips entered on a HAR, electronic form data were searched for matching catch records (e.g., number of anglers were equal) from the same day. Compliance (HAR%) was calculated as a percentage, dividing the sum of electronic form trip records by the sum of HAR estimated trips,

(# electronic reported fishing trips / # HAR- estimated fishing trips) * 100.

Anomalous records were examined for patterns of inaccuracy. Vessel-specific HAR% was plotted against total electronic logbook submissions to examine any relationship between compliance and the volume of records submitted.

Timeliness

Except for complying with the federal statute-required "first week of the following month" schedule, study participants were issued no instructions on how often to transmit electronic data. Therefore, the frequency of electronic logbook reporting provides information on how comprehensively study participants submitted data to NOAA Fisheries. "Timeliness" is defined here as the delay between fishing date and data availability. Catch records data were

considered available for scientific use (e.g., proofing, summarization) on the date records were delivered to the SRHS. For comparison, an idealized delay for paper form data was assumed to be no more than 37 days. For electronic form data, delay was calculated by subtracting the fishing date from the date of self-reported, electronic delivery (i.e., delivery over the Internet to SFTP servers), and is reported in units of whole days. The minimum, maximum, mean, and median time delays are reported for individual vessels, and for all vessels combined.

Costs

Costs to initiate this project are discussed in the context of a permanent survey-wide switch to electronic reporting. Annual operating costs of the current paper-based system are presented for the most recent year available (2009). Costs of this pilot project are compared with projected costs for a region-wide implementation of electronic reporting. The cost of additional software development and a data delivery maintenance contract is based upon the costs incurred to fund this project. Projected costs to implement electronic reporting survey-wide in the SRHS are based on estimates provided by the software developer. Headboat port agent paper form handling costs were calculated through interviews with SRHS staff. A fraction of 40 weekly hours for six staff were multiplied by a generalized hourly labor cost provided by SRHS program managers. Anticipated costs for training and teaching tool development are presented, as well as labor and training costs for electronic logbook program administration.

RESULTS

This project commenced in summer 2009. Initial software development required approximately three months. During that time, eight headboats from four southeastern U.S Atlantic coastal states (i.e., approximately 10% of the U.S. south Atlantic fleet) were approached and agreed to voluntarily participate in the project. Vessel owners/operators were asked to complete both the mandatory paper logbook and electronic logbook between October 2009 and October 2010. The system of paper form collection and delivery to the SRHS was not altered for this project. Electronic logbook program software was uploaded during October 2009.

The fishing activity of seven vessels is presented; three vessels reported data throughout the entire project period. One vessel was sold before seasonal fishing trips began, and the new vessel owners declined participation, and a replacement vessel was added six months into the project period. In a second case, a vessel owner withdrew after many months of non-participation and a replacement vessel was added five months into the project period. In both instances of substitution, the replacement vessels came from the same state. One replacement vessel was sold and exited the fishery four months before the end of the project period; it was not replaced. In a third case, a vessel operator stated his intentions to participate, but following the commencement of seasonal fishing and initial data transmissions (two trips reported), he ceased communications with project staff. The vessel was removed from analysis; a replacement was not available. In a fourth case, a vessel owner suffered an acute computer failure during the height of the fishing season. Unable to acquire a replacement computer, the vessel stopped participating four months before the end of the project.

Pilot testing of electronic logbook reporting

Over 13 months, a total of 4,859 species records were transmitted by vessel owners/operators from seven headboats. These records describe the fishing activity of 14,900 anglers on 719 trips. Trips are not tallied by vessel to protect confidentiality.

Reliability

Data were delivered reliably to the SRHS, with 95% of all trips accounted for by both paper and electronic methods (Table 1). Reliability ranged by vessel from 93% to 100%. Instances of mismatch (n = 30 trips) were examined individually and attributed to random sources of error (e.g., single trips accidentally omitted). Four of seven vessels reported 100% of catch records by both methods.

Accuracy

Bioprofile records were examined from 77 trips where electronic catch records were also submitted by vessel owner/operators. A total of 47 fish species and one family (Trichiuridae: cutlassfishes) were reported in 486 bioprofile records (i.e., fish identifications and lengths were recorded by headboat port agents; Tables 3). If species identifications are assumed here to be error free, than instances where accuracy is < 100% denotes trips where specimens were sampled by port agents but not accurately reported by vessel owners/operators. Overall, species reporting by vessel owner/operators was 67% accurate (Table 2). Accuracy ranged by vessel from 62% to 100%. Species-specific accuracy ranged from 0% to 100%. Several species (n = 15) were sampled only once by port agents and were not present in electronic form reporting. Reporting was 74% accurate for species listed in the Snapper Grouper Management Complex. Reporting was 44% accurate for species that are unmanaged or managed separately (e.g., spottail pinfish, dolphin fish).

Compliance

Comparing trips reported by electronic logbook to available, matching HARs resulted in 93% compliance (Table 4). Compliance ranged by vessel from 89% to 100%. For one vessel, the number of trips reported by electronic logbook exactly matched the tally of trips recorded by a port agent. Vessels reporting more individual trips generally exhibited lower compliance rates (Figure 6).

Timeliness

Electronic logbook reporting was timelier than the current paper form reporting system (Table 5). Minimum time delay was zero days for six of seven vessels, meaning it was feasible to transmit data to the SRHS program on the same day fish were caught. The longest delay between data entry and availability was 107 days between fishing date and the receipt of electronic records, which would fall outside reporting compliance statutes. Mean and median time delay were both less than 37 days for all but one vessel. For all vessels, the mean and median time delays were 20 and 9 days, respectively.

Cost

For 2009, the cost of a paper record system was approximately $81K (Table 6). Funding for this project ($51K) was allocated for initial software development, field test support for seven vessels, data analysis and report writing. Primary pilot project labor was provided by two contractors, but in-kind costs (e.g., man hours) were incurred by eight SRHS program staff, especially in support of project-specific data. Vessel owners/operators have not informed NOAA Fisheries of costs incurred while providing data to this project, but it is assumed that an

unknown amount of in-kind costs were necessary to fill out both paper and electronic catch records.

The one-time cost of implementing a region-wide electronic logbook system (approximately 160 boats), on a contract basis, is estimated to be $96K. Further savings on software improvements may come from recently completed pilot projects that tested electronic reporting (e.g., GOM charter boat survey, run by FWCC. Post-implementation, the annual cost of continuing electronic reporting is estimated to be $36K, primarily for support of secure server maintenance and technical support. If technical support is adequately funded (e.g., a daily-staffed phone support system, consistent Internet site updates) it is expected that programmatic objectives can be achieved with minimal remote site visits from SRHS staff. Port agent paper form handling costs are calculated as 3,200 annual labor hours x $20 / hr = $64K (Table 6). Development of a training manual and supplies ($3K), and orientation materials for port agents ($1K), would assist a successful, permanent transition from paper to electronic catch record reporting.

Correspondence with project participants

Following the initiation of electronic data collection, correspondence was sent to the group of project participants on three occasions. A letter was sent on 13 May 2010 to notify participants that data collection was progressing well. A letter was sent on 8 September 2010 to thank participants for their continued input and remind them that the project period would end on 31 October 2010. On 1 November 2010, a final letter was sent to thank participants and solicit feedback to improve both the electronic logbook computer program and this pilot project (see Appendices A and B)

CONCLUSIONS AND RECOMMENDATIONS

Electronic reporting was effectively tested for a subset of headboats fishing along the southeastern U.S. Atlantic coast. We recommend a headboat fleet-wide implementation of electronic logbook methods. We further recommend that technical support services be strongly supported during a transition to electronic reporting, and moderately supported into foreseeable out-years.

Electronic logbook performance and SRHS programmatic reporting

Electronic logbook methods were reliable and improved upon on the timeliness of data delivery. As four of seven vessels delivered 100% of trip records in both paper and electronic form, it was concluded that systematic, software-created sources of error were not a concern. When data delivery is timelier, compliance and accuracy may be assessed more often than is currently achieved, and procedures for in-season quota monitoring can be further developed. Regarding the development of annual catch and effort estimates, we believe that the electronic logbook will allow for more timely completion. We conservatively estimate that annual summaries could be completed by the end of March of the following year, a savings of 1-3 months.

Intrinsic improvement: quality control, less handling, more secure delivery

Electronic logbook reporting yielded three inherent improvements over paper form reporting. First, unlike paper records, electronic forms were designed with quality control features that reduce simple mistakes. For example, some data entry fields were restricted to a

vetted range of values (e.g., specific combinations of latitude and latitude along the U.S. south Atlantic coastline), or qualified relative to other fields (e.g., *# of Anglers Who Fished* cannot be entered greater than *# Anglers*). Additionally, trip type (e.g., ½ day, full day) is automatically determined within the electronic forms, as calculated with submitted departure time and arrival time. Such controls are not possible with paper form reporting.

Secondly, electronic data transmission achieved delivery to the SRHS with less intermediary steps, reducing opportunities for handling error. Noting that compliance was lowest for the busiest vessels, eliminating a delayed paper form retrieval schedule should reduce opportunities for paper forms to be mishandled between creation and delivery to the SRHS program, and reduce opportunities for recall bias. Electronic transmissions also eliminate handling and verification steps associated with key-punch services. Given that some vessels reported catches on the day fishing occurred, the timely transmission of electronic form data to the SRHS appears most limited by a participant's access to the Internet for transmission.

Finally, reduced intermediary steps make delivery of electronic data more secure. Eliminating three instances where confidential paper form data are shipped by courier reduced security risks. Upon electronic transmission, permanent electronic catch records were stored both on local computer memory and at the remote server site. Vessel owners/operators also had the opportunity to voluntarily back up their entire database to remote servers (Figure 3: "send DB backup"), such that all data could be archived to a remote site at will.

Regarding voluntary participation

Vessel participation in this project was neither mandatory nor rewarded. Indeed, monetary compensation in exchange for participation was judged inappropriate. In five of eight

original cases, vessel owners or operators ended cooperation before the end of the 13-month study period. Should electronic reporting be designated the primary method to monitor compliance in the headboat fleet, effective regulatory and enforcement infrastructure should be instituted before mandating a transition from paper reporting.

Internet-based software interface

Throughout this project, electronic catch records were entered into a stand-alone software application. Software updates (n = 4) were distributed by coordinating remote downloads with individual vessel owners/operators or by prompting the use of update applications within the software environment. An Internet-based software interface was requested by study participants and is strongly recommended for future consideration, as is the development of mobile software applications. Internet submissions may be remotely and continually monitored. Software applications may be universally updated during scheduled maintenance periods, and public message postings offer an efficient method of communicating with vessel owners/operators. Further, data archiving can be more secure in an Internet-based application, as data are not exclusively stored locally. A computer failure, as experienced by one vessel owner (see Appendix B), would only be an obstacle until replacement equipment is found. Fleet-wide compliance, however, would require the availability of adequate computer resources and widely available Internet access.

Training of vessel owners/operators and data proofing by headboat port agents

The comparison of electronic catch records and bioprofile data was moderately affected by mistaken data entry and missing information, notably trip date mismatches and species identification inconsistencies between vessel owners/operators and port agents. Improvements

are recommended to increase the quality of information. Instances where infrequently-caught species were present in bioprofile samples but not included on catch records, as well as lower accuracy rates for species managed outside the Snapper Grouper Management Complex, indicate that vessel owners/operators are not fully aware of their reporting responsibilities and may be ignoring some fish species. The calculation of "accuracy" in this study could be strongly affected by species misidentification. Though it is likely that commonly caught fish species are identified correctly, disagreement on the identity of more rarely-caught species appears problematic (e.g., whitebone porgy records were in agreement for only one of 16 trips where port agents recorded the species, resulting in 6% accuracy for the species). We recommended the coupling of large-scale implementation of an electronic logbook with a restatement of SRHS objectives, enhanced training, and vigorous orientation to new data entry methods. Additionally, the creation of supporting reference materials is recommended (e.g., Internet site, instruction manuals, species ID guides).

Though electronic logbook methods are reliable, 7% of trips documented on HARs were unreported, suggesting that underreporting exists and the role of port agents to verify headboat activity is crucial. It is recommended that the expertise of port agents be further utilized to provide a local level of quality control and training. Species identification mistakes would be efficiently addressed at the local level if, for example, known and consistent species omissions and misidentification could be addressed promptly and in person. Headboat port agents could be directed to proof and correct data from local vessels prior to use by the SRHS. Vessel representatives have requested that future electronic reporting software include species pictures and interactive location maps. Port agents are ideal NOAA Fisheries representatives to carry out localized software training.

Law enforcement

In this study, electronic logbook records were transferred directly to a central data depository. An adoption of fleet-wide electronic logbook could greatly enhance monitoring to confirm the status of reporting compliance. The time needed for compliance review could be considerably reduced.

Cost and Benefit

If fleet-wide paper and electronic reporting are not operated concurrently, the most significant cost is the one-time software design and implementation effort. Anticipated costs to institute an electronic logbook ($96K) compare favorably with 2009 programmatic costs to operate a paper system ($80K). If electronic logbooks were operated as a contract in follow-on years, annual costs are reduced considerably (estimated $36K per year) to maintain and update an electronic logbook system. Significant program savings is expected by lessening paper form handling duties for port agents, freeing shipping and printing costs and a significant fraction of 3,200 annual labor hours as reclaimed opportunity costs (estimated 25-35% of labor hours). Port agents could reallocate time for evaluating electronic records from individual vessels, biological sampling and additional exercises to validate self-reported data.

Intrinsic improvements resulting from electronic logbook use, as described above, should also benefit programmatic quality assurance and quality control efforts. Cost benefits are especially expected as a result of more timely data delivery. Increased speed in the generation of in-season and annual harvest estimates should allow the redirection of labor for data analysts and program managers.

The scope of this study is not adequate to fully quantify potential costs or cost savings to the headboat industry in the southeastern U.S. However, it is clear that an exclusively electronic logbook program would require that vessel owners/operators maintain capable computer equipment and reliable Internet access; initial capital investment and Internet provider costs may be incurred by vessel owners. However, based on feedback (see answers to question two, Appendix B), an increase in reporting effort would not be experienced as the result of a transition in logbook form; savings in the form of time and effort are expected. Additionally, collaborative efforts between the SRHS and vessel owners/operators may continue to yield innovative time savings into the future.

Technical recommendations for improving the SE Logbook Application computer program

Aside from documented suggestions (Appendix B), comments intended to improve the form and function of the SE Logbook Application computer program were received informally throughout the study period. Vessel owners/operators, contracted software designers, port agents and SRHS staff all contributed ideas. The most-received suggestion was an Internet-based portal to enter catch records, as discussed above. Vessel owners/operators and port agents also proposed an expansion in use of visual aids within the electronic logbook application (e.g., maps of fishing area, species identification aids). Several vessel representatives requested that future data entry efforts be made more efficient. Specifically, "smart menus" were suggested to track a user's past entries and save time on future entries (e.g., given past entries, a list of the most common species entered for a particular vessel are featured first in drop-down menus). Multiple SRHS staff requested that the SE Logbook Application exhibit a query function so that effort and catch could be summarized according to a user's needs. The addition of fishing depth information to positional data was suggested by stock assessment scientists and SRHS staff, as

459 was an increase in the precision of positional data, and the addition of a field where a target
460 species are designated by vessel owners/operators.

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462 ACKNOWLEDGMENTS

463 Funding for this project was provided by a MRIP For-Hire Workgroup grant for $51,000 to the
464 Sustainable Fisheries Branch, Southeast Fisheries Science Center, NOAA Beaufort Laboratory.
465 K. Fitzpatrick, J. Hackney and T. Kolkmeyer coordinated many communications with remotely
466 located port agents, responded to data requests and provided SRHS documentation. The
467 dedicated work of SRHS headboat port agents greatly assisted this project, in particular, E.
468 Corpeno, P. Kirwin, E. O'Neal-Morie, and A. Poholek. C. Petersen and A. Petersen provided
469 technical support and consultations in regards to the Southeast Logbook Application computer
470 program.

471

TABLES AND FIGURES

Table 1. Summary statistics describing the reliability of data voluntarily transmitted by participants in a pilot electronic logbook project. "Reliability" is presented as a percentage, dividing the sum of electronic reported fishing trips by the sum of matching paper reported fishing trips. Reliability is reported for seven (7) individual headboat vessels, and for all vessels combined.

Vessel	Reliability (%)
A	100
B	94
C	100
D	100
E	93
F	97
G	100
All	95

Table 2. Summary statistics describing the accuracy of data voluntarily transmitted by participants in a pilot electronic logbook project. "Accuracy" (Bio%) is presented as a percentage, dividing the numbers of species present in electronic data by the numbers of matching specimens present in bioprofile samples. Accuracy is reported for seven (7) individual headboat vessels, and for all vessels combined.

Vessel	Bio%
A	100
B	63
C	77
D	67
E	62
F	64
G	70
All	67

Table 3. Species present in corresponding bioprofile and electronic logbook catch records. These data were used to calculate the accuracy of self-reported electronic catch records. Records were aggregated here for all vessels. Instances where Accuracy is < 100% denotes trips where specimens were sampled by headboat port agents but not reported by vessel owners/operators.

Common Name	Genus	species	Trips spp. present in both bioprofiles and catch records	Trips spp. present in bioprofiles **but not** in catch records	Total	Accuracy
Red Porgy	Pagrus	pagrus	12	2	14	86
Whitebone Porgy	Calamus	leucosteus	1	15	16	6
Knobbed Porgy	Calamus	nodosus	1	2	3	33
Spottail Pinfish	Diplodus	holbrooki	17	11	28	61
Jolthead Porgy	Calamus	bajonado	1	4	5	20
Littlehead Porgy	Calamus	proridens	0	1	1	0
Scup	Stenotomus	chrysops	4	9	13	31
Vermilion Snapper	Rhomboplites	aurorubens	27	6	33	82
Red Snapper	Lutjanus	campechanus	6	0	6	100
Silk Snapper	Lutjanus	vivanus	1	0	1	100
Yellowtail Snapper	Ocyurus	chrysurus	8	2	10	80
Lane Snapper	Lutjanus	synagris	8	3	11	73
Gray Snapper	Lutjanus	griseus	20	0	20	100
Mutton Snapper	Lutjanus	analis	15	0	15	100
Red Grouper	Epinephelus	morio	6	1	7	86
Warsaw Grouper	Epinephelus	nigritus	2	0	2	100
Rock Hind	Epinephelus	adscensionis	0	1	1	0
Gag	Mycteroperca	microlepis	33	2	35	94
Scamp	Mycteroperca	phenax	2	1	3	67
Yellowmouth Grouper	Mycteroperca	interstitalis	0	1	1	0
Black Sea Bass	Centropristis	striatus	60	8	68	88
Bank Sea Bass	Centropristis	ocyurus	1	11	12	8
Sand Perch	Diplectrum	formosum	0	1	1	0
White Grunt	Haemulon	plumieri	17	8	25	68

Table 3 – continued. Species present in corresponding bioprofile and electronic logbook catch records. These data were used to calculate the accuracy of self-reported electronic catch records. Records were aggregated for all vessels. Instances where Accuracy is < 100% denotes trips where specimens were sampled by headboat port agents but not reported by vessel owners/operators.

Common Name	Genus	species	Trips spp. present in both bioprofiles and catch records	Trips spp. present in bioprofiles **but not** in catch records	Total	Accuracy
Tomtate	Haemulon	aurolineatum	9	7	16	56
Cobia	Rachycentron	canadum	6	1	7	86
Spanish Mackerel	Scomberomorus	maculatus	1	0	1	100
Greater Amberjack	Seriola	dumerili	7	1	8	88
Lesser Amberjack	Seriola	fasciata	0	1	1	0
Almaco Jack	Seriola	rivoliana	1	1	2	50
King Mackerel	Scomberomorus	cavalla	6	2	8	75
Ocean Triggerfish	Canthidermis	sufflamen	0	1	1	0
Gray Triggerfish	Balistes	capriscus	43	10	53	81
Bluefish	Pomatomus	saltatrix	0	1	1	0
Queen Triggerfish	Balistes	vetula	0	1	1	0
Pinfish	Lagodon	rhomboides	0	3	3	0
Graysby	Epinephelus	cruentatus	2	0	2	100
Coney	Cephalopholis	fulva	0	1	1	0
Bigeye	Priacanthus	arenatus	0	2	2	0
Little Tunny	Euthynnus	alletteratus	2	6	8	25
Dolphin	Coryphaena	hippurus	5	7	12	42
Great Barracuda	Sphyraena	barracuda	2	3	5	40
Banded Rudderfish	Seriola	zonata	1	3	4	25
Carolina Hake	Urophycis	earlli	0	1	1	0
Cutlassfish, Unidentified	Trichiuridae		0	1	1	0
Sharpnose Shark	Rhizoprionodon	terraenovae	1	7	8	13
Southern Flounder	Paralichthys	lethostigma	0	3	3	0
Gulf Flounder	Paralichthys	albigutta	0	1	1	0

Table 4. Summary statistics describing the compliance rate exhibited by participants in a voluntary, pilot electronic logbook project. "Compliance" (HAR%) is presented as a percentage, dividing the sum of electronic trip records by the sum of HAR-estimated trips. Compliance is reported for seven (7) individual headboat vessels, and for all vessels combined.

Vessel	HAR%
A	96
B	92
C	94
D	100
E	92
F	98
G	89
All	93

Table 5: Summary statistics describing the timeliness of data voluntarily transmitted by participants in a pilot electronic logbook project. Delay was calculated by subtracting fishing trip date from the date of self-reported, electronic delivery (i.e., delivery over the Internet to secure FTP servers), and is reported in units of whole days. The minimum, maximum, mean, and median time delays are reported for seven (7) individual headboat vessels, and for all vessels combined.

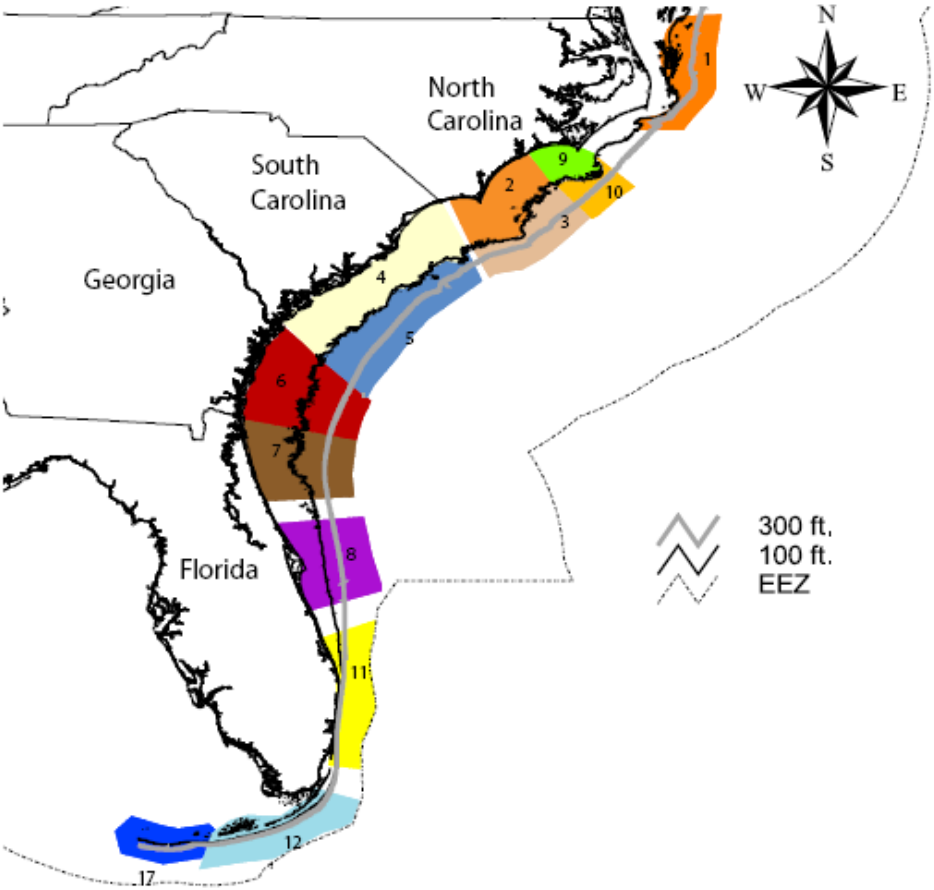
Vessel	Min	Max	Mean	Median
A	0	32	7	5
B	0	41	7	5
C	0	13	1	0
D	2	37	17	16
E	0	107	59	64
F	0	31	10	9
G	0	70	25	22
All	0	107	19	9

510 Table 6: Itemized costs of paper logbook submissions to the SRHS. Data are from 2009.

Item	Cost
Port agent paper form handling costs	$64,000
Contracted paper form data entry	$14,000
Paper form printing	$1,000
Port agent-related shipping	$1,500
Data entry-related shipping	$500
	$81,000

511

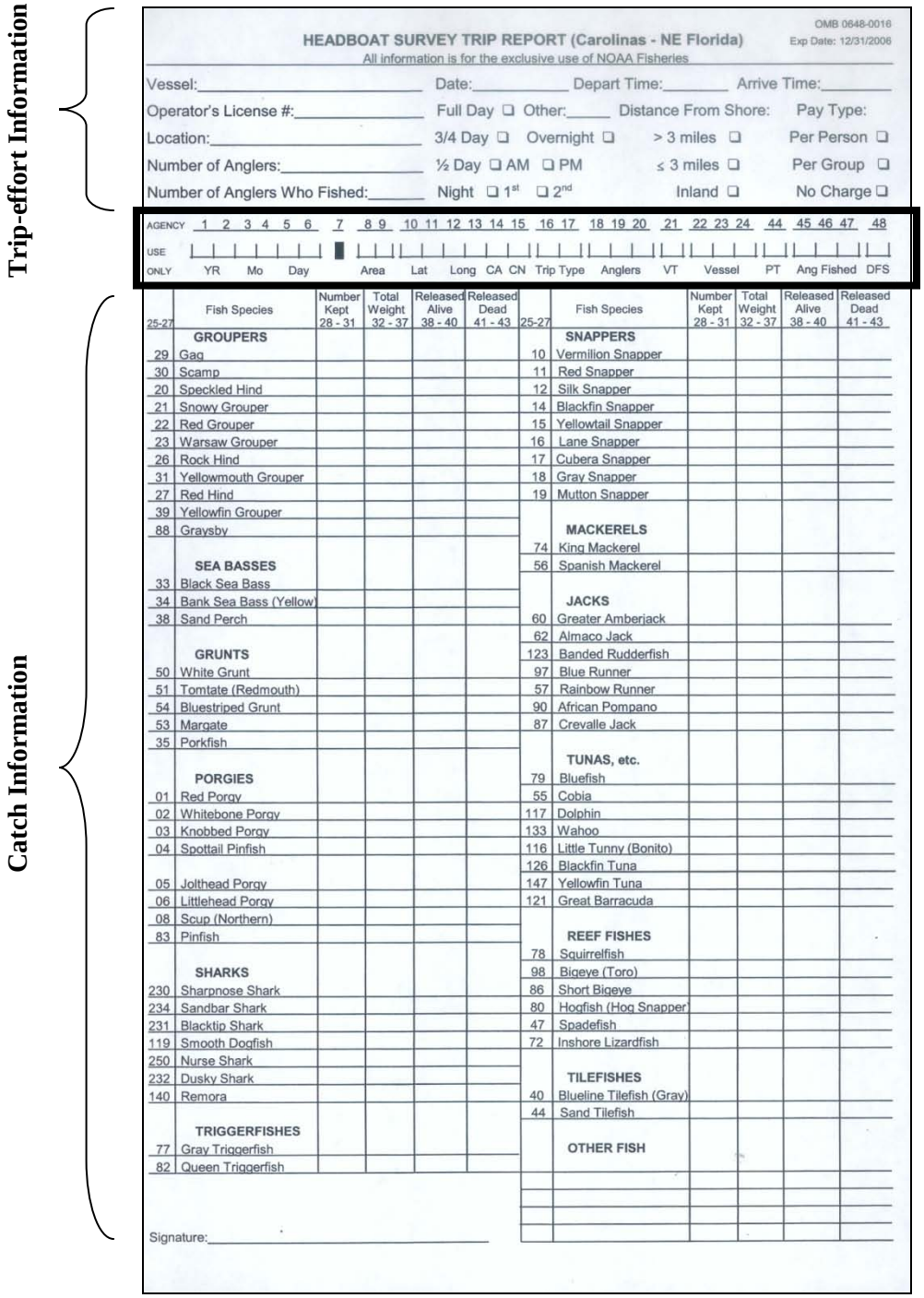
512



513

514 Figure 1: Study area used in the Southeast Region Headboat Survey. Colored boxes display
515 standard statistical reporting areas based on the coastline and boundaries of four southeastern
516 U.S. Atlantic coastal states. Two ocean depth contours are illustrated (100-ft, 300-ft), as well as
517 the boundary of the U.S. exclusive economic zone.

518



519

520 Figure 2: Appearance of paper Headboat Survey Trip Report data sheets used in this pilot
521 project. For a single trip, vessel representatives enter trip information into the top portion of the
522 form, and catch information is entered in species-specific rows. Headboat port agent data entry
523 is required to code trip information (bold box).

524

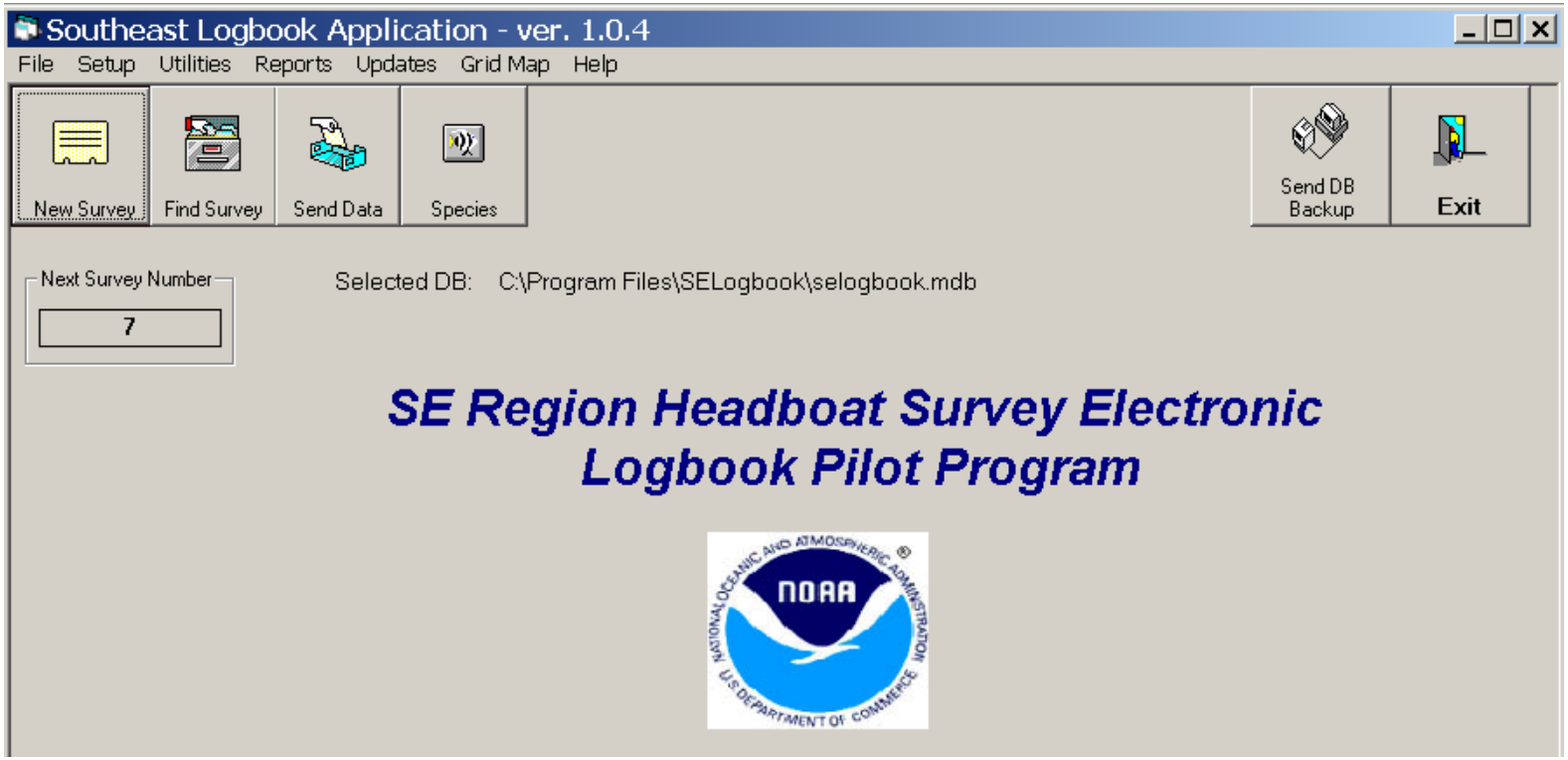


Figure 3: Appearance of the initial entry screen within the electronic Southeast Logbook Application computer program (version 1.0.4).

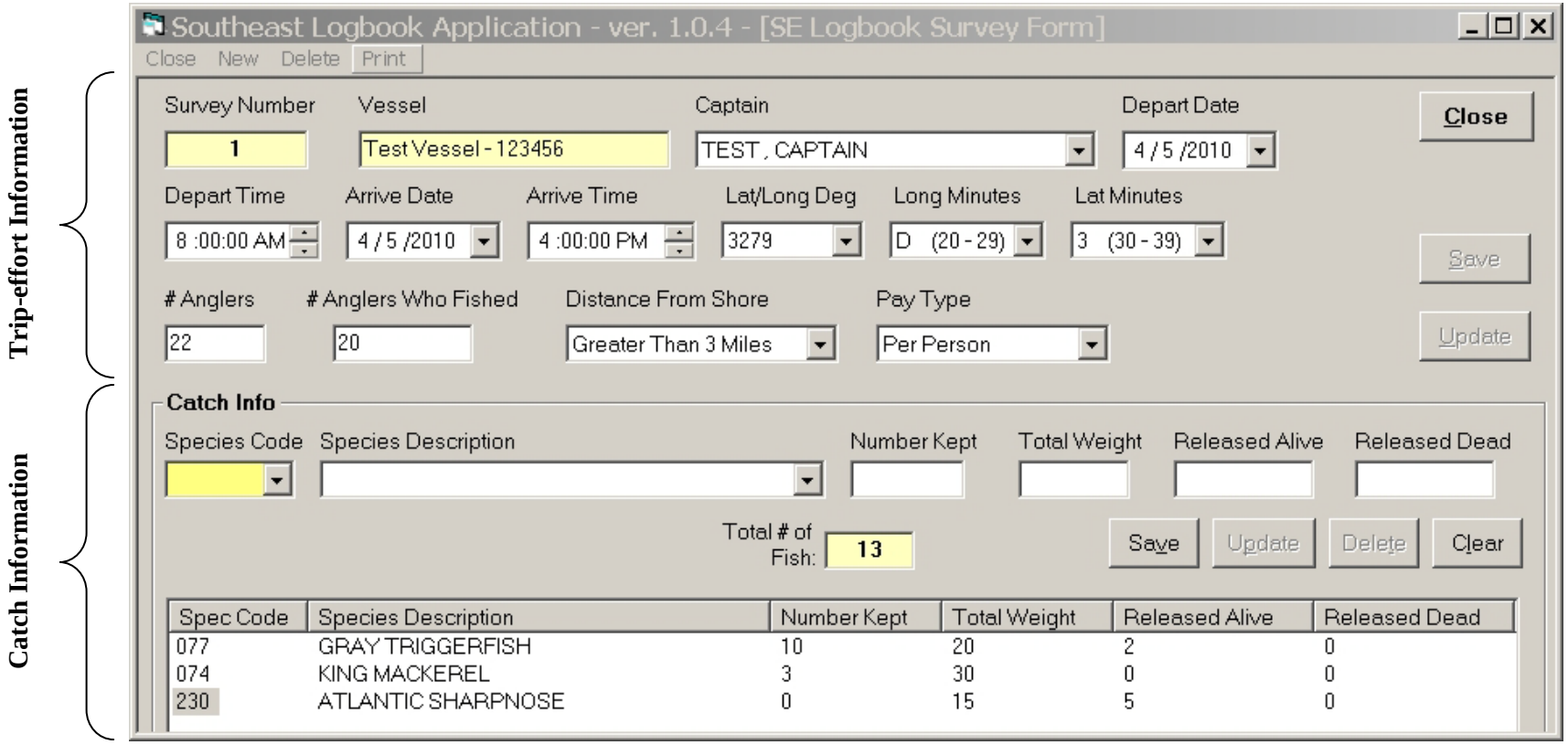


Figure 4: Appearance of the data entry screen within the electronic Southeast Logbook Application computer program (version 1.0.4). After the application is used once, yellow shaded boxes are automatically populated. Trip information is entered once at the start of a particular data entry session. Catch information is entered in row format for each species caught on a trip.

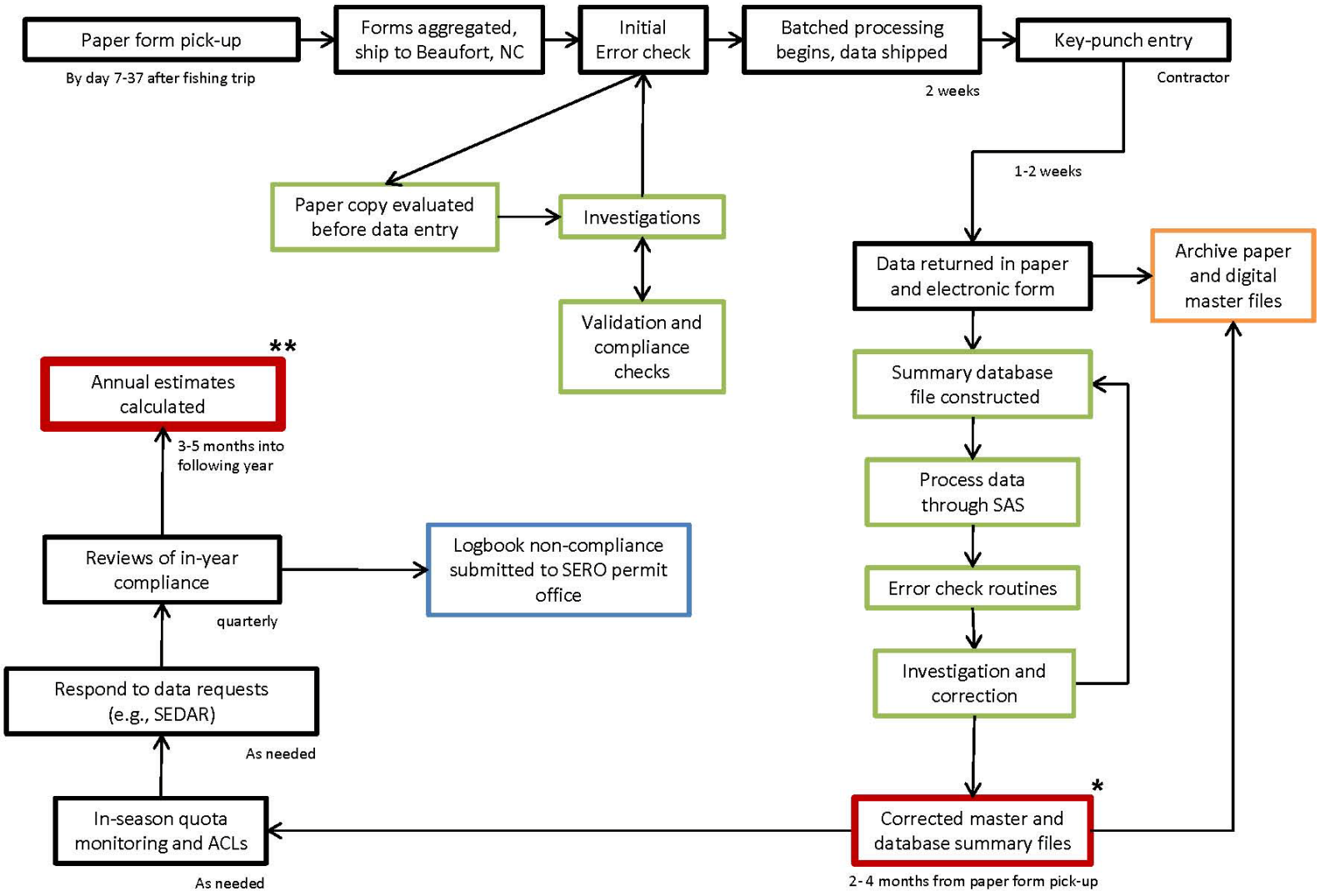


Figure 5. SRHS data flowchart for paper logbook data. The figure displays a conceptual flow of information from creation (paper form pick-up of an individual catch record by a headboat port agent) to in-season availability (*), to annual summary file availability (**). Steps are based on 2010 SRHS program procedures.

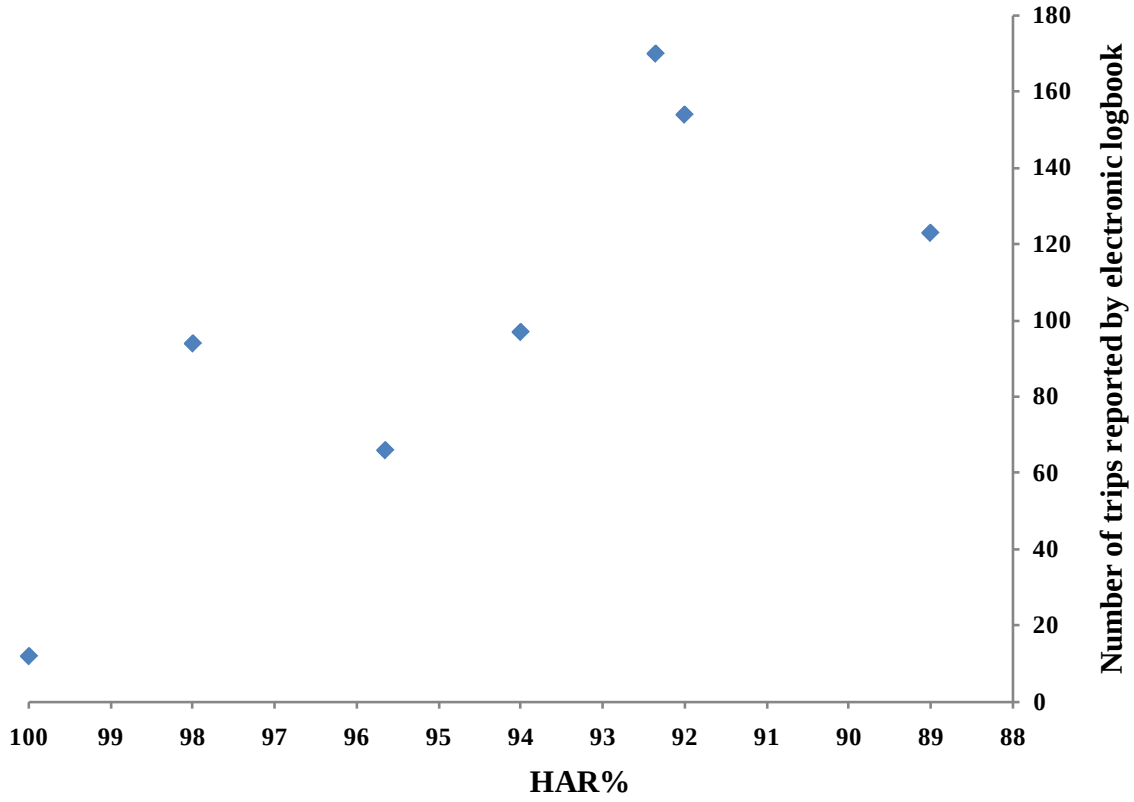


Figure 6: Scatter plot of compliance and number of trips reported by electronic logbook. Each data point represents a vessel. Compliance (HAR%) is calculated as, (# electronic reported fishing days / # HAR estimated fishing days) * 100.

Appendix A. Letter mailed to participating vessel owner/operators on 3 November 2010. Following the close of data collection on 31 October 2010, positive and negative criticisms were solicited regarding the electronic logbook computer application implemented during this pilot project.

Pilot Study: Implementation of Electronic Logbooks on Headboats

Operating in the U.S. South Atlantic

01 November 2010

Dear pilot study participants:

Once your trips through October 31, 2010 are entered and sent electronically, headboat reporting can return to paper forms only. Thank you. We are grateful for the time and effort you all have put into this project.

Additionally, please find a questionnaire and stamped envelope included with this letter. We are seeking positive and negative criticism to improve both the electronic logbook computer program and this pilot study. **We hope you'll take a few moments to let us know what you think.** As with all data, feedback from participants is valuable and is considered confidential. Comments will be summarized and included in final reporting to NOAA leadership.

Again, all participants will receive a copy of final reports. Thank you very much for your work, and please contact us with any questions. [edit: contact information was provided]

Please provide us with your honest feedback and return your answers to Ken Brennan.

Have you noticed any software "bugs" we should know about?

Please list three (3) features of the electronic SE Logbook Application you find positive / helpful in fulfilling federal reporting requirements:

Please list three (3) features of the electronic SE Logbook Application you find negative / annoying in fulfilling federal reporting requirements:

If the headboat fleet made a transition to electronic reporting ONLY, what aspect(s) of electronic reporting do you predict new users would find confusing?

Other suggestions or comments?

Appendix B. Voluntary, anonymous feedback received from participating vessel owner/operators within this pilot study. A letter was mailed to participating vessel owner/operators on 3 November 2010. Replies received to date are listed in the order received (n=7).

Have you noticed any software "bugs" we should know about?

"It was either the pay type or the distance from shore that slowed me down a little. Most of the application you could breeze through with the tab button and type a letter or two and it would come up."

"Would be nice to be able to report more specific locations in the [comment redacted for confidentiality]."

"No."

"No, system works well.'

[Blank]

"The software was easy to use. Do not notice any bugs. When we needed updates there was plenty of support."

"It does not transmit the information."

Please list three (3) features of the electronic SE Logbook Application you find positive / helpful in fulfilling federal reporting requirements:

"Fast once you got educated and figured it out! I even enjoyed using it!"

"Quick. Easy. Logical."

"Easy entry. Quick to update if you make an effort. Good [unreadable] report."

"Simple. Efficient. User friendly."

[Blank]

"At the dock it is easy to use and what we really liked was the reports that we could generate."

"It is faster than hand writing. Easy to keep up with."

Please list three (3) features of the electronic SE Logbook Application you find negative / annoying in fulfilling federal reporting requirements:

Just the learning curve at the beginning which really wasn't bad at all. The help from Claude was great!"

"None, really."

"None."

"Double reporting – electronic and then paper. Computer crashed and lost all data – need backup system? So, if I hadn't kept records in my log, I would have no idea of data for 2010 season."

[Blank]

"Nothing too negative."

"Fish codes. Need a clickable map. Should prefill #'s."

If the headboat fleet made a transition to electronic reporting ONLY, what aspect(s) of electronic reporting do you predict new users would find confusing?

"As I said before, a small learning curve that would be worth the investment to me to get faster and better data."

"Nothing, easy system!"

"None."

"Initial start-up, I believe it would take someone like Claude to set-up the system for each headboat operator. Once system is running then it's straight forward."

[Blank]

"Easy to use. The only thing that may hinder reporting is if it has to be done off shore there may not be connections (however I guess info could be entered then sent once the boat returns to the dock). Commercial fishermen may find it more difficult because of the salt air damage that may occur to computers. Headboats generally have dryer conditions in the captain's quarters."

"Most fishermen have a hard time with computers."

Other suggestions or comments?

"This program could be integrated easily into the private recreational sector too, which would close a huge gap in the data collection needed to gain a better understanding of our resources!"

"None."

"If we could provide data on releases that differentiated between keepers and 'shorts'?"

"I would suggest expanding the program from the headboat fleet to the entire for hire sector."

[Blank]

[Blank]

[Blank]