

# National Marine Fisheries Service Southeast Region Electronic Monitoring and Reporting Regional Implementation Plan

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**NOAA**  
**FISHERIES**

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## Abbreviations Used in this Document

ACCSP	Atlantic Coastal Cooperative Statistics Program
AIS	automated information system
CFMC	Caribbean Fishery Management Council
CMP	coastal migratory pelagic
ELB	electronic logbook
EM	electronic monitoring
ER	electronic reporting
FMC	fishery management council
FMP	fishery management plan
GMFMC	Gulf of Mexico Fishery Management Council
GSMFC	Gulf States Marine Fisheries Commission
HMS	highly migratory species
IBQ	individual bycatch quota
IFQ	individual fishing quota
ITQ	individual transferable quota
NMFS	National Marine Fisheries Service
SAFIS	Standard Atlantic Fisheries Information System
SAFMC	South Atlantic Fishery Management Council
SEFSC	NMFS Southeast Fisheries Science Center
SERO	NMFS Southeast Regional Office
VMS	vessel monitoring system

## List of Terms

**Electronic monitoring (EM)** – The use of technologies – such as vessel monitoring systems or video cameras – to passively monitor fishing operations through observing or tracking. Video monitoring is often referred to as EM.

**Electronic reporting (ER)** – The use of technologies - such as phones, tablets, or computers - to record, transmit, receive, and store fishery data.

**Electronic technology (ET)** – Any electronic tool used to support catch monitoring efforts both on shore and at sea, including electronic reporting (e.g., e-logbooks, tablets, apps) and electronic monitoring (VMS, video cameras, and sensors).

**Vessel Monitoring System (VMS)** – Electronic monitoring technology that allows the tracking of fishing vessels, including their position, time at position, course, and speed.

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# Background

There is a growing need for more timely and accurate data for fisheries management and science. Recognizing these growing demands for data collection, the National Marine Fisheries Service (NMFS) published policy guidance in May 2013 on the use of electronic technology for fishery-dependent data collection (NOAA 2013a). The policy included guidance on the use of both electronic monitoring (EM) and electronic reporting (ER). Later that year NMFS also published a discussion draft summarizing EM/ER guidance and best management practices for federally-managed species (NOAA 2013b), and in January 2014 a national EM workshop was held (Lowman et al. 2014). The May 2013 policy guidance gave specific directive for NMFS to develop regional EM/ER plans.

In the Southeast, there has been growing interest and use of EM/ER. Over the past 15 years, numerous pilot studies have been completed examining the use of EM and ER in federally managed fisheries (see **Table 1**). The Gulf of Mexico and South Atlantic Fishery Management Councils (FMCs) have both required the use of ER and/or vessel monitoring systems (VMS) for shrimp, commercial reef fish, headboats, and federally-permitted dealers, and there is growing interest to expand the use of ER in the charter for-hire, private, and commercial sectors. Requirements to monitor annual catch limits (ACLs) have also increased the need for more timely data to ensure catch limits are not exceeded and accountability measures are triggered. The plan will serve as a roadmap for EM/ER development and implementation throughout the Southeast Region.

Initial input on the plan was solicited from the Gulf of Mexico, South Atlantic, and Caribbean FMCs. An EM/ER Implementation Plan Committee, comprised of fishery management council and NMFS representatives, reviewed a draft plan in November and each regional FMC reviewed a revised plan at meetings in December 2014 and January 2015. Additional input was obtained from stakeholders and constituents during a public comment period from January 9-February 9, 2015. Appendix 1 summarizes public comments received as well as NMFS responses to those public comments.

**Table 1. Timeline of electronic reporting and electronic monitoring implementation and testing in the Southeast Region, 2000-present.**

**2000**

- Bluefin Data LLC develops electronic reporting system for Louisiana commercial seafood dealers to report their purchases. Electronic reporting via trip tickets later expanded to other Gulf of Mexico states.

**2003**

- Vessel monitoring systems required for South Atlantic rock shrimp (SAFMC 2003)

**2004**

- Phase I testing of shrimp ELBs begins (Cole et al. 2005)
- Electronic reporting via trip tickets expanded to North Carolina

**2006**

- Vessel monitoring systems required for Gulf of Mexico commercial reef fish vessels (GMFMC 2005a)

**2007**

- Commercial red snapper IFQ program implemented; IFQ dealers required to report electronically via Web-based system; IFQ allocation transfers completed electronically (GMFMC 2006)
- Gulf of Mexico shrimp vessels selected by NMFS to report are required to participate in the ELB program to collect shrimp effort data (GMFMC 2005b).

**2008**

- Electronic monitoring pilot study conducted onboard Gulf of Mexico longline vessels (Pria et al. 2008)

**2009**

- Southeast Region Headboat Survey begins testing a personal computer (PC)-based ER system for headboats.

**2010**

- Commercial grouper-tilefish IFQ program implemented; IFQ dealers required to report electronically via Web-based system; IFQ share and allocation transfers completed electronically (GMFMC 2009)

**2011**

- iSnapper pilot study begins testing recreational ER via a iPhone/iPad application (Stunz et al. 2014)

**2012**

- Tablet and phone-based ELB pilot testing begins for headboats participating in the Southeast Region Headboat Survey.
- Electronic monitoring pilot study conducted onboard commercial snapper-grouper bandit reel vessels (Baker 2012).
- Gulf of Mexico Shareholder's Alliance begins testing EM on Gulf of Mexico Fishing Vessels (Tate 2012)
- Electronic reporting via trip tickets expanded to South Carolina and Georgia

**2013**

- Pilot testing of phone-based ELBs begins in the U.S. Caribbean (Steinback 2014).
- Mote Marine Laboratory receives NFWF funding to establish an electronic monitoring center to advance regional capacity transition to EM

**2014**

- A new cost-sharing program for Gulf of Mexico shrimp ELBs is implemented to collect fishing effort data. Shrimp vessels must participate if selected to report by NMFS (GMFMC 2013a).
- South Atlantic and Gulf of Mexico headboats required to report logbooks electronically (SAFMC/GMFMC 2013).
- South Atlantic and Gulf of Mexico federally permitted commercial dealers required to report purchases electronically (GMFMC/SAFMC 2013)
- Pilot testing begins to evaluate the use of ELBs for commercial vessels in the Gulf of Mexico and South Atlantic (see GMFMC August 2014 briefing book accessible at: [www.gulfcouncil.org](http://www.gulfcouncil.org)).
- Southeast Regional Office begins development of the Bluefin Tuna Individual Bycatch Program, which will track landings and bycatch of bluefin tuna in the Atlantic and Gulf of Mexico.

## Goals and Objectives

The goal of this plan is to provide an operational strategy for implementing and expanding the use of EM/ER for federally managed commercial and recreational fisheries in the Southeast Region. Numerous data collection challenges currently exist in the Southeast Region. Some of the primary challenges that EM/ER may address include reducing time lags in reporting which can prevent or reduce ACL/quota overages, improving the precision of recreational catch estimates, increasing the amount of data available for estimating regulatory discards, identifying bycatch hotspots, providing catch records histories for commercial and for-hire vessels, increasing sampling efficiency, and reducing redundancies in data collection. Addressing these many challenges can help fishermen, scientists, and managers by preventing overfishing and harvest overages, improving stock assessments and scientific research, and providing greater flexibility through use of innovative management strategies.

In the Southeast, the primary focus is on expanding the use of ER to improve the quality and timeliness of fisheries data for use by managers and scientists. Greater, more immediate benefits are expected to be realized through expanded use of ER, especially if reporting accuracy and precision are improved and more timely data can be validated to reduce data collection biases. Although the Southeast Regional Office (SERO) and Southeast Fisheries Science Center (SEFSC) view EM as important to improving science and management, development and implementation of EM, especially use of video camera systems, is considered a longer-term implementation goal than ER for most fisheries. There are already many fisheries in the Southeast using VMS or pilot testing video camera systems and SERO and the SEFSC see great utility in these technologies for habitat protection, bycatch/catch estimation, and enforcement of fishery regulations.

The primary objectives of this plan are to:

1. Define regional objectives for the use of EM/ER;
2. Establish a framework for EM/ER development and implementation in the Southeast;
3. Identify challenges impeding the use of EM/ER in the region and potential solutions for overcoming those challenges;
4. Develop a prioritized list of fisheries suitable for EM/ER implementation;
5. Identify and quantify (where possible) costs and infrastructure needed for expansion of EM/ER use; and,
6. Develop a process for reviewing progress made toward EM/ER implementation.

Additionally, this plan generically discusses timelines for implementing EM/ER in various fisheries and sectors, but it is recognized that in many situations, implementation and use of EM/ER will be contingent on the feasibility of the technology and input, recommendations, and regulatory actions made by the regional FMCs. Therefore, the plan is not overly prescriptive as to when EM/ER may be implemented.



The primary goal for increasing the use of ER in the Southeast Region is to improve data timeliness, accuracy, and precision for use in management and science. This goal was also identified by each of the three regional FMCs when submitting input on this plan. More timely data are needed to aid management with monitoring catch, avoiding bycatch, setting season lengths, evaluating catch limits, and incorporating the most recent data into scientific studies and management.

In addition to expanding the use of ER, the SERO and the SEFSC are interested in exploring and expanding the use of EM. The primary goal for increasing the use of video monitoring in the Southeast Region is to improve documentation and monitoring of catch and bycatch in federally managed fisheries, and interactions with protected species, especially given limited observer coverage in many fisheries. Use of EM could increase reporting rates and result in new, innovative management strategies that seek to minimize bycatch through identification of bycatch hotspots. Benefits of such technology must be weighed against costs, potential stakeholder support/opposition, and the size and characteristics of vessels operating in each fishery.

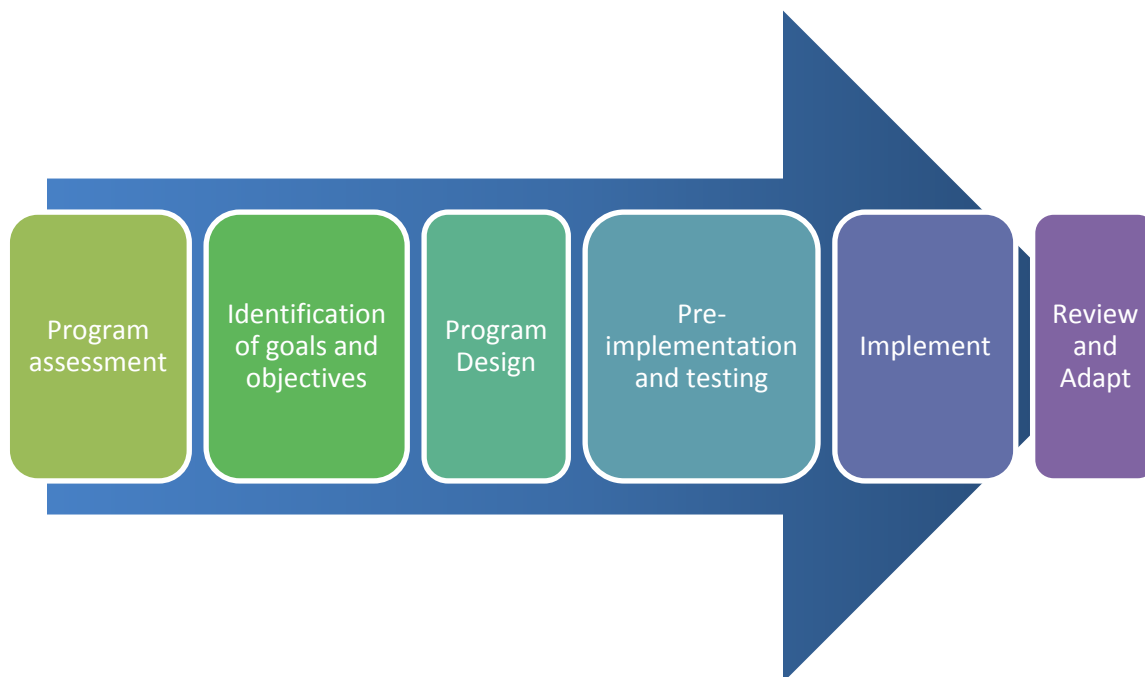
SERO and the SEFSC are also interested in expanding the use of VMS. VMS are already used in many fisheries to aid enforcement and enhance monitoring of protected areas, special management zones, and catch share programs. The primary goal for requiring and expanding the use of VMS technology in the Southeast Region is to improve quota monitoring and tracking, especially for catch share managed fisheries, and to ensure compliance with spatial management regulations. VMS are also useful for estimating effort and catch, which is currently done in the Gulf of Mexico shrimp fishery. Similar to video camera systems, the required use of VMS must be balanced against the costs of use and stakeholder support/opposition.

In addition to the goals described above, other regional goals for EM/ER include, but are not limited to: 1) improving perceptions and stakeholder buy-in regarding the data collection process through implementation of robust, validated data collection programs; 2) increasing data accessibility for managers, scientists, fishermen, and other constituents; 3) developing standardized reporting practices and systems that reduce reporting burden and enhance quality control/quality assurance of submitted data; and 4) establishing effective partnerships with stakeholders that allow for consideration of new, innovative, and beneficial technologies, as well as a means to fund their implementation, including industry cost-sharing where appropriate.

Given the diversity of Southeast fisheries, it is recognized that sub-region and fishery specific goals will be needed for the Gulf of Mexico, South Atlantic, and Caribbean. These sub-region and fishery-specific goals will be more explicitly defined during Phase II of the framework implementation process, which is described in the next section.

# Framework for EM/ER Implementation

The need for EM/ER is driven by clearly identified problems. The application of EM/ER can, in some cases, have significant costs, requiring solutions to known problems be clearly identified in order to articulate the need for EM/ER before it is pursued. Successful implementation of EM/ER requires a well-defined process. The process should outline steps for assessing EM/ER needs, development, implementation, and evaluation, with particular emphasis on whether EM/ER could augment or replace existing systems (NOAA 2013b). The process is intended to increase efficiency by streamlining and standardizing the process for EM/ER implementation, and is not intended to delay progress especially when pilot studies and extensive work has already been completed. As proposed in NOAA’s draft guidance and best practices for EM/ER (NOAA 2013b), the SERO and SEFSC, in coordination with its partners, intends to use a six phase process for EM/ER consideration and development (**Figure 1**). Each of these phases, and how they will be applied, is further discussed below.



**Figure 1. Phases of electronic monitoring and electronic reporting consideration and development.**

## Phase I – Assessment

Each fishery, as well as sectors within a fishery, have unique characteristics. EM/ER needs can vary greatly from fishery to fishery and/or sector to sector. There are a variety of different tools for monitoring and reporting, but each has strengths and weaknesses (NOAA 2013b). For each fishery or sector identified as a priority for EM or ER, the SERO and SEFSC, in coordination with its partners, will conduct an initial assessment of monitoring tools that may be appropriate

for that particular fishery either on a voluntary or mandatory basis. Capabilities and limitations of EM/ER will be clearly identified within the context of the current monitoring system. Existing infrastructure, funding sources, critical data gaps, stakeholder support/opposition, and management objectives will all be considered during the assessment phase, and challenges impeding implementation will be identified.

It is critical that EM/ER objectives align with fishery management objectives and are not counter to scientific objectives. Stakeholders depend on accurate data for managing and assessing fish stocks, and it is important that stakeholders have confidence in the data (NOAA 2013b). The willingness of industry, state agencies, data collectors, and other stakeholders to use EM/ER will first be assessed before proceeding with further development. Stakeholder engagement in the Southeast will occur in many different ways and include: discussions at regional FMC meetings, state commission meetings, scientific panels, and stakeholder public hearings. Regional FMCs will also be encouraged to establish EM/ER advisory panels to advise on EM/ER development and implementation. Public input will be accepted through the regional FMC and NMFS rulemaking process, as well as solicited via advisory groups and scientific panels. Ultimately, costs must be realistic and affordable to the agency and stakeholders before proceeding. Consistent with the NOAA Electronic Technologies Policy (NOAA 2013a), no fishery-dependent ET program will be approved by NMFS if it creates an unfunded or unsustainable cost of implementation or operation contrary to applicable law or regulation. NMFS will work with the Councils and industry where cost sharing of monitoring costs is deemed appropriate, and develop, where applicable, transition plans from present to future funding arrangements.

## **Phase II – Identification of Monitoring Program Goals and Objectives**

Clearly defined objectives are essential to successful development of catch monitoring systems. Too often, constituents and managers focus on tools for collecting data electronically before focusing on what information is needed to enhance management of the fishery. Additionally, objectives can vary greatly depending on whom you ask, making it complicated for those designing EM/ER data collection systems and tools to have a clear understanding of what is being accomplished.

Goals and objectives for EM/ER will be developed in coordination with the regional FMCs, state partners and commissions (e.g., ACCSP, GSMFC), enforcement, stakeholders, scientific committees, advisory panels, data analysts, and scientists. Data needs will be identified based on management plan objectives, scientific needs, and fleet/fishery characteristics. Each fishery management plans (FMP's) management objectives should be reviewed with ER/EM in mind, and new or modified objectives should be created to support increased use of EM/ER.

## **Phase III – Program Design**

Based on the goals and objectives identified during Phase II, comparative analyses will then be conducted to assess the tradeoffs of different EM/ER systems and how they compare with

existing data collection programs. Data flows will need to be mapped to compare and contrast existing and newly proposed EM/ER systems. Costs, data timeliness and quality, ease of use, enforceability, and industry support, as well as many other factors, will be evaluated to assess the most appropriate options for EM/ER. Strong at-sea and/or dockside validation of catch and effort will be a key consideration for ER to ensure statistically sound and scientifically robust catch and effort estimates can be produced. Once an EM/ER system has been selected for development, a plan for testing and evaluating the EM/ER applications and overall program will also be developed. The pilot test plan will estimate costs and potential challenges, as well as define end-points for testing and steps to achieve full implementation if pilot testing is successful.

The SERO and SEFSC will work with the regional FMCs at this stage in the process and identify any needed regulatory changes for EM/ER programs. We also intend to work with industry members, other stakeholders, and EM/ER vendors to build buy-in, establish trust, identify infrastructure needs, develop regulations, and ensure quality data are collected (Lowman et al. 2014). Prior to implementation, regulatory changes will be made, as needed. Long-term archival storage of the data and how it will be handled for future use will also be considered by information technology staff, managers, and data users. A preferred EM/ER tool will then be selected based on cost considerations, input received, and the strengths and weaknesses of each tool in relation to the goals and objectives defined during Phase II.

The program design selected will need to be scientifically sound and statistically valid as NMFS is required to use the best scientific information available for collecting data per National Standard 2 of the Magnuson-Stevens Fishery Conservation Act. EM/ER data collection approaches must be unbiased and there is a need for information to be consistent with historical time series for use in determining the status of stocks. Any fishery-dependent survey or sampling approach developed should be statistically and scientifically certified for use, and a plan for calibrating new data collection methods to old methods should be determined prior to implementation, as needed. Alternative methods for reporting, such as paper-based reports, should also be identified for use in the event of technological problems or catastrophic events.

#### **Phase IV – Pre-implementation**

Once an EM/ER tool and program design has been selected, hardware/software and other information technology equipment will need to be purchased. Costs for program development and implementation will need to be determined during Phase III, including available infrastructure that can support new programs and who will pay for the costs of EM/ER. Funding will be needed for infrastructure and to hire agency personnel and/or contractors to support implementation of the EM/ER program. Presuming adequate funding is available, installation of EM/ER equipment will then commence with necessary testing of equipment. Data management, quality control/quality assurance procedures, and handling practices will also be defined and contingencies will be established for EM/ER equipment failure (NOAA 2013b). Costs will also be further refined during this phase and any necessary adjustments to long-term funding needs will be identified.

Pre-implementation should also involve pilot testing. Pilot studies allow for EM/ER equipment and technologies to be tested, and provide an opportunity for modifications and changes prior to full-scale implementation. It is important to involve stakeholders in this stage of the process to gather feedback based on their experience in the pilot, as well as recommendations they think will improve the final product. Pilot studies also can be used to assess if management goals and scientific needs are met, before mandating EM/ER use. For instance, the Gulf Headboat Collaborative is currently testing an allocation-based catch share system that uses VMS and ER technology to track fishing activity and catches. The program is conducted as a pilot, with approximately  $\frac{1}{5}$  of the headboat fleet participating. ACCSP is also funding development and reporting of logbooks via handheld tablets. ACCSP is partnering with the Rhode Island Department of Fish and Wildlife and Rhode Island Party Charter Boat Association on the project. Results from these and other pilots will help inform the Councils, NMFS, and stakeholders as to the utility of EM/ER for use in for-hire fisheries and allocation-based management systems. If successful, these and other pilot studies will serve as a useful basis for longer-term management strategies considered by regional FMCs.

#### **Phase V – Implementation**

During the implementation phase, final regulatory changes will be made. Customer service contacts will also be identified to help EM/ER users troubleshoot problems and resolve questions. Personnel (contractors, agency employees) will be properly trained to assist fishermen and dealers with reporting and monitoring requirements. Staff will collect feedback from industry members and vendors to resolve any unforeseen issues and make any needed refinements to the system. Infrastructure will also be expanded based on available funding to support data collected. Initial input, feedback, and results received post-implementation will also be conveyed to the regional FMCs, stakeholders, and other user groups.

#### **Phase VI – Review and Adaption**

In the final phase, performance of the EM/ER program will be evaluated. Performance will be evaluated based on identified goals and metrics specified for evaluation. Initially, reviews will happen more frequently, especially for new EM/ER programs, in order to provide more frequent updates and feedback to the regional FMCs, their Advisory Panels and Scientific and Statistical Committees, and stakeholders regarding program performance. Review of established performance measures for ER/EM programs should be done in conjunction with stakeholders and any adjustments should be made based on identified performance measures (see Assessing Implementation Plan Progress section). Thereafter, periodic reviews of EM/ER programs will be conducted to ensure goals are still being met, funding is adequate, and stakeholder satisfaction remains high.

# Technological Capabilities

Numerous electronic technologies are already used in the Southeast Region for reporting and monitoring. Below is a brief description of existing technological capabilities, as well as other technologies that are currently being tested throughout the Southeast Region. Additional information on implementation and testing of various EM/ER technologies in the Southeast Region is contained in **Table 1**.

## Electronic Reporting Systems

There are a variety of ways electronic reports are collected from fisheries in the Southeast. These include personal computer based software programs, Web-based software, and applications available on tablets and smart phones. Beginning in early 2014, headboats in the Gulf of Mexico and South Atlantic were required to submit trip-level logbooks electronically. Electronic logbook reports are required on a weekly basis and may be submitted via the Web or smart phone/tablet applications. In August 2014, dealers purchasing federally managed species were required to submit electronic trip tickets using software developed by Bluefin Data LLC or through Standard Atlantic Fisheries Information System (SAFIS) software developed and maintained by the Atlantic Coastal Cooperative Statistics Program (ACCSP). Additionally, a Web-based system is used to report commercial dealer landings and conduct share and allocation transfers for the Gulf of Mexico Red Snapper and Grouper-Tilefish Individual Fishing Quota (IFQ) programs.

Electronic logbooks are also required in the Gulf of Mexico shrimp fishery to collect fishing effort and location information. Gulf shrimp permit holders are required to participate in the program if selected. Shrimp vessels selected to report have data recording devices with global position system (GPS) units that record a vessel's location every 10 minutes. Data are automatically transmitted to NMFS via a cellular phone connection. Vessel speeds are estimated between data points to determine the vessels fishing activity, which can then be used to calculate shrimp fishing effort and bycatch. Costs of the program are shared with shrimp vessel owners. One-time costs to the government for shrimp electronic logbooks (ELBs) were approximately \$2 million dollars and reoccurring costs are approximately \$313,000 annually (GMFMC 2013c). One-time installation costs for ELB installation were paid for by the government. Reoccurring costs to the shrimp fishermen for data transmission service fees are approximately \$120,000 annually.

In addition to the mandatory ER programs discussed above there are also several pilot studies underway or recently completed to test the use of logbooks and other ER systems in commercial and recreational fisheries. These include, but are not limited to, a Web-based logbook pilot study of Gulf of Mexico for-hire vessels funded by the Marine Recreational Information Program (MRIP) in 2010-11 (Donaldson et al. 2013), a smart phone/tablet application (iSnapper) funded by the Marine Fisheries Initiative (MARFIN) grant program to test ER in for-hire and private fisheries (Stunz et al. 2014), and a phone-based reporting system

(Digital Deck) to test ER in U.S. Caribbean fisheries (Steinback 2014). In 2013 and 2014, several Gulf of Mexico states implemented or began testing new voluntary or mandatory ER systems for collecting red snapper recreational catch data, and Florida intends to begin a new collection program for recreationally caught reef fish in 2015 (see August 2014 GMFMC briefing book available at: [www.gulfcouncil.org](http://www.gulfcouncil.org)). North Carolina will also implement a for-hire electronic logbook program beginning in 2015.

## Video Camera Systems

Electronic video monitoring systems consist of a control box, sensors (e.g., GPS, hydraulic pressure transducer, and a winch rotation sensor), and cameras. The control box continuously records sensor data, as well as provides feedback on system operations (Pria et al. 2008). Video images are captured with cameras typically during fishing operations, and may be triggered to go on or off when winches rotate or hydraulic pressure changes. After video imagery is captured, it is viewed to enumerate and identify landed and discarded catch.

Video camera systems are currently not required in any federally managed fishery in the Southeast Region. Two pilot studies were conducted on commercial vessels in the Gulf of Mexico and South Atlantic. Pria et al. (2008) conducted an EM pilot study onboard Gulf of Mexico longline vessels. The study compared catch identification between observer and EM methods. Comparisons showed good agreement (>80%) between observer and EM methods, but identification discrepancies were observed for some species. EM was not able to reliably determine catch discarding due to inconsistent catch handling and limited camera views. Overall, study results indicated EM was useful for collecting fishing activity, spatial-temporal data, and assessing catch composition, but further work was needed to reliably determine catch disposition data.

In the South Atlantic, Baker (2012) examined the use of video cameras onboard commercial snapper-grouper bandit reel vessels. Results of the study were similar to those of Pria et al. (2008). Observer count data matched well with EM video count data, but species identification was less accurate. Many species important to the snapper-grouper fishery were difficult for the EM video reviewers to identify. The results indicated that EM monitoring could augment existing data collection programs provided steps were taken to improve catch counts and species identification.

A third study conducted by Tate (2012) and Batty et al. (2014) is still ongoing. The study is evaluating the use of EM in the Gulf of Mexico bandit reel and longline fishery, and preliminary results are similar to those of the studies discussed above. This project demonstrated that EM could be used to reliably document fishing effort and retained catch, but that major changes to camera installation would be required to accurately record discarded fish.

A related National Fish and Wildlife Foundation project by Mote Marine Laboratory (Sarasota, Florida) is also underway with the intent of establishing an EM center for the commercial reef fish fishery. Another project also recently began in 2014 that is piloting the use of camera

systems onboard five Southwest Florida shrimp vessels to accurately account for sawfish and other large marine bycatch in shrimp trawl fisheries (J. Carlson, SEFSC, pers. comm.)

## Vessel Monitoring Systems

VMS are satellite-based systems installed on fishing vessels to monitor vessel movement and activity. VMS systems consists of a mobile transceiver unit placed on the vessel, a communications service provider that supplies the wireless link between the vessel's unit and the NMFS Office of Law Enforcement (OLE), and a secure OLE facility where staff can monitor compliance. The data are kept secure and confidential and are only accessible by staff with clearance to access confidential VMS data. The system is programmed to send a signal once an hour 24-hours a day and 7 days a week, but can be turned off under certain circumstances if the vessel owner applies for a power down exemption.

In the Southeast, VMS are required on Gulf reef fish vessels, South Atlantic rock shrimp vessels, and various Highly Migratory Species (HMS) vessels. There are currently five type-approved VMS units for use by fishermen. Units range in price from \$2,300 to \$3,800. Additional costs include installation and monthly service charges which average \$45 to more than \$60 depending on the service provider. Currently, NMFS has a reimbursement program for fishermen purchasing VMS units to comply with fishery management regulations.

In the Southeast, VMS are used by federal fishery managers and law enforcement to monitor fishing activity and enforce spatial-area closures and gear-restricted areas. Additionally, they can be used by enforcement and the Coast Guard to locate vessels in the event of emergencies, thereby enhancing safety-at-sea. VMS data have also been used in some instances to assess the impacts of proposed regulations, such as spatial area closures. VMS provides detailed location information, but fishing activity must often be predicted using vessel speeds or a combination of other trip/area specific variables. Data collected currently through VMS include hail out notifications (e.g., gear, type of fishing) when a vessel leaves port and hail in notifications (e.g., time of landing, landing amounts, dealer, vessel identification) when a vessel returns to port. VMS units are also capable of collecting data similar to an electronic logbook. The Gulf of Mexico IFQ programs and Headboat Collaborative pilot program allow vessels to electronically submit hail in notifications prior to landing via VMS. The hail-in notifications include vessel name, landing location, to which dealer they will be selling fish, time of landing, and pounds landed by species or share category. At their June 2014 meeting, the Gulf of Mexico Fishery Management Council expressed interest in using VMS for EM/ER in the for-hire fleet.

## Other Technologies

The automated information system (AIS) is a tracking system used on ships and by vessel traffic services. AIS is a maritime navigation safety communications system that is currently mandatory for vessels 65 feet or more in length. It is being used by the U.S. Coast Guard to improve national security and maritime safety. AIS is not compatible with VMS as it uses



different reporting rates and communication systems. However, AIS may be a cost-effective alternative to VMS that could be used in the future to monitor fishing activity in the Southeast. AIS, in addition to other satellite tracking systems, is currently being used to combat illegal fishing activity in other areas of the world (Skirble 2015).

## Fisheries Suitable for EM/ER in the SE Region

The Gulf of Mexico, South Atlantic, and Caribbean FMCs manage hundreds of species in 19 FMPs. These species are harvested by both commercial and recreational fishermen. Some species managed by FMPs are suitable for EM/ER, while EM/ER is not needed for others (e.g., federal harvest for red drum and corals, except octocoral, is prohibited). Additionally, EM and/or ER is already extensively used in some fisheries (e.g., Gulf of Mexico shrimp) and modes (Gulf of Mexico and South Atlantic headboats), reducing the need for further development or implementation. **Tables 2-3** summarize current monitoring and reporting requirements by FMP, region, and sector (commercial, recreational). They also identify fisheries potentially suitable for EM or ER. A more detailed description of Southeast Region fisheries potentially suitable for EM/ER is provided below and summarized in **Figure 2**. This list was developed with input from each of the regional FMCs. A variety of factors were considered when selecting fisheries suitable for EM/ER. These factors included economic value of the fishery, existing regional FMC and stakeholder support for EM/ER, the extent of EM/ER pilot research already conducted, potential costs, and existing infrastructure to support expansion of EM/ER. Region-wide priorities for EM/ER are also discussed. Prioritization of the list will be reviewed and discussed annually with the regional FMCs.

### Gulf of Mexico

Reef Fish and Coastal Migratory Pelagics (CMP) – The Reef Fish and CMP FMPs contain more than 30 species of snappers, groupers, jacks, hogfish, triggerfish, cobia, and mackerels. Reef fish and CMP account for a majority of the ACL's monitored in the Gulf of Mexico and many reef fish managed under the commercial IFQ programs. Additionally, many of these species co-occur and are caught and discarded as bycatch while fishing for other target species. Electronic reporting is already required of dealers purchasing reef fish and CMP, and headboats are required to report trip-level logbooks of landings and discards. Commercial logbooks are currently submitted via paper, but there is an ongoing pilot study to test at-sea vessel electronic logbooks (ELBs; Pierce 2014). There is also growing interest in the monitoring of recreational catches in the for-hire sector using ELBs. Because many reef fish species co-occur, there is also a need to monitor the abundance and species composition of fish that are not retained by commercial and recreational fishermen. The Gulf of Mexico and South Atlantic FMCs have established a technical subcommittee, which provided recommendations on an electronic reporting system for charter vessels in late 2014 (GMFMC/SAFMC 2014). Additionally, efforts are underway to improve recreational catch estimation of red snapper, with many states conducting pilot studies in 2014 (see August 2014 GMFMC briefing book available at: [www.gulfcouncil.org](http://www.gulfcouncil.org)). Electronic reporting improvements are the primary priority for reef fish and CMPs. Improvements and development of ER include:

1. Pilot testing and developing ELBs for commercial reef fish and CMPs (as well as HMS) to obtain more timely and finer spatial resolution data,

2. Development and implementation of an ER system for federally permitted charter vessels, including the potential use of VMS (as supported by the Gulf of Mexico FMC); and,
3. Continued pilot testing and development of various state based electronic reporting systems for monitoring red snapper and other reef fish catches of private anglers.

Given the video monitoring challenges discussed earlier in this plan, particularly with identification of species and enumeration of bycatch, EM is not foreseen to be a viable option for replacing onboard observers. However, EM use in the reef fish and CMP fisheries may aid catch accounting and identification of interactions with marine mammals and sea turtles.

Shrimp - The Gulf of Mexico shrimp fishery is one of the nation's most economically valuable fisheries (GMFMC 2013a). Shrimp vessels are required to carry ELBs, if selected by NMFS. Fishing effort data collected from ELBs is critical to assessment of shrimp stocks and a key component for estimating juvenile red snapper bycatch mortality attributable to the shrimp fishery. Recently, a cost-sharing program for shrimp vessel ELBs was implemented in the Gulf of Mexico (GMFMC 2013a). No additional needs for shrimp ELBs are foreseen at this time.

However, expanded use of EM may be warranted. A 2012 Biological Opinion recommended NMFS better assess the impacts of incidental take in fisheries (NMFS 2012). The Biological Opinion also indicated that NMFS must have a plan to increase observer effort for the shrimp trawl fishery in south and southwest Florida where sawfish interactions are most likely to occur using standard observer protocols and/or using EM. There is some observer coverage in southwest Florida; however, EM could serve as an alternative to observers for documenting sea turtle and sawfish interactions in the shrimp trawl fishery. Pilot testing is currently underway to test the use of camera systems for accurately accounting for smalltooth sawfish interactions onboard Southwest Florida shrimp vessels (J. Carlson, SEFSC, pers. comm.)

**Table 2. Summary of the existing monitoring tools currently implemented in *commercial fisheries* of the Southeast Region. Green cells indicate fisheries where electronic technologies have already been implemented and regulated programs are in place. Fisheries where additional Electronic Reporting (ER) and Electronic Monitoring (EM) could potentially be suitable are noted, and yellow cells indicate those fisheries that have been identified as the highest priority for implementation.**

Region	Fishery	Current Requirements						Additional ER Potentially Suitable?	VMS or EM Potentially Suitable?
		Dealer Electronic Reporting	Paper logbooks/reports	Electronic Logbooks/reports	VMS	Video	Observers		
Caribbean	Reef Fish	N	Y	N	N	N	N	elogbook - pilot testing began in 2014	
	Queen Conch	N	Y	N	N	N	N		
	Spiny Lobster	N	Y	N	N	N	N		
	Corals and Reef Associated Plants and Invertebrates	Harvest and possession prohibited except with Federal permit for scientific research, exempted fishing, or exempted educational activity							
Gulf of Mexico	Reef Fish	Y	Y	N	Y	N	Y	elogbook - pilot testing in 2015	EM for protected resource interactions; reef fish bycatch
	Shrimp	N	N	Y	N	N	Y		
	Aquaculture	Y	N	Y	N	N	N	Proposed regulations	
	Red Drum	Y	N	N	N	N	N		
	Corals	N	Y	N	N	N	N		
Gulf of Mexico and South Atlantic	Coastal Migratory Pelagics	Y	Y	N	N	N	Y	elogbook - pilot testing in 2015	
	Spiny Lobster	Y	N	N	N	N	N		
South Atlantic	Snapper-Grouper	Y	Y	N	N	N	N	elogbook - pilot testing in 2015; wreckfish ITQ online system	Pingers or VMS in black sea bass pot fishery; EM for snapper-grouper bycatch
	Shrimp	Y - Rock Shrimp Only	N	N	Y - Rock Shrimp Only	N	N		EM for rock shrimp to link location specific catch/bycatch to VMS data
	Dolphin-Wahoo	Y	Y	N	N	N	N	elogbook - pilot testing in 2015	
	Golden Crab	Y	Y	N	N	N	N	elogbook	Pingers for crab traps
	Sargassum	N	N	N	N	N	Y		
	Corals	N	Y	N	N	N	N		

**Table 3. Summary of the existing monitoring tools currently implemented in *recreational fisheries* of the Southeast Region. Green cells indicate fisheries where electronic technologies have already been implemented and regulated programs are in place. Fisheries where additional Electronic Reporting (ER) and Electronic Monitoring (EM) could potentially be suitable are noted, and yellow cells indicate those fisheries that have been identified as the highest priority for implementation.**

Region	Fishery	Current Requirements					Additional ER Potentially Suitable?	EM Potentially Suitable?
		Paper logbooks/reports	Electronic Logbooks	VMS	Video	Observers		
Caribbean	Reef Fish	N	N	N	N	N		
	Queen Conch	N	N	N	N	N		
	Spiny Lobster	N	N	N	N	N		
	Corals and Reef Associated Plants and Invertebrates	Harvest and possession of corals is prohibited except with Federal permit for scientific research, exempted fishing, or exempted educational activity; harvest of aquarium trade species allowed.						
Gulf of Mexico	Reef Fish	Y - Headboat only	Y - Headboat only	N	N	N	eLogbooks for charter; pilot testing electronic apps for private sector	VMS, if used in conjunction with electronic reporting or catch share program; pilot testing VMS in Headboat Collaborative
	Shrimp	Shrimp are not recreationally harvested in the Gulf of Mexico EEZ						
	Aquaculture	Proposed for commercial purposes only.						
	Red Drum	N	N	N	N	N		
	Corals	Live rock harvested for commercial purposes. Harvest and possession of corals prohibited except with Federal permit for scientific research, exempted fishing, or exempted educational activity.						
Gulf of Mexico and South Atlantic	Coastal Migratory Pelagics	Y - Headboat only	Y - Headboat only	N	N	N	eLogbooks for charter	
	Spiny Lobster	N	N	N	N	N		
South Atlantic	Snapper-Grouper	Y - Headboat only	Y - Headboat only	N	N	N	eLogbooks for charter	
	Shrimp	Shrimp are not recreationally harvested in the South Atlantic EEZ						
	Dolphin-Wahoo	Y - Headboat only	Y - Headboat only	N	N	N	eLogbooks for charter	
	Golden Crab	Golden crabs are not recreationally harvested in the South Atlantic EEZ						
	Sargassum	Sargassum is not recreationally harvested in the South Atlantic EEZ						
	Corals	Live rock harvested for commercial purposes. Harvest and possession of corals prohibited except with Federal permit for scientific research, exempted fishing, or exempted educational activity.						

## South Atlantic

Snapper-Grouper and Coastal Migratory Pelagics – The South Atlantic FMC manages more than 50 species of snappers, groupers, mackerels, and other reef fish. Similar to the Gulf of Mexico, these species account for a majority of the ACLs monitored in the South Atlantic. Many of these species co-occur and are caught and discarded as bycatch while fishing for other target species. In the past several years, the South Atlantic FMC has approved new regulations to improve data timeliness in the South Atlantic, including ER by dealers and headboats. These regulations are intended to assist NMFS in monitoring ACLs and prevent, to the extent practicable, overages from occurring. With the exception of dealers and headboats, ER is not currently being done in other aspects of the snapper-grouper and CMP fisheries. Regulations require that the owner or operator of a vessel for which a commercial permit for South Atlantic snapper-grouper has been issued, who is selected to report by the Science and Research Director (SRD) must participate in the NMFS-sponsored ELB and/or video monitoring reporting program as directed by the SRD.

The South Atlantic FMC is also interested in implementing ELBs in the charter and commercial sectors of the Snapper-Grouper and CMP fisheries to improve assessments and data timeliness, and there is a need to modernize the wreckfish individual transferable quota (ITQ) program, which currently relies on paper-based coupons. Electronic reporting improvements are the primary priority for snapper-grouper and CMPs in the South Atlantic. Improvements and development of ER include:

1. Pilot testing and developing ELBs for commercial snapper-grouper and CMPs (as well as HMS) to obtain more timely and finer spatial resolution data;
2. Development and implementation of an ER system for federally permitted charter vessels;
3. Including wreckfish in the SERO Web-based catch share reporting system; and,
4. Pilot testing and development of various state-based electronic reporting systems for monitoring red snapper and other reef fish catches of private anglers.

Bycatch is also a major component to many snapper-grouper and CMP stock assessments, and better documentation of bycatch is needed. Bycatch reporting is a component of ER systems for headboats and could be included in ELBs and other ER systems developed for snapper-grouper and CMP fisheries. NMFS and the Gulf and South Atlantic Fisheries Foundation conduct a limited amount of observer coverage in the South Atlantic, so bycatch estimation in the commercial snapper-grouper and CMP fisheries relies primarily on self-reported discard logbooks. Better documentation of discards and discard mortality, potentially through the use of video EM, would improve the information used in stock assessments. However, as discussed previously, EM must overcome the challenges of species identification and enumeration of bycatch to be useful for science and management.

Lastly, there is potential for EM to better inform site selection and monitoring of spatial-area closure actions. For example, the South Atlantic FMC is interested in exploring the using of EM

to monitor black sea bass pots and fishing activity. Pingers on pots, tablets with GPS, or VMS could potentially be used. Use of EM could aid the South Atlantic FMC and NMFS in monitoring where fishing activity occurs in relation to spatial-area closures. Any such use of EM would be contingent on the regulations proposed by the South Atlantic FMC, and FMP objectives.

Golden Crab – There are only 11 permitted vessels that participate in the golden crab fishery. The fishery is managed with permit, gear, and area restrictions, as well as a 2 million pound ACL. In recent years, less than 50% of the ACL has been harvested. Golden crab vessels are also required to maintain logbooks, but there are often significant lags in data reporting and data entry. Data timeliness could be greatly improved and data entry costs could be reduced through implementation of ELBs in the golden crab fishery. Additionally, the South Atlantic FMC is interested in exploring the use of trap gear pingers to differentiate trap locations from vessel location, as traps are often deployed near habitat areas of particular concern (HAPC) or other closed areas.

Shrimp – Unlike the Gulf of Mexico, the use of ELBs is not required in the South Atlantic shrimp fishery. Regulations require that the owner or operator of a vessel that fishes for shrimp in the South Atlantic exclusive economic zone or in adjoining state waters, or that lands shrimp in an adjoining state, must provide information for any fishing trip, as requested by the SRD, including, but not limited to, vessel identification, gear, effort, amount of shrimp caught by species, shrimp condition (heads on/heads off), fishing areas and depths, and person to whom sold.

Like the Gulf of Mexico shrimp fishery, expanded use of EM may be warranted for the South Atlantic shrimp fishery. A 2012 Biological Opinion recommended NMFS better assess the impacts of incidental take of sea turtles in shrimp fisheries (NMFS 2012). The Biological Opinion also indicated that NMFS must have a plan to increase observer effort for the shrimp trawl fishery in south and southwest Florida where sawfish interactions are most likely to occur using standard observer protocols and/or using EM. Electronic monitoring could serve as an alternative to observers for documenting sea turtle and sawfish interactions in the shrimp trawl fishery.

Rock Shrimp – There are approximately 100 federally permitted vessels with limited access South Atlantic rock shrimp permits, and another 100 federally permitted vessels with open access rock shrimp permits that can shrimp off North and South Carolina. Vessels have been required to carry a VMS since 2003. Vessel monitoring systems were required to enhance enforcement and protect critical habitat, such as the Oculina HAPC. The South Atlantic FMC is interested in expanding the use of EM to link location-specific catch and bycatch data to VMS data. This will aid the South Atlantic FMC and shrimp industry in better evaluating the impacts and trade-offs of spatial-area closures on shrimp harvest and coral protection.

Dolphin-Wahoo - Commercial fishers are required to report paper-based logbooks for dolphin-wahoo, while commercial dealers and headboats are required to report purchases and catches of dolphin-wahoo electronically on a weekly basis. Recreational charter and private landings are collected by MRIP, which surveys anglers and captains using a combination of dockside

intercepts and phone calls to estimate catch and fishing effort. Similar to snapper-grouper and CMP species, it is a priority to pilot test and develop ELBs for commercial fisheries to obtain more timely and finer spatial resolution data and to develop and implement an ER system for federally permitted charter vessels, in accordance with recommendations made by the Gulf of Mexico and South Atlantic FMC's Technical Subcommittee.

## **U.S. Caribbean**

Commercial Fisheries – Commercial landings are reported by fishermen via catch record logbooks. In the U.S. Virgin Islands, catch records are recorded on a monthly basis and are submitted weeks to months after fishing has occurred. In many instances, catch records are not submitted until the time of permit renewal (July of each year), resulting in less reliable data. Commercial logbook reporting in the Gulf of Mexico and South Atlantic has also experienced similar problems with lags in logbook reporting.

Commercial landings from Puerto Rico come from self-reported fisher logbooks. Commercial landings from Puerto Rico have been incompletely reported and expansion factors are required to estimate unreported landings (SEDAR 2009). Often, expansion factors are large and result in commercial landings being expanded by 50% or more (SEDAR 2009). Late reporting and lags in data entry also result in commercial landings being made available six months to years after the fishing year has ended, making ACLs difficult to monitor. For example, only Puerto Rico landings through 2012 were available to project 2014 season lengths and determine if ACLs had been exceeded (SERO 2014).

Steinback (2014) has been evaluating the use of smart phone-based ER for submitting catch record data by U.S. Caribbean commercial fishers. The Digital Deck ER platform is being tested by fishers in Puerto Rico and the U.S. Virgin Islands and the software allows agencies to access, review, and approve catch records submitted. Given the delays in reporting discussed above, ER use in the U.S. Caribbean commercial fisheries could provide more timely data for ACL monitoring. In particular, the Puerto Rico deepwater snapper unit 2 complex could greatly benefit from more timely and accurate reporting. Puerto Rico has already established a limited entry program for deepwater snapper fishermen. In recent years, the ACL for deepwater snapper unit 2 has been exceeded by a significant amount, requiring the season to be shortened. In-season, near real-time ER would aid fishers and managers in monitoring the ACL for this complex and could allow NMFS and the Caribbean FMC to use new management strategies (e.g., in-season fishery management and accountability measures) to decrease management and scientific uncertainty and increasing stakeholder support.

Recreational Sector – Currently, there is no program to collect recreational landings in the U.S. Virgin Islands and for-hire and private vessel landings and effort in Puerto Rico are estimated by MRIP through a combination of dockside intercept and phone surveys. The Caribbean FMC is interested in exploring the use of EM/ER in the recreational sector. At this time, ER in Caribbean FMC managed recreational fisheries are viewed as a low priority compared to



enhancements in commercial reporting and development of a recreational data collection program for the U.S. Virgin Islands.

Electronic Monitoring – There are limited applications for use of EM in the U.S. Caribbean. EM is often used to monitor bycatch, but there are few size limits for federally managed U.S. Caribbean species. Also, many vessels are too small and too exposed to carry either VMS or video EM equipment. Use of EM is considered a very low priority for U.S. Caribbean fisheries.

## Region-Wide

In addition to specific regional fisheries where EM/ER may be suitable, there are also many needs that are not fishery specific for enhancing and improving efficiency during sampling and data processing. There is a need to explore the feasibility of alternative data collection systems to improve data capture efficiency and accuracy; and ensure success of future fisheries management and research goals and objectives. Electronic technology can be used to increase sampling efficiency, eliminate redundancies in reporting through data standardization, and increase quality control and quality assurance through automated error checking.

Dockside Sampling/Observers – Improvements in both sampling efficiency and integration of data are needed when conducting observer and dockside data collection in the Southeast. For instance, electronic measuring boards are currently used to collect headboat data. Trip and sample information are stored and later downloaded to a database for use, saving port agents time entering data. Electronic measuring boards have been tested for commercial uses and the SEFSC is beginning to explore use of handheld computers or tablets to link electronic measuring boards to other devices, such as scales, cameras, and bar code readers. A tablet application has already been developed for the shark observer program but work is still needed to make it more practical for field use. There is interest in expanding the use of handheld electronic devices for commercial and recreational data entry to improve data timeliness and accuracy.

Recreational Data Collection – Recreational fishermen account for a majority of the harvest for many key species (Coleman et al. 2004) and there is significant need to improve the precision of recreational catch statistics. In the Southeast, recreational catches are monitored with a variety of surveys, including MRIP, the Southeast Headboat Survey, and creel surveys conducted by Texas and Louisiana. There are also numerous pilot projects either underway or that have been recently completed (Baker and Oeschger 2011; Donaldson et al. 2013; see August 2014 Gulf of Mexico FMC briefing book available at: [www.gulfcouncil.org](http://www.gulfcouncil.org)) looking at the use of ER for collecting catch and effort data in private and for-hire fisheries. As discussed above, the Gulf of Mexico and South Atlantic FMCs are interested in pursuing use of ER and potentially VMS (at least for Gulf of Mexico vessels and headboats involved in catch share programs) to monitor fishing activity and catches. The SERO and SEFSC will continue to support the FMC's and their Technical Subcommittee as they move forward with recommendations for ER in the for-hire sector. Both voluntary and mandatory reporting approaches should be considered, and methods should be further developed to integrate self-reported data into

analyses and assessments, where applicable. Also, innovative approaches and human-dimension analysis should be used to get private anglers interested in reporting data.

There is a need to improve data timeliness of recreational data, especially for headboats. Headboats are now required to report on a weekly basis and reports may be submitted via the Web or smart phone/tablet applications. Currently, in-season headboat landing estimates of major federally-managed species are available based on periodic data requests. NMFS is interested in expanding the availability of in-season landings data to all species managed with ACLs. Processes for quality control/quality assurance of in-season data and enhancements to data estimation and deliver procedures are needed to provide in-season landing estimates more real-time (within 1-2 months of reporting).

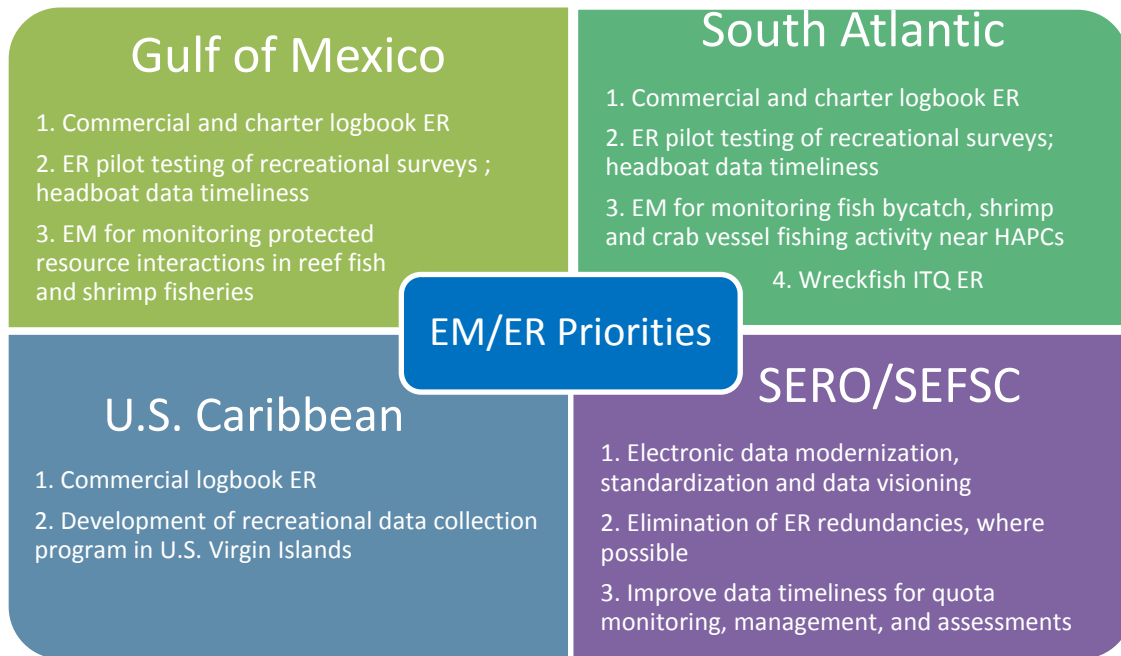
Improving private recreational data collection in the Southeast Region is also a high priority. Over the past several years, NMFS and Gulf of Mexico states have met to discuss, review, and develop pilot studies and new sampling programs designed to collect catch and effort data for red snapper and/or other managed fish species. Pilot studies are underway to evaluate the use of self-reported catch data via smartphone and tablet applications. NMFS will continue to support these data collection efforts and will coordinate with the Office of Science and Technology and MRIP consultants to review new sampling approaches. (?) Any new survey design should be reviewed by expert consultants prior to implementation and ideally should be pilot tested alongside existing data collection surveys for purposes of calibration.

Data Standardization/Redundancies – NMFS, in collaboration with its partners, is also interested in better standardizing data, and eliminating reporting redundancies, where applicable. For instance, bottlenecks exist for integrating and standardizing age/growth data collected and are housed across multiple databases. Standardization and better integration of electronic data will increase efficiency and reduce staff processing time to reconcile datasets.

Another area ripe for improvement is integration of data collected during biological sampling. Trip level information is collected along with biological data during dockside and observer sampling. Often, considerable time is spent linking biological samples to trip level data collections. Electronic technologies, such as bar code scanners, represent a technological solution for automatically linking information for a trip, saving staff time and resulting in enhanced standardization and integration of data collections.

Finally, another area in need of improvement is the reporting redundancies that currently exist in the Southeast Region. Whenever possible, requirements and software should be standardized across fisheries, including HMS, so that fishermen can use the same EM/ER hardware and software in multiple jurisdictions. Coordination with states is essential so that state and federal data collection programs are not duplicative or in conflict with each other. Reporting redundancies exist primarily in commercial fisheries where dealers and fishermen are required to report via logbooks, trip tickets, and catch share programs. These redundancies place a greater burden on industry when reporting, and are often challenging to reconcile across multiple data sets. In 2014, the Greater Atlantic Region initiated a fishery-dependent

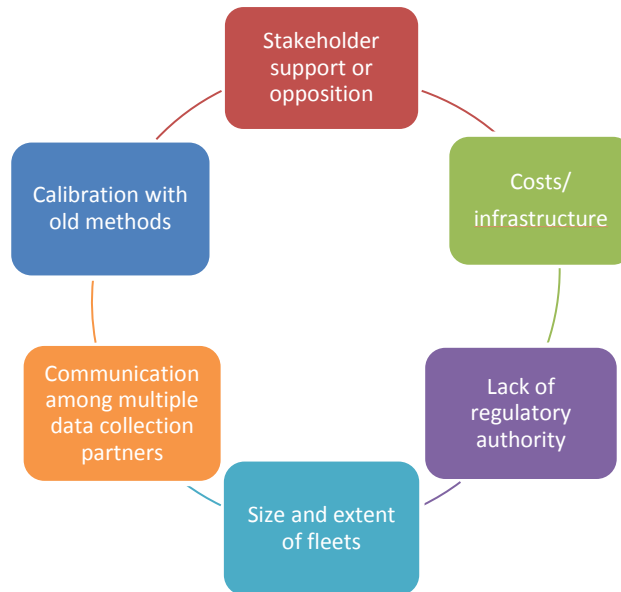
data visioning project, which was a collaborative effort among government, industry, private institutions, and academia to better understand the data needs of the fishing industry and other stakeholders. The process is providing a holistic review of fishery dependent data collection methods and systems throughout the region with the goal of cataloguing current data needs and uses, data system strengths and weaknesses, and future data system needs. The Southeast Region would benefit from a similar process that brings together industry, state partners and commissions (e.g., ACCSP, GSMFC), and other interested stakeholders. Additional work is needed to map existing data flows to determine where redundancies exist and how data reporting, validation, storage, and analysis can be made more efficient.



**Figure 2. Southeast Region EM/ER Priorities for the Gulf of Mexico, South Atlantic, U.S. Caribbean and Southeast Regional Office/Southeast Fisheries Science Center.**

# Challenges Impeding EM/ER Implementation

The use of electronic technologies in the Southeast Region has increased greatly in recent years, but several challenges still remain that impede broader use of EM/ER. These challenges fall into six primary categories: 1) costs/infrastructure, 2) lack of regulatory authority, 3) size and extent of fleets, 4) communication and collaboration among multiple data collection partners, 5) calibration with old data collection methods, and 6) stakeholder support or opposition (Figure 3).



**Figure 3. Challenges impeding EM/ER use in the Southeast Region.**

Costs can be incurred by the agency, state and local governments, as well as fishermen. Although applications and Web sites for reporting catch are generally free or inexpensive, and are readily available for use on computers and smartphones, there are many other costs that apply to electronic data collections. Costs to fishermen may include initial purchase of EM/ER equipment, EM/ER equipment maintenance, and monthly service fees. Costs to the agency for various sampling methods and survey designs can vary greatly depending on the level of dockside validation for catch, effort validation, and required infrastructure. Infrastructure needed for managers and scientists to store and process data includes: data storage and processing, quality control and quality assurance conducted once data are submitted, and the electronic tools selected to report. Additionally, there are often increased costs associated with enforcement, especially if regulatory requirements are placed on when and how data are to be provided.

Regulations also constrain use of EM/ER in the Southeast Region. Often there is a lack of regulatory authority to either implement or enforce EM/ER. Many regulations currently refer to paper-based reporting requirements, may not contain standardized reporting requirements

(where applicable), and may be insufficient for ensuring accurate and timely data (e.g., regulations needed for reporting delinquency, reporting frequency and timeliness). Also, some states may have stricter recording laws than federal recording laws, and there may be aspects of EM and ER requirements that cannot be enforced by state law enforcement officers.

Technical and scientific challenges also exist. The size and geographic extent of fishing fleets in the Southeast is very large, especially for the recreational sector. There are also multiple data collection partners (GulfFIN, ACCSP, states, and NMFS), and current data collection efforts in many instances rely heavily on state partners to collect commercial and recreational data. Better coordination and communication among partners is critical to improving data collection programs as well as fostering an environment of cooperation rather than competition. Such collaboration will also eliminate inefficiencies, redundancies, and delays when developing EM/ER products. Given the multiple partners, it is critical to have buy-in from all data collection partners and ensure that ownership and oversight of any new EM/ER reporting system is clearly defined. There are also challenges with calibrating old methods of data collection with new EM/ER methods. Calibration of data is critical to ensure data can be incorporated into time series used for assessments, which requires running surveys at the same time, resulting in additional costs.

Lastly, there is often mixed industry support for EM/ER and willingness to participate may vary greatly across constituencies. Buy-in often varies by region, organization, and the level of reporting burden that may be placed on the industry.

## Infrastructure and Costs

Costs and infrastructure present a major challenge when modifying, developing, and implementing EM/ER systems. Costs are a significant concern to many fishermen, as well as NMFS, and it is important to understand the burden on the government, industry, and other partners when establishing new EM/ER requirements. This section discusses existing infrastructure in the Southeast Region, as well as at the GSMFC and ACCSP. Based on NOAA EM/ER guidance and best practices (NOAA 2013b), infrastructure needs extend beyond EM/ER hardware and also encompass needed personnel for developing and maintaining EM/ER. Given there is likely to be no large influx of government funds to support EM/ER on a continuing basis (NOAA 2013b), other options for funding EM/ER are also be discussed, including redirection of existing government funds and cost-sharing with industry.

NMFS recognizes that infrastructure expansion and development should not fall solely on the agency. Where applicable, development of standards for collecting necessary data should be developed. This will allow NMFS to utilize the expertise of third-party vendors with expertise in software development and data collection design. It will also allow NMFS to utilize existing infrastructure and services that potentially can be expanded through existing partners, such as ACCSP and the GSMFC.

### Current Infrastructure

Southeast Fisheries Science Center – The SEFSC collects and aggregates landings, bycatch, and catch-effort data from fisheries managed by the Gulf of Mexico, South Atlantic, and Caribbean FMCs and coastal and oceanic species managed by the HMS Division of NOAA Fisheries. Commercial landings of federally managed species are collected electronically in cooperation with state partners and the regional Fisheries Information Networks (GSMFC, ACCSP). The SEFSC collects commercial vessel reports on catch and fishing effort and deploys observers on vessels in some fisheries for use in bycatch estimation and catch rate monitoring. The SEFSC collects electronic catch and effort information from the headboat fishery from North Carolina through Texas and integrates those data with information on recreational fisheries collected by the Texas Parks and Wildlife Department and the NOAA Fisheries MRIP program. The SEFSC uses the recreational and commercial information to conduct research and to support fisheries management.

Southeast Regional Office - The SERO collects and aggregates landings data and quota share transactions for the Gulf of Mexico red snapper and grouper-tilefish IFQ programs, and the South Atlantic wreckfish ITQ program. SERO also is responsible for monitoring and tracking quota for the Gulf Headboat Collaborative exempted fishing permit, which is currently being pilot tested through December 2015. In addition, SERO processes and issues permits and is currently developing an online Web-based system for permit renewal. SERO information technology programmers are responsible for maintaining the existing catch share Web-based systems, building new catch share electronic data collection systems, developing mobile

applications, and for designing and developing a Web-based system for permit renewal. SERO also has a team of customer service staff responsible for the day-to-day administration and oversight of the Gulf of Mexico and South Atlantic catch share programs, including data auditing of landing transactions. Funding support for administration, enforcement, and monitoring of Gulf of Mexico catch share programs is provided through collection of cost recovery fees from IFQ fishermen.

Office of Law Enforcement – OLE oversees NOAA Fisheries' VMS program. At the SERO, a VMS program manager and technicians monitor and track vessel activity in coordination with law enforcement agents and officers, and catch share program staff. OLE staff in the Southeast are responsible for monitoring South Atlantic rock shrimp, Gulf of Mexico reef fish, and Atlantic HMS. They also conduct customer service and coordinate VMS software updates with vendors.

Atlantic Coastal Cooperative Statistics Program – ACCSP provides standardized, centralized systems to collect and manage commercial dealer and trip reports, and for-hire trip reports through the SAFIS. SAFIS has several applications (eDR, e1-Ticket, eTRIPS, eLogbooks) available to Atlantic coast harvesters, dealers, and anglers. Each application is developed based on common standards agreed upon by all program partners with adjustments made to better meet partner's reporting requirements. After review, these data are made available for fishery monitoring and management purposes.

SAFIS provides a number of alternate mechanisms to input data that include PC systems (Primarily Trip Ticket – a Bluefin product) and flat file upload from dealer based systems. Recently, ACCSP has developed a mobile version (available on tablets only) of the SAFIS eTRIPS application.

In addition, ACCSP maintains the Data Warehouse that contains comprehensive commercial landings and catch and effort data as well as some biological sampling and copies of the recreational landings and effort estimates MRIP. These data are derived from SAFIS after quality assurance and quality control measures, as well as many other data sources, and are used for stock assessment and other purposes. ACCSP staff collaboratively develop and maintain information systems to support electronic reporting with multi-faceted data flows, and provides current and historic fishery statistics to state and federal government agencies and the public. ACCSP and its partner agencies share the benefits of centralized processing and distributed data ownership. ACCSP employs 10 staff plus contract support as needed to support the data systems infrastructure and other functions.

Gulf Fisheries Information Network (GulfFIN) – The Gulf States Marine Fisheries Commission (GSMFC) coordinates the development and management of the GulfFIN Data Management System that supports recreational and commercial data collected by state partners in the Gulf of Mexico. The GSMFC coordinates the collection and management of commercial landings data from the Gulf of Mexico through an electronic trip ticket collection system. Commercial dealers are provided software from Bluefin Data Inc. (a contractor to GSMFC). State and federal partners receive commercial landings data electronically through this reporting system. Additionally, the GSMFC provides for the conduct of the MRIP survey in Mississippi,

Alabama, and Florida for shore, for-hire, and private modes. It provides coordination of the survey including the field intercept survey of shore, for-hire and private boat anglers to estimate angler catch using the existing MRIP methodology, and entry of the data. The GSMFC also takes an active role in the coordination of state partner research through MRIP. In 2010-2011, a pilot electronic logbook program for the for-hire fleet was tested in the Gulf of Mexico. GSMFC coordinated with Florida and Texas to collect and manage the electronic data provided by for-hire captains. Data were submitted via a web tool and delivered to GSMFC for quality control and analysis. Data were shared with both partner states and federal partners for analyses to determine the successfulness of the pilot program. GSMFC is committed to providing support for all recreational and commercial electronic data programs that might be needed by state and federal partners in the Gulf of Mexico.

## Costs

Despite the extensive amount of infrastructure currently in place, there are still additional costs that must be considered when implementing or expanding EM/ER. Costs may include, but are not limited to costs for: infrastructure (databases, archival data storage, hard drives), data collection tools and maintenance, data validation, quality control/quality assurance and review, and personnel. As mentioned earlier, costs must be realistic and affordable to the agency and stakeholders before proceeding. No fishery-dependent EM/ER program will be approved by NMFS if it creates an unfunded or unsustainable cost of implementation or operation (NOAA 2013a).

During public input on this plan many stakeholders requested more detailed EM/ER costs be added. However, given the wide array of EM/ER technology currently available, as well as the rapid changes in technology occurring, and the varying purpose and scope of EM/ER programs, it is difficult to quantify the absolute costs associated with implementation of specific EM/ER programs in this plan. NMFS believes it is most appropriate to identify specific costs associated with EM/ER development during Phases III and IV of the framework implementation process. The following section describes general categories of costs that will be considered during EM/ER development. When EM/ER costs are considered, they should be compared to existing reporting and monitoring costs. For instance, paper-based reporting requirements may be more costly and burdensome to NMFS and industry, and moving to ER may result in cost savings. This will allow for potential cost savings (or cost reassignment) or increases to be clearly identified. It will also allow for economic, social, and/or biological benefits to be compared and conveyed to the regional FMCs, industry, and other stakeholders. Costs and challenges from other regions and areas, where applicable, should also be explored and the cost burden on all entities should be critically evaluated. The costs and design for any EM/ER program should be scaled to the program's objectives to identify what is most important to achieve.

In evaluating costs, NMFS should consider establishing data standards and auditing data, rather than serving as a software developer. This could allow for cost savings by reducing upfront



costs for development, maintenance, and upgrades. NMFS, or other partners, would then accept data, validate it as it comes in, and store the data for use.

Electronic Reporting – Costs for ER include hardware, software, field and customer service personnel, and data analysts. Hardware and software allow for input, storage, and transmission of data and are required for both the data providers (e.g., fishermen, dealers) and data receivers (e.g., NMFS, ACCSP, GSMFC, third-party vendors). Hardware includes laptops, computers, and servers for entering or receiving data, while software is required for data entry via tablets, computers, VMS, and mobile devices. Hard drives and databases are necessary for archival storage of collected data. ER start-up costs may include purchase of hardware and development of software. Longer term costs would include hardware maintenance and software upgrades.

Field and customer service personnel are often overlooked by industry participants wanting ER. They are needed to validate data, answer questions, conduct training, and troubleshoot problems. Information technology personnel are also needed for maintaining servers and databases. Costs for analysis and IT maintenance include staff or contractor salaries, training, and travel to conduct outreach with industry partners. Start-up costs may also include bulk mailings to program participants.

Video Monitoring – Similar to ER, video monitoring requires hardware, field personnel, and data analysts to collect, retrieve, review, and analyze catch data. Additional law enforcement may be needed to review and monitor violations associated with EM. Software may also be needed to automate image review. Costs include video camera hardware and cables, sensors, hard drives for data storage, and costs for installation, maintenance, and repair of video camera systems. Start-up costs include video camera installation, which is typically done by a third-party contractor.

Field personnel are needed to install software, retrieve hard drives, conduct outreach with industry, and ensure proper installation of video monitoring systems. Once data are retrieved, analytical staff must review and analyze video data and enter results into databases. Costs associated with personnel include salaries, travel, and training.

Vessel Monitoring Systems – Costs for VMS are described in the Technological Capabilities section of this document. Costs include purchase and installation of the VMS unit by a certified marine technician, as well as transmission costs, which are typically paid for by industry. OLE VMS technicians are needed to monitor fishing activity, conduct customer service, and troubleshoot problems. Additional law enforcement and U.S. Coast Guard resources are also needed to respond to potential violations associated with monitoring of VMS data. There are also costs associated with software development, such as reporting forms.

## **Funding sources for EM/ER**

Several potential funding sources exist for EM/ER implementation. These include funds from the NMFS' observer program, MRIP program, Fisheries Information System, bycatch reduction

funds, catch share funds, and EM/ER budget line. Funding for new or ongoing projects is also available through a competitive grant application process to ACCSP. And NMFS is authorized to collect up to 3 percent of the ex-vessel value of fish harvested for administration, enforcement, and monitoring of catch share programs. There may also be cost savings resulting from reduced reporting burdens or fewer at-sea observer days due to EM/ER implementation. This would allow existing data collection funds to be shifted to support new EM/ER activities.

In addition to government funding of EM/ER, consideration should also be given to sharing EM/ER costs with industry and agency partners, including but not limited to, the regional FMCs, states, Commissions, and ACCSP. NMFS is committed to working with the Councils, states, commissions, and industry where cost sharing of EM/ER is deemed appropriate, and develop where applicable transition plans from present to future funding arrangements. During Phase I assessment of any new or modified EM/ER program (see Framework for EM/ER Implementation section), cost sharing with industry should be considered. Costs that could be shared include, but are not limited to, purchase of hardware and software, labor costs for EM/ER administration, and transmission costs. In the Southeast Region, cost sharing is already occurring in Gulf of Mexico catch share programs, the Gulf of Mexico shrimp ELB program, and VMS programs. For catch share programs, fishermen pay cost recovery fees to support program administration, monitoring, and enforcement. In the Gulf of Mexico shrimp fishery, South Atlantic rock shrimp VMS program, and Gulf of Mexico reef fish VMS program, the government purchased ELBs or VMS units and fishermen pay for monthly transmission fees.

## **Funding Requirements**

In order to implement EM, ER, or VMS, funding support would be needed for the following activities:

- Purchase of video monitoring and/or VMS hardware (if not cost-shared with industry);
- Contractor or full-time employee (FTE) positions for ER and/or EM software development;
- Contract with VMS vendors for software development;
- Contractors or FTE positions for field personnel to conduct outreach and validation of ER data;
- FTE positions for law enforcement agents/officers and Joint Enforcement Agreements with states to enforce EM/ER requirements;
- Contract for EM provider company to install, retrieve, and support deployment of video cameras on commercial fishing vessels
- Infrastructure support (i.e., servers, IT personnel, archival data storage, etc.) for NMFS or one of its data collection partners (ACCSP, GSMFC) to build capacity to handle ER and/or EM data.

## Timelines for Implementation

A primary key to successful EM/ER implementation is identifying clear timelines, expectations, and objectives (Lowman et al. 2014). Involving all stakeholders in the EM/ER implementation process is extremely important. Although NMFS may have the authority to implement EM/ER in some situations, implementation in many cases will be contingent on stakeholder buy-in and regulatory actions taken by the regional FMCs and in some cases state legislatures. **Table 4** summarizes general timelines for implementing EM/ER priorities in the Southeast Region over the next three years. These timelines are not overly prescriptive as implementation is contingent on numerous factors that may prevent or limit implementation, including but not limited to costs, infrastructure, and regulatory impediments. More detailed timelines for EM/ER implementation will be developed on a fishery and sector specific basis through the framework process outlined earlier in this document.

During the annual review of this document with regional FMCs, timelines will be revisited and new priorities will be added. This will allow for timeline modifications due to unforeseen circumstances or faster implementation than previously expected. It will also allow for removal of completed priorities and the addition of new priorities, particular those related to electronic monitoring.

**Table 4. Timelines for EM/ER implementation in the Southeast Region.**

Region	Priority	Implementation Timeline				
		pre-2014	2014	2015	2016	2017
Gulf and S. Atl	For-hire charter e-logbooks	Pilot-tested logbooks in Gulf of Mexico (2010-11)	Convene Technical Subcommittee; recommend design	Revise regulations; identify funding; develop software and infrastructure	Continue 2015 development, as needed; Begin implementation; Develop software acceptance criteria and data standards	Initial implementation; Coordination with FIN partners
Gulf and S. Atl	Commercial e-logbooks		Begin recruiting participants for pilot-testing	Pilot testing and infrastructure development	Revise regulations; Develop software acceptance criteria	Initial implementation; Coordination with FIN partners
Gulf and S. Atl	ER recreational surveys for red snapper and/or reef fish	FL begins specialized red snapper survey on east coast for 2012 recreational fishing season; LA implemented a quota monitoring system for red snapper in 2013	LA Creel implemented; AL, MS, and TX pilot test electronic reporting surveys for red snapper; meetings held with states and survey design experts to recommend improvements to surveys	LA Creel side-by-side benchmarking with MRIP; Texas A&MCC begins ER panel survey; Florida begins NFWF study to estimate reef fish landings and effort; AL, MS, and TX continue pilot studies; NC logbook program begins	Benchmarking and certification completed for LA; benchmarking begins for other state surveys	Modify processes for integrating estimates from state programs for use in quota monitoring
Gulf and S. Atl	Video monitoring of reef fish and protected resources	Several EM studies completed in Gulf and S. Atl (2008-2014); work ongoing at Mote Marine Lab	Pilot study begins for testing EM on shrimp vessels to monitor protected species bycatch	Determine feasibility of using EM on a sample of vessels and determine what improvements are needed	Work with vendors to make needed changes; Begin revising regulations to accommodate EM in SE fisheries; Begin developing software acceptance criteria and data standards	Finalize regulations and standards and coordinate with FIN partners.
Gulf and S. Atl	Headboat data timeliness	Paper-based reporting prior to 2014; ER pilot testing conducted before making ER mandatory	ER becomes mandatory - weekly reporting, but landings data only available upon request in-season	Landings estimates will be available in two month waves; 45 days after the end of a wave. Pilot test submission of logbooks via VMS.	Modify processes for producing in-season landing estimates in more real-time	Initial implementation of all ER advances for quota monitoring

**Table 4 (cont'd). Timelines for EM/ER implementation in the Southeast Region.**

Region	Priority	Implementation Timeline				
		pre-2014	2014	2015	2016	2017
S. Atl	Wreckfish ITQ	Paper-based coupon system currently in place		Assess regulatory changes needed to require ER; begin amend regulations	Amend regulations; Build online Web-based reporting and tracking system	Initial implementation
Caribbean	Commercial e-logbooks	Digital Deck begins pilot project testing electronic logbooks	Continued pilot testing of electronic logbook	Coordinate voluntary electronic submissions of logbooks with territories	Work with Caribbean FMC and territories to determine need for mandatory e-reporting for all or a sample of fishers	Revise regulations to accommodate e-logbooks
Caribbean	U.S.V.I. recreational data collection	Evaluation of recreational sampling and estimation methods	Characterize U.S. Caribbean boat-based fishery; pilot study to assess queen conch and spiny lobster catch and effort	Review outcomes of pilot studies; continue exploring development of a recreational survey in the USVI	Conduct additional pilot testing, as needed.	
Region-wide	Fishery-dependent data standardization and visioning	SEFSC data review conducted in 2013; headboat data migrated to Oracle database	Electric Edge Inc. begins review process for System Modernization Project	SERO/SEFSC and partners convene a Fishery Dependent data visioning workshop in late-2015	Begin addressing input from workshop and coordinate with states/territories to determine infrastructure of fishery independent monitoring program; Determine funding source	Determine preferred survey design; continue addressing fishery dependent data workshop recommendations.

## Assessing Implementation Plan Progress

EM/ER is merely a tool intended to help better achieve fishery management objectives. The success of this plan will be contingent on steps taken by the agency, regional FMCs, commissions, ACCSP, and constituents to expand and successfully implement use of EM/ER in the Southeast Region. However, it should be recognized that EM/ER is only a tool and may not be applicable or appropriate for all fisheries.

NMFS agrees with the FMCs that success should not be measured based on the number of fisheries or FMPs using EM/ER technology. Rather, success should be based on whether or not EM/ER is:

1. Increasing the timeliness and accuracy of data for use in:
  - a. Stock assessments (e.g., landings and discards);
  - b. Management (e.g., ACL monitoring to prevent overages, bycatch monitoring); and,
  - c. Enforcement (e.g., spatial-area closures, bycatch monitoring).
2. Aiding in achievement of FMP objectives and federal fishery mandates.

The benefits of EM/ER will be limited if FMP objectives are not achieved or if EM/ER fails to produce more timely and accurate data due to late reporting, non-standardized reporting practices, and lack of sufficient data validation.

When developing new programs, performance measures should be considered that are quantifiable. Such performance measures could include data timeliness (before and after EM/ER), data accuracy (number of data entry errors; reductions in data entry errors when checked at time of entry), data gaps filled, degree of participation, or other factors.

Annually, the progress made toward implementing EM/ER will be reviewed with each of the FMCs. This annual review will provide an opportunity for the FMCs to give input on the plan and recommend additional future priorities for EM/ER development and implementation. It will also allow objectives to be identified for improving data collection and documenting costs for EM/ER development. If FMP objectives are not being met, or data timeliness and accuracy is not being achieved, it will also serve as an opportunity to reconsider the use of EM/ER for management, science, and enforcement in particular fisheries.

## References

- Baker, Jr., M. Scott. 2012. Characterization of bycatch associated with the South Atlantic snapper-grouper bandit fishery with electronic video monitoring, at-sea observers, and biological sampling. North Carolina Sea Grant, Wilmington, NC. NOAA Cooperative Agreement NA09NMF4540138. 101 pp.
- Baker, Jr., M. Scott, and I. Oeschger. 2011. Description and initial evaluation of a text message based reporting method for recreational anglers. *Marine and Coastal Fisheries Dynamics and Ecosystem Science*. 1:1 pp. 143-154.
- Batty, A., M. Beck, L. Fetherston, T. Phillips, C. Neidig, and T. King. 2014. Electronic monitoring: pilot study in the Gulf of Mexico reef fish fishery. Poster presentation presented at the 2014 National Electronic Monitoring Workshop, Seattle, WA. Accessed at: [http://www.eminformation.com/wp-content/uploads/2014/01/Battyyetal\\_EM-in-the-Gulf-of-Mexico.pdf](http://www.eminformation.com/wp-content/uploads/2014/01/Battyyetal_EM-in-the-Gulf-of-Mexico.pdf) on September 11, 2014.
- Cole, J.G., L.R. Martin, and B.J. Gallaway. 2005. Estimation of shrimp effort in the Gulf of Mexico – report on phase I activities. Reported submitted to the National Marine Fisheries Service, Southeast Fisheries Science Center by LGL Ecological Research Associates, Inc. Galveston, TX. 37 pp.
- Coleman, F., W. Figueira, J. Ueland, and L. Crowder. 2004. The impact of United States recreational fisheries on marine fish populations. *Science*. 305: 1958-1960.
- Donaldson, D., G. Bray, B. Sauls, S. Freed, B. Cermack, P. Campbell, A. Best, K. Doyle, A. Strelcheck, and K. Brennan. 2013. For-hire electronic logbook study in the Gulf of Mexico: final report. Submitted to NMFS, Marine Recreational Information Program Operations Team. 63 pp.
- GMFMC. 2005a. Final amendment 18A to the fishery management plan for the reef fish resources of the Gulf of Mexico. Gulf of Mexico Fishery Management Council, Tampa, FL. 192 pp.
- GMFMC. 2005b. Amendment number 13 to the fishery management plan of the shrimp fishery of the Gulf of Mexico, U.S. waters. Gulf of Mexico Fishery Management Council, Tampa, FL. 192 pp.
- GMFMC. 2006. Amendment 26 to the Gulf of Mexico reef fish fishery management plan to establish a red snapper individual fishing quota program. Gulf of Mexico Fishery Management Council, Tampa, FL. 298 pp.

- GMFMC. 2009. Amendment 29 to the reef fish fishery management plan – effort management in the commercial grouper and tilefish fisheries. Gulf of Mexico Fishery Management Council, Tampa, FL. 302 pp.
- GMFMC. 2013a. Framework action to establish funding responsibilities for the electronic logbook program in the shrimp fishery of the Gulf of Mexico. Gulf of Mexico Fishery Management Council, Tampa, FL. 39 pp.
- GMFMC/SAFMC 2013. Modifications to federally-permitted seafood dealer reporting requirements. Generic amendment to the fishery management plans in the Gulf of Mexico and South Atlantic regions. Gulf of Mexico and South Atlantic Fishery Management Council, Tampa, FL, 136 pp.
- GMFMC/SAFMC. 2014. Technical subcommittee report to the Gulf of Mexico and South Atlantic Fishery Management Councils: Recommendations for Electronic Logbook Reporting. Gulf of Mexico Fishery Management Council, Tampa, FL. Accessed at: <http://safmc.net/sites/default/files/meetings/pdf/Council/12-2014/Data/ElecReportingRec11262014.pdf> on February 10, 2015. 18 pp.
- Lowman, D., S. McTee, and A. Fredston-Herrman. 2014. National Electronic Monitoring Workshop: final summary report. Accessed at: <http://www.eminformation.com/wp-content/uploads/2014/05/2014-NatEMWorkshop-24July.pdf> on September 11, 2014. 66 pp.
- NMFS. 2012. Reinitiation of Endangered Species Act (ESA) section 7 consultation on the continued implementation of the sea turtle conservation regulations, as proposed to be amended, and the continued authorization of the Southeast U.S. shrimp fisheries in Federal waters under the Magnuson-Stevens Act. National Marine Fisheries Service, Southeast Region, St. Petersburg, FL. 302 pp.
- NOAA. 2013a. Policy on electronic technologies and fishery-dependent data collection. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Policy Directive 30-133, May 3, 2013.
- NOAA. 2013b. Discussion draft - electronic monitoring and electronic reporting: guidance and best practices for federally managed fisheries. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, August 2013.
- Pierce, B. 2014. Commercial electronic logbook pilot project. Presentation to the Gulf of Mexico Fishery Management Council, August 2014. National Marine Fisheries Service, Southeast Fisheries Science Center. Accessed at Gulf Council's ftp site on September 11, 2014.



- Pria, M.J., H. McElderry, M. Dyas, and P. Wesley. 2008. Using electronic monitoring to estimate reef fish catch on bottom longline vessels in the Gulf of Mexico: a pilot study. Archipelago Marine Research Ltd., Victoria, British Columbia, Canada. 42 pp.
- SAFMC. 2003. Shrimp amendment 5 to the fishery management plan for the shrimp fishery of the South Atlantic region (Rock Shrimp). South Atlantic Fishery Management Council, Charleston, SC. 140 pp + appendices.
- SAFMC. 2013. Joint South Atlantic/Gulf of Mexico generic charter/headboat reporting in the South Atlantic Amendment. South Atlantic Fishery Management Council, Charleston, SC. 98 pp.
- SEDAR. 2009. Caribbean fisheries data evaluation. Southeast Data, Assessment, and Review Procedures Workshop 3 held in San Juan, Puerto Rico, January 26-29, 2009. 195 pp.
- SERO. 2014. Update of ACL landings for Caribbean reef fishes and projected season lengths NMFS, Southeast Regional Office, St. Petersburg, FL. SERO-LAPP-2014-03. 4 pp.
- Skirble, R. 2015. 'Eyes on the Seas' curtail illegal fishing. Accessed at: <http://www.voanews.com/content/project-eyes-on-the-sea-curtail-illegal-fishing-/2614408.html> on February 16, 2015.
- Steinback, C. 2014. USVI and Puerto Rico digital deck pilot project. Presentation to the Caribbean Fishery Management Council at their April 2014 meeting. Point 97. 19 slides.
- Stunz, G.W., M. Johnson, D. Yoskowitz, M. Robillard, and J. Wetz. 2014. iSnapper: design, testing, and analysis of an iPhone-based application as an electronic logbook in the for-hire Gulf of Mexico red snapper fishery. Harte Research Institute for Gulf of Mexico Studies, Corpus Christi, TX. NOAA Cooperative Grant NA10NMF4540111. 64 pp.
- Tate, T.J. 2012. Gulf WildTM, sustainable fisheries, and electronic monitoring, piloting toward healthy fishery and wildlife populations: improved monitoring for commercial fishing vessels. Gulf of Mexico Shareholder's Alliance. Accessed at: <http://sfpcms.sustainablefish.org.s3.amazonaws.com/2012/03/02/Sustainable%20Fisheries%20and%20Electronic%20Monitoring-59968362.pdf> on November 14, 2014. 4 pp.

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## Appendix 1: Response to Public Comments

NMFS solicited public comments on this plan from January 9-February 9, 2015. The comment period was announced via regional FMC meetings and a Fishery Bulletin and distributed to constituents receiving the NMFS Southeast Regional Office's Fishery Bulletin mailing list. A total of 43 comments were received from individual fishermen, fishing organizations, and non-governmental organizations. Opposition to the plan (15 individual comments) was primarily from South Atlantic commercial and recreational fishermen who were opposed to the use of VMS and EM systems. Some opposing the use of VMS and/or EM did support the use of ER. Support for the plan (28 individual comments) came primarily from for-hire charter fishermen in the Gulf of Mexico, fishing organizations, and NGOs. Those supporting the plan generally agreed that the use of EM/ER can improve the timeliness and accuracy of catch data for use in science and management. No comments were directly received from Caribbean commercial or recreational fishermen. Below is a summary of comments received and responses to each comment:

**Comment 1:** Many fishermen opposed the plan, especially any requirements for VMS or video monitoring. Reasons for opposition included: Commercial fishermen are overregulated, electronic technologies are too time consuming to use, data will be publicly released and not made confidential, EM data will lead to catch shares and/or marine protected areas, fishermen cannot afford EM equipment, and EM violates privacy rights of U.S. citizens.

**Response:** NMFS recognizes that many constituents do not support the use of EM and/or ER. Throughout the plan, NMFS has indicated that development and implementation of EM/ER requires weighing the benefits of such technology against costs and potential stakeholder support/opposition. Any EM/ER program developed would need to follow the framework implementation process described in this document, which allows constituents, organizations, advisory panels, and regional FMCs to provide input so that their concerns can be considered and addressed. Regional FMCs will also need to decide how EM/ER data will be used for management, and whether it should or should not be used in conjunction with management approaches such as MPAs and catch shares. NMFS recognizes that it is key to having stakeholder support and buy-in for effective use of EM/ER in science and management. NMFS also must abide by strict confidentiality standards, as mandated by the Magnuson-Stevens Act, therefore preventing public release of confidential fishery data.

**Comment 2:** Who will pay the costs for electronic technology? The plan should include a detailed breakdown of funding for EM/ER implementation. Costs and benefits associated with EM/ER in conjunction with onboard observers should be described. The economic burden on commercial fishermen and for-hire vessels should be critically evaluated.

**Response:** The plan does not indicate who will pay the costs for EM/ER technology. Costs will be contingent on the program developed and could be paid for by the government, fishermen, or shared among several entities. The plan also does not include specific costs because such costs are highly contingent on the design of an EM/ER program, are rapidly changing as new

technology is developed, are contingent on the technology (hardware/software) chosen, as well as the existing or needed infrastructure to support such a program. NMFS, in conjunction with its partners, will need to clearly define EM/ER costs for each individual program/fishery during Phases III-IV of the framework implementation process, including how EM/ER will be funded and who will pay those costs. As an example, the Gulf and South Atlantic FMCs recently convened a technical subcommittee which provided recommendations and detailed cost comparisons for ER in the charter sector.

Comment 3: If VMS is required, will dually permitted vessels be required to get new VMS systems?

Response: At this time, no recommendations for requiring VMS are being made. If VMS is required in the future for a particular fishery then the need for purchasing new VMS systems for dually-permitted vessels will be dependent on the EM/ER plan design that is approved and necessary hardware and software required.

Comment 4: The plan does not discuss the impacts of EM/ER on safety at sea, does not describe economic impacts on recreational and commercial fishermen, and does not describe new regulations that will be needed if the plan is implemented.

Response: The plan does discuss some of the regulatory impediments to EM/ER. Any new regulations that will be needed will be developed in a separate plan amendment by the regional FMCs. Included in the plan amendment will be biological, social, economic, and administrative analyses that describe the benefits, costs, and impacts of any newly proposed regulations. Additionally, the plan does discuss safety at sea, in the context of VMS.

Comment 5: Ensure the EM/ER framework process is used to increase efficiency, and not delay implementation progress given the many pilot studies that have already been performed. Consider ways to streamline the process by combining steps in the process.

Response: NMFS agrees that the framework process should be used to streamline and standardize the process for EM/ER development and implementation. The framework process should not be used to delay implementation progress, especially in instances when sufficient pilot testing has already been completed. Additional text was added to the EM/ER Framework Implementation Process section to clarify this point.

Comment 6: The plan should include an increased emphasis on EM given the low onboard observer coverage for Gulf of Mexico commercial fisheries. Improved capabilities for video monitoring are needed to document catch and bycatch and move toward full catch accounting.

Response: EM is considered important for improving science and management, especially use of video camera systems to document bycatch. NMFS will continue to support pilot studies for EM in the Southeast (such as those currently occurring in the shrimp fishery), as well as work ongoing by industry and other research institutions, such as Mote Marine Laboratory. NMFS

views ER as a higher priority in the short-term that will provide more immediate benefits. This plan and implementation progress will be reassessed annually, given NMFS, constituents, and the regional FMCs an opportunity to reprioritize EM/ER implementation as programs come online. Use of EM can be costly and thus needs careful consideration from stakeholders, regional FMCs, and NMFS during development of actions as to whether benefits outweigh costs.

Comment 7: The plan should explicitly define sub-region and fishery-specific goals given the diversity of fisheries in the Southeast.

Response: NMFS agrees and intends to develop fishery-specific goals by sub-region during Phase II of the framework implementation process for EM/ER. Additional text was added to the 'Goals and Objectives' section to clarify NMFS intent.

Comment 8: The plan should recommend voluntary reporting for recreational fisheries and methods should be developed for integrating self-reported data into stock assessments. Also, innovative approaches should be developed to interest private anglers in reporting data.

Response: NMFS agrees that options for voluntary submission of data should be considered and where possible integrated into data analyses and assessments. Additional text was added to this document clarifying that both voluntary and mandatory approaches for data collection should be considered, where applicable. However, voluntary data does have limitations and potential biases that would need to be validated and resolved before such data could be used. Validation of catch and effort is essential for producing statistically and scientifically sound data.

Comment 9: NMFS should develop an EM/ER workgroup comprised of commercial, charter, and private anglers. NMFS should also develop an EM/ER governance structure similar to the existing MRIP governance structure.

Response: NMFS agrees that an EM/ER workgroup would be useful to advise on EM/ER development and implementation, but believes such a workgroup would be more appropriate as a Council advisory panel. The plan now recommends development of an EM/ER advisory panel. NMFS does not believe a governance structure similar to MRIP is necessary at this time, especially if the framework process outlined in this plan is effectively used for EM/ER implementation and stakeholder engagement. SERO and SEFSC staff will continue to coordinate with MRIP staff and consultants, when applicable, on recreational data collection methods.

Comment 10: NMFS should hold regional EM/ER workshops and encourage the regional FMCs to create and maintain advisory panels and regional committees specific to EM/ER.

Response: NMFS agrees that regional FMCs should develop EM/ER advisory panels and additional text was added to the plan recommending APs be developed. The plan also

discusses fishery-dependent data visioning, similar to what has been done in the Northeast, Such a process could be done through regional workshops and bring together industry, state partners and commissions (e.g., ACCSP, GSMFC), and other interested stakeholders to address EM/ER and other fishery-dependent data needs.

Comment 11: EM/ER best practices guidelines criteria for EM and ER need solid description, either in this document or as a separate report.

Response: NMFS agrees that EM/ER best practices are needed, but such criteria would be more appropriate in a separate document. See NOAA 2013b for more information.

Comment 12: How will public input be accepted for implementation or integration of EM/ER?

Response: Public input will be accepted through the regional FMC and NMFS rulemaking process, as well as solicited via advisory groups and scientific panels. Additional text was added to the document to clarify how public input will be accepted.

Comment 13: Identification of goals and objectives (Phase II of implementation process) could be done in conjunction with Phase I assessment.

Response: NMFS believes it is important to keep Phase I assessment of EM/ER separate and distinct from defining goals and objectives in Phase II. The framework process is consistent with draft NOAA guidance and best practices for EM/ER.

Comment 14: The implementation plan could be streamlined by designing and developing programs modeled after similar, existing programs or encompassing experience gained from previous pilot testing. As it is currently drafted, it seems that each new program will have to undergo the full 6-step process where it might not always be necessary.

Response: NMFS agrees that more streamlined processes are needed, especially when EM/ER has already undergone pilot testing. Additional text was added to the plan clarifying NMFS intent to not delay progress on EM/ER implementation when pilot studies and extensive work has already been completed.

Comment 15: A strong, viable at-sea and/or dockside validation of catch and effort is essential for producing statistically and scientifically sound data and should be emphasized more strongly in the framework process for implementation.

Response: NMFS agrees that validation of catch and effort is critical for statistically robust data collection programs. Additional emphasis was added to the plan in the EM/ER Framework Implementation Process section.

Comment 16: Shrimp trawls should be added to the list of priority fisheries for EM, including the use of underwater cameras.

Response: NMFS does not agree that EM for shrimp trawls should be given higher priority. NMFS also does not agree that underwater cameras would be useful for monitoring shrimp trawls or bycatch in many areas, due to water turbidity. NMFS is currently pilot testing EM in the Southwest Florida shrimp fishery and will continue to conduct research on the utility of EM for shrimp bycatch. Annually, NMFS will also review this plan and determine if priority fisheries need to be modified.

Comment 17: Requirements and software should be standardized across fisheries so that fishermen can use the same EM/ER in multiple jurisdictions.

Response: NMFS agrees that software and hardware requirements should be standardized to the extent practical. Data standardization and elimination of reporting redundancies are priorities identified in this plan for NMFS to address.

Comment 18: Electronic technologies should be integrated with dockside and biological sampling to streamline data entry and submittal while also more efficiently linking sampling data to trip level information.

Response: NMFS agrees that electronic technologies should be integrated with dockside and biological sampling. Improvements in both sampling efficiency and integration of data are needed when conducting observer and dockside data collection in the Southeast. NMFS has identified this as a plan priority to address.

Comment 19: The plan specifically describes costs for new EM/ER systems but does not discuss costs of maintaining 'status quo' programs, such as paper logbooks. Also, the costs of not developing EM/ER should also be analyzed.

Response: NMFS agrees that costs of 'status quo' programs should also be addressed when developing EM/ER. Additional text was added to the Costs and Infrastructure section of this plan. Costs should be compared to existing reporting and monitoring costs. For instance, paper-based reporting requirements may be more costly and burdensome to NMFS and industry, and moving to ER may result in cost savings. This will allow for potential cost savings (or cost reassignment) or increases to be clearly identified. It will also allow for economic, social, and/or biological benefits to be compared and conveyed to the regional FMCs, industry, and other stakeholders. Costs and challenges from other regions and areas, where applicable, should also be explored and the cost burden on all entities should be critically evaluated.

Comment 20: Additional information should be provided about how ER technologies could be used to improve reporting and avoid bycatch hotspots.

Response: NMFS agrees that EM/ER could be used to improve reporting and identify bycatch hotspots. Additional text was added to the Goals and Objectives section of this plan discussing the use of EM/ER for monitoring bycatch hotspots. Further management needs for bycatch

monitoring of hotspots will need to be address in coordination with the regional FMCs and stakeholders.

Comment 21: Further discussion of EM/ER as it pertains to enforcement is needed in the plan.

Response: Additional text was added throughout the plan discussing use of VMS and AIS for enforcement. Also, in the Costs and Infrastructure section, additional discussion was added discussing the burden and costs to enforcement of EM/ER.

Comment 22: Reviews should occur quarterly, not annually as proposed.

Response: NMFS will regularly monitor progress made on this plan. However, given it takes considerable time to design, develop, and implement EM/ER NMFS believes it is appropriate to evaluate plan progress on annual rather than quarterly basis.

Comment 23: Any ER program should include discard information (*e.g.*, species, size, disposition at release, release methods, predation) as well as capturing location of fishing activity. Currently, the discard information in existing data programs (*i.e.*, MRIP) are generally highly uncertain and ER programs are potentially a way of getting better discard and discard mortality estimates, in addition to better characterizing the discarded catch through the use of cell phone/camera technology.

Response: NMFS agrees that finer spatial resolution of catch and effort data are needed to improve both research and management. This should be a major consideration when developing any EM/ER program.

Comment 24: Minimum data elements and standards are needed to advance electronic reporting in the private recreational fisheries as well as the development of the infrastructure needed to warehouse and submit data for management and scientific use. It will be important to have these standards developed to help guide proposed ER programs through the implementation plan to ensure consistency and uniformity across the region.

Response: NMFS agrees and is working with state partners, the GSMFC, and ACCSP to review and update recreational data standards, as necessary.

Comment 25: Dockside sampling programs should report data electronically so that data can be more readily integrated with fishermen electronic logbooks for cross-referencing trip and catch information as part of the validation of ER programs.

Response: NMFS agrees and has identified this as a priority in the Fisheries Suitable for EM/ER section of this plan.

Comment 26: The data collected from the Southeast headboats via electronic logbooks should be made available in a more timely fashion. The targeted timeframe for doing so should be identified and prioritized in the Plan.

Response: Improving headboat data timeliness is identified as a priority in this plan. Improvements and timelines for implementation are specified in Table 4.

Comment 27: Coordinating with all levels of fishery management and data collection agencies (State, Commission, Council, NMFS, NOAA) is essential for uniformity, efficiency, and stakeholder buy-in, and to meet the EM/ER objectives.

Response: NMFS agrees that coordination among the regional FMCs, commissions, ACCSP, states, and stakeholders is key to successful EM/ER, and has emphasized this throughout the plan and framework process for implementation.

Comment 28: MRIP and States are key stakeholders that should be an integral part of development and implementation of recreational ER programs since they provide existing infrastructure and funding through that program that can be utilized for efficiency of validations, for instance.

Response: NMFS agrees. MRIP and the states are directly involved in the development of new, alternative recreational data collection programs currently being pilot tested or implemented by various Gulf and South Atlantic States. MRIP has contributed staff time and contracted with survey design experts and statisticians to assist in the development of new recreational data collection programs. MRIP has also developed a certification process for new surveys. Existing MRIP and state infrastructure should be used, whenever possible, to increase efficiency and minimize costs when developing new EM/ER programs.

Comment 29: Review of established performance measures for ER/EM programs should be done at least annually and should directly include stakeholders (e.g., appropriate Advisory Panels) and any adjustments should be made accordingly to maintain performance measures (e.g., targeted validation levels, accuracy, timeliness).

Response: NMFS agrees review of performance measures should involve stakeholders. Additional text was added to Phase VI of the Process for EM/ER Implementation section.

Comment 30: The proposed timeline is offered as a guideline rather than as a requirement. Implementation of some ET should occur as early as 2016. A clear schedule for EM/ER implementation is needed.

Response: It is difficult to specify a timeline for mandatory EM/ER because implementation is contingent on many factors, including but not limited to, the feasibility of the technology, regulatory actions made by the regional FMCs, costs, and infrastructure. Implementation as early as 2016 is contingent on these factors being addressed. NMFS is committed to moving



forward as quickly and feasibly as possible, but must be pragmatic when specifying implementation timelines and ensuring EM/ER is done right and expeditiously.

Comment 31: It might be constructive to stakeholders to see the costs or budgets associated with existing ER/EM programs (*e.g.*, Headboat ELB, Shrimp ELB, commercial reef fish VMS) including all aspects of reporting and validation, but also savings gained through increased efficiencies and reduced redundancies. That could be added as an appendix to the implementation plan if feasible.

Response: NMFS agrees. Additional text was added to the plan indicating costs and data flows of existing programs should be compared with any new EM/ER proposed program. These comparisons will occur during specific development of an EM/ER program, and therefore are not included herein.

Comment 32: To manage stakeholder expectations, it should be emphasized that incorporating data from ER programs does not necessarily mean higher quality, more accurate/precise data. These programs have to be strongly linked to validation programs or we may just be swapping one highly uncertain data stream for another, perhaps even more highly uncertain, data stream which is available faster. Any self-reported data, especially through new ER programs where potentially a much larger amount of data will be submitted, needs to be scientifically and statistically validated on a continuous basis.

Response: NMFS agrees that scientifically sound and validated data collection programs are necessary. Strong at-sea and/or dockside validation of catch and effort will be a key consideration for ER to ensure statistically sound and scientifically robust catch and effort estimates can be produced. The benefits of EM/ER will be limited if FMP objectives are not achieved or if EM/ER fails to produce more timely and accurate data due to late reporting, non-standardized reporting practices, and lack of sufficient data validation.

Comment 33: Stakeholder expectations on the timeline for implementation and use of the data generated from ER programs must be appropriately managed together with all the partners involved including the Councils, states agencies and State Marine Fisheries Commissions.

Response: NMFS agrees and will annually review this plan with stakeholders and the regional FMCs to determine progress made. Regular review will also allow for reprioritization of EM/ER and modification of timelines as necessary.

Comment 34: The plan should clearly indicate how support for EM will be increased.

Response: NMFS recognizes that support for EM is important to improve constituent buy-in and effectiveness of data collected. NMFS will need to work with the regional FMCs, state, and Commission partners as specific plans for EM are developed. The benefits of EM for science and management will need to be clearly determined to increase stakeholder support for such technology.

Comment 35: A certification process should be developed that outlines the needed minimum data elements and program designs and standards. Adherence to these standards should be a requirement for use and incorporation into management and scientific processes.

Response: NMFS agrees that program standards should be required. The program design selected will need to be scientifically sound and statistically valid as NMFS is required to use the best scientific information available. EM/ER data collection approaches must also be unbiased and there is a need for information to be consistent with historical time series for use in determining the status of stocks. Any fishery-dependent survey or sampling approach developed should be statistically and scientifically certified for use, and a plan for calibrating new data collection methods to old methods should be determined prior to implementation.

Comment 36: What are the implications of this program with the Gulf Council? How will management and policies need to adapt to this program? What management opportunities may arise from the implementation program? And how will EM/ER facilitate a full retention or maximized retention fishery?

Response: NMFS will work in close coordination with the regional FMCs to implement this plan and the priority EM/ER areas outlined within it. Implementation of EM/ER is expected to address several limitations of current data collection programs, including but not limited to: time lags in reporting, precision of catch estimates, additional data for estimating regulatory discards, providing catch records histories, increasing sampling efficiency, and reducing redundancies in data collection. The management opportunities that arise from EM/ER will be contingent on the goals and objectives of the regional FMC and fishery being managed, including potential use of full or maximized retention management approaches.

Comment 37: Provide further detail on how public-private partnerships can exist in a successful EM/ER program.

Response: NMFS cannot simply delegate core functions, such as data collection, essential to fulfilling our legal responsibilities. However, there are many potential opportunities that exist for successful public-private partnerships when developing and implementing EM/ER. These include, but are not limited to, experimental testing through exempted fishing permits, establishing traditional contracts with private entities for data collection, analysis, and processing, conducting EM/ER research with private entities and industry, and development of management strategies that involve a more collaborative management atmosphere between government, industry, and private entities.