

NOAA Fisheries Southeast Region Electronic Monitoring and Reporting Regional Implementation Plan

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Abbreviations Used in this Document

ACCSP	Atlantic Coastal Cooperative Statistics Program
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
IBQ	individual bycatch quota
IFQ	individual fishing quota
NMFS	National Marine Fisheries Service
SAFIS	Standard Atlantic Fisheries Information System
SAFMC	South Atlantic Fishery Management Council
SEFSC	NOAA Fisheries' Southeast Fisheries Science Center
SERO	NOAA Fisheries' 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 electronic reporting 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.

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 Council/NMFS representatives, reviewed a draft plan in November and each Council reviewed a revised plan at Council meetings in December 2014 and January 2015. Additional input will be obtained from stakeholders and constituents in late 2014 and early 2015, with the goal of completing the plan by early 2015. Once finalized, the plan will serve as a roadmap for EM/ER development and implementation throughout the Southeast Region.

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 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 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).
- 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 fisheries in the Southeast Region. 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 for EM and SERO and the SEFSC see great utility in this technology for habitat protection 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 the SERO and SEFSC recognize 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 catches, 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 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. Benefits of such technology must be

weighed against costs, potential stakeholder 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 is already used in many fisheries to aid enforcement and enhance monitoring. 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.

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; and 3) developing standardized reporting practices and systems that reduce reporting burden and enhance quality control/quality assurance of submitted data.

Framework for EM/ER Implementation

A clearly defined process for successful implementation of EM/ER is critical. 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). As proposed in NOAA's draft guidance and best practices for EM/ER (NOAA 2013b), the SERO and SEFSC intend to use a six phase process for EM/ER consideration and development (**Figure 1**). Each of these phases, and how SERO and the SEFSC intend to apply them, is further discussed below.

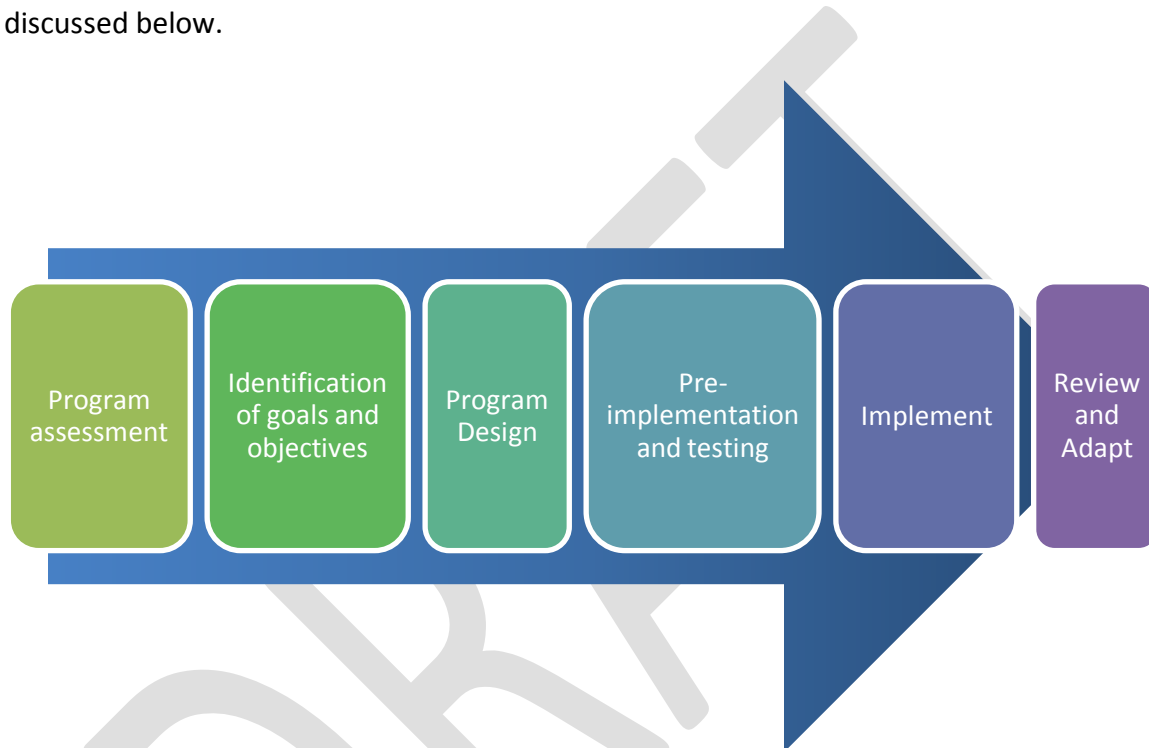


Figure 1. Phases of electronic monitoring and electronic reporting consideration and development.

Phase I – Assessment

Each fishery and sectors within a fishery have unique characteristics and EM/ER needs may greatly vary from fishery to fishery and one sector to another. 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 the Councils, other state data collection partners (states, GSMFC, ACCSP) will conduct an initial assessment of monitoring tools that may be appropriate for that particular fishery. 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 SERO and SEFSC will need to assess the willingness of industry, state agencies, and other stakeholders to use EM/ER 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. 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 NOAA Fisheries if it creates an unfunded or unsustainable cost of implementation or operation contrary to applicable law or regulation. NOAA Fisheries 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.

The SERO and SEFSC will develop goals and objectives for EM/ER in coordination with the regional FMCs, state partners, fishery commissions, enforcement, stakeholders, and scientists. Data needs will be identified based on management plan objectives, scientific needs, and fleet/fishery characteristics. Each 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, the SERO and SEFSC will then conduct comparative analyses to assess the tradeoffs of different 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. 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, develop regulations, and ensure quality data are collected (Lowman et al. 2014). Prior to implementation, regulatory changes will be made, as needed. 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 the National Marine Fisheries Service (NMFS) is required to use the best scientific information available for collecting data per National Standard 2 of the Magnuson-Stevens 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.

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 and 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. Results from this pilot will help inform the Councils, SERO and SEFSC staff, and stakeholders as to the utility of EM/ER for use with an allocation-based management system. If successful, the pilot study will serve as a useful basis for longer-term management strategies considered by the Gulf of Mexico and South Atlantic 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. SERO and SEFSC 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, the SERO and SEFSC anticipates 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. 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 ELBs were approximately \$2 million dollars and reoccurring costs are approximately \$313,000 annually (GMFMC 2013c). One-time costs to shrimp fishermen for ELB installation were \$300,000 and reoccurring costs for data transmission service fees are \$1.08 million dollars (GMFMC 2013c).

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). 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 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. 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 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 FMC expressed interest in using VMS for EM/ER in the for-hire fleet.

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 fisheries potentially suitable for EM/ER in the Southeast Region is provided below and summarized in **Figure 2**. This list was developed with input from each of the regional FMCs. Region-wide priorities for EM/ER are also discussed. Prioritization of this list will be reviewed annually and discussed with the regional FMCs.

Gulf of Mexico

Reef Fish and Coastal Migratory Pelagics (CMPs) - The Reef Fish and Coastal Migratory Pelagics (CMPs) FMPs contain more than 30 species of snappers, groupers, jacks, hogfish, triggerfish, cobia, and mackerels. Reef fish and CMPs 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 CMPs, and headboats are required to report trip-level logbooks of landings. 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. The Gulf of Mexico and South Atlantic FMCs have established a technical subcommittee, which will provide recommendations on an electronic reporting system for for-hire vessels by the end of 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). Electronic reporting improvements are the SERO and SEFSC's 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 to obtain more timely and finer spatial resolution data,
2. Development and implementation of an electronic reporting 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.

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	N	N	N	N	N	elogbook - pilot testing began in 2014	
	Queen Conch	N	N	N	N	N	N		
	Spiny Lobster	N	N	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	N		
	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 prohibited except with Federal permit for scientific research, exempted fishing, or exempted educational activity						
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						

Given the video monitoring challenges discussed earlier in this plan, particularly with identification of species and enumeration of bycatch, the SERO and SEFSC do not foresee EM 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). The SERO and SEFSC do not foresee any additional needs for shrimp ELBs 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. Electronic monitoring 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.)

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, these species account for a majority of the ACLs monitored in the South Atlantic. 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.

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. The SERO and SEFSC are also interested in modernizing the wreckfish individual transferable quota (ITQ) program, which still relies on paper-based coupons. Electronic reporting improvements are the SERO and SEFSC's 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 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. NMFS and the Gulf and South Atlantic Fisheries Foundation conduct a limited amount of observer coverage in the South Atlantic, so bycatch estimation 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.

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 of the SERO and SEFSC to pilot test and develop ELBs for commercial fisheries to obtain more timely and finer spatial resolution data and to develop and implement an electronic reporting 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 (June 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, the SERO and SEFSC view ER in Caribbean FMC managed recreational fisheries 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 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. 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. The SERO and SEFSC is interested 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). 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) 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.

The SERO and SEFSC also recognize the importance of improving private recreational data collection. Over the past several years, the SERO and SEFSC has been working with MRIP staff and various Gulf of Mexico states to review 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. The SERO and SEFSC will continue to support these data collection efforts and will coordinate with the Office of Science and Technology and MRIP consultants the review of 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 – The SERO and SEFSC are 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 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. 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. Last year, the Greater Atlantic Region initiated a fishery-dependent data visioning project. It is a collaborative effort among government, industry, private institutions, and academia to better understand the 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, fishery commissions, and other interested stakeholders.

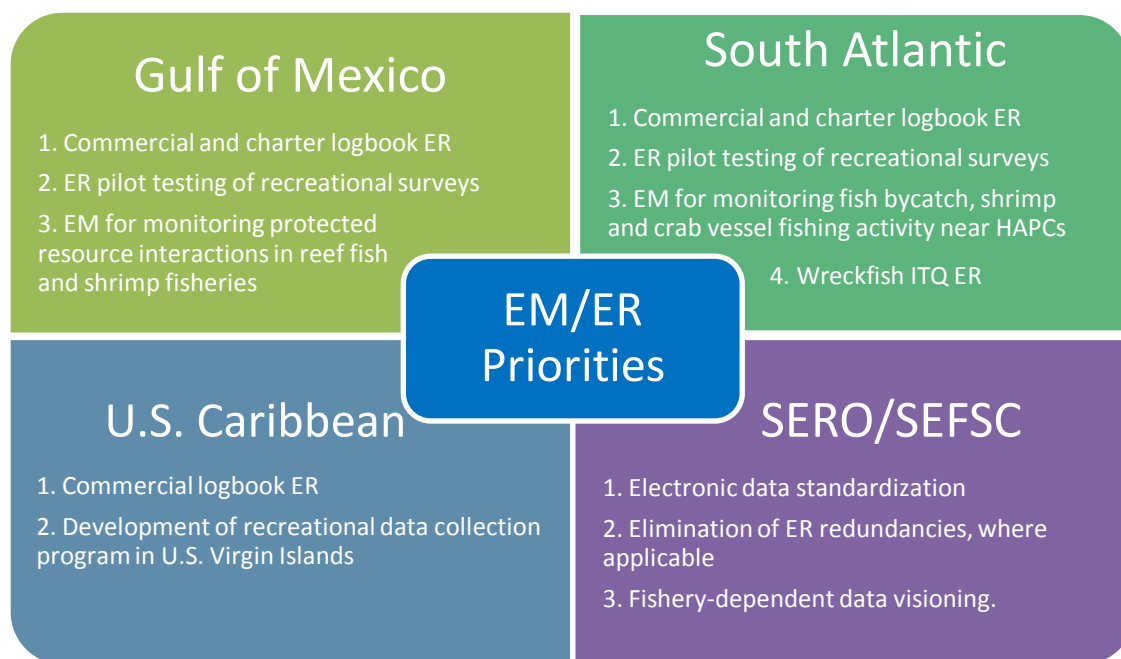


Figure 2. Southeast Region EM/ER Priorities for the Gulf of Mexico, South Atlantic, U.S. Caribbean and Southeast Regional Office/Southeast Fisheries Science Center.

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) insufficient regulations, 3) size and extent of fleets, 4) multiple data collection partners, 5) calibration with old methods, and 6) stakeholder opposition (**Figure 3**).

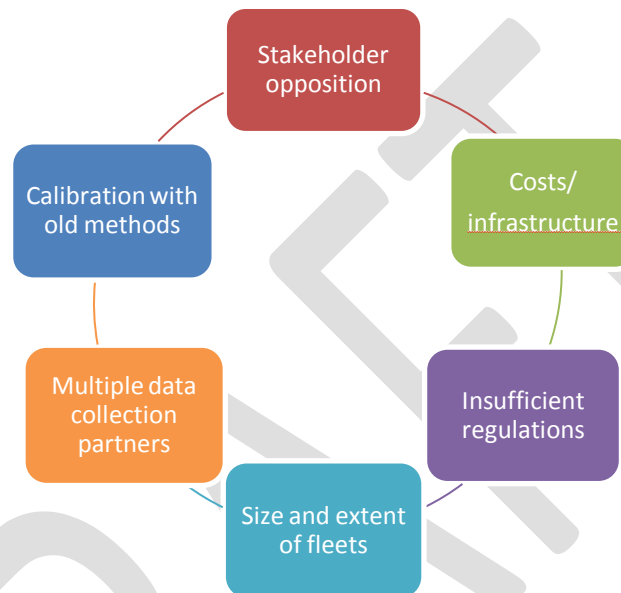


Figure 3. Challenges impeding EM/ER use in the Southeast Region.

Costs can be incurred both by the agency 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 regulations are insufficient 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).

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 and eliminating redundancies in effort. 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 constituents. Buy-in often varies by region, organization, and the level of reporting burden that may be placed on the industry.

Costs and Infrastructure

This section will be completed during development of the final implementation plan. Estimated costs for foreseeable EM/ER projects and systems will be discussed, including costs for infrastructure, data collection tools and maintenance, validation, quality control/quality assurance, and information technology personnel. The section will also discuss the current infrastructure status of the fleet, at the SERO and SEFSC, at the marine fishery commissions (GSMFC, ACCSP), and in the service provider sector when it comes to EM/ER technology. Based on NOAA EM/ER guidance and best practices (NOAA 2013b), assessment of infrastructure will extend beyond needed 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 will also be discussed, including redirection of existing government funds and cost-sharing with industry.

DRAFT

Timelines for Implementation

A primary key to successful EM/ER implementation is identifying clear timelines, expectations, and objectives (Lowman et al. 2014). The SERO and SEFSC recognize the importance of involving all stakeholders in the EM/ER implementation process. 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. The following summarizes general timelines for implementing EM/ER in the Southeast Region (**Table 4**). 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.

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

This table will be completed during development of the final implementation plan and will include EM/ER implementation timeframes for various fisheries/sectors during 2015-2017. Longer-term EM/ER initiatives will also be discussed.

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 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;
 - b. Management (e.g., ACL monitoring to prevent overages); 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.

Annually, the SERO and SEFSC intend to review progress made toward implementing EM/ER 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 the SERO and SEFSC, in conjunction with the FMCs, to identify objectives for improving data collection and document 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/Battyetal_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 NOAA Fisheries Service, 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 meeting summary. Gulf of Mexico Fishery Management Council, Tampa, FL. Accessed at: http://safmc.net/sites/default/files/meetings/pdf/Council/09-2014/DataColl/A7_SummaryCBTechComReport.pdf on September 15, 2014. 13 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 NOAA Fisheries Service, Southeast Regional Office, St. Petersburg, FL. SERO-LAPP-2014-03. 4 pp.
- 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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