



**NOAA**  
**FISHERIES**

# Ecosystem-based Fishery Management in the U.S. Caribbean Region:

## Roadmap Implementation Plan

## Caribbean Region EBFM Roadmap Implementation Plan

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NOAA Fisheries has long recognized the importance of ecosystem-based fisheries management (EBFM). The [Ecosystem Based Fishery Management Policy](#) and [Road Map](#) describes the strategy NOAA Fisheries will employ to implement EBFM based on six guiding principles. NOAA Fisheries defines EBFM in the Policy as “a systematic approach to fisheries management in a geographically specified area that contributes to the resilience and sustainability of the ecosystem; recognizes the physical, biological, economic, and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals.” To implement EBFM, the Policy identifies and outlines six guiding principles:

1. Implement ecosystem-level planning;
2. Advance our understanding of ecosystem processes;
3. Prioritize vulnerabilities and risks of ecosystems;
4. Explore and address trade-offs within an ecosystem;
5. Incorporate ecosystem considerations into management advice;
6. Maintain resilient ecosystems.

The EBFM Roadmap calls for the development of implementation plans to guide NOAA Fisheries’ efforts in implementing EBFM over the next 5 years. The purpose of this Implementation Plan is to identify and coordinate priority EBFM milestones among the Southeast Regional Office (SERO), the Southeast Fisheries Science Center (SEFSC) and our Caribbean Fishery Management Council (Council) partners in the Caribbean region.

### **Regional Context**

Beginning in January 2012, the Council initiated the process of shifting from a spatially undifferentiated fisheries management approach to an island-based approach via their 2010 and 2011 Caribbean Annual Catch Limit amendments. In essence, the Council established separate stock/complex harvest reference points for each of the Puerto Rico, St. Thomas/St. John, and St. Croix island platforms. However, while the revised approach was place-based, it only peripherally addressed other components of management within the context of a coral reef ecosystem. Nonetheless, this shift established the baseline for conducting ecosystem-based management in the region.

In November 2014, NOAA Fisheries approved a non-regulatory Environmental Assessment (EA) submitted by the Council that proposed a transition from species-based fishery management plans (FMP) to island-based FMPs. Subsequent to NOAA Fisheries approval of the EA, the Council began developing the island-based FMPs, which are scheduled for completion in April 2019. The purpose of this transition is to facilitate management of U.S. Caribbean fishery resources by reorganizing the

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federal fishery management strategy to better account for biological, social, and economic differences among the islands comprising the U.S. Caribbean. The stated need for this transition is threefold: (1) prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery in the U.S. Caribbean, (2) take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches, and (3) provide for the sustained participation of the fishing communities of the U.S. Caribbean and to the extent practicable, minimize adverse economic impacts on such communities.

In the U.S. Caribbean, recreational and commercial fishing activities reflect local preferences and are, in many instances, dependent on the coral reef community and associated seagrass, mangrove, and unvegetated habitats. In addition, the harvest obtained by each fishing sector is generally consumed locally, with little if any export. Thus, harvest patterns reflect the personal, cultural, and marketing preferences of the local community on each island. Those preferences contrast substantially between Puerto Rico and the U.S. Virgin Islands (USVI). For example, the commercial fishery in Puerto Rico is predominantly a snapper fishery; whereas, the St. Croix commercial fishery predominantly targets parrotfish. Preferences also differ among the islands that comprise the USVI and even among ethnic groups within each USVI island. With parrotfish as an example, St. Croix fishers purposely target these species, reflecting a culturally driven market consuming up to 240,000 lbs of parrotfish annually. In contrast, commercial fishers on St. Thomas consider parrotfish as bycatch, and commercial catch of all parrotfish species from the waters surrounding St. Thomas/St. John averages less than 36,000 lbs annually. Such preferences have ecological ramifications, as parrotfish and other herbivores provide essential grazing services to the coral reef ecosystem.

Natural and anthropogenic factors affecting habitats and their associated species also differ among islands. While St. Croix supports medium and heavy industries (e.g., petroleum storage farm, rum distillery), St. Thomas is more tourist-oriented, and the much larger island of Puerto Rico supports over 3 million residents and a host of industrial, tourism, and service industries. In addition to these differences are potential and realized differences in natural events that impinge on each island, including for example hurricanes, freshwater inputs, and ocean current patterns. Studies of larval dispersal and population connectivity indicate that biological connections among neighboring islands are complex and at least some fish stocks exhibit fine-scale structure. In combination, these harvest preferences, anthropogenic impacts, natural events, and complex biological linkages combine to create a mosaic of conditions unique to each island's coral reef ecosystem and the fishing communities reliant on that ecosystem.

### **Stakeholder Engagement**

The concept of Ecosystem Based Fisheries Management (EBFM) has been presented to a wide range of U.S. Caribbean interest groups, including the Council, local agency staff, fishers and community

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representatives, academia, and members of non-governmental organizations. Each of these groups will contribute as key partners in the advancement of EBFM in the Caribbean region. Because a truly ecosystem-based approach to fishery management in the region requires extending beyond the U.S. Caribbean exclusive economic zone, peripheral partners may include management entities operating at the scale of the Caribbean basin (e.g., Western Central Atlantic Fishery Commission) and each of the Gulf of Mexico and South Atlantic Fishery Management Councils. Other federal agency partners include the United States Geological Survey, the Environmental Protection Agency, and the United States Fish and Wildlife Service. In addition to NOAA Fisheries' Southeast Regional Office and Southeast Fisheries Science Center, essential partners within NOAA include Sea Grant, the Southeast Region Grants Office, the Coral Reef Conservation Program, the National Coral Reef Monitoring Program, the National Center for Coastal Ocean Science, the Office of Science and Technology, the Office of Oceanic and Atmospheric Research, the National Ocean Service's Integrated Ocean Observing System and Office of Marine Sanctuaries, and the Southeast and Caribbean Regional Collaboration Team. To ensure an organized approach to EBFM development, partners will be engaged in a stepwise fashion as the plan progresses from outline through conceptual model and into a fully-fleshed management approach.

### **Expected Benefits**

Effective management of fisheries dependent on the complex coral reef ecosystem requires an ecosystem-based approach. Applying an EBFM approach in the U.S. Caribbean region will improve management of fisheries and associated living marine resources, while best anticipating climate change impacts to the ecosystem, by taking full advantage of available information to identify and monitor linkages among living marine resources. Similarly, the EBFM approach will ensure that community responses to fishing impacts are better understood and more effectively managed. The EBFM approach also serves to fully exploit NOAA and partner research and data collection efforts by incorporating the expanse of available data while controlling the consequences of data limitations that are not likely to be overcome due to logistic and budgetary constraints. For example, research has demonstrated that coral reef resilience is reduced by land-based stressors. Thus, an important aspect of managing coral reefs and the fisheries they support is effective understanding and mitigation of watershed influences. Watershed issues cannot be directly managed by the Council, instead requiring effective interagency cooperation. Finally, the EBFM approach aims to achieve NOAA's goal of increasing sustainable contributions to the nation's economy through fishery and marine resource management, mapping, exploration, observation, and prediction.

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**Table of Road Map Actions and Associated Milestones**

Road Map #	Road Map Action Item	Timing	Associated Milestone	Target date	Point of Contact	SERO Organizational or Science Priorities
<b>Guiding Principle 1: Implement ecosystem-level planning</b>						
1a2	Develop U.S. Caribbean regional EBFM engagement strategies	Short	Draft strategy, for engaging participants and the public, approved by the Council	June 30, 2019	Caribbean Fishery Management Council	Org SFD 5 - Serve on and provide support services to the NMFS National and Regional Integrated Ecosystem Assessment Program. Org SFD 40- Engage stakeholders in the development of a Fishery Ecosystem Plan (FEP) in collaboration with the Council; specifically, develop a platform to integrate stakeholder data.
1a5	NOAA Fisheries support for Ecosystem Plan Development Teams and Ecosystem Committees (or equivalent groups) that Councils establish	Continuing	Council has established a Fishery Ecosystem Plan (FEP) team, included participation by NOAA Fisheries/SERO/SF Caribbean Branch	October 1, 2017 to establish initial plan team, but this is a continuing effort	SERO Sustainable Fisheries Division	Org SFD 40- Engage stakeholders in the development of an FEP in collaboration with the Council; specifically, develop a platform to integrate stakeholder data.
1b1	Establish Fishery Ecosystem Plan Coordinator/Analyst for U.S. Caribbean in the Southeast Regional Office	Mid	SERO Sustainable Fisheries Division has assigned an FEP Coordinator	October 1, 2017	SERO Sustainable Fisheries Division	Org SFD 40- Engage stakeholders in the development of a Fishery Ecosystem Plan (FEP) in collaboration with the Council; specifically, develop a platform to integrate stakeholder data.

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Road Map #	Road Map Action Item	Timing	Associated Milestone	Target date	Point of Contact	SERO Organizational or Science Priorities
1b3	Assist Caribbean Councils in their development of new, or revision of existing, Fishery Ecosystem Plans	Continuing	FEP is being developed for Caribbean Region, led by Council with assistance from SERO Sustainable Fisheries Division	Continuing	Caribbean Fishery Management Council, SERO Sustainable Fisheries Division	Org SFD 40- Engage stakeholders in the development of a Fishery Ecosystem Plan (FEP) in collaboration with the Council; specifically, develop a platform to integrate stakeholder data.
<b>Guiding Principle 2: Advance understand of ecosystem processes</b>						
2a4	Develop and maintain core data and information streams	Continuing		Continuing	SEFSC Fisheries Statistics Division	Org SFD 53 Coordinate fishery-dependent data collection among all sources, including states, and transition to electronic reporting. SERO Science Priority - Continue to invest in maintaining and improving the fishery-dependent data for the reef fish and snapper-grouper fisheries that are crucial inputs for stock assessments. SERO Science Priority - Characterize the species composition, age, sex, size, fecundity, genetics, and disposition of all snapper-grouper, reef fish, dolphin wahoo, and coastal migratory pelagic species that are captured in commercial and recreational fisheries and are expected to be assessed in the next 3-5 years
<b>Guiding Principle 3: Prioritize vulnerabilities and risks to ecosystems and their components</b>						

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Road Map #	Road Map Action Item	Timing	Associated Milestone	Target date	Point of Contact	SERO Organizational or Science Priorities
3b1	Ensure that factors which impact managed species are being considered	Continuing	Develop EBFM guidance document that identifies factors impacting managed species	2018	SEFSC Sustainable Fisheries Division, SERO Sustainable Fisheries Division	Org SFD 5 - Serve on and provide support services to the NMFS National and Regional Integrated Ecosystem Assessment Program.
3b3	Conduct fishing community vulnerability assessments for the U.S. Caribbean region	Short	This item is dependent upon the development of species vulnerability indices.	TBD	SERO Sustainable Fisheries Division	SERO Science Priority - Develop community level species vulnerability and catch diversity measures based upon the species diversity indices being developed. Org SFD 50 - Continued development and improvement of social indicators and community vulnerability tools for application to the social/community effects of proposed management changes
<b>Guiding Principle 4: Explore and address trade-offs within an ecosystem</b>						
4a1	Assess and bolster ecosystem and living marine resource modeling needs in the Southeast Fishery Science Center	Short-Mid	Enhance and refine data-limited assessment model toolbox	2018	SEFSC Sustainable Fisheries Division	SERO Science Priority - Develop/enhance stock assessment methods, particularly for data poor species. SERO Science Priority - Model ecosystems at spp.-complex level or even single species level (i.e., incorporating red tide into gag assessments).
<b>Guiding Principle 5: Incorporate ecosystem considerations into management advice</b>						

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Road Map #	Road Map Action Item	Timing	Associated Milestone	Target date	Point of Contact	SERO Organizational or Science Priorities
5a1	Delineate, evaluate, and explore best practices for estimating and using system-wide or aggregate group harvest limits, ecological production measures, and other ecosystem level reference points to inform management decisions	Mid	Guidance document described in 3b1 includes discussion of potential uses of aggregate harvest limits in the U.S. Caribbean region	2019	SEFSC Sustainable Fisheries Division, SERO Sustainable Fisheries Division	SERO Science Priority - Develop/enhance stock assessment methods, particularly for data poor species
5b2	Support consistent and effective implementation of the NS1 guidelines, which includes guidance on incorporating ecosystem information into stock management	Mid	Guidance document described in 3b1 will include consideration of NS1 guidelines and exceptions to those guidelines	Ongoing	SEFSC Sustainable Fisheries Division, SERO Sustainable Fisheries Division	Org SFD 6 - Serve on national expert panels to address social and/or economic issues associated with fisheries management, such as the revision of the National Guidelines on the Conduct of Economic Assessments, and the Fishing Vessel Returns Workgroup

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Road Map #	Road Map Action Item	Timing	Associated Milestone	Target date	Point of Contact	SERO Organizational or Science Priorities
5c1	Explore protocols for considering ecosystem-level information in essential fish habitat reviews, identifying ecosystem-level habitat areas of particular concern, and setting habitat conservation objectives and/or indicators	Short	The Council is scheduled to initiate its next 5-year review of essential fish habitat (EFH) information in fiscal year 2018 pending recovery from the effects of Hurricane Maria.	2019	SERO EFH Coordinator, Caribbean Fishery Management Council Habitat Staff	Org SFD 5 - Serve on and provide support services to the NMFS National and Regional Integrated Ecosystem Assessment Program
5c2	Finalize and implement National Bycatch Reduction Strategy	Short	Caribbean region component of National Bycatch reduction strategy completed	2016	SERO Sustainable Fisheries Division	Org SFD 16 - Evaluate current standardized bycatch reporting methodologies based on the SBRM final rule. Focus new standardized bycatch reporting program efforts and improvements on fisheries with bycatch across a range of species to maximize the potential of future bycatch reduction efforts
<b>Guiding Principle 6: Maintain resilient ecosystems</b>						
6a1	Evaluate and track ecosystem-level reference points to assess changes in ecosystem-level resilience	Continuing	Guidance document described in 3b1 discusses indicators of ecosystem-level status and performance	Continuing	SEFSC Sustainable Fisheries Division, SERO Sustainable Fisheries Division	Org SFD 5 - Serve on and provide support services to the NMFS National and Regional Integrated Ecosystem Assessment Program

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Road Map #	Road Map Action Item	Timing	Associated Milestone	Target date	Point of Contact	SERO Organizational or Science Priorities
6a2	Evaluate, conduct and track ecosystem goods and services valuation methods and best practices	Mid	Initial measures of community well-being for the Caribbean have been developed and need to be vetted and ground-truthed	Late 2018	SERO Sustainable Fisheries Division	SERO Science Priority - Examine the social and economic effects on fishermen, their families, and their communities of coastal development and coastal land management in the U.S. Caribbean, including, but not limited to, impacts on participation and production in the commercial, recreational, and subsistence fishing sectors
6a3	Develop best practices for tradeoff evaluation with respect to overall ecosystem and community resilience and well-being	Mid	Initial measures of community well-being for the Caribbean have been developed and need to be vetted and ground-truthed	Late 2018	SERO Sustainable Fisheries Division	SERO Science Priority - Develop community level species vulnerability and catch diversity measures based upon the species diversity indices being developed. Org SFD 50 - Continued development and improvement of social indicators and community vulnerability tools for application to the social/community effects of proposed management changes
6b1	Explore community health and well-being socio-economic metrics	Mid	Initial measures of community well-being for the Caribbean have been developed and need to be vetted and ground-truthed	Late 2018	SERO Sustainable Fisheries Division	SERO Science Priority - Evaluate the existence and magnitude of subsistence fishing in the Caribbean region. Org SFD 50 - Continued development and improvement of social indicators and community vulnerability tools for application to the social/community effects of proposed management changes

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6b2	Adopt community vulnerability analyses to a broader range of cumulative factors	Mid	Initial measures of community well-being for the Caribbean have been developed and need to be vetted and ground-truthed	Late 2018	SERO Sustainable Fisheries Division	SERO Science Priority - Develop community level species vulnerability and catch diversity measures based upon the species diversity indices being developed. Org SFD 50 - Continued development and improvement of social indicators and community vulnerability tools for application to the social/community effects of proposed management changes
6b3	Track community health, well-being and vulnerability socio-economic metrics	Mid-continual	Initial measures of community well-being for the Caribbean have been developed and need to be vetted and ground-truthed	Late 2018	SERO Sustainable Fisheries Division	SERO Science Priority - Develop community level species vulnerability and catch diversity measures based upon the species diversity indices being developed. Org SFD 50 - Continued development and improvement of social indicators and community vulnerability tools for application to the social/community effects of proposed management changes

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## **Discussion**

1a2 (Short): Development of an EBFM engagement strategy has been initiated by the Council in conjunction with the Southeast Regional Office's (SERO) Sustainable Fisheries Division and external partners. An overview of the engagement strategy was presented to the Council at their spring 2018 meeting. The initial focus of the engagement strategy will be to guide participation in development of the Fishery Ecosystem Plan (FEP) that will serve as a dynamic guidance document for EBFM in the U.S. Caribbean region. That component of the engagement strategy is scheduled for completion by June 2019, although developing and implementing the engagement strategy is an ongoing process. Providing support services to NOAA Fisheries' ecosystem assessment programs as well as development of an FEP for the Caribbean are among the organizational priorities for SERO's Sustainable Fisheries Division.

1a5 (Continuing): This is a continuing regional responsibility, led by the Council but requiring involvement from NOAA Fisheries and external partners. The Council has established an FEP development team, presently including staff from the Council, SERO's Sustainable Fisheries Division, the SEFSC, NOAA's Biogeography Branch and Coral Reef Conservation Program, the University of Puerto Rico, and the Pew Charitable Trusts. As FEP guidance is developed via a conceptual model, additional partners will be added as guided by the Council's engagement strategy. Development of an FEP for the Caribbean as addressed in 1a5, 1b1, and 1b3 is one of the organizational priorities for SERO's Sustainable Fisheries Division.

1b1 (Mid): The Council, in cooperation with SERO's Sustainable Fisheries Division, has identified an FEP Coordinator, an essential start point for development of EBFM in the U.S. Caribbean region.

1b3 (Continuing): The FEP Coordinator is leading the development of the region's FEP, which will serve as a guiding document for the development and maintenance of FMPs for each of the Puerto Rico, St. Thomas/St. John, and St. Croix sub-regions. Fishery management will be focused on the island scale, with the role of the FEP to provide hierarchical guidance at each of the island, region, and basin scales.

2a4 (Continuing): Developing and maintaining the various types of core data elements is an ongoing priority for the SEFSC Fisheries Statistics Division. In addition, coordinating fishery data collection programs among all sources is one SERO's Sustainable Fisheries Division organizational priorities.

3b1 (Continuing): To ensure that factors impacting managed species are being considered, SERO's Sustainable Fisheries Division has developed a guidance document that identifies programmatic information sources pertinent to EBFM. This a long-term priority requiring engagement of an interdisciplinary team to flesh out the factors and produce indicators (e.g., index of Sea Surface Temperature, Atlantic Meridional Oscillation). Without these time series, it is not possible to use these factors in quantitative analyses (e.g. assessments). Providing support services to NOAA Fisheries'

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ecosystem assessment programs is one of the organizational priorities for SERO's Sustainable Fisheries Division.

3b3 (Short): Accomplishment of this action item will depend upon the development of the biological species vulnerability indices that are used to create the community species vulnerability measures. Once those measures are available, a protocol similar to what has been developed in other regions will be implemented to create measures that target a community vulnerability to climate change related to species vulnerability. Development of community level species vulnerability and catch diversity measures are among SERO's science priorities. In addition, the continued development and improvement of social indicators and community vulnerability tools is an organizational priority for SERO's Sustainable Fisheries Division.

4a1 (Short-Mid): The SEFSC continues to enhance and refine data-limited assessment models, which is a science priority for SERO, but even those models will require data enhancements that may not be forthcoming in the near- or mid-term.

5a1 (Mid): The guidance document discussed in 3b1 includes a consideration of the potential application of system-wide reference points. Identification of system-wide or aggregate harvest limits will require substantial enhancements to data availability and data limited assessment models led by SEFSC staff.

5b2 (Mid): The guidance document discussed in 3b1 includes a consideration of the effective implementation of NS1 guidelines within the context of EBFM. Development and appropriate application of exceptions to standard reference points and management approaches in response to limitations on data availability will require the involvement of SEFSC staff and is an ongoing task. One of the organizational priorities of SERO's Sustainable Fisheries Division is to serve on national expert panels to address social and/or economic issues associated with fisheries management, such as revision of the National Guidelines.

5c1 (Short): The Council is scheduled to initiate its next 5-year review of essential fish habitat (EFH) information in fiscal year 2018 pending recovery from the effects of Hurricane Maria. In 2018, the Habitat Conservation Division will advise the Council habitat staff to consider ecosystem information in their EFH review. Following submission of the review, the Habitat Conservation Division will review and evaluate how the Council considered ecosystem information and will include recommendations back to the Council for considering ecosystem-level information, habitat areas of particular concern and habitat conservation objectives/indicators in future EFH updates and 5-year EFH reviews. Providing support services to NOAA Fisheries' ecosystem assessment programs, including EFH updates and reviews, is one of the organizational priorities for SERO's Sustainable Fisheries Division.

5c2 (Short): Considerations for bycatch reduction in the U.S. Caribbean region have been included in the NOAA Fisheries National Bycatch Reduction Strategy published in December 2016.

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Implementation plans are in development. In addition, new guidance on criteria to be used when evaluating standardized bycatch reporting methodology (SBRM) in FMPs was provided in a final rule published on January 19, 2017. SERO staff will be working with the Council to review the SBRMs in their FMPs. Reviewing SBRMs and making improvements to bycatch reduction and reporting methodology is one of SERO Sustainable Fisheries Division's organizational priorities.

6a1 (Continuing): Quantifying and tracking these indicators will require a multi-disciplinary team and a great deal of effort. A similar indicator approach developed for the Gulf of Mexico required over a dozen collaborators and one full time FTE to coordinate the effort and lead the drafting of the report. To maintain that document so it continues to be up-to-date also requires a considerable amount of resources and staff time. This is not a trivial undertaking and should be considered a long-term effort. Providing support services to NOAA Fisheries' ecosystem assessment programs is one of the organizational priorities for SERO's Sustainable Fisheries Division.

6a2 (Mid): Ecosystem services measures are being evaluated through the Gulf of Mexico Integrated Ecosystem Assessment and conceptual modeling, but have not been applied to the Caribbean region at this time. Additionally, there is an Ecosystem Services Valuation National Working Group led by Dan Lew that is evaluating and extending theoretical best practices tailored to the needs of NMFS. A sub-group of this working group is focused on application of current ecosystem services valuation methodologies to analysis of fisheries actions and identification of barriers to their usage (white paper expected in 1-2 years). Examining the social and economic effects on fishermen, their families, and their communities on coastal development and coastal land management in the U.S. Caribbean is a SERO science priority.

6a3 (Mid): The evaluation of tradeoffs between the overall ecosystem and community resilience and well-being are being advanced through conceptual ecosystem models being developed by the Gulf of Mexico Integrated Ecosystem Assessment Steering Committee, but have not been applied to the Caribbean region at this time. Continued development and improvement of social indicators and community vulnerability tools is one of the organizational priorities of SERO's Sustainable Fisheries Division.

6b1 (Mid): Community health and well-being socio-economic metrics are being developed for the Caribbean region at the county level and are comparable to the Community Social Vulnerability Indices that have been developed across other regions. These measures are in early development stage and will require vetting and ground-truthing. One of SERO's science priorities is the evaluation of the existence and magnitude of subsistence fishing in the Caribbean region. In addition, the continued development and improvement of social indicators and community vulnerability tools is one of the organizational priorities of SERO's Sustainable Fisheries Division.

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6b2 (Mid): Work on expanding the community vulnerability measures to a broader range of cumulative factors is planned but work on the current set of community vulnerability measures needs to be completed prior to expanding them. Development of community level species vulnerability and catch diversity measures is a SERO science priority. In addition, the continued development and improvement of social indicators and community vulnerability tools is one of the organizational priorities of SERO's Sustainable Fisheries Division.

6b3 (Mid): Community well-being measures have been developed with two comparable time frames based on the U.S. Census American Community Survey data for most regions. Analysis will be completed in latter 2018. The Caribbean community well-being measures will be tracked through time once vetting and ground-truthing of current measures has been conducted. Development of community level species vulnerability and catch diversity measures is a SERO science priority. In addition, the continued development and improvement of social indicators and community vulnerability tools is one of the organizational priorities of SERO's Sustainable Fisheries Division.