Review of Standard Bycatch Reporting Methodologies for the U.S. Caribbean

1. Background

The National Marine Fisheries Service (NMFS), including the Southeast Regional Office (SERO) and Southeast Fisheries Science Center (SEFSC), is responsible for the conservation, management, and protection of marine resources and their habitat in the Exclusive Economic Zone (EEZ) of the southeastern United States. NMFS works cooperatively with the Caribbean Fishery Management Council (Caribbean Council [Puerto Rico, St. Thomas and St. John, St. Croix]), South Atlantic Fishery Management Council (South Atlantic Council [from North Carolina to eastern Florida including the Atlantic side of the Florida Keys]), and Gulf of Mexico Fishery Management Council (Gulf Council [from Texas to western Florida]), to accomplish regional fisheries management goals. In combination, the Councils and NMFS currently have 15 different fishery management plans (FMP), many of which manage diverse species complexes such as reef fish or corals as a unit. Two of the FMPs are jointly managed by the South Atlantic Council and Gulf Council. On September 22, 2020, NMFS approved the Comprehensive FMP for the Puerto Rico EEZ (Puerto Rico FMP; Caribbean Fishery Management Council [CFMC] 2019a), the Comprehensive FMP for the St. Thomas and St. John EEZ (St. Thomas/St. John FMP; CFMC 2019b), and the Comprehensive FMP for the St. Croix EEZ (St. Croix FMP; CFMC 2019c) (collectively “island-based FMPs”). The island-based FMPs have been approved by the Secretary of Commerce and will replace four U.S. Caribbean-wide FMPs (Reef Fish, Spiny Lobster, Queen Conch, Corals and Reef Associated Plants and Invertebrates). Rulemaking is currently being developed to implement the island-based FMPs.

1.1 What is bycatch and how is it recorded/monitored by NMFS?

Under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), bycatch is defined as fish that are harvested in a fishery, but are not sold or kept for personal use. Bycatch includes economic discards of fish that are caught but discarded because of low market value due to size, sex, or quality, or for other economic reasons. Bycatch also includes regulatory discards, which are fish that are discarded because regulations do not allow fishermen to retain the fish. For example, bycatch can result from prohibitions intended to reduce or eliminate directed fishing pressure on vulnerable stocks or species. In other cases, bycatch results from regulations such as size limits designed to protect spawning individuals or those that have not yet had a chance to grow to marketable size and/or spawn. For protected species, bycatch is a type of “take,” which can include capturing, collecting, harming, harassing, hunting, killing, pursuing, shooting, trapping, or wounding any species protected by the Marine Mammal Protection Act (MMPA) or the Endangered Species Act (ESA), or attempting to engage in any such conduct. While “take” is generally prohibited for protected species under the MMPA and ESA, prohibitions on take may be exempted in some circumstances so that fishing can continue, so long as conservation objectives are still met.
The Magnuson-Stevens Act (MSA), Section 303(a)(11), states that FMPs shall: “Establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority—(A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided.” With regard to minimizing bycatch and bycatch mortality, NMFS’s guidelines on National Standard 9 (MSA 301(a)(9)) at 50 CFR 600.350 states: “A review and, where necessary, improvement of data collection methods, data sources, and applications of data must be initiated for each fishery to determine the amount, type, disposition, and other characteristics of bycatch and bycatch mortality in each fishery for purposes of this standard and of section 303(a)(11) and (12) of the Magnuson-Stevens Act.”

Thus, FMPs developed by the Councils and NMFS must include a standardized methodology to collect, record, and report to NMFS data on bycatch in each fishery. The standardized methodology allows NMFS to assess the amount and type of bycatch occurring in the fishery. The methodology should include required processes for collecting, recording, and reporting data on bycatch, should be standardized for each fishery, and must be designed and operated within available funding levels. The most appropriate methods depend on the conservation and management objectives of the fishery, the data uncertainty associated with the standardized bycatch reporting methodology (SBRM), and feasibility and cost of collecting the data.

The SBRM final rule, which was effective February 21, 2017 (82 FR 6317, January 19, 2017), defines “standardized reporting methodology” as “an established procedure or procedures used to collect, record, and report bycatch data in a fishery, which may vary from one fishery to another.” See 50 CFR 600.1605(a). As long as the bycatch reporting methodology is consistent for all the participants in that fishery (or sector of said fishery), then the methodology would be considered to be “standardized.” The purpose of this document is to review SBRMs that are currently in place for fisheries in the Caribbean Council’s jurisdiction according to the criteria established in the SBRM final rule.

### SBRM Review Criteria

| 1. Bycatch characteristics |
| 2. Feasibility of methodology (cost, technical, operational) |
| 3. Data uncertainty |
| 4. Data use for assessing amount and type |

### 1.2 Criteria for Reviewing SBRMs

The SBRM final rule specified national requirements and guidance for establishing and reviewing SBRMs (82 FR 6317, January 19, 2017). The rule requires that a FMP identify the required standardized procedure or procedures used to collect, record, and report bycatch data in a consistent manner for a fishery. The final rule also requires that a Council and NMFS analyze the following when establishing or reviewing SBRMs: (1) the characteristics of the bycatch occurring in the fishery, (2) the feasibility of the methodology from cost, technical, and operational perspectives, (3) the uncertainty of the data resulting from the methodology, and (4) how the data resulting from the methodology are used to assess the amount and type of bycatch occurring in the fishery. Recognizing that there may be a need to adjust how a SBRM is
implemented, this rule also directs Councils to consider how the implementation of a SBRM may be adjusted while still meeting its purpose and suggests that a Council should provide guidance to NMFS on how to adjust the implementation of the SBRM consistent with the FMP.

All FMPs must be consistent with this final rule by conducting a review of the existing FMPs within five years of its effective date, or by February 21, 2022. After the initial review of SBRMs for consistency with this rule, Councils should conduct a review, in consultation with NMFS, of their existing standardized reporting methodologies at least every five years. The review should provide information to determine whether or not a FMP needs to be amended. The SBRM final rule applies only to the Magnuson-Stevens Act definition of fish bycatch. This definition encompasses species of fish, sea turtles, and coral. Species such as marine mammals and sea birds are not considered fish and will not be addressed in this review.

Characteristics of the bycatch occurring in the fishery

When evaluating a SBRM, the final rule indicates that a Council must consider information about the characteristics of bycatch in the fishery when available, including, but not limited to, the amount of bycatch occurring in the fishery, the importance of bycatch in estimating the fishing mortality of fish stocks, and the effect of bycatch on ecosystems. In concert, these considerations will design the most appropriate reporting methodology (i.e., SBRM) for a specific fishery or fishery sector. The amount of bycatch may vary from one fishery or fishery sector to another and depend on how the fishery operates, including fleet size, gear types used, gear selectivity, fishing effort, fishing location, and market conditions. The importance of bycatch in estimating the fishing mortality will depend on the amount of bycatch occurring in the fishery and the level of uncertainty associated with those bycatch data. For example, if bycatch represents a very small fraction of total fishing mortality estimates, it may be less important if there is a lot of uncertainty around the bycatch data than if the bycatch is a substantial portion of fishing mortality. Information about the effect of bycatch on the ecosystem could also affect the choices that a Council makes about establishing or amending its SBRM. The rule also recognizes that other factors may be relevant to establishing a standardized reporting methodology including the overall magnitude and/or economic impact of the fishery. This means that when establishing or reviewing an SBRM, it may be appropriate to consider the value of a fishery to a community and how the uncertainty associated with the bycatch data and the use of the bycatch data in developing conservation and management measures could affect decisions that impact that value.

Feasibility of the SBRM methodology

The final rule requires that a SBRM be feasible from cost, technical, and operational perspectives. Data collection, reporting, and recording procedures can be expensive and be logistically challenging to design and implement. The rule indicates that it is reasonable and appropriate for a Council to analyze issues of feasibility when considering or reviewing a SBRM and to ultimately choose a methodology that is feasible (i.e., capable of being implemented) from cost, technical, and operational perspectives. As a Council is designing a SBRM, there may be some predictable feasibility constraints that can be reasonably expected to arise on a periodic basis that may require adjustment of the implementation of the established SBRM, but that over time does not undermine the SBRM described in the FMP. For example, the level of funding for observer coverage may vary from year to year and a Council may need to consider approaches
for prioritizing resources in the case of a funding shortfall. Thus, there may be some predictable feasibility constraints that can be reasonably expected to arise on a periodic basis that may require adjustment of the implementation of the established SBRM, but that over time does not undermine the SBRM described in the FMP.

Data uncertainty resulting from the SBRM methodology

The final rule requires that a SBRM be designed so that the uncertainty associated with the resulting bycatch data can be described, quantitatively or qualitatively. The rule recognizes that different degrees of data uncertainty may be appropriate for different fisheries. Understanding the uncertainty of the bycatch data will assist Councils in developing conservation management measures that, to the extent practicable minimize bycatch, and minimize the mortality of bycatch. For example, a Council may choose to adopt measures that are more conservation-based in instances where bycatch data are a large component of fishing mortality and are highly uncertain.

How data are used to assess amount and type of bycatch

The SBRM final rule requires a Council to consider how the data resulting from a SBRM are used to assess the amount and type of bycatch occurring in the fishery. The SBRM final rule clarifies that bycatch assessment procedures are not part of a standardized reporting methodology; however, a Council does need to describe the procedure or procedures used to assess the amount and type of bycatch as a part of the standardized reporting methodology identified in a FMP. The SBRM proposed rule (81 FR 9413, February 25, 2016) indicates that there are several steps leading to the development of conservation and management measures to minimize bycatch and bycatch mortality to the extent practicable. First, bycatch data are collected, recorded, and reported pursuant to a SBRM. Second, bycatch data from a SBRM, as well as other information about the fishery, are used to assess (i.e., evaluate or estimate) the amount and type of bycatch in a fishery. Third, bycatch assessments, evaluations, or estimates are used, sometimes in conjunction with the stock assessment process, to inform Councils as they develop conservation and management measures to minimize bycatch and bycatch mortality to the extent practicable. The final rule indicates that activities to collect, record, and report bycatch data in a fishery are connected to, but distinct from, the methods used to assess bycatch and the development of measures to minimize bycatch or bycatch mortality. This distinction will help clarify the key policy choices and objectives associated with establishing a reporting methodology, and not confuse those choices with statistical and technical approaches for estimating bycatch that are inherently scientific and data dependent, with the policy choices associated with developing measures to minimize bycatch.

Although bycatch assessment is not part of the standardized reporting methodology, bycatch assessment must be considered. The final rule states that a Council must consult with its Scientific and Statistical Committee (SSC) and the regional NMFS science center, as appropriate, on reporting methodology design considerations such as data elements, sampling designs, sample sizes, and reporting frequency. Information provided through the consultation process will enable a Council to develop a standardized reporting methodology that incorporates scientific input and that will provide data that can be used to assess the amount and type of bycatch occurring in the fishery. In the design of a SBRM, the Council should also consider the scientific methods and techniques available to collect, record, and report bycatch data that could improve the quality of bycatch estimates.
1.3 Overview of Bycatch Reporting

The U.S. Caribbean region contains predominantly multi-species fisheries, with relatively high commercial and recreational fishing pressure. Commonly used gear types in the U.S. Caribbean commercial and recreational fishing sectors include handlines, traps, and spear. Anecdotal information suggested that the vast majority of fish harvested in the U.S. Caribbean are retained for the market or for personal use – including species with low market value. Additionally, gear types that are noted for producing large amounts of bycatch (e.g., trawling) are essentially absent from the U.S. Caribbean fisheries. With the exception of species that are commonly believed to be ciguatoxic, economic discards in this region appear to be minimal. What little bycatch occurs is generally confined to regulatory discards.

2. Island-based FMPs

2.1 Standardized Bycatch Reporting Requirement

Standardized bycatch reporting requirements were specified in the Caribbean Sustainable Fisheries Act Amendment (CFMC 2005) and those requirements were restated and incorporated in the island-based FMPs. The island-based FMPs, which were developed by the Caribbean Council and reviewed by their SSC, were approved by the Secretary of Commerce on September 22, 2020. The SBRM components included in the island-based FMPs are: (1) the proposed development of a federal permit system for commercial and charter boat fishermen participating in Caribbean Council-managed fisheries, with an associated mandatory monthly reporting requirement; (2) utilization of the Marine Recreational Fisheries Statistics Survey (MRFSS)/Marine Recreational Information Program (MRIP) to provide bycatch information for the recreational sector from Puerto Rico and the USVI; and (3) consultation with Puerto Rico in an effort to modify the commercial trip ticket system currently in place to require standardized collection of bycatch data.

Proposed development of a federal permit system for commercial and charter boat fishermen participating in Caribbean Council-managed fisheries, with an associated mandatory monthly reporting requirement

Under this component of the SBRM, permits would be issued to commercial and charter vessels to allow them to fish for queen conch (where allowed), spiny lobster, reef fish, and pelagic fish as managed under the island-based FMPs in federal waters off Puerto Rico and the USVI. Submission of monthly catch logbooks to the SEFSC would be required to renew a permit, similar to what is currently required for federally-managed fisheries in the South Atlantic and Gulf of Mexico (Gulf). Initially, there would be no specific eligibility criteria required, so as to encourage issuance of permits to all vessels fishing in the EEZ. The federal permit system for the U.S. Caribbean would be administered by NMFS SERO. The procedures for the application and permitting process for the South Atlantic and Gulf fisheries can be found in the Code of Federal Regulations (CFR) at, 50 CFR Section 622.4 and on the SERO Web site at

---

1 Trip ticket system is a broader term for the program in place that is responsible for the collection of commercial data and includes the commercial catch report forms submitted by commercial fishermen as well as any field sampling efforts conducted to verify the commercial landings.
Most federal permits are issued on the month of incorporation, or birth month of the individual, which spreads the permitting administrative workload throughout the calendar year. Implementation of a federal permit allows for the requirement of separate catch reporting. Without a federal permit to identify and locate participating vessels, logbooks cannot easily be distributed. Federal permit holders would have to maintain a logbook to record their fishing activity. Logbook format and data reporting methods would be determined when an action requiring a federal permits comes to NMFS for approval and implementation. However, any permit-specific requirements would be in addition to the following basic requirements. The permit holder must report catch, effort, and discards by species, location, time, and other factors as specified by the Caribbean Council; report protected species observations; report any lost gear or damage to coral reef habitat; complete a daily logbook within a specified time limit after completion of the fishing day; and submit reports within 30 days of returning to port. Reports would most likely be transmitted to the SEFSC for data management.

Utilization of MRFSS/MRIP database to provide additional bycatch information on the recreational sector

This component of the SBRM would provide fishery managers a means to monitor the bycatch of individual recreational fishermen in Puerto Rico and the USVI. MRIP, and its precursor MRFSS, is a state-regional-federal partnership that develops, improves, and implements a national network of surveys to measure total recreational fishing effort and catch of finfish species. MRFSS/MRIP surveys do not collect information on invertebrates. Through these surveys, fishermen report the number of recreational fishing trips taken and the number of fish caught to NMFS and state and regional partners. The estimates of recreational catch would then be used to assess and maintain sustainable stocks.

In Puerto Rico, implementation of MRFSS occurred in late 1999, funded in part by the U.S. Fish and Wildlife Service’s Sportfish Restoration Program. Field work began in 2000, staffed by employees of Puerto Rico’s Department of Natural and Environmental Resources (DNER). Shortly thereafter, a consulting company was contracted to increase the number of interviewers. Since 2013, contractors have been hired by NMFS to conduct recreational data collection, and the MRFSS program evolved into MRIP. The MRIP revised dockside survey approach implemented many changes and improvements to the Puerto Rico recreational data collection program that were designed to remove potential biases from the previous design. At the same time, a contract was established to extend the Atlantic Access Point Angler Intercept Survey to Puerto Rico and to maintain a staff of 15, including one on-island field supervisor who managed the field staff while also ensuring program quality. Data collection by MRIP in Puerto Rico ceased in 2017 due to the impacts of Hurricane Maria and has not resumed to date. Bycatch information for recreationally caught finfish species in Puerto Rico is available from those historical MRFSS/MRIP surveys (2000-2017).

Initial federal attempts to collect recreational catch and effort data in the USVI were made from 1979 to 1981. However, that effort was discontinued in 1982 due to a lack of sufficient funds. In 1999, NMFS and the USVI Department of Planning and Natural Resources (DPNR) reinitiated efforts to collect recreational fisheries data. Data collection occurred in 2000, but was
again discontinued in 2001 due to difficulties with managing the program, hiring competent staff, and retaining those staff.

A Regional Implementation Plan for MRIP in the U.S. Caribbean was developed in 2017 by a team of individuals from NMFS, DNER, DPNR, National Ocean Service, Gulf States Marine Fisheries Commission (https://www.fisheries.noaa.gov/resource/document/mrip-regional-implementation-plan-us-caribbean-2017). Currently the Caribbean Regional Implementation Team is working to update the 2017 plan, and to reestablish MRIP in Puerto Rico and establish the program in the USVI. The greatest challenge to a successful recreational data collection program in the U.S. Caribbean region has been the lack of a governance structure that effectively supports and manages human resources, that ensures data are collected according to predefined sampling timelines and locations, and that provides quality data management and delivery. The team is currently working on the governance options for collecting recreational data through a current fishery information network (FIN) or through a new Caribbean-specific FIN. Once a U.S. Caribbean MRIP governance structure is established, steps will be taken to design and implement MRIP in the USVI. Further, the existing Puerto Rico MRIP, which ceased sampling in 2017 due damage to infrastructure from Hurricane Maria will be revised as appropriate to resolve issues with the type, quality, and consistency of data being collected. Once MRIP is reconstituted in the U.S. Caribbean, bycatch data will be collected by the program as required by the SBRM provided in the island-based FMPs. That bycatch data would likely include information on all species caught by recreational fishermen, including invertebrate species as appropriate, which will allow for the assessment of the amount and type of recreational bycatch for Puerto Rico and the USVI. Until such a time that MRIP is operational in the U.S. Caribbean region, this component of the SBRM would only allow for a historical look at bycatch of recreationally caught finfish off Puerto Rico.

Consult with Puerto Rico in an effort to modify the commercial trip ticket system currently in place to require standardized collection of bycatch data

This SBRM would achieve standardized bycatch data reporting in Puerto Rico through the current trip ticket system, which is managed at the state level. In the USVI, commercial data collection started in 1974. While fisheries data have been collected for the commercial sector since 1967 in Puerto Rico through voluntary reports by fishers, it was not until 2005 that reporting became mandatory. Monthly commercial catch reporting is mandatory in both Puerto Rico and the USVI. Fishermen report landings in Puerto Rico and the USVI to the Puerto Rico DNER and the USVI DPNR, respectively. Information collected varies by area, and only the USVI currently includes a field for fishers to report bycatch in a standardized way. This component of the SBRM would allow for standardized collection of bycatch in both Puerto Rico and the USVI.

Landings data for the USVI fisheries are mailed or delivered to the DPNR on a monthly basis. DPNR requires that all reports for a 12-month period (July to June) be submitted before renewing a commercial fishing license.

Monthly landings data for Puerto Rico are collected from fishermen, fish buyers, and fishing associations by DNER port agents (four at the moment) and the program's principal investigator.
The Puerto Rico trip ticket system was established in 2003. A trip ticket has to be submitted for each trip. Data fields on Puerto Rico's commercial catch report form include fishing (landing) date; if landings are reported by the fisherman or by a fish house; name(s) of fisherman and/or helper; fishing license number(s); vessel registration number; municipality where landings occurred; fishing center (landing area); gear type (amount or size of gear type); soak time (for traps/pots); fishing effort (hours fishing); weight in pounds by species or taxonomic family; market value; depth; fishing area (grid map), and if fishing occurred less than or greater than nine miles from shore. Catch report forms use numeric codes for common names and species identification.

Unlike the USVI forms, the commercial catch report form in Puerto Rico does not currently collect information on discards. However, forms used before 2012 included fields for describing the disposition and amount of discarded fish and/or lobster (e.g., discarded alive, discarded dead, and “other”). In the USVI, commercial catch report forms include fields to indicate the amount of discarded fish and/or invertebrates (e.g., queen conch, lobster). However, the USVI commercial catch report forms do not request additional information about the disposition of the discards (e.g. discarded dead or discarded alive, etc.) The USVI commercial catch report forms include fields for commercial fishermen to enter discard data by species and by gear type, thus allowing the collection of species-specific and gear-specific bycatch information. The collection of bycatch information for purposes of the SBRM may benefit from the inclusion of more specific fields on the commercial catch report forms in the USVI as described above, and from including fields for bycatch information on the Puerto Rico commercial catch report form.

2.2 Characteristics of Bycatch

2.2.1 Amount and Type of Bycatch

Species managed by the Caribbean Council in the island-based FMPs include coral reef resources (coral, sea cucumbers, sea urchins), queen conch, spiny lobster, and finfish species (reef fish and pelagic fish in all island areas, and rays in Puerto Rico). There is no harvest allowed for any species of coral (e.g., stony corals, octocorals, black corals), sea cucumbers, or sea urchins in or from the EEZ off Puerto Rico, St. Thomas and St. John, and St. Croix. Gear types typically used to harvest these species include diving (i.e., hand collection) and trawls. Trawls are not an authorized gear type for U.S. Caribbean fisheries in federal waters and fishermen fishing by hand collection are highly selective in species they target. While sea cucumbers and sea urchins could crawl onto or in trap gear, they are not likely to be trapped inside. Thus, no bycatch is expected for these species in the respective management areas.

In the U.S. Caribbean fisheries, queen conch are harvested by hand. No discards of queen conch have been observed in U.S. Caribbean fisheries using hook and line and trap gear types (Southeast Data Assessment and Review [SEDAR] 14 2007). Harvest of queen conch is prohibited in the EEZ off Puerto Rico and St. Thomas and St. John, and bycatch is not expected from other fisheries. Regulatory discards of queen conch in the EEZ off St. Croix could occur as there are minimum sizes, commercial trip limits and recreational bag limits, and area prohibitions in federal waters, as well as the potential for fishing season reductions pursuant to an accountability measure. Despite regulations that prohibit the removal of the shell underwater,
circumventing this regulation is not uncommon. Economic discards are not expected to be common, since queen conch meat is sold by the pound (aggregate), and illegal harvest of undersized queen conch may be occurring. Mortality associated with discarded queen conch is expected to be small as the species does not experience barotrauma or damage by fishing gear. Data on recreational landings are not available for St. Croix, where harvest of queen conch in federal waters is allowed seasonally, and so any information on bycatch of queen conch during recreational fishing activities is sparse for queen conch. As with commercial fishing for queen conch in St. Croix, regulatory discards are possible. Little to no bycatch of queen conch is expected in other recreational fisheries because hook and line gear is used and is unlikely to capture queen conch.

Regulatory discards of spiny lobster could occur in the EEZ off Puerto Rico, St. Thomas and St. John, and St. Croix as there are minimum sizes and prohibitions on the harvest of berried females. Regulatory discards also could occur during any fishing season closure implemented under the accountability measures. Economic discards may also occur due to market preference. Only commercial catch report forms in the USVI allow for reporting bycatch information. The current Puerto Rico commercial catch report forms do not solicit bycatch information, but previous iterations of the forms did. Spiny lobster bycatch mortality may be low, at least in the USVI, where spiny lobster discards are returned to the seabed in the traps, thus reducing predation risk (MRAG 2006). Spiny lobster bycatch in the U.S. Caribbean was deemed negligible in the SEDAR 57 spiny lobster stock assessments due to the fishing gear and methods predominantly used to harvest spiny lobster (i.e., traps and diving) (SEDAR 57 2019). Spiny lobster bycatch is not expected from hook and line or diving. Recreational data are not available in the USVI or for invertebrate species in Puerto Rico and so any information on bycatch of spiny lobster during recreational fishing activities is sparse. As with commercial fishing for spiny lobster, regulatory discards are possible. Little, if any, bycatch is expected in other recreational fisheries because hook and line gear is used is unlikely to capture spiny lobster.

Reasons for discard of spiny lobster:
1) Smaller than legal size
2) Egg bearing females
3) Smaller than legal size, with eggs

The SEDAR 57 (2019) assessment for spiny lobster relied on commercial and recreational data through 2016. For Puerto Rico, discard data were reported during 2012-2013, with only 23 spiny lobsters from 12 trips reported as discarded dead. For St. Thomas and St. John, discard data were reported during July 2011 to December 2016, with a total of 202 spiny lobster from 51 trips reported as discarded dead during July 2011 to December 2015. No dead discards of spiny lobster were reported for St. Thomas and St. John in 2016. For St. Croix, discard data were collected during July 2011 to December 2016, with a total of 27 spiny lobster from 5 trips reported as discarded dead during 2012 to 2014. No dead discards of spiny lobster were reported for St. Croix during 2011, 2015, or 2016.

Regulatory discards of finfish species in Puerto Rico, St. Croix, and St. Thomas and St. John could occur as there are minimum sizes for certain reef fish, accountability measures that could result in fishing season closures to prevent exceedances of catch limits, and seasonal and area
closures. Economic discards for non-marketable species can also occur. However, anecdotal information suggests that there is very little economic bycatch, as most of the catch is used for personal consumption or use.

Reasons for discard of finfish bycatch (MRAG 2006a, 2006b; Olsen and Hill 2013)

1) Risk of ciguatera – examples include jacks, some bigger snappers, goatfish, mackerel, barracuda
   - Some of the ciguatera risk species are used to bait traps (*Lutjanus*, Priacanthidae)
   - More evident in seine nets, followed by fish traps, hand line, and lastly lobster traps (for the USVI)
2) Smaller than market size (e.g., surgeonfish, triggerfish, porgies, jacks, and coney, rock hind, graysby, and red hind groupers)
   - Seen more in fish traps, followed by hand line; less in lobster traps and seine nets (in the USVI)
3) Non-marketable species (e.g., filefish, flounder, butterflyfish, angelfish)
   - This also includes species damaged by predation
   - Not much variation among gear types
4) Difficulties in the market place (market filled with a particular species [fish discarded at sea])
5) Used as bait (it comprises an insignificant element of the bycatch at least in St. Thomas fisheries [MRAG 2006b])
6) Dead in traps
7) Regulatory discards
8) Non-targeted species

Bycatch information is available from MRFSS/MRIP surveys for recreationally caught finfish off Puerto Rico during 2000 to 2017. Recreational data collection in Puerto Rico ceased in 2017 due to the impacts of Hurricane Maria and has not resumed to date, although efforts are underway to reestablish MRIP surveys in the U.S. Caribbean. Table 1 illustrates recreational discards from those surveys during 2016 and 2017. In 2016, recreational discards were dominated by “Other Fishes” followed by barracuda. In 2017, recreational discards were dominated by lane snapper and “Other Fishes.”

**Table 1.** Recreational discards of species reported to the MRIP program off Puerto Rico during 2016 and 2017. PSE refers to the percent standard error. Values greater than 50% are very imprecise.

<table>
<thead>
<tr>
<th>Species</th>
<th>Released Alive 2016</th>
<th>PSE 2016</th>
<th>Released Alive 2017</th>
<th>PSE 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barracudas</td>
<td>40,570</td>
<td>38.8</td>
<td>2,459</td>
<td>78</td>
</tr>
<tr>
<td>Other Sharks</td>
<td>2,341</td>
<td>79.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Skates/Rays</td>
<td>0</td>
<td>0</td>
<td>248</td>
<td>94.2</td>
</tr>
<tr>
<td>Dolphins</td>
<td>6,299</td>
<td>61.4</td>
<td>2,969</td>
<td>96</td>
</tr>
<tr>
<td>Atlantic Croaker</td>
<td>2,422</td>
<td>102.5</td>
<td>309</td>
<td>102</td>
</tr>
<tr>
<td>Other Drum</td>
<td>15,660</td>
<td>80.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Eels</td>
<td>9,924</td>
<td>78.2</td>
<td>514</td>
<td>80</td>
</tr>
<tr>
<td>Other Grunts</td>
<td>146</td>
<td>93.2</td>
<td>6,129</td>
<td>97.6</td>
</tr>
</tbody>
</table>
Recreational catch data of finfish species were collected in the USVI during 1979-1981 and 2000, but were discontinued due to logistical problems. As such, bycatch information for recreational fishing is not currently available for the USVI. Once MRIP surveys are reconstituted in the U.S. Caribbean, bycatch data will be collected by the program as required by the SBRM provided in the island-based FMPs. Those bycatch data would likely include information on all species targeted by recreational fishermen, including invertebrate species like queen conch and spiny lobster.

The trip ticket systems for Puerto Rico and the USVI have also provided bycatch information on commercial catch for finfish. As noted previously, bycatch information for the trip ticket system was used in the SEDAR 57 stock assessments for spiny lobster. A previous stock assessment for red hind found that although discards may occur for Puerto Rico and USVI commercial fisheries, and were reported, there has been no available method for estimating the extent of those discards (SEDAR 35 2014). It is expected that with the implementation of SBRMs for a federal permit system with a logbook requirement as well as reconstituting the MRIP program that these data should become available for future stock assessments. A study in the USVI to measure bycatch in the St. Thomas and St. Croix commercial fisheries was conducted by MRAG Americas, Inc. (MRAG) in 2005-2006, which found that considerable numbers of finfish were being discarded. Reasons for discarding catch included species with a high risk of ciguatera, unmarketable sized finfish (usually fish that were considered to be too

<table>
<thead>
<tr>
<th>Species</th>
<th>Released Alive 2016</th>
<th>PSE 2016</th>
<th>Released Alive 2017</th>
<th>PSE 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Grunt</td>
<td>8,899</td>
<td>59</td>
<td>165</td>
<td>81.9</td>
</tr>
<tr>
<td>Herrings</td>
<td>7,058</td>
<td>63.9</td>
<td>17,101</td>
<td>94.5</td>
</tr>
<tr>
<td>Blue Runner</td>
<td>12,823</td>
<td>73.9</td>
<td>596</td>
<td>62.4</td>
</tr>
<tr>
<td>Crevalle Jack</td>
<td>36,278</td>
<td>59.9</td>
<td>428</td>
<td>88.8</td>
</tr>
<tr>
<td>Greater Amberjack</td>
<td>597</td>
<td>93.2</td>
<td>80</td>
<td>108.9</td>
</tr>
<tr>
<td>Other Jacks</td>
<td>25,237</td>
<td>46.2</td>
<td>2,679</td>
<td>54.3</td>
</tr>
<tr>
<td>Other Fishes</td>
<td>55,140</td>
<td>28.8</td>
<td>34,777</td>
<td>33.3</td>
</tr>
<tr>
<td>Other Porgies</td>
<td>0</td>
<td>0</td>
<td>57</td>
<td>108.9</td>
</tr>
<tr>
<td>Puffers</td>
<td>1,765</td>
<td>85.7</td>
<td>29</td>
<td>109</td>
</tr>
<tr>
<td><em>Epinephelus</em> Groupers</td>
<td>35,414</td>
<td>42.5</td>
<td>5,433</td>
<td>55.2</td>
</tr>
<tr>
<td>Other Sea Basses</td>
<td>16,002</td>
<td>72</td>
<td>1,801</td>
<td>97.8</td>
</tr>
<tr>
<td>Lane Snapper</td>
<td>32,394</td>
<td>31.8</td>
<td>65,095</td>
<td>72</td>
</tr>
<tr>
<td>Other Snappers</td>
<td>8,082</td>
<td>57.6</td>
<td>10,035</td>
<td>51.2</td>
</tr>
<tr>
<td>Red Snapper</td>
<td>0</td>
<td>0</td>
<td>160</td>
<td>109</td>
</tr>
<tr>
<td>Vermilion Snapper</td>
<td>0</td>
<td>0</td>
<td>182</td>
<td>102</td>
</tr>
<tr>
<td>Yellowtail Snapper</td>
<td>31,466</td>
<td>38.6</td>
<td>18,586</td>
<td>38</td>
</tr>
<tr>
<td>Triggerfishes/Filefishes</td>
<td>2,229</td>
<td>96.7</td>
<td>293</td>
<td>80</td>
</tr>
<tr>
<td>King Mackerel</td>
<td>208</td>
<td>102.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Little Tunny/Atlantic Bonito</td>
<td>1,304</td>
<td>84.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other Tunas/Mackerels</td>
<td>909</td>
<td>67.9</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


small), and non-marketable species. The study suggested that, at least for St. Thomas, there may be a high compliance with minimum size regulations for reef fish (MRAG 2006b).

Commercial and recreational discard information from these sources are being considered in the SEDAR 80 operational stock assessment for queen triggerfish, which is currently underway.

2.2.2 Importance of Bycatch in Estimating Fishing Mortality / Effect of Bycatch on Ecosystems

The ecological effects of bycatch mortality are the same as fishing mortality from directed fishing efforts. If not properly managed and accounted for, either form of mortality could potentially reduce stock biomass to an unsustainable level. Release mortality rates for fish species managed by the Caribbean Council are widely variable by species and fishing sector, and are dependent on fishing mode. Release mortality rates are expected to be very low or negligible for corals, queen conch, and spiny lobster. Generally, release mortality is highly correlated with depth for reef fish species with highest mortality associated with the deepest depth of capture (Campbell et al. 2014; Pulver 2017; Rudershausen et al. 2014; Stephen and Harris 2010; Wilson and Burns 1996). Many species can be captured over a broad depth range or transition to different depth zones throughout their life history so release mortality rates can be highly variable. Recent SEDAR assessments include estimates of release mortality rates based on published studies and industry input. Stock assessment reports can be found at http://sedarweb.org/.

2.3 Feasibility of the SBRM

Currently, the only collection of bycatch information in Puerto Rico and the USVI for the commercial sector consists of reporting through the current trip ticket systems, which are managed at the state level. In the USVI, commercial catch report forms currently include a bycatch field for collection of bycatch data, but the current Puerto Rico commercial catch report form does not. However, the previous Puerto Rico commercial catch report form allowed for the inclusion of bycatch information. It is feasible to start collecting bycatch information again for Puerto Rico and NMFS will request that the commercial catch report form be updated to do so. In addition, NMFS will request that additional bycatch information (e.g., the disposition of the discards) be requested on the USVI commercial catch report forms. At least in Puerto Rico, there is very little economic bycatch as most of the catch is used (e.g., sold or retained for personal consumption), when otherwise lawful.

Another component of the SBRM for the commercial sector is to establish federal commercial and charter vessel permits that require logbooks that include a discard component. An amendment to the island-based FMPs is needed to establish a federal permit system in the U.S. Caribbean. Commercial and for-hire logbooks associated with federal permits are required for certain fisheries in the South Atlantic and Gulf, and those permit programs and logbooks include a component to collect discard information.
The component of the SBRM for the recreational sector consists of utilizing bycatch information collected from MRFSS/MRIP surveys. This SBRM was in use in Puerto Rico until 2017; however, sampling ceased following Hurricane Maria. MRFSS/MRIP surveys were attempted in the USVI, but were discontinued due to logistical problems. Once MRIP surveys are reconstituted in the U.S. Caribbean, bycatch data will be collected by the program for Puerto Rico and the USVI, as required by the SBRM provided in the island-based FMPs.

The SBRMs in the island-based FMPs are feasible from a cost, operational, and technical standpoint. Since commercial catch report forms have previously been used (Puerto Rico) or are currently being used (USVI) to obtain bycatch data from the commercial sector, modifying the commercial catch report forms to include bycatch information fields (e.g., number and disposition of bycatch by species and gear type used on the Puerto Rico form and disposition of bycatch on the USVI forms) should require little effort or resources from NMFS and the state agencies, and would fulfill the SBRM to obtain standardized bycatch data. For the SBRM to develop a federal permit system for commercial and charter vessels, logbooks have been effectively used in federally-managed fisheries in the South Atlantic and Gulf. Although resources would be needed to establish such a system in the U.S. Caribbean, the benefits associated with the data collected would outweigh the costs and would provide managers with an additional tool to ensure that stocks are being sustainably managed. Finally, MRIP catch and effort surveys have been used throughout the United States, including the U.S. Caribbean, to obtain estimates of recreationally discarded finfish species. Efforts are underway to reconstitute MRIP surveys in Puerto Rico, and initiate them in the USVI. Though the specifics of what that reconstituted MRIP in the U.S. Caribbean will entail are still being developed, the operating costs would be expected to be similar to those previously expended, but by revising the catch and effort surveys to reflect current fishery characteristics, the resultant data generated would be better suited to the management needs of the region (e.g., include catch information of invertebrate species like spiny lobster). Because aspects of these SBRMs included in the island-based FMPs have been used before in the U.S. Caribbean and elsewhere in the Southeast region, the SBRMs as described are feasible from a cost, operational, and technical standpoint.

2.4 Data Uncertainty Resulting from the SBRM

Commercial fishery landings data for Puerto Rico and the USVI are available from self-reported fisher logbooks. Quantifying the amount of uncertainty in the commercial landings, including any bycatch information reported, from self-reported logbooks is difficult to determine without a process in place to verify the landings. Changes in data uncertainty through the modification of the commercial catch report forms (e.g., add fields to report the number and disposition of bycatch by species and gear) would similarly be difficult to determine. Research recommendations from SEDAR processes for improving bycatch information collected include: obtain species-specific estimates of discards from the commercial sector in Puerto Rico and quantify size and discard condition of fish discarded by Puerto Rico and USVI commercial fisheries (SEDAR 46 2016), and investigate for unaccounted discards in self-reported

---

2 In the USVI, initial attempts to collect recreational catch and effort data were made from 1979 to 1981, when NOAA conducted data collection efforts following the MRFSS protocol. That effort was discontinued in 1982 due to lack of sufficient funds. In 1999, NOAA and the USVI’s Department of Planning and Natural Resources reinitiated efforts to collect recreational fisheries data. Data collection occurred in 2000, but was again discontinued in 2001 due to difficulties with managing the program and hiring, training, and retaining staff.
commercial logbook data to quantify the number of spiny lobster discarded dead and discarded alive (SEDAR 57 2019). The SEFSC has projects underway to design a port sampling survey that would improve data collection in the U.S. Caribbean.

In the South Atlantic and Gulf, the uncertainty of data collected from commercial logbooks for federally-permitted fisheries has been evaluated through analyses associated with framework and FMP amendments. Estimates of total discards for a species are calculated using a species-specific mean discard rate for the vessels reporting discards and applying that rate to the calculated total effort reported by the fishery to the coastal logbook program. Data uncertainty in self-reported discard rates can be high for species that are not caught in large numbers or are of little economic interest (particularly of bycatch species); with coefficient of variation routinely exceeding 100%. However, discard estimates for more commonly taken species have less data uncertainty. Thus, based on the experiences in the South Atlantic and Gulf, it is expected that the SBRM requirement of a federal permit and associated logbook requirements specified in an amendment to the island-based FMPs would be able to provide meaningful discard estimates for the commercial sector with varying degrees of uncertainty depending on how commonly a species is discarded.

For the recreational sector, estimates of discards from private recreational and charter fishermen are collected through MRIP, which includes dockside surveys. The percent standard error, or PSE, is a measure of uncertainty associated with the recreational catch estimates. The higher the PSE, the lower the confidence that an estimate is close to the actual population value. MRIP indicates that a PSE value greater than 50 indicates a very imprecise estimate and is often due to a species being infrequently encountered. As stated above, MRIP was never operational in the USVI and ceased operating in Puerto Rico in 2017. Even when operational in Puerto Rico, it did not collect information on invertebrate discards, such as queen conch and spiny lobster. As seen in Table 1 in the attached document, the majority of the PSEs estimated for recreationally caught finfish in Puerto Rico for 2016 and 2017 were greater than 50, which indicates imprecise estimates. The 2017 MRIP Regional Implementation Plan for the U.S. Caribbean Region identified methods to resolve issues with the type, quality, and consistency of data being collected from MRIP surveys in Puerto Rico including: updating the effort survey methodology; including alternate fishing modes like diving, kayaking, and jet skis; modify sampling methodology for tournaments; and include invertebrate species such as queen conch and spiny lobster. Additional needs identified included the need to expand catch sampling surveys to include nights, weekends, and holidays and data from the smaller islands, like Culebra and Vieques off Puerto Rico. The MRIP Regional Implementation Team for the U.S. Caribbean is currently reviewing the 2017 Regional Implementation Plan and working to reconstitute MRIP in Puerto Rico and initiate in the USVI. That process would consider previous sources of data issues and work to increase the precision of the MRIP recreational catch estimates.

Thus, the SBRM in the island-based FMP will allow the Council to describe the uncertainty associated with the commercial and recreational bycatch data.
2.5 How Data Are Used to Assess Bycatch

The SBRMs that have been in use in the U.S. Caribbean (i.e., MRIP recreational bycatch estimates and commercial trip ticket systems bycatch reporting) have provided bycatch data that are used for fishery management and in stock assessments. Discard information for select data-limited finfish from MRIP surveys was considered in SEDAR 46 and discard information for spiny lobster from commercial catch report forms was considered in SEDAR 57. In addition, the ongoing SEDAR 80 stock assessment for queen snapper considers available discard information. Bycatch data from the SBRM to develop a federal commercial and charter permit program that includes logbook requirements also will provide information useful for management and stock assessments. Likewise, restarting the MRIP program in the U.S. Caribbean, and extending it to the USVI, will provide useful information on bycatch of finfish and invertebrate species targeted from recreational fishing. This has been illustrated in the South Atlantic and Gulf, where discard information from commercial logbooks and MRIP is routinely used to assess if new management measures are necessary, to develop these measures, and to evaluate the potential impacts of management measures. The SEFSC uses these data in stock assessments to incorporate bycatch into estimates of total fishing mortality. The Caribbean Council’s SSC use bycatch information from commercial trip ticket systems, and MRIP where applicable, as they review the status of a species and develop acceptable biological catch recommendations, and would be able to rely on bycatch information from commercial and charter logbooks or the reconstituted MRIP in the same manner. Discard information from the Caribbean Council’s SBRMs (i.e., discards from commercial catch report forms to date for the USVI and through 2012 for Puerto Rico; MRIP recreational discards through 2017 for Puerto Rico) will be considered in the current assessment for queen triggerfish (SEDAR 80).

2.6 Literature Cited


SEDAR (Southeast Data, Assessment, and Review) 80. 2021. General Recreational Survey Data for Queen Triggerfish in Puerto Rico. NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida. 26 pp.
