Statistical Consultants' Report: Review of Virgin Islands Sampling Needs

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1. Introduction

A two days and a half workshop (September 10 to 12th, 2012) was scheduled in St. Thomas, US Virgin Islands (USVI) to discuss the data needs for USVI including the past and current sampling approaches. The objective is to examine data collection methods needed to estimate recreational fish catch and effort. State and federal staff, consultants and stakeholders involved in the USVI fisheries management prepared presentations and provided access to references describing previous studies designed to estimate catch and effort for different species. In this report we focus on USVI, we describe what we learned from USVI fishing activities, data needs, past and current data collection efforts, perceived challenges for implementing sampling design and our recommendations. From the workshop presentations, clarifications from workshop members, and the references we learned that:

- Recreational fishing is important for USVI locals and it is considered an important tourist attraction (Toller et al, 2005).
- Commercial fishing licenses are mandatory in St. Thomas, St. John and St Croix since 1972.
- There are no recreational fishing licenses required (Garcia-Moliner, 2009), except for shrimp on St. Croix and bait and line fishing in the Great St. James Marine Reserve, St. Thomas.
- Tourists, who fish, primarily participate in charter or private boat fishing (Adams et al, 1996).
- Some of the recreational fishing targeted non-game species (e.g. conch and spiny lobster) in St Croix years ago (Tobias, 1985). These targeted non-game species are still currently of interest to recreational fishers in both St. Thomas/St. John District and St. Croix District.
- Three fishing sectors are well defined in USVI: offshore pelagic and deepwater snapper, inshore pelagic, and reef fish fisheries. Each sector targets different species, for example, deep water in excess of 2,000 meters is available 400 meters off the north coast of St. Croix and constitutes a good location for fishing large pelagic gamefish such as blue marlin, white marlin, tuna, dolphin and wahoo (Tobias, 1995; Toller et al, 2005; Tobias and Dupigny, 2009). Inshore species include great barracuda, cero mackerel, little tunny and numerous jack species (e.g. crevalle jack, bar jack and blue runner). Reef fisheries include snappers, groupers, grunt, triggerfish, and squirrelfish (Toller et al, 2005).

- Historically, over 60% of the recreational boats fishing in USVI during marlin season originate from the US mainland, Puerto Rico, Dominican Republic, Bahamas and British Virgin Islands, while the remaining percent of boats are owned by local residents (Brandon, 1986). These vessels participate in one of the St. Thomas International Game Fish Association (IGFA) blue marlin tournaments.
- The blue marlin tournament season extends from mid-June to mid-September in St. Thomas.
- Dolphin and wahoo are two of the most important species for USVI recreational and commercial fishers (Toller et al, 2005; Tobias and Dupigny, 2009).
- Recreational fishing is estimated to be around 10% of commercial fishing (Jennings, 1992; Mateo, 2004). No territorial license is required for recreational fishing. By federal law a recreational angler cannot sell their catch.
- A High Migratory Species (HMS) angling permit or HMS Charter/Headboat permit is required for highly migratory species (HMS – billfishes, tunas, swordfish, and sharks) in federal waters.
- All vessels located in USVI territorial waters for more than 60 days are required to be registered in the USVI. Documented US and foreign vessels must register in the USVI if present longer than 60 days. These vessels will keep their documentation number as their territorial registration number and must display the USVI registration sticker on the port side of the vessel. The maximum stay of 60 days need not be consecutive days in the territory.
- Most species of fish in the estuarine inshore areas and open waters are harvested by both recreational and commercial fishers.
- The Magnuson Fishery Conservation and Management Act (1976) mandates the collection of data for both commercial and recreational marine fisheries to end and prevent overfishing through the use of annual catch limits (ACLs) and accountability measures (AMs).

An expected outcome of this report is a list of recommendations or guidelines for a cost-efficient sampling design to collect data for establishing recreational annual catch limits (ACLs) for St Croix, St. Thomas and St. John.

It was clear to the consultants that the workshop attendees were aware of the challenges involved in the collection of catch and effort data given the widespread recreational fishing activity carried out in several modes. These fishing modes include pier and shore fishing, private vessels, for-hire rentals, charters vessels, dive charters and diving.

2. Data Needs

Data needs were determined by workshop attendees and include

- Total catch and effort estimates to determine ACLs and to better manage fisheries at different levels:
    - Geographic: St. Thomas/St. John and St. Croix.
    - Species.

  - Across time to evaluate trends.
- Total catch and effort estimates by mode (e.g. charter, private vessel, shoreline).
- Biological data (e.g. tissue, age, size and growth) is required to estimate maturity. This is particularly useful for species such as conch and spiny lobsters to determine if recreational fishers are harvesting legal sizes of these species.
- Estimates of the total number of recreational fishers in each island and type of gear.
- Estimates of the frequency of fishing trips and spatial (location) and temporal distribution (e.g. time of day, days of week) of fishing activities.
- Estimates of the total and size of catch per fishing trip by species.
- Effort by species and fishing mode are needed to better manage the different fish stocks.
- Estimates of landings and effort data on recreational high migratory species (HMS), billfish, tuna and shark species.
- Estimates of release (alive and discarded) and bycatch data.
- Estimates of invertebrates landed.

3. Past data collection efforts and lessons learned.

Early federal attempts to collect catch and effort data were made from 1979 to 1981 when the National Marine Fisheries Service (NMFS) conducted data collection in the USVI as part of the Marine Recreational Fisheries Statistics Survey (MRFSS) effort. However by 1982, the MRFSS in USVI was discontinued for lack of sufficient funds. In 1999, the NMFS and USVI Department of Fish and Wildlife reinitiated efforts to collect recreational fisheries data. The data collection occurred in 2000, but it was discontinued again in 2001. Several issues were identified in these past data collection efforts as possible factors that might influence the success of future sampling efforts for collecting recreational fisheries data in USVI. For example, there was some difficulty to recruit, hire and retain field interviewers, thus there is a need for better selection, training and compensation of field interviewers, especially if the number of intercepts of recreational fishers are low as appeared to be the case in 2000-2001[1].

A number of problems were discovered in the frames used to collect effort and catch data. There is a concern that the past and current sampling designs for the intercept survey may not capture "subsistence fishing" which is considered relevant in some regions of the USVI; subsistence sites may not have been included in the site registry or were almost never selected. A thorough update of the USVI site registry to reflect more reliable pressure estimates (defined as the average number of fishers in the site) for each wave is needed to increase sampling efficiency and productivity. In the past, MRFSS selected many access sites with very low activity (i.e. low pressure measures) resulting in very low numbers of intercepts at these sites (i.e. low productivity). In order to obtain better

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estimates of effort (fisher-days), improved frames (e.g. better data on telephone ownership, household distribution and composition) are needed for the telephone portion of the MRFSS (Osborn and Lowther, 2002).

In addition, the fishing activity in USVI has evolved over time and newly targeted species and types of gears have emerged (e.g. diving). Some fishers use several types of gears during the same trip, making it difficult to separate the effort corresponding to each type of gear.

The coastal geography of the different islands makes it challenging to implement the standard data collections approaches. For example in St. Croix, many open spaces that provide easy access to the water for fishing purposes create a challenge for field interviewers and survey planning. Private sites and marinas and safety issues in particular for night fishing result in under-coverage of certain populations of anglers.

There is a mandatory internet/telephone reporting system in USVI for all billfishes, swordfish, and bluefin tuna. Although bluefin tuna are not found in the USVI territorial or federal waters, this system provides information on any landing of bluefin tuna, non-tournament billfish and swordfish within 24 hours of landing. However, the numbers that are discarded dead, bycatch data, and the catch and release information is not currently collected in the HMS reports. In addition, there is a suspicion of under reporting of the HMS landings.

Tournaments data are well covered in USVI. Reported tournament data include landing by species, number of vessels, and weight and size. USVI Division of Fish and Wildlife monitors tournaments to collect data on number of landings. However, tournament boats occasionally do not return to the tourney site if no targeted fish were caught. For tournament boats that either do or do not return to the tourney site, the non-targeted species may not be provided at dockside for weigh-in.

All HMS tournaments operators are required to register their tournament with the HMS Management Division of NMFS. The NMFS Southeast Fisheries Science Center notifies tournament operators if the tournament has been selected for reporting. All billfish tournaments are selected for reporting.

4. Recommendations

- ***Clear Statement of Objectives***

Development of a large scale data collection program requires a clear statement of objectives. This also includes an understanding of the priorities to be placed on the objectives if all cannot be achieved at a reasonable cost. While total effort and catch are understood to be key data

requirements, priorities are needed to determine the importance of obtaining estimates by island, by species, by mode, and by other dimensions. It is common in practice for the cost of a survey to not depend on the size of the whole population as much as it depends on the number of subpopulations and domains within it for which estimates are desired. It is likely that the same is true for a USVI recreational fisheries survey.

- ***Understanding of the basic requirements for a data collection process.***

The project team needs to identify the most pressing needs for recreational fishing data and develop proposals to address those needs. The USVI may require several pilot studies to build up the basic pieces needed to carry out a data collection process: 1) determination of study goals, 2) develop the study frame, 3) develop and pretest the data collection instrument, 4) formulate a sample design, 5) establish data collection protocols and procedures, 6) produce plans for data quality control and management, 7) develop the estimation process and data analysis procedures.

Proposals do not have to address every question and data needs that have been discussed. Pilot studies can be developed gradually or in simultaneous studies, allowing the project team to learn from each pilot study. Based on lessons learned at each step, further pilot studies can then be proposed to evaluate alternative approaches and solutions to the problems observed. For example, a data collection design for catch/effort might be very different from a data collection design for biological data. Similarly, the design of a finfish survey might not be appropriate for the conch/spiny lobster.

- ***Coordination of Effort and Catch Estimates***

Typically, MRFSS surveys separate the estimation of effort (e.g. as number of fisher-days by mode or number of intercepts per day and mode) and catch by mode within each survey wave. For example, effort is estimated by telephone surveys of residents and boat captains. Population surveys of residents, usually by telephone, provide estimates of the number of fisher days or fishing trips during a survey wave (typically 2 months). Intercept surveys provide more detailed data on catch per fisher day or fishing trip. Intercept surveys also provide estimates by species, by size, and by biological measures (e.g. based on scale samples or otoliths). Catch data from vessel trip intercepts is sometimes aggregated over all fishers on the vessel, but a count of fishers is required in those cases. However, even if the main catch and effort data are collected separately, there are many ways in which both surveys can be adjusted to account for coverage issues, take advantage of complementarity between them or are replaced for specific subpopulations. For instance in the Eastern US mainland surveys, both effort and catch from “for hire” vessel trips are identified separately since the effort data are obtained from vessel captains and excluded from the resident surveys.

For the USVI, the high volume of fishing by visitors (nonresidents) will make it necessary to separate effort and catch by resident status. For visitors, the intercept survey may be the only approach to obtain effort, as well as catch, information. For tournaments, questions on the data collection form to identify residents and nonresidents are necessary to distinguish catch and effort by residency. The general methodology for multiple frame sampling (e.g. , multiple frames may include a list of resident's addresses, a list of resident's phone numbers, a list of permanent USVI registered vessels and a list of visiting vessels) can be utilized to increase coverage (including coverage of visitors) while avoiding double counting. In a multiple frame scenario, a single frame will not cover the entire population (e.g. a list of resident addresses will not include visitors). However, an alternate frame may be available (e.g., list of visiting vessels) that covers a subpopulation that might not be covered by the first frame (e.g., a list of resident addresses). For example Tucker et al. (2007) estimated that 46.4% of households have only telephone, 6% have only cell phones, 42.2% have both, and 5.4% have neither. Therefore a survey of all residents of VI may consider a combination of phone and mail data collection modes to improve coverage of USVI residents.

- ***Effort Estimation***

One approach to obtain effort estimates (e.g. average number of fisher trips) in the USVI that has been used for MRFSS is a telephone or mail survey of households. If the law to enforce the requirement of angler licenses passes, then this angler list can be used as the frame for a mail or phone survey to collect information on effort. If such listing is not available, then a telephone and/or mail survey of residents can be used instead. Borrowing from existing studies (e.g. MRFSS), a questionnaire can be designed to collect effort information about fishing trips and sites. The questionnaire used on the mainland would be modified to include the unique features of USVI, including the geography and targeted species (e.g., conch). Additional items about the area of fishing (e.g. island) can be included, and a map showing labeled grids can help the respondent identify the fishing area. For this mail/phone survey, it will be necessary to revise and update any phone frame or mailing address frame for the different islands. With the increasing use of cellular phones, any telephone survey would need to include numbers from a telephone landline and cellular frame. In the mainland, ABS (address based sampling) frames of household addresses have been providing an excellent frame of households with nearly complete coverage. This should be explored to determine coverage rate of this frame in the USVI.

Standard survey methodology practices include multiple contacts if a phone survey is used or multiple mailings to a household in the case of mail surveys. Multiple mailings and the use of financial incentives are the two most effective approaches to increase the response rate. The information collected would provide effort data on sites/marinas/piers/beach used for shore fishing, different ports for landing (private and public) and offshore areas for fishing.

- ***Catch and biological data***

A number of sampling methods to collect catch and biological data at the fishing sites or marinas/ports can be considered. For shore fishing, the different islands can be divided in segments of reasonable size and or expected effort; marinas, boat ramps or piers can be clustered by proximity to facilitate survey coverage; marinas or sites with high pressures can be split in sections of manageable size to ensure coverage. As with the current MRFSS design used on the mainland, the intercepts can be performed at different time intervals to estimate effort at different time points.

Anglers returning from their fishing trips can be intercepted and biological data collected. Each angler intercepted can be asked if he/she owns a HMS permit, and detailed information with regard to discard and catch release data for HMS can be collected. Counts of the number of anglers observed at each survey site should be recorded. As discussed earlier, visiting anglers need to be identified to permit estimation of their fishing effort as well as their catch. Counts of anglers at each survey round can also be utilized to update fishing pressure estimates for future rounds of the survey.

- ***Private Boat Registration List***

The recreational vessels license is updated each June and can provide an alternative frame for estimating fishing effort related to vessels (Tobias and Dupigny, 2009). This list will also include non-resident (US and foreign) vessels if present in USVI waters for longer than 60 days. In addition to addressing the under-coverage of non-resident vessels, this list can be considered as a frame for a survey designed to obtain information on number of boat trips, fishing area, gear type, and target species. This information can be used to determine pressure (e.g. average number of trips per week and month) for each vessel and marina. It is possible to match the vessel permit list with the HMS permit list. If the vessel owner has also an HMS permit, a set of questions can be added to a questionnaire to request information on catch and release data for HMS. Rental and dive boats should be identified. A modified questionnaire designed for these groups to capture effort information is needed for these boats. This would provide a baseline to determine the numbers of these boats that do participate in recreational fishing which is currently unknown.

- ***Charter Boats***

Although there are few charter boats in the USVI, it is important to obtain records of catch and effort from this group to assure full coverage of recreational fishing. Charter boats are registered; some charter boats have commercial fishing licenses and are required to submit trip tickets and others may keep recreation catch logbooks, although the use of the logbook is not mandatory. Proposing that submission of the logbooks be mandatory should be considered. Rather than

requiring mandatory reporting on every trip, a sampling design that selects a random sample of weeks or trips could be considered. Charter boat captains would then report only on this selected sample of weeks/trips. As a quality check, visits to some charter boats should be incorporated into the study design. Charter boat captains can be contacted ahead to determine day of departures, and a sample of charter boats trips would be observed to obtain catch and effort information. A pilot study could validate the charter boat logbook in USVI by comparing intercept with logbook data.

- ***HMS Registration List***

Another list of recreational anglers that can be used to provide separate information on recreational catch is the HMS permit listing. The effectiveness of reporting for billfish (e.g. blue and white marlin, sailfish and spearfish) using the HMS reporting system should be examined given the concerns raised at the meeting about compliance. It is clear that obtaining catch and release of billfish is important, although it is not clear that accurate data are currently being collected.

Separate surveys (phone or mail) of a sample of listed members can be done to assess the under-reporting suspected in the current phone/internet system. Results of pilot studies done elsewhere on catch cards should be examined to determine if methods can be improved to obtain catch estimates.

- ***Tournaments***

Tournaments are extremely important in the USVI and can be considered a separate subpopulation (stratum) in the overall study design. Initially, data collected from the various tournaments should be reviewed and documented. This would help determine what additional information is needed from various tournaments.

All boats registered in the tournament and returning to the marina are intercepted to obtain information on catch. It is critical to record not only the billfish that were caught and released, but also the bycatch. Collaboration with the USVI Department of Fish and Wildlife is important. Data should be recorded for all tournaments to obtain the effort, catch and release data for both the targeted species in the tournament and the bycatch. Additional training should be provided to the observers in the tournament (USVI Department of Fish and Wildlife staff) so that all information can be collected.

- ***Other Options to Obtain Catch and Effort***

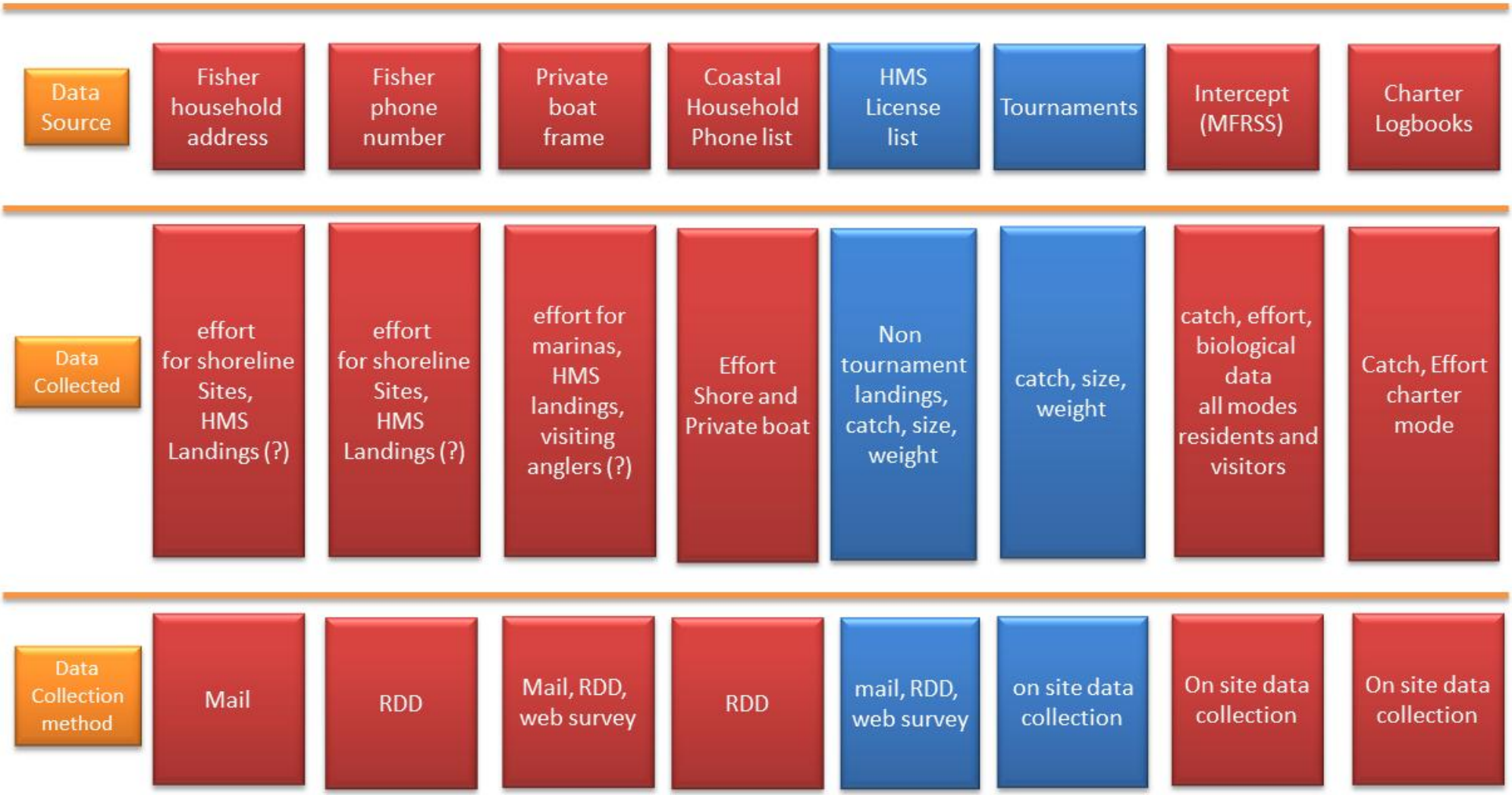
Other options discussed briefly at the meeting to collect effort and catch estimates include 1) using an airplane to count the number of anglers on the shoreline and the number of vessels in different

areas, 2) using a monitoring vessel to patrol the coast and count anglers in the shore and vessels fishing, and 3) a mix of creel surveys with a mail survey (Hoening et al, 1997 and Ditton and Hunt, 2001). The costs associated with these must be also examined to determine if these can realistically obtain the data needed given the cost for these approaches.

- ***Other Comments***

  - In order to convey the importance of these surveys and to improve participation of USVI residents, it is critical to invest resources into approaches to improve survey participation. For example, public meetings should be scheduled, newspaper articles explaining the need to conduct the survey, fliers posted in fishing clubs, and engagement of stakeholders and universities will bring the message to different sectors. Researchers involved with the proposed study should emphasize the need to obtain reliable catch and effort data and the implications of inaccurate data to the fisheries and USVI economy. Discussing the impact of fishing pressure on various areas of the islands should be covered for anglers to understand that without appropriate estimation and management, the fishery can spiral downwards.
  - To further encourage participation, incentives are recommended. Incentives can include token gifts such as caps, T-shirts, a useful recreational fishing item, etc., all displaying the USVI survey logo or other agencies sponsoring the survey. The token gift is used to encourage participation and shows appreciation for the fisher's participation in the survey.
  - Focus groups can help researchers understand why there were barriers to telephone communication during the last survey that was done in the USVI. This is important to determine in order to assess the effectiveness of developing either a mail or telephone survey to obtain effort information.
  - Data coordination across surveys that are conducted in the region, and data collected across agencies, is critical not only to estimate catch for different species but also to avoid double counting. Figure 1 illustrates the many sources where catch and effort information might be collected in a study of this magnitude. Blue color denotes the ongoing data collection methods, and red denotes new methods (e.g. the use of angler license) or methods that are currently used in mainland that could be used in USVI. For example, effort might be obtained from anglers using random sampling of coastal household telephones or by directly contacting anglers if a license frame is available. Effort for vessels and marinas (defined as average number of vessel trips) can be obtained from a survey of private and charter vessels. Catch may be obtained from the HMS program, tournaments, intercept surveys and the charter logbooks. We recommend a national level coordination of activities in this region, with NMFS supervising these activities. Methods to produce estimators using different types of data (e.g. survey data, report card data, etc.) should be explored.

Figure 1. Recreational Fish Catch and Effort Data Sources



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