A pilot program to assess methods of collecting bycatch, discard, and biological data in the commercial fisheries of the US Caribbean

(Saint Croix)

MRAG Americas

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Final Report

A pilot program to assess methods of collecting bycatch, discard, and biological data in the commercial fisheries of the US Caribbean

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1 Introduction

NOAA Fisheries awarded a Cooperative Research Program (http://www.grants.gov/search/search.do?mode=VIEW&oppId=9891) grant to MRAG Americas to conduct a pilot program to deploy observers in St. Croix fisheries. The purpose of this project is to assess the potential for obtaining information on bycatch, discards, and biological data from commercial fisheries off St. Croix in the US Caribbean. The project focused on methods for obtaining information on composition and disposition of bycatch and discards at sea, opportunities for collecting biological data at sea, and the use of captain or crew for collecting data if space or safety on vessels does not allow observers.

For this project, the US Virgin Islands Division of Fish and Wildlife (DFW), MRAG Americas, Inc. (MRAG), and the Southeast Fisheries Science Center (SEFSC), teamed with a commercial fisher from the US Virgin Islands to conduct a pilot observer program in the waters of St. Croix (Figure 1). The results of the project could form the basis for planning a comprehensive observer program in the US Caribbean if management agencies should decide such a program is necessary. The project focused on gears typically used on the continental shelf platform of the USVI: traps/pots, nets, hook and line, and diving. Similar vessels are used for the four gear types (see adjacent photo).

The pilot project addressed two primary issues:

1. The feasibility associated with placing observers onboard commercial fishing vessels (see picture) in the US Caribbean including:
   - Financial, space, and safety considerations for placing observers on board
   - Limitations to data collection on board
   - Coordination and cooperation issues with fishers

2. Alternative methods of obtaining bycatch information other than to placing observers on board. Under the method being explored, selected fishers will return to port with the total catch for sampling of retained and discarded components (referred to as “captain samples”).

The project secondarily addressed the specific data to be obtained. The project is the first opportunity in the U.S. Virgin Islands to collect bycatch and related data on an individual trip level, and could provide an assessment of the magnitude of bycatch and discards for these fisheries. Problems of data bias could arise in the pilot project because placement

of observers on vessels will be voluntary and fishers may operate differently when they have an observer on board. In addition, this pilot project will supplement the port sampling activities of the USVI, DPNER, DFW by increasing the number of biological samples. Significant reductions in funding of port sampling activities from traditional, funding sources (e.g., NOAA, NMFS, State Federal Cooperative Statistics Program and the Interjurisdictional Program) have significantly impacted the number of biological samples collected by DFW port samplers (see SEDAR 8 Yellowtail Snapper and Spiny Lobster RW Report 2005 and SEDAR 4 Deepwater Snapper Report, November 2004).

Recently the SEDAR process documented that too-small sample sizes and lack of regular (ongoing) data collection needed to construct an adequate time-series of catch and abundance indices hindered the basic analyses conducted for the SEDAR 8 yellowtail snapper analyses (see http://www.sefsc.noaa.gov/sedar/download/S8RW_FinalConsensus.pdf?id=DOCUMENT SEDAR 8 yellowtail snapper Consensus Report, June 2005). Supplemental data collections, such as planned by this pilot project, could provide critical information needed for evaluation of the U.S. Caribbean fisheries resources.

2 Operations

Dr. Robert Trumble of MRAG and Ms. Nancie Cummings of the NMFS, SEFSC served as principle investigators of this project. Dr. Barbara Kojis and Dr. Roger Uwate of DFW provided oversight. Mr. William Tobias of DFW served as the observer supervisor on St. Croix. USVI DFW employees working on this project took leave without pay for any time spent working on the pilot observer project.

Mr. Hector Rivera, a commercial fisher and former DFW environmental specialist/port sampler, served as the primary observer during this project period. Mr. David Camoyan served as backup observer through December 2004. Subsequently, Dr. Wes Toller, fisheries biologist with DFW, provided observer coverage to supplement the coverage from Mr. Rivera. Mr. Willy Ventura of DFW assisted Mr. Rivera and Dr. Toller with biological sampling. Both Mr. Ventura and Dr. Toller have extensive experience with sampling the fish species found in the St. Croix fisheries. In the accompanying picture Mr. Ventura (left) and Mr. Rivera process fish from an observer sample. Mr. Tobias provided training to assure understanding and compliance with the observer protocol.

2.1 Protocol development

MRAG Americas developed a draft set of protocols for the St. Croix observer project, and routed the draft to Federal and Territorial partners. The protocol called for sampling catches in the same manner as suggested in the NMFS SEFSC Trip Interview Program (TIP see http://www.sefsc.noaa.gov/tip.jsp) sampling manual, for sampling of landings, and for recording catch and biological data using TIP forms. In addition to the TIP forms, the draft protocol contained forms for collecting data on survival of discarded bycatch, for recording protected species interactions, and confirming vessel participation in the observer project. Only one substantial change from procedures initially anticipated was made: originally data was to be collected on a haul by haul or set by set basis. However, St. Croix fishers typically do not fish in a way that corresponds to individual hauls or sets. Net fishers make a single set, and hook and line vessels fish more or less continuously in a general area over a number of hours. As a result, we attributed all catch from a single vessel in a day as a single set. Following review of the draft protocol, a final version (Appendix) was prepared and distributed to all participants in the project.

2.2 Equipment

The DFW supplied port sampling equipment for use by observers during this project. The port sampling kit included a Chatillon metric pan scale (20 kg capacity X 50g), a one-meter measuring board, a caliper and a 1.5 m measuring tape. Coolers and plastic bags were provided for retained by-catch. Mr. Rivera received a complete kit that he kept in his vehicle for ready availability for sampling following an observer trip. In addition, DFW supplied a life jacket for the observer. The project purchased a hand-held GPS for use in tracking fishing and transit locations of the fishing vessel and a hand-held VHF radio to increase chances of successful communication in case of an emergency. A digital camera was provided to obtain a photographic record of sampled trips and bycatch. Ice was provided on request to fishers to maintain their catch fresh during biostatistical sampling.

2.3 Training

The past experience of Mr. Rivera and Mr. Ventura in collecting biological samples and working with local fishers reduced the amount of time required for observer training. Training focused on differences from the normal port sampling procedures and changes that would be necessary for this pilot observer project. Prior to the start of at-sea observing, Dr. Trumble, Dr. Uwate and Mr. Tobias met with Mr. Rivera and Mr. Ventura to discuss the objectives of the project and the sampling plan as outlined in the draft protocol. At this meeting, safety concerns were emphasized. Mr. Tobias followed up with a review of the data collection procedures and a review of the final protocol immediately before the beginning of at-sea observing.

3 Results

3.1 Observer coverage

The project schedule called for two months of preparation (July and August 2004) prior to the beginning of at-sea observing in September. Preparations took nearly four months, and at-sea observing began in late October 2004.

Subsequent to the preparation of the proposal, the St. Croix and St. Thomas/St. John Fisheries Advisory Committees (FAC) had recommended that the USVI government implement a prohibition on gill and trammel nets in the territory, effective on January 1, 2005. In light of potential restrictions on the use of this gear, the DFW staff wished to obtain information on total catch of the net fisheries prior to the proposed implementation deadline for use in analysis of the impacts on the nets on USVI fisheries. Thirty-five fishers reported using gill nets and nine fishers reported using trammel nets on St. Croix during 2003 (Kojis 2004). Of these 44 net fishers, approximately 11 were considered highliners in the fishery (those that have harvested a combined total of more than 10,000 pounds of fish in the last five years).

As a result of the proposed net ban, the project team diverted all at-sea observations in October through December 2004 to vessels fishing nets. Due to the pending restrictions by the USVI government on the use of gill and trammel nets, cooperation from the net fishers was initially less than ideal, and most net fishers refused to participate in protest. Mr. Rivera spent much time discussing the observer program with net fishers with the hope that additional fishers will participate in the bycatch observer program. Mr. Rivera reported that fishers using hook and line, trap, and dive gear were, however, willing to carry observers and to collect captain samples.

Even though the FAC had recommended a January 1, 2005 net ban, the DFW had not scheduled an implementation of the ban during this period. During a public hearing during January 2005, DWF announced that discussion of a net ban would continue into the future. Over the next several weeks, the net fishers became more agreeable to taking observers on fishing trips, in part because of the efforts by Mr. Rivera discussing the observer program with fishers. The number of observer trips rose substantially during April and May 2005. Mr. Rivera reported that prompt payments ($100 for observer trips and $200 for captain trips) to cooperating fishers may have had an impact on undecided fishers, and led to increased participation in the project by the net fishers

The June through September 2005 period saw a continuation of the progress made in April and May of increasing number of observer trip. However, some fishers using several gear types, especially nets and traps, refused to participate in the program, due to pending territorial and federal regulations to restrict those gears. Many expressed concerns to the program samplers, that data collected by observers would be used to justify additional management restrictions. However, Mr. Rivera reported that as more fishers participated in the study, others who originally refused to participate provided

their assistance. Payments for observer trips and captain trips may have helped to convince several previously uncooperative fishers to take observers.

The end of the contract period (September 30, 2005) found the project several samples short of completing the sample design. We requested and received a no-cost extension that allowed us to obtain the remaining samples. During the October 2004 through February 2006 period of observer deployment, the project obtained 40 observer trips and 10 captain samples (Table 1).

Of the 190 licensed fishers registered from St. Croix, approximately 120 can be considered full time and active (William Tobias, DFW, pers. comm.). Of these, we obtained data from 20 fishers; these 20 fishers represented approximately 17% of full time and 11% of total permits. The project obtained samples from five net fishers, six trap fishers, five dive fishers, and seven hook and line fishers. Several fishers fished more than one gear: two fished both net and trap and one fished net and hook and line. The relatively small proportion of participating fishers resulted in part because of refusals from many fishers contacted (fishers of all gear types refused to participate; in part because many hook and line fishers fish for pelagic fish that are not part of this study; and in part because many fishers use vessels too small to carry an observer and still have room for gear and crew.

3.2 Feasibility of observer coverage

3.2.1 Space, safety, and financial considerations for placing observers on board

As anticipated, the small size of most fishing vessels – generally less than 25 feet – in St. Croix presented limited space for observers to conduct work at sea based on vessel size. Gear type and at-sea conditions affected the effective space available for observers. Rough seas typical of St. Croix waters, especially during winter months, increased the difficulties of observers to make observations. Of the gears sampled, space was the biggest issue for trap fishing trips (see adjacent photo). For boats less than 25 feet in length, space was further restricted when traps were hauled by hand (which requires two crew). The space required for handling traps left little room for observers to collect samples or observe fishing activities, which compromised the ability of

observers to adequately collect complete bycatch data. Observers had problems obtaining all data from vessels using traps. Observers on trap vessels often had to make visual estimates of numbers and species caught in the traps.

The observer protocol called for observers to board only vessels that had passed safety inspections by the US Coast Guard or USVI authorities. However, only a few of the vessels actually had safety inspections. In spite of the small size of the vessels and lack of safety inspection, observers felt safe on board all vessels sampled. All observers had the final choice whether to ride along on any vessel. Observers chose to ride all available vessels, or they would not have had access to sufficient vessels to achieve the target number of 40 observer trips and 10 captain trips set for this project. The project provided all observers with a life jacket and a hand-held VHF radio to enhance personal safety.

Due to the small vessel size and open-ocean sea conditions, observers experienced harsh conditions on board nearly all trips, which points to a need for experienced at-sea observers who understand and can accept harsh conditions and an often stressful working environment. Observers get beaten by high speed transits in rough seas in small vessels, often wind/sea conditions causing onboard balance problems. Observers face uncomfortable and severe exposure to sun, wind, rain, and seawater. Loose fishing gear and the general state of vessel condition may expose observers to increased risk of injury. However, observers did not report any data lost as a result of the conditions at sea.

The St. Croix pilot observer project had two key financial aspects: financial impacts on vessels of carrying an observer, and compensation to the observer team (observers, observer supervisor, and biological sampler).

Fishers, especially those using traps, experienced inconvenience and trip delays from having observers on board. Observers slowed down operations and thereby increased the length of trips. If trap fishers find no retainable fish in a trap, the trap often goes back to the sea with any catch left in as bait. Therefore, taking out bycatch for the observer is time consuming; the extent of this issue varies by fisher. In addition, removal of bycatch used traditionally as bait, could potentially impact subsequent catch rate success and impact fisher profit, short term. Compensation to fishers of $100 per observer trip partially offset the inconvenience. Fishers who participated by bringing in fish otherwise discarded (captain samples) were compensated $200 for the extra time and effort required and the potential loss of profits from loss of bycatch used normally as bait.

Previously cooperative fishers did not need the financial compensation to participate in the observer project. These fishers have participated in previous Federal and Territorial projects when requested. However, the $100 or $200 compensation had a major impact on the decision to participate by fishers who do not routinely volunteer to cooperate with scientific research projects of this scope. Without the payments, fisher participation would have been diminished substantially. Management measures and pending regulations in the recent past in the US Caribbean, particularly gear restrictions and area closures, may have led fishers to take a suspicious view of management agencies and resistance to further actions and thus to participation in any efforts related to management

research. Further, many fishers are very independent and want to set their own schedules without adjusting to accommodate observers. Although financial compensation may have enticed some fishers to participate, not all fishers may have felt the compensation made up for the other negative aspects of having observers on board (e.g., change in schedule, slowing down the fishing process, possible reduction in catch from loss of bycatch used traditionally as bait- trap and hook and line fishers)

The observers and observer supervisor suggest that higher payments may have further increased participation by overcoming the antipathy to management. Therefore, fishers apparently need some incentive to participate. For some, the incentive comes from recognition of the need for data and a desire to improve data quality. For others, the incentive comes from direct financial compensation.

Observer pay of $200 per observer day is roughly comparable to pay rates of observer programs managed by NMFS. Recent solicitations for observer programs in the Northeast and Pacific Islands Regions specified minimum observer pay of $13.21 per hour plus overtime consistent with the Fair Labor Standards Act, which converts to around $180 per day base rate. The short-term and irregular observer activities and experience of the observers justifies payments above a base rate. Observers found the payment adequate for the work performed. The scientific staff of DFW that participated in the project reported that funding from the project provided a substantial staff incentive to collect data. The DFW staff supported the data collection aspect, especially given reductions in port sampling activities. In addition to increased data collection, the project gave DFW staff an opportunity to build relationships with fishers and to learn about actual fishing operations. In addition, utilization of trained DFW staff offered an additional confidence to the quality of the resulting data collection. When available, qualified and trained biologists are an asset to this type of research project and should be used.

3.2.2 Limitations to data collection

The small size of vessels, limited space on board, and rough sea conditions prevents observers from processing samples on board in nearly cases. This adds substantially to the time observers spend, as they must perform all sampling on shore after completion of the fishing trip. Sampling on shore may have enhanced data quality as a second sampler was available for processing the catch and a stable sampling table made measurements and recording easier. Sampling on shore resulted in a tradeoff of additional confidence in data quality at the cost of delaying the process to some degree.

However, several issues may lead to questions of representativeness of the data.

- Representativeness of samples to total USVI St. Croix fishery: The observer team could obtain agreement from only 20 different fishers, or about 17% of the full time fishers, to participate in the fishery. We experienced many refusals, and focused on the most productive fishers who tended to cooperate best. Therefore, observer samples may not adequately represent the entire commercial fishery of St. Croix. The project distributed the observer trips equally among the gear types (10 each) and

captain trips nearly equally among the gears (2-3 each). The number of fishers participating was also nearly equal across the gears (5-7 each).

- Discard numbers: Some lobster fishers may have altered their harvest behavior in the presence of observers (e.g. shorts or berried females could have been discarded, which might otherwise have been harvested in the absence of an observer).

- Definition of discard vs. bycatch: In some cases, miscommunication between observer and fisher may have blurred the definition of bycatch, such that "bycatch" specimens may have had other uses (bait, barter, give-away) in the absence of an observer. Trap bycatch can be used in several ways, and disposition of retained catch may vary. Assignment of specimens as bycatch must be made by the fisher, not by observer, but it was often not communicated clearly by fisher. Therefore, a potential exists for misunderstanding between observer and fisher. The observer team has some concerns that fishers labeled some catch as bycatch because they thought that was what the observer wanted. Therefore, analysts must be aware that fishers may have retained some catch labeled as bycatch (discards) in the absence of observers.

- Excluded fishery: We did not obtain any samples of conch fishing trips by commercial fishers.

- Discard Mortality Not Determined: The project had a secondary objective to see if observers could collect viability data for discards. Observers could not consistently ascertain the condition of discarded fish because of the working conditions onboard the small fishing vessels. Observers did collect some viability data, but only for several trips. The initial protocol called for a multi-stage set of viability conditions; Observers determined that, at best, they could estimate condition as "viable" or "not viable." Fishers often left many organisms (treated in the data as discards) in the trap as bait; this bait may survive multiple hauls but will ultimately die if not released. For fish trap catch, estimating mortality/vitality is seriously confounded by fate of discards once they are tossed over the side due to predation by birds (especially frigate birds) or fish (especially barracuda). Seabirds often follow trap boats to feed on discards.

- Variability in fishing methods: Even within a gear category/method, fisher behavior or species preference can dramatically alter the composition of catch. For example, some lobster divers also harvest substantial quantities of fish (on spear) while others carry spears but rarely use them.

3.2.3 Coordination and cooperation issues with fishers

A subset of about only 17% of the 50 full time fishers allowed observers on fishing vessels or agreed to bring in captain samples. Fishers usually refused to cooperate with the pilot observer program. The success we achieved for the project derived from the rapport of the observer team with the fisher community. The rapport allowed the observer

team to impart information with a credibility that could not likely have happened with a less well known and respected team, even if otherwise well experienced. This project used primarily bilingual observers, which likely made the participating fishers more at ease during the at-sea and shore sampling process and overall helped garner the support we received. Many fishers do not know English and may not have cooperated with non-Spanish speaking observers.

Non-participants generally fell into two categories: a small organized opposition and an unorganized opposition.

A small group of fishers started a movement opposing commercial fisher participation in this bycatch study because they felt the data would be "used against them." Fishers got the idea that data would be used against them and that the program would do them harm in the future. This was especially a concern for net fishers who face prohibition of net gear. These fishers tried to recruit other fishers to join them, and tried to convince Mr. Rivera, the fisher partner/observer, to quit the program. While this organized opposition did not prevent observers from meeting fishers and requesting their participation, it did create a social stigma against one observer from a number of fishers. Further, fishers have been asked to participate in a number of surveys, most recently in socio-economic surveys, and often don't see positive impacts resulting from such data collections. Many fishers view DFW and enforcement personnel without distinction.

More generally, fishers were generally reluctant to slow or alter harvest operations so that observers could complete their work. This was especially the case for trap fishers, who tended to be the least cooperative among the fishery types. Other fishers did not want to alter fishing or marketing operations to carry observers or wait for sample processing by observers. Some fishers initially agreed to cooperate, then changed their minds or plans and cancelled without calling back, leaving the observer waiting at the departure site. These components of the unorganized opposition could have biased project results.

3.3 Alternatives to putting an observer onboard

This project tested captain samples as an alternative to placing observers on board fishing vessels. This was necessary in particular to sample vessels that were deemed too small to carry an observer. The captains who participated agreed to bring fish they would have otherwise discarded into port for sampling by the observer team. Some analysts and managers could have concerns that fishers

may not bring in total catch, and may discard catch to deliberately bias the bycatch data. However, the observer team did not detect any evidence, from talking with fishers and during sampling of catch, that fishers had biased the sample. Some gear types are more appropriate and less likely for bias as targets of captain samples. For example, fishers haul entangling nets into a vessel without sorting at sea (see adjacent photo), which makes the entire catch available for sampling on shore as fishers sort retained catch from catch to be discarded at home. Deepwater snapper fisheries catch relatively few non-target species, which makes bringing in discards a minor activity. However, bringing in trap bycatch requires more effort from captains than for other fisheries, and offers an easy opportunity to bias data by discarding species that could cause management concern or by leaving bycatch in the trap as bait.

This project did not test other possible alternatives to observers. We considered but did not test the following methods.

- The bycatch information recorded on USVI, DFW Commercial Catch Report (CCR) forms could also be used. However this dataset has yet to be analyzed. Issues with ability of fishers to recall discards, major difficulty and reluctance that some fishers have in filling out forms, and possible intentional bias may reduce the accuracy of these data. In addition, the tendency of some fishers to combine catch over several trips could introduce additional concerns in analysis of fisher reported bycatch/discard.
- Vessel monitoring systems (VMS) can be used to track fisher movements. However, VMS does not provide data on catch and discards. VMS cannot confirm when or if fishers actually fish. VMS could support observer activities but cannot substitute for direct observations and biological measurements provided by at-sea observers.
- Closed circuit television cameras and other electronic monitoring (EM) can provide useful information about fishing activities and catch. However, EM cannot obtain biological data. The small size of vessels leaves little room for installation of EM gear. Costs of EM are generally less than observer coverage but still high relative to vessel revenues.
- For some gears, a bycatch study could be conducted from a non-fishing vessel with a commercial fisherman accompanying. For example, to study trap bycatch, the fisher could visit his traps in a research vessel with a research team hauling traps at a pace controlled by study objectives. This would enable better info on vitality criteria using aquaria and also allow divers to record the fate of discards (eaten by birds or predatory fish). The expense of such charter-vessel research would limit the observations to relatively few vessels.

3.4 Data analysis

The voluntary participation in the pilot observer project means that we could not distribute observer coverage over the fleet with a randomized or stratified procedure to obtain representative coverage of the St. Croix fishing fleet. Refusal to participate by

some segments of the fleet precluded sampling of these vessels. Other vessels too small to carry observers are included in the sampling only to the extent that fishers participated through the captain samples. Therefore, use of the data must occur with caution.

No biological samples from St. Croix, other than those from this project, were collected during the period of the pilot observer project. Therefore, analysts preparing scientific support documents for management purposes of reef fish fisheries for St. Croix must either use these data or have no data for the period. Analysts and managers must ascertain the appropriateness of these data for the purpose intended, and determine whether the samples sufficiently represent the fishing activities of St. Croix fishing fleet.

3.4.1 Comparison of observer and captain samples

To assist analysts decide the representativeness of the samples, we have made simple comparisons of two key aspects of the data. First, we compared effort summaries of observer samples with captain samples. With only 40 observer samples and 10 captain samples, distributed over numerous gears and time periods, detailed statistical analysis of the results were not practical nor supported. However, the patterns and ranges of attributes for pooled observer samples and pooled captain samples (Tables 2-11) showed similarity such that we detected no obvious differences. Under the conditions with which the data collections occurred, the captain samples seemed comparable to the observer samples.

Port samplers collected both observer and captain samples over 10 distinct landing sites (Table 2). Altona Lagoon, Castle Nugent, Frederiksted Fish Market, and Molasses Dock accounted for 32 and 7 of the 40 observer samples and 10 captain samples, respectively. These four landings site account for the majority of commercial landings of St. Croix (William Tobias, USVI DFW, pers. comm.).

Crew sizes for both observer and captain samples predominantly fell in the 2-4 person range (Table 3), although captain sample trips had somewhat smaller crew size. In general, gill and trammel net fishers sampled tended to have crew size of three or more, while other gears tended to have crew size less than three (Table 4). Some captain samples occurred from vessels too small to carry an observer, which may have accounted for their generally smaller crew size. In general, a vessel smaller than 16 ft in length was considered too small to safely carry an observer. However, larger vessels were considered too small in some cases. In rougher weather or on trips further offshore, observers went out on larger vessels. Observers did not ride trap vessels smaller than abut 24 ft because the space required by the traps did not leave room for an observer.

Similar to crew size, the observer trips had a somewhat higher fraction of days fished (0.23) compared to captain sample trips (0.17) (Table 5). The smaller size of vessels in the captain samples may lead to shorter trips. Both observer trips and captain sample trips occurred on single days (Table 6). None of the trips in the St. Croix pilot study extended to multiple days. Observers converted actual fishing time in hours to fractions of days.

Days fished did not suggest substantial differences between observer and captain trips over gears or areas (Table 7). The largest differences occur with only one captain sample, which may be a sample size issue.

Bycatch in percentage of numbers of the total catch from observer samples ranged from zero to 55% of the total catch (Table 8), with the preponderance of the samples in the zero to 20% range. The captain samples generally fell within this range, but did not show the extreme high values of the observer samples. The overall mean for observer samples (12%) was lower than the mean for captain samples (20%). Bycatch in weight from observer samples ranged from zero to 53% of the total catch (Table 9), with the preponderance also in the zero to 20% range. The captain samples also had a more narrow range, from zero to 26%, but with a similar mean.

3.4.2 Comparison of bycatch and retained catch

As expected from Caribbean fisheries, the observers sampled a variety of species, resulting in over 100 unique species. Many of these species appeared as retained catch and often also were identified as bycatch (Tables 10 and 11). Most species were caught in low numbers and represented small amounts of weight. Several species appeared in relatively high numbers in either retained catch or in bycatch. Blue tang made up almost 15% of the sample observations for bycatch, but just 7% of retained catch; ocean surgeon fish made up 34% of the sample observations, but less than 1% of the retained catch (Table 10). Ballyhoo and redtail parrotfish made up 10.5% and over 25% of the sample observations for retained catch, respectively, but less than 1% of the discards.

The high representation of blue tang, ocean surgeonfish, ballyhoo, and redtail parrotfish in the samples also showed as high numbers of individuals in the samples (Table 11). However as expected, the small size of some species showed as small representation by weight. Blue tang and ocean surgeon fish, which each accounted for about 23% of the bycatch by numbers accounted for only 6% and <1% of the bycatch by weight.

May want to do quick summary/check of major fmp species or to compare what the fmp says is bycatch with what the pilot study indicates. Just idea, I am not even sure if the FMP or SFA idenfied any specific bycatch species or if there is any historical info. We could compare with. [I don't think this will help. In the past, folks said bycatch didn't occur, so we should have little or record of bycatch.]

Another idea- juan Agar offered me some information on ethnic groups. We can link now the fisherman id to the 'ethnic group'- may see if there is any pattern here. I realize we only have 20 fishers but I doubt they were all 1 ethnic group. [Unless we think ethnic groups have different bycatch characteristics, I don't see what this would do for us.]

Another idea- table bycatch percentages by location sampled- to explore whether there was a difference spatially. Probably is some depending on how the catch is utilized

(subsistence vs market preferences). [I don't feel strongly about this. Whatever you think.]

Finally possibly we should prepare a simple table of bycatch and retained catch %'s by gear- but we first have to deatl with the multiple gear coding issue; here would have to choose/select a 'main gear' to which to apply the catch. [YES, WE NEED THIS]

3.4.3 Interactions with protected species

The observers did not encounter fishing gear interactions with marine mammals, sea turtles or sea birds. However, they observed interactions between sea birds and bycatch – especially for trap fishing samples. Seabirds preyed on releases from traps, which likely contributed a substantial source of mortality for trap fishing discards/bycatch.

3.4.4 Opportunity observations

The project restricted observations to trips targeting species under fishery management plans of the Caribbean Council. However, several trips obtained data for pelagic fish not managed by the Council. The pelagics were caught opportunistically by fishers; in most cases, hook and line fishers targeting deepwater snapper caught pelagic fish by trolling on the way out to the fishing grounds or on the way in. The data for pelagic fish provide some biostatistical information, but should not be considered as an integral part of this project.

4 Summary and Conclusions

The successes obtained by this project resulted from two key points: rapport with fishers on the part of the observers, port samplers, and observer coordinator, and payments to fishers for their participation. While some fishers, those who generally cooperate, would have participated in any event, many others did not want to participate. The combination of personal contact and payments convinced others to take part. A bilingual staff (Mr. Rivera and Mr. Ventura) also contributed to the ability to make personal contacts. As a result, the observers obtained useful information from fishers, and could provide feedback to fishers concerning plans and policies of DFW.

The project demonstrated that implementing an observer program would be difficult under the best of circumstances and would require flexibility in nearly all logistical operations. The small vessels have little room for an observer, and many have no room at all, making it difficult for direct observer placement. With an already small crew size (including captain) of 1-3 people, fishers could not afford to reduce fishing capacity by 25-50% by leaving a crew member home to make room for an observer. Doing so would negatively impact the fishing operation.

However, this project demonstrated that fishers can bring in fish (catch) otherwise destined for discarding for later sampling by observers at the dock. The captain samples obtained during this project demonstrated similarities in attributes to the samples collected by observers, although small sample sizes precluded rigorous statistical analysis. This method has potential for data collection that warrants additional research. Data collected by fishers has a high potential for bias, if fishers have something to hide or a desire to portray the fishery in more favorable light. In this project, we could find no reason for participating fishers to bias the data. However, a program that utilizes captain samples would require an assessment of the probability that bias would occur, and if the level of bias is small enough relative to the overall value of the data to justify establishing the program. That is, if the choice is biased data or no data, which choice leaves the program better off.

The opposition voiced against the observer project and the need for payments to bring fishers into participation suggests that fishers would have a strong resistance to any mandatory program. This is not a surprising conclusion, as most observer programs start with opposition from fishers. However, previous opposition on the part of St. Croix fishers to DWF proposed measures to ban nets very likely contributed to some portion of the resistance to the observer project, and less opposition to the observers may have resulted in a less contentious management environment. An initial opposition to observers would not mean that an observer program would fail. However, a successful program in the USVI would take careful and detailed planning to implement (AFSC 2003), and to minimize the opposition:

- Determine goals and objectives
- Design a program to meet goals and objectives
- Determine logistic support required, especially enforcement and who pays
- Implement the program
- Monitor progress toward and achievements of goals and objectives, and provide a mechanism to modify as necessary.

This project demonstrated that many fishers in the USVI St. Croix fisheries need an incentive to cooperate. Direct payments to fishers are highly unlikely in a normal observer program, and many observer programs (e.g., the North Pacific Groundfish Observer Program) require payments by fishers for observers. Efforts to develop non-monetary incentives would benefit an observer program and would be worthwhile exploring if authorities decide to further develop an observer program for the USVI. Because many fishers believe that data collection programs will find (or produce) information that could be used against them, development of an observer program should focus on explaining the how the data will be used and the benefits that will accrue to fishers from management improvements. If fishers buy in into a program because they expect some benefits, long or short term, support will increase and opposition will decrease. Providing concrete information, such as from meetings with questions and answers and from reports of plans and progress, to fishers during development and operations of a program will help alleviate suspicion and enhance buy-in.

The DFW staff reported high satisfaction with the pilot observer project and the opportunity to collect biosample data on a regular basis. Funding did not permit normal biosampling during the period of this project. The DFW staff pointed out the benefits of both data collection and the opportunity to interact with fishers.

5 Recommendations

This project demonstrated the feasibility of collecting observer data on the small vessels of St. Croix, the difficulties and limitations to the observer coverage, and presented an alternative to observers for collecting data. Under some conditions, data collected by an observer program or captain sample program of the type tested here may be suitable for management needs. However, to determine that, careful planning for the program should occur, that includes determination if a USVI observer program can achieve specified goals and objectives. We recommend a report on observer coverage prepared for NMFS (AFSC 2003) to assist with this evaluation and planning.

If management agencies in the US Caribbean determine that an observer program is needed, we recommend the following:

This project demonstrated a need to provide fishers with an incentive to support, or at least not oppose, an observer program. We recommend explaining the benefits of an observer program through an education effort of meetings and reports that clearly lay out the goals of the program, how the program will operate, and what it will achieve.

Observers ride on small, open vessels, often in rough weather. We recommend enhancing safety for observers by requiring a Coast Guard (or other maritime agency) safety inspection for each vessel prior to taking an observer, providing a personal locator beacon for each observer, and providing a personal first aid kit for each observer.

As part of a Cooperative Research Program project, requiring participation of fishers, this project used a commercial fisher as the primary observer. Some fishers may not have carried an observer to avoid possible publicizing proprietary fishing locations. We recommend establishing a conflict of interest policy in which observers could have no financial interest in the fishery other than through observing.

Fishers and observers did not always use the same definition of bycatch. Fishers may have included in bycatch those fish not destined for sale that fishers intended to give away. We recommend an effort to understanding of the fisher's "decision tree" for handling of catch, to interpret catch disposition, especially with fish trap samples (catch vs. discard; discard vs. bait; discard vs. bycatch).

Trap samples are more difficult and time consuming for observers to process, and delays can negatively impact fishers' schedules. We recommend development of a standardized method for treating samples to minimize disruption to fishers. Trap bycatch may require a special study to develop efficient and effective measures.

Literature Cited

AFSC. 2003. NMFS Fisheries Observer Coverage Level Workshop: Defining a Basis. Alaska Fisheries Science Center, Seattle, WA. 45pp.

Kojis, B. 2004. Census of the marine commercial fishers of the U.S. Virgin Islands. Caribbean Fishery Management Council Report. 87pp.

Tables

Table 1. Number of observer and captain samples by month and gear, St. Croix Pilot observer project October 2004 – March 2006.

Month	**Gill/Trammel Net**		**Trap/Pot**		**Dive**		**Hook and Line**	
	Observer	Captain trip	Observer	Captain trip	Observer	Captain trip	Observer	Captain trip
October 2004	1							
November	3	2						
December			1					
January 2005							1	
February							3	
March							2	
April	2*				4		2	
May					4			
June	1				2			
July	1		1					
August	2		5					
September		1	2	2		1	2	1
December			1					
February 2006						1		2
Total	10	3	10	2	10	2	10	3

*Two umbrella net trips were included in this figure.

Table 2: Number of interviews by Site sampled (year, landing site, sampling method)

		SAMPLE_METHOD		
		FISHERMAN SAMPLE	OBSERVER TRIP	All
YEAR	SITE_NAME			
2004	FREDERIKSTED FISH			
	MARKET	1		1
	MOLASSES DOCK	1	5	6
	All	2	5	7
2005				
	ALTONA LAGOON		7	7
	CASTLE NUGENT	1	6	7
	CHRISTIANSTED DOCK	1	1	2
	CHRISTIANSTED HARBOR		1	1
	FREDERIKSTED FISH			
	MARKET		7	7
	MOLASSES DOCK	1	7	8
	SALT RIVER		1	1
	SALT RIVER MARINA		2	2
	TAGUE BAY	2	2	4
	UNKNOWN_VI		1	1
	All	5	35	40
2006				
	ALTONA LAGOON	1		1
	CASTLE NUGENT	1		1
	FREDERIKSTED FISH			
	MARKET	1		1
	All	3		3
All				
	ALTONA LAGOON	1	7	8
	CASTLE NUGENT	2	6	8
	CHRISTIANSTED DOCK	1	1	2
	CHRISTIANSTED HARBOR		1	1
	FREDERIKSTED FISH			
	MARKET	2	7	9
	MOLASSES DOCK	2	12	14
	SALT RIVER		1	1
	SALT RIVER MARINA		2	2
	TAGUE BAY	2	2	4
	UNKNOWN_VI		1	1
	All	10	40	50

Table 3: Crew statistics by year, sampling method

	SAMPLE_METHOD					
	FISHERMAN SAMPLE		OBSERVER TRIP		All	
	NUM_CREW		NUM_CREW		NUM_CREW	
	N	Mean	N	Mean	N	Mean
YEAR						
2004	2.00	3.00	5.00	3.80	7.00	3.57
2005	5.00	2.20	35.00	2.66	40.00	2.60
2006	3.00	1.33			3.00	1.33
All	10.00	2.10	40.00	2.80	50.00	2.66

Table 4: Crew statistics Croix Observer Project by Landing Site_name, Sampling Method and Gear, pooled over year/month

		SAMPLE_METHOD					
		FISHERMAN SAMPLE		OBSERVER TRIP		All	
		NUM_CREW		NUM_CREW		NUM_CREW	
		N	Mean	N	Mean	N	Mean
GEAR NAME	SITE_NAME						
DIVING OUTFITS,	ALTONA LAGOON			7.00	2.71	7.00	2.71
OTHER	CASTLE NUGENT	1.00	2.00	2.00	2.50	3.00	2.33
	MOLASSES DOCK	1.00	2.00			1.00	2.00
	UNKNOWN_VI			1.00	3.00	1.00	3.00
	All	2.00	2.00	10.00	2.70	12.00	2.58
GILL NETS, GL 1-2							
INCH	MOLASSES DOCK			1.00	3.00	1.00	3.00
	SALT RIVER			1.00	4.00	1.00	4.00
	All			2.00	3.50	2.00	3.50
LIFT NETS	SITE_NAME						
	FREDERIKSTED FISH						
	MARKET			2.00	2.00	2.00	2.00
	All			2.00	2.00	2.00	2.00
LINES HAND, OTHR							
STILL FSH.BOT	ALTONA LAGOON	1.00	1.00			1.00	1.00
	FREDERIKSTED FISH						
	MARKET	1.00	1.00	4.00	2.00	5.00	1.80
	All	2.00	1.00	4.00	2.00	6.00	1.67
LINES LONG,							
BOTTOM, REEF FISH	MOLASSES DOCK			2.00	2.00	2.00	2.00
	TAGUE BAY	1.00	1.00	2.00	2.00	3.00	1.67
	All	1.00	1.00	4.00	2.00	5.00	1.80
LINES TROLL							
	FREDERIKSTED FISH						
	MARKET			1.00	3.00	1.00	3.00
	MOLASSES DOCK			1.00	3.00	1.00	3.00
	All			2.00	3.00	2.00	3.00
POTS AND TRAPS,							
FISH	CASTLE NUGENT			2.00	4.00	2.00	4.00
	CHRISTIANSTED DOCK	1.00	3.00	1.00	2.00	2.00	2.50
	CHRISTIANSTED HARBOR			1.00	4.00	1.00	4.00
	MOLASSES DOCK			4.00	2.75	4.00	2.75
	SALT RIVER MARINA			1.00	2.00	1.00	2.00
	All	1.00	3.00	9.00	3.00	10.00	3.00
POTS AND TRAPS,							
LOBSTER INSHR.	SALT RIVER MARINA			1.00	2.00	1.00	2.00
	TAGUE BAY	1.00	1.00			1.00	1.00
	All	1.00	1.00	1.00	2.00	2.00	1.50
TRAMMEL NETS							
	CASTLE NUGENT	1.00	4.00	2.00	4.00	3.00	4.00
	FREDERIKSTED FISH						
	MARKET	1.00	3.00			1.00	3.00
	MOLASSES DOCK	1.00	3.00	4.00	3.75	5.00	3.60
	All	3.00	3.33	6.00	3.83	9.00	3.67

Table 5: Days fished Statistics by year and sampling method

	SAMPLE_METHOD					
	FISHERMAN SAMPLE		OBSERVER TRIP		All	
	DAYS_FISH		DAYS_FISH		DAYS_FISH	
	N	Mean	N	Mean	N	Mean
YEAR						
2004	2.00	0.18	5.00	0.23	7.00	0.21
2005	5.00	0.16	35.00	0.23	40.00	0.22
2006	3.00	0.18			3.00	0.18
All	10.00	0.17	40.00	0.23	50.00	0.22

Table 6: Days fished Statistics by year and sampling method

	SAMPLE_METHOD					
	FISHERMAN SAMPLE		OBSERVER TRIP		All	
	DAYS_OUT		DAYS_OUT		DAYS_OUT	
	N	Mean	N	Mean	N	Mean
YEAR						
2004	2.00	1.00	5.00	1.00	7.00	1.00
2005	5.00	1.00	35.00	1.00	40.00	1.00
2006	3.00	1.00			3.00	1.00
All	10.00	1.00	40.00	0.98	50.00	1.00

table 5 in hours fished.

Table 7: Days fished statistics, St. Croix Observer Project by Sampling Method, Gear, Area Fished - pooled over year/month

		SAMPLE_METHOD					
		FISHERMAN SAMPLE		OBSERVER TRIP		All	
		DAYS_FISH		DAYS_FISH		DAYS_FISH	
		N	Mean	N	Mean	N	Mean
GEAR NAME	AREA_FISHED						
DIVING OUTFITS, OTHER	52100.3000	2.00	0.17	1.00	0.10	3.00	0.15
	52100.4000			9.00	0.09	9.00	0.09
	All	2.00	0.17	10.00	0.09	12.00	0.10
GILL NETS, GL 1-2 INCH	52100.1000			1.00	0.20	1.00	0.20
	52100.3000			1.00	0.10	1.00	0.10
	All			2.00	0.15	2.00	0.15
LIFT NETS	52100.1000			2.00	0.05	2.00	0.05
	All			2.00	0.05	2.00	0.05
LINES HAND, OTHR STILL FSH.BOT	52100.1000	1.00	0.17	2.00	0.50	3.00	0.39
	52100.5000	1.00	0.20			1.00	0.20
	52100.6000			2.00	0.00	2.00	0.00
	All	2.00	0.19	4.00	0.25	6.00	0.23
LINES LONG, BOTTOM, REEF FISH	52100.3000			1.00	0.45	1.00	0.45
	52100.4000	1.00	0.10	2.00	0.64	3.00	0.46
	52100.5000			1.00	0.29	1.00	0.29
	All	1.00	0.10	4.00	0.50	5.00	0.42
LINES TROLL	52100.2000			2.00	0.32	2.00	0.32
	All			2.00	0.32	2.00	0.32
POTS AND TRAPS, FISH	52100.2000			1.00	0.13	1.00	0.13
	52100.3000			5.00	0.22	5.00	0.22
	52100.4000	1.00	0.20	2.00	0.42	3.00	0.34
	52100.6000			1.00	0.20	1.00	0.20
	All	1.00	0.20	9.00	0.25	10.00	0.25
POTS AND TRAPS, LOBSTER INSHR.	52100.6000	1.00	0.10	1.00	0.63	2.00	0.37
	All	1.00	0.10	1.00	0.63	2.00	0.37
TRAMMEL NETS	52100.1000	1.00	0.16			1.00	0.16
	52100.3000	2.00	0.23	6.00	0.23	8.00	0.23
	All	3.00	0.20	6.00	0.23	9.00	0.22
All	52100.1000	2.00	0.17	5.00	0.26	7.00	0.23
	52100.2000			3.00	0.26	3.00	0.26
	52100.3000	4.00	0.20	14.00	0.22	18.00	0.22
	52100.4000	2.00	0.15	13.00	0.22	15.00	0.21
	52100.5000	1.00	0.20	1.00	0.29	2.00	0.25
	52100.6000	1.00	0.10	4.00	0.21	5.00	0.19
	All	10.00	0.17	40.00	0.23	50.00	0.22

Table 8: Bycatch and Retained Catch Proportions by Interview, St. Croix Observer Project by Sampling Method

Table ------

	SAMPLE_METHOD											
	FISHERMAN SAMPLE				OBSERVER TRIP				All			
	bycatch_num_-prop		ret_num_prop		bycatch_num_-prop		ret_num_prop		bycatch_num_-prop		ret_num_prop	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
INT_ID												
1					1.00	0.23	1.00	0.77	1.00	0.23	1.00	0.77
2					1.00	0.10	1.00	0.90	1.00	0.10	1.00	0.90
3	1.00	0.22	1.00	0.78					1.00	0.22	1.00	0.78
4	1.00	0.15	1.00	0.85					1.00	0.15	1.00	0.85
5					1.00	0.21	1.00	0.79	1.00	0.21	1.00	0.79
6					1.00	0.27	1.00	0.73	1.00	0.27	1.00	0.73
7					1.00	0.51	1.00	0.49	1.00	0.51	1.00	0.49
8					1.00	0.08	1.00	0.92	1.00	0.08	1.00	0.92
9					1.00	0.12	1.00	0.88	1.00	0.12	1.00	0.88
10					1.00	0.03	1.00	0.97	1.00	0.03	1.00	0.97
11					1.00	0.37	1.00	0.63	1.00	0.37	1.00	0.63
12					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
13					1.00	0.04	1.00	0.96	1.00	0.04	1.00	0.96
14					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
15					1.00	0.06	1.00	0.94	1.00	0.06	1.00	0.94
16					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
17					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
18					1.00	0.01	1.00	0.99	1.00	0.01	1.00	0.99
19					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
20					1.00	0.20	1.00	0.80	1.00	0.20	1.00	0.80
21					1.00	0.17	1.00	0.83	1.00	0.17	1.00	0.83
22					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
23					1.00	0.02	1.00	0.98	1.00	0.02	1.00	0.98
24					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
25					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
26					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
27					1.00	0.20	1.00	0.80	1.00	0.20	1.00	0.80
28					1.00	0.06	1.00	0.94	1.00	0.06	1.00	0.94
29					1.00	0.17	1.00	0.83	1.00	0.17	1.00	0.83
30					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
31					1.00	0.10	1.00	0.90	1.00	0.10	1.00	0.90
32					1.00	0.06	1.00	0.94	1.00	0.06	1.00	0.94
33					1.00	0.10	1.00	0.90	1.00	0.10	1.00	0.90
34					1.00	0.13	1.00	0.87	1.00	0.13	1.00	0.87
35					1.00	0.28	1.00	0.72	1.00	0.28	1.00	0.72
36					1.00	0.55	1.00	0.45	1.00	0.55	1.00	0.45
37					1.00	0.01	1.00	0.99	1.00	0.01	1.00	0.99
38					1.00	0.16	1.00	0.84	1.00	0.16	1.00	0.84
39	1.00	0.00	1.00	1.00					1.00	0.00	1.00	1.00
40	1.00	0.25	1.00	0.75					1.00	0.25	1.00	0.75
41	1.00	0.33	1.00	0.67					1.00	0.33	1.00	0.67
42					1.00	0.16	1.00	0.84	1.00	0.16	1.00	0.84

Table 8 (Cont.): Bycatch and Retained Catch Proportions by Interview, St. Croix Observer Project by Sampling Method

	SAMPLE_METHOD											
	FISHERMAN SAMPLE				OBSERVER TRIP				All			
	bycatch_num_-prop		ret_num_prop		bycatch_num_-prop		ret_num_prop		bycatch_num_-prop		ret_num_prop	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
INT_ID												
43					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
44	1.00	0.00	1.00	1.00					1.00	0.00	1.00	1.00
45					1.00	0.11	1.00	0.89	1.00	0.11	1.00	0.89
46	1.00	0.24	1.00	0.76					1.00	0.24	1.00	0.76
47	1.00	0.30	1.00	0.70					1.00	0.30	1.00	0.70
48					1.00	0.33	1.00	0.67	1.00	0.33	1.00	0.67
49	1.00	0.36	1.00	0.64					1.00	0.36	1.00	0.64
50	1.00	0.11	1.00	0.89					1.00	0.11	1.00	0.89
All	10.00	0.20	10.00	0.80	40.00	0.12	40.00	0.88	50.00	0.14	50.00	0.86

Table 9: Bycatch and Retained Weight Proportions by Interview, St. Croix Observer Project by Sampling Method

	SAMPLE_METHOD											
	FISHERMAN SAMPLE				OBSERVER TRIP				All			
	bycatch_wgt_prop		ret_wgt_prop		bycatch_wgt_prop		ret_wgt_prop		bycatch_wgt_prop		ret_wgt_prop	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
INT_ID												
1					1.00	0.11	1.00	0.89	1.00	0.11	1.00	0.89
2					1.00	0.08	1.00	0.92	1.00	0.08	1.00	0.92
3	1.00	0.13	1.00	0.87					1.00	0.13	1.00	0.87
4	1.00	0.07	1.00	0.93					1.00	0.07	1.00	0.93
5					1.00	0.11	1.00	0.89	1.00	0.11	1.00	0.89
6					1.00	0.13	1.00	0.87	1.00	0.13	1.00	0.87
7					1.00	0.53	1.00	0.47	1.00	0.53	1.00	0.47
8					1.00	0.04	1.00	0.96	1.00	0.04	1.00	0.96
9					1.00	0.09	1.00	0.91	1.00	0.09	1.00	0.91
10					1.00	0.03	1.00	0.97	1.00	0.03	1.00	0.97
11					1.00	0.27	1.00	0.73	1.00	0.27	1.00	0.73
12					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
13					1.00	0.02	1.00	0.98	1.00	0.02	1.00	0.98
14					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
15					1.00	0.09	1.00	0.91	1.00	0.09	1.00	0.91
16					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
17					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
18					1.00	0.02	1.00	0.98	1.00	0.02	1.00	0.98
19					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
20					1.00	0.22	1.00	0.78	1.00	0.22	1.00	0.78
21					1.00	0.12	1.00	0.88	1.00	0.12	1.00	0.88
22					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
23					1.00	0.12	1.00	0.88	1.00	0.12	1.00	0.88
24					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
25					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
26					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
27					1.00	0.23	1.00	0.77	1.00	0.23	1.00	0.77
28					1.00	0.19	1.00	0.81	1.00	0.19	1.00	0.81
29					1.00	0.09	1.00	0.91	1.00	0.09	1.00	0.91
30					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
31					1.00	0.38	1.00	0.62	1.00	0.38	1.00	0.62
32					1.00	0.09	1.00	0.91	1.00	0.09	1.00	0.91
33					1.00	0.07	1.00	0.93	1.00	0.07	1.00	0.93
34					1.00	0.08	1.00	0.92	1.00	0.08	1.00	0.92
35					1.00	0.14	1.00	0.86	1.00	0.14	1.00	0.86
36					1.00	0.30	1.00	0.70	1.00	0.30	1.00	0.70
37					1.00	0.05	1.00	0.95	1.00	0.05	1.00	0.95
38					1.00	0.09	1.00	0.91	1.00	0.09	1.00	0.91
39	1.00	0.00	1.00	1.00					1.00	0.00	1.00	1.00
40	1.00	0.23	1.00	0.77					1.00	0.23	1.00	0.77
41	1.00	0.17	1.00	0.83					1.00	0.17	1.00	0.83
42					1.00	0.26	1.00	0.74	1.00	0.26	1.00	0.74

Table 9 (Cont.): Bycatch and Retained Weight Proportions by Interview, St. Croix Observer Project by Sampling Method

	SAMPLE_METHOD											
	FISHERMAN SAMPLE				OBSERVER TRIP				All			
	bycatch_wgt_-prop		ret_wgt_prop		bycatch_wgt_-prop		ret_wgt_prop		bycatch_wgt_-prop		ret_wgt_prop	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
INT_ID												
43					1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
44	1.00	0.00	1.00	1.00					1.00	0.00	1.00	1.00
45					1.00	0.24	1.00	0.76	1.00	0.24	1.00	0.76
46	1.00	0.12	1.00	0.88					1.00	0.12	1.00	0.88
47	1.00	0.14	1.00	0.86					1.00	0.14	1.00	0.86
48					1.00	0.26	1.00	0.74	1.00	0.26	1.00	0.74
49	1.00	0.26	1.00	0.74					1.00	0.26	1.00	0.74
50	1.00	0.09	1.00	0.91					1.00	0.09	1.00	0.91
All	10.00	0.12	10.00	0.88	40.00	0.11	40.00	0.89	50.00	0.11	50.00	0.89

Table 10: Number of Sample observations for St. Croix Observer Project by Year, Disposition of catch

	DISPOSITION											
	BYCATCH				RETAINED				All			
	LENGTH		WEIGHT		LENGTH		WEIGHT		LENGTH		WEIGHT	
	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN
COMMON_NAME												
AMBERJACK,GREATER	2.0	0.2	2.0	0.2					2.0	0.0	2.0	0.0
ANGELFISH,FRENCH					9.0	0.1	9.0	0.1	9.0	0.1	9.0	0.1
ANGELFISH,GRAY					6.0	0.1	6.0	0.1	6.0	0.1	6.0	0.1
ANGELFISH,QUEEN	2.0	0.2	2.0	0.2	17.0	0.2	17.0	0.2	19.0	0.2	19.0	0.2
BALLYHOO					786.0	10.5	786.0	10.5	786.0	9.2	786.0	9.2
BARRACUDA,GREAT	1.0	0.1	1.0	0.1	6.0	0.1	6.0	0.1	7.0	0.1	7.0	0.1
BEARDFISH	19.0	1.8	19.0	1.8					19.0	0.2	19.0	0.2
BLUE TANG	157.0	14.6	157.0	14.6	454.0	6.1	454.0	6.1	611.0	7.1	611.0	7.1
BUTTERFLYFISH,BANDED	60.0	5.6	60.0	5.6					60.0	0.7	60.0	0.7
CHUB,BERMUDA	1.0	0.1	1.0	0.1	2.0	0.0	2.0	0.0	3.0	0.0	3.0	0.0
CONCH,QUEEN	2.0	0.2	2.0	0.2					2.0	0.0	2.0	0.0
CONEY	8.0	0.7	8.0	0.7	82.0	1.1	82.0	1.1	90.0	1.1	90.0	1.1
COTTONWICK					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
COWFISH,HONEYCOMB	6.0	0.6	6.0	0.6	267.0	3.6	267.0	3.6	273.0	3.2	273.0	3.2
CRAB,MARINE					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
CREOLE FISH	1.0	0.1	1.0	0.1	1.0	0.0	1.0	0.0	2.0	0.0	2.0	0.0
DOCTORFISH	29.0	2.7	29.0	2.7	402.0	5.4	402.0	5.4	431.0	5.0	431.0	5.0
DRUMMER,WHITEMOUTH					52.0	0.7	52.0	0.7	52.0	0.6	52.0	0.6
DURGON,BLACK	17.0	1.6	17.0	1.6	58.0	0.8	58.0	0.8	75.0	0.9	75.0	0.9
FILEFISH,ORANGE	35.0	3.2	35.0	3.2	26.0	0.3	26.0	0.3	61.0	0.7	61.0	0.7
FILEFISH,ORANGESPOT	6.0	0.6	6.0	0.6					6.0	0.1	6.0	0.1
FILEFISH,PYGMY	1.0	0.1	1.0	0.1					1.0	0.0	1.0	0.0
FILEFISH,SCRAWLED	5.0	0.5	5.0	0.5	4.0	0.1	4.0	0.1	9.0	0.1	9.0	0.1
FILEFISH,WHITESPOTTED	6.0	0.6	6.0	0.6	2.0	0.0	2.0	0.0	8.0	0.1	8.0	0.1
FLOUNDER,PEACOCK	12.0	1.1	12.0	1.1					12.0	0.1	12.0	0.1
FLYING GURNARD	4.0	0.4	4.0	0.4					4.0	0.0	4.0	0.0
GOATFISH,SPOTTED					38.0	0.5	38.0	0.5	38.0	0.4	38.0	0.4
GOATFISH,YELLOW					11.0	0.1	11.0	0.1	11.0	0.1	11.0	0.1
GRAYSBY	5.0	0.5	5.0	0.5	4.0	0.1	4.0	0.1	9.0	0.1	9.0	0.1
GROUPER,TIGER					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
GRUNT,BLACK					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
GRUNT,BLUE STRIPED	3.0	0.3	3.0	0.3	59.0	0.8	59.0	0.8	62.0	0.7	62.0	0.7
GRUNT,CAESAR					36.0	0.5	36.0	0.5	36.0	0.4	36.0	0.4
GRUNT,FRENCH	16.0	1.5	16.0	1.5	39.0	0.5	39.0	0.5	55.0	0.6	55.0	0.6
GRUNT,TOMTATE	10.0	0.9	10.0	0.9	43.0	0.6	43.0	0.6	53.0	0.6	53.0	0.6
GRUNT,WHITE	2.0	0.2	2.0	0.2	405.0	5.4	405.0	5.4	407.0	4.8	407.0	4.8
HIND,RED					135.0	1.8	135.0	1.8	135.0	1.6	135.0	1.6
HIND,ROCK					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
HOGFISH,SPANISH					10.0	0.1	10.0	0.1	10.0	0.1	10.0	0.1
HOUNDFISH	8.0	0.7	8.0	0.7	11.0	0.1	11.0	0.1	19.0	0.2	19.0	0.2
JACK,BAR	8.0	0.7	8.0	0.7	111.0	1.5	111.0	1.5	119.0	1.4	119.0	1.4
JACK,BLACK					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
JACK,HORSE EYE	25.0	2.3	25.0	2.3	2.0	0.0	2.0	0.0	27.0	0.3	27.0	0.3

Table 10 (Cont.): Number of Sample observations for St. Croix Observer Project by Year, Disposition of catch

	DISPOSITION											
	BYCATCH				RETAINED				All			
	LENGTH		WEIGHT		LENGTH		WEIGHT		LENGTH		WEIGHT	
	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN
COMMON_NAME												
JACK,YELLOW					12.0	0.2	12.0	0.2	12.0	0.1	12.0	0.1
LIZARDFISH,SAND DIVER	1.0	0.1	1.0	0.1					1.0	0.0	1.0	0.0
LIZARDFISHES	1.0	0.1	1.0	0.1					1.0	0.0	1.0	0.0
LOBSTER,CARIB. SPINY	17.0	1.6	17.0	1.6	214.0	2.9	214.0	2.9	231.0	2.7	231.0	2.7
LOBSTER,SPANISH SLIP.					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
LOBSTER,SPOTTED SPINY	1.0	0.1	1.0	0.1					1.0	0.0	1.0	0.0
MACKEREL,CERO					2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0
MARGATE					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
MARGATE,BLACK					3.0	0.0	3.0	0.0	3.0	0.0	3.0	0.0
MOJARRA,YELLOWFIN					7.0	0.1	7.0	0.1	7.0	0.1	7.0	0.1
MORAYS	1.0	0.1	1.0	0.1					1.0	0.0	1.0	0.0
NEEDLEFISHES	6.0	0.6	6.0	0.6					6.0	0.1	6.0	0.1
OTHER FISHES	1.0	0.1	1.0	0.1					1.0	0.0	1.0	0.0
PARROTFISH,PRINCESS	3.0	0.3	3.0	0.3	26.0	0.3	26.0	0.3	29.0	0.3	29.0	0.3
PARROTFISH,QUEEN	8.0	0.7	8.0	0.7	53.0	0.7	53.0	0.7	61.0	0.7	61.0	0.7
PARROTFISH,REDBAND	18.0	1.7	18.0	1.7	113.0	1.5	113.0	1.5	131.0	1.5	131.0	1.5
PARROTFISH,REDFIN					296.0	4.0	296.0	4.0	296.0	3.5	296.0	3.5
PARROTFISH,REDTAIL	6.0	0.6	6.0	0.6	1992.0	26.6	1992.0	26.6	1998.0	23.3	1998.0	23.3
PARROTFISH,STOPLIGHT	1.0	0.1	1.0	0.1	317.0	4.2	317.0	4.2	318.0	3.7	318.0	3.7
PORCUPINEFISH	15.0	1.4	15.0	1.4					15.0	0.2	15.0	0.2
PORGY,JOLTHEAD					7.0	0.1	7.0	0.1	7.0	0.1	7.0	0.1
PORKFISH	1.0	0.1	1.0	0.1	1.0	0.0	1.0	0.0	2.0	0.0	2.0	0.0
PUDDINGWIFE	4.0	0.4	4.0	0.4	23.0	0.3	23.0	0.3	27.0	0.3	27.0	0.3
ROCK BEAUTY	5.0	0.5	5.0	0.5	2.0	0.0	2.0	0.0	7.0	0.1	7.0	0.1
RUNNER,BLUE					7.0	0.1	7.0	0.1	7.0	0.1	7.0	0.1
SAILFISH	1.0	0.1	1.0	0.1					1.0	0.0	1.0	0.0
SCAD,MACKEREL					158.0	2.1	158.0	2.1	158.0	1.8	158.0	1.8
SCHOOLMASTER	2.0	0.2	2.0	0.2	49.0	0.7	49.0	0.7	51.0	0.6	51.0	0.6
SCORPIONFISH,REEF	15.0	1.4	15.0	1.4					15.0	0.2	15.0	0.2
SCORPIONFISHES,THONYH	2.0	0.2	2.0	0.2					2.0	0.0	2.0	0.0
SENNET,SOUTHERN	2.0	0.2	2.0	0.2	2.0	0.0	2.0	0.0	4.0	0.0	4.0	0.0
SHARK,BIGEYED SIXGILL					12.0	0.2	12.0	0.2	12.0	0.1	12.0	0.1
SHARK,CARIBBEAN REEF					2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0
SHARK,NURSE					8.0	0.1	8.0	0.1	8.0	0.1	8.0	0.1
SNAPPER,BLACK					5.0	0.1	5.0	0.1	5.0	0.1	5.0	0.1
SNAPPER,BLACKFIN					51.0	0.7	51.0	0.7	51.0	0.6	51.0	0.6
SNAPPER,DOG	1.0	0.1	1.0	0.1	1.0	0.0	1.0	0.0	2.0	0.0	2.0	0.0
SNAPPER,GLASSEYE					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
SNAPPER,GRAY(GREY)					5.0	0.1	5.0	0.1	5.0	0.1	5.0	0.1
SNAPPER,LANE					11.0	0.1	11.0	0.1	11.0	0.1	11.0	0.1
SNAPPER,MAHOGANY	2.0	0.2	2.0	0.2	14.0	0.2	14.0	0.2	16.0	0.2	16.0	0.2
SNAPPER,MUTTON	2.0	0.2	2.0	0.2	14.0	0.2	14.0	0.2	16.0	0.2	16.0	0.2
SNAPPER,QUEEN					87.0	1.2	87.0	1.2	87.0	1.0	87.0	1.0
COMMON_NAME												
SNAPPER,SILK					6.0	0.1	6.0	0.1	6.0	0.1	6.0	0.1
SNAPPER,VERMILION					2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0
SNAPPER,YELLOWTAIL	6.0	0.6	6.0	0.6	406.0	5.4	406.0	5.4	412.0	4.8	412.0	4.8
SPADEFISH,ATLANTIC	1.0	0.1	1.0	0.1	6.0	0.1	6.0	0.1	7.0	0.1	7.0	0.1
SQUIRRELFISH,LONGSPIN	13.0	1.2	13.0	1.2	94.0	1.3	94.0	1.3	107.0	1.2	107.0	1.2
STINGRAY,SOUTHERN	7.0	0.6	7.0	0.6					7.0	0.1	7.0	0.1

Table 10 (Cont.): Number of Sample observations for St. Croix Observer Project by Year, Disposition of catch

	DISPOSITION											
	BYCATCH				RETAINED				All			
	LENGTH		WEIGHT		LENGTH		WEIGHT		LENGTH		WEIGHT	
	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN
SURGEON,OCEAN	366.0	34.0	366.0	34.0	70.0	0.9	70.0	0.9	436.0	5.1	436.0	5.1
TILEFISH,SAND	13.0	1.2	13.0	1.2					13.0	0.2	13.0	0.2
TRIGGERFISH,OCEAN	37.0	3.4	37.0	3.4					37.0	0.4	37.0	0.4
TRIGGERFISH,QUEEN	8.0	0.7	8.0	0.7	86.0	1.1	86.0	1.1	94.0	1.1	94.0	1.1
TRUNKFISH	2.0	0.2	2.0	0.2	17.0	0.2	17.0	0.2	19.0	0.2	19.0	0.2
TRUNKFISH,SMOOTH	54.0	5.0	54.0	5.0	55.0	0.7	55.0	0.7	109.0	1.3	109.0	1.3
TRUNKFISH,SPOTTED	3.0	0.3	3.0	0.3	131.0	1.8	131.0	1.8	134.0	1.6	134.0	1.6
TUNA,BLACKFIN					6.0	0.1	6.0	0.1	6.0	0.1	6.0	0.1
TUNNY,LITTLE					23.0	0.3	23.0	0.3	23.0	0.3	23.0	0.3
WAHOO					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
All	1077.0	100.0	1077.0	100.0	7484.0	100.0	7484.0	100.0	8561.0	100.0	8561.0	100.0

Table 11: Sum of Catch and Weight Landed by Species year, disposition of catch

	DISP											
	BYCATCH				RETAINED				All			
	NUMBER		WEIGHT		NUMBER		WEIGHT		NUMBER		WEIGHT	
	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum
COMMON_NAME												
AMBERJACK,GREATER	3.0	0.2	8.2	0.0					3.0	0.0	8.2	0.0
ANGELFISH,FRENCH					9.0	0.1	19.0	0.3	9.0	0.1	19.0	0.0
ANGELFISH,GRAY					8.0	0.1	14.8	0.2	8.0	0.1	14.8	0.0
ANGELFISH,QUEEN	2.0	0.1	0.3	0.0	17.0	0.2	16.7	0.3	19.0	0.2	16.9	0.0
BALLYHOO					787.0	11.1	149.1	2.4	787.0	9.0	149.1	0.2
BARRACUDA,GREAT	1.0	0.1	7.5	0.0	6.0	0.1	16.2	0.3	7.0	0.1	23.6	0.0
BEARDFISH	19.0	1.1	7.9	0.0					19.0	0.2	7.9	0.0
BLUE TANG	387.0	23.3	5423.1	6.3	285.0	4.0	139.5	2.3	672.0	7.7	5562.6	6.0
BUTTERFLYFISH,BANDED	60.0	3.6	8.7	0.0					60.0	0.7	8.7	0.0
BUTTERFLYFISH,FOUREYE	40.0	2.4	1930.0	2.2					40.0	0.5	1930.0	2.1
CHUB,BERMUDA	1.0	0.1	3.6	0.0	2.0	0.0	3.3	0.1	3.0	0.0	6.9	0.0
CONCH,QUEEN	2.0	0.1	2.7	0.0					2.0	0.0	2.7	0.0
CONEY	29.0	1.7	1181.9	1.4	81.0	1.1	46.7	0.8	110.0	1.3	1228.6	1.3
COTTONWICK					1.0	0.0	0.6	0.0	1.0	0.0	0.6	0.0
COWFISH,HONEYCOMB	5.0	0.3	3.3	0.0	250.0	3.5	165.0	2.7	255.0	2.9	168.3	0.2
CRAB,MARINE					1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
CREOLE FISH	1.0	0.1	0.5	0.0	1.0	0.0	0.4	0.0	2.0	0.0	1.0	0.0
DOCTORFISH	29.0	1.7	10.1	0.0	397.0	5.6	264.3	4.3	426.0	4.9	274.4	0.3
DRUMMER,WHITEMOUTH					52.0	0.7	67.3	1.1	52.0	0.6	67.3	0.1
DURGON,BLACK	17.0	1.0	15.8	0.0	54.0	0.8	43.7	0.7	71.0	0.8	59.5	0.1
FILEFISH,ORANGE	39.0	2.3	12.4	0.0	26.0	0.4	29.9	0.5	65.0	0.7	42.2	0.0

Table 11 (Cont.): Sum of Catch and Weight Landed by Species year, disposition of catch

	DISP											
	BYCATCH				RETAINED				All			
	NUMBER		WEIGHT		NUMBER		WEIGHT		NUMBER		WEIGHT	
	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum
COMMON_NAME												
FILEFISH,ORANGESPOT	6.0	0.4	2.5	0.0					6.0	0.1	2.5	0.0
FILEFISH,PYGMY	1.0	0.1	0.3	0.0					1.0	0.0	0.3	0.0
FILEFISH,SCRAWLED	5.0	0.3	12.6	0.0	4.0	0.1	5.6	0.1	9.0	0.1	18.2	0.0
FILEFISH,WHITESPOTTED	11.0	0.7	2151.7	2.5	2.0	0.0	2.5	0.0	13.0	0.1	2154.2	2.3
FLOUNDER,PEACOCK	12.0	0.7	3.5	0.0					12.0	0.1	3.5	0.0
FLYING GURNARD	4.0	0.2	2.7	0.0					4.0	0.0	2.7	0.0
GOATFISH,SPOTTED					37.0	0.5	13.0	0.2	37.0	0.4	13.0	0.0
GOATFISH,YELLOW					11.0	0.2	3.9	0.1	11.0	0.1	3.9	0.0
GRAYSBY	5.0	0.3	2.0	0.0	4.0	0.1	2.4	0.0	9.0	0.1	4.4	0.0
GROUPER,TIGER					1.0	0.0	1.4	0.0	1.0	0.0	1.4	0.0
GRUNT,BLACK					1.0	0.0	1.7	0.0	1.0	0.0	1.7	0.0
GRUNT,BLUE STRIPED	3.0	0.2	1.0	0.0	53.0	0.7	34.4	0.6	56.0	0.6	35.4	0.0
GRUNT,CAESAR	6.0	0.4	300.0	0.3	35.0	0.5	12.1	0.2	41.0	0.5	312.1	0.3
GRUNT,FRENCH	88.0	5.3	6953.7	8.1	39.0	0.6	10.8	0.2	127.0	1.5	6964.5	7.6
GRUNT,SPANISH	8.0	0.5	600.0	0.7					8.0	0.1	600.0	0.7
GRUNT,TOMTATE	10.0	0.6	3.3	0.0	30.0	0.4	15.8	0.3	40.0	0.5	19.1	0.0
GRUNT,WHITE	2.0	0.1	0.7	0.0	403.0	5.7	178.9	2.9	405.0	4.6	179.6	0.2
HIND,RED					133.0	1.9	97.8	1.6	133.0	1.5	97.8	0.1
HIND,ROCK					1.0	0.0	3.6	0.1	1.0	0.0	3.6	0.0
HOGFISH,SPANISH	5.0	0.3	340.0	0.4	10.0	0.1	7.1	0.1	15.0	0.2	347.1	0.4
HOUNDFISH	8.0	0.5	7.6	0.0	11.0	0.2	13.1	0.2	19.0	0.2	20.7	0.0

	DISP											
	BYCATCH				RETAINED				All			
	NUMBER		WEIGHT		NUMBER		WEIGHT		NUMBER		WEIGHT	
	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum
COMMON_NAME												
JACK,BAR	34.0	2.0	18.1	0.0	79.0	1.1	70.0	1.1	113.0	1.3	88.2	0.1
JACK,BLACK					1.0	0.0	2.1	0.0	1.0	0.0	2.1	0.0
JACK,HORSE EYE	25.0	1.5	96.1	0.1	2.0	0.0	4.4	0.1	27.0	0.3	100.5	0.1
JACK,YELLOW					11.0	0.2	10.3	0.2	11.0	0.1	10.3	0.0
LIZARDFISH,SAND DIVER	1.0	0.1	0.4	0.0					1.0	0.0	0.4	0.0
LIZARDFISHES	1.0	0.1	4.6	0.0					1.0	0.0	4.6	0.0
LOBSTER,CARIB. SPINY	18.0	1.1	35.2	0.0	213.0	3.0	478.5	7.8	231.0	2.6	513.7	0.6
LOBSTER,SPANISH SLIP.					1.0	0.0	1.2	0.0	1.0	0.0	1.2	0.0
LOBSTER,SPOTTED SPINY	1.0	0.1	0.6	0.0					1.0	0.0	0.6	0.0
MACKEREL,CERO					2.0	0.0	1.7	0.0	2.0	0.0	1.7	0.0
MARGATE					1.0	0.0	1.7	0.0	1.0	0.0	1.7	0.0
MARGATE,BLACK					3.0	0.0	4.4	0.1	3.0	0.0	4.4	0.0
MOJARRA,YELLOWFIN					5.0	0.1	2.4	0.0	5.0	0.1	2.4	0.0
MORAYS	2.0	0.1	3000.4	3.5					2.0	0.0	3000.4	3.3
NEEDLEFISHES	6.0	0.4	3.6	0.0					6.0	0.1	3.6	0.0
OTHER FISHES	1.0	0.1	0.7	0.0					1.0	0.0	0.7	0.0
PARROTFISH,PRINCESS	3.0	0.2	2.8	0.0	38.0	0.5	24.0	0.4	41.0	0.5	26.8	0.0
PARROTFISH,QUEEN	3.0	0.2	3.6	0.0	50.0	0.7	55.7	0.9	53.0	0.6	59.3	0.1
PARROTFISH,REDBAND	17.0	1.0	5.8	0.0	105.0	1.5	71.2	1.2	122.0	1.4	77.0	0.1
PARROTFISH,REDFIN					294.0	4.2	289.9	4.7	294.0	3.4	289.9	0.3
PARROTFISH,REDTAIL	41.0	2.5	28.9	0.0	1911.0	27.0	1868.8	30.4	1952.0	22.3	1897.7	2.1

	DISP											
	BYCATCH				RETAINED				All			
	NUMBER		WEIGHT		NUMBER		WEIGHT		NUMBER		WEIGHT	
	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum
COMMON_NAME												
PARROTFISH,STOPLIGHT	1.0	0.1	1.2	0.0	316.0	4.5	359.8	5.8	317.0	3.6	360.9	0.4
PORCUPINEFISH	15.0	0.9	37.8	0.0					15.0	0.2	37.8	0.0
PORGY,JOLTHEAD					15.0	0.2	15.4	0.3	15.0	0.2	15.4	0.0
PORKFISH	1.0	0.1	23.1	0.0	1.0	0.0	0.7	0.0	2.0	0.0	23.8	0.0
PUDDINGWIFE	4.0	0.2	5.0	0.0	24.0	0.3	19.5	0.3	28.0	0.3	24.4	0.0
PUFFERS	32.0	1.9	7950.0	9.2					32.0	0.4	7950.0	8.6
ROCK BEAUTY	5.0	0.3	1.5	0.0	2.0	0.0	0.9	0.0	7.0	0.1	2.4	0.0
RUNNER,BLUE					7.0	0.1	6.3	0.1	7.0	0.1	6.3	0.0
SAILFISH	1.0	0.1	25.0	0.0					1.0	0.0	25.0	0.0
SCAD,MACKEREL					158.0	2.2	46.8	0.8	158.0	1.8	46.8	0.1
SCHOOLMASTER	2.0	0.1	5.2	0.0	49.0	0.7	61.6	1.0	51.0	0.6	66.9	0.1
SCORPIONFISH,REEF	15.0	0.9	10.2	0.0					15.0	0.2	10.2	0.0
SCORPIONFISHES,THONYH	2.0	0.1	2.0	0.0					2.0	0.0	2.0	0.0
SENNET,SOUTHERN	2.0	0.1	1.3	0.0	2.0	0.0	1.3	0.0	4.0	0.0	2.6	0.0
SHARK,BIGEYED SIXGILL					12.0	0.2	122.0	2.0	12.0	0.1	122.0	0.1
SHARK,CARIBBEAN REEF					2.0	0.0	16.4	0.3	2.0	0.0	16.4	0.0
SHARK,NURSE	6.0	0.4	52000.0	60.5	8.0	0.1	182.2	3.0	14.0	0.2	52182.2	56.6
SNAPPER,BLACK					5.0	0.1	8.6	0.1	5.0	0.1	8.6	0.0
SNAPPER,BLACKFIN					52.0	0.7	45.6	0.7	52.0	0.6	45.6	0.0
SNAPPER,DOG	1.0	0.1	0.3	0.0	1.0	0.0	0.8	0.0	2.0	0.0	1.0	0.0
SNAPPER,GLASSEYE					1.0	0.0	0.6	0.0	1.0	0.0	0.6	0.0

	DISP											
	BYCATCH				RETAINED				All			
	NUMBER		WEIGHT		NUMBER		WEIGHT		NUMBER		WEIGHT	
	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum
COMMON_NAME												
SNAPPER,GRAY(GREY)					5.0	0.1	2.4	0.0	5.0	0.1	2.4	0.0
SNAPPER,LANE					11.0	0.2	7.4	0.1	11.0	0.1	7.4	0.0
SNAPPER,MAHOGANY	3.0	0.2	100.6	0.1	14.0	0.2	6.5	0.1	17.0	0.2	107.1	0.1
SNAPPER,MUTTON	2.0	0.1	0.6	0.0	14.0	0.2	34.4	0.6	16.0	0.2	34.9	0.0
SNAPPER,QUEEN					72.0	1.0	154.0	2.5	72.0	0.8	154.0	0.2
SNAPPER,SILK					6.0	0.1	11.5	0.2	6.0	0.1	11.5	0.0
SNAPPER,VERMILION					2.0	0.0	2.4	0.0	2.0	0.0	2.4	0.0
SNAPPER,YELLOWTAIL	6.0	0.4	8.4	0.0	406.0	5.7	435.3	7.1	412.0	4.7	443.7	0.5
SPADEFISH,ATLANTIC	1.0	0.1	0.2	0.0	6.0	0.1	15.2	0.2	7.0	0.1	15.5	0.0
SQUIRRELFISH,LONGSPIN	44.0	2.6	3444.0	4.0	92.0	1.3	34.8	0.6	136.0	1.6	3478.8	3.8
STINGRAY,SOUTHERN	7.0	0.4	18.2	0.0					7.0	0.1	18.2	0.0
SURGEON,OCEAN	377.0	22.7	97.8	0.1	63.0	0.9	21.4	0.3	440.0	5.0	119.2	0.1
TILEFISH,SAND	13.0	0.8	9.7	0.0					13.0	0.1	9.7	0.0
TRIGGERFISH,OCEAN	37.0	2.2	8.9	0.0					37.0	0.4	8.9	0.0
TRIGGERFISH,QUEEN	8.0	0.5	3.8	0.0	86.0	1.2	103.5	1.7	94.0	1.1	107.3	0.1
TRUNKFISH	2.0	0.1	0.6	0.0	16.0	0.2	26.7	0.4	18.0	0.2	27.3	0.0
TRUNKFISH,SMOOTH	111.0	6.7	43.3	0.1					111.0	1.3	43.3	0.0
TRUNKFISH,SPOTTED	3.0	0.2	0.5	0.0	131.0	1.9	69.1	1.1	134.0	1.5	69.6	0.1
TUNA,BLACKFIN					6.0	0.1	14.1	0.2	6.0	0.1	14.1	0.0
TUNNY,LITTLE					23.0	0.3	32.0	0.5	23.0	0.3	32.0	0.0
WAHOO					1.0	0.0	26.2	0.4	1.0	0.0	26.2	0.0

Table 11 (Cont.): Sum of Catch and Weight Landed by Species year, disposition of catch

	DISP											
	BYCATCH				RETAINED				All			
	NUMBER		WEIGHT		NUMBER		WEIGHT		NUMBER		WEIGHT	

	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum	Sum	ColPctSum
COMMON_NAME												
WRASSE,YELLOWHEAD	1.0	0.1	0.3	0.0					1.0	0.0	0.3	0.0
All	1664.0	100.0	85997.1	100.0	7077.0	100.0	6153.1	100.0	8741.0	100.0	92150.2	100.0

Table 10 and 11—
Explore gear differences
Explore area differences 9landign sites vs species- group by coasts if possible
Explero ethnic group vs differences in species
Explore seasonality differences

Evaluate some of the individual species--- looks to be some codigng errors in weights (lbs vs grams likely)

Figures

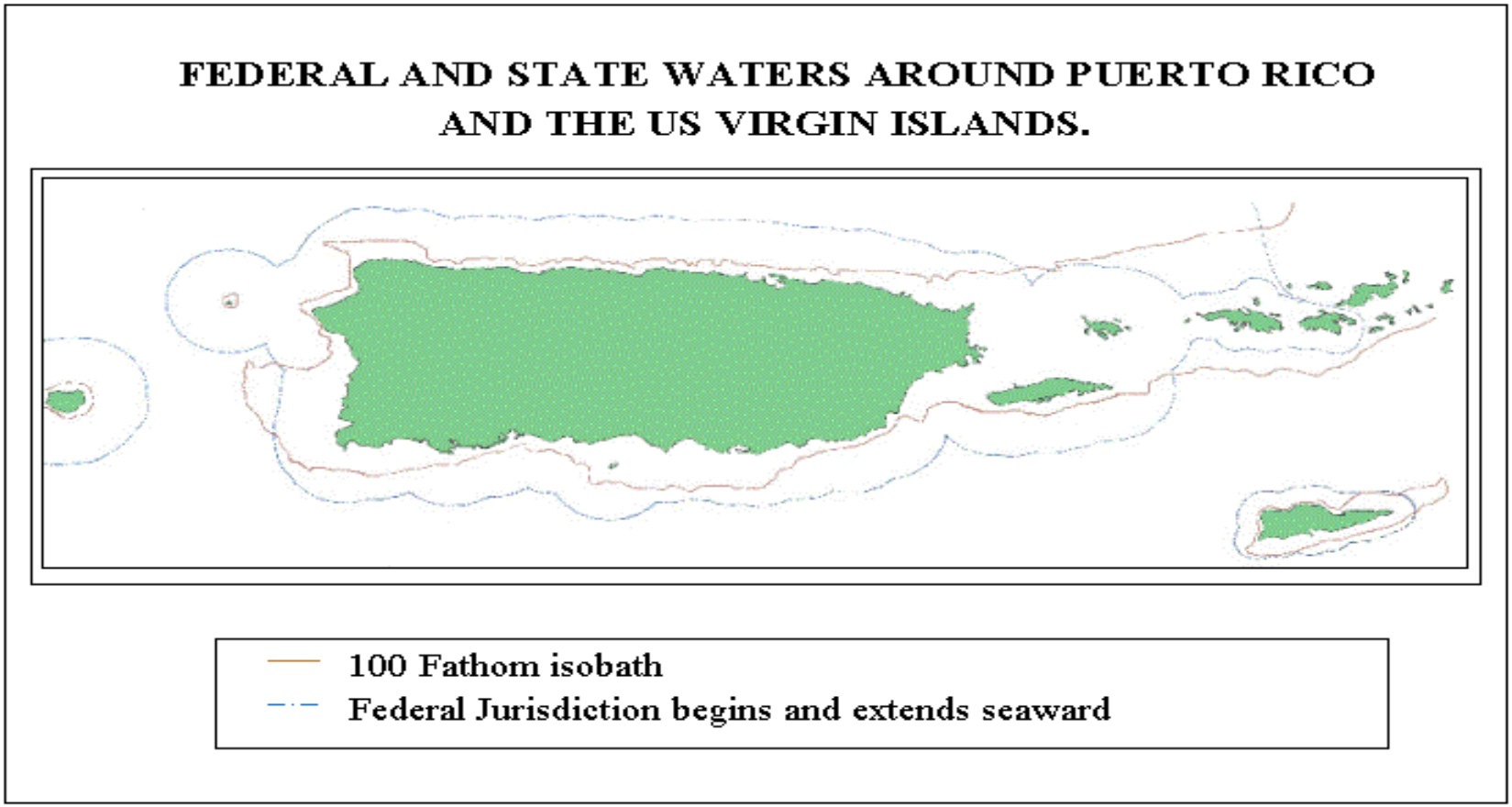

Figure 1. Federal and State waters around Puerto Rico and the U.S. Virgin Islands

Appendix

St. Croix Small-scale Fisheries Pilot Observer Project
Observer Protocol: September 2004

Objectives

The purpose of this project is to assess the potential for obtaining information on bycatch, discards, and biological data from the commercial fisheries of the US Caribbean, to help characterize the total catch for the US Caribbean region. This type of information does not exist in the US Caribbean, although it is required by the Magnuson-Stevens Fishery Conservation and Management Act. The project will focus on St. Croix fisheries to develop methods for obtaining information on composition and disposition of bycatch and discards at sea, opportunities for collecting biological data at sea, and the use of captain or crew for collecting data if space or safety on vessels does not allow observers. USVI DFW, MRAG Americas, Inc., and the Southeast Fisheries Science Center (SEFSC), will team with commercial fishers from the US Virgin Islands to conduct the pilot observer program. The results of the project could help management agencies determine whether bycatch and discards are a problem, and whether an observer program could help obtain necessary data.

The immediate objective is to develop and implement a pilot observer scheme capable of monitoring catch and discards on small-scale vessels using fishing gears most commonly used by St. Croix commercial fishers. The project will primarily address feasibility issues associated with placing of observers onboard commercial fishing vessels in the US Caribbean, with emphasis on the fisheries of St. Croix:

- Financial, space, and safety considerations for placing observers on board
- Limitations to data collection on board
- Coordination and cooperation issues with fishers
- Alternatives to placing observers on board.

However, the project will obtain the only available data on bycatch and discards in the US Virgin Islands, and will supplement the USVI biostatistical sampling program. Therefore, collecting and maintaining high quality data is priority for the project. It will be important to provide an explanation to fishers of why the information is being collected and how it will be used. This can be provided by the observer when contacting fishers.

Approximately 240 fishers possess commercial licenses on St. Croix. Of these, roughly half are full-time fishers. Fishers may have a preferred species or set of species in mind at the beginning of each trip, but the large diversity of species in the US Caribbean will mean that fishers often catch species in addition to those preferred. Fishers will retain those fish with market (sale) or subsistence (take home) value, and may discard fish without value. The proportion of discards from the total catch in St. Croix is unknown; however, the gears that catch the majority of landings probably have the greatest amount of discards. These gear types are:

- Trammel and gillnets nets
- Hook and line
- Pots/trap
- Dive

The observer will have the following priorities, described in more detail in following sections:

- Emphasize net gear during period before net ban. Try to obtain six net observations. Otherwise, maintain four vessels per month sampling schedule – one each for hook and line, pot/trap, dive.
- Try to ride a different vessel for each observation.
- Individual length and weight measurements for the discarded catch
- Individual length and weight measurements for the retained catch
- Interactions with marine mammals, sea turtles, and seabirds
- Select approximately 10 fishers to collect discard data with no observer on board.

Approach

The approach presented below will address those components of the program associated with the following areas:

- Training for observers
- Selecting vessels for observer deployment
- Identifying data that can be collected at sea and ashore
- Operational procedures for fishers and observers
- Safety

Stage 1: Observer training

The observer and back up observer have extensive experience in working with fishers of St. Croix and with collecting biosamples using the TIP format. Therefore, the amount of formal training needed before the start of observations is minimal. The observer supervisor will meet with the observers prior to the start of sampling, using this protocol as a guide to assure that the observers are proficient with:

- Sampling protocol;
- Operational protocols;
- Data collection forms;
- Safety

Stage 2: Select vessels for observer deployment

The Division of Fish and Wildlife (DFW) maintains the license registry for commercial licenses. The observer supervisor will obtain a randomly-ordered list of currently-licensed vessels from DFW, sorted into the four gear types: net, pot/trap, hook and line, and dive.

The observer will contact license holders on the list and determine 1) if they are planning to fish in the pilot program period, and 2) if they will voluntarily take an observer. The observer, in consultation with the observer supervisor, will remove the names of fishers who will not fish during the experiment or who will not carry the observer. From the remaining license holders, the observer, in consultation with the observer supervisor, will establish which boats are suitable for observer deployment. The selection criteria will be based on the following elements:

- Willingness of captain/skipper to accept an observer;
- Gear type and characteristics;
- Size – is there adequate space for an observer;
- Seaworthiness of the vessel;
- Work space availability for sampling tasks;
- Safety equipment onboard.

To the degree possible, we will select appropriate vessels in advance, and make arrangements with captains who agree to accommodate the observer. Observer will start at the top of each gear list, and contact fishers until he can schedule a ride. The observer will select first vessel on the list, try to set up a ride, go to the next if necessary. If insufficient fishers volunteer to carry an observer to provide approximately 10 vessels per gear type, a second ride on a boat is acceptable if the boat uses a different gear from the first observation on the vessel. If second rides on vessels using a different gear are insufficient to meet distribution goals, then OK to ride the same vessel with same gear twice. During the vessel selection process, the observer will explain to the vessel owner/operator that the pilot observer project intends to help collect information on the entire catch (retained and discards – see Introduction), and that the $100 payment will require assistance from the operator in making retained catch accessible to the observer for sampling.

While on board with a volunteer fisher, the observer will discuss the captain data-collection program. The observer will determine which captains have the capacity and interest to fill out the forms and bring in the samples. If possible, the observer will schedule the first five captain-collection trips on different vessels. After the first five trips, the project team will decide whether to repeat collections from prior vessels or to continue with different vessels. The captain data-collection will not collect information from net trips, to maximize the opportunity to assess potential of this method for gears remaining in the fishery. The observer will explain that the $200 payment will require assistance from the operator in making retained catch accessible to the observer for sampling.

Because nets will phase out around December, the observer will concentrate on obtaining rides for net gear at the beginning of the project, and attempt to obtain observations on six net vessels before the net are banned. Although the project design calls for four trips per month, one on each gear type, the observer must schedule more than one net trip per month, and can schedule multiple net trips in a month during the period before the net ban starts. After the net ban goes into effect, the observer will schedule trips to stay approximately on target for one trip for each remaining gear type per month. Any trips budgeted for net observations but not used will be redistributed to other gear types.

The observer will notify the fisher that we will record all catch information; fisher must agree to fish legally for duration of observed trip.

When an observer completes a trip on a vessel or picks up a sample from a captain's trip, the observer and captain will sign the trip confirmation form. Payment to the captain cannot occur without this form.

Stage 3: Identifying data that can be collected at sea and ashore

Data collected during this project will have two main components: biological data and fishing operations data. Biological data will consist of lengths and weights for all individuals of each species in the retained catch and in the discarded catch of each haul or set; estimates of survival potential for individuals to be discarded (at the time the fisher would have thrown them over the side); interactions with marine mammals, sea turtles, and/or sea birds; and other data to be determined based on observer experience. Fishing operations data will consist of date, time, vessel, captain, etc. Specific information and procedures are described in the Stage 4 section.

This project assumes that the small size of vessels in St. Croix will prevent most cases of weighing and measuring specimens on-board the vessels. In most cases, the observer will retain fish to be discarded for processing on shore, although some prohibited species (undersized lobster and conch or berried lobster) may require efforts to collect data at sea. However, the Observer will note for each trip the feasibility for sampling on-board. The observer will:

- Describe the procedures used for on-board sampling of lobster and conch, if any, and any problems encountered with the sampling
- Evaluate whether any on-board sampling for fish was feasible, and if so, what level of sampling
- Describe how the captain felt about the possibility of on-board sampling (likely to participate, opposed, etc.)

The project will provide a handheld GPS and a digital camera for use by the observer to document fishing tracks and locations and to record unusual incidents.

The data collected should be prioritized to fulfill program objectives, but where possible collect as much baseline information as practically possible to provide a complete picture of fishing activity. The data recording formats will be differentiated into information that can be collected at sea or ashore by either observers or skippers.

Stage 4: Data collection procedures

The Observer will keep sampling protocol as similar as practical to the current bio-sampling conducted under the Federally-sponsored biosampling (tiponline). The pilot observer project will collect data from entire trips, rather than try to sample on a haul-by-haul basis. However, the observer will keep in mind the desirability of sampling sets or hauls, and help determine if fishers fish in a way that could constitute a “set” or “haul.” To maintain consistency among vessels, the observer will collect biological data from retained catch as soon as possible after the vessel returns to port, but place all discards in labeled bags for processing the next day or days. The observer may place all discarded fish in a cooler while on board, for transfer to a bag or bags later. The observer will attempt to weigh and measure every specimen of the discarded catch and of the retained catch. If fishers sort retained catch into market and subsistence categories, the observer will sample each separately. The observer will weigh and measure undersized and berried lobsters and undersized queen conch on board; the observer will return these animals to sea as quickly as possible in as good a condition as possible. The observer will make notes on the capability of collecting data at sea.

Even though observer instructions call for weights for every specimen in the catch, which would provide the total catch by addition, observers may not be able to sample all specimens in every case. Therefore, a procedure for estimating total catch may be needed. US Caribbean fishers typically place retained catch in coolers. Observers could estimate weight of retained catch by standardizing the weight of catch to the volume of the coolers. The sum of retained catch (determined from direct weights or estimated by volume) and weight of discarded catch (determined from laboratory samples) would represent total catch.

The chance for fish to survive after being discarded (viability) is an important bit of information for assessing the impacts of discards on fish stocks. The requirement for observers to place discards in bags in a cooler prevents an observation of viability of discarded fish in the water. However, estimation of discard survival is important information. To help assess the feasibility of collecting this information, the observer will make qualitative observations on a tally sheet for each haul or set of viability as fish go into the bag:

- Strong – active when stimulated, firm opercular pressure, no or minor bleeding, gills red
- Weak – limited activity when stimulated, weak opercular pressure, moderate bleeding, gills pink
- Moribund – no activity when stimulated, no opercular pressure, extensive bleeding, gills pale

The observer supervisor will discuss this component of the project with the observer during debriefing to determine if modifications are needed in-season, or if the collection is feasible at all. For example, a live/dead division may be all that can be reasonably obtained.

The observer will record basic information for each trip on interactions with marine mammals, sea turtles, and sea birds. The form will document the gear, the species, and the interaction.

The observer may assist fisher with sorting, icing, or other activities that constitute minimal danger to the observer or to the vessel. The observer may not haul or retrieve gear, operate the fishing vessel, or any other activity that may result in danger to the observer or to the vessel. The observer should consult first with the Mr. Tobias and if necessary with Dr. Trumble or Dr. Uwate on a case by case basis for specific activities that may arise.

Following each 1 or 2 trips, the observer and supervisor will meet to debrief the previous trips, and specifically discuss:

- Problems found on the vessel caused by vessel
- Problems found on the vessel caused by captain or crew
- Opportunities to sample on board
- Protected species interactions
- Illegal activities
- Capability of captain to perform captain-sample duties
- Amount of biological sampling time relative to 5-hr per trip time budget

Stage 5: Safety

Observers will not ride on vessels deemed as unsafe. Commercial fishing vessels in US waters are subject to US Coast Guard safety regulations. Observers will confirm that each vessel selected for an observation, and for which the captain has agreed to carry an observer, has a current Coast Guard or DPNR safety inspection. The observer should ask the captain about safety inspections at the time of the selection, and confirm that the vessel has a current inspection before boarding.

The observer will notify the observer supervisor of each trip, and will report estimated time of departure and estimated time of return. The observer will notify the observer supervisor at the end of each trip. Observers will be outfitted with a life jacket and a personal EPIRB. Observers should, but are not required to, wear the life jacket during fishing operations. However, the observer must have the life jacket stored in a safe, accessible location, not subject to blowing or washing off the vessel and easily reached in an emergency. The EPIRB must be attached to the lifejacket or the to the observer’s person at all times while on board.

The observer will be outfitted with a handheld marine VHF radio to supplement cellular telephone access.

St. Croix Pilot Observer Project
Discard mortality tally form: September 2004

Vessel Name		Gear	
Vessel ID		Date	
	Condition		
Species	Strong	Weak	Moribund

St. Croix Pilot Observer Project
Protected species interaction form

Vessel Name			Vessel ID
Date			Gear
Latitude			Longitude
Species	Size	Interaction Code	Comments

Interaction code - Enter the interaction code. If an animal is involved with more than one interaction during one haul or set, list them as separate records with different interaction numbers.
1 - Deterrence Used – Protected species was deterred or a deterrent was attempted. Log this interaction using this code even if the deterrence was not successful.
2 - Entangled in Gear (Not Trailing Gear) - A protected species was captured by the fishing gear and the animal was released/escaped without fishing gear attached.
3 - Entangled in Gear (Trailing Gear) - A protected species was captured by the fishing gear and the animal was released/escaped alive with some fishing gear attached.
4 - Killed By Gear - A protected species was captured and died due to interactions with the fishing gear.
5 - Killed By Propeller - A protected species hit the propeller and died.
6 - Previously dead - A protected species was captured by the fishing gear and was dead prior to coming into contact with the vessel or fishing gear.
7 - Lethal removal - Vessel personnel killed a protected species entangled in fishing gear, but death was not due entirely to the entanglement.
8 - Boarded Vessel - A protected species boarded the vessel on its own volition.
9 - Feeding on Catch -A protected species was observed feeding on catch not yet landed.
10 - Other - Interaction occurred that is not included in the list of interaction codes.
11 - Unknown - The vessel or vessel personnel had some interaction with a protected species, but the observer did not directly view the interaction and/or ascertain what the interaction was.

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President: Professor John Beddington F.R.S.

St. Croix Observer Project
Vessel Participation Confirmation

Captain: _____

Vessel: _____

Date: _____

Check one:

☐ I confirm that Observer _____ performed at-sea observer duties on the vessel above ($100 compensation to the Captain).

☐ I confirm that the captain of the vessel above collected discard samples at the request of Observer _____ ($200 compensation to the Captain).

Please Fax or mail this form to Beth Weiland, MRAG Americas to initiate payment.

_____ _____
Signature of Captain **Signature of Observer**

Captains' Address: