THE GILL AND TRAMMEL NET BUYBACK AND BAN IN ST. CROIX, U.S. VIRGIN ISLANDS

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Abstract

This study examines the perceptions about the biological and socio-economic performance of the gill and trammel net buyback and ban in St. Croix, U.S. Virgin Islands. The objective of the buyback was to assist fishermen transition to other gears while the ban sought to protect parrotfish populations, reduce by-catch and minimize gear-habitat interactions. The analysis drew from 43 individuals knowledgeable about the buyback and ban process, including commercial fishermen, recreational diving and fishing charter operators, members of non-governmental environmental organizations, and professionals involved in resource management, research and outreach. Overall, the results underscored a perception gap between former net fishermen and other stakeholder groups, especially when dealing with biological and socio-economic impacts of the ban. Survey results showed that former net fishermen and a slight majority of the resource managers believed that buyback payments were insufficient to transition to other gears, especially traps, whereas members of the diving, charter, and environmental group disagreed. On average, fishermen received less than one-fifth of the amount that they deemed reasonable to start a new operation. Most fishermen believed that the net ban had increased the protection of parrotfish; however, resource managers were more guarded due to the absence of independent biological studies. The diving, charter and environmental group was skeptical about increases in parrotfish abundance. Fishermen and, to lesser extent resource managers, felt the ban adversely impacted the profitability of fishing operations and fishermen's livelihoods. Out of the original nine net fishermen bought out, only five remained owner operators.

Key words: Gillnet, trammel net, buyback, ban, St. Croix, socio-economic.

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1. Introduction

The rapid expansion of the gill and trammel net fishery in St. Croix, U.S. Virgin Islands with its associated biological and ecological impacts generated substantial concern among fishery managers and resource users. In contrast to the conventional use of these nets, where schools of fish head towards them where they either get gilled or entangled, Crucian fishermen developed a distinctive technique where divers herd schools of fish into the nets, which are strategically placed between their diurnal foraging grounds and nocturnal resting grounds. These nets intercept schools of fish mainly at dusk when they migrate between grounds (Toller and Tobias, 2007). Because divers actively tend their nets, this unique fishing technique out-competed other traditional fishing techniques (Toller and Tobias, 2007).

Diver-assisted net fishing is an extremely effective harvesting method for catching large numbers of reef fish species, especially parrotfish (Scaridae) and, to a lesser extent, surgeonfish (Acanthuridae). Parrotfish play an important ecological role in coral reef ecosystems because they are grazers that remove algae which could otherwise interfere with settlement and survival of coral recruits (Brock 1979; Mumby 2006; Burkepile and Hay 2010). The ecological role of parrotfish has become more important since the 1980's when there was Caribbean-wide decline of a dominant sea urchin (*Diadema antillarum*), which was another key grazer (Sandin and McNamara, 2012). Declining parrotfish populations are believed to have contributed to a phase-shift from coral-dominated to algal-dominated communities in reef systems (Hughes, 1994). Parrotfish is also a popular seafood species among locals. In the last decade, parrotfish

landings accounted for about 30% of the total landings and for 20% of the aggregate revenues in St. Croix (Figure 1 and 2).[1,2] Nets also catch threatened and endangered species such as sea turtles (Toller and Tobias, 2007). Moreover, the setting and removal of the nets has been documented to uproot corals, gorgonids, sponges and other sessile organisms (Tobias, 2004; Toller and Tobias, 2007).

In May 2008, the Department of Planning and Natural Resources (DPNR) of the U.S. Virgin Islands implemented a gill and trammel net buyback to minimize the economic hardship due to a soon to be enforced ban on nets in the island of St. Croix.[3] The intent of the net ban was to address concerns about the health of parrotfish populations, excessive by-catch of non-marketable species and protected and endangered species, and damaging gear-habitat interactions.

This study examines the perceptions of various stakeholder groups about the biological and socio-economic performance of the net buyback and ban in St. Croix, U.S. Virgin Islands. The assessment of perceptions is a valuable tool for policy-making since it allows resource managers to gauge the needs and experience of the various user groups impacted by past policy interventions. They can provide insight whether policy interventions should be scaled up or abandoned altogether and also can help guide future policy interventions. Divergent perceptions may signal that managers may have to further

[1] The National Marine Fisheries Service (NMFS) has cooperative agreements with the Territory of the U.S. Virgin Islands and relies on the Territory to collect and process landings and price data. The Southeast Fisheries Science Center (SEFSC) maintains this information in their Accumulated Landings System (ALS) database.

[2] In the U.S. Virgin Islands, the fishing year runs from July 1 to June 30 of the following year.

[3] The use of gill and trammel net was prohibited with the exception of surface gill nets for baitfish ballyhoo, gar, and flying fish.

refine previous policy interventions and/or improve their delivery (Marshall, 2007).

The paper is structured as follows. Section 2 provides an overview of the Crucian gill and trammel net fishery, and Section 3 introduces the methodology employed. Section 4 summarizes the main results from the interviews, and section 5 offers the main conclusions of this study.

2. Rise and Fall of the Gill and Trammel Net Fishery

The use of gill and trammel nets rose rapidly in the late 1980's following numerous storms and hurricanes that disrupted local fisheries, especially the trap fishery, and declining catch rates (Tobias, 2004; Toller and Tobias, 2007).[4] Local fishermen lacking access to federal emergency funding to replace their traps and unwilling to withstand further losses turned to gill and trammel nets. Fishermen preferred nets because they could be brought back after each fishing trip without exposing them to dangerous weather conditions, theft, and poaching (Toller and Tobias, 2007). In 1995, the State of Florida outlawed the use of commercial entanglement nets which further fueled the expansion of the Crucian net fishery because gear suppliers began marketing their surplus nets in the island (Tobias 2004).[5] Fishermen also favored nets over traps because the latter delivered larger catches and economic returns. Tobias (2004) reports that between 1990/91 and 2002/03, the share of reef-fish species taken by traps declined from 88.7% (263,527 lbs.) to 42.8% (148,229 lbs.) while the share of reef fish taken by nets increased from 11.3% (33,482 lbs.)

[4] Hurricanes Hugo, Luis, Marilyn, Bertha, Hortense, Georges, and Lenny struck the island of St. Croix (Tobias, 2004).

[5] A voter referendum conducted in November 1994 approved a ban on nets over 500 square feet in Florida state waters. In July 1995, the net ban was implemented (Adams, Jacob, and Smith. 2009).

to 57.2% (198,409 lbs.).[6]

Over time, apprehension over the use of gill and trammel nets grew because of the size of parrotfish landings and its potential impact on the health of these stocks and also because of the wasteful disposal of part of the landings (Gordon and Uwate, 2003; Kojis, 2004; Messineo and Uwate, 2004). Large amounts of unsold or spoiled fish were being dumped along roadsides, beaches and collection bins (Toller and Tobias, 2007).[7] In response to these concerns, the St. Croix Fishery Advisory Committee (FAC) recommended disallowing the use of gill and trammel nets in October 2002 (Rothenberger *et al*., 2008). The St. Croix FAC also proposed a one-time net buyback to be conducted concurrently with the net ban to soften any socio-economic dislocation (Uwate and Tobias, 2005; Niesten and Gjertsen, 2010). Toller and Tobias (2007) noted the FAC believed that outlawing the use of nets would be the most effective and readily enforced management tool. The U.S. Virgin Islands commercial fishermen census identified 43 gill and trammel net fishermen (34 gillnet and 9 trammel fishermen) who fished primarily for parrotfish and surgeonfish (Tobias 2004; Kojis, 2004).[8]

Following the St. Croix FAC recommendation, the DPNR held a number of contentious meetings dealing with the net ban, which gave added impetus to a one-time gill and

[6] Because the early trip ticket reports did not collect species-specific information, parrotfish landings for this period are not available. However, a 2002 biostatical analysis of the catch taken by nets indicated that parrotfish accounted for 83% of the catch by weight (Tobias, 2004).

[7] The intentional dumping or discarding known as 'wanton waste' in prohibited in the U.S. Virgin Islands (Toller and Tobias, 2005).

[8] Our original plan was to sample all 43 documented gill and trammel net fishermen; however, while conducting out the fieldwork, our liaisons told us that our target population was somewhat large because many fishermen had misreported the number of nets they owned to pre-empt future regulations. Our liaisons suggested that about half our identified target population were bona fide net fishermen.

trammel net buyback. The National Oceanic and Atmospheric Administration (NOAA) Coral Reef Conservation Program (CRCP) provided a $75,000 grant to the DPNR to assist with the net buyback. Out of this amount, DPNR spent about $55,000 to purchase nets and the remaining funds went to administering the grant (overhead).[9]

During the public meetings, net fishermen contended that the proposed ban would impose an undue financial hardship not only to them but also on their crews and fishing related businesses and instead suggested area and seasonal closures and weekly harvest windows (i.e., fish only 2 days per week). After deliberating the merits of the fishermen plan, the St. Croix FAC concluded that it was inadequate to curb overfishing and also was difficult to enforce (Uwate and Tobias, 2005; Toller and Tobias, 2007). Following FAC deliberations and additional discussions with fishermen, guidelines to participate in the buyback were developed (Toller and Tobias, 2007). To qualify for compensation, fishermen had to demonstrate that they had landed 10,000 lbs. or more using nets between 1998/1999 and 2002/2003. Compensation levels were set in proportion to the reported landings to soften any hardship on those most dependent on nets.

A few St. Croix FAC members suggested that the decision to uphold the ban was also driven by fear that additional area and/or seasonal closures were to be established in St. Croix, especially in Lang Bank (Figure 3). At the time, the Caribbean Fishery Management Council (CFMC) was developing management proposals to satisfy the requirements of the Sustainable Fisheries Act (SFA). Among the management actions being considered, were the establishment of large area closures to rebuild overexploited stocks and prevent

[9] The Division of Fish and Wildlife of the U.S. Virgin Islands is supported entirely by the federal government, with approximately 85% from US Fish and Wildlife and 15% from NOAA (Gjersten, 2009).

overfishing, which caused dismay among local fishermen (Kojis and Quinn, 2012). Fishermen were still upset about the 2001 expansion of the Buck Island Reef National Monument (BIRNM), which closed about 7.4% of St. Croix's fishable area (Karras and Agar, 2009). Unlike the islands of St. Thomas and St. John, St. Croix has a small shelf area, which mostly occurs within its three nautical mile territorial jurisdiction (Kojis, 2004; Valdés-Pizzini *et al*., 2010). Because there were fewer fishermen that fished with nets relative to the number of fishermen that fished in Lang Bank, the FAC maintained their support for the ban. In the end, the CFMC decided against additional area closures in St. Croix and St. Thomas/St. John except for a small area closure off St. Thomas (Grammanik Bank).

In July 2006, Governor Charles W. Turnbull signed a bill prohibiting the use of gill and trammel nets. The bill was to take effect on January 1, 2007, when the new Governor John P. de Jongh, Jr. took office. However, the new administration decided not to enforce the ban for six months to give fishermen the opportunity to find a senator to sponsor legislation that would replace the ban (Gjersten, 2009). Meanwhile, the new authorities of the U.S. Virgin Islands' Division of Fish and Wildlife (USVI DFW), which is housed within DPNR, favored replacing the net ban with a limited entry program. The DPNR limited entry plan drew from a net fishermen management plan developed by the St. Croix Commercial Fishermen's Association (SCCFA), which called for a limited entry program with transferable licenses (capped at 9 fishermen), gear restrictions (length, height, and mesh size of the nets), annual quota to be equally divided among the licensed fishermen, by-catch reduction targets for targeted and non-targeted species, and a season closure to protect spawning aggregations which was to run from August 1 to October 31 (SCCFA, n.d.). The plan also had a penalty schedule for non-compliance, which included gear confiscation for

the first offence and license forfeiture for the second offence.

Under the DPNR limited entry program, fishermen were to be granted licenses which entitled them to land up to 200,000 lbs. of fish per year using nets (about 22,000 lbs. per fishermen, Gjersten, 2009). The DPNR plan was to continue for a few years to allow fishermen to gradually phase out of the fishery (Gerstein, 2009). On February 2008, FAC reversed its support for the ban and backed the gradual phase out plan. However, Governor de Jongh upheld the ban to minimize the risk of overfishing parrotfish stocks (Gjersten, 2009). In May 2008, DPNR began implementing the buyback and enforcing the ban.

In June 2008, nine fishermen signed a memorandum of agreement to receive gill and trammel net buyback funds. The memorandum stated that to receive compensation, fishermen currently using gill and trammel nets were eligible to one share of the buyback funds if they had landed at least 10,000 lbs. with nets between 1998/99 and 2002/03. It also stated that for each 10,000 lbs. above the initial 10,000 lbs., an additional equal share of the total buyback funds was to be allotted. All in all, fishermen collected between $865 and $16,435 depending on their reported landing history. The median payment was $4,325.[10] In addition, the memorandum stated that fishermen had to turn over the purchased nets to the Division of Environmental Enforcement. It also reminded fishermen that only gillnets for baitfish (e.g., ballyhoo, gar and flying fish) were allowed and that penalties for gill and trammel net violations included a $1,000 fine and the confiscation of vessel and equipment.

[10] The average payment was $6,549.

3. Methodology

To learn about the views regarding the biological and socio-economic performance of the net buyback and ban, we surveyed 43 individuals familiar with the net buyback and ban process.[11] To achieve stakeholder diversity, we interviewed 17 former net fishermen, 8 recreational diving and fishing charter operators, 6 members of environmental organizations, and 12 professionals involved in resource management, research and/or outreach. We grouped the stakeholders into four groups to facilitate the exposition of the main results. The four stakeholder groups included: all but one of the former net fishermen who participated in the net buyback (8 in total, the 9th fisherman left the island), former net fishermen that did not participate in the buyback (9), resource managers (12) and members of diving, charter, and environmental group (14). Members of the resource management, diving, charter and environmental groups were surveyed opportunistically based on the recommendations of our liaisons. Members of the CFMC, USVI DWF and FAC were our liaisons. We aggregated the opinions of the diving and charter operators and environmental group because of their shared views and for space sake. The voluntary, in-person interviews took place in July 2012.

The survey instrument contained both open and closed-ended questions.[12] It elicited information about demographics, participation in the fishery, opinions about the reasons for the ban and buyback, changes in fishing practices and views about the biological,

[11] We also interviewed 4 additional fishermen who did not fish with gill and trammel nets. Because of the small sample size, we did not summarize their views in the tables but we briefly touch on their views about the buyback and ban. In hindsight, we wished we had devoted more time and resource s to canvass the views of this stakeholder group.

[12] The survey instruments are available in the Appendix.

economic and social impacts of the ban. Stakeholders were asked about their perceptions regarding whether the ban protected parrotfish populations, mitigated by-catch, and protected coral reefs. They were also asked whether the ban had impacted fishermen's ability to support themselves and their families, generated economic hardships to the local fishing community, and reduced user conflicts. In addition, drawing on the data from our in-person-interviews we developed grid charts using ArcGIS showing the location of the main fishing grounds before and after the ban.

4. Results and Discussion

4.1. Perceptions about the economic and social impacts of the net buyback

The survey revealed conflicting views about the performance the buyback process, which was anticipated because support and satisfaction with regulatory decision-making among stakeholder groups mainly rests on their perceptions about the fairness of the process and outcome (Lind and Tyler, 1988; Smith and McDonough, 2001).

Fishermen were the most dissatisfied user group because they believed that the payments were insufficient to offset the financial hardship imposed by the ban (Table 1). Though many resource managers echoed this sentiment, as a group they believed that they had done their best with the available funds and information. Many members of the diving, charter, environmental, and resource manager groups believed that the process had been fair since it was the result of a lengthy, consultative process and the most affected fishermen had received some compensation to transition to other fishing gears.

A number of fishermen pointed out that during the consultative process most fishermen were more concerned with the ban rather than with the buyback itself because they believed that ultimately they would be able to defeat or at least further delay the adoption of the ban. Fishermen did not want to give up this extremely lucrative fishery. Some fishermen reported that they earned between $40,000 to 80,000 per annum using nets (Lohr, 2007). Fishermen also contended that resource managers had their mind set on the ban and did not adequately consider the use of area and/or seasonal closures and individual quotas.

When we questioned all net fishermen whether the buyback had targeted the appropriate individuals, their opinions were divided. Half felt that the buyback was appropriately directed towards the most dependent fishermen, while others believed that everybody that used nets, regardless of their landings, should have received at least partial compensation. Many objected that helpers and licensed fishermen fishing for someone else were not included in the buyback, especially when a dealer was bought out. [13] Most members of the diving, charter, and environmental group did not know whether the appropriate fishermen had been bought out because they were not aware of the names of the beneficiaries and the amount of the payment awarded.

Whether fishermen had been properly compensated was the dominant topic in often heated discussions about the socio-economic impacts of the buyback. Overwhelmingly, net fishermen believed that the amount of compensation offered was inadequate to make up for their forgone income and to assist in the conversion to other fishing gears. Fishermen

[13] Purportedly, a fish monger received buyback payments because fishermen working for him had recorded landings under his license.

who participated in the buyback believed that sensible payments should have been in the $25,000 to $50,000 range. On average, fishermen received less than one-fifth of the amount that they believed would have been reasonable.

Fishermen also claimed that to switch to other gears, on average, they needed about $30,000. One fisherman explained that the buyback funds were insufficient to offset the forgone revenues because the cost of an individual trap with the associated buoy and ropes ranged between $200 and $300.[14,15] Moreover, traps take longer to fish, are less productive, have higher maintenance costs, and are prone to theft and poaching. With the exception of one fisherman who used the buyback payments to support himself, all the others stated that they had used them to purchase traps, handlines, spear guns and SCUBA equipment. One fisherman claimed that he had shared part of the buyback funds with his crew and used the rest to buy traps.

Resource managers had mixed feelings about compensation levels. A slight majority did not voice an opinion because they did not know how much compensation was offered. However, those who expressed a favorable view (without knowing the compensation amount) felt that fishermen should have been grateful for the compensation they received. In contrast, those who were critical about compensation levels believed that the government should have not only paid for the value of their nets but also for their forgone

[14] Agar *et al.* (2008) report that the cost of a Crucian arrowhead trap with ropes and buoys was about $120 in 2003, which translates to about $150 in today's dollars.

[15] Crucian fishermen are currently developing a trap reduction program to ensure that this fishery can operate in a sustainable manner. The current proposal stipulates that the maximum number of traps per fisherman be capped at 150, which if we use the lower cost estimate translates to $30,000. This amount was cited above as the cost of the average investment needed to transition to other gears.

income. They noted that it was hard to value the time, money and effort that went into assembling the nets. One resource manager suggested that their compensation should have been in the $30,000 to $50,000 range. The majority of the members of the diving, charter, and environmental group did not express an opinion, but those who did, felt that fishermen should considered themselves fortunate for receiving compensation.

We also inquired whether buyback funds had eased fishermen's transition into other fishing gears. As shown in **Error! Reference source not found.**, most fishermen, especially those that participated in the buyback, strongly disagreed with this statement. The few fishermen, who felt the payments had helped, stated that limited financial assistance was preferable to having none. A small majority of resource managers felt that the buyback funds were insufficient for the transition. One resource manager noted that buyback payments would have been more helpful had they been disbursed in 2003 when its purchasing power was greater. Those resource managers who felt that the buyback had been helpful to fishermen observed that the funds were meant as an aid to switch to other fisheries, not as compensation for their forgone income from net fishing. Members of the diving, charter, and environmental group shared this sentiment. Further, many believed that that the transition would have been a considerably harder had they not received this assistance.

We also probed what could have been done differently to improve the buyback process. Fishermen that were bought out submitted that compensation should be far more generous to offset their forgone revenues and/or closely match realistic startup costs for adopting new fishing gears. A few fishermen reiterated that the local government should

have followed their proposed limited entry program. Others suggested that the government should have provided them with either new fishing gears or, at least, the materials that would allow them to build their own gear. The group of fishermen that were not bought out believed that buyback funding should have been available to everybody who worked with nets, including crew because they all had families to support. One fisherman suggested providing a temporary monthly stipend to crew while they sought alternative employment. Another fisherman argued that a fairer buyback payment formula would have paid a fixed amount per net and another amount based on the value of the landings.

Resource managers offered additional ideas. While a few thought that buyback payments should have been higher, others believed that the transition to the ban should have been slower. In addition, they felt that additional guidance on how to move forward should have been provided. Others considered that additional funds should have also been appropriated to strengthen the monitoring and enforcement of the ban. A few said that DPNR should have tried the fishermen's management plan before moving forward with the ban. Members of the diving and charter group believed that the government should have been more assertive in setting policy. Members of the diving, charter, and environmental group felt that the government officials should have decided early on an implementation date to give fishermen ample time to prepare for the transition (2-3 years). Members of the environmental community believed that more should have been done to support alternative livelihoods like providing them with training and/or grants to start new businesses, or at least, help them identify alternative sources of funding to assist them in the transition.

4.2. Impact of the gill and trammel net ban on fishing practices

Net fishermen stated that outlawing nets had a profound effect on their contractual arrangements and the way they fished. Noticeably, only five of the original nine net fishermen that participated in the buyback remained owner operators. The others began fishing for other fishermen or supplemented their income engaging in non-fishing activities.[16] In contrast, the number of owner operators of the group of net fishermen that did not qualify for the buyback, did not change after the ban. However, this latter group of fishermen displayed greater inter-annual variation in the number of trips taken suggesting that these fishermen may operate both as owner operators and as hired captains in a given year.[17]

Fishermen that were bought out stated that the volume and value of their landings significantly declined despite taking longer trips. Following the ban, they told us that, on average, the number of trips remained the same (about 3.5 trips/weeks) but its duration increased from 8.3 to 10.6 hours per trip. Also, fishermen reported that, on average, aggregate landings dropped by about 56% (from 368 lbs. per trip to 161 lbs. per trip) and gross revenues by about 50% (from $998 to $550 per trip) following the ban. Despite the well-known limitations of fisheries statistics from self-reported trip ticket records, these

[16] Two of them reported that they had begun fishing on full-time basis for others. A third one became a part-time fisherman who also worked in construction to eke out a living. Two of these former owner operators began fishing for other former net fishermen who participated in the buyback. The fourth fisherman no longer lived on the island.

[17] Hired captains do not report landings under their name, even though, they may have a commercial fishing license.

tend to be consistent with fishermen's claims of lower aggregate landings but catching higher valued species. The trip ticket database indicates that, on average, the aggregate landings per trip of the net fishermen who took part in the buyback fell by 30% (from 296 lbs. in 2007/2008 to 208 lbs. in 2010/2011), whereas the average landings of those who were not bought out fell by 9% (from 113 lbs. to 103 lbs. during the same period).

The self-reported catch records also document that between 2007/2008 and 2010/2011, on average, fishermen who were bought out landed about a quarter of the amount of parrotfish previously landed (43 lbs. vs. 196 lbs.) but landed more lobster (37 lbs. vs. 11 lbs.) and snapper (52 lbs. vs. 7 lbs.). In contrast, the net fishermen who did not partake in the buyback landed slightly less parrotfish (13 lbs. vs. 18 lbs.) but more conch (17 lbs. vs. 7 lbs.) during the same period.

Naturally, lower production levels translated into smaller crew sizes and compensation. The typical gill and trammel net operation hired between 2 and 4 crew while the average fish trap or spearfishing operation employs between 1 and 2 crew. The average compensation of the crew fell from $116 to $99 per trip. Reportedly, a small number of displaced crew began fishing for conch with SCUBA.

Fishermen also adjusted to the new conditions by switching to other fishing gears and/or modifying the composition of their catch. Most of them began fishing with spear guns and traps. While many continued targeting parrotfish, they also sought lobster, conch and snappers. A few mentioned turning to handlines to harvest coastal pelagics. Spearfishing was favored over trap fishing because of its lower capital cost and lower susceptibility to gear loss and poaching. It is important to note that some of the former net fishermen were arrested for fishing illegally with the proscribed nets in 2008 and 2009

(Gjertsen, 2009; St. Croix Source, 2009). Also, in 2010, a Hawksbill sea turtle, which is an endangered species, was found dead in an illegal gill net (Shea, 2010).

Concurrently, and somewhat unexpectedly, many net fishermen also began using a contentious fishing method known as 'fish bagging', which the government is expected to outlaw (USVI DFW, 2010). This controversial harvesting method is similar to the proscribed one; however, instead of using a gill or trammel net, fishermen use a 'modified' ¼ inch mesh size seine net (300-400 ft. long x 6-14 ft. deep).[18] Like with the former netting method, divers steer parrotfish and surgeonfish into a circular bag at one end of the net. Once the fish enters the bag, the bag is closed. The diver then removes the bag from the net and transports it to the boat (USVI DFW, 2010). The fishermen we interviewed stated that this technique generated about 200 lbs. per trip, which yielded about $750 in revenues. In addition, the fishermen noted that after switching gears they began concentrating their fishing effort on the SW corner of the island (Figures 4 and 5).[19]

Although, little is known about its impacts on fisheries, coral reef habitats and endangered and protected species, most stakeholders believe that this method undermines the intent of the ban.

4.3. Perceptions about the biological, economic and social impacts of the net ban

4.3.1. Support for the net ban

[18] Kojis (2004) reported that trammel nets ranged from 200-1000 ft. in length and 4-8 ft. in height (3-3.5 in. mesh size) and gillnets ranged from 90-1000 ft. in length and 3-12 in height (1.3-3.5 in. mesh size).

[19] Care must be exercised when reading too much into the reported distribution of fishing effort since most of the net fishing took place in shallower waters (up to 30 meters) than reported.

The survey showed that there were conflicting views about the need for the net ban. All the fishermen that participated in the buyback were initially vehemently opposed to it because of its adverse impacts on their and their families' well-being. A few expressed frustration with the government's reluctance to adopt their management plan instead of an outright ban. Four years after the ban, only one fisherman of the original nine changed his opinion. He now acknowledges that nets were catching excessive amounts of parrotfish which generated wasteful by-catch. The haphazard setting of nets also negatively impacted the seafloor. The remaining fishermen continued to object to the ban because of its detrimental impacts on their incomes. They stressed that the payments provided were insufficient to transition to other gears, especially traps.

Overwhelmingly, the other former net fishermen, who did not receive buyback financing, were also adamantly opposed to the ban because it threatened their livelihoods. Of this group, only one fisherman initially backed the ban because he believed that net fishermen were dumping excessive amounts of un-sold fish. However, he did point out that the fishermen's management plan would have been preferable to an out-right ban. After four years, all but one of these fishermen continued to be opposed to it because of its negative impacts on their families and crews.

We also interviewed a small number of fishermen who did not use nets. This stakeholder group believed that the ban was appropriate because exploitation rates were unsustainable. They also objected to the large amounts of by-catch, much of which was discarded. These views are consistent with those reported by USVI DFW documents (Gordon and Uwate, 2003; Kojis, 2004).

Across the other stakeholder groups, the vast majority of the respondents offered concordant views about their support for the ban. They believed that the ban was necessary to restore ecological balance. These stakeholders believed that the Crucian method of fishing with nets had resulted in over-exploited parrotfish populations, excessive by-catch, especially of juvenile fish and sea turtles, dumping of un-marketable fish on land, and had adversely impacted coral reefs. Members of the environmental group acknowledged that while the ban was a step towards recovering coral reefs, additional measures dealing with other pressures like land-based sources of pollution, sea level rise, and ocean acidification were also required. The few resource managers that disagreed with the net ban felt that pursuing the fisherman's proposed plan would have been preferable given that many of net fishermen turned to 'modified' seine nets. They also noted that the reporting of landings is believed to be worsening. Failing to report or misreporting landings is a common method to repudiate management actions that are perceived to be harsh and unfair (Scott, 1987; Garcia-Quijano, 2009; Matos-Caraballo and Agar, 2011).

4.3.2. Views on the biological performance of the net ban

Next we examined fishermen's perceptions about the biological efficacy of the ban. Specifically, we inquired about its ability to protect parrotfish populations, reduce the by-catch of species like butterfly fish, coastal sharks, small grunts and surgeonfish, and protect coral reefs habitats. **Error! Reference source not found.** summarizes the views of the different stakeholders.

Toller and Tobias (2007) claim that parrotfishes are vulnerable to overexploitation because a single set of a net can remove an entire breeding school due to the social and

gregarious nature of this species. This study found conflicting views about the ability of the ban to protect parrotfish populations. Most fishermen believed that the abundance of parrotfish had increased because the proscribed nets were the most productive gear. They also pointed out that traps and spear guns could not yield similar landings. Several fishermen claimed that they were seeing more parrotfish in the water after the ban. One fisherman stated that spillover of fish biomass from the BIRNM into adjacent fishing grounds was the main reason for the improved condition of the parrotfish resource. Those fishermen who had doubts about its ability to protect parrotfish populations felt that the ban was unnecessary because there were plenty of fish prior to it. Moreover, they stated that the abundance of parrotfish had not changed since the adoption of the ban. Only one net fisherman felt that the parrotfish populations needed a 'break to be able to spawn'. Resource managers were the most guarded about their views. The majority of them felt uncomfortable voicing an opinion because of the absence of biological monitoring. The few managers that held a favorable opinion believed that declining landings were helping to rebuild parrotfish stocks and improve the species composition.

The members of the diving, charter and environmental group also had mixed views about the ban protecting the parrotfish resource. A majority felt that the ban had accomplished little because they perceived slight or no changes in abundance. However, they recognized that any recovery would be slow. A few noticed that they are still seeing fishermen fishing with nets. [20] They also believed that overfishing was going on since they continue to observe large numbers of small-sized parrotfish in the water. These groups

[20] During the interviews with this stakeholder group it became evident that some of them were not aware that fishermen could legally fish using the 'fish bagging' method.

voiced concern about the weak enforcement and the absence of biological studies. In general, the diving and charter group had slightly more upbeat opinion about protection gains than the environmental group who was more indecisive about its performance.

The majority of the interviewees believed that the ban had helped reduce the incidental take of species like butterfly fish, coastal sharks, small grunts and surgeonfish. Many net fishermen and resource managers judged that the ban had mitigated the take of by-catch species because there were fewer nets in the water, which moderated harvesting levels, which in turn reduced by-catch. Also, fishermen stated that traps, spear guns, and the 'modified' seine nets were more species selective than the former gill and trammel nets. Net fishermen claimed that the undesired fish could be more easily released with the 'modified' seine nets. The diving, charter, and environmental group believed that the ban had helped reduce by-catch. One of the divers interviewed reported seeing higher numbers of turtles and blue tangs following the ban. Nonetheless, they were skeptical whether the use of 'modified' seine nets had actually diminished the take of by-catch species.

Net fishermen's sentiments about the effect of the ban on coral reefs were in stark contrast to the views of other stakeholders. Most net fishermen argued that the ban did not protect corals reefs because they did not place nets over the coral reefs. They claimed that otherwise, nets would get entangled. Instead, they blamed hurricanes for the degradation of local coral reefs. Many net fishermen, who did not partake in the buyback, felt that the environmentally friendly placement of the 'modified' seine nets and the sharp reduction in the number of gill and trammel nets had also benefited coral reefs. Resource managers were divided about the impact of the ban on coral reef health. About one third of them felt that the ban was ineffective because the 'modified' seine nets continued to pose a threat to

coral reefs whereas another third of them felt that ban helped coral reefs because the number of net and habitat interactions probably declined. The remaining third of the resource managers was unsure about the impacts of the ban on coral reefs. The diving, charter, and environmental group thought that the ban was a good first step towards the protection of coral reef habitats; however, they deemed that additional efforts addressing other anthropogenic threats (e.g., land-based pollution, climate change) were needed.

4.3.3. Views on the socio-economic performance of the ban

The survey also examined the economic consequences of the net ban on fishermen's ability to sustain themselves and their families. It also asked whether the ban had generated hardships to the wider fishing community, reduced user conflicts, mitigated dumping, and affected parrotfish markets. Tables 3 and 4 summarize the perceptions about the socio-economic performance 4 years after the adoption of the net ban.

As anticipated, the vast majority of the net fishermen stated that outlawing nets had adversely impacted the profitability of their fishing operations, especially those fishermen who participated in the buyback. The criticisms were similar to those voiced in the buyback discussion. Fishermen offered three main reasons for their discontent. First, nets were substantially more productive and lucrative than other fishing gears. Second, the net prohibition forced them to make substantive investments in alternative fishing gears, especially traps. Fishermen pointed out that the buyback funds received were insufficient to transition and that they could not afford to purchase materials (e.g., wire, ropes, buoys) and fishing equipment (e.g., spear guns, scuba) to stay in business because they already held loans on their houses, trucks and boats. Third, the new gears were not only less

productive but also more expensive to operate and maintain (e.g., traps). A number of fishermen stated that setting up and running their operation had become more expensive because they had to venture further out.

Most resource managers believed that the ban had harmed profits, at least initially. They added that if the alternative gears had delivered similar landings and earnings, then fishermen would have not resorted to fishing with the 'modified' seine nets or, in some cases, illegally with the proscribed nets. They also noted that the waning profits were evident in the fewer employment alternatives available to crew members and fish cleaners. The only resource manager that disagreed believed that most net fishermen were (or should have been) prepared for the gear switch because they had been working with FAC for years on the details and timing of the ban. This resource manager also pointed out that the most dependent fishermen received buyback funds to help transition into other gears not to make up for the forgone revenues. About half of the members of the diving, charter, and environmental group believed that forbidding the use of nets had adversely affected profits, especially early on when fishermen switched to new gears. However, they generally agreed that landings and associated profits were unsustainable. Less than a third of the members of these groups disagreed because they believed that fishermen were versatile and could easily transition to other gears and fisheries and also because they had received buyback funds. A small number felt that many fishermen continued to fish illegally so any adverse economic impacts were likely negligible.

Most of fishermen reported that making a living to support themselves and their families had become harder because of the lower landings and earnings since the ban. Only

a couple of them reported that after an initial slump, they were able to build up their landings to close to pre-ban levels. They also pointed out that even though they used multiple gears, the transition to other gears demanded greater knowledge of the various fisheries, fishing grounds, and fishing equipment as well as additional time and financial resources. It is worthwhile noting that the alternative livelihoods programs (e.g., interpretive ranger program and captain's licensing programs) developed by The Nature Conservancy (TNC) did not attract net fishermen's attention, probably because the opportunities offered were not lucrative enough to compete with fishing, nor provided the lifestyle offered by fishing (Niesten and Gjertsen, 2010).

The diving, charter, and environmental group and to a lesser extent resource managers doubted that the ban negatively impacted fishermen's livelihoods. They thought that any hardship was short-lived, especially given the buyback compensation received. Moreover, they believed that fishermen were resilient and were able to move into other fisheries. They also noted that many of the fishermen were part-timers. Furthermore, they felt that the existing fishing practices were unsustainable which required scaling them down to levels commensurate with the biological potential of the resource. In contrast, those resource managers that were more sympathetic to the predicament of the fishermen believed that the net ban had forced some of them to fish illegally. They also felt that forgoing the fisherman's management plan was a lost opportunity.

There was wide consensus among fishermen that outlawing nets had adversely impacted their local communities, particularly crew members, fish cleaners, net menders, and folks that worked in restaurants and tackle shops. Fishermen observed that as they transitioned to less productive gears both the number of employment opportunities and

remuneration declined. While fishermen could not quantify the overall loss of employment because crew members also engage in other temporary, low-skilled activities, they observed that the average net operation hired between 4 and 7 individuals, including onshore helpers that remove fish from the nets and sort them into coolers for the market and net menders. Hired captain and crew remuneration declined because they are often paid a share of the boat's income after deducting operating expenses. The lower supply also affected restaurants.

Resource managers were equally divided about the communal impacts of the ban. A sizable majority of the resource managers shared the concerns voiced above by fishermen whereas the others felt that the impacts were minimal because they were concentrated on a few fishermen and the impacts were short-lived. They also believed that the ban had made more fish available to all fishermen. The majority of the members of the diving, charter, and environmental group perceived the impacts were minor, too.

When probed whether the net prohibition had lessened user conflicts, the majority of the net fishermen believed that conditions stayed the same. They perceived that resource users were still quarreling. They also stated that other resource users, especially recreational divers had to learn to share the resource. Nonetheless, a small group of former net fishermen acknowledged that tensions with the wider fishing community had eased. Resource managers had mixed feelings. While they acknowledged that some progress had been made, they stated that conflicts between extractive and non-extractive users remained. They noted that the use of 'modified' seine nets, which is widely perceived as a means to circumvent the ban, remains an unresolved issue. The use of the 'modified' seine

nets also troubled members of the diving, charter, and environmental group. A handful of resource managers also noted that the crowding of fishing grounds with traps could be a renewed source of conflict.

Reports about illegal dumps of finfish, turtles, corals and other invertebrates on land upset the local community who demanded better protection of local fish stocks and coral reef habitats (Duval, 2003; Toller and Tobias, 2007; Grace-McCaskey, 2012). When we inquired fishermen whether dumping had decreased following the ban, most believed that this issue had long been resolved.[21] They said that dumping had decreased because landings had declined. They also mentioned that they were taking measures to minimize the take of by-catch species.

The majority of the resource managers believed that disposing of by-catch on land had declined too. Officials from the Division of Environmental Enforcement, the law enforcement arm of the DPNR, stated that they had not received calls reporting these types of violations since the ban. Most managers felt that disposing of fish on land had declined because landing volumes fell and because this wasteful practice unsettled the local community. A few managers pointed out that public outrage had forced fishermen to be more aware of the perceived impacts of their fishing practices. One resource manager stated that most of the dumping was caused by an inexperienced fisherman who rather than giving away his unsold fish, disposed of it on land. Many of the members of diving,

[21] Results on Table 4 give the impression that fishermen had mixed views about the impact of the ban on illegal dumping. However, in reality, the perceived mismatch is due to the belief of the dissenting fishermen who felt that dumping was never an issue. Hence, they questioned the efficacy of the ban.

charter, and environmental group did not have an opinion about the impact of the ban on dumping. About a third of this last group felt that dumping had decreased because of the lower landings levels and absence of reports dealing with illegal dumping of fish.

The vast majority of the net fishermen believed that the ban impacted the parrotfish market. They stated that parrotfish had become more expensive because of the lower supply but also because they were able to pass on the higher fuel costs to their customers. Fishermen reported that parrotfish prices about doubled from about $2.75 (or $2.93 in 2012 dollars) in 2008 to $5 per pound in 2012. They also noted that the lower landings made it harder to satisfy the demand from restaurants. Net fishermen also reported that some customers were reluctant to purchase spearfished parrotfish because its meat was pierced. Most members of the diving, charter, and environmental group did not voice an opinion about market impacts because they claimed that they were not familiar with it. About half of the resource managers interviewed were also not familiar with the impact of the ban on the parrotfish market. Those who felt that the ban had impacted the market felt that prices had risen somewhat because the supply of parrotfish had been limited.

5. Conclusions

The net buyback and ban were one of the most contentious fishery management issues facing the island of St. Croix in the past decade. After a 5-year consultative process, DPNR finally implemented the buyback and started enforcing the ban on nets. To learn from this unique management intervention we investigated stakeholder groups' views about its

biological and socio-economic performance. Our study documented diverse views about its efficacy.

Four years after the adoption of the ban, the vast majority of the former net fishermen continue to view the ban unfavorably because of the forgone income which supported their families and crew members. In response to the net ban and somewhat unforeseen, many fishermen continued to fish in a similar fashion but with 'modified' seine nets. Our findings also document that gill and trammel net fishermen were also upset about the buyback. Buyback payments were considered insufficient to switch to other gears, especially traps. On average, fishermen received less than one-fifth of the amount that they deemed reasonable. The study also documented that resource managers' views about the adverse socio-economics impacts tended to coincide with fishermen's ones whereas members of the diving, charter, and environmental group tended to have somewhat opposing views.

We also found that net fishermen believed that the ban had a positive impact on parrotfish populations and by-catch reduction while resource managers were more guarded and members of the diving, charter, and environmental group were skeptical about any biological gains. Similarly, there were conflicting views about the protection afforded to coral reefs because fishermen claimed that they did not place their nets over coral reefs. Unfortunately, there are no biological studies that have examined these issues.

Several lessons can be learned from this experience. First, despite several years of planning and consultation to facilitate consensus, the buyback and ban yielded mixed results partly because the funds offered were inadequate to transition to other gears and maintain net fishermen's lifestyle. While the decision to purchase fishermen's nets as

opposed to their vessels and/or fishing licenses was the most appropriate given the available funds, in hindsight, more planning should have been devoted to understanding how fishermen may react to the ban. Gear restrictions, in general, generate strong incentives for fishermen to come up with ways to make up for the forgone landings and revenues by substituting unrestricted gears (or inputs) for restricted gears (Campbell, 1989). Ultimately, effort restrictions will be effective depending on the ease by which the restricted gear (or input) can be substituted in the production of effort (Campbell, 1989). In St. Croix, a few fishermen turned to 'modified' seine nets when the gill and trammel nets were proscribed. The absence of follow up regulations to bar the use of the 'modified' seine nets further undermined the efficacy of the ban.

In addition, while it is unclear whether the fishermen management plan would have worked out given fishermen's limited compliance with the current ban, the government's limited monitoring and enforcement capabilities and the unlikely exclusion of the less dependent net fishermen, the proposed limited entry regime coupled with assignment of individual quotas would have encouraged fishermen to better align their interests with the government's conservation goals. However, this would have demanded more resources. It is doubtful that the local government would have been able to use the buyback funds to establish a limited entry program and secure additional resources to fund the on-going monitoring of individual quotas.

Finally, while buyback funds were meant as a sign of goodwill to assist in the transition to new gears, no resources were allocated to monitor and evaluate the biological and socio-economic impacts of the ban. While most stakeholders believed that the ban had been effective meeting certain objectives such as minimizing the dumping of un-sold fish,

there was no formal evaluation on its impact on the health of parrotfish and surgeonfish stocks, by-catch mitigation, and the condition of coral reef habitats. Failing to evaluate the biological performance and socio-economic impacts of politically charged interventions not only limits the credibility of fishery agencies but ultimately hinders their ability to conserve and protect fishery resources and habitats. Policy evaluations may also aid the identification of other policies better suited to address conservation and livelihood needs.

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Table 1: Perceptions about the impact of the net buyback.

Beliefs about the performance of the buyback	Stakeholder group	Responses (%)			N
		Yes	No	DK/NA	
Was the buyback process fair?					
	Net fishers in buyout	-	100.0	-	8
	Other net fishers	33.3	66.7		9
	Resource managers	41.7	33.3	25.0	12
	Diving/Charter/Environ.	57.1	-	42.9	14
Was 'right' group bought out?					
	Net fishers in buyout	37.5	37.5	25.**0**	8
	Other net fishers	44.4	44.4	11.1	9
	Resource managers	58.3	16.7	25.0	12
	Diving/Charter/Environ.	28.6	-	71.4	14
Were buyback payments sufficient?	Net fishers in buyout	-	100.0	-	8
	Other net fishers	11.1	77.8	11.1	9
	Resource managers	25	33.3	41.7	12
	Diving/Charter/Environ.	42.9	-	57.1	14
		Before then ban(%)	After the ban(%)	DK/NA	N
Support for the net ban					
	Net fishers in buyout	-	12.5	-	8
	Other net fishers	11.1	11.1	-	9
	Resource managers	91.6	83.3	-	12
	Diving/Charter/Environ.	85.7	92.8		14
Efficacy of the net ban					
	Net fishers in buyout	-	12.5	-	8
	Other net fishers	-	11.1	-	9
	Resource managers	-	75.0	-	12
	Diving/Charter/Environ.	-	71.4	-	14

Table 2: Beliefs about the biological performance of the net ban.

Beliefs about the biological performance	Stakeholder group	Responses						
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	DK/NA	N
Protected parrotfish populations								
	Net fishers in buyout	37.5	37.5	12.5	12.5	-	-	8
	Other net fishers	22.2	44.4	-	33.3	-	-	9
	Resource managers	16.7	16.7	-	8.3	16.7	41.7	12
	Diving/Charter/Envi	-	21.4	35.7	7.1	14.3	21.4	14
Reduced by-catch from nets								
	Net fishers in buyout	12.5	62.5	-	12.5	12.5	12.5	8
	Other net fishers	-	77.8	22.2	-	-	-	9
	Resource managers	33.3	50.0	-	-	-	16.7	12
	Diving/Charter/Envi	21.4	35.7	-	14.3	7.1	7.1	14
Protected coral reefs from nets								
	Net fishers in buyout	-	-	-	37.5	62.5	-	8
	Other net fishers	-	44.4	-	11.1	44.4	-	9
	Resource managers	8.3	25.0	-	16.7	16.7	33.3	12
	Diving/Charter/Envi	14.3	42.9	7.1	14.3	-	21.4	14

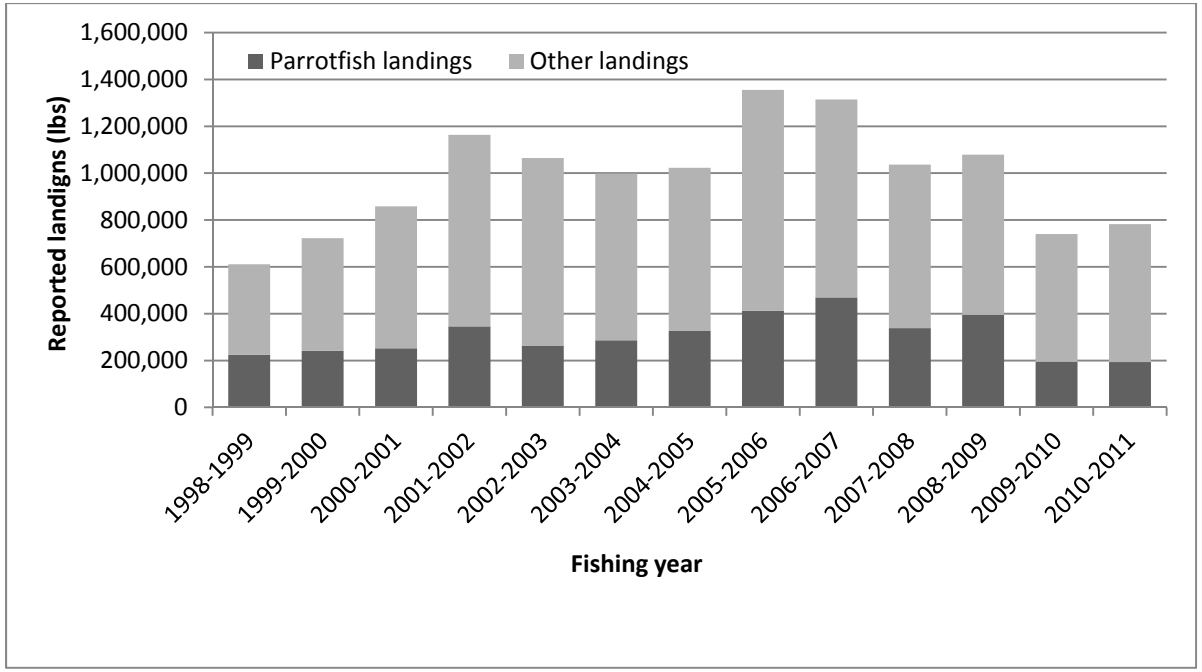
Table 3: Beliefs about the socio-economic performance of the net buyback and ban.

Beliefs about socio-economic performance	Stakeholder group	Responses						
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	DK/NA	N
Adversely impacted profitability								
	Net fishers in buyout	75.0	25.0	-	-	-	-	8
	Other net fishers	66.7	11.1	11.1	-	-	11.1	9
	Resource managers	33.3	41.7	-	8.3	-	16.7	12
	Diving/Charter/Envir	7.1	42.9		14.3	14.3	21.4	14
Adversely impacted fishermen's ability to support themselves and								
	Net fishers in buyout	62.5	25	-	-	-	12.5	8
	Other net fishers	55.6	11.1	33.3	-	-	-	9
	Resource managers	8.3	33.3	-	33.3	16.7	8.3	12
	Diving/Charter/Envir	-	14.3	-	50.0	7.1	28.6	14
Generated socio-economic hardships to the local fishing								
	Net fishers in buyout	75	12.5	-	12.5	-	-	8
	Other net fishers	55.6	22.2	22.2	-	-	-	9
	Resource managers	16.7	25.0	-	25.0	16.7	16.7	12
	Diving/Charter/Envir	-	28.6	-	28.6	28.6	14.3	14
Buyback eased transition to other gears and/or livelihoods								
	Net fishers in buyout	-	-	-	-	100.**0**	-	8
	Other net fishers	11.1	22.2	-	11.1	44.4	11.1	9
	Resource managers	-	33.3	8.3	33.3	8.3	16.7	12
	Diving/Charter/Envir	7.1	35.7	-	28.6	-	28.6	14

Table 4: Beliefs about the socio-economic performance of the net ban.

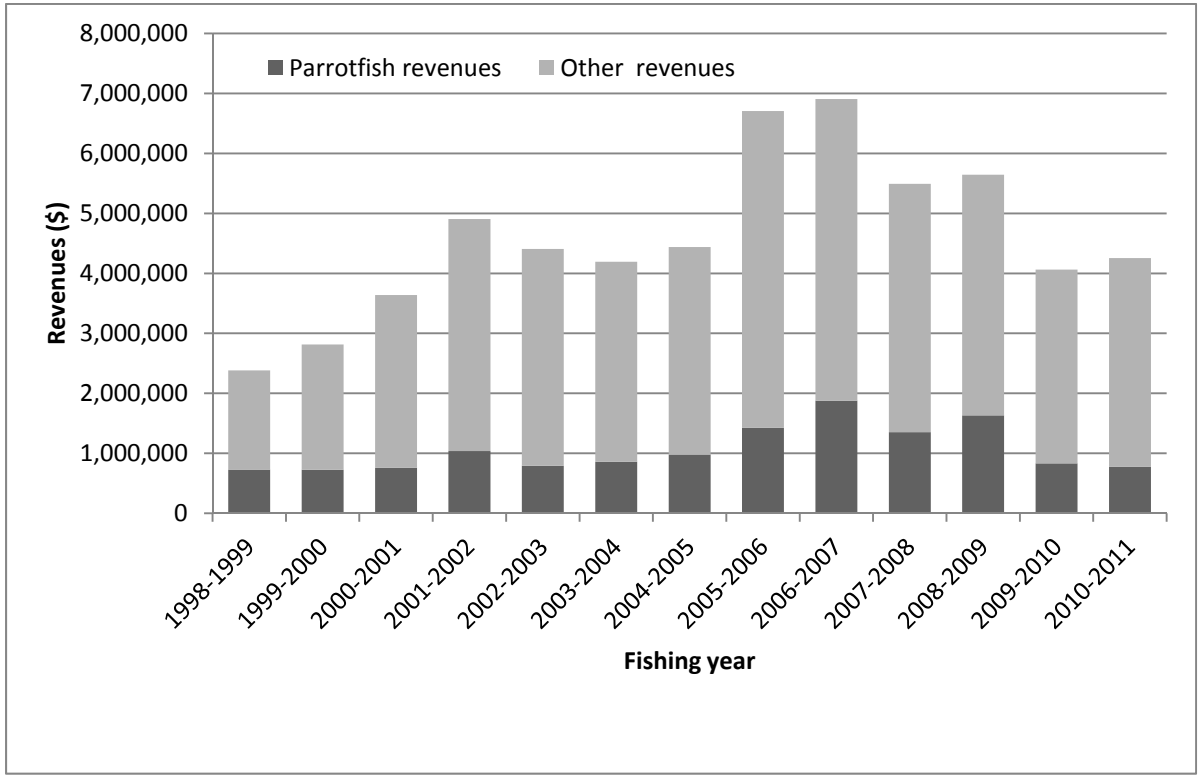
Beliefs about socio-economic performance	Stakeholder group	Responses						
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	DK/NA	N
Reduced dumping of by-catch								
	Net fishers in buyout	25.0	25.0	-	37.5	-	12.5	8
	Other net fishers	-	55.6	-	11.1	-	33.3	9
	Resource managers	16.7	58.8	8.3	-	-	16.7	12
	Diving/Charter/Envir	21.4	14.3	7.1	-	14.3	42.9	14
Reduced user conflicts								
	Net fishers in buyout	-	37.5	50.0	12.5	-	-	8
	Other net fishers	-	22.2	77.8	-	-	-	9
	Resource managers	8.3	33.3	8.33	41.7	8.3	-	12
	Diving/Charter/Envir	-	35.7	7.1	42.9	7.1	7.1	14
Changes in parrotfish market								
	Net fishers in buyout	37.5	50.0	12.5	-	-	-	8
	Other net fishers	22.2	44.4	33.3	-	-	-	9
	Resource managers	8.3	16.7	16.7	8.3	-	50.0	12
	Diving/Charter/Envir	-	-	21.4	7.1	-	71.4	14

Figure 1: Reported landings of parrotfish and other species in St. Croix.



Source: SEFSC Accumulated Landings System (ALS) Database

Figure 2: Reported revenues of parrotfish and other species in St. Croix.



Source: SEFSC Accumulated Landings System (ALS) Database

Figure 3: Main marine protected areas and seasonal closures in St. Croix, U.S. Virgin Islands.

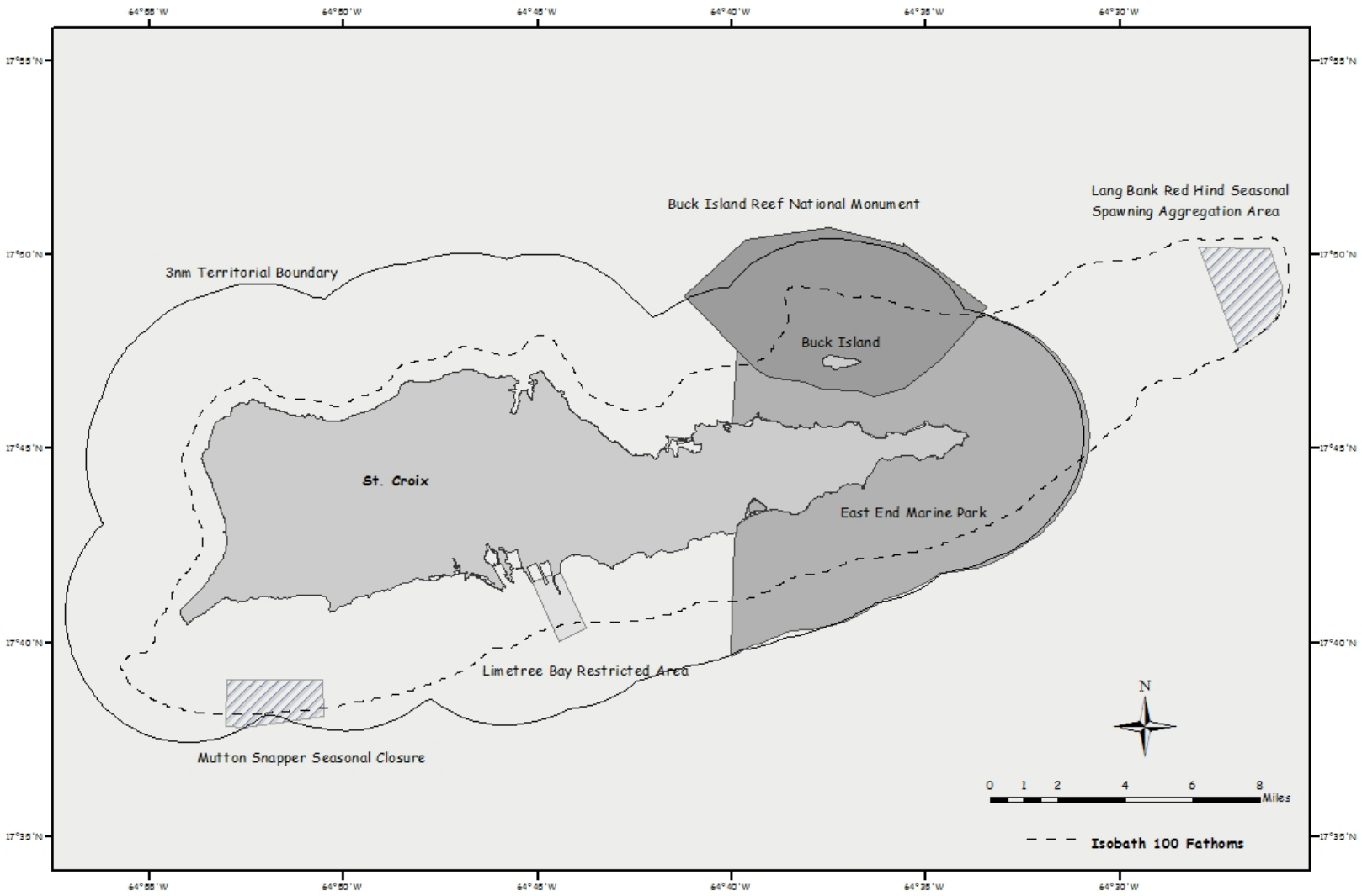


Figure 4: Reported main fishing grounds before the ban

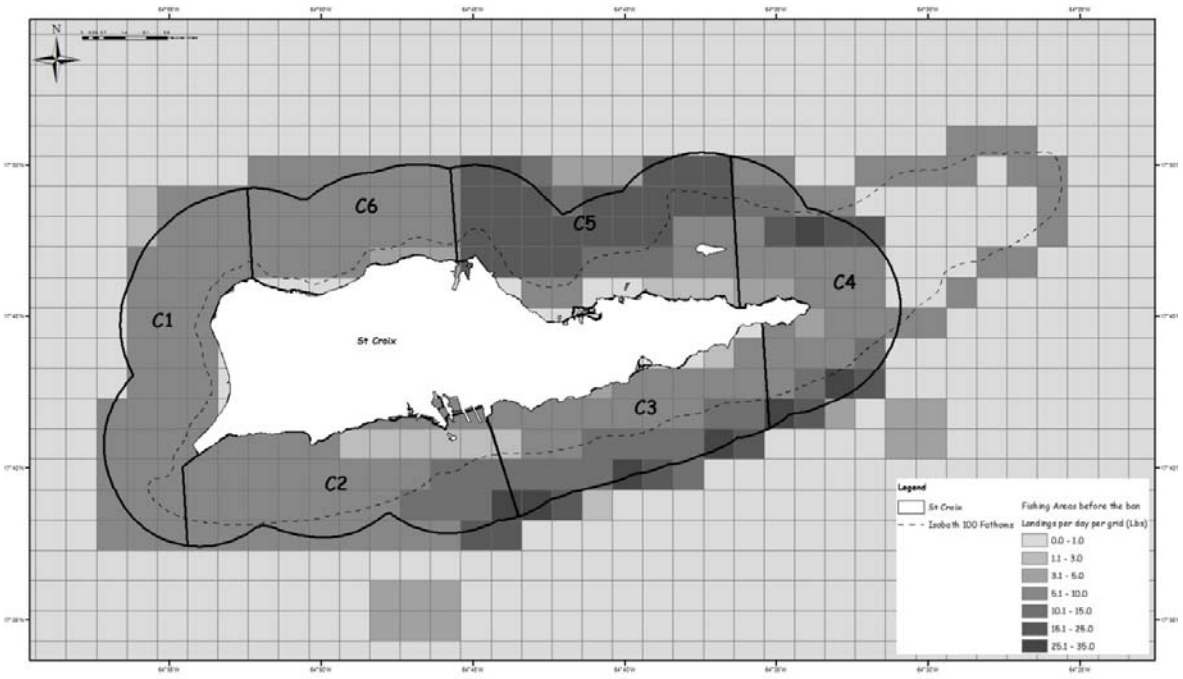
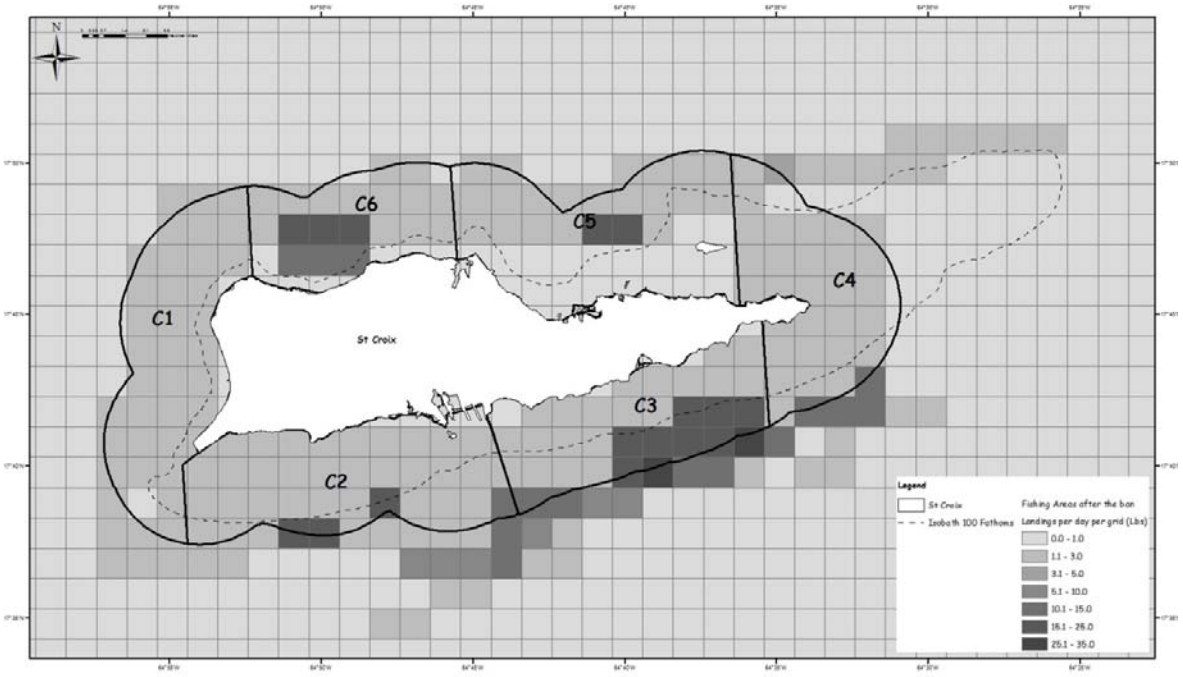


Figure 5: Reported main fishing grounds after the ban



7. Appendix

Gill & Trammel Net Survey – Fishermen's Perceptions on the Net Ban and Buy Back Program's Performance.

July 2012

Dear fishermen,

Thank you for agreeing to participate in our survey.

Public reporting burden for this collection of information is estimated to average one hour per response including the time for reviewing the instructions, searching the existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspects of this burden to Bob Walker, National Marine Fisheries Service, 75 Virginia Beach Drive, Miami, Florida 33149. Comments on the content of the survey should be addressed to Dr. Juan Agar, National Marine Fisheries Service, 75 Virginia Beach Drive, Miami, Florida 33149.

This reporting is required under and is authorized under 50 CFR 622.5(a) (1) (v). Information submitted will be treated as confidential in accordance with NOAA Administrative Order 216-100. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection displays a currently valid OMB Control Number. The NMFS requires this information for the socio-economic assessment of the gill net ban and buy back in St Croix, U.S. Virgin Islands. These data will be used to assess fishermen's perceptions on the net ban and buy-back management performance.

All of your information will be confidential. We will not use people's names in our reports, or write anything that could be used to identify you. Participation in this survey is voluntary, and you do not need to answer any questions you do not wish to answer. If you agree with that, and do not have any questions, I would like to start the interview asking you some questions about your fishing practices.

Socio-demographic information

1) How old are you? _____years

2) How long have lived in your community? ___ years_____ community name

3) How many years of commercial fishing experience do you have? _____ years

4) Number of dependents? ___ people (including yourself)

5) Do you own a boat? No. __ ,size (ft)___ ,no. engines____, total hp__

6) What is your role in the fishing operation?
☐ Captain [☐ w/license] ☐ Helper [☐ w/license] ☐ Other:_____

7) How would you describe your level of participation?
☐ Year-round, full-time,

☐ Year-round, part-time [☐Subsistence ☐ additional income]

☐ Seasonal, full-time [☐Subsistence ☐ additional income]

☐ Seasonal, part-time [☐Subsistence ☐ additional income]

☐ No longer fish

☐ Occasionally

8) How long did you fish with trammel and gill nets? _____ years, _____start _____end

9) What percentage of your household income is derived from fishing? ___%
Non-fishing activities: _____

10) Why did you begin using gill and trammel net? What is the advantage of using gillnet instead of trammel net (or vice versa)?

_____
_____

11) Why do you fish and/or eat parrotfish? Why is it culturally important?

_____
_____
_____
_____

Performance of the G&T ban

12) In your mind, what were the main reasons behind the gill and trammel net ban?

_____
_____
_____

13) Did you initially support the gill and trammel net ban? □ Yes □ No Why?

_____
_____
_____

14) Do you support the gill and trammel net ban now? □ Yes □ No Why?

_____
_____
_____

15) Do you believe the ban was beneficial? □ Yes □ No In what sense? Why?

_____
_____
_____
_____

Now let's talk about the main impacts of the gill and trammel net ban.

Biological Impacts: [1=strongly agree, 2=agree, 3=no change, 4=disagree, 5= strongly disagree, 6=Don't Know, 7=No Answer]

1) Do you believe that the abundance of parrotfish changed after the ban? **[1-3: large/moderate/small increase, 4= no change, 5-7= large/moderate/small decrease, 8 =Don't Know]**

_____
_____
_____

2) Do you agree or disagree that the ban effectively protected parrotfish populations? [SA, A, No change, D, SD, DK,NA]

_____
_____
_____

3) Do you agree or disagree that the ban effectively reduced the by-catch of species like butterfly fish, coastal sharks, small grunts and small surgeonfish? [SA, A, No change, D, SD, DK,NA]

_____
_____
_____

4) Do you agree or disagree that the ban effectively protected coral reefs from the adverse impacts of fishing with nets? [SA, A, No change, D, SD, DK,NA]

_____
_____
_____

5) Other biological impacts:_____
_____

Fishing practices Impacts: (gear switching, new areas, species target):

6) Do you agree or disagree the ban significantly affect the way you fish? [SA, A, No change, D, SD, DK,NA]
   □ Gear switching: _____
   □ Fishing areas (map): _____
   □ Effort (trips/hrs. fishing) : _____
   □ Target species _____
   □ Landings (lbs/trip)_____
   □ Other_____
   _____

7) Do you agree or disagree the ban effectively reduce dumping (on land) of by-catch species? [SA, A, No change, D, SD, DK,NA]

_____

Economic Impacts:

8) Did your income from fishing change due to the ban? □ Increase □ Decrease □ No change
9) Do you agree or disagree the ban adversely affect the profitability of your fishing operation? [SA, A, No change, D, SD, DK,NA]
   □ Start-up costs for new gear and boat _____
   □ Changes in trip costs_____
   □ Forgone income_____
   □ Loans _____
   □ Other _____
   _____

10) Do you agree or disagree the ban significantly affected the market for parrotfish? [SA, A, No change, D, SD, DK,NA] How?
   □ Changes in parrotfish price ($/lb)_____
   □ Changes in parrotfish's demand (from restaurant, walking clients, hotels)
   _____
   □ Changes in parrotfish's supply (shortfalls, other gears, imports)
   _____
   □ Other _____
   _____

Community/Social Impacts (conflicts with other users such as divers or charters):

11) Do you agree or disagree the ban adversely impact your ability to support yourself and your family? [SA, A, No change, D, SD, DK,NA]

_____

_____

   □ Changes in family income structure
   □ Changes in fishers business activities
   □ Other

12) Do you agree or disagree the ban create social or economic hardships for the fishing community? [SA, A, No change, D, SD, DK,NA] Which ones?

_____

_____

13) Do you agree or disagree the ban reduce conflicts with other user groups? [SA, A, No change, D, SD, DK,NA]

_____

_____

□ Conflicts with diver operators
□ Conflicts with charters
□ Conflicts with managers
□ Conflicts with other fishermen_____
□ Conflict with divers or spearfishing fishers
□ Other

14) Do you believe that there has been good compliance with the ban? □ Yes □ No Why?

_____

_____

About the BUYBACK

15) Was your gear purchased in the buyback? □ Yes □ No
16) If yes, How much of it was bought back? What did do with any gear left over?

_____
_____
_____

17) If yes, how did you use those funds or money? (e.g., new gear, new boats)

_____
_____
_____

18) If no, what did you do with the nets?

_____
_____
_____

19) Did you participate in meetings dealing with the buyback? □ Yes □ No
20) Did the managers listen to the fishermen? What were the disagreements about?

_____
_____
_____

21) Do you believe that the process of the buyback was fair? □ Yes □ No Why?

_____
_____
_____

22) Do you think that the 'right' group of people was bought out of the fishery? □ Yes □ No
Why?

_____
_____
_____

23) Were fishermen properly compensated? □ Yes □ No
If no, what would have been a proper compensation?

_____
_____
_____
_____

24) Do you agree or disagree the buyback effectively helped you transition to alternative gears and/or livelihoods? [SA, A, No change, D, SD, DK,NA]

_____
_____
_____
_____

25) How could have the buyback been improved? What could have been done differently?

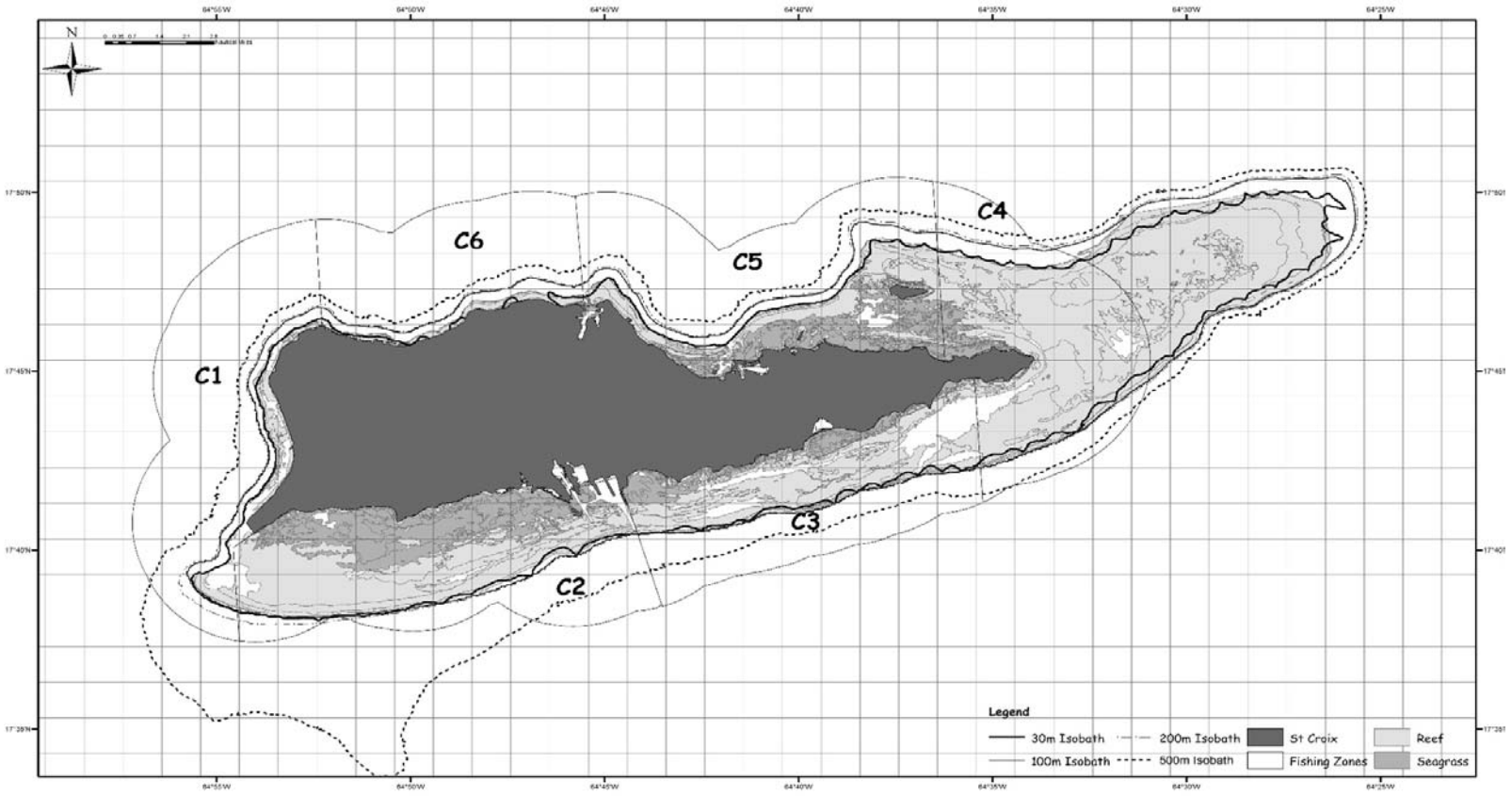
_____
_____
_____

***** **Crew information** *****

26) After the net ban how did you adapt (e.g., non-fishing employment, change captains, new gears, roles in the fishing operation)?

_____
_____
_____
_____
_____
_____

Fishing Areas Please, draw on the map the areas where you fished before the net ban (in Red) and the areas you go fishing now (in Blue)



Unemployment

27) Has the recent unemployment impacted:

□ Local fishery

□Your ability to support yourself and your family

□ Fishing community

28) What are the main impacts?

_____
_____
_____
_____
_____
_____
_____
_____

29) Lionfish: □ presence in the water (□ little □ a lot) □ catch □ sell (where, $/lb, lb/trip)

_____
_____
_____
_____
_____

Costs and Earnings

30) Costs and earnings information per trip before the net ban.

	Main single gear _____	single gear #2 _____	Multiple gears Primary_____ Secondary_____
Trip duration Soak time	_____ days/hrs _____ days/hrs	_____ days/hrs _____ days/hrs	_____ days/hrs _____ days/hrs
Gas and oil ($/trip)	$ _____ _____ gallons	$ _____ _____ gallons	$ _____ _____ gallons
Ice ($/trip)	Make own ice Yes☐ No☐ Depends ☐ $ _____	Make own ice Yes☐ No☐ Depends ☐ $ _____	Make own ice Yes☐ No☐ Depends ☐ $ _____
Bait ($/trip)	Capture own bait Yes☐ No☐ Depends ☐ $_____	Capture own bait Yes☐ No☐ Depends ☐ $_____	Capture own bait Yes☐ No☐ Depends ☐ $_____
Food ($/trip)	$ _____	$ _____	$ _____
Other costs: (_____)	$ _____	$ _____	$ _____
Total cost ($/trip)	$ _____	$ _____	$ _____
Average revenues ($/trip)	$ _____	$ _____	Primary $ _____ Secondary $_____
Net payment to crew (after costs)	% ___ Vessel %____Captain %____Helpers	% ___ Vessel %____Captain %____Helpers	% ___ Vessel %____Captain %____Helpers
Number of crew	Number of crew: _____ $_____/crew/trip	Number of crew: _____ $_____/crew/trip	Number of crew: _____ $_____/crew/trip
Average landings of top species (lb./trip)	1: _____lbs. _____ $/lb 2: _____lbs. _____ $/lb 3: _____lbs. _____ $/lb 4: _____lbs. _____ $/lb	1: _____lbs. _____ $/lb 2: _____lbs. _____ $/lb 3: _____lbs. _____ $/lb 4: _____lbs. _____ $/lb	Prim1:_____lbs. _____ $/lb Prim. 2: _____lbs. _____ $/lb Prim. 3::_____lbs. _____$/lb Sec.1: _____lbs. _____ $/lb Sec. 2: _____lbs. _____ $/lb Sec.3:_____lbs. _____ $/lb
Where did you use to sell the main target species?			

31) Costs and earnings information per trip after the net ban.

	Main single gear _____	single gear #2 _____	Multiple gears Primary_____ Secondary_____
Trip duration Soak time	_____ days/hrs _____ days/hrs	_____ days/hrs _____ days/hrs	_____ days/hrs _____ days/hrs
Gas and oil ($/trip)	$ _____ _____ gallons	$ _____ _____ gallons	$ _____ _____ gallons
Ice ($/trip)	Make own ice Yes☐ No☐ Depends ☐ $ _____	Make own ice Yes☐ No☐ Depends ☐ $ _____	Make own ice Yes☐ No☐ Depends ☐ $ _____
Bait ($/trip)	Capture own bait Yes☐ No☐ Depends ☐ $_____	Capture own bait Yes☐ No☐ Depends ☐ $_____	Capture own bait Yes☐ No☐ Depends ☐ $_____
Food ($/trip)	$ _____	$ _____	$ _____
Other costs: (_____)	$ _____	$ _____	$ _____
Total cost ($/trip)	$ _____	$ _____	$ _____
Average revenues ($/trip)	$ _____	$ _____	Primary $ _____ Secondary $_____
Net payment to crew (after costs)	% ___ Vessel %____Captain %____Helpers	% ___ Vessel %____Captain %____Helpers	% ___ Vessel %____Captain %____Helpers
Number of crew	Number of crew: _____ $_____/crew/trip	Number of crew: _____ $_____/crew/trip	Number of crew: _____ $_____/crew/trip
Average landings of top species (lb./trip)	1: _____lbs. _____ $/lb 2: _____lbs. _____ $/lb 3: _____lbs. _____ $/lb 4: _____lbs. _____ $/lb	1: _____lbs. _____ $/lb 2: _____lbs. _____ $/lb 3: _____lbs. _____ $/lb 4: _____lbs. _____ $/lb	Prim1:_____lbs. _____ $/lb Prim. 2: _____lbs. _____ $/lb Prim. 3::_____lbs. _____$/lb Sec.1: _____lbs. _____ $/lb Sec. 2: _____lbs. _____ $/lb Sec.3:_____lbs. _____ $/lb
Where did you use to sell the main target species?			

Gill & Trammel Net Survey – Stakeholder's Perceptions on the Net Ban and Buy Back Program's Performance.

July 2012

Performance of the Gill &Trammel net ban

1) In your mind, what were the main reasons behind the gill and trammel net ban?

_____
_____
_____

2) Did you initially support the gill and trammel net ban? □ Yes □ No Why?

_____
_____
_____

3) Do you support the gill and trammel net ban now? □ Yes □ No Why?

_____
_____
_____

4) Do you believe the ban was beneficial? □ Yes □ No In what sense? Why?

_____
_____
_____

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8) Do you agree or disagree that the ban effectively protected coral reefs from the adverse impacts of fishing with nets? [SA, A, No change, D, SD, DK,NA]

_____
_____

9) Other biological impacts: _____

10) Do you agree or disagree the ban effectively reduce dumping (on land) of by-catch species? [SA, A, No change, D, SD, DK,NA]

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_____

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11) Do you agree or disagree the ban significantly affected the market for parrotfish? [SA, A, No change, D, SD, DK,NA] How?
□ Changes in parrotfish price ($/lb)_____
□ Changes in parrotfish's demand (from restaurant, walking clients, hotels)
_____
□ Changes in parrotfish's supply (shortfalls, other gears, imports)
_____
□ Other _____
_____

12) Do you agree or disagree the ban adversely affect the profitability of the fishermen's fishing operation? [SA, A, No change, D, SD, DK,NA]
□ Start-up costs for new gear and boat _____
□ Fishing income_____
□ Changes in trip costs_____
□ Forgone income_____
□ Loans _____
□ Other _____

Community/Social Impacts (conflicts with other users such as divers or charters):

13) Do you agree or disagree the ban adversely impact the fishermen ability to support himself and his family? [SA, A, No change, D, SD, DK,NA]

_____

_____

□ Changes in family income structure
□ Changes in fishers business activities
□ Other

14) Do you agree or disagree the ban create social or economic hardships for the fishing community? [SA, A, No change, D, SD, DK,NA]

_____

_____

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_____

_____

□ Conflicts with diver operators
□ Conflicts with charters
□ Conflicts with managers
□ Conflicts with other fishermen_____
□ Conflict with divers or spearfishing fishers
□ Other

16) Do you believe there has been good compliance with the ban? □ Yes □ No Why?

_____

_____

About the BUYBACK

17) Did you participate in meetings dealing with the buyback? □ Yes □ No
Do you believe the managers listen to the fishermen? What were the disagreements about?

_____

_____

_____

18) Do you believe that the process of the buyback was fair? □ Yes □ No Why?

_____

_____

_____

_____

19) Do you think that the 'right' group of people was bought out of the fishery?
□ Yes □ No

_____

_____

_____

20) Were fishermen properly compensated? □ Yes □ No
If no, what would have been a proper compensation?

_____

_____

_____

_____

21) Do you agree or disagree the buyback effectively helped the fishermen transition to alternative gears and/or livelihoods? [SA, A, No change, D, SD, DK,NA]

_____
_____
_____
_____

22) How the buyback could have been improved? What could have been done differently?

_____
_____
_____
_____
_____
_____