APPENDIX D

St. Kitts and Nevis Fisheries Uses and Values Project

St. Kitts and Nevis
Fisheries Uses and Values Project

Report to The Nature Conservancy

In partial fulfillment of Contract No. FY10-C-AID-ECaribe-Ecotrust,
The Nature Conservancy
Southeastern Caribbean Program and Global Marine Team

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28 October 2010

*This report was made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of its Cooperative Agreement Number 538-A-00-09-00100-00 (*BIODIVERSITY THREAT ABATEMENT *Program) implemented by prime recipient The Nature Conservancy and partners. The contents and opinions expressed herein are the responsibility of the* BIODIVERSITY THREAT ABATEMENT *PROGRAM and do not necessarily reflect the views of USAID.*

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1 Introduction

Ecotrust was retained by The Nature Conservancy (TNC) in February of 2010 to collect, compile, and analyze commercial fishery data in support of a larger TNC effort, funded by USAID, focused on a case study national marine zoning plan for St. Kitts and Nevis. During the spring and early summer of 2010, our research team developed and deployed an interactive, custom computer interview instrument, Open OceanMap, to collect geo-referenced information from local fishers about the extent and relative importance of St. Kitts and Nevis commercial fisheries. We compiled these data in a geographic information system (GIS) that we delivered to TNC for integration into a central geodatabase. This report, which details the approach and methods we used to collect, compile, and analyze commercial fisheries data in St. Kitts and Nevis, and the geodatabase containing the fishing grounds datasets completes our deliverables to TNC under the terms of the contract.

Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the commercial fishers who participated in this study as well as the countless other community members, TNC staff, and observers of this project.

We are deeply thankful to the 51 St. Kitts and 65 Nevis fishers who participated in this project—making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us. We thank our project coordinator, who was contracted by TNC, Janice Hodge, and her field staff. We also acknowledge the support, assistance, staff, and time provided by the Department of Planning and the Department of Fisheries on both St. Kitts and Nevis.

Private information of survey participants was carefully protected throughout this process. The information contained in this report is only that which respects confidentiality, as was verbally agreed upon between participants and staff conducting interviews. To protect individual information, all information contained herein and presented in mapped products has been aggregated to a level that does not allow association to any personal information.

We believe that this project has made a significant contribution to the marine knowledge base on St. Kitts and Nevis—not only by informing marine zoning efforts, but also by enhancing the public's and decision-makers' understanding of the importance of the coastal ocean to individual fishers and to coastal communities. Furthermore, we believe this project, and the lessons learned therein, can be leveraged to catalyze and inform other similar projects.

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2 Background

In order to meet current and future demands on the marine environment, The Nature Conservancy (TNC) is supporting a national marine zoning plan for The Federation of St. Kitts and Nevis. The goal of the marine zoning plan is to minimize conflict between user groups and optimally accommodate existing/future human uses while maintaining healthy marine habitats and ecosystems. To support the plan, TNC is conducting a comprehensive assessment of human uses and the distribution of marine habitats within the country's territorial seas, also known as its exclusive economic zone (EEZ).

In order to do this, TNC has identified major data gaps such as habitat distribution, recreational/tourism use areas, and commercial fishery areas. Through the collection of these spatial data and additional coordination across the various user groups, it may be determined which human uses are compatible and should be allowed in particular marine zones.

In St. Kitts and Nevis, as elsewhere in the Caribbean, commercial fisheries support local communities and economies. Fisheries involve vessels of varying sizes and capacities, using a variety of gear types and fishing strategies, and covering a large part of the coastal ocean. In general, this spatial component of fishing activities is relatively poorly understood. While a variety of data are collected by national agencies to monitor and enforce fishery regulations, the thematic, temporal, and spatial resolution of these data vary considerably. To inform a marine zoning plan, accurate spatial information about coastal fisheries is central to inform intelligent policy decisions.

To fill these gaps in data, Ecotrust, was contracted by TNC to collect new information on the spatial extent of commercial fishing activities in St. Kitts and Nevis and the fishers who are actively engaged in these fisheries. In the absence of comprehensive observer coverage, vessel monitoring systems or spatially explicit landing receipts, by far the best source of information about the fishing grounds is the fleet itself. By engaging local stakeholders in the planning process and asking them about the value they place on specific areas of the ocean, these data can support spatial planning that protects the marine environment while minimizing impacts on fishing communities.

In this project, we built upon existing approaches to collect fisher's expert knowledge about their fishing grounds. The goal was to develop maps of the fishing grounds in St. Kitts and Nevis and to characterize the relative importance of various fisheries. The following sections contain detailed descriptions of 1) the methods; 2) summary statistics; and 3) data and map output used to address the spatial information gaps in commercial fisheries of St. Kitts and Nevis.

3 Methods

In this project, we built on methods developed in previous projects on the West Coast of the United States (Scholz et al. 2004; 2005; 2006a; 2008). More specifically, we used a computer interface to administer a survey, collect information from fishers, and analyze the responses in a geographic information system (GIS). A key innovation in this project was working with TNC staff, in-country agency officials, and local fishers to define the country's fisheries in terms of how they are managed and harvested. To that end, we differentiated fisheries in terms of practices and/or species (group)-gear configurations and used port groups to classify participants and design a representative sample.

While the use of GIS technology and analysis in marine and fishery management has expanded steadily over the past decade (Meaden 1996; Kruse et al. 2001; Breman 2002; Valavanis 2002; Fisher and Rahel 2004), its use for socioeconomic research is still somewhat limited. Many of the applications reviewed in the recent

literature focus on urban populations or natural resource use in developing countries (Gimblett 2002; Goodchild and Janelle 2004; Anselin et al. 2004). Nevertheless, a growing body of literature has examined GIS-enabled approaches to community-based MPA design (Aswani and Lauer 2006; Hall and Close 2006; St. Martin et al. 2007; Ban et al. 2009).

Some of the most pertinent applications of GIS technology to socioeconomic questions in fisheries concern the spatial extent of fishing effort and intensity (Caddy and Carocci 1999; Green and King 2003) and use participatory methods similar to the ones employed here (Wedell et al. 2005; St. Martin 2004; 2005; 2006). We built on these approaches and adapted them for the St. Kitts and Nevis context, following best practices for the use of participatory GIS in natural resource management (Quan et al. 2001), as described in the remainder of this section.

3.1 Project Planning Methods

In December 2009, Ecotrust staff conducted a project planning meeting with TNC staff and St. Kitts and Nevis agency staff in Miami. The goals of this planning effort were two-fold: 1) to understand the larger project context; and 2) to develop a draft survey. These goals, as well as specific tasks completed and/or information gathered to meet these goals are described in more detail here.

3.1.1 Understand the larger project context

This project is one component of a larger four component TNC project focused on marine zoning, policy, livelihoods, and education/outreach (Project description for Associate Cooperative Agreement No. 538-A-00-09-00100-00). The marine zoning effort is only happening on St. Kitts and Nevis and is focused on multiple ocean uses, which will be analyzed and assessed using Marxan w/Zones. Uses being considered include: commercial fishing, recreation, tourism, development and planning, conservation and transportation.

In addition to providing valuable information for the marine zoning effort, TNC had three organizational goals for this project:

- To not only produce one-time project outputs, but to also create a comprehensive, standardized spatially-explicit format that can be updated in the future.
- To build in-house capacity for replicating this work elsewhere by training TNC staff in the project methods and implementation.
- To build in-country capacity.

3.1.2 Develop draft survey

Another goal of the project planning meeting was to develop a draft survey. Ecotrust, TNC, and in-country agency staff first reviewed and discussed information relevant to adapting the current Open OceanMap survey design for application to St. Kitts and Nevis. Topics discussed included a) a review of St. Kitts and Nevis fisheries, fisheries management, and existing fisheries data, which informed both survey and sample design; b) a review of existing Open OceanMap survey questions; c) preferred Open OceanMap design—desktop or internet based; and d) appropriate scales for data attribution (e.g., to individual shapes, to all shapes, to all fisheries, to an individual).

Using this base information, meeting participants next discussed how this information could be tailored to meet the project needs and objectives. More specifically, the following topics were discussed:

- Robustness of existing fishery data.
- Web based or desktop version of Open OceanMap.
- Port and fishery stratification.
- Potential weighting schemes and questions necessary to create various weightings.

- Base information for Open OceanMap maps—nautical charts, key references, etc.
- Additional quantitative or qualitative questions.
- Confidentiality.
- Outreach and educational materials.

Ecotrust subsequently presented TNC and in-country partners with a draft survey for review. Subsequent revisions and adjustment were made based on feedback received.

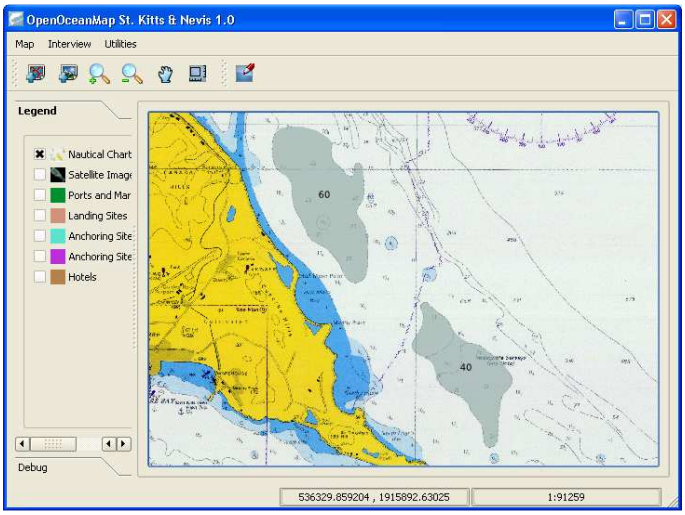
3.2 Survey Methods

Ecotrust worked with TNC and in-country staff to gather existing fisheries data and develop a preliminary survey design. TNC, in-country, and Ecotrust staff then conducted a series of in-country outreach meetings with members of the St. Kitts and Nevis fishing communities to provide a project overview, answer questions, raise general awareness, and solicit potential interview participants. Ecotrust also utilized existing data from the St. Kitts and Nevis Fisheries Departments to form an initial sample design, which was developed based on the number of full-time captain/owners found in each landing site.

Ecotrust also developed materials to train and build the capacity of TNC and in-country staff to conduct the fieldwork. These materials, already submitted to TNC, included:

- Survey Manual – this manual included a copy of the survey, detailed step-by-step information on survey and sample design, how to conduct an interview and use the Open Ocean Map tool, how to organize and track files, and examples of survey documentation.
- Fisher and Vessel Database – a database on all St. Kitts and Nevis Fisheries Department data and list of targeted fishers in each landing site.
- Data Collection Sheet – survey and spatial fishing data collection sheet.
- Data Collection Tracking Sheet – used by the in-country project coordinator to keep track of files and interviews.
- Open Ocean Map tool – survey tool to capture spatial fishing areas and additional non-spatial survey data.

Figure 1. Screenshot of Open Ocean Map Tool



During the initial outreach meetings, it was determined that the Fisheries Department data contained a number of data artifacts that made it difficult to use for sample design, so we solicited information (i.e., names and contact information) for active fisher captains within each port. Active fisher co-ops on St. Kitts

were key sources of this information. On Nevis, a Department of Fisheries staff member was able to provide an updated list of active commercial fishery captains for the entire island. Using this information, a list of active full-time captain/owners for each island was created along with the goal to interview 100% of the captains from landing sites with 10 or fewer fishers and 75% for those with more than 10 fishers. Data collection then proceeded in two waves, first concentrating on St. Kitts fishers (with in-country, Ecotrust, and TNC staff) and then Nevis fishers (with in-country and TNC staff). The project's original intent was to train in-country staff to conduct all interviews with commercial fishers; however, for a two week period, an Ecotrust staff member was retained to assist in-country staff members in conducting interviews and provide technical support. In addition, additional fieldwork was conducted by TNC staff.

Interview efforts in St. Kitts typically focused on one landing site per day. Key informants such as fisheries officers or port managers would communicate to field staff an appropriate time to arrive at the landing site, which typically coincided with the time fishers would return from a day of fishing. Working from a list of captains in each landing site, port managers or field staff members would then identify these fishers as they brought their catch in. Once identified, field staff members would approach the fisher to explain the purpose of the mapping project and solicit an interview. In the process of soliciting and interview, confidentiality was discussed and project staff explained how personal information would be protected. If the fisher consented to the interview, basic demographic and socioeconomic questions were asked and then fishing areas for each of his fisheries were mapped. Approximately 43% of interviews (22 fishers) on St. Kitts were conducted using the mapping tool on laptop computers; however, due to varying levels of field staff proficiency in computer use, and/or lack of power or of the right voltage to operate laptops, data were also collected via hard copy surveys in which fishers pointed to areas on nautical charts and notes were taken describing the boundaries and depths of these areas. Approximately, 57% of interviews (29 fishers) took this form and these data were later digitized by Ecotrust staff using the mapping tool.

In Nevis, field staff members used several strategies to seek out fishers to interview. First, field staff were split into several groups, each of whom were charged with seeking out fishers operating from a particular landing site. These landing sites were usually in close proximity to where field staff members live, making it easier to find each fisher. Typically, field staff members would either call or speak with fishers to pre-arrange interview times and travel to their house to conduct an interview. Confidentiality was discussed at the beginning of each interview and it was explained that final mapped products would only depict aggregated information from 3 or more fishers. On Nevis, approximately 80% of interviews (52 fishers) were conducting using the mapping tool directly and 20% of interviews (13 fishers) were conducted using paper surveys.

3.2.1 Study region

The Federation of Saint Kitts (St. Kitts) and Nevis, is a federal two-island nation located in the Leeward Islands of the West Indies. The capital city of the federated state is Basseterre on the larger island of St. Kitts. The smaller island of Nevis lies about two miles (3km) southeast of St. Kitts, across a shallow channel called "the Narrows". The coastline length of both islands combined is 135km and both islands are approximately 360 km^2 in area. The Federation's surrounding EEZ waters extend out to adjacent territorial waters (e.g., St. Eustatius and Anguilla) to cover 20,400 km^2 in area with a shelf area of 845 km^2. The islands are volcanic in origin, with large central peaks covered in tropical rainforest, and surrounding flatter terrains in which the majority of the population on both island reside. As of 2005, approximately 48,000 people live in the Federation with approximately 10,000 people living in Nevis. At that time, the main source of income on both islands was from tourism, sugar processing (which has since closed), and consumer product assembly. In 2005, according to the United Nations Fisheries and Aquaculture Organization (FAO), commercial fisheries gross domestic product was approximately to be worth $3.8 million (FAO 2006).

Based on initial information from the in-country fisheries agencies, thirteen landing sites on St. Kitts and Nevis were selected as focus sites:

- St. Kitts: Basseterre East, Basseterre West, Old Road, Sandy Point, Conaree, and Dieppe Bay.
- Nevis: Charlestown, Jessups, Cotton Ground, Jones Bay, Newcastle, Long Haul, and Indian Castle.

It was later found that Basseterre East and Basseterre West were not substantially different enough so as to merit separation. Basseterre East and West are of relatively close proximity- approximately a quarter-mile down the main road from each other. Furthermore, as interviews commenced within both ports, it was determined that several fishers use both landing sites and that there were no differences in spatial fishing patterns or fisheries when launching from Basseterre East or West. The primary determinant of if a fisher docked in Basseterre East or West was if they were going to sell their catch at the local market in Basseterre West or sell their catch to the Basseterre East fisheries complex. For these reasons, these two ports were combined, resulting in 12 focus landing sites between the two islands.

3.2.2 Fishery names

Based on initial findings, there were ten fishery groups of interest on St. Kitts and Nevis. The groups are listed in Table 1 with the associated target species.

Table 1. Fishery grouping and associated local names species

Fishery Group Name	Associated Target Species	
Coastal pelagics	Gars Ballyhoo	Jacks Small tuna
Ocean pelagics	Billfishes Dolphinfish	Tuna Mackerel
Coastal demersals	Surgeon/Doctorfish Triggerfish Grunts Hinds Squirrelfish	Snappers Goatfish Parrotfish Groupers
Demersal shelf/deep slope	Snappers	Groupers
Lobster	Caribbean spiny lobster	
Conch	Queen conch	
Shark	Various species	
Diamondback squid	Diamondback squid	
Turtle	Leatherback Hawksbill	Green Loggerhead
Bait	Ballyhoo	Anchovy/Sardine

Fishery group names are consistent with the St. Kitts and Nevis Fisheries Management Plan (2007); however, some of the fishery and gear type combinations may have a common or local name. Table 2 lists possible local names for the fisheries associated with a particular fishery group/gear type combination. Knowing and employing these local names may be useful when referencing specific fisheries.

Table 2. Local names for formal fishery group and gear type combinations

Formal Fishery Group Name	Gear Type	Local Name
Coastal pelagics	Beach seine	Coastal pelagics or net fishery
Coastal pelagics	Troll/handline	Tuna and bonito
Ocean pelagics	Troll/handline	Large offshore pelagics
Coastal demersals	Trap	Reef fish or nearshore trap/pot fishery
Coastal demersals	Handline/rod and reel	Reef fish or nearshore handline/banking
Coastal demersals	Spear gun	Reef fish or nearshore spear
Coastal demersals	Gillnet	Reef fish or nearshore gillnet
Demersal shelf/deep slope	Trap	Snappers and groupers or deep slope trap/pot
Demersal shelf/deep slope	Handline/rod and reel	Snappers and groupers or deep slope handline
Lobster	Dive (free, SCUBA) and trap	Lobster
Conch	Dive (free and SCUBA)	Conch
Shark	Hook and line and gillnet	Shark
Diamondback squid	Light stick/hook and line	Squid
Turtle	Turtle net	Turtle
Bait	Net or castnet	Bait fish

3.3 Data Analysis Methods

Data were entered into an open source geographic information system (GIS) using a custom-built interface known as Open OceanMap, which was modified for the St. Kitts and Nevis study region. The interface allowed field staff to enter fishing grounds identified by respondents directly into a spatial database, and standardize this information across a number of respondents or fisheries. Furthermore, Open OceanMap was programmed to allow field staff to draw shapes of the fishers' grounds in their natural sizes (polygons) rather than confining responses to a grid. Although data can be summarized to a variety of grids for the subsequent analysis, the raw data were entered in natural shapes and at the spatial scale that made sense to respondents.

All interviews followed a shared protocol:

1. Maximum extent: Using electronic and paper nautical charts of the area, fishers were asked to identify, by fishery, the maximum extent north, south, east, and west they would forage or target a species.
2. Scaling: They were then asked to identify, within this maximum forage area, areas of critical economic importance over their cumulative fishing experience, and to rank these using a weighted percentage—an imaginary "100 dollars" that they distributed over the fishing grounds.
3. Landing site association: All areas each fisher identified were then attributed to his specified home landing site.

The first step established the maximum extent of the fleet in each fishery. This differed for all fisheries, some of which range far along the Leeward Islands, while others were confined to inshore waters. In the subsequent analysis this allowed us to distinguish between fisheries that take place wholly or partially in the territorial seas of St. Kitts and Nevis. While an initial concern was the limited extent of the base maps provided, additional information on depth collected by field staff allowed us to adequately capture areas beyond the boundaries of the base map. Coastal pelagics – troll/handline, demersals shelf/deep slope – handline/pole line, and ocean pelagics – troll/handline were the only fisheries that occasionally extended beyond the extent of the base maps.

The second step serves to scale respondents' reporting of the relative importance of the fishing grounds to a common scale. This is important for making inter and intra fishery comparisons. We chose 100 dollars as an intuitive common sum scale for scoring the relative importance of subareas identified within the larger fishing grounds. It also provides us with a convenient accounting unit for aggregating the stated importance per unit area in the intermediary steps of the various analyses performed.

The landing site association is relevant for linking the fishing grounds to landing sites, since not all landings are necessarily made in ports adjacent to the grounds.

The analysis of the fishing ground information follows a series of discrete steps:

3.3.1 Determining the fishing grounds

Through interviews following the above protocol, fishers are asked to identify their fishing grounds for a specific fishery. In order to determine the fishing grounds *G* for any given fishery, the fishing grounds identified by the fisher (i.e. the area of all the shapes, *j)* is summarized. Each fisher *f* interviewed, identifies his/her fishing grounds G_f, per fishery as one or more shapes $G_f = \sum j$, where j = 1,...,...n. The number of shapes differs for each respondent and by fishery. If there is only one shape, then $G_f = j$.

Each shape *j* in fisher's *f's* fishing grounds is then converted to a grid with a 100m-cell size. For example, in the Lobster fishery, each shape identified by a fisher now equals some multiple of 100m cells, so the total number of cells in one shape, C_j = n, where n = 1,...,C. The lobster fishing grounds for each fisher G_f, is now represented by the total number of cells for all of his\her shapes:

$$G_f = \sum_{j=1}^{J} C_j$$

But, in order to normalize each shape by the total area, the entire lobster fishing grounds $G_{lobster}$, need to be determined. This will be used in a later step that effectively weights the response according to the relative size of the respondent's fishing footprint to the composite fishing grounds. The composite fishing grounds $G_{lobster}$, is based on all the shapes provided by all fishers, and it is necessary to account for the possible overlap of shapes identified by multiple fishers. This is done by expressing whether a cell exists for *j* in any given location (cell) through the following equation:

$$G = \sum b_{(x,y)},$$
$$b = 1 \vee 0$$

Where *b* = result of the Boolean expression:
does *j* exist for any *f* for location *x, y*. 1 = true, 0 = false.

If we were to just sum the number of cells of every *j,* identified by every *f,* the resulting sum would not be for a unique *x, y* location and count multiple occurrences in the same location. In other words, the fishing grounds of any one fisher G_f, are smaller or equal to the total grounds for that fishery.

3.3.2 Determining the relative economic importance (REI)

Each respondent allocates a budget, Ω, of 100 "dollars," representing his or her total effort for that fishery, by allocating some portion of dollars, *P,* to each shape, *j,* on their fishing grounds, G_f , such that $\sum P_j = 100$. Each shape *j* is now associated with a distinct number of cells, C_j, and a weight, P_j.

$$\sum_{j=1}^{J} P_j = 100$$

The value of each cell in the shape is then the number of dollars allocated to the shape divided by the number of cells in the shape. So as not to overstate the relative importance of cells associated with shapes identified by fishers who reported smaller fishing grounds (thus concentrating value in a sub-section of the composite grounds, *G),* we multiply the value of each cell *(P_j / C_j),* by the number of cells for that fisher's grounds, G_f, divided by the total number of cells in the composite fishing grounds for the entire shape *(G_f / G)*. This weights the response according to the relative size of the respondent's fishing footprint, C_j, to the composite fishing grounds, *G,* or normalizes by the total area.

Each cell for every given shape is now represented by the relative economic importance value normalized by the total area, or *V*.

$V_j = (P_j / C_j) * (G_f / G)$

Where:

P = the stated economic importance value
C = the number of cells
j = the shape
G = the total number of cells in the entire fishery
G_f = the total number of cells in the fishing grounds of one fisher

Consider this example:

For this example there are only two respondents. Collectively they have drawn five shapes: respondent *A* has identified three shapes and respondent *B* has identified two shapes. They have each allocated their budget of dollars accordingly.

Respondent A identifies three shapes, which cover 50, 100, and 10 cells, respectively. She then weighs them 20, 75, and 5 dollars each, for a total budget of 100 dollars.

Shape *j*	No. of cells C_j	No. of dollars P_j	Value per cell (P_j / C_j)
A_1	50	20	20/50 = 0.4
A_2	100	75	75/100 = 0.75
A_3	10	5	5/10 = 0.5
A's total grounds G_A	160 cells	100 dollars	

Respondent *B* identifies two shapes, which cover 20, and 100, respectively. He then weighs them 80 and 20 dollars each, for a total dollars budget of 100.

Shape j	No. of cells C_j	No. of dollars P_j	Value per cell (P_j / C_j)
B_1	20	80	80/20 = 4
B_2	100	20	20/100 = 0.2
B's total grounds G_B	120 cells	100 dollars	

All of respondent B's first shape ($j_{B,1}$), overlaps with a portion of respondent A's second shape ($j_{A,2}$). The total number of cells in the composite fishing grounds, G, thus equals 260. In order to account for the relative size of each respondent's fishing footprint, $C_{(j)}$, to the composite fishing grounds, G, the value per cell (P_j / C_j) is multiplied by the number of cells for that shape, divided by the total number of cells in the composite fishing grounds (C_j / G).

Respondent A

Shape j	Value per cell (P_j / C_j)	Relative Economic Importance Value $V_j = (P_j / C_j) * (G_A / G)$
A_1	20/50 = 0.4	0.4 * 0.6 = 0.24
A_2	75/100 = 0.75	0.75 * 0.6 = 0.45
A_3	5/10 = 0.5	0.5 * 0.6 = 0.3

Respondent B

Shape j	Value per cell (P_j / C_j)	Relative Economic Importance Value $V_j = (P_j / C_j) * (G_B / G)$
B_1	80/20 = 4	4 * 0.46 = 1.84
B_2	20/100 = 0.2	0.2 * 0.46 = 0.092

For each cell shared between the two shapes, the relative stated economic importance value of the cell is the sum of the values assigned by each fisher whose shapes (i.e. fishing grounds) overlap in that cell.

$$O_{x,y} = \sum_{f=1}^{F} V_{f(x,y)}$$

Where O = the sum of all Vs for a given location (x,y cell).

So for the 20 cells in respondent B's shape (B_1), with a REI value of 1.84, which overlap with 20 of the 100 cells in respondent A's shape (A_2), with a REI value of 0.45, the aggregate value equals 2.29.

The aggregate value, O, is the share of the total fishing effort budget, $B = f * 100$, where $f = 2$ for this example, that is apportioned to $O_{x,y}$. In the case of our example, 2.29 dollars out of a total of 200 would get

assigned to each of the 20 cells where there is overlap. The remaining area that comprises the rest of the fishing grounds is assigned the REI values that are calculated for each cell for each shape, $O_{x,y} = V_{x,y}$

The result of this analysis is a weighted surface of the extent and stated importance of the fishing grounds for each fishery.

3.3.3 Quality assurance and quality control

Quality assurance and quality control (QA/QC) involved a four-step process:

1. Editing of shapes by Ecotrust staff based on notes from interviews and/or when required to standardize the data (e.g., clipping a shape to the shoreline).
2. Providing the project coordinator with maps and a verification checklist.
3. Reviewing the maps with in-country staff who conducted the interviews on both St. Kitts and Nevis. Those staff provided a list of comments and points of clarification for the island-wide and federation level maps.
4. Meeting with fishing communities (individuals and groups) in late August/early September on each island to:
    a. Clarify the comments and points, which were compiled by in-country and Ecotrust staff.
    b. Review and discuss how the maps were created, how individual information was combined to create the aggregate maps per port and combined to create island and federation maps.
    c. Review maps for accuracy and presentation—Local fishers were presented with maps representing fishing grounds their island. During semi-structured meetings with one or multiple fishers (approximately 45 in total) at the landing sites of Basseterre (East), Old Road, Sandy Point, Dieppe Bay, Charlestown, Jessups, Jones Bay, Newcastle, Long Haul, and Indian Castle, we solicited general feedback on the accuracy of the extent of the fishing grounds and the associated values within the extent. Additionally, the specific comments and points of clarification regarding certain datasets developed through the internal review by field staff were discussed with the fishers for confirmation.
    d. Review and discuss how this information will be used to inform the zoning analysis conducted by TNC and its potential use for other types of planning or management, including gathering ideas from the fishers regarding their thoughts on how this information could best be used.

Internally, we employed several QA/QC protocols that were designed to catch inconsistencies and other problems with individual data. For example, for non-spatial data we ran a check to make sure each fishery captured for an individual had the appropriate corresponding information such as the percentage of the fisher's income from a particular fishery. For spatial data, we checked that depth demarcations were consistent with the limits of a particular fishery (e.g., conch – free dive occurs no greater than X meters) and that mapped data were consistent with shapefile notes.

After the initial review meetings held in Charlestown, it became apparent that most of the fishers' responses on extent and accuracy of value were best reflected in the island-wide maps (versus landing site maps). Review meetings in other ports confirmed this. Additionally, to ensure that the fishing grounds (extent and value) were reflected in the island- and country- wide maps that were used in the zoning analysis, we attempted to capture and confirm responses across landing sites for each island that could be used to identify gaps (either areas that were missing from the maps or areas that were incorrect in terms of the extent and/or value associated with a given area). That said, based on the comments gathered during the in-country review process, we made changes only to the island- and country-wide maps. For details on how and what modifications were made based on the comments received, see Appendix A.

4 Results and Deliverables

Primary project results and deliverables can be broadly categorized as summary statistics and map products (geodatabases), which are both discussed in further detail below.

4.1 Summary Statistics

We report here summary statistics highlighting survey findings. Statistics are reported both by island (St. Kitts and Nevis) and for the entire country. We report on the following:

- Summary of number of fishers interviewed by landing site.
- Survey representation by landing site grouping.
- Survey results by fishery and gear type.
- Summary statistics of fish price and catch sales.
- Fisheries income dependency by landing site.
- Summary responses from qualitative questions.

As mentioned previously, over seven weeks during the spring and summer of 2010, Ecotrust personnel, TNC personnel, and in-country field staff interviewed 51 fishers on St. Kitts and 65 fishers on Nevis (116 total). The following fisheries received the highest number of responses across both islands: coastal demersals – trap (59) and demersals shelf/deep slope – pole/handline (54) (see Table 3). In total, the 51 fishers on St. Kitts and the 65 fishers on Nevis provided 151 and 139 individual fishing ground files, respectively. It should be noted that these numbers and those in Table 4 are not mutually exclusive, in that a fisher often participates in more than one fishery.

Table 3. Summary of reported fisheries

	St. Kitts	Nevis	Federation
Bait – net/cast net	8	2	10
Coastal demersals – gillnet	—	2	2
Coastal demersals – pole/handline	6	3	9
Coastal demersals – spear gun	9	1	10
Coastal demersals – trap	22	37	59
Coastal pelagics – beach seine	4	2	6
Coastal pelagics – troll/handline	2	2	4
Conch - dive (free)	1	5	6
Conch - dive (SCUBA)	7	3	10
Demersal shelf/d. slope – pole/handline	33	21	54
Demersal shelf/d. slope – trap	6	11	17
Diamondback squid - light stick	—	1	1
Lobster - dive (free)	1	4	5
Lobster - dive (SCUBA)	7	3	10
Lobster - trap	21	17	38
Ocean pelagics - troll/handline	20	21	41
Shark - gillnets	—	1	1
Shark - hook & line	3	—	3
Turtle - turtle net	1	3	4
Grand Total	**151**	**139**	**290**

Basic summary statistics are reported by fishery in Table 4. It is interesting to note that participants in the turtle fishery, on average, are substantially older than participants in other fisheries. The five participants in the lobster–dive (free) fishery had the highest average household income from fishing (88%).

Table 4. Summary statistics by fishery

		Average					
Fishery	Number sampled	Age	Years experience in fishery	Household income from fishing	Household size	Income from specific fishery	Number of crew
Bait – net/cast net	10	50	26	78%	4	0%	2
Coastal demersals – gillnet	2	51	16	30%	6	33%	2
Coastal demersals – pole/handline	9	56	28	81%	3	36%	1
Coastal demersals – spear gun	10	40	17	74%	5	29%	3
Coastal demersals – trap	59	53	27	70%	5	56%	1
Coastal pelagics – beach seine	6	57	16	81%	4	56%	3
Coastal pelagics – troll/handline	4	56	30	70%	2	11%	2
Conch – dive (free)	6	48	25	78%	5	33%	1
Conch – dive (SCUBA)	10	41	20	76%	5	69%	2
Demersal shelf/deep slope – pole/handline	54	48	22	71%	4	36%	2
Demersal shelf/deep slope – trap	17	51	26	69%	2	35%	2
Diamondback squid – light stick/hook and line	1	48	10	80%	1	5%	1
Lobster – dive (free)	5	46	22	88%	3	25%	2
Lobster – dive (SCUBA)	10	42	21	74%	5	22%	2
Lobster – trap	38	50	25	80%	4	28%	2
Ocean pelagics - troll/handline	41	44	20	66%	4	51%	2
Shark – gillnet	1	–	35	20%	1	21%	1
Shark – hook and line	3	48	17	80%	2	4%	3
Turtle – turtle net	4	68	38	68%	2	20%	2

Table 5 reports basic port level summary information. All respondents were male. The average respondent (at the Federation level) was 50 years old, have 24 years of commercial fishing experience, and participates in three fisheries. On average, fishing accounts for approximately 68% of his household income. It is interesting to note that, on average, there is greater dependency on commercial fishing from St. Kitts respondents (79% of household income) than Nevis respondents (60% of household income).

Table 5. Summary statistics by port

			Average					
		Number responding	Age	Years experience	% household income	Household size	Number of fisheries	% co-op members
St. Kitts	Basseterre	15	49	22	92%	3	2	29%
	Conaree	2	41	14	70%	6	5	0%
	Dieppe Bay	16	44	21	68%	5	3	86%
	Old Road Town	9	55	26	91%	4	3	88%
	Sandy Point	9	50	24	69%	3	3	0%
Nevis	Charlestown	16	54	28	46%	8	2	93%
	Cotton Ground	2	60	19	68%	2	2	50%
	Indian Castle	11	54	28	46%	2	2	63%
	Jessups	5	54	23	90%	4	3	80%
	Jones Bay	10	52	24	63%	3	2	38%
	Long Haul	5	46	25	78%	3	2	80%
	Newcastle	16	50	22	62%	4	2	79%
St. Kitts - TOTAL		51	49	23	79%	4	3	62%
Nevis - TOTAL		65	52	25	60%	4	2	73%
Federation - TOTAL		116	50	24	68%	4	3	69%

Individuals participating in the conch, lobster, and snapper fisheries were asked to estimate the average price (in EC dollars) per pound typically received for these species (see Table 6). It is interesting to note that while prices for conch and snapper are comparable across the two islands, the average price of lobster varies substantially.

Table 6. Average price per pound received ($EC)

	Fishery		
	Conch	Lobster	Snapper
St. Kitts	$8.00	$17.93	$12.21
Nevis	$8.00	$14.63	$11.84
Federation	$8.00	$16.00	$11.98

Given that the survey targeted captains, participants were asked to provide information about how their crew is typically compensated (see Table 7). Receiving either a share of the revenue or a share of the catch were the most popular methods of compensation on both islands, although it is interesting to note that sharing of revenue was more common on Nevis (55%) and share of catch was more common on St. Kitts (55%). Only two respondents, both on St. Kitts, reported paying salary as compensation.

Table 7. Summary of crew compensation

	Payment Method	Number of respondents	Percentage of respondents
St. Kitts	Salary	2	4%
	Share of the Revenue	17	33%
	Share of the Catch	28	55%
	TOTAL	51	—
Nevis	Salary	0	0%
	Share of the Revenue	36	55%
	Share of the Catch	27	42%
	TOTAL	65	—
Federation	Salary	2	2%
	Share of the Revenue	53	46%
	Share of the Catch	55	47%
	TOTAL	116	—

Note: Some respondents did not specify how crew was paid– the total number of responses does not equal the total number of respondents
Note: Some respondents cited different payment methods for different fisheries

Table 8 reports on the average percentage share of profit (in the form of revenue or catch) allocated between crew members and captains. During the interview process, several survey respondents indicated that the dominant social norm is to share all profits equally amongst the crew and captain. Table 8 corroborates this information as, of the 78 respondents to this question, 72% of them indicated they share profits equally.

Table 8. Average crew and captain shares

	Average			Equal shares	
	Number of crew	Crew share (% after expenses)	Captain share (% after expenses)	Summary of respondents	Percentage of respondents
St. Kitts	2	60%	40%	38	84%
Nevis	1	49%	52%	40	62%
Federation	2	53%	48%	78	72%

Table 9 presents a summary of typical species-specific distribution channels. As expected, the conch fishery is the primary export fishery, with over half of the conch harvested by respondents being sold to exporters. Popular sales to hotels and restaurants include ocean pelagics and lobster on both islands.

Table 9. Distribution of catch

		Personal use	Private customers	Hotels/ restaurants	Basseterre fisheries complex	Nevis fisheries complex	Exporter	Other
Ocean Pelagics	St. Kitts	4%	47%	48%	1%	1%	0%	0%
	Nevis	4%	19%	63%	0%	11%	4%	0%
	Federation	4%	30%	57%	0%	7%	2%	0%
Coastal Pelagics	St. Kitts	7%	50%	23%	8%	0%	12%	0%
	Nevis	4%	71%	0%	0%	0%	25%	0%
	Federation	6%	57%	16%	5%	0%	16%	0%
Demersal Fisheries	St. Kitts	2%	49%	26%	21%	0%	0%	2%
	Nevis	10%	72%	11%	0%	7%	0%	0%
	Federation	7%	64%	16%	8%	5%	0%	1%
Conch	St. Kitts	0%	25%	8%	1%	0%	66%	0%
	Nevis	2%	37%	19%	0%	0%	41%	0%
	Federation	1%	32%	15%	0%	0%	51%	0%
Lobster	St. Kitts	2%	36%	51%	10%	0%	0%	0%
	Nevis	5%	30%	56%	0%	0%	10%	0%
	Federation	3%	33%	54%	4%	0%	6%	0%
Shark	St. Kitts	1%	50%	49%	0%	0%	0%	0%
	Nevis	0%	100%	0%	0%	0%	0%	0%
	Federation	1%	67%	33%	0%	0%	0%	0%
Squid	St. Kitts	–	–	–	–	–	–	–
	Nevis	0%	0%	100%	0%	0%	0%	0%
	Federation	0%	0%	100%	0%	0%	0%	0%
Turtle	St. Kitts	–	–	–	–	–	–	–
	Nevis	10%	90%	0%	0%	0%	0%	0%
	Federation	10%	90%	0%	0%	0%	0%	0%

In addition to asking individuals what percentage of their total household income comes from commercial fishing, we also asked them to estimate what percentage of their commercial fishing income comes for specific fisheries. Table 10 shows the average percentage income from each fishery for those individuals participating in that specific fishery. For example, for the 62 respondents who participate in the coastal demersals–trap fishery, on average, this fishery represents 56% of their commercial fishing income. Generally, greatest income dependency on both islands is associated with the conch–dive (SCUBA) fishery.

Table 10. Summary of fishery dependency[1]

Fishery	Federation		St. Kitts		Nevis	
	Number of respondents	Average % income from fishery	Number of respondents	Average % income from fishery	Number of respondents	Average % income from fishery
Bait – net/cast net	—	—	—	—	—	—
Coastal demersals – gillnet	3	33%	—	—	3	33%
Coastal demersals – pole/handline	10	36%	3	35%	7	36%
Coastal demersals – spear gun	8	29%	7	31%	1	20%
Coastal demersals – trap	62	56%	16	33%	46	63%
Coastal pelagics – beach seine	7	56%	5	53%	2	63%
Coastal pelagics – troll/handline	4	11%	2	7%	2	15%
Conch – dive (free)	8	33%	2	35%	6	32%
Conch – dive (SCUBA)	9	69%	7	69%	2	70%
Demersal shelf/deep slope – pole/handline	47	36%	27	37%	20	34%
Demersal shelf/deep slope – trap	9	35%	5	34%	4	36%
Diamondback squid – light stick/hook & line	1	5%	—	—	1	5%
Lobster – dive (free)	3	25%	—	—	3	25%
Lobster – dive (SCUBA)	11	22%	6	24%	5	19%
Lobster – trap	34	28%	20	34%	14	20%
Ocean pelagics – troll/handline	36	51%	15	34%	21	64%
Shark – gillnet	2	21%	1	1%	1	40%
Shark – hook and line	2	4%	2	4%	—	—
Turtle – turtle net	4	20%	1	5%	3	25%

In an effort to better understand fishing effort on St. Kitts and Nevis, we examined the number of fisheries respondents participate in as well as the common target fishery combinations that occur. As seen in Table 11, over half of respondents participate in only one or two fisheries. An additional 28% of respondents participate in three fisheries. No respondent participates in more than seven of the 19 fisheries (species-gear type) considered in this study.

Table 11: Number of fisheries participated in

Number of fisheries	n=	% of total	Cumulative
One	31	27%	27%
Two	34	29%	56%
Three	32	28%	84%
Four	9	8%	91%
Five	3	3%	94%
Six	5	4%	98%
Seven	2	2%	100%
	116	—	—

[1] The number of respondents may be greater or less than the total number of fishers participating in a fishery as a fisher may have chosen not to answer this question or, similarly, may have chosen not to provide a shapefile for a fishery in which he participates.

Table 12 categorizes respondents based on the number of fisheries in which they participate and then summarizes the fishers participating in each fishery for a give category. For example, of the 31 individuals who participate in only one fishery, eight participate in coastal demersals – trap.

Table 12: Fishery participation

Number of fisheries	n=	Bait – net/cast net	Coastal demersals – gillnet	Coastal demersals – pole/handline	Coastal demersals – spear gun	Coastal demersals – trap	Coastal pelagics – beach seine	Coastal pelagics – troll/handline	Conch - dive (free)	Conch - dive (SCUBA)	Demersal shelf/d. slope – pole/handline	Demersal shelf/d. slope – trap	Diamondback Squid – light stick	Lobster - dive (free)	Lobster - dive (SCUBA)	Lobster - trap	Ocean pelagics - troll/handline	Shark - gillnets	Shark - hook & line	Turtle - turtle net
One	31	0	1	0	1	8	3	0	0	3	3	5	0	0	0	0	7	0	0	0
Two	34	1	0	5	1	18	0	1	0	1	15	6	0	1	1	9	9	0	0	0
Three	32	3	1	4	2	18	2	1	3	2	20	1	0	3	5	15	12	1	1	2
Four or more	19	6	0	1	6	15	1	1	3	4	17	4	1	1	4	14	13	0	2	2

There are a number of interesting points that can be taken from this table:

- Individuals participating in only one fishery target only eight of the 19 fisheries considered. Individuals participating in two fisheries target 12 of the 19 considered and those participating in three fisheries target 18 of the 19 considered.
- Coastal demersals – trap, demersal shelf/deep slope – pole/handline and ocean pelagics – troll/handline are popular fisheries across all categories.
- While the lobster-trap fishery is important for individuals participating in two or more fisheries, no respondent participating in only one fishery participates in lobster-trap.

Finally, we assessed whether there were specific fishery combinations that are more likely to occur within each category. The 31 respondents participating in only one fishery are most likely to target coastal demersals – trap (8) and ocean pelagics – troll/handline (7). That said, all eight coastal demersals – trap and six of the seven ocean pelagics – troll/handline respondents are from Nevis.

Respondents participating in two fisheries targeted a variety of combinations with the following being the most popular: coastal demersals – trap and lobster – trap (9 of 35), demersal shelf/d. slope – pole/handline and ocean pelagics - troll/handline (6 of 35). In both cases, while two fisheries are targeted, the gear type remains the same. Again, differences were seen between the two islands, with all but one of the coastal demersals – trap and lobster – trap (8), demersal shelf/d. slope – pole/handline and ocean pelagics - troll/handline (5) combinations being fished by Nevis fishers.

It is interesting to note that only nine of the 31 fishers (29%) targeting one species and 11 of 34 fishers (32%) targeting two species are from St. Kitts. In contrast, 13 of 19 fishers (68%) targeting four or more species are from St. Kitts

Respondents participating in trap fisheries were asked two additional questions:

- How many traps on average do you fish with?
- What is the average length of time each trap remains in the water?

The average number of traps used for both lobster and demersals shelf varied substantially between St. Kitts and Nevis, with respondents on St. Kitts using more traps (see Table 13). The average number of traps used on Old Road for lobster is substantially larger than other landing sites as two of the largest fishing vessels/operations are located within this site.

Table 13. Summary statistics for trap fisheries

		Lobster - trap		Coastal demersals - trap		Demersal shelf - trap	
	Landing site	Average number of traps	Average trap soak time (days)	Average number of traps	Average trap soak time (days)	Average number of traps	Average trap soak time (days)
St. Kitts	Basseterre	22	7	22	7	30	7
	Conaree	60	4	60	4	—	—
	Dieppe Bay	24	10	18	7	—	—
	Old Road	113	4	22	11	65	3
	Sandy Point	40	4	29	5	8	7
Nevis	Charlestown	23	4	31	5	28	4
	Jessups	28	2	28	2	—	—
	Cotton Ground	26	6	26	6	—	—
	Jones Bay	35	6	22	6	—	—
	Newcastle	20	7	26	6	—	—
	Long Haul	11	6	11	6	19	5
	Indian Castle	13	2	23	3	38	5
St. Kitts - TOTAL		42	7	27	6	46	5
Nevis - TOTAL		22	4	27	5	31	5
Federation - TOTAL		33	6	27	34	36	5

4.1.1 Qualitative responses

In addition to quantitative responses described previously, survey participants were also asked a series of qualitative questions including:

- How well are your fisheries doing?
- What things are impacting your fisheries?
- Are you aware of out-of-country fishers in your waters?

This section summarizes responses to these questions. Responses were coded into broad categories and reported accordingly.

Of the 88 individuals who responded to the question about how their fisheries are doing, only 11 (13%) responded positively. For the remaining 77 individuals, responses such as 'fair', 'up and down', 'not too good', 'declining' and 'getting harder' were common.

Responses to the question asking fishers what they perceived to be impacting their fisheries were varied (see Table 14). Of those who responded to this question (41 did not), the most popular response weather/ocean dynamics (17%). Other popular responses were poaching (12%) and other (12%), which included loss of reef, fewer educated people participating in fishing, high fuel costs, tourism, and fear of the sea by younger populations.

Table 14. Perceived impacts to fisheries

Coded category	Number of responses	Percentage of responses
Climate change	5	5%
Development	6	6%
Harvesting juvenile fish	5	5%
Hurricane	9	9%
Increased competition	5	5%
Mesh size regulations	9	9%
Overfishing	9	9%
Poaching	12	12%
Runoff	2	2%
Volcano	4	4%
Water temperature	4	4%
Weather /ocean dynamics	17	17%
Other	12	12%
No Response	41	–
TOTAL[2]	140	–

The majority of respondents reported that they do not see out-of-country fishers in St. Kitts and Nevis waters (see Table 15). Of the 16 individuals responding that they do see out-of country fishers, ten were from St. Kitts and six were from Nevis. St. Barts and Antigua were the countries reported as most frequently seen, with four fishers reporting siting of fishers from these two countries. Other countries reported included Redondo, Montserrat, Guadeloupe, St. Eustatis and St. Martin. Both the frequency of sightings and the types of species being targeted varied substantially among respondents.

Table 15. Summary of out-of-country fisher sightings

	Number of respondents	Percentage of respondents
Yes	16	14%
No response	40	34%
No	60	52%

[2] Fishers could provide multiple responses, therefore, the number of responses does not equal the number of respondents.

4.2 Map Products

Table 16 presents a summary of datasets or maps available for each commercial fishery by landing site, island and federation. A "✓" indicates that the fishing grounds datasets are available. It should be noted that only island and federation level maps (highlighted) were updated and submitted as final products. The fishery by landing site datasets made available July 2010 are considered final and no modifications were made to those datasets based on the in-country review that occurred in August and September 2010. Those dataset will be archived and considered an intermediary dataset. The fishery by island and Federation datasets available as of September 24th, 2010 have been updated based on the in-country review (Appendix A) and are considered final. In addition, Figures 1–3 show example maps at the island and federation level (St. Kitts and Nevis) for the coastal demersal – trap fishery.

Table 16. Summary of available map products

Fishery	Basseterre	Conaree	Dieppe Bay	Old Road	Sandy Point	Charlestown	Jessups	Cotton Ground	Jones Bay	Newcastle	Long Haul	Indian Castle	St. Kitts	Nevis	Federation
Bait – net/cast net	✓	✓	✓	✓		✓							✓	✓	✓
Coastal demersals – gillnet						✓						✓		✓	✓
Coastal demersals – pole/handline	✓		✓		✓	✓			✓			✓	✓	✓	✓
Coastal demersals – spear gun	✓	✓	✓		✓	✓							✓	✓	✓
Coastal demersals – trap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Coastal pelagics – beach seine	✓		✓	✓		✓		✓		✓			✓	✓	✓
Coastal pelagics – troll/handline			✓							✓		✓	✓	✓	✓
Conch – dive (free)	✓					✓	✓			✓		✓	✓	✓	✓
Conch – dive (SCUBA)	✓		✓			✓	✓			✓			✓	✓	✓
Demersal shelf/deep slope – pole/handline	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Demersal shelf/deep slope – trap	✓			✓	✓	✓				✓	✓	✓	✓	✓	✓
Diamondback squid – light stick/hook & line						✓							·	✓	✓
Lobster – dive (free)	✓					✓	✓		✓	✓			✓	✓	✓
Lobster – dive (SCUBA)	✓	✓	✓			✓			✓				✓	✓	✓
Lobster – trap	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Ocean pelagics – troll/handline	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
Shark – gillnet									✓			✓		✓	✓
Shark – hook and line	✓		✓		✓								✓		✓
Turtle – turtle net					✓					✓		✓	✓	✓	✓

Figure 1

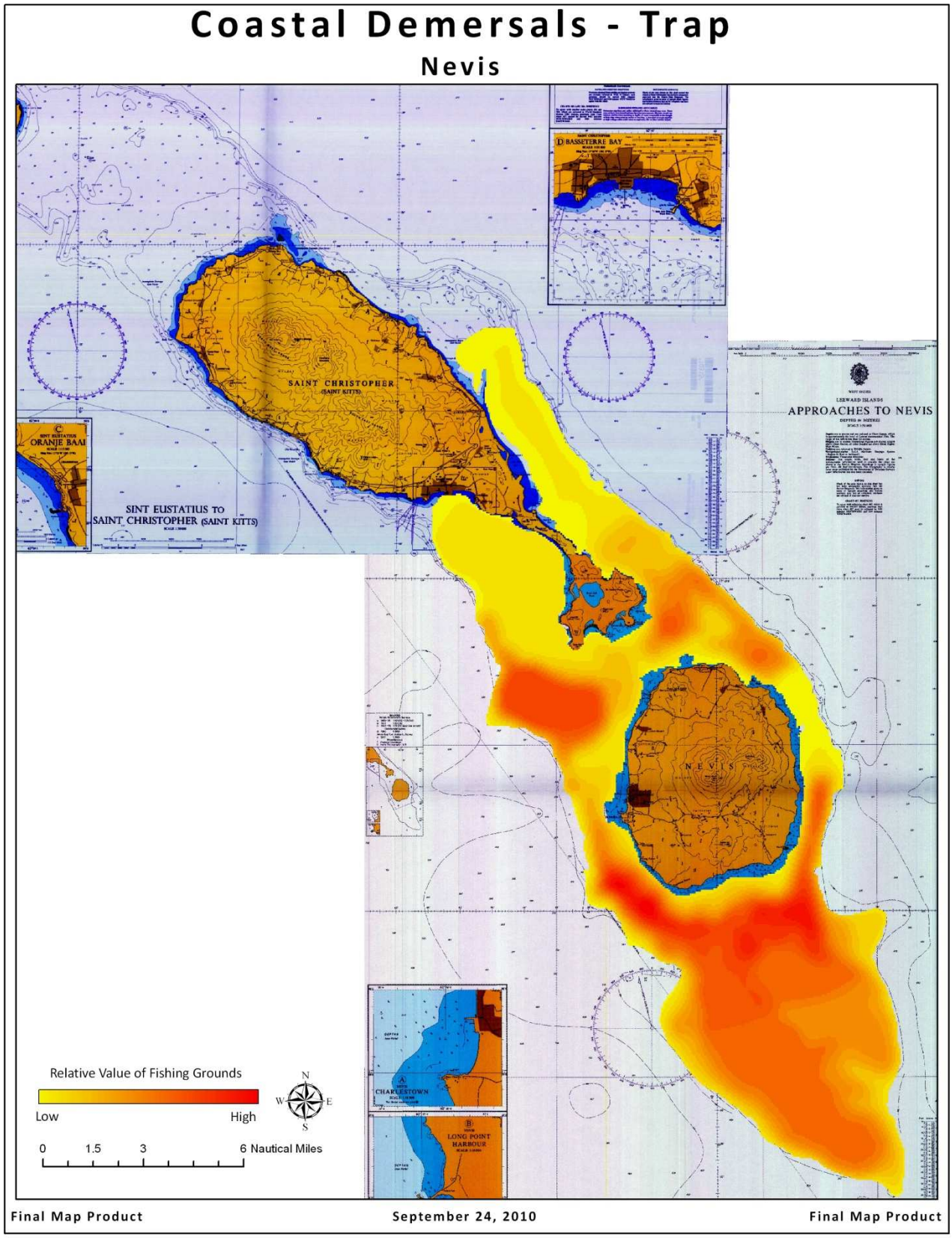

Coastal Demersals - Trap
Nevis
SAINT CHRISTOPHER
(SAINT KITTS)
BASSETERRE BAY
APPROACHES TO NEVIS
ORANJE BAAI
SINT EUSTATIUS TO
SAINT CHRISTOPHER (SAINT KITTS)
NEVIS
CHARLESTOWN
LONG POINT
HARBOUR
Relative Value of Fishing Grounds
Low
High
N
W
E
S
0
1.5
3
6 Nautical Miles
Final Map Product
September 24, 2010
Final Map Product

Figure 2

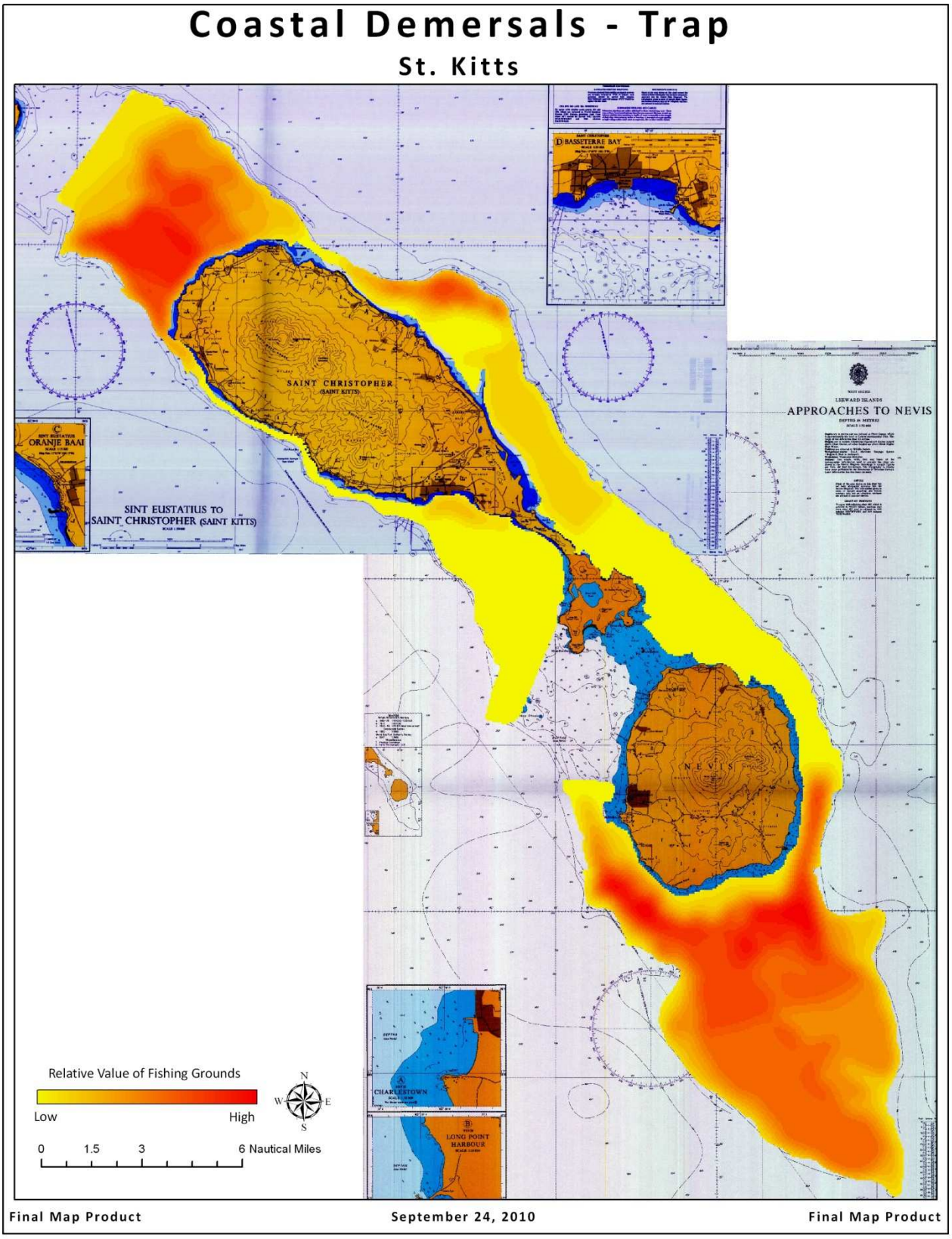
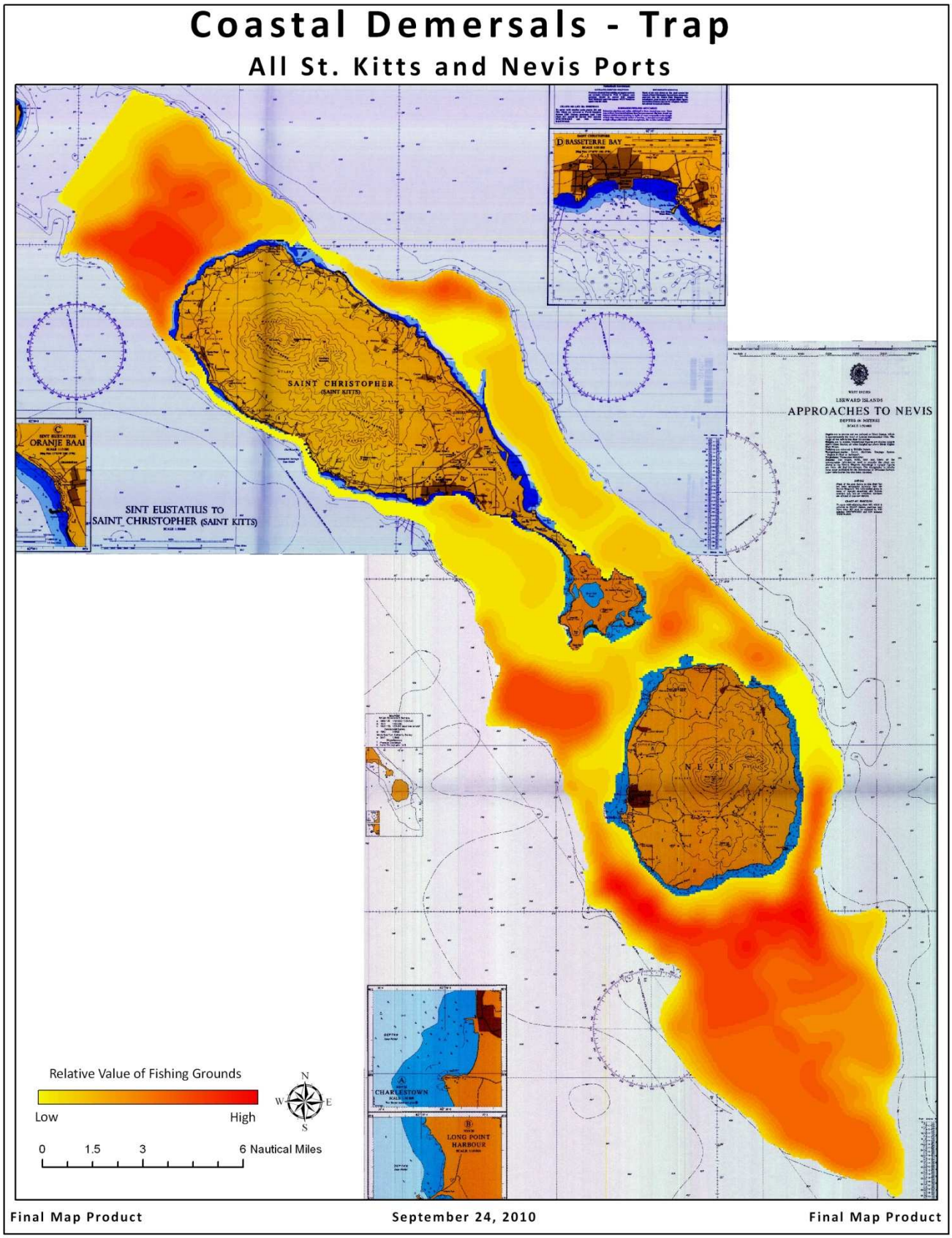

Coastal Demersals - Trap
St. Kitts
SAINT CHRISTOPHER
(SAINT KITTS)
D BASSETERRE BAY
APPROACHES TO NEVIS
ORANJE BAAI
SINT EUSTATIUS TO
SAINT CHRISTOPHER (SAINT KITTS)
NEVIS
A
CHARLESTOWN
B
LONG POINT
HARBOUR
Relative Value of Fishing Grounds
Low
High
N
W
E
S
0
1.5
3
6 Nautical Miles
Final Map Product
September 24, 2010
Final Map Product

Figure 3


Coastal Demersals - Trap
All St. Kitts and Nevis Ports
D BASSETERRE BAY
SAINT CHRISTOPHER
(SAINT KITTS)
APPROACHES TO NEVIS
ORANJE BAAI
SINT EUSTATIUS TO
SAINT CHRISTOPHER (SAINT KITTS)
NEVIS
CHARLESTOWN
LONG POINT
HARBOUR
Relative Value of Fishing Grounds
Low
High
N
W
E
S
0
1.5
3
6 Nautical Miles
Final Map Product
September 24, 2010
Final Map Product

For the first round of deliverables, we provided a series of maps and two geodatabases. One geodatabase contained all of the raster data products created through the aggregation analysis. The data were created at the landing-site, island-wide, and federation-wide level. A map was created for each dataset—a total of 157 datasets/maps. The second geodatabase included all of the individual data collected from the fishers during the interview process. These data are provided in vector geodatabase. For the final round of deliverables, we are providing updated ArcMap projects and a raster geodatabase containing all of the fisheries at the island-wide and federation-wide levels—a total of 53 datasets/maps. All of the data provided include metadata conforming to the Federal Geographic Data Committee (FGDC) standards (http://www.fgdc.gov/standards). The Nature Conservancy will house all deliverables and manage the updating and confidentiality of data.

5 Discussion

This section reflects on several methodological and process lessons we learned in the hope of informing future iterations and/or applications of our approach.

5.1 Staffing

Trained field staff, either from Ecotrust or the client organization, are likely to play a key role in training and data collection phases of the project as well as overall project coordination. Findings from this project suggest that the overall project can be strengthened several ways. First, by having trained staff available (in-country) for several weeks after the training session to insure successful implementation—to conduct interviews to see if the set of questions and procedures work properly and/or to shadow the coordinator and work with field staff to conduct interviews until field staff are comfortable. Second, an in-country project coordinator is critical to the project's success, and if there are multiple islands/regions/cultures within the study area, it may be useful to consider having multiple project coordinators. Finally, by coordinating with relevant in-country agencies and organizations (including co-ops) —whose staff ideally are trained and have the capacity to conduct interviews if appropriate.

5.2 Existing Data

Increased focus on both the availability and role of existing data at the beginning of the project likely will help strengthen and streamline future projects. Suggested ways for increasing this focus include 1) creating a list of general data needs (for sample and survey design) for the project at the beginning to work from (e.g. checklist for what is and is not available, who is the gatekeeper, etc.); 2) characterize any existing data (e.g. how often are data collected, what do they represent, etc.); and 3) vetting existing data with in-country fishers early in the project. One finding was the importance to in-country agency staff and fishers of leveraging any existing data to minimize survey length and not duplicate efforts (e.g. modifying the survey to incorporate existing data). That said, as was later determined in this project, one of the better sources of information on who fishes were and where they fish came directly from the fishing community. Training field staff to use outreach meetings for investigative purposes—e.g., how many people fish from this port, what fisheries do they target, how many boats are there—as the information is both useful for the project and for subsequent outreach meetings—e.g., in Dieppe Bay, say, "I heard in Old Road they used to have seven net boats and now they have one. Are you having a similar experience here?" can help assess the usefulness of local knowledge data early on in the project. A better understanding of both the availability and role of existing data early on in future projects will help balance these types of considerations.

5.3 Survey Design

In addition to input, review, and feedback from the client and in-country agency staff, early review of the survey design by additional individuals in-country (e.g. fishers) will help minimize problems with the survey during implementation. Key points for consideration include: a) interview length; b) question framing; c) fishery names; and d) fishery groupings.

5.4 Tool/Interview/Post Interview Processing

Creating a more flexible mapping tool and streamlining post-interview data processing will likely help improve the quality of data received. In order to minimize the need to digitize hand-written surveys/notes, it should be confirmed early on that each field staff member has access to a laptop. However, hard-copy nautical charts and data sheets with the full suite of interview questions should be available at all times in case laptops are not available or if the situation calls for a hand-written interview. With a more flexible mapping tool, it will be possible to go backwards in an interview and review and verify shapefiles and other data at the end of an interview. Thus adjustments and corrections may be done immediately which reduces the possibility of error in post-interview data processing. Furthermore, creating a tool which captures all interview questions and shapefile notes will also streamline the need to digitize data and reduce the number of survey components the project coordinator will need to check for consistency and accuracy. The project coordinator may then focus more on coordinating and conducting interviews as less time is required to manage data. Ideally, the project coordinator would simply send data files directly to Ecotrust along with one document, which indicates which fishers were interviewed.

In summary, this type of research presented many challenges, yet we believe that the lessons learned in this project have been invaluable. Furthermore, we believe this project, and the lessons learned therein, can be leveraged to catalyze and inform other similar fisher mapping projects in the Caribbean and elsewhere. By nature, this type research has continued to evolve by attempting to transfer existing knowledge, methods, and tools to a new geography, different fisheries, and cultural settings. Much insight was gained on how to successfully adapt previous applications of this work so that they were informed by the local or regional context of St. Kitts and Nevis.

As stated in the introduction, we believe that this project has made a significant contribution to the marine knowledge base on St. Kitts and Nevis – not only by informing marine zoning efforts, but also by enhancing the public's and decision-makers' understanding of the importance of the coastal ocean to individual fishers and to coastal fishing communities. Likewise, we hope the engagement of the St. Kitts and Nevis fishing community in the marine zoning effort is now strengthened through this effort. This strengthened engagement, at a minimum, provides the foundation for future or long-term support for implementation of a zoning plan or inclusion in fisheries management. Through this project, fishers' collective knowledge can now inform current and future marine planning analyses and discussions, where the goal is to better understand and minimize conflict between user groups and optimally accommodate existing/future human uses while maintaining healthy marine habitats and ecosystems.

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Appendix A: Description of modification made based on in-country review

The following is a description of the data edits performed based on review comments from the fishers of St. Kitts and Nevis collected by Charles Steinback and Shawn Margles (TNC) during their review trip to St. Kitts and Nevis in August/September 2010.

1. **Coastal Demersal – Hand line:**
   a. **Nevis edits:** The fishing grounds on the backside of Nevis were connected into a larger area.
      - To complete this edit, we extended the existing shapes to connect and cover the area requested.
   b. **St. Kitts edits:** The area from Sandy Point to Black Rocks was edited to make the higher value area between 100ft and 250 ft deep.
      - To complete this edit, we used the contour lines to split the polygons at the appropriate depths and then adjusted the penny value to make sure the most value was between 100 and 250 ft.
   c. **Federation edits:** No specific edits were made to the Federation dataset. Any changes seen are due to the edits performed on the individual island datasets.
2. **Coastal Demersal – Spear gun:**
   a. **Nevis edits:** We extended the fishing grounds around the island to Butlers and up to Grid Iron Reef. The reef was also given additional value to emphasize its importance.
      - To complete this edit, we added two new shapes to the dataset. The first extended the area around the island up to Grid Iron reef; and the second was over the reef to give that area additional importance.
   b. **St. Kitts edits:** The reefs on the Atlantic side of the island were given some additional value to increase the importance from a lower value (yellow color) to middle level (orange color) importance.
      - To complete these edits, the penny value of the reefs was increased to make sure overall value was raised to a mid-level importance.
   c. **Federation edits:** No specific edits were made to the Federation dataset. Any changes seen are due to the edits performed on the individual island datasets.
3. **Coastal Demersal – Trap:**
   a. **Nevis edits:** We extended the high value fishing grounds on the backside of Nevis up to Butlers between 100ft and 250ft deep.
      - To complete this edit, we extended the existing data to match the requested edit.
   b. **St. Kitts edits:** The South Bank area (south of Nevis) was adjusted to have the same value as the Nevis Island dataset. The areas on the Atlantic side of the island between Black Rocks and Cayon were adjusted to have a similar level of importance as the St. Kitts Lobster – Trap dataset.
      - To complete this edit, we updated the attribute table to include all of the Nevis South Bank data in the St. Kitts dataset. We also copied and pasted the Lobster – Trap data from the Atlantic side to these data and then updated the attribute information so they would be included in this dataset.
   c. **Federation edits:** No specific edits were made to the Federation dataset. Any changes seen are due to the edits performed on the individual island datasets.
4. **Coastal Pelagic – Seine:**
   a. **Nevis edits:** An additional area of importance was added between Charlestown and Dogwood Point at the same depths as the original data. The area over Monkey Shoals was trimmed from a rectangle box shape to follow the contour line that encircles the shoals.

- To complete this edit, we drew a new area along the coast from Charlestown to Dogwood Point, and then we trimmed the area over Monkey Shoals to the contour.

b. **St. Kitts edits:** The area from Basseterre to Sandy Point was included and extended out to 1,200ft. The area was given similar value as the Atlantic side of the island.
   - To complete this edit, we copied an existing shape and adjusted it to match the requested edit.

c. **Federation edits:** No specific edits were made to the Federation dataset. Any changes seen are due to the edits performed on the individual island datasets.

5. **Conch – SCUBA Dive:**
   a. **Nevis edits:** The data were trimmed to a depth of 120ft and the area on the Atlantic side of the island was increased in value.
      - To complete this edit, we made a polygon with which we trimmed all of the data. We also adjusted the penny values in the table to emphasize the important area.
   b. **St. Kitts edits:** The data were trimmed to a depth of 120ft and the area on the Atlantic side of the island was increased in value.
      - To complete this edit, we made a polygon with which we trimmed all of the data. We also adjusted the penny values in the table to emphasize the important area.
   c. **Federation edits:** No specific edits were made to the Federation dataset. Any changes are due to the edits performed on the individual island datasets.
6. **Demersal Shelf/Deep Slope – Hand line:**
   a. **Nevis edits:** The value of the fishing grounds on the Atlantic side of the island was extended up to North Friar's Bay on St. Kitts. The areas between the South Bank and Butlers were connected.
      - To complete these edits, we extended and edited individual fishermen shapes and made them fit the requested edit.
   b. **St. Kitts edits:** The area from Sandy Point to Black Rocks was edited to make the higher value area between 350ft and 600 ft deep.
      - To complete this edit, we used the contour lines to split the polygons at the appropriate depths and then adjusted the penny value to make sure the majority of value was between 350 and 600 ft
   c. **Federation edits:** The data were trimmed to a maximum depth of 1,500ft around both of the Islands.
      - To complete this edit, we made a polygon with which we trimmed all of the data.
7. **Demersal Shelf/Deep Slope – Trap:**
   a. **Nevis edits:** The fishing grounds on the South Bank were adjusted to have a similar value representation as the Demersal Shelf/Deep Slope – Hand line data.
      - To complete this edit, we copied the Demersal Shelf/Deep Slope – Hand line data for the South Bank and updated it to reflect the correct fishery information. We then included the additional data in the analysis for Demersal Shelf/Deep Slope – Trap.
   b. **St. Kitts edits:** The fishing grounds on the South Bank were adjusted to have a similar value representation as the Demersal Shelf/Deep Slope – Hand line data.
      - To complete this edit, we copied the Demersal Shelf/Deep Slope – Hand line data for the South Bank and updated it to reflect the correct fishery information. The data were then included in the analysis for Demersal Shelf/Deep Slope – Trap.
   c. **Federation edits:** The data were trimmed to a depth of 200ft to 1,000ft and the highest value area was focused between 600ft and 1,000ft.

- To complete this edit, we made a polygon with which we trimmed all of the data.

8. **Lobster – Trap:**
   a. **Nevis edits:** More value was added to the South Bank area between 40–80ft.
      - To accomplish this edit, we queried all the lobster-trap data we had from both islands that was in or around the South Bank and updated the attribute table to make sure that the fishing data were used in the analysis for both islands.
   b. **St. Kitts edits:** The South Bank area was filled in to make it similar to Nevis—the areas on the Atlantic side were extended from Black Rocks to the south end of the Island; the areas along Nevis from Long Haul to South Bank were increased in value; and the area from the Salt Pond to Old Road was also increased in value.
      - To complete most of these edits, we updated existing data to be included in the processing for St. Kitts. Where this was not possible, we added additional shapes to the dataset that accomplished the edit requested.
   c. **Federation edits:** No specific edits were made to the Federation dataset. Any changes seen are due to the edits performed on the individual island datasets.