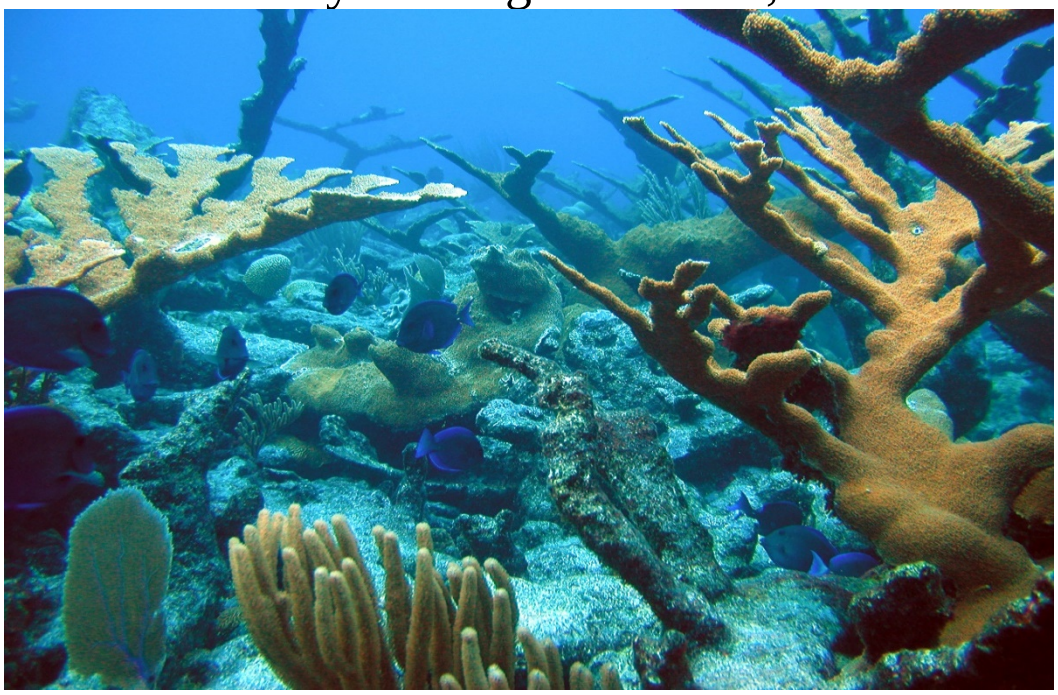
NOAA Technical Memorandum CRCP 35

National Coral Reef Monitoring Program Socioeconomic Monitoring Component

Summary Findings for USVI, 2017



NOAA Coral Reef Conservation Program

Silver Spring, MD

April 2019

United States Department of Commerce	National Oceanic and Atmospheric Administration	National Ocean Service
Wilbur L. Ross, Jr. Secretary	Neil Jacobs Acting NOAA Administrator	Dr. W. Russell Callender Assistant Administrator

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About this document

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to understand and predict changes in the Earth's environment and to conserve and manage coastal and oceanic marine resources and habitats to help meet our Nation's economic, social, and environmental needs. As a branch of NOAA, the National Ocean Service (NOS) conducts or sponsors research and monitoring programs to improve the scientific basis for conservation and management decisions. The NOS strives to make information about the purpose, methods, and results of its scientific studies widely available.

Coral Reef Conservation Program (CRCP) along with the National Centers for Coastal Ocean Science (NCCOS) uses the NOAA Technical Memorandum NOS series to achieve timely dissemination of scientific and technical information that is of high quality but inappropriate for publication in the formal peer-reviewed literature. The contents are of broad scope, including technical workshop proceedings, large data compilations, status reports and reviews, lengthy scientific or statistical monographs, and more. NOAA Technical Memoranda published by the CRCP, although informal, are subjected to extensive review and editing, and reflect sound professional work. Accordingly, they may be referenced in the formal scientific and technical literature.

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Executive Summary

The Socioeconomic Component of the National Coral Reef Monitoring Program (NCRMP) is currently in the process of monitoring socioeconomic indicators across all United States (US) coral reef territories and jurisdictions. These indicators fall under the following broader categories: demographics of these areas, human use of coral reef resources, and knowledge, attitudes, and perceptions of coral reefs and coral reef management. The overall goal of this endeavor is to track relevant information regarding each jurisdiction's population, social and economic structure, societal interactions with coral reef resources, and the responses of local communities to coral management. From there, these baseline data are used to develop indicators that describe the state of each jurisdiction and provide researchers with the ability to compare jurisdictions to one another. The National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Conservation Program (CRCP) will use the information for future research, to assess the socioeconomic outcomes of management activities, and to improve the results of programs designed to protect coral reef resources.

Coral reefs in the USVI face environmental stressors that include climate change, diseases, storms, coastal development and runoff, coastal pollution, tourism and recreation, fishing, and groundings (NOAA CRCP, 2017). These facts exemplify the strong impact of human activities in this region. It is also important to note that the communities of this region benefit from coral reef resources through the tourism industry, commercial fishing, and a range of recreational activities enjoyed by residents (NOAA CRCP, 2015).

This report outlines socioeconomic information relevant to coral reef resources in the United States Virgin Islands (USVI). The survey results contained within this document are representative of each of the three main islands in the USVI: St. Thomas, St. John, and St. Croix. The findings were derived from a combination of data gathered through household surveys conducted from February to April of 2017 and additional secondary sources of socioeconomic information for the region.

With respect to human participation in recreational coral reef-related activities, the surveys demonstrated that USVI residents participate in swimming (79% participate) and beach recreation (78% participate) most frequently. In terms of activities that place residents in close proximity with coral reefs, survey results indicated that 17% of residents dive and 45% of residents snorkel. Additionally, just over 40% of residents indicated that they participate in fishing or gathering of marine resources. Residents who fish/gather marine resources were asked about the reasons why they extract resources, and the most frequent choice was "for fun/personal enjoyment" (65% of fisher/gatherers), followed by "to feed myself and my family/household" (64% of fisher/gatherers). When examining residents' perception of the condition of marine resources, it was found that the amount of marine debris/trash had a more negative perceived condition than any other marine resource condition assessed in the survey: 36% of residents indicated that the current condition of the amount of marine debris/trash was "bad." Thirty-five

percent of residents indicated that the amount of coral had declined over the last decade, but it must be noted that there was a relatively large amount of uncertainty amongst the population concerning coral condition. Residents of different islands differed in their perceptions of marine resource condition. On average, residents of St. John had a more positive perception of marine resource condition when compared to residents of St. Thomas.

Surveys also revealed that USVI residents generally support a range of potential marine management policies and regulations (such as size limits for harvesting fish, increased enforcement of wastewater and storm water regulations, and more restrictions on construction practices), and are mostly familiar with the various threats faced by coral reefs (such as hurricanes, pollution, and coastal development). In terms of the value that USVI residents place upon coral reefs, 92% of survey respondents agreed that coral reefs are important to USVI's culture and 79% agreed that coral reefs protect USVI from erosion and natural disasters.

USVI experienced a number of social challenges between 2000 and 2010, including a decreasing population, a declining real gross domestic product, and an increasing unemployment rate. Additionally, in 2012, St. Croix's economy was negatively impacted by the closure of the Hovensa oil refinery, which was the largest employer on the island (Goedeke *et al.,* 2016). The ongoing economic issues faced by the territory pose significant risk to the well-being of the population.

There were key lessons learned from this first NCRMP socioeconomic data collection in USVI. First, there is a need to distinguish between locally caught and imported fish for the survey question pertaining to fish consumption and fishing activity. Second, the NCRMP team plans to refine the community involvement question in order to make the definition of "community" less ambiguous. Finally, the USVI iteration of the NCRMP socioeconomic survey was the first questionnaire to address lionfish consumption amongst residents, as this was an important piece of information for local partners and coral reef managers. As similar surveys are implemented across other US coral reef jurisdictions, the NCRMP team will be making adjustments to the data collection effort to improve on the type of information being generated; thus, the findings contained within this report should be considered a starting point in the development of more detailed research questions for future work. These findings also represent the baseline assessment for future socioeconomic monitoring of USVI's coral reefs, and they will feed into composite indicators that will detail the status of USVI's coral reef adjacent communities in relation to the other US coral reef jurisdictions. Surveys will be repeated in each US coral reef jurisdiction after the completion of a full monitoring cycle, approximately once every five to seven years.

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List of Acronyms

ACS	American Community Survey
AQI	Air Quality Index
ATTAINS	Assessment Total Maximum Daily Load Tracking and Implementation System
BEA	Bureau of Economic Analysis
BIRNM	Buck Island Reef National Monument
BLS	Bureau of Labor Statistics
C-CAP	Coastal Change Analysis Program
CRCP	Coral Reef Conservation Program
DPNR	Virgin Islands Department of Planning and Natural Resources
ENOW	Economics National Ocean Watch
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
HHS	Department of Health and Human Services
MPA	Marine Protected Area
NCCOS	National Centers for Coastal Ocean Science
NCRMP	National Coral Reef Monitoring Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NWS	National Weather Service
OCM	Office for Coastal Management
OMB	Office of Management and Budget
OR&R	Office of Response and Restoration
QPL	Questionnaire Programming Language
RDD	Random Digit Dialing
SCUBA	Self Contained Underwater Breathing Apparatus
UNEP	United Nations Environment Programme
US	United States
USGS	United States Geological Survey
USVI	United States Virgin Islands
VIGFC	Virgin Islands Game Fishing Club
WTP	Willingness To Pay
WTTC	World Travel and Tourism Council

Introduction

In 2007, the National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Conservation Program (CRCP) underwent an external review by an expert panel to provide an independent assessment of the CRCP's effectiveness in meeting its mandates and to suggest recommendations for future improvement. Some major recommendations from the external review included increasing the CRCP's social science portfolio, strategically using social science to improve coral reef management by engaging local communities, and better assessing the social and economic consequences of management policies, interventions, and activities on local communities. In response, the *CRCP Social Science Strategy* (Loper *et al.*, 2010) recommended three priority activities:

1. Developing of a set of national-level social science indicators
2. Collecting these indicators via regular and repeated jurisdictional surveys
3. Increasing social science capacity within the coral reef conservation program.

In 2010, the CRCP created the National Coral Reef Monitoring Program (NCRMP), which for the first time, included a socioeconomic monitoring component that would improve the CRCP's ability to track social science information in coral reef jurisdictions. The socioeconomic component of the NCRMP addresses the first two priorities. Since the socioeconomic component of the NCRMP is situated within a larger social science program dedicated to a range of social science activities in United States (US) and international coral reef jurisdictions, the results of this monitoring have a wide range of applications.

The inclusion of socioeconomic indicators in the NCRMP represents a strong step forward for the CRCP, which has recognized the need to integrate socioeconomic information with biophysical indictors relevant to the conservation of coral reef resources. The main purpose of the Socioeconomic Component of the NCRMP is to answer the following questions: What is the status of human knowledge, attitudes, and perceptions regarding coral reefs? And, how are human uses of, interactions with, and dependence on coral reefs changing over time? Integration of socioeconomic information will strengthen national coral reef monitoring and improve the Program's ability to explain how people interact with coral reef resources, as well as how coral reef ecosystems and coral reef management strategies are perceived by the public -- issues of utmost interest to the Program's partners, resource managers, and policy makers.

The NCRMP is an integrated long-term program designed to monitor the condition of coral reefs and coral reef ecosystems. Since 2014, the Program has been conducting sustained observations of biological, climatic, and socioeconomic indicators in US states and territories where coral reefs are present. More information about all components of the NCRMP can be explored in "NOAA Coral Reef Conservation Program: National Coral Reef Monitoring Plan" (NOAA CRCP, 2014) available at: ftp://ftp.library.noaa.gov/noaa_documents.lib/CoRIS/CRCP/noaa_crcp_national_coral_reef_monitoring_plan_2014.pdf.

Purpose of this Report

This technical memorandum presents the findings from the initial United States Virgin Islands (USVI) NCRMP socioeconomic data collection. The report presents preliminary social indicators and provides examples of how indicators can be used to analyze changes over time in a long-term setting. The main objective is to lay the groundwork for combining and comparing socioeconomic variables with the goal of developing meaningful indicators that can be used to examine trends in human dimensions of coral reef resources and better understand human influences on effective coral reef conservation. It should be noted that this report presents information that, in many instances, has been collected for the first time. In all instances, the information represents baseline socioeconomic data for the NCRMP. Some of the variables presented in this report identify gaps in information, and we provide suggestions on how these gaps can be addressed in the future.

Overall Approach of the Socioeconomic Component of NCRMP

The socioeconomic component of NCRMP gathers and monitors a collection of socioeconomic variables, including demographics in coral reef areas, human use of and their interactions (over time) with coral reef resources, as well as knowledge, attitudes, and perceptions of coral reefs and coral reef management. The overall goal is to track relevant information regarding each jurisdiction's population, social and economic structure, their interactions with coral reef resources, and the responses of local communities to coral management actions. The CRCP will use the information in future research, to assess and monitor socioeconomic status and change over time, to assess the socioeconomic outcomes of management activities, and to improve programs designed to protect coral reefs within each jurisdiction. Ultimately, in consultation with stakeholders, partners, and other scientists, the information collected will inform the development of indicators. The development of composite indicators is a method that allows researchers to measure the complex two-way relationship between the environment and humans and track the various facets of this relationship over time by breaking down an intellectually complex and immeasurable concept into its various smaller and more measurable parts to improve communication and policy (Schirnding, 2002).

Each indicator will be created using primary data from resident surveys in US coral reef jurisdictions and from existing socioeconomic data collected from secondary sources such as the US Census Bureau and local government agencies. These indicators will include information about the population, the social and economic structure, the impacts of society on coral reefs, and the contributions of healthy corals to nearby residents. The indicators can also be used to track and assess the status of human knowledge, attitudes, and perceptions regarding coral reefs and management activities related to coral reef resources. The indicators and the rationale for their selection are provided below in Table 1. The process of selecting and prioritizing these indicators can be further explored in the workshop report "Developing Social and Economic Indicators for Monitoring the US Coral Reef Jurisdictions" (Lovelace and Dillard, 2012) available at:

https://data.nodc.noaa.gov/coris/library/NOAA/CRCP/project/626_Loper/Social_and_Economic_Indicators_for_Monitoring_the_U.S._Coral_Reef_Jurisdictions_Workshop_Report_2012.pdf.

Indicator Development

The indicators identified in Table 1 will be developed at the conclusion of the first full monitoring cycle by combining data from **primary** and **secondary** sources. The assessment of all US coral reef jurisdictions will draw on indicators that may be composites of multiple distinct measures that address the same higher level concepts such as 'Attitudes towards coral reef management strategies.' For example, Dillard *et al.* (2013) established a methodology for creating composite indicators of well-being in coastal communities; and this work will be used as a guide for developing indicators for the well-being of populations living in US coral reef jurisdictions. Box 1 provides a description of the conceptual framework for developing the community well-being composite indicators, as an example of the way in which multiple measures can be used to assess a single composite indicator, such as Basic Needs or Economic Security, that ultimately captures aspects of a larger concept like well-being. It should be noted that the data presented in this report represent the current status of the collection, and are ultimately intended to contribute to the development of indicators. Once developed, these indicators will be used to assess all US coral reef jurisdictions at the conclusion of the first full monitoring cycle. Both the primary and secondary data presented in this report serve as a snapshot of the collection and analysis of the NCRMP socioeconomic monitoring component for USVI in 2017.

Primary Data

Primary data for the socioeconomic component of NCRMP are collected via a survey administered to individuals reporting on behalf of their households. The survey instrument is composed of one consistent set of questions for all US coral reef jurisdictions, as well as a sub-set of jurisdiction-specific questions relevant to local management needs. NCRMP socioeconomic data are collected using a variety of modes as appropriate to the context in each jurisdiction. For example, in USVI, a mixed mode approach including a random digit dial (RDD) telephone survey method that utilized both landlines and cell phones and a face-to-face intercept method was employed. For all jurisdictions, the aim is a representative sample of the population that meets a 95% confidence level with a minimum of a +/-5% margin of error. The survey methodology generally follows Dillman's Tailored Design Method (Dillman *et al.*, 2009). It should be noted that the survey was developed by utilizing questions from a "bank" of over 120 questions. These questions were approved for use by the Office of Management and Budget (OMB), which is responsible for administering the Paper Work Reduction Act (1995), which ensures that the public is not unduly burdened (in terms of time) and that confidentiality is assured. Surveys are planned to be repeated in each US coral reef jurisdiction after the completion of a full monitoring cycle, approximately once every five to seven years.

Secondary Data

Not only is the use of secondary data ideal for the development of a sustainable, cost effective, and long term socioeconomic monitoring plan, but secondary data are also well suited for the development of indicators used to track population and environmental trends over time. Secondary data collection involves compiling data that were gathered by other organizations from multiple sources and across US coral reef jurisdictional geographies into a centralized database. The use of data sources that are collected in a standardized way over time (such as US Census Bureau data) can help facilitate the integration of social, economic, and biophysical data collected under the NCRMP because integration is aided by broad spatial and temporal coverage of social, economic, and biophysical data. Many of the secondary datasets that provide social and economic data have this quality and allow for more robust analyses along with biophysical data.

Table 1: NCRMP Socioeconomic Indicators

	Indicators	Rationale
1	Participation in coral reef activities (including snorkeling, diving, fishing, harvesting)	Measuring participation in coral reef activities enhances understanding of the economic and recreational importance of coral reefs to local residents as well as the level of extractive and non-extractive pressures on reefs
2	Perceived resource condition	Assessment of perceived conditions is a complement to biophysical information and is key to evaluating differences in levels of support for various management strategies
3	Attitudes towards coral reef management strategies	Monitoring this information over time will be valuable to decision makers, as it will provide insight into possible changes in public perception concerning coral reef management strategies
4	Awareness and knowledge of coral reefs	Monitoring this information over time is key to tracking whether CRCP constituents understand threats to coral reefs and will help inform management strategies (and education/outreach efforts)
5	Human population trends (change) near coral reefs	Monitoring human population trends is important for understanding increasing pressure on coral reefs, as well as reef-adjacent populations
6	Economic impact of coral reef fishing to jurisdiction	Tracking the economic contributions of coral reefs can help justify funds allocated for coral reef protection
7	Economic impact of dive/snorkel tourism to jurisdiction	Tracking the economic contributions of coral reefs can help justify funds allocated for coral reef protection
8	Community well-being	Tracking changes in health, basic needs, and economic security enhances understanding of linkages between social conditions and coral reefs
9	Cultural importance of coral reefs	Measuring cultural importance improves understanding of traditional and cultural significance of coral reefs to jurisdictional residents, and whether this is changing over time
10	Participation in behaviors that may improve coral reef health (*e.g.*, beach cleanups, sustainable seafood choices)	Measuring participation improves understanding of positive impacts to coral reefs as well as negative impacts
11	Physical Infrastructure	Assessment of coastal development footprint, physical access to coastal resources, and waste management/water supply infrastructure provides general understanding of human impact on the coast
12	Knowledge of coral reef rules and regulations	Tracking this information over time at the jurisdictional/national level will inform investment in education and outreach
13	Governance	Measurement of governance provides information on the current status of local institutions involved in coral reef conservation, number of functioning management strategies, and percent area of coral reefs under protection

Box 1: Composite Indicator – Community Well Being

Well-being is a concept used to assess the status of people, either individually or collectively, at different scales (e.g., individual, community and national; Costanza *et al.* 2007). Well-being assessments can be used to determine how people are doing in relation to an optimum standard of life experience (Doyal and Gough 1991) and are generally used by decision-makers to inform policies and programs focused on improving the societal conditions. It provides a means of tracking the relationship between communities and the environment, and a better means of understanding the ecosystem as a whole. When the environment is providing ecosystem services that communities need and desire, well-being has positive gains. Conversely, if there is decline or disruption in ecosystem services, we may expect a decline in well-being, particularly with increased dependence on these services (Butler and Oluoch-Kosura 2006; Costanza *et al.* 1997; MEA 2005). Being able to predict the consequence to humans, both positive and negative, associated with changes in ecosystem states is critical to informed management.

Composite indicators that can ultimately be tracked alongside coral reef ecosystem condition will be employed. The composite indicators are shown in Figure 1 below and each composite indicator is conceptually complex. At the conclusion of the first monitoring cycle, the coral reef jurisdictions like USVI will be scored on selected indicators of well-being. These scores will be compared across US coral reef jurisdictions and will then be used in statistical analyses with indicators of environmental condition to analyze the dynamic relationship between the ecosystem services that people regularly enjoy and community well-being.

Figure 1: Framework of composite indicators for well-being and ecosystem condition, adapted from Dillard *et al.* 2013

Geographic Scope

Overall, the NCRMP focuses on the CRCP's geographic priority areas; however, as some of those areas are uninhabited, the socioeconomic variables are being collected from only the inhabited areas. When feasible, indicators formulated at the sub-jurisdictional scale (i.e. an individual island and/or county) will be reported alongside biological indicators collected at the same scale. Efforts will be made to ensure sufficiently robust sample size to allow for reporting of socioeconomic indicators at appropriate sub-jurisdictional scales. Table 2 displays the seven US coral reef jurisdictions that are encompassed by the socioeconomic monitoring effort.

Table 2: Geographic scope of current NCRMP Socioeconomic Monitoring

Location	Sampling Units
American Samoa	Island of Tutuila
Florida	Martin, Palm Beach, Broward, Miami-Dade, and Monroe Counties
Hawai'i	Islands of Hawaii, Maui, Oahu, Kauai, Molokai, and Lanai
Puerto Rico	Islands of Puerto Rico, Vieques, and Culebra
Commonwealth of the Northern Mariana Islands	Islands of Saipan, Tinian and Rota
Guam	Entire island of Guam
US Virgin Islands	Islands of St. Croix, St. Thomas, and St. John

Jurisdiction Description

The USVI (Figure 2) is a group of islands in the Caribbean that is an insular area of the United States located 40 miles east of Puerto Rico. The islands are geographically part of the Virgin Islands archipelago, consisting of the main islands of St. Thomas, St. John, and St. Croix, and additional surrounding minor islands, and are located in the Leeward Islands of the Lesser Antilles. The territory's capital is Charlotte Amalie on the island of St. Thomas. Of the three main islands, (see Figure 2), St. Thomas is the most populous, whereas St. John is the least populous (US Census Bureau, 2010) and most rural, due to a large section of the island being managed by the Virgin Islands National Park.

Coral reef ecosystems in the USVI comprise a mosaic of habitats (e.g., coral and other hardbottom areas, seagrasses, mangroves) which house a diversity of organisms. Island communities depend on these biologically rich ecosystems for the important ecosystem services they provide such as shoreline protection and the support of valuable socioeconomic activities

(e.g., fishing, tourism). Coral reefs generally form fringing, patch, or spur and groove formations that are distributed in patches around the three main islands and several smaller islands. Climate change, coral bleaching, and increasing sea surface temperatures continue to stress USVI coral reefs, especially since the major Caribbean coral bleaching event of 2005. The effects of hurricanes on USVI coral reefs have been well documented and reviewed, and tropical storms have been shown to be a major force structuring reef communities in the Caribbean (Rothenberger *et al.*, 2008).

USVI's climate is classified as equatorial (Kottek *et al.*, 2006), with little seasonal change throughout the year. Temperatures are moderate to hot year round, with Charlotte Amalie's annual average maximum temperature being 87.4 °F (minimum = 75.3 °F). USVI has a defined rainy season that lasts from April to November (concentrated between May and October), with an annual average precipitation of 40.01 inches (Southeast Regional Climate Center, 2012). In the winter, the northeast trade winds prevail.

Tourism is an important part of USVI's economy, directly producing a GDP of $590.5 million and directly supported approximately 5,500 jobs in 2016 (World Travel and Tourism Council (WTTC), 2016). Due to its island status and its favorable Caribbean climate, USVI is a frequently visited tourist destination for US and foreign travelers alike. These high rates of tourism, coupled with relatively higher population density near the coast, bring even more humans into contact with coral reef ecosystems in the region; thereby creating more opportunities for humans to derive ecosystem services from reefs, but also more opportunities for human-induced stressors to impact reefs.

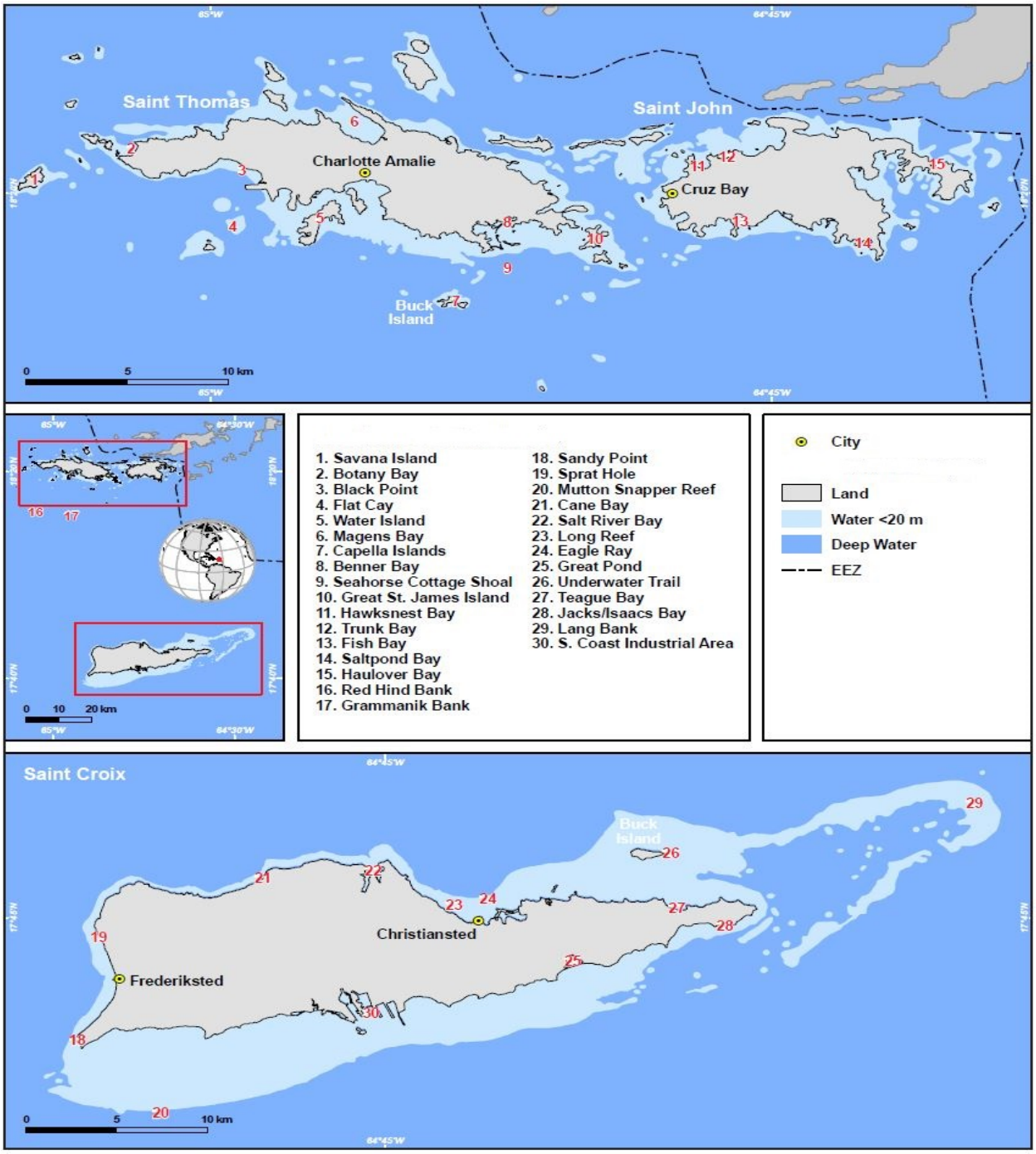

Figure 2: Map of USVI[1]

Source: K. Buja, 2008

[1] It should be noted that not all bays and reefs in the USVI are labeled in Figure 2.

Methodology

2017 NCRMP Survey

Resident surveys took place in USVI on the islands of St. Thomas, St. John, and St. Croix in 2017. The potential respondent universe for this study was adults, eighteen years or older, who live on one of the three above islands for at least 6 months out of the year. Due to the importance of understanding all potential users of the coral reefs who may be affected by activities related to NOAA's CRCP, the survey was not restricted to those who live directly on the coastline. Therefore, all adults in these regions were included in the potential respondent universe. The survey instrument utilized for the NCRMP socioeconomic data collection in USVI is found in Appendix 2 of this report.

The USVI survey data collection was focused on the following indicators:

- Participation in coral reef activities[2] (including snorkeling, diving, fishing, harvesting)
- Perceived resource condition
- Attitudes towards coral reef management strategies and enforcement
- Awareness and knowledge of coral reefs
- Cultural importance of reefs
- Participation in behaviors that may improve coral reef health
- Awareness/knowledge of coral reef rules and regulations

More information on the general survey methods applied can be found here: http://www.coris.noaa.gov/monitoring/resources/FAQs_NCRMP_Social_Survey.pdf, while details for the USVI effort are provided below.

Residents of the three aforementioned islands (Figure 3) over the age of 18 and residing in USVI at least six months out of the year were surveyed via telephone and face-to-face interview from February to April of 2017.

[2] The most direct linkage between beaches and coral reefs is through the protection afforded to beaches by coral reefs, which help protect beaches from erosion due to storm events. Additionally, reefs provide material for "natural beach replenishment" (NOAA CRCP 2015). As a result of these linkages, coral reefs are important to coastal residents' and visitors' use of the beach (Shivlani 2014).

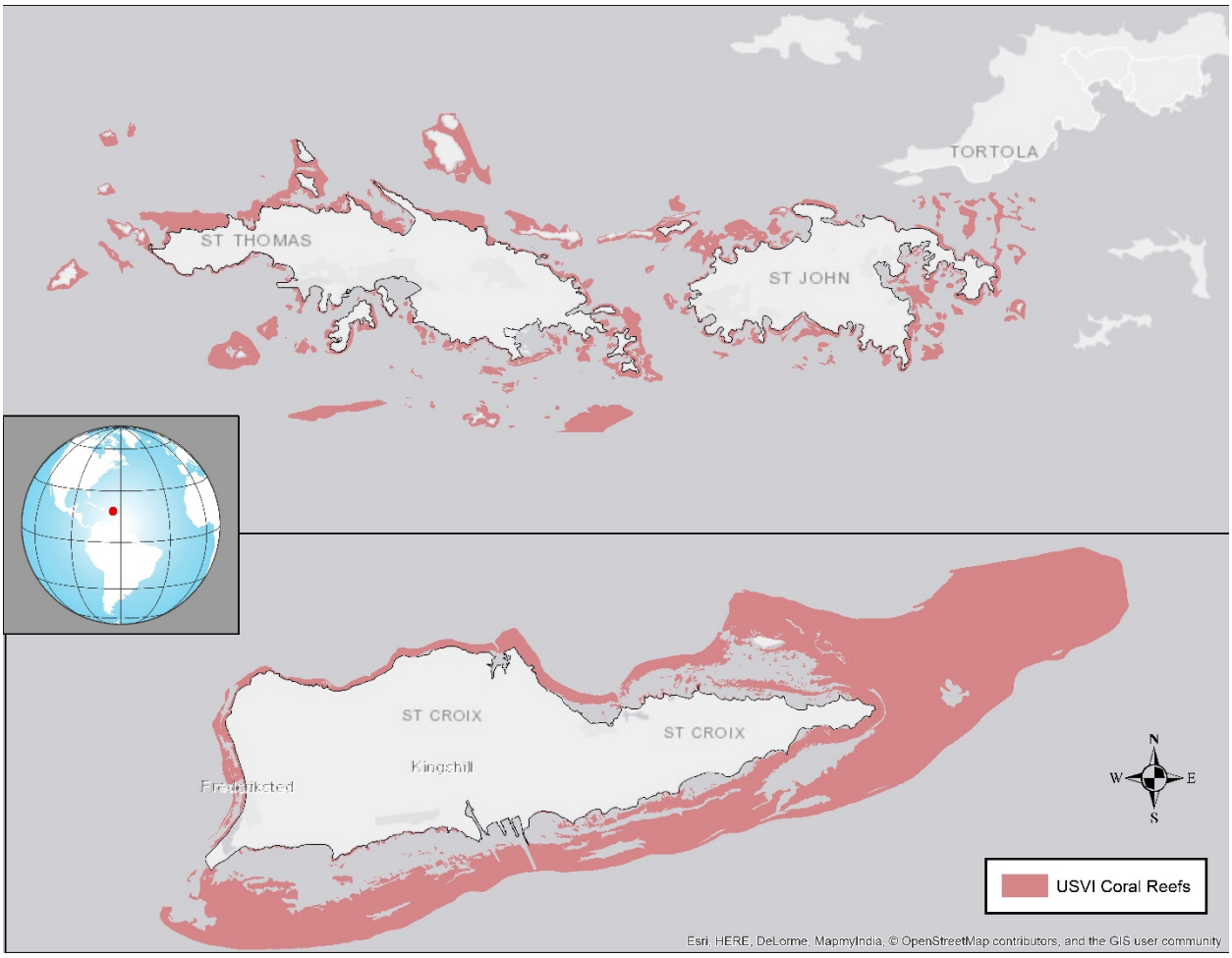

Figure 3: Location of sampled islands in USVI in relation to coral cover

The telephone surveys used a dual-frame sampling plan. This plan incorporated both landline and cellular telephone numbers to ensure maximum coverage and representation of those with telephones, including young adults, singles, and mobile-only households. To ensure representative sampling, the researchers purchased a representative telephone database from Marketing Systems Group (a firm specializing in the development of telephone survey samples) that included both landline and cellular records for residents of the USVI. The software used for telephone data collection was Questionnaire Programming Language (QPL). The survey questionnaire was programmed so that QPL branched, coded, and substituted phrases in the survey based on previous responses to ensure the integrity and consistency of the data collection. Telephone surveying times were Monday through Friday from 9:00 a.m. to 9:00 p.m., Saturday from noon to 5:00 p.m., and Sunday from 5:00 p.m. to 9:00 p.m., local time. A five-callback design was used to maintain the representativeness of the sample, to avoid bias toward people easy to reach by telephone, and to provide an equal opportunity for all to participate. When a respondent could not be reached on the first call, subsequent calls were placed on different days of the week and at different times of the day.

For the in-person interviews, a team of professional interviewers conducted all in-person interviews with residents of St. Thomas, St. John, and St. Croix. The in-person interviews were conducted as intercept surveys. Using contractor local knowledge, in-person surveys were conducted at more than 30 sites frequented by USVI residents (Table 3). These sites were selected to be geographically distributed around the islands in locations designed to capture residents of all ages, ethnicities, and income strata. The researchers collected approximately 70% of responses using in-person interviews. In-person sampling allowed researchers to reach respondents who did not answer calls from unknown numbers, as well as for the high proportion of USVI residents without functioning telephones. To encourage participation, surveys were conducted at multiple locations each day. Each site was manned for six hours per day, including the highest traffic hours with daylight at each location. In-person surveys were administered using tablets or laptops, with the data entered directly in real-time using data collection software. The on-site in-person surveys were conducted from 9:00 a.m. to 5:00 p.m. local time.

Table 3: Sites for in person survey intercepts

St. Thomas	St. John	St. Croix
Downtown Red Hook	The Marketplace Complex	Salt River Marina
Red Hook Ferry Terminal	Starfish Market	Cane Bay
Bureau of Motor Vehicles	Cruz Bay Park	DIVI Carina Bay
Frenchtown Park	Human Services Building	Christiansted Boardwalk Waterfront
Tutu Park Complex	Coral Bay—Coral Harbor	Sunny Isle Mall
Cost-U-Less	Westin Resort	Gallows Bay Stores
Bolongo Bay	Ferry Dock	Christiansted Downtown
Magens Bay	Wharfside Village Complex	Rainbow Beach
Downtown Charlotte Amalie	Mongoose Junction Complex	Purple Papaya
Airport	The Lumberyard Complex	Dorsch Beach
	Fire Department East	Crucian Gold Store
	Fire Department West	
	National Park Visitors Center	

The survey was offered in two languages: English and Spanish. A total of 1,188 interviews were completed, yielding a response rate (the number of people who were interviewed by the total number of people in the sample who were eligible to participate) of approximately 28% for the phone surveys and 15-20%[3] for the in-person surveys. No names or personally identifiable information were collected during surveying. A breakdown of the demographic results of the survey compared to the 2010 US Census is available in Appendix 3.

This report presents a summary of select measures collected via the survey instrument and secondary data sources. A presentation on all survey data results and some selected statistical analyses for USVI is available at: http://www.coris.noaa.gov/monitoring/socioeconomic.html.

Secondary Data Collection

Socioeconomic data were compiled for USVI from secondary data sources including the US Census Bureau, the US Bureau of Economic Analysis (BEA), the US Bureau of Labor Statistics (BLS), the Environmental Protection Agency (EPA), the US Department of Health and Human Services (HHS), the National Weather Service (NWS), and local government agencies. Secondary data collection included cleaning and transforming data prior to analyses, maintaining documentation from original sources, evaluating data for errors, and other data proofing procedures.

The secondary data collection for USVI was focused on the following indicators:

- Human population change near coral reefs
- Community well-being
- Physical infrastructure
- Economic impact of coral reef fishing to jurisdiction
- Economic impact of dive/snorkel tourism to jurisdiction

Many of the secondary data presented in this report were taken from the NCRMP socioeconomic project collection as described above. More information about original sources for these data can be found in the data sources table (Appendix 4). Secondary data items included in this report, but not in Appendix 4, are not considered part of the formal NCRMP secondary data collection because they are unique to the jurisdiction or are not available in a standardized format over time.

[3] For the in-person surveys, the estimated response rate is between 15% and 20%. In-person interviewers were on the move and pursuing potential respondents as frequently as possible, as well as making adjustments to location and approach in an effort to maximize response. As a result, the precise response rate is not known. However, approximately one out of every five potential respondents started the survey, with a large majority of those who start—about 75% to 80%--completing the entire survey.

As the secondary data collection and final indicator development for USVI is in progress, there are several indicators that will be more comprehensively addressed by combining the survey (primary) and secondary data. These include indicators which benefit from both existing data from management plans, as well as survey data concerning the involvement of local residents in resource management decisions (e.g., Governance). At the conclusion of the first full cycle of monitoring, the following indicators will be developed using a combination of primary and secondary data:

- Governance
- Community well-being
- Cultural importance of coral reefs
- Participation in behaviors that may improve coral health

Data analysis

Data analysis of both primary and secondary data included descriptive analyses (e.g., measures of central tendency, examination of distribution), as well as examinations of statistical relationships between variables (e.g., cross tabulations, correlation, regression analyses). Additionally, geospatial analyses were used to examine the extent of governance and specifically, the amount of coral reef area under protected status. Some of the key findings will be discussed in the following sections of this report.

In order to obtain a representative sample of each island, St. John was oversampled compared to its proportion of the USVI total population. Therefore, when analyzing data for the USVI as a whole, post-stratification sampling weights had to be utilized. The data for each island are weighted during statistical analysis to match the island's proportion of residents with the three islands' total. Results of the study were also weighted by age and gender,[4] in addition to by island. Therefore, with the exception of comparisons between islands,[5] any conclusions that are stated concerning relationships between knowledge, attitudes, perceptions, human use, and demographics based on NCRMP survey data have utilized these weights in their calculations. It also must be noted that the following frequency tables and graphs do not utilize these post-stratification weights, as no statistical conclusions are being drawn from them. Instead, they are merely illustrating the frequency distribution of responses to each survey question.

[4] Age and gender weights are based on census data for the age 18 and older population of the Virgin Islands.
[5] Unweighted data are used in island comparisons in order to have the necessary sample size for representativeness of each island. Weighted data are used in other statistical analysis to make inferences on USVI in its entirety, as a stratified random sample.

Coral reefs in St. Croix, USVI (Photo Credit: NOAA CCMA Biogeography Team)

Results: Primary Data Indicators

Results are reported by indicator in order to demonstrate which individual measures will be used to assess the indicators presented in Table 1. The first section of indicators presented includes those measured through the use of primary survey data; the first of which is the frequency of participation in marine activities related to coral reefs, as displayed in Table 4.

Frequency of participation in recreational and extractive activities

Table 4 outlines residents' self-reported frequency of participation in coral reef related activities. It must be noted that these results reflect only those residing in USVI at least six months out of the year, and do not take tourist activity participation into account. Bolded values represent the highest frequency choice for each activity. Participation in non-extractive recreational reef activities varies in USVI, with the two activities that residents participate in most frequently being swimming (79% participate) and beach recreation (78% participate). Participation in extractive activities such as fishing from shore (24% participate), fishing from a boat, canoe, or paddleboard (23% participate), and gathering of marine resources (16% participate) is less common.

Table 4: Frequency of participation in various extractive and non-extractive reef activities (n=1,188)

Activity Type	Activity	Once a month or less	2-3 times a month	4 times a month or more	Never	Not Sure
Recreational	Swimming/wading	28%	15%	**36%**	19%	2%
	Snorkeling	20%	9%	16%	**54%**	2%
	Recreational Diving (SCUBA)	10%	3%	4%	**82%**	2%
	Waterside/beach camping	24%	3%	4%	**69%**	1%
	Beach recreation	**39%**	15%	24%	20%	2%
	Motorized Boating	24%	8%	13%	**53%**	2%
	Non-motorized Boating	18%	4%	5%	**71%**	2%
	Stand Up Paddle boarding, surfing, windsurfing, kitesurfing	11%	3%	3%	**82%**	0%
Extractive	Fishing from shore	16%	4%	3%	**75%**	1%
	Fishing from a boat, canoe or paddle board	14%	3%	6%	**76%**	1%
	Gathering of marine resources	11%	3%	3%	**83%**	1%

Figure 4 displays residents' self-reported reasons for fishing. These questions were only answered by residents who indicated that they fish and/or gather in the "activity" question (Table 4). Therefore, the sample size for this question is relatively small when compared to other questions in the survey, as it is only reflective of 40% of residents. The most common reason for fishing among USVI residents who fish is "for fun/personal enjoyment," with 65% of residents who fish indicating that they fish "for fun/personal enjoyment", followed by "to feed myself and my family/household," with 64% of residents who fish indicating that they fish "to feed myself and my family/household." Of residents who fish, fishing "to sell" was the least chosen response, with 84% of residents indicating that they never sell their catch.

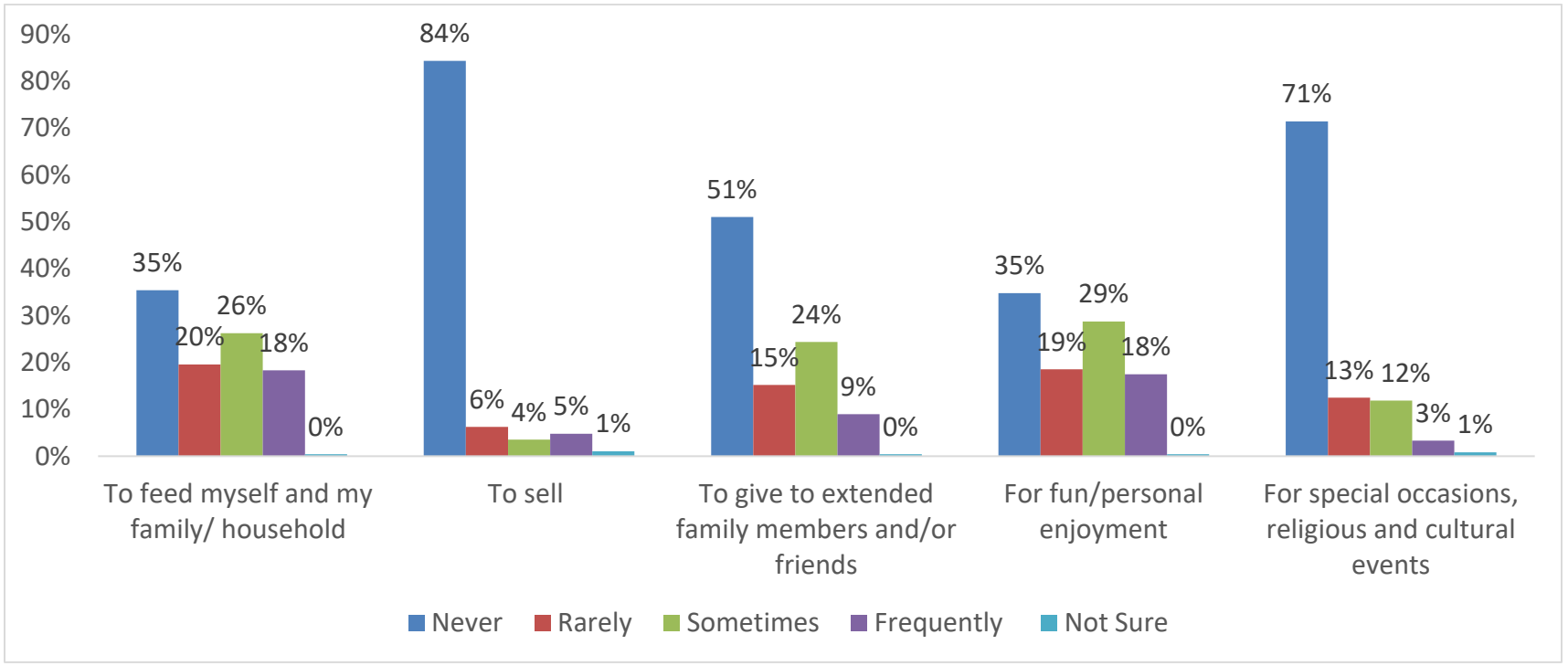

Figure 4: Frequency of fishing for various purposes in USVI (n = 480)

Frequency of seafood consumption

Of the 1,188 people that responded to the question "How often do you or your family eat fish/seafood?" 95% indicated that they consume seafood, with 64% indicating that they consume seafood at least once a week. And of the 1,171 people that answered the question "How often does your family eat fish/seafood that is harvested from coral reefs?" 70% indicated that they consume seafood from coral reefs, with 23% indicating that they consume seafood from coral reefs at least once a week. Additionally, survey respondents were asked if they or their family consume lionfish (*Pterois volitans*), with 9% of the 1,162 who answered this question indicating that they do consume lionfish. When considering from where residents obtained their seafood, "purchased by myself or someone in my household at a store or restaurant" was the most frequently encountered response, with 59% of residents indicating that they use this source as one of their sources for seafood. This choice was followed by "purchased by myself or someone in my household at a market or roadside vendor" (56%).

Participation in behaviors that improve coral reef health

Residents were also asked about pro-environmental behaviors, such as participating in beach clean-ups or volunteering for an environmental group, with the assumption that these types of behaviors would help sustain and/or improve coral reef health in the region. Of the 1,188 that responded, almost two thirds (64%) indicated that they never participate in pro-environmental behavior, and 38% of residents indicated that they participate in environmental behavior at least "several times a year."

Advertisement for beach clean-up in USVI (ad credit: whattodo-vi.com)

Perceived resource condition

Figure 5 illustrates residents' perceptions of the current condition of marine resources in USVI. Residents responded most favorably when asked about their perceived condition of ocean water quality, with almost three fourths (72%) of residents indicating that current ocean water quality condition is "good." Residents responded least favorably when asked about their perceived condition of the amount of marine debris/trash, with 36% of residents indicating that the current condition of the amount of marine debris/trash is "bad." Residents revealed the most uncertainty about the condition of the "amount of coral" and "health of coral" (35% and 34% not sure, respectively).

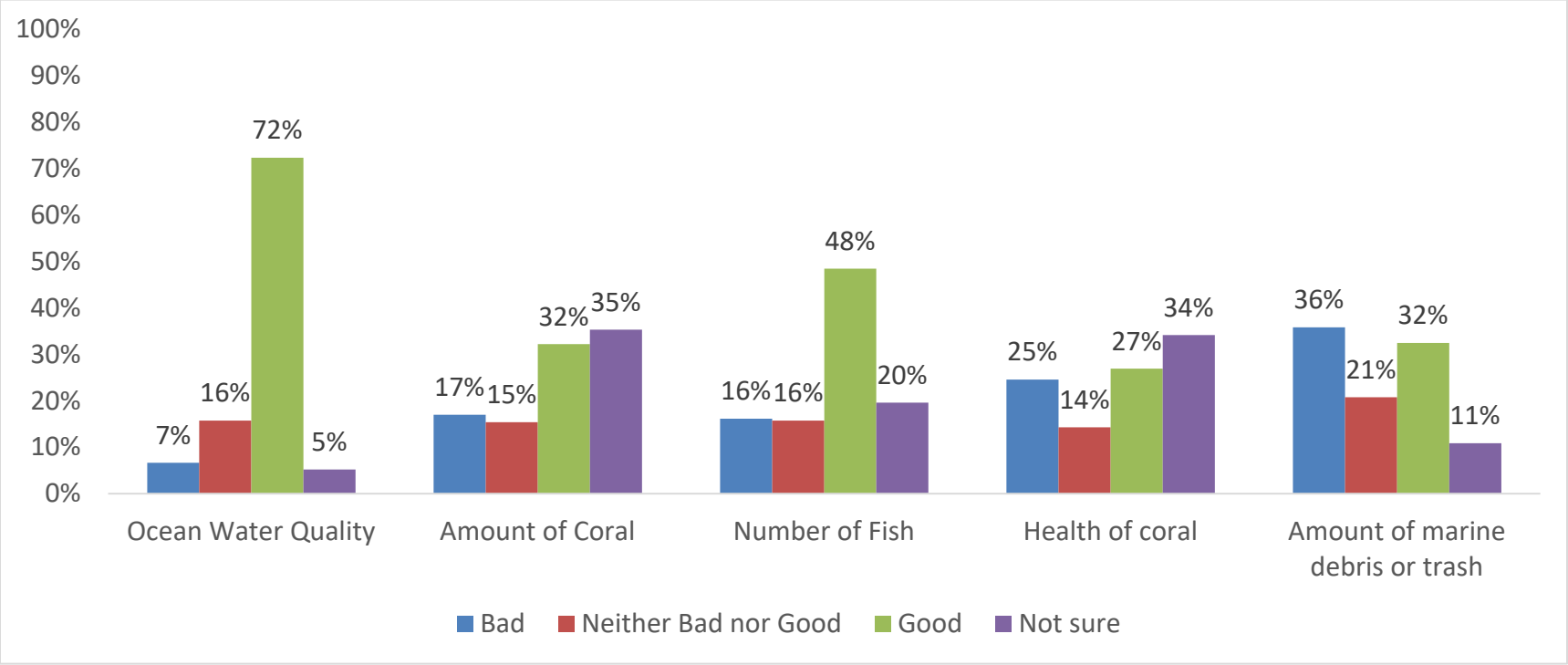

Figure 5: Resident opinions regarding current conditions of marine resources (n = 1,188)

Figure 6 illustrates residents' perceptions concerning the change in the condition of marine resource over the last 10 years in USVI. Overall, a small proportion of residents believe that the condition of these marine resources has gotten better over the last decade. "Number of fish" was the marine resource that the highest proportion of residents feel has gotten worse over the last decade (38%), though a similar number of residents also considered "amount of coral," "health of coral", and "amount of marine debris or trash" to have gotten worse, as well. When asked about the change in condition over the last decade, the marine resources that residents were most unsure as it relates to perceived condition about were again "amount of coral" (38%), and "health of coral" (37%).

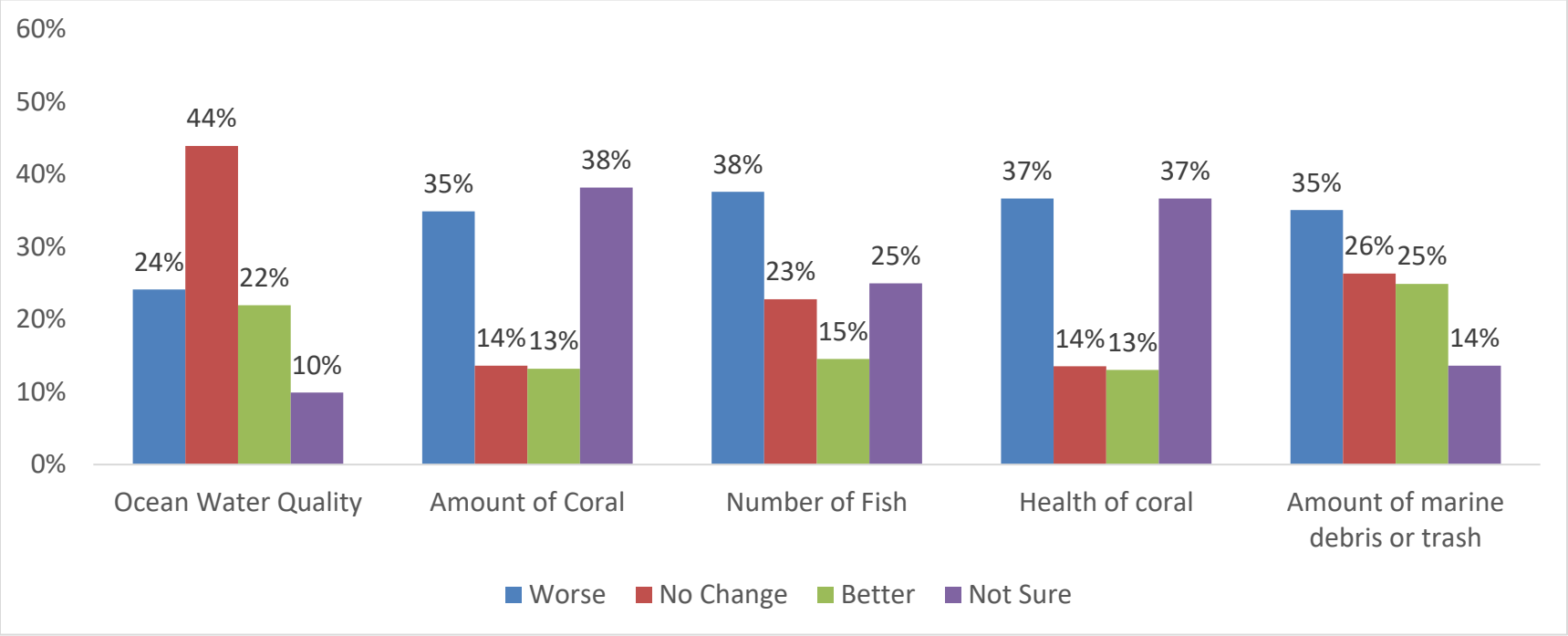

Figure 6: Resident opinions on change in condition of marine resources over past 10 years (n = 1,188)

Residents were asked how they felt the condition of marine resources will change over the next 10 years as well. Of the 1,188 that responded, 37% indicated that they think the condition of marine resources will "get worse" over the next decade, while 14% feel the condition will "stay the same," and 34% believe the condition will "get better."

Knowledge of coral reef rules and regulations

In order to operationalize the indicator of "knowledge of coral reef rules and regulations," Figure 7 displays residents' self-reported relative familiarity with MPAs in USVI. It was found that 55% of residents are familiar with MPAs, and 42% are either unfamiliar with MPAs or unsure of their familiarity.

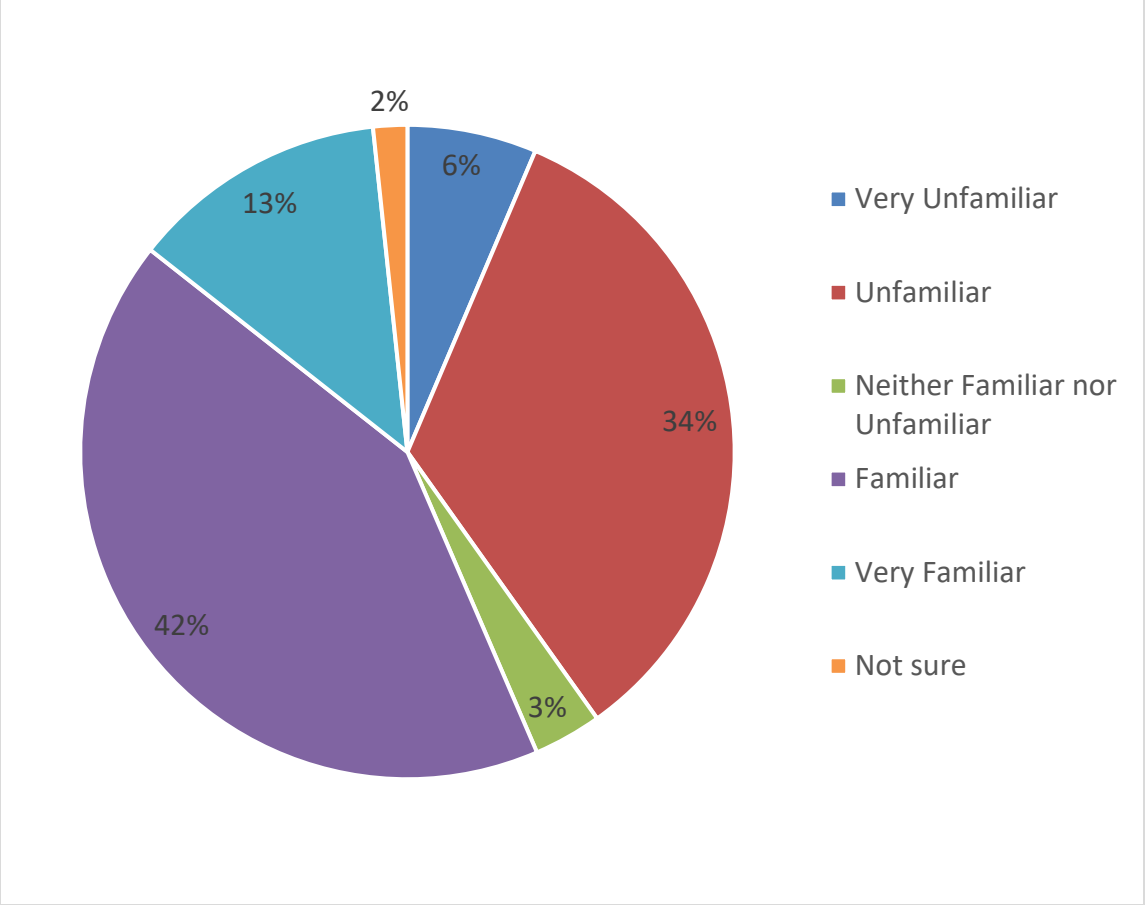

Figure 7: Residents' familiarity with Marine Protected Areas (MPAs) in USVI (n = 1,188)

Attitudes towards coral reef management strategies

Table 5 depicts resident opinions regarding the various purposes and functions of marine protected areas (MPAs). Bolded values represent the highest frequency choice for each statement. When examining resident attitudes toward MPA statements, residents most agree with "MPAs protect coral reefs" (88%) and least agree with "There should be fewer locally managed MPAs in USVI" (67% disagree). Residents are the most unsure about "There has been economic benefit to USVI from the establishment of locally managed MPAs" (25%). It also must be noted this series of questions was only answered by residents who indicated that they are "neither unfamiliar nor familiar," "familiar," or "very familiar" with MPAs (58% of the 1,188 residents who answered the MPA familiarity question; see survey instrument in Appendix 2).

Table 5: Resident opinions regarding marine protected areas in USVI (n = 705)

MPA Statement	Disagree	Neither Agree nor Disagree	Agree	Not Sure
MPAs protect coral reefs	3%	3%	**88%**	6%
MPAs increase the number of fish	4%	6%	**79%**	10%
There should be fewer locally-managed MPAs in the USVI	**67%**	9%	15%	9%
There should be more locally-managed MPAs in the USVI	14%	9%	**67%**	9%
There has been economic benefit to the USVI from the establishment of locally-managed MPAs	9%	7%	**58%**	25%
Fishermen's livelihoods have been negatively impacted from the establishment of locally-managed MPAs in the USVI	**33%**	13%	**33%**	20%
Locally managed MPAs help increase tourism in the USVI	10%	8%	**67%**	14%
The establishment of locally-managed MPAs increases the likelihood that people will vacation in the USVI	11%	12%	**67%**	9%
I would support adding new locally managed MPAs in the USVI if there is evidence that the ones we have are improving the USVI's marine resources	9%	5%	**82%**	4%
I generally support the establishment of locally-managed MPAs	6%	6%	**84%**	4%

Figure 8 depicts residents' attitudes toward various management options that were presented in the survey as common strategies used in the management of coral reef ecosystems. Overall, residents are generally supportive of all potential management strategies that could be used to improve the protection of coral reefs, with the exception of "imposing a license requirement and fee for land-based recreational fishers." The management option with the most support is "increased enforcement of wastewater and stormwater regulations to preserve water quality" (90% agreement). The management strategy that residents are the most unsure about is "amending building regulations to consider sea level rise and climate impacts" (20% either "not sure" or "neither support nor oppose").

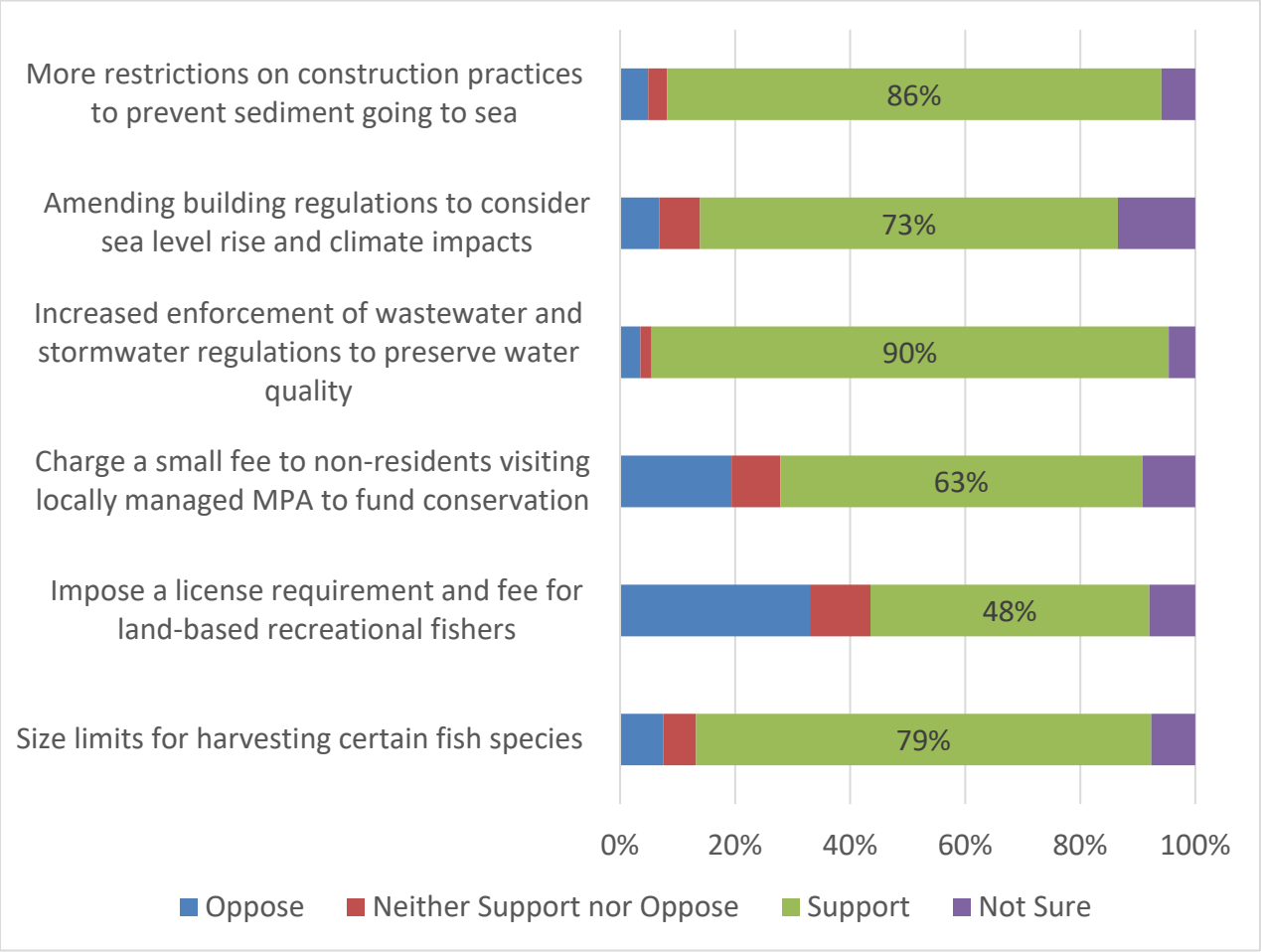

Figure 8: Resident opinions regarding potential management strategies for USVI (n = 1,188)

Awareness and knowledge of coral reef functions and threats

Figure 9 displays resident attitudes pertaining to the services and byproducts of healthy coral reef ecosystems. The majority of residents agree with the statements depicted in the graph, except for one item: 80% of residents disagree with the statement "coral reefs are only important to fishermen, divers and snorkelers." The statement that residents are most unsure about is "coral reefs protect USVI from erosion and natural disasters" (13%).

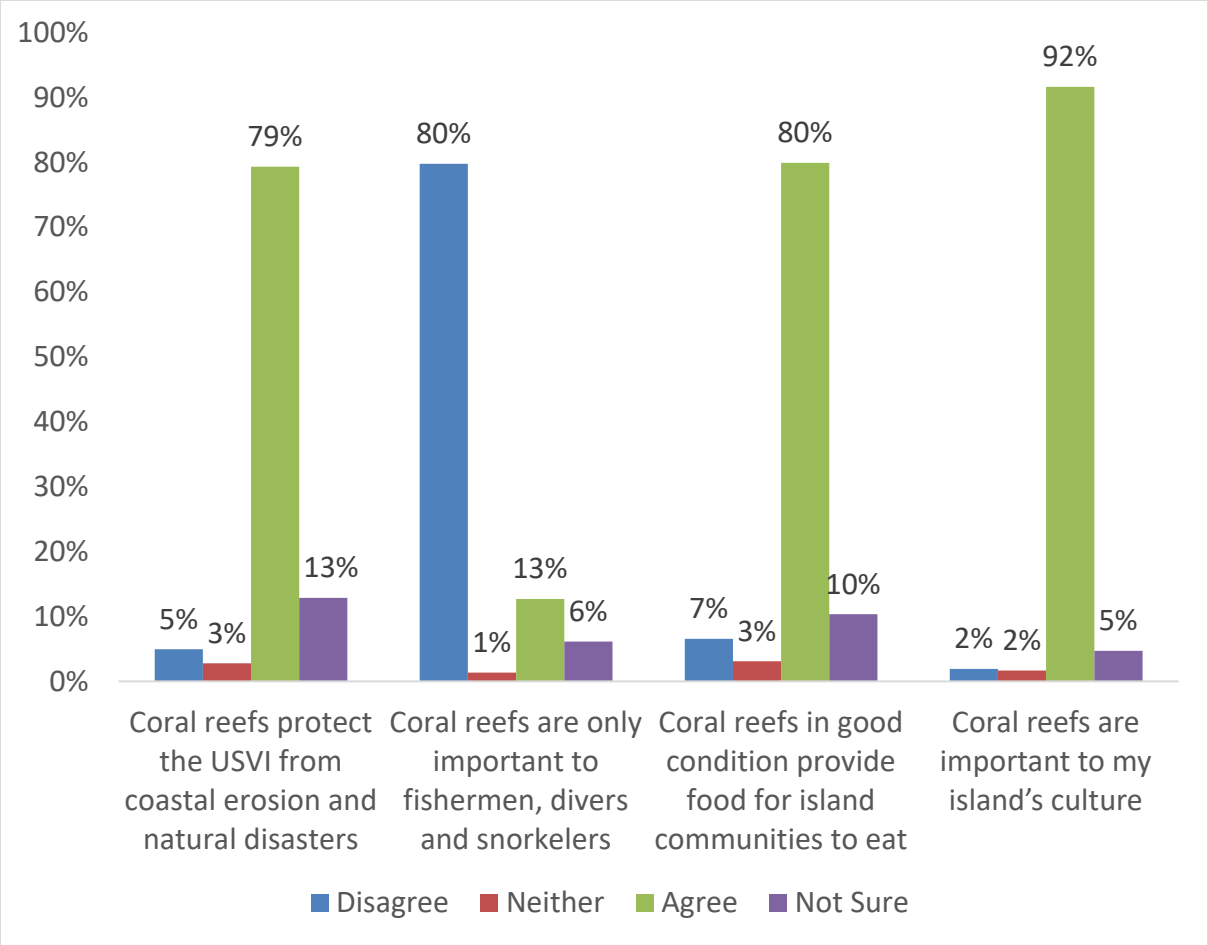

Figure 9: Resident perceptions regarding coral reef services (n = 1,188)

Familiarity with threats

Residents were also asked about their relative familiarity with issues that pose a threat to coral reef ecosystems. Overall, residents are mostly familiar with the various threats faced by coral reefs. The majority of residents are familiar with most of the ten threats listed in the survey; however, the majority are unfamiliar with two issues (coral bleaching and damage from SCUBA divers and snorkelers). Figure 10 shows that residents are most familiar with the threat of hurricanes (87%), followed by the threat of pollution and runoff (79%).

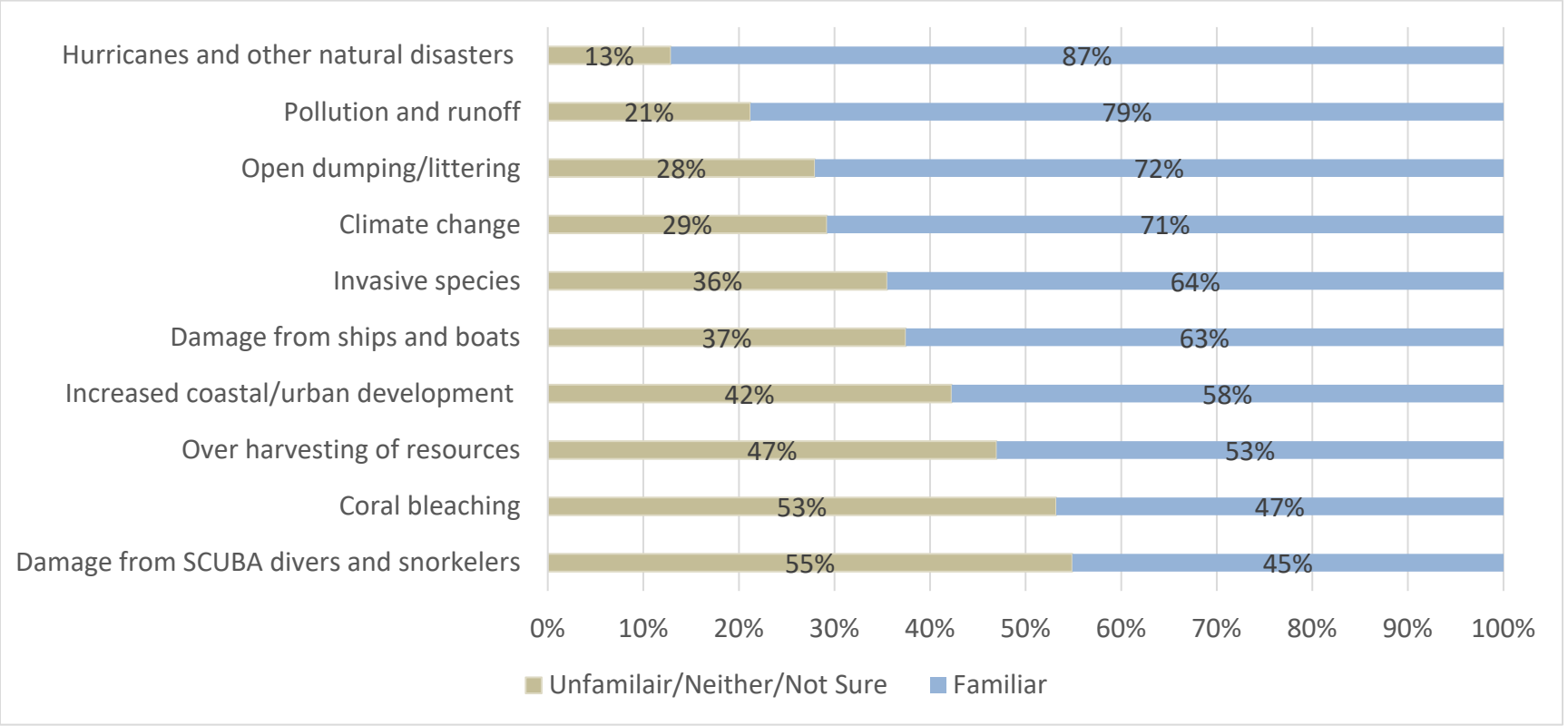

Figure 10: Residents' familiarity with threats to coral reefs (n = 1,188)

Level of threats to coral reefs

Figure 11 illustrates resident perceptions concerning the level of threat severity facing coral reef ecosystems. Almost half of the residents (45%) believe that the severity of threats to coral reefs is "large" or "extreme." Three percent of residents indicated that they believe coral reefs are facing no threats at all. Additionally, 15% of residents indicated that they are not sure about overall coral reef threat severity.

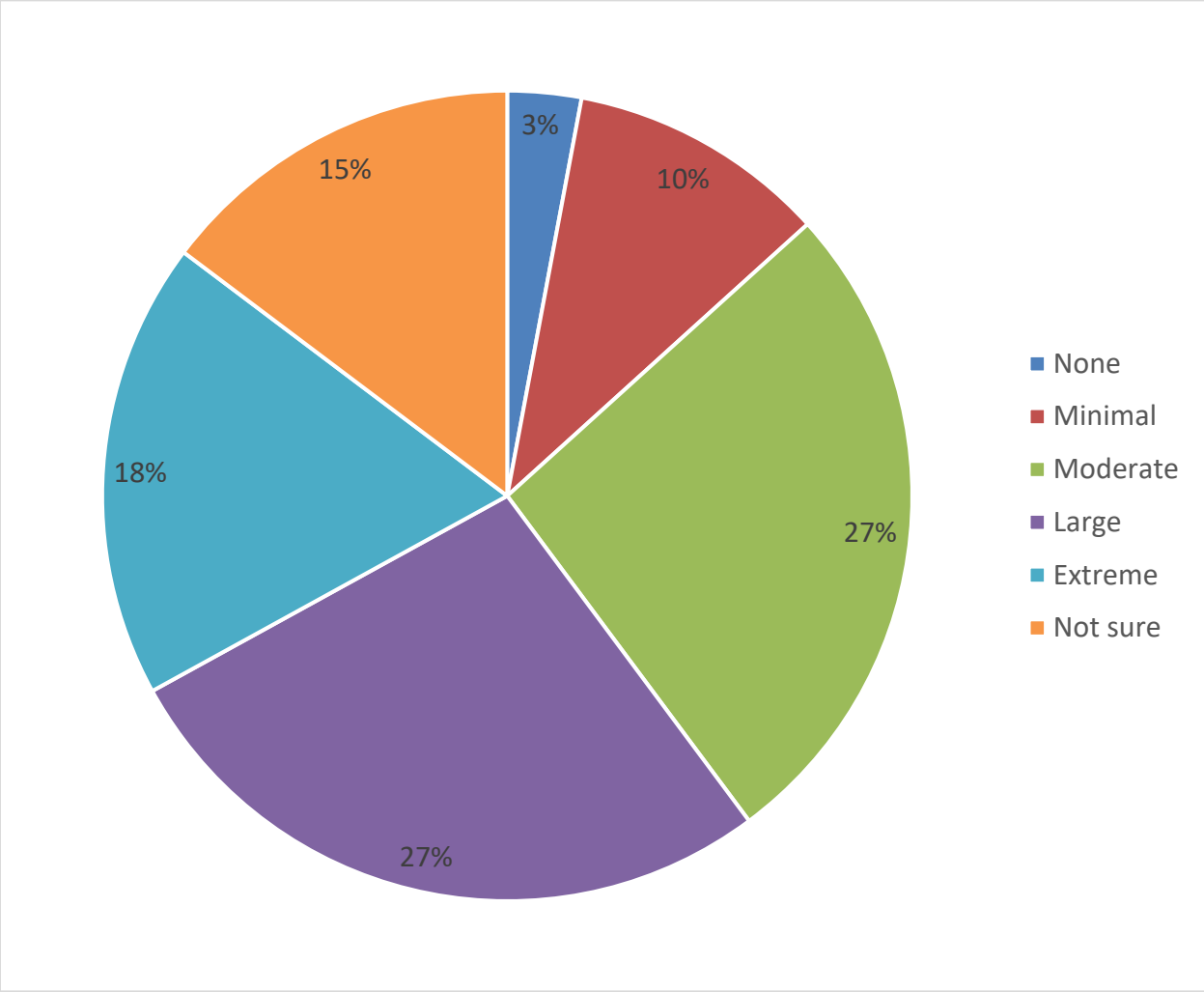

Figure 11: Residents' perceptions of the severity of threats to coral reefs (n = 1,188)

Results: Secondary Data Indicators

In the following section, the measures presented for each indicator originate from secondary data sources. The final indicators may be ultimately measured through secondary data alone or through a combination of primary and secondary data.

Human population composition and trends near coral reefs

Figure 12 illustrates the recent trend in population numbers for USVI (World Bank). The population of USVI has been steadily declining since 2000. The reported 2000 population of 108,639 people has decreased by 5% to 102,951 people in 2016.

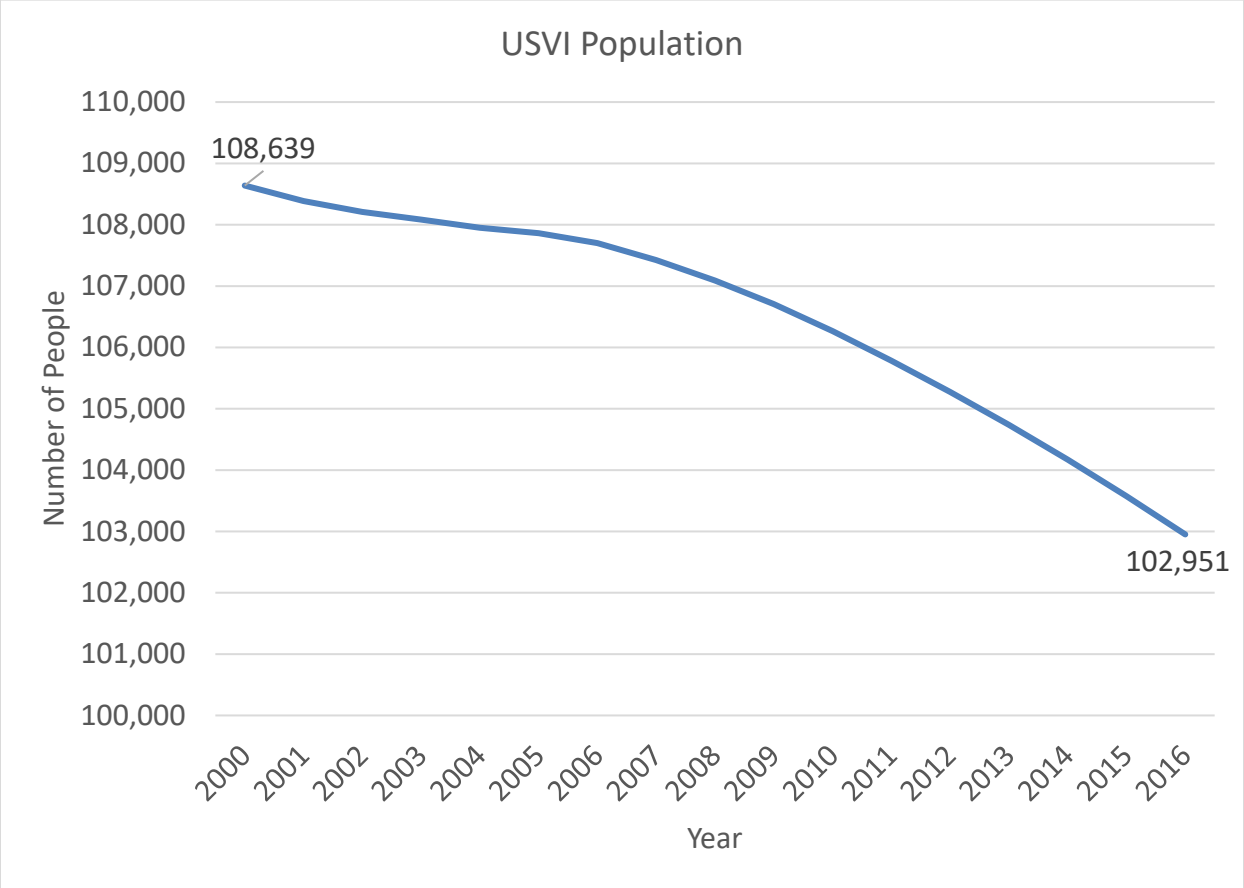

Figure 12: USVI population trend

Source: World Bank Development Indicators: Population, Total

Table 6 indicates that only the island of St. Thomas exhibited a population increase from 2000-2010. Additionally, St. Thomas surpassed St. Croix as the most populous US Virgin Island throughout this decade. St. Croix experienced the largest population decrease from 2000-2010 with a decrease of 2,633 people (-5%) (US Census).

Table 6: Population change for each USVI Island, 2000-2010

Region	Population change	Percent Change
St. Croix	-2,633	-5%
St. John	-27	-1%
St. Thomas	453	1%

Source: US Census Bureau, Annual Estimates of Resident Population

Table 7 shows that from 2000 to 2010, population density increased in St. Thomas, but decreased for St. Croix, St. John, and for the USVI as a whole (US Census). St. Croix exhibited the largest decline in population density (-5%) over the course of the decade, and the overall population density of USVI decreased by 2% from 2000 to 2010.

Table 7: Population density for each USVI island, 2000-2010

	Population Density, 2000 (persons per square mile of land area)	Population Density, 2010 (persons per square mile of land area)	Percent change in population density, 2000-2010
St. Croix	642.3	607.3	-5%
St. John	214.0	211.8	-1%
St. Thomas	1638.5	1649.1	1%
USVI Total	812.2	792.2	-2%

Source: US Census Bureau, Decennial Census of Population and Housing

Figure 13 depicts USVI's population density (persons per square kilometer) at the Estate level in relation to coral reef cover. It is widely understood that increased population density in proximity to coral reefs can lead to stress in the coral reef ecosystem (Brewer 2013). The inset map illustrates an area of high population density (the area of Charlotte Amalie) in relation to coral cover, and shows how USVI contains areas of relatively high population density that may impact its coral reef ecosystem through stressors from development, recreation, and other types of anthropogenic effects.

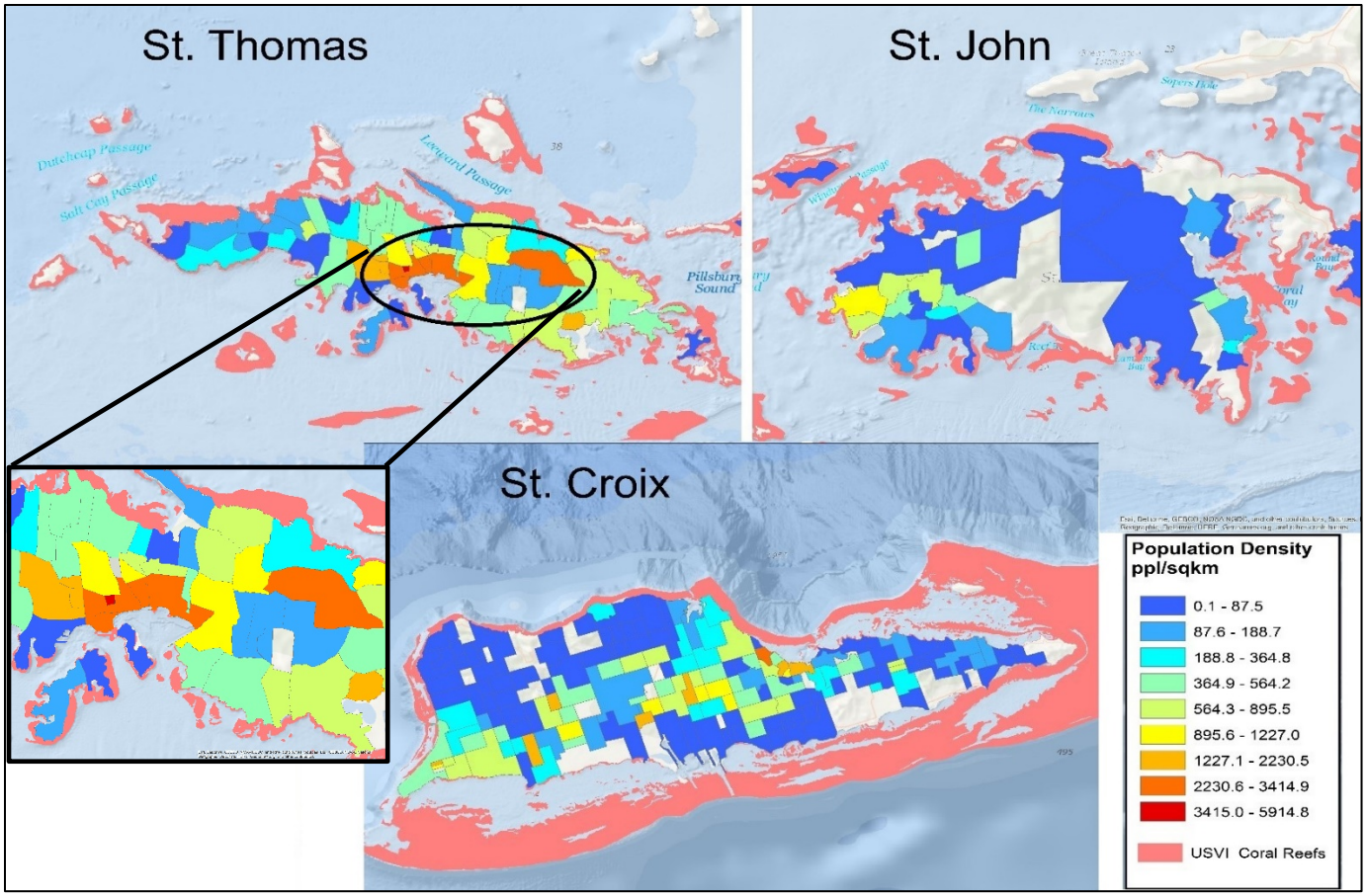

Figure 13: Population density (2010) in USVI by Estate and proximity to coral cover; inset of Charlotte Amalie.

Racial Composition and Age Structure of USVI

As evidenced by Figure 14, the racial composition of USVI is predominantly black (74%), followed by white (16%), and other/two or more races (7%). Additionally, 17% of USVI residents identified as Hispanic in 2010 US Census, 59% of whom identified as Puerto Rican.

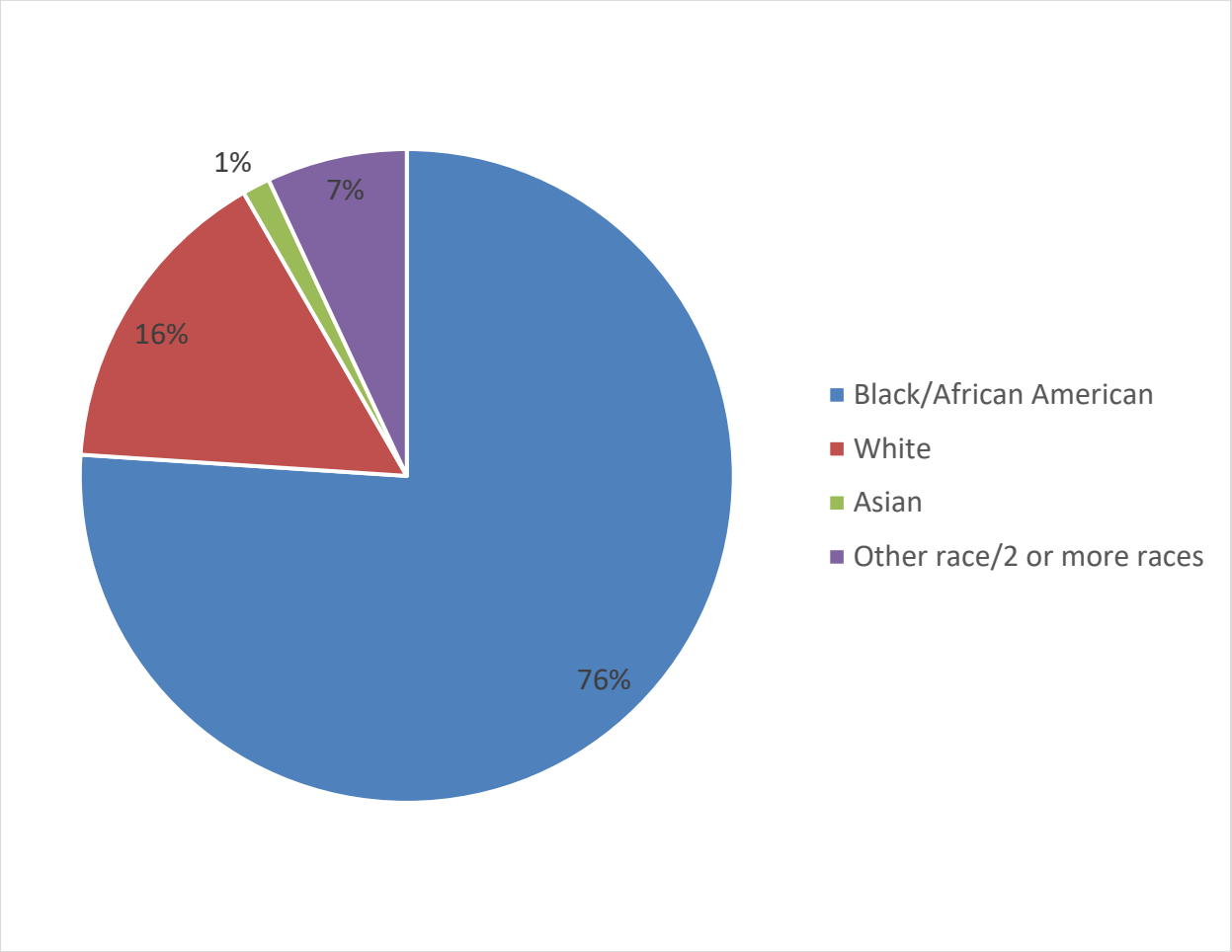

Figure 14: Racial and ethnic composition of USVI

Source: US Census Bureau, Decennial Census of Population and Housing

As for the age structure of the population of USVI, the 2010 US Census Bureau reports that 25% of the population was under 18 years old (32% in the 2000 Census) and 14% of the population was 65 years or older (8% in 2000 Census). The 2010 US Census Bureau reports an overall median age of 39.2 years old for the USVI population (33.4 years old in 2000 Census).

Community well-being

In addition to the basic demographics described above, composite indicators can be utilized to further explain social variance (see Box 1). Five composite indicators related to human well-being are being tracked as part of the NCRMP socioeconomic component: Economic Security, Health, Basic Needs, Access to Social Services, and Education.

Each composite indicator is conceptually complex. The indicators, demonstrated in Figure 15 with *Economic Security*, are comprised of multiple of measures that, in turn, operationalize multiple dimensions of the composite indicator.

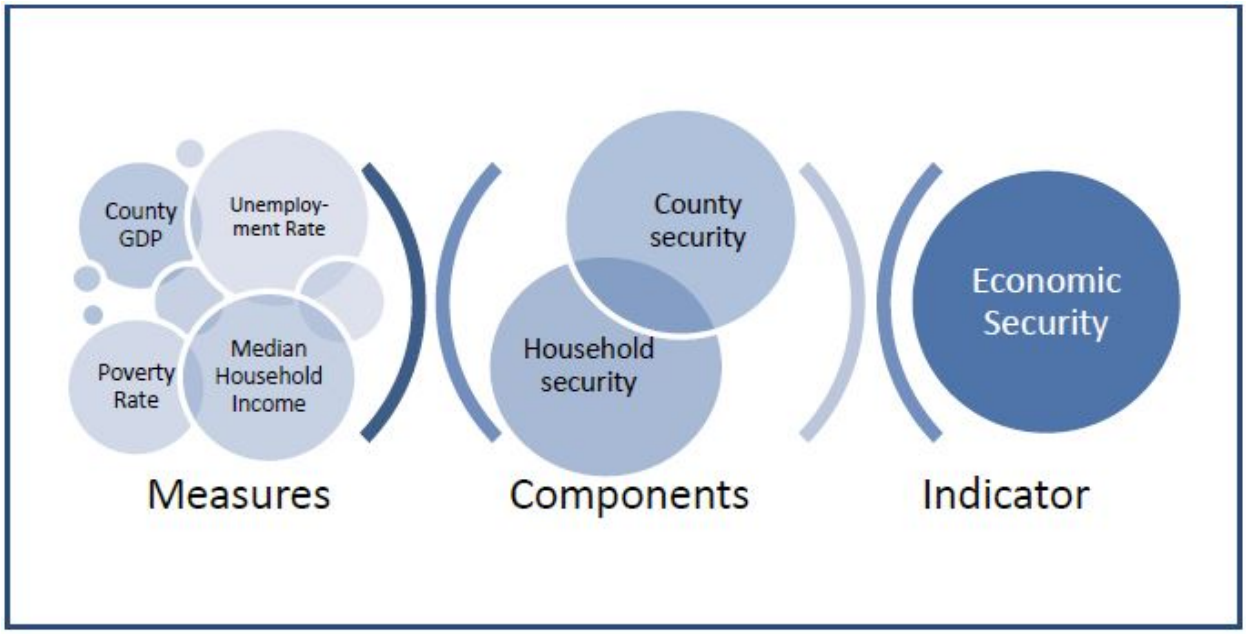

Figure 15: Economic Security presented as an example of operationalizing a composite indicator

At the conclusion of the first monitoring cycle, the coral reef jurisdictions will be scored on select indicators of well-being. These scores will allow for comparisons across jurisdictions, and will be used in statistical analyses with indicators of environmental condition to analyze the dynamic relationship between the ecosystem services that people regularly enjoy and community well-being. A selection of measures that will be used to operationalize the well-being indicators of Economic Security, Health, Basic Needs, Access to Social Services, and Education are presented and discussed below.

Economic Security

The measures used to operationalize economic security will include gross domestic product, median household income, the percent of the population in poverty, unemployment rate, and the amount of households receiving public assistance.

One of the most telling measures of economic well-being is real GDP[6]. Figure 16 shows that from 2006 to 2015, real GDP decreased by 28%; however, this ten year period was marked by a 5% increase in real GDP from 2006-2008 and a steady decrease in real GDP from 2008-2015. As a result, USVI's economy is smaller than it was 10 years ago, and has been steadily declining since 2008 due the territory's lagged recovery from the Great Recession, with a marked decline in 2012 after the closure of the HOVENSA oil refinery, which had been a significant employer in the territory (Austin 2018). This declining trend is different from the nationwide US trend, in which there has been considerable growth over the last 10 years and a stronger recovery from the recession.

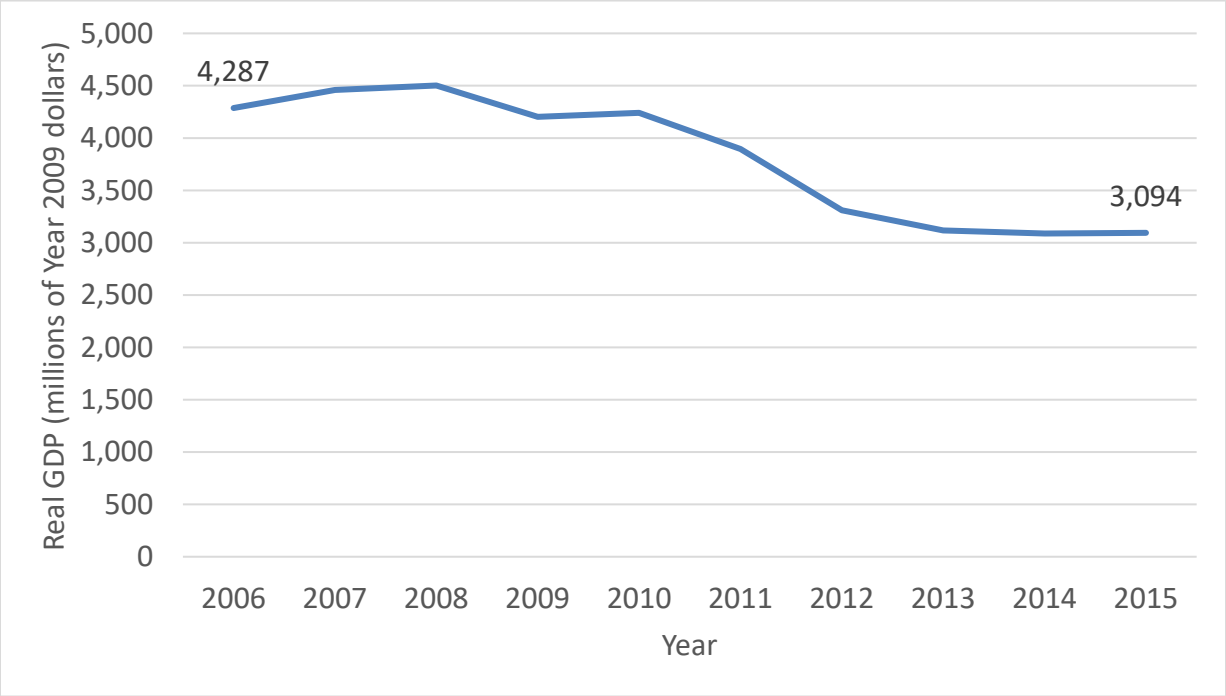

Figure 16: Real GDP trend in USVI

Source: Bureau of Economic Analysis

According to the 2010 US Census, 8.7% of the civilian population in USVI age 16 years and older were unemployed. This was an increase of 0.1% from the figure of 8.6% reported in the 2000 US Census.

Figure 17 shows that real median household income, measured in 2009 dollars using the consumer price index, increased in St. Croix and St. Thomas, but decreased in St. John from

[6] Real GDP is GDP adjusted for inflation. A single base dollar year (2009) based on the consumer price index is used to compare values across years.

2000 to 2010 (US Census). The largest increase was observed in St. Croix, where real median household income increased by 31% over the course of the decade. For USVI as a whole, real median household income increased by 17% from $31,812 in 2000, to $37,254 in 2010.

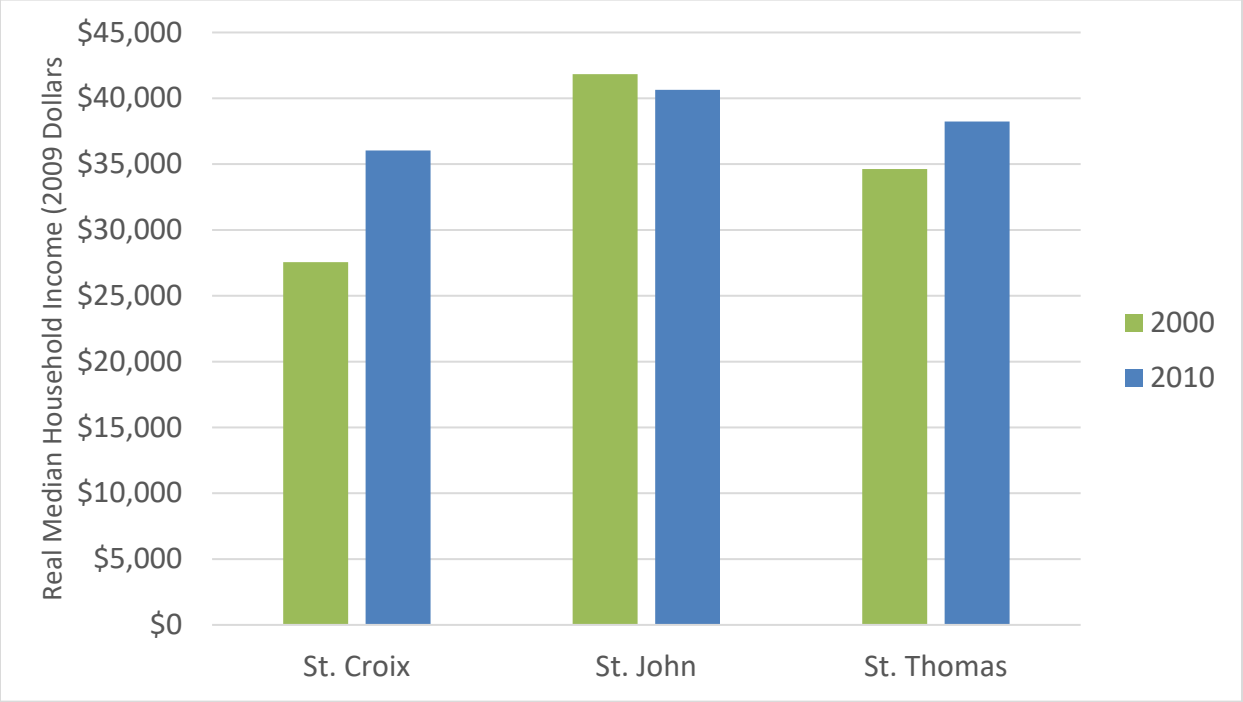

Figure 17: Median household income in USVI (inflation adjusted to 2009 dollars)

Source: US Census Bureau, Decennial Census of Population and Housing

Additionally, Figure 18 shows that the percent of the population below the poverty line decreased on all US Virgin Islands from 2000 to 2010, with the largest decrease observed in St. Croix (-13%) (US Census). For USVI as a whole, the poverty rate decreased by 10% from 32% in 2000, to 22% in 2010.

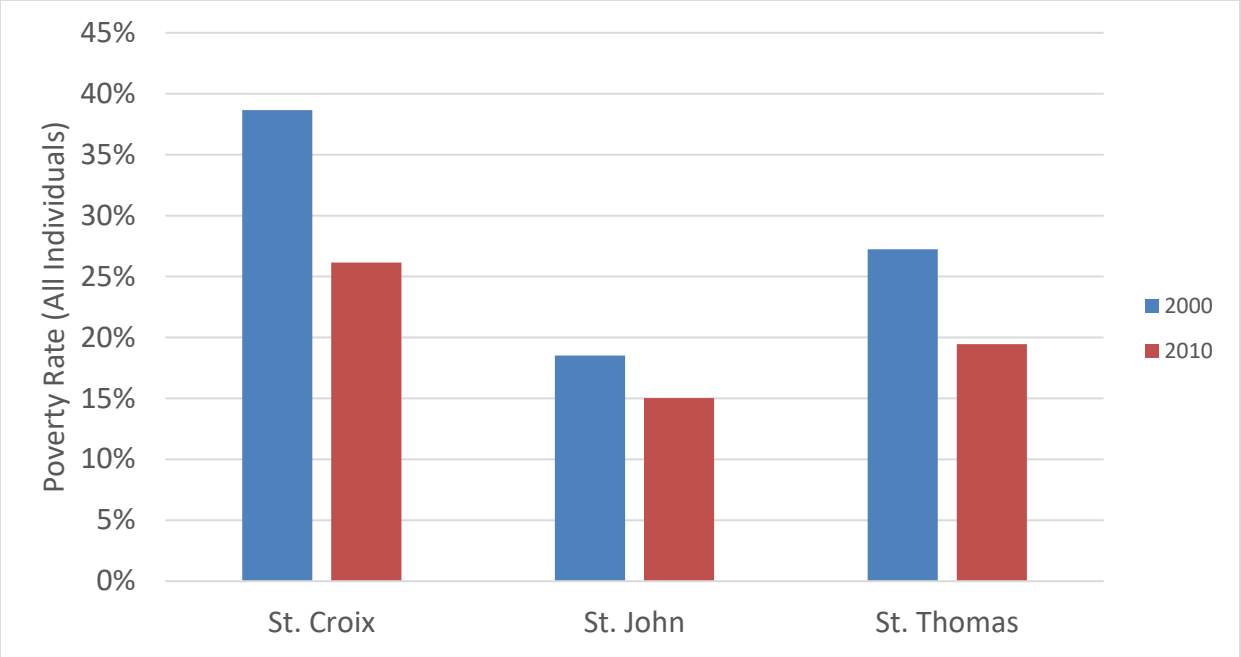

Figure 18: Level of poverty in USVI

Source: US Census Bureau, Decennial Census of Population and Housing

Figure 19 indicates that the percentage of households receiving public assistance income increased in St. John and St. Thomas, but decreased in St. Croix from 2000 to 2010 (US Census). In St. John, the percent of households receiving public assistance income almost doubled from 1.6% in 2000, to 3.5% in 2010. For USVI as a whole, the percentage of households receiving public assistance income increased from 6% in 2000, to 7% in 2010. It should be noted that the previous Census was completed in 2010 and these numbers have likely changed. These figures will be updated upon the completion of the 2020 US Census.

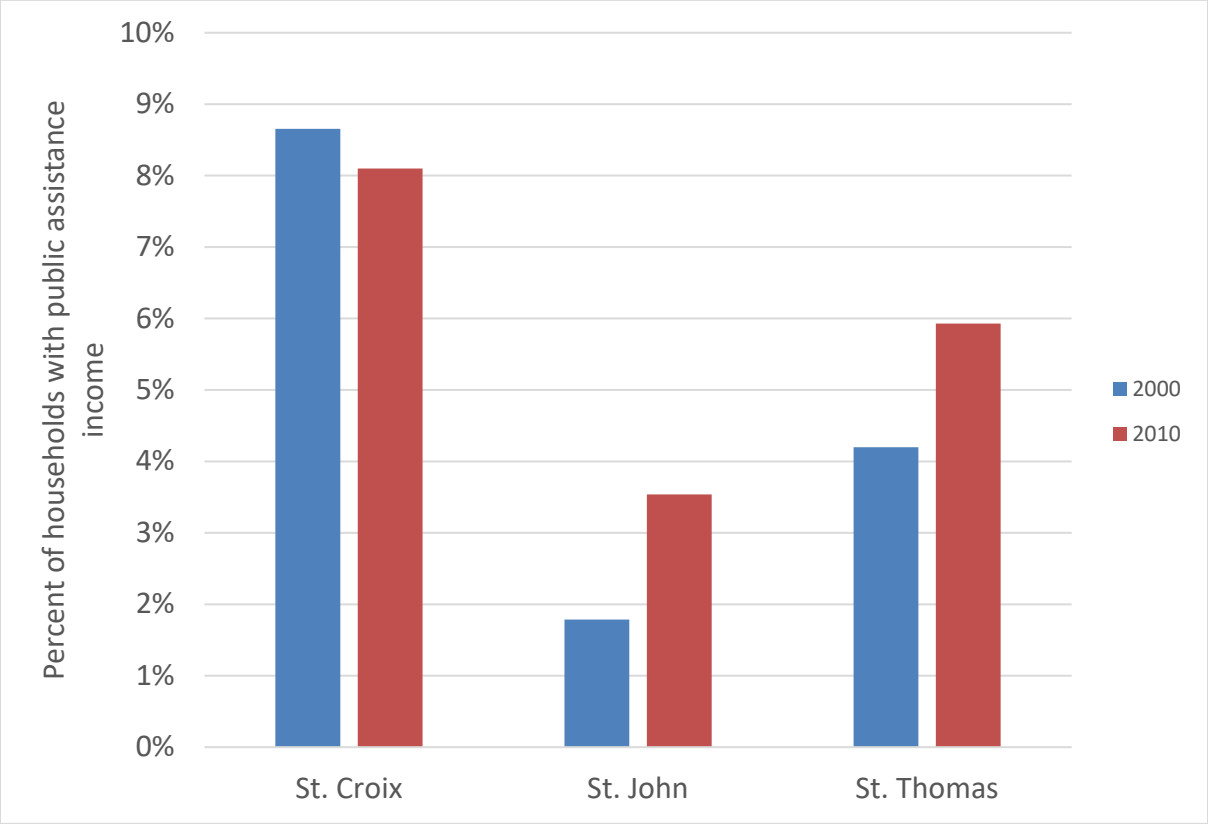

Figure 19: Public assistance in USVI

Source: US Census Bureau, Decennial Census of Population and Housing

Health

Health, both physical and mental, contributes tremendously to individual and population well-being. Measures of life expectancy, mortality, and opportunity for a healthful lifestyle can be used to assess a population's health. Some of the measures that will be used as part of the indicator for health across all jurisdictions include leading cause of death, life expectancy, and three categories of age-adjusted death rates (from all cancers, from heart disease, and overall). The leading cause of death in USVI (2010-2012) was diseases of the heart, and the average life expectancy (2012) was 79.61 years of age. In 2010, the age-adjusted death rate from all cancers was 109.3 per 100,000 people (US average: 172.8 per 100,000 people), the age-adjusted death rate from heart disease was 149.7 per 100,000 people (US average: 179.1 per 100,000 people),

and the overall age-adjusted death rate was 663.2 per 100,000 people (US average: 747 per 1000,000 people). It is important to track the overall health of the population in relation to the state of the environment, as the impact of environmental stressors on human health has been shown to result in severe consequences. For example, a recent report finds that "the air we breathe, the food we eat, the water we drink, and the ecosystems which sustain us are estimated to be responsible for 23% of all deaths worldwide" (UNEP, 2016).

Basic Needs, Access to Social Services, and Education

Basic needs, access to social services, and education are important social dimensions of well-being. The measures for basic needs include those related to the adequacy of housing, access to healthy food, and clean water. Basic needs are linked to the environment and its ability to provide the regulating and provisioning services that are necessary for water, food, and shelter. Of the 2010 US Census Bureau reported figure of 55,901 housing units in USVI, 43,214 (77%) were occupied. Of the occupied housing units, 20,700 (48%) were owner-occupied and 22,514 (52%) were renter-occupied. In 2010, the median value of owner occupied housing units in USVI was $254,296, and the median age of housing units was 30 years. The average household size in 2010 was 2.41 persons per household, and this was a decrease of 9% from the figure of 2.64 persons per household reported in 2000. Similarly, the average family size in USVI also decreased by 7% from 3.34 persons per family in 2000 to 3.12 persons per family in 2010.

In 2010, 70% of the civilian non-institutionalized population in USVI had health insurance coverage. Also as of 2010, 21% of occupied USVI households lacked access to a vehicle, and 4% of occupied households lacked access to telephone service. Additionally, 7% of occupied USVI households lacked access to a complete kitchen. As of 2010, 62% of occupied households in USVI had access to a computer or laptop at home; of those, 86% had access to internet service (US Census).

One of the key components of community well-being is education. K-12 enrollment, along with high school and college educational attainment will be combined to examine education. Figure 20 shows that in 2010, 69% of USVI residents aged 25 and older had completed high school or higher, and 19% of USVI residents aged 25 and older had completed a bachelor's degree or higher. Both of these figures represented an increase in educational attainment since 2000, in which 61% of USVI residents aged 25 and older had completed high school or higher, and 17% of USVI residents aged 25 and older had completed a bachelor's degree or higher (US Census).

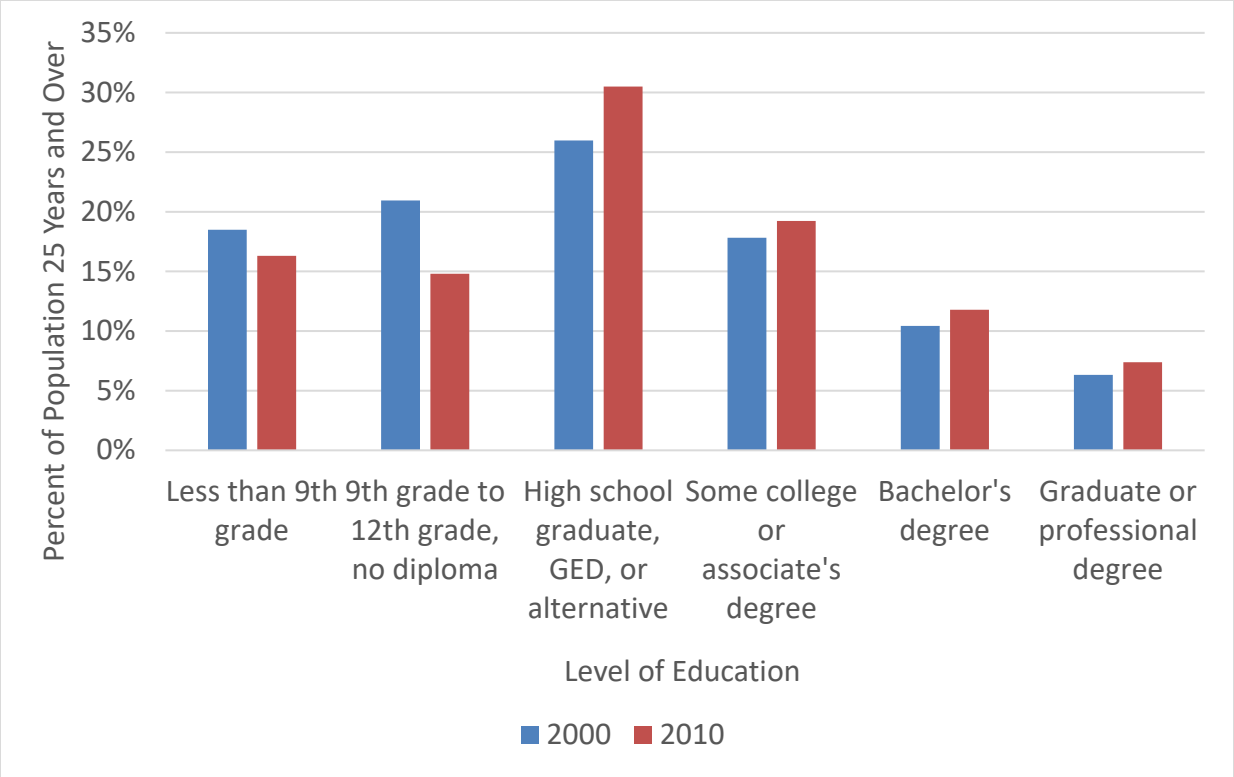

Figure 20: Levels of educational attainment in USVI

Source: US Census Bureau, Decennial Census of Population and Housing

Physical Infrastructure

In addition to the five community well-being indicators, an indicator of physical infrastructure is monitored in order to track coastal development, access to coastal resources, and waste management/water supply infrastructure. Indicators for physical infrastructure relate to both the human development footprint, as well as measures in place to mitigate human impacts to the marine environment (e.g., point and non-point sources of land-based pollution, sewage treatment and abatement). Some key aspects of physical infrastructure in USVI are outlined below. It should also be noted that the USVI sustained heavy impacts during the 2017 Atlantic hurricane season, receiving direct impacts from both Hurricane Irma and Hurricane Maria, as well as indirect impacts from Hurricane Jose. These storms had profound impacts on island infrastructure and the USVI is still recovering.

Pollution

Water

In 2012, 100% of all beaches were monitored in USVI. Of these, 40% were impacted by a beach advisory action; however, less than 1% of beach days were impacted (EPA, 2012). And as evidenced by Table 8, of the USVI ocean and near coastal water bodies that were assessed, 11.6% were deemed to be "impaired" in 2016 (EPA, 2016). A waterbody is considered "impaired" if any one of its uses is not met ("uses" include aquatic life, recreation, fish/wildlife propagation water supply, fish consumption, etc., and "impairments" can be caused by a variety of things including bacteria, fecal coliforms, dissolved oxygen, sulfate, algal blooms, metal content, mercury, etc.). Although water pollution is present, the problem is not as widespread as some neighboring Caribbean islands. For example, 86.2% of coastal shoreline water bodies assessed were deemed to be impaired in Puerto Rico in 2016 (EPA, 2016).

Table 8: USVI water quality assessment report; 2016

	Ocean and Near Coastal Waters (sq miles)
Good waters	372.1
Previously impaired waters now attaining all uses	2.6
Threatened waters	0.0
Impaired waters	48.6
Total assessed waters	420.6
Percent of assessed waters that are impaired	11.6%

Source: US Environmental Protection Agency; Assessment and Total Maximum Daily Load Tracking and Implementation System (ATTAINS)

Air

According to the 2014 EPA National Emissions Inventory, USVI produced 52,609 short tons of "Tier 1" emissions in the year 2014 (a 309% decrease since 2011), 59% of which was particulate matter 10, and 19% of which was carbon monoxide. Other emissions included in this figure include ammonia, nitrogen oxide, volatile organic compounds, and sulfur dioxide. The large decrease could be due, in part, to the closure of the HOVENSA oil refinery. The EPA tracks daily air quality through its Air Quality Index (AQI), and Table 9 illustrates the number of days under each quality condition as defined by the EPA for the USVI. In 2016, the USVI experienced a total of three days (5% of all days that were tracked) in which the air was "moderate," and experienced zero "unhealthy" days. In 2015, there were 34 days in which the air was "moderate" (23% of all days that were tracked), and zero "unhealthy" days.

Table 9: USVI air quality days

	# Days with AQI	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2015	147	113	34	0	0	0
2016	64	61	3	0	0	0

Source: US Environmental Protection Agency, Air Quality Index

Land cover

Impervious land cover[7] is a good indicator of development, and may also be associated with land-based pollution that can damage coral reefs. USVI had a total of 44.3 square kilometers of impervious cover in 2012, which was approximately 11.4% of its total land area (387.8 square kilometers) (NOAA Digital Coast, C-CAP). St. Croix had the most impervious land cover out of the three US Virgin Islands with 27.1 square kilometers, but St. Thomas had the most proportional impervious coverage with 14.4% of its total land area (Table 10).

Table 10: Impervious surfaces by island, 2012

Region	Total Land Area (Sq. km)	Impervious Cover (Sq. km)	Percent of Impervious Cover
St. Croix	226.4	27.1	12.0%
St. John	64.0	3.1	4.9%
St. Thomas	97.4	14.0	14.4%
USVI Total	**387.8**	**44.3**	**11.4%**

Source: 2012 NOAA C-CAP

As of 2000, the development of man-made shorelines in USVI reached a total of 75.74 km (47.06 miles), or about 7.8% of the recorded total (NOAA/OR&R, 2000). For the purposes of this report, man-made shorelines include: sheltered solid man-made structures (wooden or concrete seawalls, boat docks, etc. that are not directly exposed to the ocean); riprap (large stones or other large, rough-cut solid materials placed on the shore to prevent or reduce erosion due to wave action); and exposed, solid, man-made structures (wooden or concrete seawalls, boat docks, etc. that are directly exposed to the ocean).

The three main population centers of the USVI are in Charlotte Amalie (St. Thomas), Christiansted (St. Croix), and Frederiksted (St. Croix). Cruz Bay is the most densely populated area on St. John; however, the island remains more rural, as most of it is under the jurisdiction of the Virgin Islands National Park.

[7] Impervious surfaces are mainly artificial structures—such as pavements (roads, sidewalks, driveways and parking lots) that are covered by impenetrable materials such as asphalt, concrete, brick, or stone. These types of materials do not let water drain through them.

Construction Permits

Construction permits are indicative of development trends and data concerning these permits are utilized here to further operationalize the indicator of physical infrastructure. The value of construction permits (in inflation adjusted dollars) granted in USVI has been steadily decreasing since 2006 (Table 11), falling by 73% as of 2015 (USVI Bureau of Economic Research, 2017). These figures indicate a declining emphasis on built development in USVI in terms of permit support.

Table 11: Construction Permits in USVI; 2006-2015

Fiscal Year	Value of construction permits; millions of dollars (nominal dollars)	Value of construction permits; millions of dollars (constant 2015 dollars)
2006	$442.7	$520.5
2007	$266.1	$304.2
2008	$273.3	$300.9
2009	$261.8	$289.2
2010	$187.2	$203.5
2011	$179.1	$188.7
2012	$141.4	$146.0
2013	$156.6	$159.3
2014	$201.4	$201.6
2015	$143.1	$143.1

Source: USVI Bureau of Economic Research

Waste Management and Water Supply

According to the latest data available, of the 55,901 housing units in USVI, 4,748 (8%) lacked complete plumbing facilities (US Census), and as of 2017, there were 2 landfill facilities in USVI (EPA, 2017): the Anguilla Landfill on St. Croix, and the Bovoni Landfill on St. Thomas. According to the US Geological Survey (2010), 69,012 (65%) were served by the public water supply (ground or surface water), and an additional 37,393 people (35%) were reported to be self-serviced. As of 2017, there were 8 public wastewater treatment facilities and 31 pump stations in USVI (Figure 21), serving approximately 69,000 people (Virgin Islands Waste Management Authority, 2017). Figure 21 displays the proximity of these wastewater treatment facilities to coral reef cover within USVI.

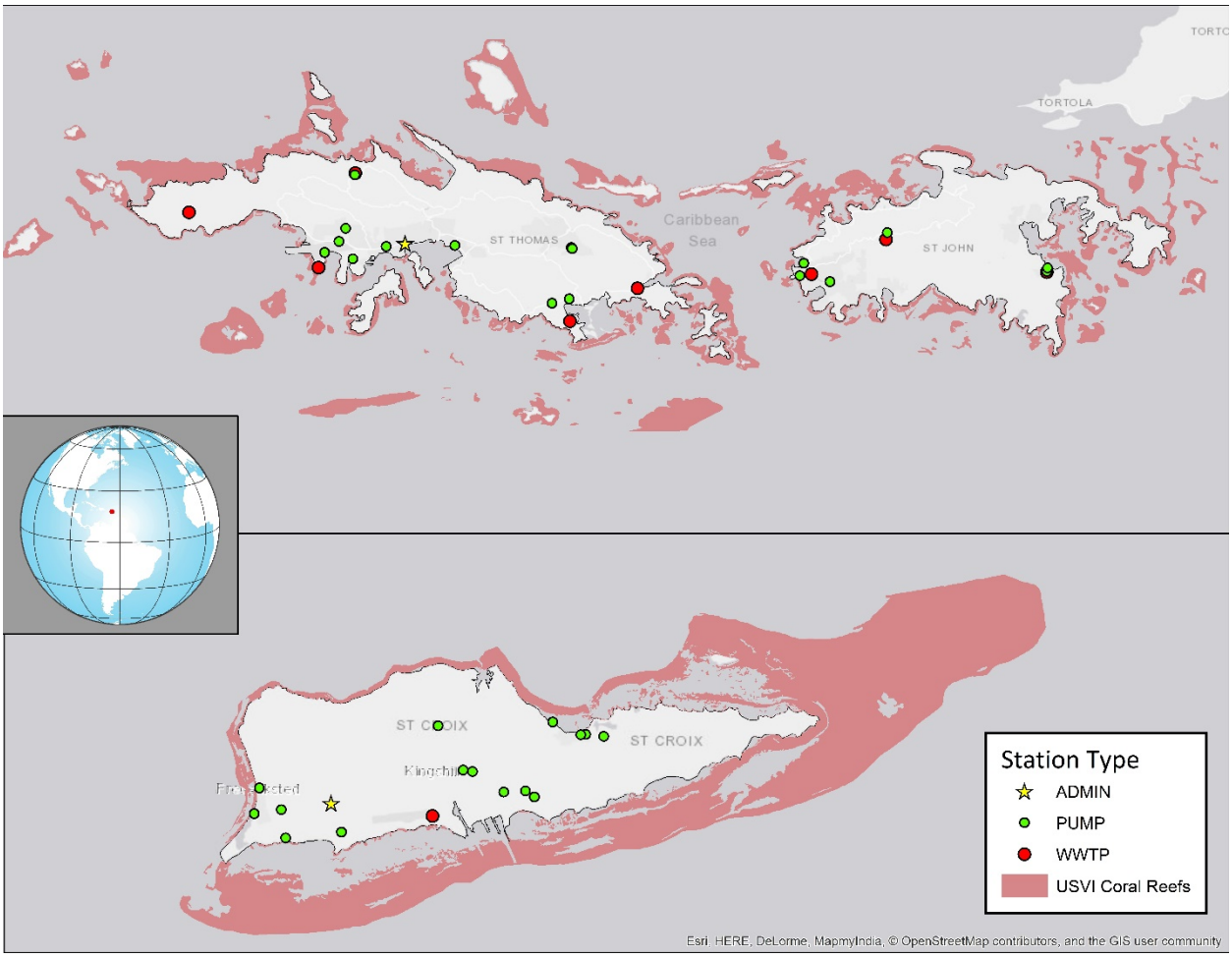

Figure 21: The proximity of wastewater treatment facilities to coral reef cover in USVI
Source: US Environmental Protection Agency

Physical Access to Coastal Resources

The Virgin Islands Department of Planning and Natural Resources (DPNR) documented public beach access points as a part of its coastal zone management program (DPNR, 2013). Table 12 below lists the number of beach access points by island. St. Croix has the most public beach access points, many of which are on the northern end of the island. Beach accessibility is widespread and mostly consistent across USVI (Figure 22).

Table 12: Public beach access in USVI

Island	Number of public beach access points
St. Thomas	21
St. John	39
St. Croix	53
USVI total	**113**

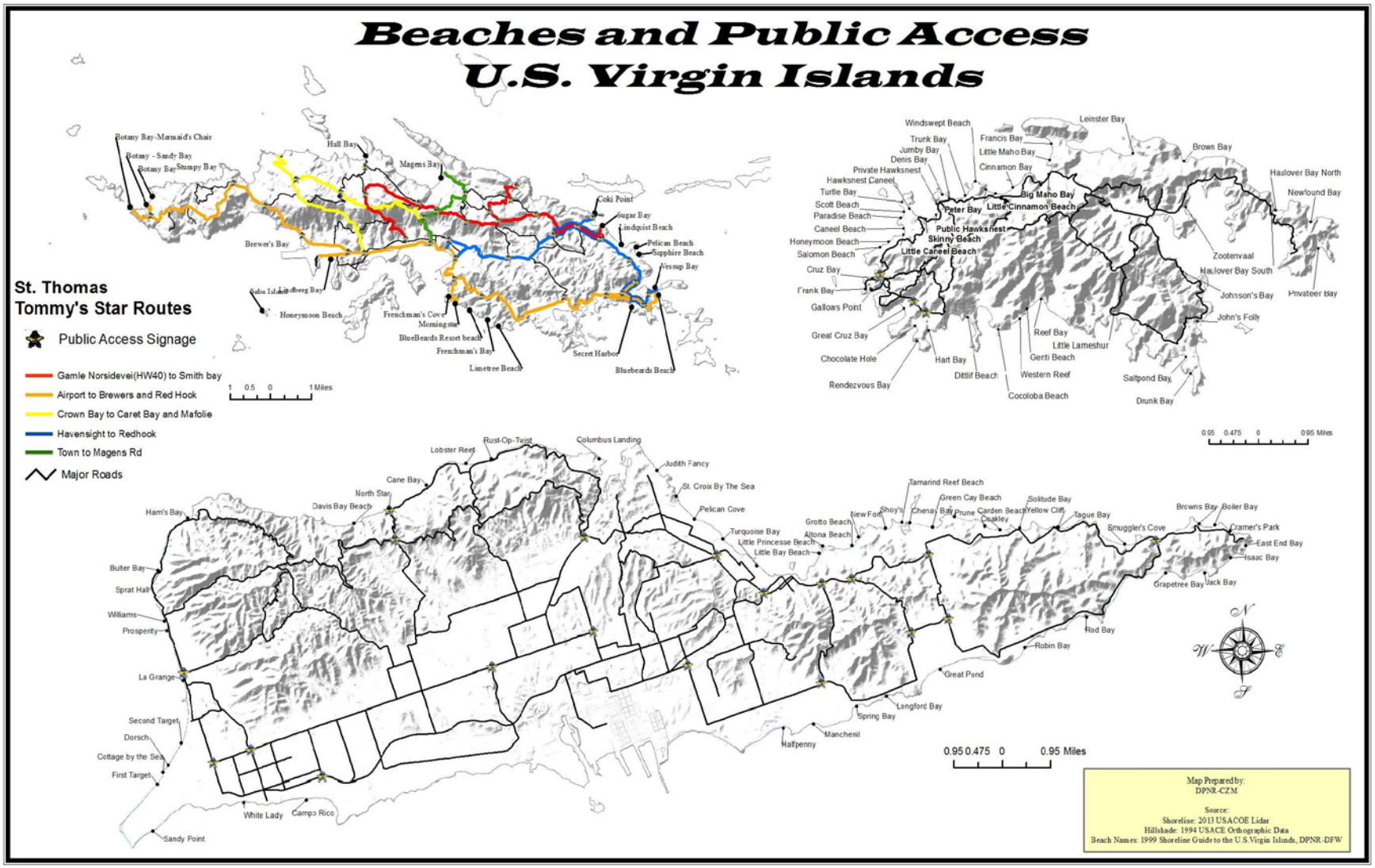

Figure 22: Beach access points in the USVI. Courtesy of DPNR Coastal Zone Management Program

Economic activities related to reefs

Also relevant to the NCRMP socioeconomic monitoring component are the various economic activities taking place along the coast. These activities can have direct and indirect impacts on coral reefs, and are outlined below.

Ocean-Related Industry

Table 13 shows a snapshot of the ocean sector economy in USVI for the year 2012. These numbers reflect the sum of all documented economic activities related to the following industries: marine construction, living resources, offshore mineral extraction, ship/boat building, tourism/recreation, and marine transportation. The ocean sector economy supported over 36,000 employees (19% of total employment) at 3,472 establishments (12% of total establishments), and provided almost $173 million in total wages (12% of total annual wages) throughout USVI in 2012 (Abt Associates, 2016).

Table 13: USVI Ocean Sector Economy, 2012 [8]

Sector	Number of establishments	Number of employees	Total Wages
Living Resources	1	N/A	N/A
Marine Construction	2	N/A	N/A
Marine Transportation	22	214	$11,030,080
Offshore Mineral Resources	5	N/A	N/A
Ship and Boat Building	1	N/A	N/A
Tourism and Recreation	373	6,524	$161,751,217
USVI Total	**404**	**6,738**	**$172,781,297**
Total Economy	**3,472**	**36,215**	**$1,393,000,000**
Ocean Economy Share	**12%**	**19%**	**12%**

Source: NOAA Digital Coast, ENOW

Fishing

Fishing activity in USVI, both commercial and recreational, is coral reef dependent. Coral reefs provide necessary habitat for several commercially important fish species such as snapper, grouper, spiny lobster, and parrotfish. There is a strong correlation between healthier, more expansive reefs and increases in fish biomass and abundance (Vincent *et al.*, 2011; Friedlander and DeMartini, 2002), and this suggests that the health of coral reefs is an important driver of commercial and recreational fishing harvest and value. The USVI are located at the edge of the

[8] At the time of this report, there were no available data concerning USVI's ocean economy's gross domestic product.

Puerto Rico Trench, an area known for having very productive big-game fishing at two well-known offshore fishing areas: the North Drop and the South Drop (Stoffle *et al.*, 2011).

Fishing is an important employment sector and source of income for USVI residents. Stoffle *et al.* (2009) found that 47% of surveyed fishermen on St. Croix indicated that it would be "very difficult" to find employment outside of fishing, while only 6% said it would be "very easy." Fishing as an occupation is the main source of income for the majority of fishing households on St. Croix, and the expressed difficulty of finding other employment highlights a perceived vulnerability fishermen have to fisheries regulations. By contrast, however, an updated study that surveyed USVI commercial fishermen found that 25% of St. Croix residents are already engaged in some other form of revenue generation in addition to fishing (Fleming *et al.*, 2017).

Table 14 displays time-series data concerning commercial fish harvest in USVI for the years 2005-2016. The overall trend in commercial reef and bottom fishery harvest has been downward since 2005. During this time, the USVI commercial fishery harvest in weight has decreased by 63%, and the USVI commercial fishery harvest value in inflation-adjusted 2015 dollars has decreased by 61%, indicating that the ecosystem has lost some of its commercial fishing value. Data also indicate that 73% of landings are reef/bottom fish species, pointing to the relative importance of these species in sustaining USVI's commercial fisheries (NOAA NMFS 2016). While healthy coral reef ecosystems directly impact coral reef fish species, it is also important to note that coral reef ecosystems still support pelagic fish population and health as they provide critical nursery habitat for juveniles (Thorrold and Williams, 1996; Doherty and Carleton, 1997) and act as a food source for pelagic species that venture near the coast, such as sharks (Roff *et al.*, 2016).

Table 14: Commercial fishing harvest for all reef and bottom fish species in USVI, 2005-2016.[9]

Year	Harvest (in metric tons)	Ex-vessel revenue (nominal dollars)	Ex-vessel revenue (Constant 2015 dollars)
2005	1,598,846	$8,348,929	$10,132,300
2006	1,767,249	$11,126,149	$13,080,786
2007	1,450,618	$8,754,643	$10,009,644
2008	1,487,858	$8,739,290	$9,620,675
2009	1,578,916	$8,949,982	$9,887,795
2010	1,166,359	$7,185,291	$7,810,085
2011	1,154,518	$6,977,743	$7,352,410
2012	712,604	$4,683,566	$4,834,990

[9] This assessment focused on reef and bottom fish species in addition to any other shellfish and marine life that depend on a coral reef or rocky hard bottom ecosystem. Species included in these figures include Jacks, Conch, Crabs, Goatfish, Grunts, Hogfish, Snappers, Lobsters, Groupers, Parrotfish, Squirrelfish, Surgeonfish, Triggerfish, Trunkfish (boxfish), and Other Shellfish.

2013	680,668	$4,384,146	$4,460,554
2014	545,697	$3,423,974	$3,428,038
2015	461,333	$2,906,694	$2,906,694
2016	592,166	$3,974,705	$3,925,188

Source: NOAA National Marine Fisheries Service (NMFS)

Kojis and Quinn (2011) conducted 2 censuses of commercial fishermen in the USVI (one in 2003 and one in 2010) and found that commercial fishers in USVI targeted reef fish species 81.6% of the time in 2010 (very similar to the reported figure of 82.3% in 2003), again indicating the importance of coral reefs in supporting USVI's commercial fisheries. A separate survey of commercial fishermen in the USVI was conducted in 2014 to examine the cost structure and profitability of the commercial fishing fleet, and found that commercial fishermen on St. Croix generate an average profit of $17,575.50 (profit margin of 17%), and commercial fishermen on St. Thomas and St. John generate an average profit of $4,972.20 (profit margin of 15%) (Fleming *et al.,* 2017).

The recreational fishery is divided into four basic categories: 1) private boat fishermen, some of whom carry commercial licenses and occasionally sell part of their catches; 2) shore-based anglers; 3) charter fishermen; and 4) subsistence fishermen, defined as anglers who use boats and shore-based targeting strategies to catch fish primarily for personal consumption (Stoffle *et al.,* 2009). While recreational fishers fish from the shore as well as boats, data indicate that boat-based recreational fishing predominates (Kojis and Tobias, 2016). Kojis and Tobias (2016) conducted a survey of boat-based recreational fishers in the USVI and found that of the 394 (out of 785[10]) owners of registered boats that responded to the survey, 37% were recreational fishers. Eighty-one percent fished primarily from their own power boats, and 16% fished from sailboats. The primary coral reef fish families targeted by recreational fishers were snappers (targeted by 49% of recreational fishers), groupers (targeted by 32% of recreational fishers), and triggerfish (targeted by 20% of recreational fishers). The most common recreational fishing technique was trolling, and fishers took an average of 3.3 trips per month with an average length of 4.4 hours.

The Virgin Islands Game Fishing Club (VIGFC) is a recreational fishing club that schedules annual fishing tournaments and events. Some of these fishing tournaments include the Couples Valentines Tournament in February, the Dolphin Derby in April (both on St. Thomas), and a Memorial Day Weekend Tournament (on St. Croix). Marlin fishing is one of the primary attractions for the recreational and for-hire fishing industry on St. Thomas. Fishermen from all over the world come to fish for marlin, as well as for other popular coastal pelagics, such as dolphinfish and wahoo (Stoffle *et al.,* 2011). It should be noted that the above mentioned tournaments mostly focus on pelagic species, and not necessarily on fish species tied directly to

[10] Based on 2013 boat registration list.

coral reefs. However, the presence of these tournaments still exemplifies the relationship that USVI residents have with the marine environment, and the connections between coral reefs and pelagic fish species has been noted (Thorrold and Williams, 1996; Doherty and Carleton, 1997; Roff *et al.,* 2016).

Van Beukering *et al.* (2011) surveyed recreational fishermen in the USVI and found that most households that participate in recreational fishing go less than once a week, usually on the weekends. Most of the fishing trips yield a catch of less than 10 fish; however, the average number of fish caught per trip is 17. Almost half of the catch is composed of shallow reef fish such as Barracuda, Tarpon, and Jacks. A willingness to pay (WTP) study was administered, and found that the estimated annual household WTP to avoid a total loss in fish availability for recreational fishing is $190. Multiplying this value by the number of households in the USVI that participate in recreation fishing yields an annual recreational fishing value of approximately $1.85 million (approximately $704,000 on St. Thomas, $35,000 on St. John, and $1.11 million on St. Croix).

Snorkeling/Diving

Van Beukering *et al.* (2011) administered a survey to a representative sample of USVI households, and calculated the economic value of diving and snorkeling in the USVI to be $12.8 million per year. Additionally, the survey found that the most frequently visited dive sites are the Tunnels of Thatch and Cow & Calf in St. Thomas, and Cane Bay and the Frederiksted Pier in St. Croix. Results also indicated that dive sites in St. Croix are visited more frequently when compared to dive sites in St. Thomas/St. John. The survey also found that USVI residents on all three islands are resistant to management options that place restrictions on diving/snorkeling.

Tourism

Tourism is an integral aspect of the USVI economy. In 2015, annual visitor arrivals reached 637,000 (World Bank, 2017). In 2016, the tourism and travel industry in USVI directly produced a GDP of $590.5 million (approximately 13.3% of USVI's total GDP), and directly supported approximately 5,500 jobs (approximately 12.7% of total employment). When indirect and induced effects are taken into account, USVI's tourism sector contributed $1.415 billion to the total economy (approximately 31.8% of USVI's total GDP), and supported approximately 12,000 jobs (approximately 28.5% of total employment). Additionally, visitor exports (money spent by foreign visitors to a country) generated $1.515 billion in USVI, and tourism generated $445.1 million in capital investments. By 2027, international tourist arrivals are forecasted to be 857,000, while tourism's total economic contribution to USVI's economy is projected to rise to $1.81 billion (WTTC, 2017).

Coastal Protection

Coral reefs are known to dissipate wave energy and provide protection to adjacent communities, including key infrastructure (Ferrario *et al.*, 2014). Van Zanten *et al.* (2014) measured the value

of coral reefs in terms of their ecosystem service of coastal protection, and found that the coastal protection value of coral reefs in the USVI is approximately $1.23 million annually.

Dive tourism in USVI (Photo Credit: Virgin Islands Free Press)

Results: Combined Primary and Secondary Indicators

The final section of results presents Governance as an example of an indicator that will be measured through a combination of the NCRMP survey data and secondary data. Below, examples of both types of measures are featured. The measurements concerning the sources of coral reef-related information, the level of trust for each information source, and involvement in coral reef decision making come from the NCRMP survey data, while all other facets of the governance indicator were derived from secondary data sources.

Governance

Governance measures such as public trust, percent area of coral reefs under management or protection, level of community involvement in decision making/local reef governance, and the presence, longevity, and focus of MPAs and other marine managed areas were used to assess governance related to coral reefs and the marine environment for USVI.

Sources of coral reef-related information and level of trust

Figure 23 shows that 48% of residents indicated that they use the newspaper as a source for information pertaining to coral reefs (first, second, or third choice). Residents' top three sources for information about coral reefs and the environment were newspaper, internet, and TV. The least used information sources were the state/local government and community leaders. When examining those who fish/gather marine resources, these residents were found to be positively correlated with the use of internet, social media, and friends/family, and were found to be negatively correlated with the use of newspaper and TV.

Residents were then asked to rate their trustworthiness of each of the top three information sources that they indicated they used (Figure 24). Users demonstrated relatively high degrees of trust ("very trustworthy" or "trustworthy") for newspaper (67%) and television (65%), but are less trusting of internet (57%). Residents who obtained information from non-profits and friends/family believe these sources to be the most trustworthy (89% and 80%, respectively), whereas the information sources found to be least trustworthy by people who use them are community leaders and social media (with only 57% and 49%, respectively, ranking these as "very trustworthy" or "trustworthy").

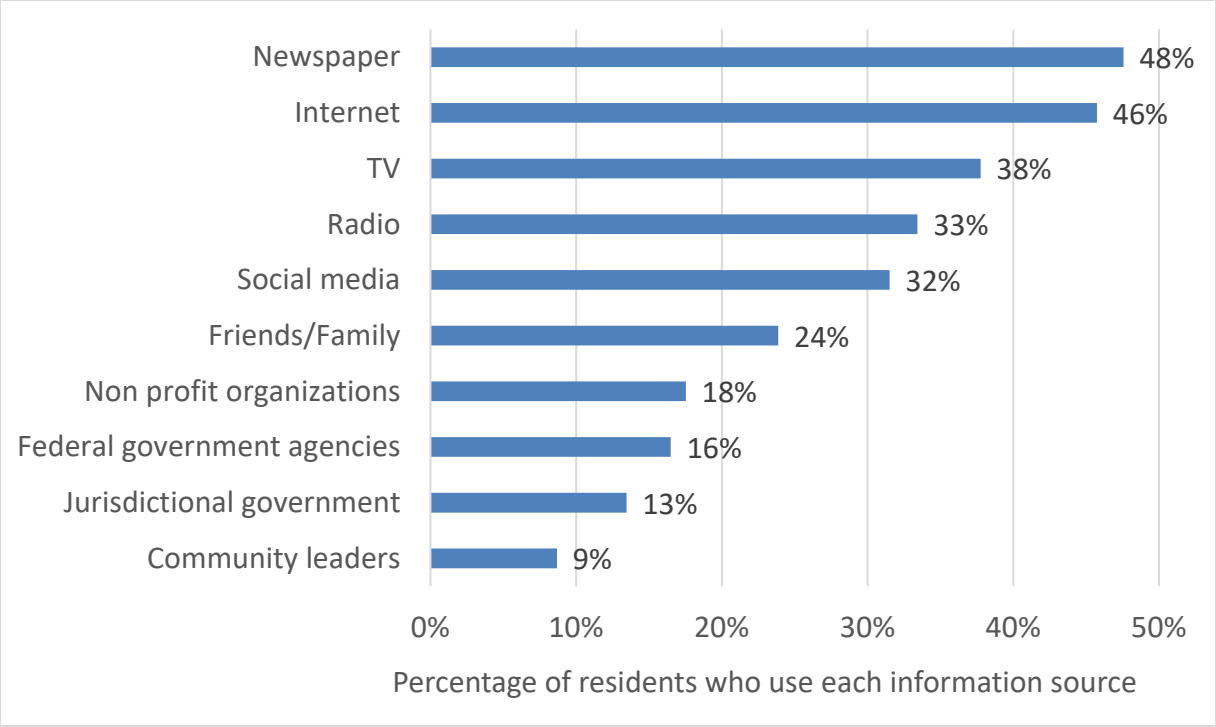

Figure 23: Top sources of information on coral reefs (n = 1,152)

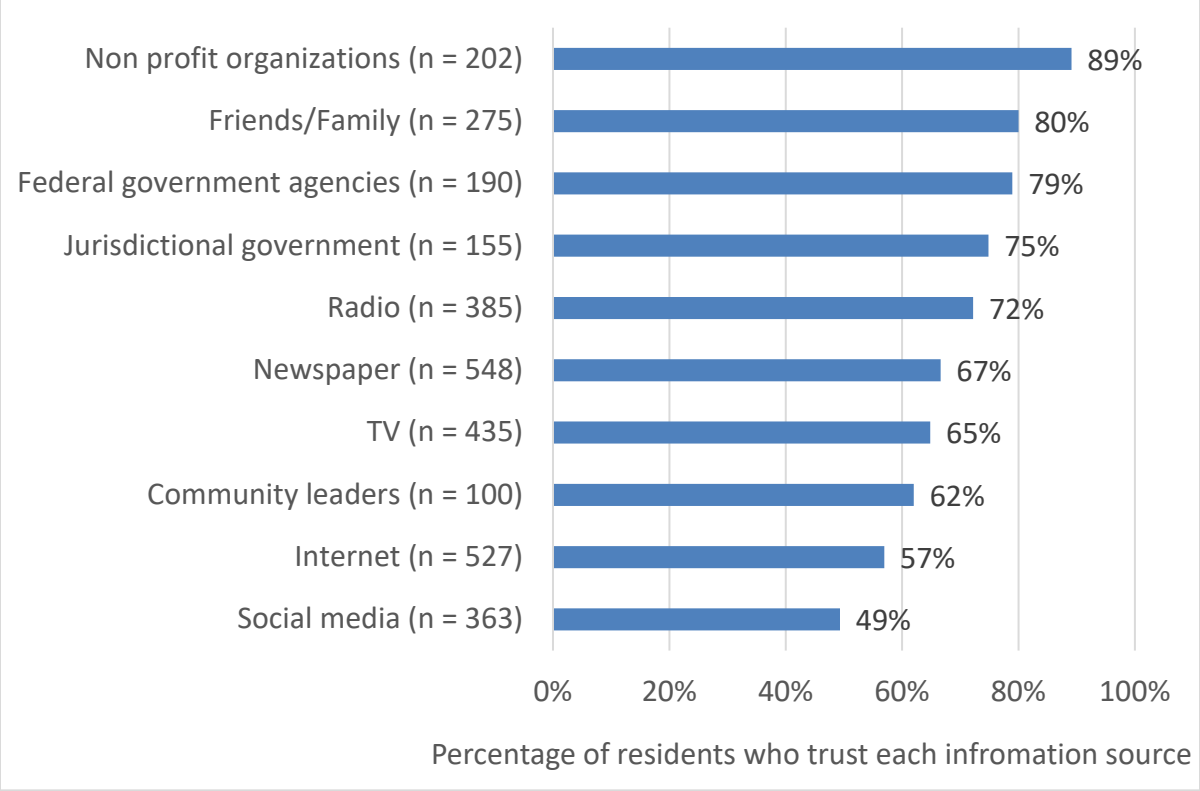

Figure 24: Resident level of trust in each coral reef information source

Involvement in coral reef management decision making

Survey respondents in USVI were asked how much they felt their communities are involved in protecting and managing coral reefs. Of the 1,188 that responded, 45% stated that communities are at least "moderately involved," and 11% stated that communities are "not at all involved." Residents were also asked this question at the individual level, and of the 1,188 who responded, 23% indicated that they themselves are at least "moderately involved" in decisions related to protecting and managing coral reefs, while 53% indicated that they are "not at all involved."

Other governance indicators

Based on the NOAA MPA Inventory, and with the St. Thomas East End Reserve (STEER) to include the Compass Point Pond Marine Reserve and Wildlife Sanctuary, Cas Cay-Mangrove Lagoon Marine Reserve & Wildlife Sanctuary, and the St. James Marine Reserve and Wildlife Sanctuary, all MPAs in USVI have management plans in place (2017) (Table 15). The oldest inventoried MPA was established in 1956, while others were established as recently as 2011. Additionally, commercial and recreational fishing are prohibited at 3 of the MPAs in USVI. Natural heritage is the primary conservation focus for 9 MPAs, and sustainable production is the primary conservation focus at 5 MPAs. Investigation shows that 42.6% of the mapped coral reef ecosystems (defined as "Coral Reef and Colonized Hardbottom") in and around USVI are under some form of management regime; however, an analysis of known coral reef habitat falling within management boundaries is not intended to equate to an assessment of management adequacy or efficacy. Additional metrics would be required for this type of evaluation.

Karras and Agar (2009) studied the views of Cruzan commercial fishermen as they relate to the socioeconomic and biological performance of the expansion of the Buck Island Reef National Monument (BIRNM) and the red hind seasonal closure off of St. Croix. They found that fishermen believed that the expansion enhanced fish production within the monument, but they were uncertain about the monument's ability to protect spawning aggregations, replenish fish abundance outside its boundaries, and its ability to protect fish sensitive sites. Fishermen also reported that the expansion marginalized their livelihoods and the well-being of their local communities, as access to productive shell-fishing grounds was curtailed. Fishermen articulated that the increasing number of closures and restrictions on fishing gear has brought "severe economic hardships," and has made them more reliant upon fishing grounds with a higher exposure to industrial waste.

In a more recent study, Agar *et al.* (2019) examined the gill and trammel net ban and buyback plan initiated in St. Croix. This management reform was aimed at protecting parrotfish populations, reducing by-catch, and minimizing gear-habitat interactions, with the goal of the buyback being mitigation of economic hardship brought on by the net ban. Drawing on in-person interviews with fishermen and other stakeholder groups, they found that the reforms had limited success; with shifting policy directives, implementation delays, limited buyback assistance, and high forgone earnings having unforeseen consequences. Most net fishermen believed that the ban had positive effects on parrotfish conservation, but also articulated that the funds received from

the net buyback program were not enough to offset the purchase of new gear nor the transition to other fisheries.

Table 15: Details of the Marine Managed Areas of USVI

Site Name	Government Level	Management Plan	Marine Area (sq km)
St. Croix East End Marine Park	Territorial	Site-Specific Management Plan	150.27
St. Thomas East End Reserves • Compass Point Pond Marine Reserve and Wildlife Sanctuary • Cas Cay-Mangrove Lagoon Marine Reserve & Wildlife Sanctuary • St. James Marine Reserve and Wildlife Sanctuary	Territorial	Site-Specific Management Plan	9.24
Hind Bank Marine Conservation District	Territorial	Non-MPA Programmatic Fisheries Management Plan	44.63
Grammanik Bank	Federal	Non-MPA Programmatic Fisheries Management Plan	1.51
Virgin Islands National Park	Federal	Site-Specific Management Plan	23.67
Virgin Islands Coral Reef National Monument	Federal	Site-Specific Management Plan	51.75
Sandy Point National Wildlife Refuge	Federal	Non-MPA Programmatic Species Management Plan	0.29
Mutton Snapper Spawning Aggregation Area	Federal	Non-MPA Programmatic Fisheries Management Plan	8.86
Frank Bay Wildlife and Marine Sanctuary	Territorial	No Management Plan	7.10
Salt River Bay National Historic Park and Ecological Preserve	Federal	Site-Specific Management Plan	2.69
Buck Island Reef National Monument	Federal	Site-Specific Management Plan	76.56
Red Hind Spawning Aggregation Area East of St. Croix	Federal	Non-MPA Programmatic Fisheries Management Plan	11.70
Total			**388.27**

Source: 2017 NOAA Marine Protected Areas Inventory

Results: Island-Level Analysis

In this iteration of the NCRMP socioeconomic survey, resources were available to obtain finer geographic representative samples of residents. In past iterations of the survey, the NCRMP Socioeconomic team was only able to obtain representative data at the jurisdiction scale (with the exception of Hawai‘i being sampled at the jurisdiction and island scale). Similar to Hawai‘i, the NCRMP Socioeconomic team was able to obtain representative samples for each island in the USVI: St. Thomas, St. John, and St. Croix. By having representative data at this scale, inferential statistics can be used to examine significant differences in human use, knowledge, attitudes, and perceptions across the three islands. This finer sampling design also allows for more meaningful comparisons with NCRMP biophysical and climate data collected at the island scale.

This section focuses on statistical comparisons across the three main islands of the USVI: St. Thomas, St. John, and St. Croix. A one-way ANOVA analysis was administered to compare the knowledge, attitudes, and perceptions of residents across the three aforementioned islands. Post-stratification sampling weights are not utilized in this analysis as they would decrease the sample size for the island of St. John to the point of non-representativeness. Each island is examined individually without weights and is compared to each of the other individual islands. Table 16 below illustrates these findings. For example, the cell “John>Thomas***” pertaining to the activity index indicates a 99% confidence that residents of St. John, on average, participate in more coral reef-related activities more frequently when compared to residents of St. Thomas.

Other findings suggest that, on average, residents of St. Croix are more likely to consume lionfish when compared to residents of St. John, and residents of St. Thomas are, on average, more likely to agree that coral reefs protect the USVI when compared to residents of St. John. Residents of St. John, on average, have a more positive perception of current marine resource condition when compared to residents of St. Thomas; however, St. John residents have a more negative perception, on average, concerning the change in condition of marine resources over the last ten years when compared to St. Croix residents, and a more negative perception, on average, concerning anticipated change in marine resource condition when compared to both St. Thomas and St. Croix residents. Further, St. John residents exhibited higher level of threat familiarity and familiarity with MPAs, on average, when compared to both St. Thomas and St. Croix residents.

Table 16: One-way ANOVA analysis across islands[11]

Variable	Conclusion
Activity index[12]	John>Thomas***
	John>Croix***
Consumes seafood purchased in a store/restaurant	Thomas>Croix**
	John>Croix*
Consumes seafood purchased at a market/roadside vendor	Thomas>John**
Consumes lionfish	Croix>John**
Condition index[13]	John>Thomas**
Last 10 years index[14]	Croix>John**
Believes marine resource condition will get worse over next 10 years	John>Thomas*
	John>Croix***
Agrees that coral reefs protect USVI from erosion/natural disasters	Thomas>John**
Agrees that coral reefs provide food for island communities	Croix>John**
Threat familiarity index[15]	John>Thomas***
	John>Croix***
Believes threat level to coral reefs is at least "large"	John>Thomas*
Is familiar with MPAs	John>Thomas***
	John>Croix**
Believes community is at least moderately involved in management of coral reefs	John>Thomas***
	John>Croix**
Is personally at least moderately involved in management of coral reefs	John>Thomas***
	Croix>Thomas***
Uses newspaper for coral reef information	Thomas>Croix*
Uses radio for coral reef information	Thomas>John***
	Thomas>Croix***
Uses television for coral reef information	Thomas>John***
	Thomas>Croix***
Uses the internet for coral reef information	Croix>Thomas***
Uses the jurisdictional government for coral reef information	Croix>Thomas*
	Croix>John*
Uses the federal government for coral reef information	John>Thomas***
	Croix>Thomas*
Uses non-profits for coral reef information	John>Thomas***
	John>Croix***
	Croix>Thomas*

[11] * = statistically significantly different with 90% confidence; ** = statistically significantly different with 95% confidence; *** = statistically significantly different with 99% confidence

[12] An additive index variable created by summing the responses to all of the activity questions. The index increases as activity participation frequency increases.

[13] An additive index variable created by summing the responses to all of the current marine resource condition questions. The index increases as positive perception increases.

[14] An additive index variable created by summing the responses to all of the change in marine resource condition questions. The index increases as positive perception increases.

[15] An additive index variable created by summing the responses to all of the threat familiarity questions. The index increases as familiarity increases.

Discussion

Based on the survey findings, a few general conclusions about the population of USVI and its interactions with and knowledge/awareness of coral reefs can be made as interesting patterns begin to emerge between islands or across demographic groups. These can be considered preliminary findings, and more detailed analyses of these data are planned for the future. This section concludes with directions for future research.

With respect to participation in reef activities, study findings indicate that USVI residents participate in purely recreational coral reef related activities at varying levels of frequency, with swimming and beach recreation being the most popular. It is believed that the reported activity participation rates are conservative estimates for USVI's coastal communities, as these estimates do not take the participation rates of tourists into account.

Fishing and gathering of resources are also common nearshore reef related activities for residents of USVI. Our findings show that 40% of households stated that they engage in fishing or gathering of marine resources. On average, residents of St. John are more likely to engage in coral-reef related activities more frequently when compared to residents of St. Thomas or St. Croix. The survey found that 65% of households consume fish/seafood once a week or more, and that most fishers (84%) do not sell the fish they catch; however, it is uncertain what proportion of fishing targets coral reef species, and what proportion of fish protein consumed comes from local fish species, as these distinctions were not specified in the survey. The need for this clarification has been noted, and the survey question will be adjusted in future iterations. Additionally, seafood consumed by USVI residents is predominantly purchased in supermarkets, grocery stores, and restaurants.

Survey respondents were asked about their perceptions of the health of USVI's coral reef resources. The findings show that residents' perceptions of marine resource conditions vary, with the exception of ocean water quality, which is generally perceived to be in good condition by residents. However, most residents perceive that the condition of marine resources has worsened over time. When examining the effect of tenure (i.e. how long a resident has lived in the jurisdiction), survey results reveal that lifelong residents have a more positive perception of the change in condition of marine resources over the last decade. Differences in perceptions concerning marine resource condition are identified between residents based on island of residence as well. On average, residents of St. John have a more positive perception of current marine resource condition when compared to residents of St. Thomas, and residents of St. Croix have a more positive perception concerning the change in marine resource condition when compared to residents of St. John. Furthermore, USVI residents from all islands who fish/gather marine resources have a more negative perception concerning current ocean water quality, current number of fish, current amount of marine debris, and the change in the number of fish when compared to those who do not fish/gather marine resources. The initial results provide strong support for continued exploration and analysis of the parameter "differences in perception" as future data collections allow for greater sample sizes. If perceptions of coral reef

health vary by location, this may correlate to differing resource quality by region, which could, in part, explain the lack of consensus across regions concerning the condition of marine resources. It would also be interesting to see if the overall decline in USVI's population will have an effect on the quality of near shore coral reefs and associated ecosystems. There have been some conflicting studies on the status of coral reefs with respect to their proximity to large population centers (Smith *et al.,* 2016; Bruno and Valdivia, 2016). If the population continues to decline, the impact, if any, on coral reef health could be correlated.

Regarding the public's awareness and knowledge of coral reefs, this study found that the majority of the population stated that they are familiar with threats facing coral reefs (except coral bleaching and damage from divers/snorkelers). That being said, 37% of residents believe that the condition of coral reef resources will get worse in the next 10 years, and 45% believe that the threats to coral reefs are "large" or "extreme." This suggests a lack of confidence amongst USVI residents that current threats to coral reefs are being (or can be) effectively addressed by current management efforts. Another interesting finding is that residents of St. John, on average, are more familiar with the threat of coral bleaching when compared to residents of St. Thomas and St. Croix. However, residents of St. Thomas, on average, were more likely to agree that coral reefs protect USVI from erosion and natural disasters when compared to residents of St. John.

The study found that the public's attitudes towards coral reef management strategies were largely positive. Residents expressed support for all of the potential marine management measures presented in the survey except "impose a license requirement and fee for land-based recreational fishers." In particular, 90% of the residents support "increased enforcement of wastewater and stormwater regulations to preserve water quality." When examining resident perceptions of MPAs, the overall sentiment toward them is positive: 67% agree that there should be more MPAs in USVI, and 88% agree that MPAs protect coral reefs. However, there is some uncertainty regarding whether MPAs have brought an economic benefit to USVI (25% were unsure), and additionally, one third of residents agree that fishermen's lives have been negatively impacted by the establishment of MPAs. Residents who fish/gather marine resources were found to exhibit significantly higher levels of familiarity with MPAs. Furthermore, residents that fish/gather marine resources to feed themselves/their household two times a month or more are, on average, more likely to agree that there should be more MPAs in USVI when compared to residents who fish/gather marine resources to feed themselves/their family less than two times a month or never. There were some other key differences across islands as it pertains to attitudes toward MPAs: residents of St. John are, on average, more familiar with MPAs when compared to residents of St. Thomas and St. Croix, but residents of St. Croix are, on average, more likely to agree that MPAs protect coral reefs when compared to residents of St. John.

We also attempted to track public participation and attitudes with respect to the governance of coral reefs and their resources. We found that 71% of all marine managed areas in USVI have management plans in place, and 42.6% of all coral reef habitat is under some form of management. There appears to be a moderate level of community involvement in coral reef

decision making, and high involvement in pro-environmental behavior aimed at improving the health of the marine environment and coral reefs (almost two thirds of survey respondents indicated that they participate in pro-environmental behavior). The survey also found that USVI residents rarely rely on the local government for information regarding coral reef topics. In contrast, use of the federal government for information is slightly more prevalent, and the federal government is considered a more trustworthy source for information.

The collection of secondary data, including economic impacts of tourism and fishing, as well as data contributing to the development of some of the community well-being indicators, will continue over time. As updated data sets are produced by other NOAA offices and relevant agencies, these will be collected, synthesized, and housed within a centralized database, and will be used to track changes over time. These data may be incorporated into indicators that combine or compare biophysical parameters (e.g., fish biomass) with commercial landings data and public perceptions of general reef health. It is notable that the net increase in population density on St. Thomas from 2000-2010 may have a potential impact on coral reef resources. Net growth could result in increased demand for coral reef ecosystem services including recreation and provisioning (e.g., food, products). Growth could also result in increases in impervious surfaces due to general urbanization, as well as higher volumes of solid and sewage waste production, which in turn, can add more stress to coral reef ecosystems in St. Thomas.

Future approaches and research ideas

There were a few lessons learned from the first NCRMP socioeconomic data collection in USVI. As similar surveys are implemented across other US coral reef jurisdictions, the NCRMP team will be adjusting the data collection effort to improve on the type of information generated. These findings should be considered a starting point to develop more detailed research questions for future work. For example, there is a need to distinguish between locally caught and imported fish with regards to the seafood consumption question. Additionally, the NCRMP team plans to refine the community involvement question in order to make the definition of “community” less ambiguous. Finally, more context and explanation of what residents perceive to be climate change impacts is needed. For instance, 71% of survey respondents indicated they are familiar with climate change, but only 47% indicated that they are familiar with the climate change impact of coral bleaching. This indicates that although residents are mostly familiar with climate change in a general sense, perhaps they are not as familiar with some of the more nuanced manifestations of climate change. The monitoring team will also aim to improve the level of comparability of questions across the different jurisdictions while maintaining questions that will provide information specifically relevant to the local context and management needs in each jurisdiction.

Another future research direction is to conduct analyses that explore relationships between different socioeconomic indicators, as well as comparisons between sub-populations as defined by the sampled residents. These may include categories such as age, gender, or familiarity with coral reefs. For example, our results showed that there is a difference in the perceptions of those

who fish/gather for marine resources versus those who do not fish/gather in relation to their attitudes towards some coral reef management measures (fishermen tend to agree less with imposing a license requirement and fee for land-based recreational fishers). The study also found that coral reef-related activity participation is more common in St. John when compared to St. Croix and St. Thomas. Additional future analysis will include an examination of the possible statistically significant differences in resident agreement levels pertaining to limited entry and access management measures versus more generalized management measures in order to understand what types of management strategies are best suited to foster support and adherence amongst the population, given what the management measure seeks to accomplish.

An additional parameter for future consideration is the impact of invasive marine species, in particular the lionfish (*Pterois volitans*), for its detrimental effects on the coral reef ecosystem. The survey effort for the USVI was the first to contain a question concerning lionfish consumption (Appendix 2). Subsequent improvements to the survey instrument might include better distinguishing the sources of information on coral reefs and level of trustworthiness. This would provide information that could be incorporated into specific public outreach and education programs for current and future management measures.

The NCRMP socioeconomic data collection builds upon and supplements the considerable social science research that has been conducted in USVI to date. Integrating the NCRMP data with these studies, or comparing and contrasting findings, has the potential to provide a more complete understanding of human interactions with coral reef resources in the territory. For example, Brander and van Beukering (2013) found that USVI's coral reefs provide an estimated $187 million in ecosystem service benefits per year to humans in year 2007 dollars (includes tourism, recreation, cultural value, amenity value, coastal protection, and commercial fishing). The socioeconomic monitoring data collected through the NCRMP provides further evidence of the contribution of USVI's coral reefs to the economic stability of its communities.

Pendleton *et al.* (2016) also articulates the significant economic, provisioning, and protection value that coral reefs provide to local communities in USVI. This study found that in 2007, 34,003 people (32% of USVI's total 2007 population) received storm and wave protection from coral reefs and that 981 fishermen were involved in coral reef fisheries that generated a dockside revenue of $6,598,431 in 2005 ($8,007,887 in 2015 dollars). By coupling studies like these with socioeconomic monitoring of coral reef-adjacent communities, we can help provide managers with useful information for determining resource management needs that will align with communities' use and value for the resource. At the highest level, the NCRMP socioeconomic data are intended to allow for analyses across jurisdictions and regions (e.g., comparisons of Pacific to Caribbean) and within a single jurisdiction over time. These investigations will be, in large part, aimed at answering questions related to the success of US coral reef conservation efforts.

In future years, the NCRMP hopes to increase sampling in order to be statistically significant at smaller geographic scales within the jurisdictions. Expanding our survey sample will improve

our ability to compare the NCRMP socioeconomic data to biophysical data collected through the NCRMP and jurisdictional agencies (for instance, comparing perceived coral reef resource condition to biological indicators), and to inform coral reef management and monitoring across the entire jurisdiction. Finally, ongoing analyses of the individual metrics presented here will advance us toward reporting the survey and secondary data collection results for a variety of composite indicators such as governance and perceived resource condition. These indicators will aid in comparisons across jurisdictions, where individual metrics may not be the same. Further, the use of indicators will support communication of complex data in a way that facilitates resource management decision making.

Coral Reefs in St. John, USVI (Photo credit: NOAA CCMA Biogeography Team)

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Appendix 1: National Coral Reef Monitoring Program

Understanding Socioeconomic Connections

The Socioeconomic Component of the National Coral Reef Monitoring Program (NCRMP) gathers and monitors a collection of socioeconomic variables, including demographics in coral reef areas, human use of coral reef resources, as well as knowledge, attitudes, and perceptions of coral reefs and coral reef management. The overall goal of the socioeconomic monitoring component is to track relevant information regarding each jurisdiction's population, social and economic structure, the impacts of society on coral reefs, and the impacts of coral management on communities. NOAA's Coral Reef Conservation Program (CRCP) will use the information for research and to improve the results of programs designed to protect coral reefs.

The main purpose of the Socioeconomic Component of NCRMP is to answer the following questions: What is the status of human knowledge, attitudes, and perceptions regarding coral reefs? And, how are human uses of, interactions with, and coral dependence on coral reefs changing over time?

More details can be found here: http://www.coris.noaa.gov/monitoring/socioeconomic.html

Appendix 2: The NCRMP Survey Instrument

OMB SUBMISSION

NOAA Coral Reef Conservation Program
National Coral Reef Monitoring Program (NCRMP)
Resident Coral Reef Survey
OMB Control Number 0648-0646

US Virgin Islands Survey

Survey conducted in (circle one): *English* *Spanish*

Introduction: *[greeting specific to jurisdiction]*

[SAMPLE TEXT WILL BE REPLACED WITH AN INTRODUCTION COMPLIANT WITH OMB REQUIREMENTS] My name is _____. We are interested in your opinions on some important environmental issues being talked about these days in the USVI. Your participation in this survey is voluntary and will be kept strictly confidential.

[IF NECESSARY:]

- Your phone number has been selected at random to participate in the island-wide survey
- We are not trying to sell you anything.

May I please proceed?

1. Yes **[Proceed to Screening Questions]**
2. No **[THANK AND TERMINATE]**

S1. I need to speak to a person in your household who is 18 years of age or older. Are you over 18 years of age?

1. Yes **[Continue to Screening Question #2]**
2. No **[Ask for the person 18 years or older who has had the most recent birthday; if no one over 18, THANK AND TERMINATE]**

98. DON'T KNOW **[THANK AND TERMINATE]**
99. REFUSED **[THANK AND TERMINATE]**

S2. Do you live at least 6 months of the year in the US Virgin Islands?

1. Yes **[Continue to Screening Question 3]**
2. No **[THANK AND TERMINATE]**

S3. We can conduct this survey in English or Spanish. For this survey, is there a particular language you would prefer to use?

1. English
2. Spanish **[SWITCH TO ALTERNATE QUESTIONNAIRE]**

Thank-you for taking the time to provide your views. This survey is being conducted in accordance with the Privacy Act of 1974 and the Paperwork Reduction Act. Your participation is voluntary, your answers are confidential and you can stop the interview at any time. The interview is expected to take less than 25 minutes. If you have questions or would like to know more about the survey I will provide you with contact information.

Notwithstanding any other provisions of the law, no person is required to respond to, nor shall any person be subjected to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number. The OMB Control number for this survey is 0648-0646.

The 25 minute estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Please send comments regarding this burden estimate or any other suggestions for reducing this burden to Peter Edwards, National Oceanic and Atmospheric Administration, National Ocean Service, Coral Reef Conservation Program, (1305 East West Highway, Silver Spring, MD, 20910, USA).

PARTICIPATION IN REEF ACTIVITIES

1. How often do you usually participate in each of the following activities?

	Never	Once a month or less	2-3 times a month	4 times a month or more	No Response
Swimming/wading					
Snorkeling					
Recreational Diving (SCUBA)					
Waterside/beach camping					
Beach recreation (beach sports, picnics)					
Motorized Boating (not for fishing purposes)					
Non-motorized Boating (kayaking, canoeing)					
Fishing from shore – casting (rod & reel), cast netting					
Fishing from a boat, canoe or paddle board – rod and reel, trolling, spear gun, free diving, SCUBA					
Gathering of marine resources (seaweed, lobsters, whelk, sea cucumber, octopus, clams, mollusks)					
Stand Up Paddle boarding, surfing, windsurfing, kitesurfing					

SKIP PATTERN-- If respondent answers 'never' to BOTH fishing and gathering of marine resources, then skip to #3:

CORAL REEF RELIANCE / CULTURAL IMPORTANCE OF REEFS

2. How often do you fish or harvest marine resources for each of the following reasons?

	Never	Rarely	Sometimes	Frequently	No Response
To feed myself and my family/ household					
To sell					
To give to extended family members and/or friends					
For fun					
For special occasions and cultural events					

3. How often do you or your family eat fish/seafood?

    a. Every day
    b. A few times a week
    c. About once a week
    d. 1-3 times a month
    e. Less than once a month
    f. Never
    g. Not sure

SKIP PATTERN-- If respondent answers f. Never, skip to question #6

4. Where do you get the fish or seafood your family eats? Please pick the top 2.

    a. Purchased by myself or someone in my household at a store or restaurant
    b. Purchased by myself or someone in my household at a market or roadside vendor
    c. Caught by myself or someone in my household
    d. Caught by extended family members
    e. Other, please specify _____

5. How often does your family eat fish/seafood that is harvested from coral reefs? (For example snapper, grouper, parrotfish, old wife, trigger fish, lobster, or conch)?
    a. Every day
    b. A few times a week
    c. About once a week
    d. 1-3 times a month
    e. Less than once a month
    f. Never
    g. Not sure

6. Do you or your family consume lionfish?
    a. Yes
    b. No
    c. Not Sure

PERCEIVED RESOURCE CONDITION

7. In your opinion, what is the current condition of the USVI's marine resources on the island of your residence? Please rank from "very bad" to "very good."

	Very Bad	Bad	Neither Bad nor Good	Good	Very Good	Not sure
Ocean Water Quality (clean)						
Amount of Coral						
Number of Fish						
Health of coral						
Amount of marine debris or trash						

8. How would you say the condition of each of the following has changed over the last 10 years? Please rank from "it has gotten a lot worse" to "it has gotten a lot better."

	A lot Worse	Somewhat Worse	No Change	Somewhat Better	A lot Better	Not Sure
Ocean Water Quality (clean and clear)						
Amount of Coral						
Number of Fish						
Health of coral						
Amount of marine debris or trash						

9. In the next 10 years, do you think the condition of the marine resources in the USVI will get worse, stay the same or improve?
    a. Get worse
    b. Stay the same
    c. Improve
    d. Not sure

AWARENESS AND KNOWLEDGE OF CORAL REEFS

10. Please indicate the extent to which you disagree or agree with each of the following statements.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree	Not Sure
Coral reefs protect the USVI from coastal erosion and natural disasters.						
Coral reefs are only important to fishermen, divers and snorkelers.						
Coral reefs in good condition provide food for island communities to eat						
Coral reefs are important to my island's culture.						

11. How familiar are you with each of the following potential threats facing the coral reefs in the USVI? Please rank from "very unfamiliar" to "very familiar."

	Very Unfamiliar	Unfamiliar	Neither Familiar nor Unfamiliar	Familiar	Very Familiar	Not sure
Climate change						
Coral bleaching						
Hurricanes and other natural disasters						
Pollution and runoff (stormwater, wastewater outfall, sediment, and marine debris)						
Increased coastal/urban development						
Invasive species (Example: Lionfish)						
Over harvesting of resources						
Damage from ships and boats (groundings or anchoring)						
Damage from SCUBA divers and snorkelers while in the water						
Open dumping/littering						

12. Do you believe that the threats to coral reefs in USVI are:

    a. Extreme
    b. Large
    c. Moderate
    d. Minimal
    e. None
    f. Not sure

ATTITUDES TOWARDS CORAL REEF MANAGEMENT STRATEGIES AND ENFORCEMENT

13. A Marine Protected Area is an area of the ocean where human activity is typically restricted to protect living, non-living, cultural, and/or historic resources such as conservation areas and sanctuaries. How familiar are you with Marine Protected Areas (MPAs)?
    a. Very Unfamiliar
    b. Unfamiliar
    c. Neither Unfamiliar nor Familiar
    d. Familiar
    e. Very Familiar
    f. Not sure

SKIP PATTERN-- If respondent answers a 'Very unfamiliar' or b 'Unfamiliar', then skip to #15:

14. Please indicate the extent to which you disagree or agree with each of the following statements.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Sure
MPAs protect coral reefs						
MPAs increase the number of fish						
There should be fewer locally-managed MPAs in the USVI						
There should be more locally-managed MPAs in the USVI						
There has been economic benefit to the USVI from the establishment of locally-managed MPAs						
Fishermen's livelihoods have been negatively impacted from the establishment of locally-managed MPAs in the USVI						
Locally managed MPAs help increase tourism in the USVI						
The establishment of locally-managed MPAs increases the likelihood that people will vacation in the USVI						
I would support adding new locally managed MPAs in the USVI if there is evidence that the ones we have are improving the USVI's marine resources						
I generally support the establishment of locally-managed MPAs						

15. The following are rules and regulations that can be used to manage the marine environment. We are interested in your opinion about the use of these rules and regulations for the protection of coral reefs. Please indicate the extent to which you disagree or agree with each of the following:

Example Management Strategies	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Not Sure
Size limits for harvesting certain fish species						
Impose a license requirement and fee for land-based recreational fishers						
Charge a small fee to non-residents visiting locally managed MPA to fund conservation						
Increased enforcement of wastewater and stormwater regulations to preserve water quality						
Amending building regulations to consider sea level rise and climate impacts.						
More restrictions on construction practices to prevent sediment going to sea						

PARTICIPATION IN BEHAVIORS THAT MAY IMPROVE CORAL HEALTH

16. How often do you participate in any activity to protect the environment (for example, beach clean ups, volunteering with an environmental group, donating to a coastal environmental charity, lionfish removal, marine debris removal)?

    a. Not At All
    b. Once a year or Less
    c. Several times a year
    d. At least once a month
    e. Several Times a Month or more
    f. Not Sure

17. Which of the following would you consider to be your top 3 sources of information about coral reefs and the environment in the US Virgin Islands?
Interviewer checks the top 3 sources of information in box below.

18. To what degree do you trust each of your top rated sources of information to provide you the most accurate information on coral reefs and coral reef related topics in the US Virgin Islands?
Respondent rates only the top 3 sources of information in box below.

Top 3	Sources	Very untrustworthy	Untrustworthy	Neither Trustworthy nor Untrustworthy	Trustworthy	Very Trustworthy	Not sure
	Newspapers, other print publications						
	Radio						
	TV						
	Internet						
	Social Media						
	Friends and family						
	Community leaders						
	Jurisdictional government agencies (DPNR)						
	Federal government agencies (NOAA, EPA, US Fish and Wildlife)						
	Non-profit environmental organizations (TNC, University of the Virgin Islands, Virgin Islands Conservation Society)						
	Other						

19. How involved is the local community in protecting and managing coral reefs?

a. Not at all involved
b. Somewhat involved
c. Moderately involved
d. Involved
e. Very involved
f. Not sure

20. How involved are you in making decisions related to the management of coral reefs in the USVI?

    a. Not at all involved
    b. Slightly involved
    c. Moderately involved
    d. Involved
    e. Very involved
    f. Not sure

DEMOGRAPHICS

I just have a few more questions that will help us to interpret our results. As a reminder, the information you provide is completely <u>confidential</u>.

21. Are you male or female?
    a. Male
    b. Female

22. What is your year of birth? _____

23. How many years have you lived in the USVI? _____ [OPEN ENDED]

24. Which part of the island do you live in (which estate)?
    _____

25. Including your primary language, please name each language you speak.
    a) English
    b) Spanish
    c) French
    d) German
    e) Italian
    f) Portuguese
    g) Danish
    h) Haitian Creole
    i) St. Lucian Creole
    j) Dominica Creole
    k) Vietnamese
    l) Tagalog
    m) Mandarin
    n) Chinese
    o) Other: Please list _____
    p) No Response

26. What race/ethnicity do you consider yourself?
    A. American Indian or Alaskan Native
    B. Asian
    C. Black or African American
    D. Puerto Rican
    E. Carolinian
    F. Chamorro
    G. Chinese
    H. Cuban
    I. Filipino
    J. Japanese
    K. White
    L. Korean
    M. Mexican
    N. Native Hawaiian or other Pacific Islander
    O. Samoan
    P. Taino
    Q. Thai
    R. Tongan
    S. Vietnamese
    T. Hispanic or Latino
    U. Other/Mixed
    V. No response

27. What is the highest level of education you have completed?
    a. 8th Grade or Less
    b. Some high school
    c. High School Graduate, GED
    d. Some college, community college or AA
    e. College Graduate
    f. Graduate School, Law School, Medical School
    g. No Response

28. What is your current employment status?
    a. Unemployed
    b. Student
    c. Employed full-time
    d. Homemaker
    e. Employed part-time
    f. Retired
    g. None of the above: Please specify _____
    h. No Response

29. What is your occupation? [***open ended***] _____

30. May I ask, what is your annual household income?
    a. Under $10,000
    b. $10,000-19,999
    c. $20,000-29,999
    d. $30,000-39,999
    e. $40,000-49,999
    f. $50,000-59,999
    g. $60,000-74,999
    h. $75,000-99,999
    i. $100,000-149,999
    j. $150,000 or More
    k. No Response

THANK YOU FOR YOUR TIME

If you would like a copy of the results, please provide us with your mailing address or email address (write on separate contact sheet that is not linked to survey answers).

Appendix 3: USVI NCRMP Survey Demographic Results[16,17]

Island	Percent of Sample	Percent of Sample (weighted)	Percent of Population (2010 US Census)
St. Thomas	36.7%	49.7%	49.7%
St. John	30.5%	4.2%	4.2%
St. Croix	32.8%	46.1%	46.1%

Gender	Sample	2010 US Census
Male	47%	47%
Female	53%	53%

Age	Sample	2010 US Census
18-24 year olds	10%	11%
25-34 year olds	14%	15%
35-44 year olds	13%	18%
45-64 year olds	35%	38%
65+ years old	16%	18%
No Response	9%	N/A

Education Level	Sample	2010 US Census
Less than high school	10%	31%
High School Graduate, GED	29%	31%
Some college, community college or AA	23%	20%
College Graduate	26%	11%
Graduate School, Law School, Medical School	7%	7%
No Response	4%	N/A

[16] The USVI NCRMP survey results are presented using post stratification sampling weights (stratified by island and weighted by age and gender).
[17] 2010 US Census results in this section refer to the adult population of USVI.

Annual Household Income	Sample[18]	2010 US Census
Under $10,000	9%	14%
$10,000 to $19,999	8%	13%
$20,000 to $29,999	15%	14%
$30,000 to $39,999	13%	11%
$40,000 to $49,999	11%	9%
$50,000 to $59,999	10%	8%
$60,000 to $74,999	9%	9%
$75,000 to $99,999	10%	9%
$100,000+	15%	12%

Race/Ethnicity	Sample	2010 US Census
Black/African American	50.54%	74.20%
White	17.06%	17.77%
American Indian/Alaskan Native	0.69%	0.42%
Asian	0.80%	1.41%
Native Hawaiian/Pacific Islander	0.38%	0.02%
Other race	24.20%	4.36%
2 or more races	1.50%	1.82%
No Response	4.60%	N/A

Languages Spoken[19]	Sample
English	93%
Spanish	34%
French	7%
Dominica Creole	3%
St. Lucian Creole	3%
Haitian Creole	2%
Other	3%

[18] Answers of "no response" are left absent from the analysis of household income due to high rate of occurrence (approximately 49%).
[19] The 2010 US Census did not collect this type of information.

Year(s) of Residence[20]	**Sample**
1 year or less	2%
2-5 years	8%
6-10 years	9%
More than 10 years (less than all my life)	68%
All my life	10%
No Response	3%

Employment Status[21]	**Sample**
Unemployed	6%
Student	2%
Employed full-time	55%
Homemaker	1%
Employed part-time	7%
Retired	18%
Other	7%
No Response	3%

[20] The 2010 US Census did not collect this type of information.
[21] The 2010 US Census did not collect this type of information.

Appendix 4: NCRMP Secondary Data Sources for USVI

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
Caribbean Tourism Organization	Caribbean Tourism Organization Individual Country Statistics and Latest Tourism Statistics Tables	2004-2014	Arrival statistics refers to the measurement of international inbound visitors (tourists (stay-over visitors), excursionists (same-day visitors) and cruise passengers) into a destination. Tourists are visitors who stay at least 24 hours in the country visited whereas Same-day visitors stay less than 24 hours in the country visited. Cruise Passengers are regarded as a special type of same-day visitor (even if the ship overnights at the port). The dataset includes Visitor summary, Tourist arrivals figures, Same day visitors, Length of stay, Arrivals by purpose of visit, Average daily expenditure, Visitor expenditure, Tourism budget, GDP at factor cost, Consumer Price Index, Hotel and Restaurant contribution to GDP; Rooms, Occupancy rates; Land Area (square Kilometres); Population (thousand, mid year 2004); Tourist arrivals by main markets; Monthly tourist arrivals.	2003-2014	http://www.onecaribbean.org/statistics/
Central Intelligence Agency	The World Factbook Life Expectancy at Birth	2013	These data represent the average number of years to be lived by a group of people born in the same year, if mortality at each age remains constant in the future.	2014	https://www.cia.gov/library/publications/the-world-factbook/rankorder/2102rank.html
Central Intelligence Agency	The World Factbook	2014	Inflation rate (consumer prices) compares the annual percent change in consumer	2003-2014	https://www.cia.gov/library/publica

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
	Inflation Rate (Consumer Prices)		prices with the previous year's consumer prices.		tions/the-world-factbook/rankorder/2092rank.html
Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), Ocean and Coastal Resource Management (OCRM), National Marine Protected Areas Center (MPAC)	MPA Inventory Database (10/2014)	2014	The MPA Inventory is a comprehensive catalog that provides detailed information for existing marine protected areas in the United States. The inventory provides geospatial boundary information (in polygon format) and classification attributes that seek to define the conservation objectives, protection level, governance and related management criteria for all sites in the database. The comprehensive inventory of federal, state and territorial MPA sites provides governments and stakeholders with access to information to make better decisions about the current and future use of place-based conservation. The information also will be used to inform the development of the national system of marine protected areas as required by Executive Order 13158.	2014	http://marineprotectedareas.noaa.gov/dataanalysis/mpainventory/
Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office for Coastal Management (OCM)	Time-Series Data on the Ocean and Great Lakes Economy for Counties, States, and the Nation between 2005 and 2012 (Sector Level) (ENOW)	2015	Economics: National Ocean Watch (ENOW) contains annual time-series data for over 400 coastal counties, 30 coastal states, 8 regions, and the nation, derived from the Bureau of Labor Statistics and the Bureau of Economic Analysis. It describes six economic sectors that depend on the oceans and Great Lakes and measures four economic indicators: Establishments, Employment, Wages, and Gross Domestic Product (GDP).	2005-2012	http://coast.noaa.gov/dataregistry/search/dataset/C3722030-943C-4BEE-B063-06715F815891

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Coastal Services Center (CSC)	Spatial Trends in Coastal Socioeconomics (STICS): Total Economy of Coastal Areas	2013	These market data provide a comprehensive set of measures of changes in economic activity throughout the coastal regions of the United States. In regard to the sources of data, establishments, employment, and wages are taken from the Quarterly Census of Employment and Wages (QCEW). These data series also is known as the ES-202 data. These data are based on the quarterly reports of nearly all employers in the United States. These reports are filed with each state's employment or labor department, and each state then transmits the data to the Bureau of Labor Statistics (BLS), where the national databases are maintained. The data for the Coastal Economies have been taken from the national databases at BLS (except in the case of Massachusetts). Gross State Product (GSP) data are taken from the Bureau of Economic Analysis (BEA), which develops the estimates of GSP from a number of sources. In regard to "employment," data are reported by employers, not employees, and does not contain any information about age. There is no difference between "employed" and "employment". The source is known as the payroll survey, a survey filed by employers every 3 months showing the number of people employed at each establishment in each of the preceding 3 months.	1990-2011	http://coast.noaa.gov/dataregistry/search/dataset/info/coastaleconomy

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
Department of Health, Vital Records and Statistics, United States Virgin Islands	Vital Statistics 2008 Natality and Mortality Indicators	2008	This report includes birth and death data for the United States Virgin Islands in the year 2008, including birth rate, death rate, and leading cause of mortality	2008	http://www.healthvi.org/assets/documents/2011/2008-natality-and-mortality-indicators.pdf
Environmental Protection Agency	EPA Assessment and Total Maximum Daily Load Tracking and Implementation System (ATTAINS)	2016	The Assessment and Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS) is an online system for accessing information about the conditions in the Nation's surface waters. The Clean Water Act requires states, territories and authorized tribes (states for brevity) to monitor water pollution and report to EPA every two years on the waters they have evaluated. This process is called assessment. Part of this process is deciding which waters do not meet water quality standards because they are too polluted. These degraded waters are called impaired (polluted enough to require action) and are placed on a State list for future actions to reduce pollution. This information reported to EPA by states is available in ATTAINS. The information is made available via the ATTAINS web reports, as well as through other EPA tools. The ATTAINS web reports provide users with easy access to view the information on the status of waters at the national, state and site-specific waterbody levels. To access	2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016	https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
			this information, click the Get Data/Tool tab above.		
Environmental Protection Agency	EPA Annual Beach Notification Summary Reports -- Closures and Advisories	2012	These fact sheets summarize beach monitoring and notification data submitted to EPAfor each swimming season. Beach water monitoring is conducted primarily to detect bacteria that indicate the possible presence of disease-causing microbes (pathogens) from sewage or fecal pollution. People swimming in water contaminated with these types of pathogens can contract diseases of the gastrointestinal tract, eyes, ears, skin, and upper respiratory tract. When monitoring results show levels of concern, the state or local government issues a beach advisory or closure notice until further sampling shows that the water quality is meeting the applicable standards. Beach water pollution can occur for a number of reasons including stormwater runoff after heavy rainfall, treatment plant malfunctions,sewer system overflows, and pet and wildlife waste on or near the beach. To help minimize beachgoers' risk of exposure to pathogens in beachwaters, EPA is helping communities build and properly operate sewage treatment plants, working to reduce overflows as much as possible, and working with the U.S. Coast Guard to reduce discharges from boats and larger ships. Under the Beaches	2006, 2010, 2011, 2012	http://water.epa.gov/type/oceb/beaches/2011_season.cfm

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
			Environmental Assessment and Coastal Health (BEACH) Act of 2000, EPA provides annual grants to coastal and Great Lakes states, territories, and eligible tribes to help local authorities monitor their coastal and Great Lakes beaches and notify the public of water quality conditions that may be unsafe for swimming.		
Environmental Protection Agency	Environmental Protection Agency; Air Quality Index Report	2016	This data set provides the number of days per year that air advisories were in effect (i.e. the number of "good" days, the number of "moderate" days, the number "unhealthy for sensitive groups" days, "unhealthy" days, and "very unhealthy" days). The data can be delineated by county or by city. The pollutants examined are CO, PM2.5, PM10, NO2, O3, and SO2.	1980-2016	https://www.epa.gov/outdoor-air-quality-data/air-quality-index-report
Environmental Protection Agency; Technology Transfer Network Clearinghouse for Inventories & Emissions Factors.	The National Emissions Inventory	2016	This data set summarizes ammonia, carbon monoxide, nitrogen oxide, particulate matter, sulfur dioxide, volatile organic compounds, mercury, acid gas, greenhouse gases, glycol ether, metals, VOC, PCBs, POM, and PAH emissions at the national, state, and county level for 2011 and 2014. Data is measured in tons.	2011, 2014	https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei
Environmental Protection Agency; Landfill Methane Outreach Program (LMOP)	Landfill-level data only	2016	LMOP tracks key data for landfill gas (LFG) energy projects and municipal solid waste (MSW) landfills in the United States. LMOP's Landfill and Landfill Gas Energy Database contains information about projects in various stages such as planning, under	2016	https://www.epa.gov/lmop/landfill-gas-energy-project-data-and-landfill-technical-data#landfills

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
			construction, operational, and shutdown, and is also a data repository for more than 2,400 MSW landfills that are either accepting waste or closed in the past few decades. The LMOP Database contains landfill information such as such as physical address, latitude and longitude, owner/operator organization, operational status, year opened, actual or expected closure year, design capacity, amount of waste in place, gas collection system status, and LFG collected amount. For landfills that report under EPA's Greenhouse Gas Reporting Program (GHGRP), LMOP cross-references that dataset by including GHGRP's 7-digit Facility Identifier.		
HML Project Team	Environmental Use and Dependence - HML Project Team Collection	2014	This data set is comprised of uses occurring in study areas as well as attendance figures for parks located in the study areas. Park visitation to national, state, and county parks as well as National Wildlife Refuge areas are included in this data set. Use data includes fishing, diving, and boating in the study area. Sources: -AS Sources: U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Homeland Security/U.S. Coast Guard Office of Auxiliary and Boating Safety, Professional Association of Diving Instructors, National Oceanic and Atmospheric Administration.	2013	

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
			-CNMI Sources: U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Homeland Security/U.S. Coast Guard Office of Auxiliary and Boating Safety, Professional Association of Diving Instructors, Diveadvisor.com, National Oceanic and Atmospheric Administration. -FL Sources: U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Homeland Security/U.S. Coast Guard Office of Auxiliary and Boating Safety, Professional Association of Diving Instructors, Diveadvisor.com, Worldwidefishing.com, Florida Fish and Wildlife Conservation Commission, Florida Department of Highway Safety and Motor Vehicles, Florida Park Service. -Guam Sources: U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Homeland Security/U.S. Coast Guard Office of Auxiliary and Boating Safety, Professional Association of Diving Instructors, Diveadvisor.com, National Oceanic and Atmospheric Administration. -HI Sources: U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Homeland Security/U.S.		

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
			Coast Guard Office of Auxiliary and Boating Safety, Professional Association of Diving Instructors, Diveadvisor.com, Worldwidefishing.com, Department of Land and Natural Resources, National Oceanic and Atmospheric Administration, Hawaii Tourism Authority, National Association of State Park Directors, County of Hawaii Fire Department: Ocean Safety Division. -PR Sources: U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Homeland Security/U.S. Coast Guard Office of Auxiliary and Boating Safety, Professional Association of Diving Instructors, Diveadvisor.com, Worldwidefishing.com, Puerto Rico Department of Natural and Environmental Resources, U.S. Department of Agriculture. -USVI Sources: U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Homeland Security/U.S. Coast Guard Office of Auxiliary and Boating Safety, Professional Association of Diving Instructors, Diveadvisor.com, Worldwidefishing.com, National Archives and Records Administration Office of the Federal Register, Department of Planning and Natural Resources Division of Fish & Wildlife.		

Source (originator)	***Data Set Title***	***Publication Date***	***Abstract***	***Data Year(s)***	***URL***
Institute for Health Metrics and Evaluation (IHME)	United States Adult Life Expectancy by County 1987-2007	2011	This is a complete time series for life expectancy from 1987 to 2007 for all US counties, and released as part of IHME research published in *Population Health Metrics.*	2007	http://ghdx.healthdata.org/record/united-states-adult-life-expectancy-county-1987-2007
National Oceanic and Atmospheric Administration (NOAA), Coastal Change Analysis Program (CCAP)	National Oceanic and Atmospheric Administration, Coastal Change Analysis Program (CCAP) Regional Land Cover Data	2012	The Coastal Change Analysis Program (C-CAP) produces a nationally standardized database of land cover and land change information for the coastal regions of the U.S. C-CAP products are developed using multiple dates of remotely sensed imagery and consist of raster-based land cover maps for each date of analysis, as well as a file that highlights what changes have occurred between these dates and where the changes were located. These data highlight the relative effects of different landscape features on water quality, such as increased polluted runoff from impervious surfaces and the mitigating impacts of forests. NOAA produces high resolution C-CAP land cover products, for select geographies. GIS and tabular data was accessed June 2012 and prepared for the project by NOAA Coastal Services Center, Charleston SC.	2001-2007 (various)	http://www.csc.noaa.gov/digitalcoast/data/ccapregional
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries	Annual Commercial Landing Statistics	2015	The NOAA Fisheries, Fisheries Statistics Division has automated data summary programs that anyone can use to rapidly and easily summarize U.S. commercial fisheries landings. These programs allow	1950-2015	http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
Service (NMFS), Fisheries Statistics Division			you to query our commercial fishery data bases and summarize United States domestic commercial landings in several formats. Domestic fishery landings are those fish and shellfish that are landed and sold in the 50 states by U.S. fishermen and do not include landings made in U.S. territories or by foreign fishermen. You can summarize the pounds and dollar value of commercial landings by your choice of years, months, states and species for the years 1990 onwards. The volume and value of 1950 onwards landings can be summarized by: years, states and species; by years, states, species and fishing gears; or years, states, species, finfish or shellfish groups, and price per pound.		landings/annual-landings/index
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service, Office of Response and Restoration, Hazardous Materials Response Division, Seattle, Washington; United States Environmental Protection Agency; United States Coast Guard; U.S. Virgin Islands Department	U.S. Virgin Islands and British Virgin Islands ESI: HYDRO (Hydrology)	2001-2008	This data set comprises the Environmental Sensitivity Index (ESI) data for the Virgin Islands. ESI data characterize estuarine environments and wildlife by their sensitivity to spilled oil. The ESI data include information for three main components: shoreline habitats, sensitive biological resources, and human-use resources. This data set contains hydrology data.	2000	http://archive.orr.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic_topic%29=entry_id,subtopic_id,topic_id&entry_id%28entry_subtopic_topic%29=849&subtopic_id%28entry_subtopic_topic%29=8&topic_id%28entry_subtopic_topic%29=1

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
of Planning and Natural Resources; British Virgin Islands Conservation and Fisheries Department; and United States Department of the Interior.					
The Henry J. Kaiser Family Foundation	State Health Facts: Infant Mortality Rate (Deaths per 1,000 Live Births)	2013	These data represent the number of infant deaths per 1,000 live births based on linked birth and death records from the period from 2007-2009.	2007-2009	http://kff.org/other/state-indicator/infant-death-rate/
The Henry J. Kaiser Family Foundation	State Health Facts: Number of Cancer Deaths per 100,000 Population	2013	These data represent age-adjusted rates per 100,000 U.S. standard population. Rates for the United States and each state are based on populations enumerated in the 2010 census as of April 1. Rates for Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas are based on the 2010 census, estimated as of July 1, 2010. Since death rates are affected by the population composition of a given area, age-adjusted death rates should be used for comparisons between areas because they control for differences in population composition.	2010	http://kff.org/other/state-indicator/cancer-death-rate-per-100000/
The World Bank	World Bank – Annual Visitor Arrivals	2017	The World Bank is a vital source of financial and technical assistance to developing countries around the world. We are not a bank in the ordinary sense	1995-2015	http://data.worldbank.org/indicator/ST.INT.ARVL

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			but a unique partnership to reduce poverty and support development. The World Bank Group comprises five institutions managed by their member countries. Annual visitor arrivals is an international tourism indicator based on the number of tourists who travel to a country other than that in which they usually reside, and outside their usual environment, for a period not exceeding 12 months and whose main purpose in visiting is other than an activity remunerated from within the country visited. When data on number of tourists are not available, the number of visitors, which include tourists, same-day visitors, cruise passengers, and crew members, is shown instead.		
The World Bank	World Bank – Fish/Mammal species threatened	2010, 2011	The World Bank is a vital source of financial and technical assistance to developing countries around the world. We are not a bank in the ordinary sense but a unique partnership to reduce poverty and support development. The World Bank Group comprises five institutions managed by their member countries. Fish species are based on Froese, R. and Pauly, D. (eds). 2008. Threatened species are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known.	2010, 2011	http://data.worldbank.org/indicator/EN.FSH.THRD.NO http://data.worldbank.org/indicator/EN.MAM.THRD.NO

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			Mammal species are mammals excluding whales and porpoises. Threatened species are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known.		
The World Bank	World Bank – Climate Change Knowledge Portal	2012	The World Bank is a vital source of financial and technical assistance to developing countries around the world. We are not a bank in the ordinary sense but a unique partnership to reduce poverty and support development. The World Bank Group comprises five institutions managed by their member countries. The World Bank Climate Change Knowledge Portal reports monthly data since 1900 on temperature and precipitation for each world nation	1900-2012	http://sdwebx.worldbank.org/climateportal/index.cfm?page=downscaled_data_download&menu=historical
The World Bank	World Bank - Population, Total	2014	The World Bank is a vital source of financial and technical assistance to developing countries around the world. We are not a bank in the ordinary sense but a unique partnership to reduce poverty and support development. The World Bank Group comprises five institutions managed by their member countries. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their	2012-2013	http://data.worldbank.org/indicator/SP.POP.TOTL

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
			country of origin. The values shown are midyear estimates.		
The World Bank	World Bank - GDP (current US$)	2014	The World Bank is a vital source of financial and technical assistance to developing countries around the world. We are not a bank in the ordinary sense but a unique partnership to reduce poverty and support development. The World Bank Group comprises five institutions managed by their member countries. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates.	2005-2013	http://data.worldbank.org/indicator/NY.GDP.MKTP.CD/countries/PR?display=graph
The World Bank	World Bank - Total greenhouse gas emissions	2015	This data set provides country-by-country greenhouse gas emissions data. Total greenhouse gas emissions in kt of CO2 equivalent are composed of CO2 totals excluding short-cycle biomass burning (such as agricultural waste burning and Savannah burning) but including other biomass burning (such as forest fires, post-burn decay, peat fires and decay of drained peatlands), all anthropogenic CH4 sources, N2O sources and F-gases (HFCs, PFCs and SF6). Source:	1970-2012	http://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE

Source (originator)	*Data Set Title*	*Publication Date*	*Abstract*	*Data Year(s)*	*URL*
			European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR), EDGARv4.2 FT2012: http://edgar.jrc.ec.europa.eu/		
The World Bank	World Bank - Methane emissions	2015	This data set provides country-by-country methane (CH4) emissions data. Methane emissions are those stemming from human activities such as agriculture and from industrial methane production. Source: European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR): http://edgar.jrc.ec.europa.eu/	1970-2012	http://data.worldbank.org/indicator/EN.ATM.METH.KT.CE
The World Bank	World Bank – Nitrous oxide emissions	2015	This data set provides country-by-country nitrous oxide (NoX) emissions data. Nitrous oxide emissions are emissions from agricultural biomass burning, industrial activities, and livestock management. Source: European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR): http://edgar.jrc.ec.europa.eu/	1970-2012	http://data.worldbank.org/indicator/EN.ATM.NOXE.KT.CE
The World Bank	World Bank - Improved water source (% of	2015	Access to an improved water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source	1990-2015	http://data.worldbank.org/indicator/SH.H2O.SAFE.ZS

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	population with access)		includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection).		
U.S. Department of Commerce Bureau of Economic Analysis	Gross Domestic Product for U.S. Virgin Islands (USVI), 2013	2014	Estimates of gross domestic product (GDP) for the territory for 2013, in addition to estimates of gross domestic product by industry and compensation by industry for 2012 are presented in this document. These estimates were developed under the Statistical Improvement Program funded by the Office of Insular Affairs (OIA) of the U.S. Department of the Interior. The latest estimates of GDP for 2007 to 2012 are also presented in this release, as well as GDP by industry and compensation by industry for 2007 to 2011.	2007-2013	http://www.bea.gov/newsreleases/rels.htm
U.S. Department of Commerce Bureau of Economic Analysis	Gross Domestic Product for U.S. Virgin Islands (USVI), 2015	2014	Estimates of gross domestic product (GDP) for the territory for 2015, in addition to estimates of gross domestic product by industry and compensation by industry are presented in this document. These estimates were developed under the Statistical Improvement Program funded by the Office of Insular Affairs (OIA) of the U.S. Department of the Interior. The latest estimates of GDP for 2007 to 2014 are also presented in this	2007-2015	http://www.bea.gov/newsreleases/rels.htm

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			release, as well as GDP by industry and compensation by industry.		
U.S. Department of Health and Human Services	National Vital Statistics Reports: Deaths: Preliminary Data for 2011	2012	These are preliminary U.S. data on deaths, death rates, life expectancy, leading causes of death, and infant mortality for 2011 by selected characteristics such as age, sex, race, and Hispanic origin. Preliminary data in this report are based on records of deaths that occurred in calendar year 2011, which were received from state vital statistics offices and processed by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) as of June 12, 2012.	2011	http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf
U.S. Department of Health and Human Services	National Vital Statistics Reports: Deaths: Final Data for 2010	2013	These data represent final 2010 data on U.S. deaths, death rates, life expectancy, infant mortality, and trends by selected characteristics such as age, sex, Hispanic origin, race, state of residence, and cause of death.	2010	http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_04.pdf
U.S.V.I. Bureau of Economic Research-Office of the Governor, 1050 Norre Gade #5 - Charlotte Amalie, U.S. Virgin Islands 00802	U.S. Virgin Islands Annual Economic Indicators	2013	This report provides information on the state of the economy of the US Virgin Islands in support of both public-sector and private-sector decision-making. Information compiled and produced by the Bureau of Economic Research is used in many ways. Government agencies use the Bureau's data for operational planning and is documented for federal grant applications, bond issues, database development, impact analysis and forecasting. Local businesses and prospective investors typically rely on the	1990, 2000, 2002-2012	http://www.usviber.org/publications.htm

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			Bureau of Economic Research information for feasibility analysis to establish new businesses or expand existing ones. Students and other researchers are also regular consumers of our research products.		
U.S.V.I. Bureau of Economic Research-Office of the Governor, 1050 Norre Gade #5 - Charlotte Amalie, U.S. Virgin Islands 00802	U.S. Virgin Islands Annual Tourism Indicators	2013	This report provides information on the state of the economy of the US Virgin Islands in support of both public-sector and private-sector decision-making. Information compiled and produced by the Bureau of Economic Research is used in many ways. Government agencies use the Bureau's data for operational planning and is documented for federal grant applications, bond issues, database development, impact analysis and forecasting. Local businesses and prospective investors typically rely on the Bureau of Economic Research information for feasibility analysis to establish new businesses or expand existing ones. Students and other researchers are also regular consumers of our research products.	1990, 2000, 2002-2012	http://www.usviber.org/publications.htm
U.S.V.I. Bureau of Economic Research-Office of the Governor, 1050 Norre Gade #5 - Charlotte Amalie, U.S. Virgin Islands 00802	U.S. Virgin Islands Annual Economic Indicators - Total Construction Permit Value	2015	This report contains data on the value of construction permits in the USVI.	2013-2014	http://www.usviber.org/Construction14.pdf

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U.S.V.I. Department of Labor	Virgin Islands Local Area Unemployment Rates	2015	Unemployment rates are calculated from Virgin Islands Department of Labor unemployment insurance claims data and the current employment statistics monthly survey of establishments	2009-2015	http://www.vidolviews.org/gsipub/index.asp?docid=430
United States Census Bureau	Census 2000	2002	Summary File 3 contains population and housing data based on Census 2000 questions asked on the long form of a one-in-six sample of the population. Population items include marital status, disability, educational attainment, occupation, income, ancestry, veteran status, and many other characteristics. Housing items include tenure (whether the unit is owner- or renter-occupied), occupancy status, housing value, mortgage status, price asked, and more. In addition to the 50 states and District of Columbia, the U.S. Census Bureau also conducts censuses and surveys in the the United States' Island Areas. Census and survey operations are conducted in cooperation with the governments of the the Island Areas and frequently include modifications to the questionnaires to help the local and federal governments better understand the populations being counted.	2000	http://www.census.gov/main/www/cen2000.html
United States Census Bureau	2010 Census	2011	Summary File 1 shows detailed tables on age, sex, households, families, relationship to householder, housing units, detailed race and Hispanic or Latino origin groups, and group quarters.	2010	http://www.census.gov/2010census/data/

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United States Census Bureau	2008-2012 ACS 5-Year Estimates	2013	The ACS provides information on more than 40 topics, including education, language ability, the foreign-born, marital status, migration and many more. Each year the survey randomly samples around 3.5 million addresses and produces statistics that cover 1-year, 3-year, and 5-year periods for geographic areas in the United States and Puerto Rico.	2012	http://www2.census.gov/acs2012_5yr/summaryfile/
United States Census Bureau	2010 Census American Samoa (AS) Summary File	2013	This summary file contains subject-matter content from the 2010 Census — age (including single years of age), sex, race and ethnicity, household type, relationship, population in group quarters, whether the residence is owned or rented (tenure), and vacancy status among other social, economic, housing, and demographic characteristics.	2010	https://www.census.gov/2010census/news/press-kits/island-areas/island-areas.html
United States Census Bureau	2010 Census Virgin Islands (VI) Summary File	2013	This summary file contains subject-matter content from the 2010 Census — age (including single years of age), sex, race and Hispanic or Latino origin, household type, relationship, population in group quarters, whether the residence is owned or rented (tenure), and vacancy status among other social, economic, housing, and demographic characteristics.	2010	https://www.census.gov/2010census/news/press-kits/island-areas/island-areas.html
United States Census Bureau	2009-2013 ACS 5-Year Estimates	2014	The ACS provides information on more than 40 topics, including education, language ability, the foreign-born, marital status, migration and many more. Each year the survey randomly samples around 3.5 million addresses and produces statistics that cover 1-year, 3-year, and 5-	2013	http://www2.census.gov/acs2013_5yr/summaryfile/

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			year periods for geographic areas in the United States and Puerto Rico.		
United States Census Bureau	Building Permits Survey	2015	Data collected include number of buildings, number of housing units, and permit valuation by size of structure. This survey covers all places issuing building permits for privately-owned residential structures. Over 98 percent of all privately-owned residential buildings constructed are in permit-issuing places.	2004-2014	http://www.census.gov/construction/bps/stateannual.html
United States Census Bureau	Quarterly Workforce Indicators	2015	The Quarterly Workforce Indicators (QWI) are a set of economic indicators including employment, job creation, earnings, and other measures of employment flows. The QWI are reported using detailed firm characteristics (geography, industry, age, size) and worker demographics information (sex, age, education, race, ethnicity). QWI data are available through the following access tools:	2013-2015	http://lehd.ces.census.gov/data/
United States Census Bureau	County Business Patterns	2014	County Business Patterns (CBP) is an annual series that provides subnational economic data by industry. This series includes the number of establishments, employment during the week of March 12, first quarter payroll, and annual payroll.	1998-2012	http://www.census.gov/econ/cbp/
US Geological Survey; National Water Information System	USGS Water Data for the Nation	2017	The U.S. Geological Survey's (USGS) National Water Information System (NWIS) is a comprehensive and distributed application that supports the acquisition, processing, and long-term storage of water data. USGS Water Data	1900-2017	https://waterdata.usgs.gov/nwis

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			for the Nation Site serves as the publicly available portal to a geographically seamless set of much of the water data maintained within NWIS. USGS Water Data for the Nation Site provides access to water data from over 1.5 million sites in all 50 States and additional border and territorial sites. The water data available via this site have been acquired as part of the USGS investigations of the occurrence, quantity, quality, distribution, and movement of the surface and underground waters that constitute the Nation's water resources.		
US Geological Survey; Water Use in the United States	Estimated Use of Water in the United States: County-Level Data	2010	These data files present water-use estimates by county for the United States, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands which support the State-level water-use estimates published in USGS Circular 1405, Estimated Use of Water in the United States in 2010. All States provided estimates for public supply, domestic, irrigation, livestock, aquaculture, industrial, mining, and thermoelectric power water use. All States also provided estimates of public supply deliveries for domestic use. All States have estimates of the total population served by public supply and how many people consume each type of water (groundwater, surface water, self-serviced). States optionally may have estimated public supply population	2010	http://water.usgs.gov/watuse/data/2010/index.html

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			served by groundwater and surface water. All States will have estimates of total irrigation. States optionally may have estimated subtotals for crop irrigation and golf-course irrigation. No consumptive-use data were collected nationally for any of the categories for 2010. No commercial water-use data were collected nationally for 2010. No wastewater release data were collected nationally for 2010. No hydroelectric power instream use data were collected nationally for 2010. Public-supply deliveries for commercial, industrial, and thermoelectric power were not collected nationally for 2010.		