PACIFIC ISLANDS FISHERIES SCIENCE CENTER

Understanding Hawai‘i Resource Users’ Knowledge, Attitudes, and Perceptions of Coral Reefs in South Kohala

Cynthia A. Grace-McCaskey

April 2016

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CONTENTS

LIST OF ACRONYMS

AIS	aquatic invasive species
CAP	conservation action plan
CRCP	Coral Reef Conservation Program
DAR	State of Hawai‘i Division of Aquatic Resources
DBEDT	Department of Business, Economic Development, and Tourism
DLNR	State of Hawai‘i Department of Land and Natural Resources
FRA	fish replenishment area
HCRS	Hawai‘i Coral Reef Strategy
KAP	knowledge, attitudes, and perceptions
MMA	marine managed area
MHI	main Hawaiian Islands
NOAA	National Oceanic and Atmospheric Administration
NWHI	Northwestern Hawaiian Islands
OMB	Office of Management and Budget
PASH	Public Access Shoreline Hawai‘i
PIFSC	Pacific Islands Fisheries Science Center
TNC	The Nature Conservancy

INTRODUCTION

The Hawaiian Archipelago extends across the Tropic of Cancer in the north central Pacific Ocean, and is one of the most isolated island groups worldwide. The archipelago consists of 8 large islands to the southeast—the main Hawaiian Islands (MHI)—and more than 120 small islands, reefs, and submerged banks to the northwest—the Northwestern Hawaiian Islands (NWHI). The entirety of the state's residents (approximately 1.4 million persons in 2013; U.S. Census Bureau, 2014) live in the MHI, which are made up of populated, high, volcanic islands with non-structural reef communities, fringing reefs, and barrier reefs. In contrast, the NWHI was designated as a Marine National Monument in 2006, renamed Papahānaumokuākea Marine National Monument in 2007, and currently entry to the Monument is by permit only.

Historically, coral reefs have always been important to the islands' visitors and residents. Coral reef resources provided food, medicines, and building materials for Native Hawaiians, as well as played an important role in social and cultural customs and traditions (Titcomb, 1972; Kirch, 1982). The traditional Native Hawaiian resource management system utilized in-depth knowledge of ocean resources to reduce waste and ensure long-term resource use. Over the last two centuries, however, economic, cultural, and political changes have altered and broken down traditional Native Hawaiian land and water use and management systems (Friedlander, 2004; Jokiel et al., 2011). Wide-scale degradation of nearshore resources likely began 100 to 200 years ago with the settlement of Western populations. Agriculture and livestock grazing became the primary land uses on Oʻahu, Maui, Molokaʻi, and Lanaʻi, which contributed to erosion and sedimentation on nearshore reefs (Gulko et al., 2002). Dredging and the filling in of nearshore reefs for residential, commercial, and military expansion led to continued reef degradation, especially in the last 100 years. Other changes include stream channelization and increased paving of land, which has reduced sediment erosion but increased runoff.

Although MHI coral reefs have suffered from degradation, they continue to be very important to the islands' residents and visitors. They provide habitat for commercial, recreational, and subsistence fishing, and produce world-renowned surfing, snorkeling, and diving locations. Of the islands' 7 million annual visitors, nearly 80 percent engage in marine activities (State of Hawaiʻi, 2010a), and coral reefs are a critical component of the islands' approximately $800 million per year marine tourism industry (Friedlander et al., 2005). Additionally, in 2002, Cesar et al. found that the average annual value of MHI coral reefs was $364 million.

Hawaiʻi Coral Reef Management

The State of Hawaiʻi Division of Aquatic Resources (DAR), under the Department of Land and Natural Resources (DLNR), is the primary agency responsible for coordinating coral reef management efforts in the MHI through consultation with the Coral Reef Working Group, an advisory group made up of various state and federal coral reef management partners. In order to develop a cohesive coral reef management strategy for Hawaiʻi, and with support from the National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Conservation Program (CRCP), DAR developed the Hawaiʻi Coral Reef Strategy (HCRS) (State of Hawaiʻi, 2010a). As part of the development of the HCRS, two priority sites were designated as areas in which site-specific management actions would be focused: (1) Kaʻanapali-Kahekili along the west side of Maui, and (2) the Pelekane Bay-Puakō-Anaehoʻomalu Bay area along the coast of

South Kohala District of Hawai‘i Island (hereafter referred to as the Big Island). In 2010, several 3- to 5-year programs were launched at the sites to implement site-based resource management and planning activities. The main intent of the programs is to develop and test strategies that could ameliorate threats to healthy coral reef ecosystems in each area. The known threats and corresponding response strategies are very similar on Maui and the Big Island.

According to the HCRS (State of Hawai‘i, 2010a), the specific goals of the strategy are:

Goal 1: Coral reefs undamaged by pollution, invasive species, marine construction, and marine debris.
Goal 2: Productive and sustainable coral reef fisheries and habitat.
Goal 3: Coral reef ecosystems resilient to climate change, invasive species and marine disease.
Goal 4: Increased public stewardship of coral reef ecosystems.

The HCRS also identified the following objectives to guide coral reef management activities in the MHI from 2010 to 2020:

1. Reduce key anthropogenic threats to two priority near-shore coral reef sites by 2015 and five by 2020 using ahupua‘a-based management.[1]
2. Prevent new aquatic invasive species (AIS) introductions and minimize the spread of established AIS populations by 2020.
3. Increase the abundance and average size of ten targeted coral reef fisheries species critical to reef health and ecological function by 2020.
4. Designate a sufficient area of marine waters under effective conservation by 2020 to ensure sustainable and resilient coral reef ecosystems.
5. Reduce anchor damage and trampling on coral reefs through the implementation of no-anchor zones, utilization of day-use mooring buoys and other means by 2020.

To help achieve the goals and objectives of the HCRS, between 2010 and 2012, The Nature Conservancy (TNC) facilitated a conservation action planning (CAP) process for the South Kohala District coastline (hereafter referred to as the South Kohala coast) in cooperation with DAR (Fig. 1). The purpose of the planning process was to develop conservation actions “to address known coral reef threats in order to maintain or restore coastal and marine life health for the benefit of people and the environment—before thresholds are crossed from which the system cannot naturally recover” (The Nature Conservancy, 2012, p. 7). Throughout the CAP process, key stakeholders and community members participated in a series of meetings and workshops designed to develop strategies for addressing threats to coral reefs along the South Kohala coast.

[1] According to Impact Assessment, Inc. (2011): “Ahupua‘a are distinct geographic areas, typically bounded by mountain ridges and the ocean. Residents in a given ahupua‘a would typically specialize in the knowledge of upland, shoreline, or offshore resources, and would cooperate to effectively manage and use those resources within and across the various ahupua‘a and moku on a given island. Knowledgeable specialists or konohiki provided guidance to enhance the management and wise use of resources throughout the ahupua‘a.” (p. iv).

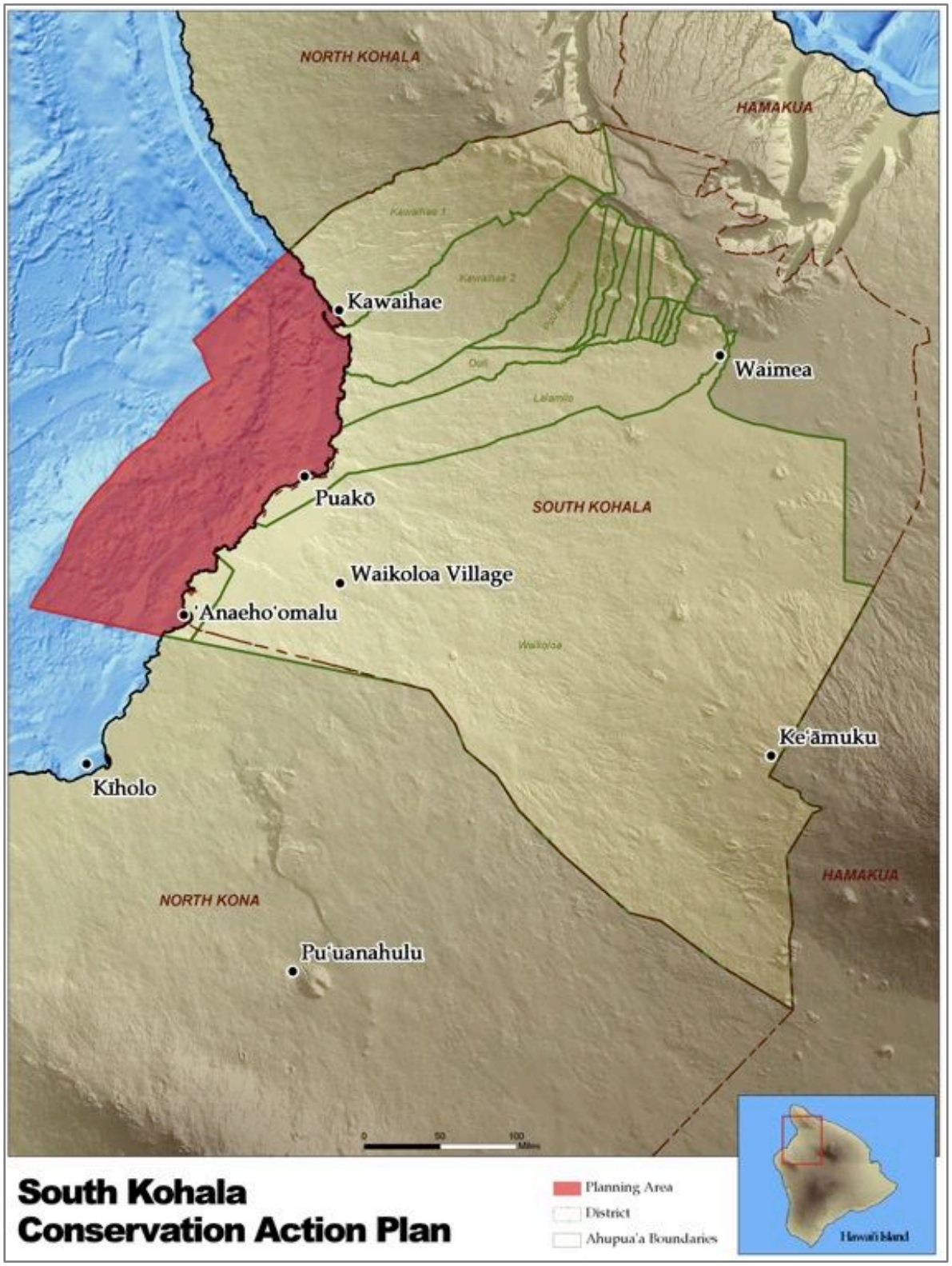

Figure 1. – The South Kohala coral reef priority site. (The Nature Conservancy, 2012)

Impetus for Knowledge, Attitudes, and Perceptions (KAP) Survey

While the perspectives of key stakeholders and community representatives were incorporated into the South Kohala CAP through their participation in a series of meetings and workshops, it was unclear whether these opinions represented those of the broader community of resource users. The survey described in this report emerged from a direct request by Hawai‘i marine resource managers to better understand resource users' knowledge, attitudes, and perceptions (KAPs) regarding coral reef health and management.

Understanding and addressing user perceptions and incorporating local knowledge and experience into planning processes is related to successful management of natural resources (Ban et al., 2013). The CAP process in South Kohala identified the importance of not just a healthy coastal ecosystem but an ecosystem that is "cared for and cherished by an island community guided by the values and traditions of South Kohala" (The Nature Conservancy, 2012, p. 3). Therefore, it is important to understand the perceptions and values of those who comprise this "community," and where these values overlap or conflict. Also, practically speaking, with limited ability to enforce regulations in the marine environment, including affected community members in regulatory decisions can increase compliance (Charles et al., 2007).

Although the initial South Kohala CAP was completed in September 2012 (see The Nature Conservancy, 2012), the plan was designed to be adaptive in nature and subject to future refinements as the plan's conservation actions are implemented and their effectiveness assessed. The KAP survey data presented here can be used to refine the CAP and develop management actions that are effective, implementable, and that address concerns of the greater community. Additionally, the survey can be repeated in the future to gauge if resource users' KAPs toward coral reef health and management in South Kohala change after management strategies have been implemented.

It should be noted, however, that the goal of the survey was not exhaustive representation of the KAPs of all persons who reside in or frequent the South Kohala coastline; nor was the goal to accurately document the KAPs of specific resource user groups, such as fishermen or scuba divers. Rather, the goal was to develop a generalized understanding of KAPs typically held by a broad range of resource users of the South Kohala coastline. Given available time and resources, an intercept survey design was utilized. Because this approach did not result in a sample equally representative of the various user groups who utilize and are dependent upon the South Kohala coastline and marine resources, analyses comparing such groups are not included in this report.

BACKGROUND

The survey described in this report was conducted along various shoreline areas of the South Kohala District of the Big Island. In this section, we provide a brief descriptive overview of the physical and human context in which the research was conducted. We assert the particular importance of historical context inasmuch as this relates directly to human and physical environmental conditions and issues in the present, including factors and issues addressed in the survey.

Physical Environment

Geography

The northwest portion of the Big Island (Fig. 2) is known as "Kohala," or "cherished land" in Hawaiian. The landscape is dominated by the Kohala mountain range, the eroding remnants of a large shield volcano that last erupted approximately 122,000 years ago (Wolfe and Morris, 1996). North Kohala and South Kohala Districts are political-geographic designations which generally follow the moku (traditional political-economic land divisions) boundaries developed by early Hawaiians. South Kohala encompasses some 343 square miles of land, most of which is sparsely populated. Waimea, the largest town in the district, was home to 9,210 persons at the

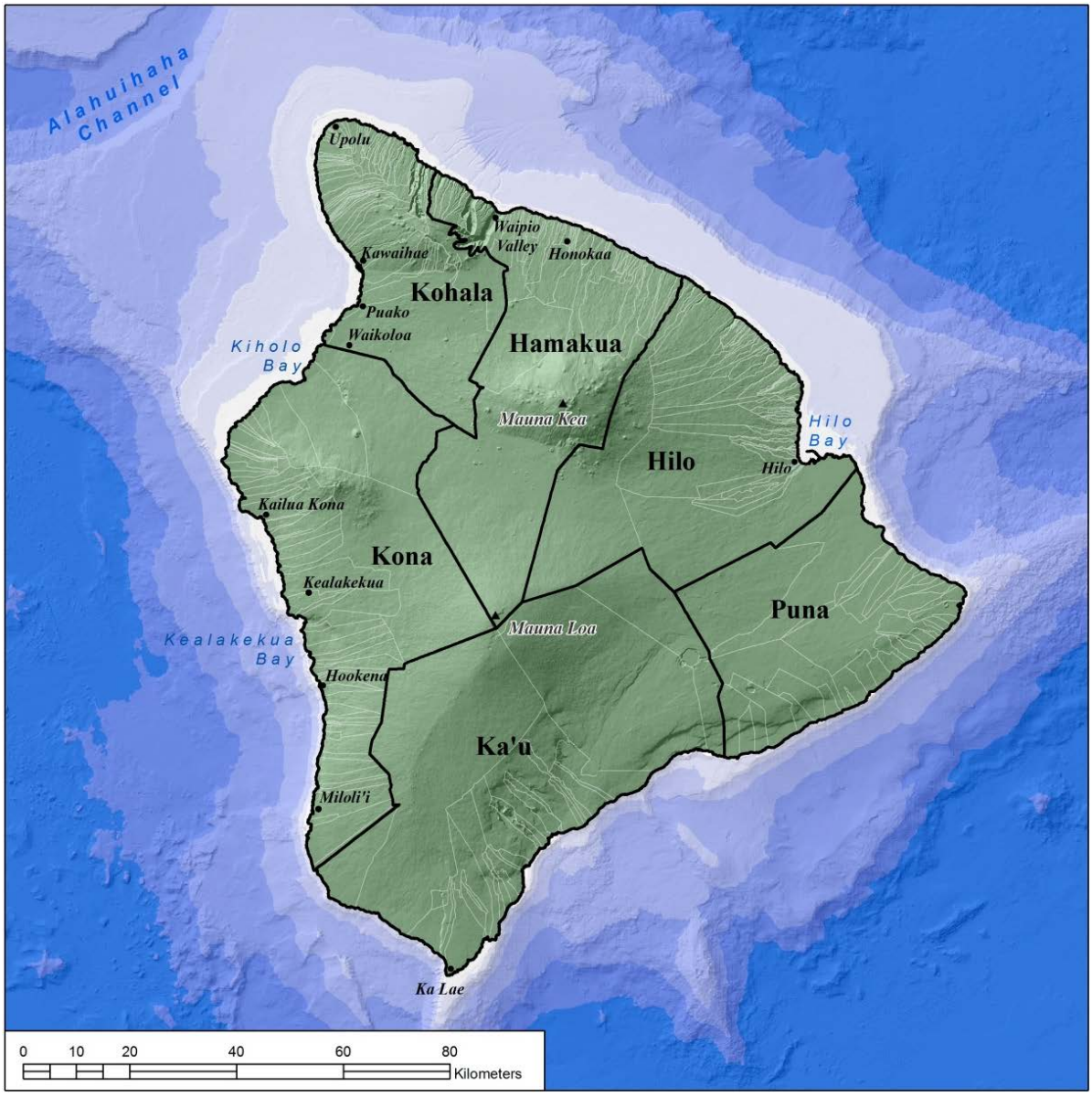

Figure 2. – Map of the Big Island. Map courtesy of B. Dieter.

time of the 2010 Census (U.S. Census Bureau, 2013). Numerous resort facilities are located along the coast, and the mountain region includes lands associated with Pu‘u O Umi Natural Area Reserve, Kohala Forest Reserve, and Parker Ranch. The Kailua-Kona airport isapproximately 25 miles from Hapuna Bay, which is situated near the mid-point of the district’s coastal zone. Honolulu is located roughly 170 air miles to the northwest.

Geology

The Kohala region was formed by lava flowing from Kohala Volcano, the second oldest of the shield volcanoes that comprise the Big Island (McDougall and Swanson, 1972). Many upland portions of South Kohala are overridden by lava from Mauna Kea (Fig. 3), while certain coastal and offshore portions are underlain by the ancient Mahukona Volcano, which subsided into the Pacific about 435,000 years ago (Clague and Moore, 1991; Fletcher et al., 2002). A succession of coral reefs subsequently grew and receded on this platform in conjunction with fluctuating sea levels late in the Pleistocene Epoch (Jupiter, 2002). Although new lava has not reached the South Kohala region for many millennia, the landscape remains very rugged and difficult to traverse. Elevation ranges from sea level to upwards of 3,000 feet. The 5,489-foot summit of Kohala Volcano is located in North Kohala.

Figure 3. – Photo of Anaeho‘omalu coast showing network of 1859 Mauna Loa lava flows. (Fletcher et al., 2002)

Climate

South Kohala is located on the leeward side of the Big Island. A rain-shadow effect (cf. Lau and Mink, 2006) on the downwind side of the Kohala range makes for a climate that is relatively warm, arid, and windy. The Kawaihae Harbor area receives an average of less than ten inches of rain each year, making it the most arid region in the state (Giambelluca et al., 2013). The average annual temperature at Puʻukohola Heiau National Historic Site, directly adjacent to Kawaihae Harbor, is about 77° F, with little variation over the course of the year (Hoover and Gold, 2006). Temperatures tend to decrease and rainfall tends to increase with elevation throughout the South Kohala region (cf. Shade, 1995).

Oceanography

Ocean circulation along the western coastline of the Big Island is influenced by energetic mesoscale cyclonic and anticyclonic eddies between 50 and 150 km in diameter (Patzert, 1969; Lumpkin, 1998). Cyclonic eddies in the region are forced by northeast trade winds interacting with surface waters in ʻAlenuihāhā Channel (Lumpkin, 1998; Dickey et al., 2008). Such eddies are thought to bring nutrient-rich waters from the depths to the euphotic zone (Lobel and Robinson, 1983), and Limouzy-Paris et al. (1997) assert that such nutrients may enhance the recruitment and survival of various coral reef fish species.

Much of the western coastline of the Big Island is protected by the remainder of the island chain from direct exposure to long-period swells generated by winter storms in the North Pacific. However, sufficiently heavy swell emanating from the north, northwest, west, and southwest can affect South Kohala and other portions of the western coastline, with occasionally damaging results (cf. Fletcher et al., 2002). Dollar and Grigg (2004) assert that the extent of impacts to coral reefs resulting from natural forces such as large swell and storm events tends to exceed that generated by human activities along the region's coastline and other swell-exposed parts of the Hawaiian Islands.

Nearshore Habitats and Ecosystems

The South Kohala coastline extends from near Kawaihae in the north to Anaehoʻomalu Bay in the south. Erosive forces acting on lava fields along the shoreline area have created many small bays, coves, and pocket beaches throughout the region. Larger sandy beaches have formed on the foreshore of bays such as Ohiki, Anaehoʻomalu, Waiulua, and Hapuna. Many of the more readily accessible coves, points, and beaches have become popular recreational areas, and four-wheel drive vehicles have improved accessibility in recent decades. Shoreline fishing, reef gleaning, spearfishing, sunbathing, swimming, and surfing are popular recreational uses. Numerous embayments are surrounded by steep though minimally elevated rocky headlands, such as at Kaiwi and Lulahala Points (Fletcher et al., 2002). Certain areas, such as around Anaehoʻomalu, Honokaʻope, and Puakō Bays, are well-developed, and numerous resorts and condominiums are situated here. Most resorts include expansive golf courses which are continually maintained with freshwater in this arid region (Fig. 4).

Figure 4. – Mauna Kea Resort golf course. (Photo courtesy of R. Oram.)

Of particular significance from an ecological perspective, numerous anchialine ponds are located in the South Kohala area. These consist of brackish waters underlain by a marine layer linked to the ocean through subterranean lava tubes. In the United States, such ponds or pools are unique to the leeward coastlines of Maui and the Big Island. Maciolek and Brock (1974) describe "open" and "closed" anchialine ponds. Open ponds demonstrate "occasional or restricted surface connections" to the ocean, while closed ponds are linked only below the surface. Both types of ponds contain numerous species of marine snails, shrimps, and mollusks. Various species of puhi (eels) and fish are also present, the latter including: ʻoʻopuʻakupa (*Eleotris sandwicensis* or stream goby); ʻaholehole (*Kuhlia sandvicensis* or Hawaiian flagtail), manini (*Acanthurus triostequs* or convict tang), and ʻamaʻama (*Mugil cephalus* or mullet) (National Park Service, 2014a). Two shrimp species – ʻopaeʻula (*Halocaridina rubra*) and a red alpheid shrimp (*Metabetaeus lohena*) – occur only in anchialine ponds (Maciolek and Brock, 1974). Brock et al. (1987) report that some 130 anchialine ponds were destroyed in 1985 during the initial phase of development of Waikaloa Resort, although a number of adjacent ponds were concurrently set aside as the Waikaloa Anchialine Pond Preservation Area.

Human Environment

Pre-Contact and Contact Period History

Kohala is one of the six moku (traditional political-economic districts) of the Big Island. Based on the work of Cordy (2000) in the Kohala region, the contemporary boundary between North and South Kohala may have been recognized even during prehistoric times. Although Waimea and other upland areas are thought to have been only moderately productive for crops such as

kalo (taro) and sweet potato, people have inhabited and farmed the region since at least 1200 A.D., with the most intensive agriculture occurring between 1400 and 1800 A.D. (Vitousek et al., 2004; Ladefoged and Graves, 2008). Cuddihy and Stone (1990) assert that wetland terracing and dryland farming methods, including clearing of forested land and alteration of stream flow, led to significant ecological changes in the Kohala region and other parts of the archipelago well prior to contact with Europeans.

Some 8,679 persons were enumerated as South Kohala residents at the time of the first Hawai‘i census in 1832. Most of the population resided near present-day Waimea, and along the coast at Puako and Kawaihae (Ellis, 2004). Inland portions of Kawaihae were also consistently inhabited (cf. Langlas, 1994), and dispersed settlements were located around various coastal anchialine pools and fishponds (Cordy, 2000). Fishponds were a particularly important source of food for indigenous Hawaiians. The fish pond at Kiholo is known to have been constructed by affiliates of Kamehameha I (Ellis, 2004). Doyle (1953) asserts that various forms of fishing were practiced from Kawaihae. Kawaihae clearly was of great significance to ancient Hawaiians, as various large heiau (temples) were constructed there (Cordy, 2000), and Pu‘ukohola Heiau at Kawaihae is closely associated with Kamehameha’s rise to power (National Park Service, 2014b).

Economic Production During the Historic Era

Like their counterparts elsewhere in the islands, Native Hawaiians residing in the South Kohala region experienced a variety of changes throughout the 19th century and beyond. Most notable among these were: the introduction of diseases for which there was little immunity; new religious ideas brought by missionaries; the establishment of a cash-based economy and new technologies; annexation to the United States as a territory in 1898 and statehood in 1959; and the oppression of indigenous rights to reside in certain areas and to pursue and use natural resources in an unimpeded fashion (cf. Bishop, 1826; Clark and Kirch, 1983).

The physical environment was also increasingly altered during the mid-1800s. For example, sandlewood was harvested in great quantities and large tracts of land became subject to the grazing effects of cattle. These activities fundamentally altered upland forest ecosystems (see Koebele, 1900). By the mid-1800s, salt, sandlewood, cattle, and potatoes were the principal objects of commerce in the South Kohala region (Greene, 1993). Kawaihae was an important point of transshipment of goods and people throughout much of this era. A large cattle ranch was gradually established in the inland regions surrounding Waimea after seafarer William Parker became friendly with King Kamehameha I in the 1820s by corralling feral bulls that had previously been gifted by explorer George Vancouver (American Cattlemen, 2012). Parker later married the King’s granddaughter, was deeded a small parcel of land, and expanded his herds and acreage to supply the whaling industry with beef and other products (Belt, Collins, and Associates, Ltd., 1967). During World War II, Waimea and adjacent ranch lands were used to house and train upwards of 40,000 American troops (Bryson, 1995), with effects on the physical environment – including the deposition of unexploded ordinance (Dayton, 2004). Parker Ranch is currently the second largest acreage of privately owned land in Hawai‘i and the fifth largest cow-calf operation in the nation (Holt, 2009). The ranch is also a founding member of the Kohala Watershed Partnership, which is currently working to minimize threats to forested watersheds in the Kohala region.

Kō (sugar cane) was brought to Hawai‘i by Polynesian voyagers and was found to grow well in many parts of the islands (Sohmer and Gustafson, 1987). Affluent Kohala residents began to invest in commercial sugar production as early as the 1860s, and by 1889, sugar cane was being cultivated on 2,140 acres in the Kohala region (Maclennan, 1983). Irrigation systems enhanced production while altering the landscape, stream flow, and aquifer dynamics in the area. A significant sugar processing operation was based at Puakō during the early part of the 20th century, and extensive quantities of raw sugar were shipped from Kawaihae over the course of time (Kumo Pono Associates, 1999). Because processing of cane required extensive quantities of water and firewood, early sugar production altered the physical environment in a variety of ways (cf. Cheesman, 2004). Extensive use of fertilizers, beginning in the late 19th century (Kuykendahl, 1967), and later chemical herbicides, also generated various environmental impacts, including alteration of groundwater chemistry in certain locations. Many residents of South Kohala worked for the Kohala Sugar Company until its closure in 1975. Work on cattle ranches and small farms provided a source of income and supplemental foods for many South Kohala residents during much of the 20th century (Fukunaga, 1975), though some also traveled to service sector jobs in Kailua-Kona.

Increasing Importance of Tourism

The decline of the Kohala sugar industry (cf. Page et al., 2007) occurred during a period of increasing attention to the prospects for tourism along the coastline. The Mauna Kea Beach Resort opened in 1965, development of the Mauna Lani Resort began in 1972, and development of resorts at Waikaloa began in the early-1980s (Hammes, 1994; U.S. Army Corps of Engineers, 1985). These and other Kohala resorts have gradually expanded to include numerous hotels, condominiums, and golf courses. Resort projects along the West Hawai‘i coastline have often been met with resistance from indigenous residents in relation to potential or actual loss of access rights (cf. Rothstein et al., 1995) and disruption of ancient burial grounds. Construction and operation of resort facilities have generated economic benefits across the region, with concurrent increases in: water usage, wastewater discharge, generation of solid waste, fertilizer and pesticide usage, and runoff from impervious surfaces (areas that water cannot penetrate).

Tourism gained in economic importance across the main islands during the 1980s, and total visitor arrivals increased statewide between 1990 and 2011. An estimated total of 1,174,280 persons visited the Big Island in 1990, and visitation increased by over 15 percent between 1990 and 2010, with 1,318,319 persons visiting the island in 2011; Approximately 84 percent of those persons visited the west side of the Big Island (Department of Business, Economic Development, and Tourism, 2013). The South Kohala coastline continues to be an important destination for island visitors and residents from around the island chain. Resort owners and managers have sought to increase patronage by diversifying available leisure and recreational activities, and most now tend to incorporate awareness of cultural and natural resources into various policies, programs, and signage. Spas, retail stores, and restaurants are numerous in and around the resort communities.

Two commercial ports on the Big Island provide deep draft mooring and freight services. These are located at Hilo and Kawaihae. Kawaihae Harbor is presently undergoing major renovations. These will expand the harbor’s capacity to safely accommodate large transport vessels, with potentially significant implications for the region’s economy (SSFM International, Inc., 2011).

Regional Population Trends

The first full-scale census of Hawai‘i’s population was conducted in 1831, at which time 130,313 persons were enumerated across the main islands, including 45,792 persons on the Big Island (Schmitt, 1977). Decades of declining populations followed, largely in relation to disease and rapid economic change among indigenous residents. Only 16,000 persons were residing on the Big Island at the time of the 1872 census (Schmitt, 1977). Significant growth began to occur late in the century as immigrants arrived to work on plantations around the islands. More than 154,000 persons were living in the state at the turn of the 20th century, with nearly 47,000 residing on the Big Island (Schmitt, 1977). The resident population continued to increase through the first half of the 20th century. Just under one-half million persons were residing in the Territory in 1950, with some 68,350 persons residing on the Big Island at that time (Schmitt, 1977). Between 1980 and 2010, the population of the Big Island doubled from 92,053 to 185,079 residents (U.S. Census Bureau, 2013).

The State of Hawai‘i continues to grow. The estimated statewide population was 1,404,054 persons in 2013 (U.S. Census Bureau, 2014). The rate of growth between the most recent decennial census years (2000 and 2010) reached 25 percent on the Big Island, which made it the most rapidly growing island in the state in population. The South Kohala population grew even more extensively, from 13,131 residents in 2000 to 17,627 residents in 2010, an increase of more than 34 percent (Table 1). Growth notwithstanding, the Big Island remains the least densely populated of all the main islands, with approximately 51 persons per square mile. In South Kohala, most residents live in Waimea, Waikaloa, or Puakō (U.S. Census Bureau, 2014). The 2010 U.S. Census revealed an increase in the total number of households similar to the overall population increase (36.3%), though there was a small increase in the percent of owner-occupied housing units (6.6%).

Other Demographic Conditions and Trends

Table 1 provides additional demographic data for South Kohala. The gender distribution of the region’s population is nearly equal, with a very small increase in the percentage of females from 2000 to 2010. The median age has increased slightly since the 2000 Census, reaching an age of 39 years in 2010. Approximately 25 percent of the population is under 18 years of age, and nearly 12 percent is over the age of 65. In terms of race or ethnicity (alone or in combination with other races), the largest percentage of South Kohala residents identified themselves as white (60.7%) in the 2000 and 2010 censuses. In 2010, 29.1 percent identified themselves as Native Hawaiian, 18.6 percent identified themselves as Filipino, and 13.4 percent identified themselves as Japanese (U.S. Census Bureau, 2014).

Table 1 also includes data regarding the economic characteristics of South Kohala residents. Although the median household income increased by more than 30 percent between 2000 and 2010, both the unemployment rate and percentage of individuals below the poverty level increased. This is largely due to the global economic crisis of the late 2000s, which led to recession in Hawai‘i’s economy, and job and income losses (University of Hawai‘i Economic Research Organization, 2008).

Table 1. – Select demographic trends in South Kohala: 2000 – 2010.

Variable	Year		Change
	2000	2010	
Population	13,131	17,627	34.2%
Population Density (persons per square mile)	37.3	51.3	38.0%
Total Households	4,648	6,335	36.3%
Owner-Occupied	58.9%	65.5%	6.6%
Renter-Occupied	41.1%	34.5%	-6.6%
Gender Distribution			
Female	50.2%	50.8%	0.6%
Male	49.8%	49.2%	-0.6%
Age Distribution			
Median Age (in years)	36.2	39.0	2.8
Under 18	29.1%	25.9%	-3.2%
Over 65	9.0%	11.7%	2.7%
Race/Ethnicity [1]			
White	60.7%	60.7%	0.0%
Native Hawaiian	31.3%	29.1%	-2.2%
Filipino	18.7%	18.6%	-0.1%
Japanese	14.5%	13.4%	-1.1%
Rate of Unemployment	3.3% [2]	9.0% [2]	5.7%
Median Household Income	$51,379 (in 1999)	$69,767 [2]	35.8%
Individuals Below Poverty Threshold	8.5%	9.3% [2]	0.8%

Notes: All data obtained from U.S. decennial census unless otherwise noted (U.S. Census Bureau, 2014); [1] Race or ethnicity, alone or in combination with other races; [2] Data from 2008 – 2012 American Community Survey, 5-year estimates.

Use of the Marine Environment

The South Kohala coastline continues to be used for a variety of food-gathering, recreational, and commercial purposes. Levine and D'Iorio (2011) used a participatory mapping exercise to characterize the nature and spatial distribution of both non-extractive and extractive human activities along the Kohala coastline. Non-extractive activities were determined to occur in much of the coastal zone; these included: camping along the shoreline, charter and private boating, marine mammal viewing, charter and non-charter diving and snorkeling, canoe and kayak paddling, surfing, swimming, and use of jet skis. Extractive activities were found to include: collection of aquarium reef fish, use of gill and throw nets, pole and line fishing, spearfishing, and gathering of limu (seaweed) and other foods and materials that can be found along the South Kohala shoreline (Levine and D'Iorio, 2011).

While golfing opportunities attract many visitors to South Kohala, resort owners and managers have sought to expand their client base by developing various ocean-based recreational activities and programs. These include: whale watching and spinner dolphin tours (cf. Glazier, 2007), charter fishing and sightseeing cruises, snorkeling and scuba diving, sea kayaking, and stand-up paddle board lessons.

With regard to boat-based fishing activities in the South Kohala region, small-boat facilities at Kawaihae Harbor have been used by captains and crew of small fishing vessels for many years. Local boat fishermen often operate in the pelagic zone, but at times also pursue bottomfish and reef fish species closer to shore. In 2011, 63 residents of South Kohala held commercial fishing licenses.

Harbor facilities are currently being expanded by the State of Hawai‘i to accommodate a larger number of small fishing vessels than has historically been the case (SSFM International, Inc., 2011). Although many were not being used at the time, Glazier (1999) counted a total of 54 small boat slips and/or moorings at Kawaihae Harbor in the late 1990s. Vessel operators based at Honokohau and other places of mooring in the Kailua-Kona area also occasionally pursue various pelagic, reef, and bottomfish species along the South Kohala coastline. These include operators of charter fishing businesses, some of which also provide opportunities for ocean wildlife scenic viewing, diving and snorkeling, and scenic cruising.

Although little research has been conducted to examine the nature and extent of wild food harvesting along the shoreline and nearshore zones of South Kohala, basic observation makes clear the importance of these activities for certain groups of residents. Extensive local knowledge and a variety of techniques and gears are used in the harvesting process. The latter include various configurations of bait or artificial lures used with rod and reel, Hawaiian slings, spears, throw nets, small gill nets, and other gear. Octopus are harvested manually by divers, opihi are pried from rocks and coral using a sharp implement, and limu is collected by hand in the shallows. The resulting foods contribute substantially to local household economies and are often consumed during holidays and cultural celebrations. Food-gathering and recreational motives for fishing tend to overlap in this and other regions of Hawai‘i (Maly and Maly, 2003; Western Pacific Regional Fishery Management Council, 2009).

Dominant Resource Management Strategies

Responsibility for coastal and marine resources in South Kohala is split between several agencies. DAR is the primary agency responsible for the management of living marine resources within three miles of the coastline. Throughout the archipelago, DAR uses several tools to manage marine resources, including various forms of marine managed areas (MMAs), rotational or season closures, restrictions on fishing gear or methods, size and bag limits on certain species, and regulations restricting the harvest of certain species.[2]

Four MMAs are located in the South Kohala region. These are: (1) Kawaihae Harbor Fisheries Management Area, (2) Waialea Bay Marine Life Conservation District, (3) Puakō Bay and Puakō Reef Fisheries Management Area, and (4) Puakō-Anaehoʻomalu Fishery Replenishment Area. Each MMA has its own set of regulations restricting certain types of fishing or the use of certain gears.

Other agencies that play important roles in the management and use of South Kohala's marine resources include (but are not limited to): DLNR's Division of Boating and Ocean Recreation, Office of Conservation and Coastal Lands, and Division of Conservation and Resources Enforcement; the State Coastal Zone Management Program under the State of Hawaiʻi's Office of Planning; and the West Hawaiʻi Fishery Council. Additionally, federal bodies that are involved in or consulted regarding marine resource management in the region include NOAA Fisheries, NOAA's Coral Reef Conservation Program, and the Western Pacific Regional Fishery Management Council.

Salient Issues

Development of the South Kohala Coast

As mentioned previously, tourism plays an important role in the Big Island's economy. Reflecting the state-wide trend, South Kohala developed as a top tourist destination throughout the 1980s and 1990s. Both total resident population and the number of visitors to South Kohala have increased greatly over the past several decades. Mauna Kea Resort, Mauna Lani Resort, and the Waikoloa Beach Resort are the three main resort areas situated along the South Kohala coast, and they accounted for 40 percent of all hotel rooms in Hawaiʻi County in 2008 (The South Kohala Community, 2008). Each resort property has several large-scale, high-end hotels, shops, restaurants, and residential units, with new development projects constantly being proposed.

Although these resorts are some of the Big Island's largest employers and generate economic benefits throughout the County, residents have raised concerns regarding the speed and manner in which the development has occurred, as well as the impact the development and large numbers of visitors have on the region's resources (The South Kohala Community, 2008; Hawaiʻi Tourism Authority, 2006; State of Hawaiʻi, 2006). Recent planning efforts, such as the South Kohala Community Development Plan (The South Kohala Community, 2008), use a

[2] Readers are referred to the DAR website (http://dlnr.hawaii.gov/dar/) for a complete description of Hawaiʻi fishing regulations.

community-based approach to ensure development plans stress the importance of managing the district's growth while ensuring the infrastructure and government services are in place to accommodate the increasing number of residents and visitors, and that the cultural and natural resources are preserved for future generations. Ultimately, it is a matter of balancing the economic benefits from increasing tourism with residents' quality of life and the health of the resources (Hawai‘i Tourism Authority, 2006; State of Hawai‘i, 2006).

Land-based sources of pollution. Coastal development, like that occurring in South Kohala, can contribute to the amount of sediment, nutrients, and other pollutants that are transported in surface-water runoff and by groundwater seepage into coastal waters (State of Hawai‘i, 2010a). This can cause disease and mortality of coral reef associated species, alter sensitive ecological functions, and disrupt growth, reproduction, and larval settlement of corals (Fabricus, 2005; International Society for Reef Studies, 2004). It is likely that sediment is the leading land-based pollutant causing alteration of reef community structure in the MHI (Friedlander et al., 2008).

Of particular concern in South Kohala is runoff of sediment from coastal development projects and fertilizers and other chemicals from the region's resorts and golf courses. Development activities, such as clearing vegetation, grading, removing and compacting soil, and adding impervious surfaces, increase polluted runoff. Stormwater collects sediment, nutrients, and chemical contaminants as it flows across parking lots, construction sites, and other lands on its way to coastal waters (Stewart et al., 2011).

In South Kohala, Pelekane Bay in particular has received a great deal of attention. Historically, it has been subjected to major alterations, including dredge and fill operations during the construction of the adjacent Kawaihae Harbor in 1959 and the construction of breakwaters and a small boat harbor shortly after (Stender et al., 2014). In 1998, the State of Hawai‘i identified Pelekane Bay and the adjacent watershed as one of the state's watersheds in most urgent need of restoration in Hawai‘i's Unified Watershed Assessment (State of Hawai‘i, 1998). Additionally, Pelekane Bay is also on the State of Hawai‘i Department of Health's 2004 Section 303(d) List of Impaired Waters due to high levels of turbidity from sediment runoff and accumulation (State of Hawai‘i, 2004; Group 70 International, Inc., 2007). As a result, many studies and projects have been conducted in Pelekane Bay and the adjacent watershed by various agencies and organizations, including the National Park Service (Hoover and Gold, 2006), The Nature Conservancy (Minton et al., 2011), NOAA Fisheries, and the University of Hawai‘i (DeMartini et al., 2013). Additionally, the Pelekane Bay Watershed Restoration Project has been working since 2009 to improve the condition of the watershed and to restore Pelekane Bay's coral reefs by reducing land-based sediment inputs. A watershed management plan has also been developed for the Wai‘ula‘ula Watershed, which lies to the north of Pelekane Bay and has two main tributaries that empty into Kawaihae Bay. The Wai‘ula‘ula Watershed Management Plan was developed in 2005 and updated in 2010 (Stewart et al., 2011).

Coastal access. Recent planning efforts (The South Kohala Community, 2008; Hawai‘i Tourism Authority, 2006) have also highlighted the need to ensure that South Kohala residents and visitors have sufficient access to beaches, coastal areas, and Native Hawaiian cultural sites. The State of Hawai‘i has supported public access to and use of the shoreline area for many years, a policy reaffirmed by the landmark 1995 Hawai‘i State Supreme Court case (Rothstein et al.,

1995) referred to as Public Access Shoreline Hawai‘i (PASH). Additionally, the Hawai‘i State Constitution, statutes, and case law guarantee shoreline access for Native Hawaiian traditional and customary gathering practices (State of Hawai‘i, 2013). Although these laws are in place, such a policy is not always enforceable. Private coastal property landowners may not allow the public to access the adjacent coastline, or may make it difficult for them to do so. Additionally, while many local residents may access the beach through resort areas to take advantage of well-maintained facilities, some resorts prevent large numbers of non-hotel guests or non-residents from visiting the beaches at their properties by limiting the number of public parking spots available, or by requiring them to register for special permits at their security gates (Fig. 5). The South Kohala Community Development Plan (The South Kohala Community, 2008) emphasizes community participation in future land use decisions that will ensure public access is available to the District's cultural and recreational sites.

Figure 5. – Example of security gate the public must go through in order to access public beaches adjacent to private resorts and communities. (Photo courtesy of C. Grace-McCaskey.)

User Conflicts Related to Fishing

West Hawai‘i (including South Kohala) has been a site of conflict around conservation and management issues since at least the 1970s, especially with respect to aquarium fishing. While commercial aquarium collectors have been taking fish from Hawaiian waters for at least 60 years, the industry started to expand in the 1960s with the introduction of commercial jet service to Hawai‘i (Walsh et al., 2004). This meant that exporters could ship fish quickly and regularly

to the U.S. mainland. Much of this effort was focused on O‘ahu, and in 1973, public concern regarding the fishery caused the Hawai‘i Division of Fish and Game (precursor agency to DAR) to require monthly collection reports. The focus of the aquarium fishery switched from O‘ahu to the Big Island in the 1980s and increased throughout that decade and the 1990s. By 2003, the majority of the fish caught in Hawai‘i were caught in waters off the Big Island, and nearly all of that (98.6%) was caught in West Hawai‘i (Walsh et al., 2004). Throughout the 1980s and 1990s, public concern about declines in reef fish populations due to the expansion of the aquarium fishery continued to grow. Much of the opposition came from the region’s recreational dive tour operators, based primarily on perceived declines in reef fish populations at popular dive sites (Capitini et al., 2004). However, there was little scientific evidence at the time on which to base management decisions. Specific studies on the potential impacts of the aquarium fishery began the late 1990s, and Tissot and Hallacher (2003) found that the abundance of seven out of ten of the aquarium species surveyed was lower in sites where collecting was known to occur compared with sites where collecting was prohibited.

In response to continued public concern over the effects of aquarium fishing and successful lobbying by a local grassroots organization (the LOST FISH Coalition), the state legislature passed a bill in 1998 to improve the management of fishery resources in West Hawai‘i (Walsh et al., 2004). A significant part of the bill, which became Act 306, involved improving management of the aquarium industry by protecting a minimum of 30 percent of the West Hawai‘i coastline through the establishment of Fish Replenishment Areas (FRAs), and reducing conflict among the region’s stakeholder groups. FRAs are marine reserves in which aquarium fish collecting is prohibited. Act 306 also authorized the West Hawai‘i Fisheries Council, a volunteer community advisory group that was formed to provide local input and guidance regarding the design of the FRAs. The proposed management plan established a network of nine FRAs which, when combined with pre-existing protected areas, closed 35.2 percent of the West Hawai‘i coastline to aquarium fishing. Notably, 93 percent of the testimony received at a DAR public hearing was in favor of the proposed management plan (Capitini et al., 2004). The plan was subsequently approved by the Governor, and the FRAs were officially closed to aquarium reef fish collectors on December 31, 1999. One of the reserves, Puakō-Anaeho‘omalu FRA, lies along the South Kohala coast.

Although biological studies have shown significant increases in aquarium reef fish abundance inside the West Hawai‘i FRAs (Williams et al, 2009; State of Hawai‘i, 2010b), Stevenson and Tissot (2013) found that aquarium fishermen and dive operators were uncertain regarding the ability of the FRA network to alleviate conflict between the groups, and antagonistic encounters were still being reported. Beginning in the early 2000s, a new set of rules governing fishing in West Hawai‘i were developed through an extensive multi-stakeholder process. While much of the focus was on the management of aquarium collection, discussions increasingly included other aspects of reef fish fishing. Among other changes, the two most controversial rules include a “white list” of 40 fish species permitted for aquarium take with size and bag limits on three of these species (no other fish may be collected for aquarium use), and a ban on spearfishing with scuba diving gear. At the time the survey described here was being administered, the rules package was going through a series of public hearings and deliberation at the State of Hawai‘i Board of Land and Natural Resources. The rules package was signed by the Governor in December 2013, several months after survey administration was completed.

KNOWLEDGE, ATTITUDES, AND PERCEPTIONS SURVEY

Survey Design

Social scientists at NOAA's Pacific Islands Fisheries Science Center (PIFSC) developed the survey, "Knowledge, Attitudes, and Perceptions of Hawa'i's South Kohala Coral Reef Priority Site," in consultation with Hawai'i coral reef managers, including HDAR and TNC. Based on these consultations, the survey was developed to address several key areas:

1. Site use patterns;
2. Knowledge about site conditions (including level of satisfaction with site conditions and perceptions of whether site conditions are improving, staying the same, or declining);
3. Perceptions of potential threats to coral reef resources in the site;
4. Attitudes toward potential coral reef and watershed management strategies;
5. Attitudes toward marine managed areas (MMAs);
6. Perceptions of benefits and services received by coral reefs in the site.

To ensure the survey could address a large number of topics but remain relatively short and quick for respondents to complete, the majority of the questions were developed as multiple choice or Likert scale questions. However, for several questions, additional space was provided for participants to write in additional comments regarding survey topics.[3] Once the survey was developed, it was vetted through appropriate processes with NOAA's Office of Management and Budget (OMB), and posted to the Federal Register for public comment. Based on constructive comments received as a result of the Federal Register notice, the survey was revised and received final OMB clearance at the end of 2012.[4]

Survey Administration

Given the level of fiscal and human resources available to conduct the research, and the extensive geographic area to be covered by the effort, it clearly was not possible to consult with an exhaustive sample of shoreline users. Rather, the research effort was designed to allow for documentation of the range of relevant knowledge, attitudes, and perceptions held by persons who currently live in the South Kohala region and/or who frequent the shoreline on a regular basis.

Big Island-based contractor Mehana Consulting was hired to pilot test and administer the written surveys along the South Kohala shoreline. A total of 202 surveys were subsequently completed between November 9, 2012 and April 19, 2013. An intercept method was used to contact, screen, and administer the survey to knowledgeable shoreline users aged 18 and over at 18 access points along the coast of the South Kohala priority site (Fig. 6). This site spans over 15

[3] Although some respondents did provide additional comments to these open-ended questions, the number of responses was very low. Additionally, quite often the comments were not directly related to the questions being asked. Therefore, while the comments may be able to provide qualitative background information for future research in the South Kohala region, they were not analyzed or included in this report.
[4] See Appendix 1 for survey instrument.

miles of coastline – from Kailapa Hawaiian Homesteads in the north to Anaehoʻomalu Bay in the south (Fig. 7).

Surveys were conducted during 10 weekend days or holidays and 24 week days over the course of the 23-week field effort. Intercept sites were chosen based on likely variability in user characteristics as these relate to type of shoreline being used, type of access point, type of activity being undertaken, time of day, and time of week (Table 2). Survey work was conducted at each of the area's 18 coastal access points at least once, and up to five times. On average, each site was visited 2.6 times and 11.2 surveys were collected per location. Sunrise and sunset times varied throughout the survey period. Therefore, the determination for "early-day" surveying was from sunrise until about 9 A.M. and "late-day" surveying was any time from 3 P.M. or later (or roughly 3 hours ± sunrise/sunset). "Mid-day" surveying took place anytime between 9 A.M. and 3 P.M. Three major holidays (Thanksgiving, Christmas, and New Year's Day) occurred during the project timeframe, and were avoided for survey administration along with the two days preceding and following each.

In total, 131 surveys were conducted on weekdays (64.9%) and 71 were conducted on weekends (35.1%). With respect to time of day during which surveys were administered, 84 surveys were collected in the early and late hours (41.6%) and 118 were collected during mid-day (58.4%). Overall, 104 of the surveys (51.5%) were conducted along the rocky shoreline, while 98 (48.5%) were conducted on sandy beaches.

Figure 6. – One respondent completes the survey, while the survey administrator screens additional participants at Paniau Beach. (Photo courtesy of C. Grace-McCaskey.)

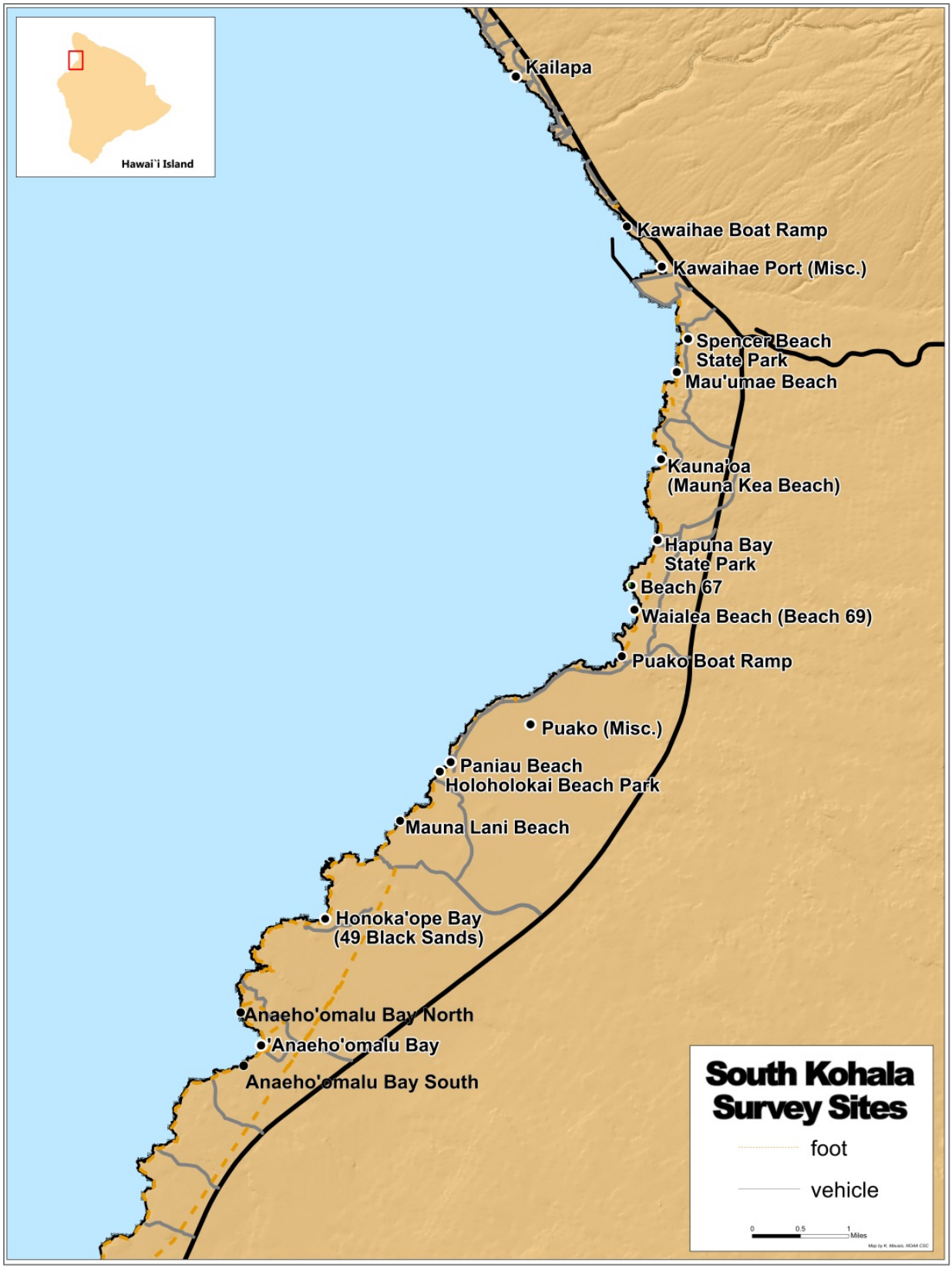

Figure 7. – South Kohala and survey intercept sites.

Table 2. – Summary description of survey intercept sites in the South Kohala study area.

Survey Site	Shoreline Type	Access Type	Primary Uses
Kailapa	rock	2WD, 4WD/ hiking	fishing
Kawaihae Boat Ramp	rock	2WD	fishing, paddling, boating, cultural use
Kawaihae Port (misc.)	rock	2WD	fishing, surfing
Spencer Beach Park	sand	2WD	swimming, sunbathing, picnicking, general recreation
Mauʻumae Beach	sand	2WD	swimming, paddling, sunbathing, picnicking, general recreation
Kaunaʻoa (Mauna Kea beach)	sand	2WD	swimming, paddling, sunbathing, picnicking, general recreation
Hapuna Beach State Park	sand	2WD	swimming, paddling, sunbathing, picnicking, general recreation
Beach 67	rock	4WD/ hiking	camping, fishing, surfing
Waialea Beach (Beach 69)	sand	2WD	swimming, paddling, sunbathing, picnicking, general recreation
Puakō Boat Ramp	rock	2WD	fishing, boating, paddling, scuba diving
Puakō (misc.)	rock	2WD	fishing, dog walking, scuba diving, sunbathing, picnicking, general recreation
Paniau Beach	rock	2WD	camping, surfing, fishing, scuba diving, sunbathing, picnicking, general recreation
Holoholokai Beach Park	rock	2WD	sunbathing, picnicking, general recreation
Mauna Lani Beach	rock	2WD	scuba diving, cultural use, fishing, sunbathing, picnicking, general recreation
Honokaʻope Beach (49 Black Sands)	sand	2WD	swimming, paddling, sunbathing, picnicking, general recreation
Anaehoʻomalu Bay-North	rock	2WD	surfing, fishing, hiking
Anaehoʻomalu Bay	sand	2WD	swimming, paddling, sunbathing, picnicking, general recreation
Anaehoʻomalu Bay-South	sand	2WD	Scuba diving, swimming, sunbathing, picnicking, general recreation

The contractor attempted to conduct surveys on 50 occasions during the 34 survey days and was successful in doing so 92 percent of the time. Surveys could not be administered on four occasions since no shoreline users were present. This occurred at Kailapa and at Holoholokai Beach Park.

It is important to note that the survey administrator utilized a variety of techniques to ensure that a wide range of resource users were approached and offered the opportunity to participate in the study. Given limited time and resources, however, it is nevertheless likely that some user groups unavoidably were under-represented in the study, such as those participating in night-time or offshore fishing and diving activities, for instance.

Response Rate

The survey effort in total yielded a high response rate. Only 10 of the 212 persons (4.7%) determined suitable for completing the survey refused to participate when approached by the survey administrator. While refusals were rare, a variety of reasons were offered by the prospective respondents: four persons stated that they weren't interested; five stated that they had insufficient time to complete the survey; one felt that survey instrument itself was too long; and one felt he or she did not know enough to complete the survey. The context of each refusal and key attributes of each refusing individual were duly noted by the administrator. Of the 202 surveys from which usable data were collected and analyzed, roughly ten surveys were not filled out in their entirety. This yielded a relatively small amount of missing data.

Respondent Summary

Demographic Attributes of Participants

A variety of demographic data were collected from survey participants. These included: place of residence, age, gender, and race/ethnicity. Summary data for these variables are presented in Figures 8 and 9, and in Table 3.

Of the 190 survey participants who reported their place of residence, 54.7 percent lived in or near the South Kohala area, as shown in Figure 8. Small towns and communities along the South Kohala coast include: Waimea (Kamuela), Waikoloa, Mauna Lani, Puakō, Kailapa Hawaiian Homesteads, and Kawaihae. An additional 30 percent of the surveys were completed by Big Island residents who reside on other parts of the island. Two surveys were completed by residents of other Hawaiian Islands, while 22 surveys (11.6%) were completed by people living in other parts of the United States, primarily the west coast. Three surveys were completed by residents of Canada.[5]

[5] Potential respondents were screened by the survey administrator before being asked to complete the survey. Individuals were deemed eligible if they were 18 years of age or older, and either lived on the Big Island or were knowledgeable repeat visitors to South Kohala.

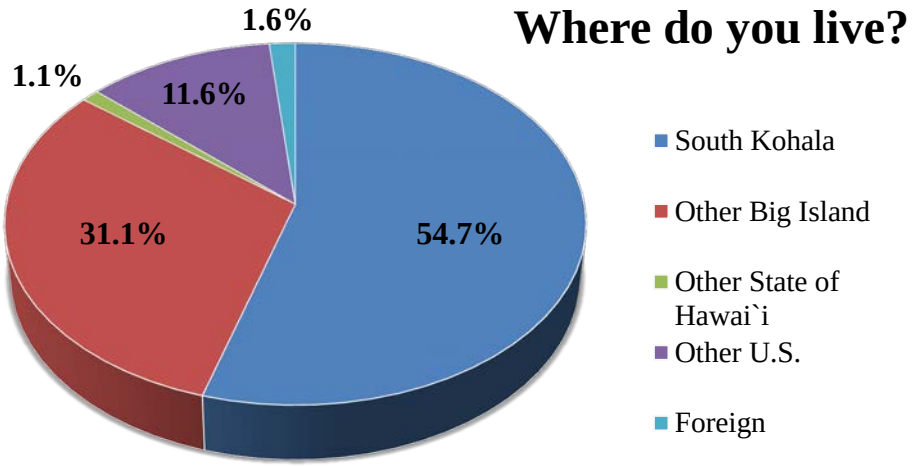

Figure 8. – Residence patterns among survey respondents [n = 190]. Note: South Kohala includes Waimea (Kamuela), Waikoloa, Mauna Lani, Puakō, Kailapa Hawaiian Homesteads, and Kawaihae.

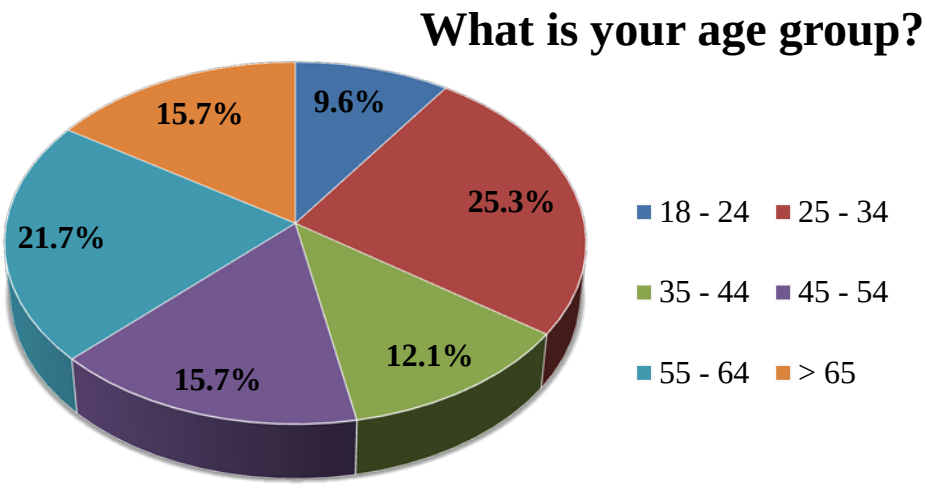

Figure 9. – Age distribution of survey respondents [n = 198].

As shown in Figure 9, the surveys were completed by individuals from several age groups. Although the greatest percentage of surveys (25.3%) was completed by individuals between 25 and 34 years of age, the distribution across all groups was generally even. Slightly more than half (55.6%) of the surveys were completed by males, while 44.4 percent were completed by females.

When asked how they described their race (Table 3), 76.8 percent of respondents identified themselves as white (either alone or in combination with other races), 23.2 percent identified as Native Hawaiian (either alone or in combination with other races), and 18.9 percent identified as Asian (including Japanese, Filipino, and Chinese; again, either alone or in combination with other races). Participants were also given the opportunity to select more than one race, and 22.2 percent did so.

Table 3. – Self-identified race patterns among survey respondents [n = 185].

Ethnicity	Number of responses	Percentage
White	142	76.8
Native Hawaiian	43	23.2
Asian	35	18.9
One race	144	77.8
Two or more	41	22.2

Survey Results

Site Use Patterns

It should be noted that the survey effort was not intended to generate comprehensive documentation of all coastal uses occurring in South Kohala. The effort was rather geared toward generating a general representation of when, how, and for what reason respondents use the coastline for various purposes during the course of the year. The resulting data provide important contextual information needed to better understand the various user groups to which respondents belong and their familiarity with conditions along the South Kohala coast.

As shown in Figures 10 and 11, nearly 80 percent of respondents had visited the South Kohala coastline more than 20 times, and more than 60 percent have been visiting the area for 10 years or more. These data suggest that the majority of survey respondents are likely to have developed extensive familiarity with the local marine environment.

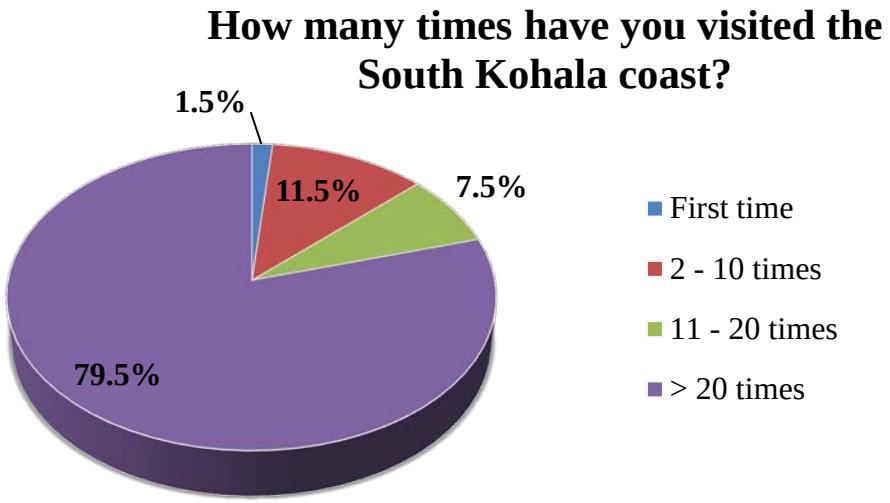

Figure 10. – Frequency of visitation to South Kohala coast [n = 200].

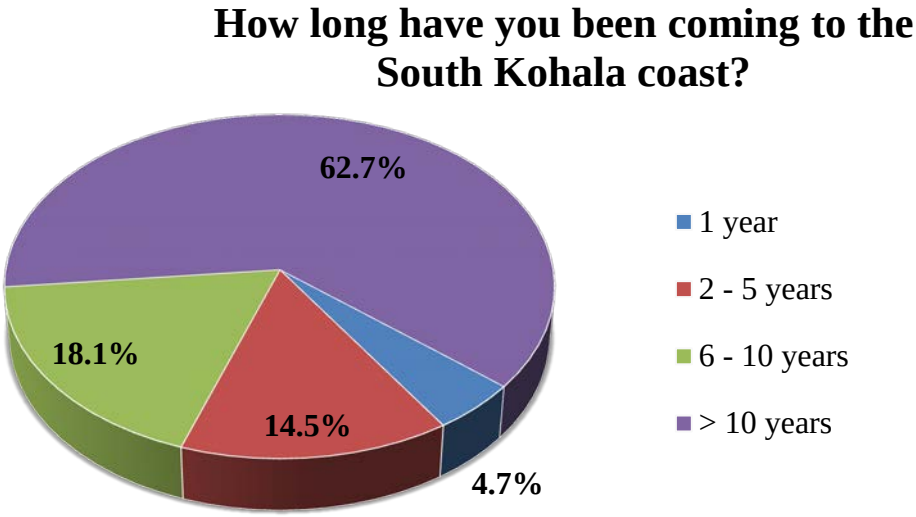

Figure 11. – Visitation to the South Kohala coast in years [n = 193].

Respondents were asked to indicate the extent to which they participate in specific activities while using the shoreline or ocean along the South Kohala coast. As depicted in Figure 12, the activities respondents reported doing most often include swimming (78.4%), sunbathing/hanging out (70.6%), and snorkeling (62.4%). The activities respondents reported doing least often include aquarium fish collecting (2.5%) and thrill craft activities (10.0%). Figures 13 and 14 show South Kohala marine resource users fishing from the shoreline and leaving Kawaihae Harbor in an outrigger canoe.

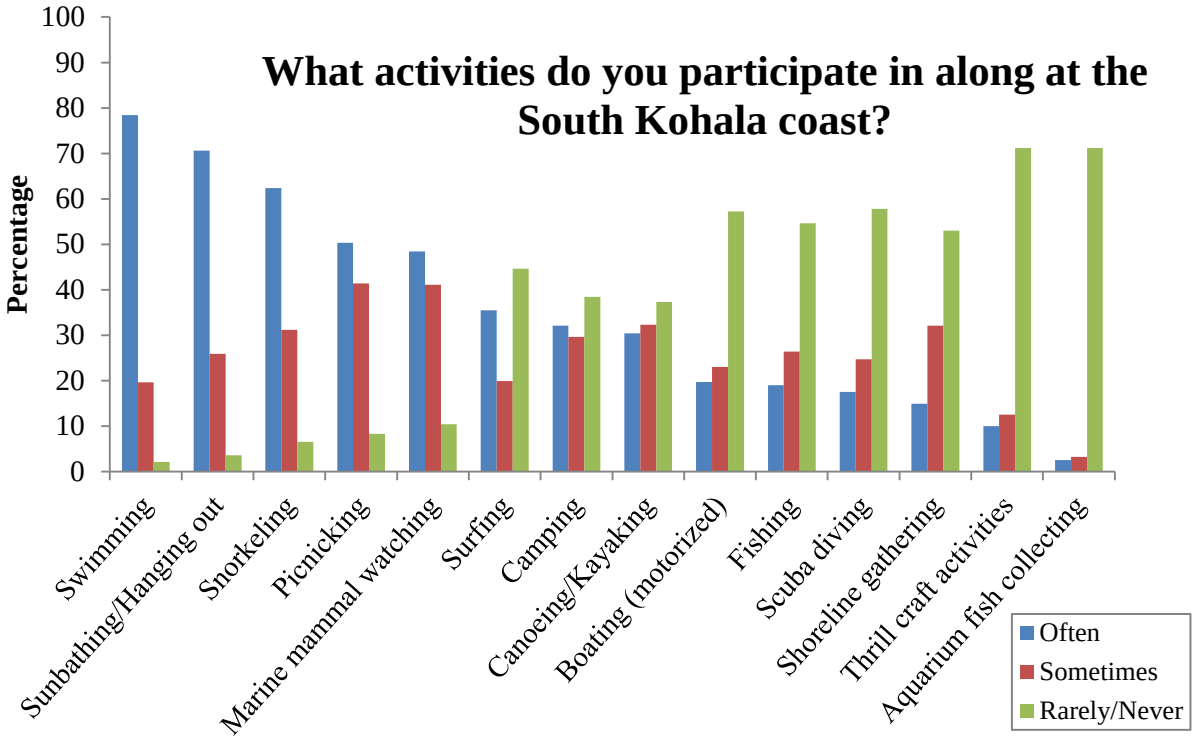

Figure 12. – Frequency of involvement in shoreline use activities along the South Kohala coast.

Figure 13. – Boy fishing at Spencer Beach Park. (Photo courtesy of C. Grace-McCaskey.)

Figure 14. – Young woman canoeing out of Kawaihae Boat Harbor. (Photo courtesy of C. Grace-McCaskey.)

Knowledge about Site Conditions

Respondents were asked a series of questions regarding: (a) their perceived knowledge of specific resource conditions along the South Kohala coast, (b) the extent to which they are satisfied with the status of those resources, and (c) the extent to which they perceive the condition of the resources to be improving, declining, or staying the same. These perceptions can have important implications for resource managers who wish to identify and respond effectively to locally important issues and problems.

Figure 15 shows the results from survey questions asking respondents how much they know about the status of key resources along the South Kohala coast. While the majority of respondents tended to assert that they knew a little about all the resources, relatively few asserted extensive knowledge about the status of any one resource. Notably, the issue of greatest uncertainty among respondents was that regarding the condition of the region's watersheds, including the health of streams and other sources of water originating in the region's upland areas.[6]

[6] We assert that self-reported lack of knowledge about upland watersheds may relate to relatively recent introduction of watershed concepts into resource management approaches and conservation campaigns in the South Kohala area. An integrated "ridge to reef" watershed management approach, viewed by some as a return to the Native Hawaiian ahupua'a management, has become increasingly emphasized in the region only in the past few years. Limited public understanding of the watershed concept in Hawai'i (cf. SeaWeb, 2013) may have important implications for current management efforts in the study area, and outreach activities may be needed to educate residents and visitors about watersheds and their linkages to coral ecosystems here and elsewhere in the Hawaiian Islands.

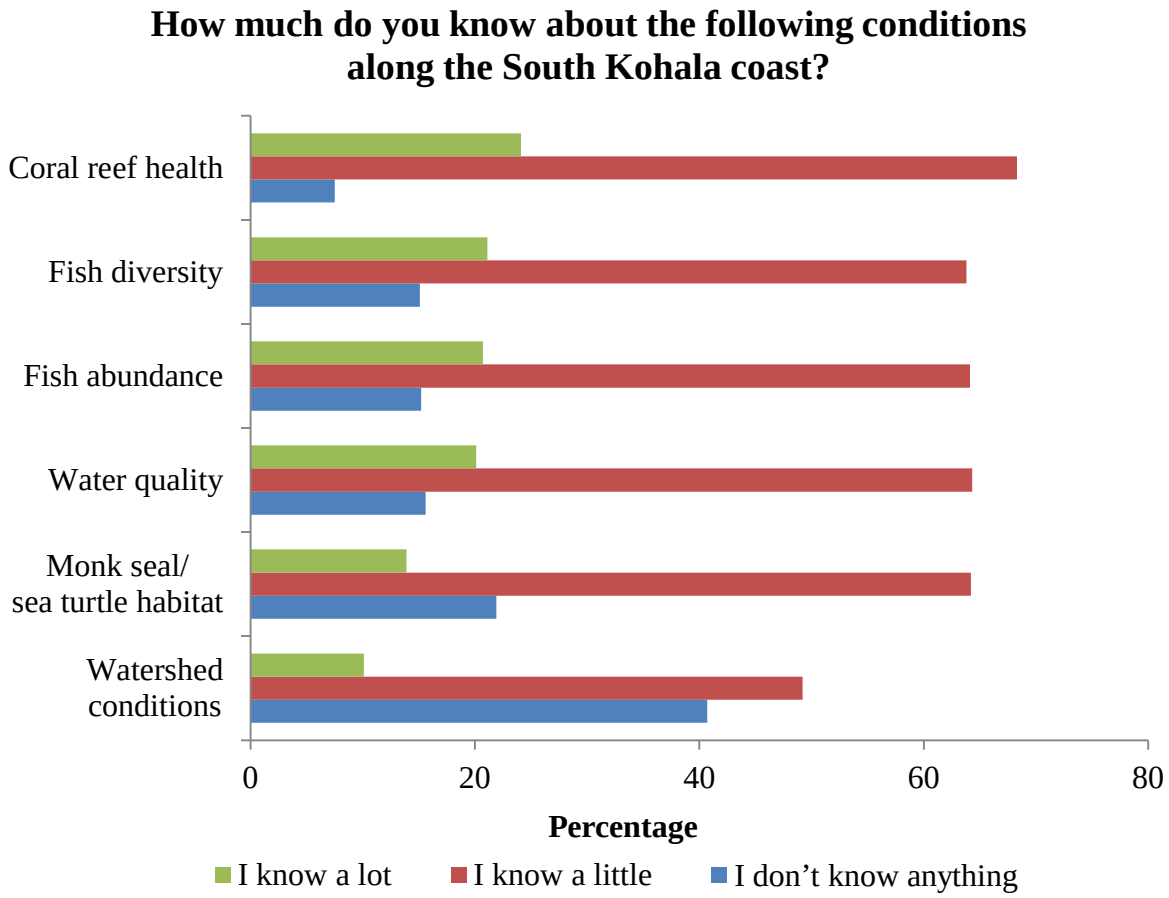

Figure 15. – Self-reported extent of knowledge about resource conditions along the South Kohala coast.

When asked about level of satisfaction with the condition of the same set of resources, participants responded in a diverse manner. As depicted in Table 4 (and designated by an asterisk) the most common response for each condition was either "somewhat satisfied" or "neutral," suggesting that respondents envision room for improvement in the status of some of the resources being considered.

However, when the categories were collapsed by combining responses for "not satisfied" with "somewhat dissatisfied," and "somewhat satisfied" with "very satisfied" (as in common practice when analyzing Likert-scale data of this nature), the results suggest that a small majority of respondents were dissatisfied with three of the conditions: fish abundance in coral reef areas (42.1%), fish diversity in coral reef areas (32.7%), and watershed conditions in upland areas (30.6%). For the other resources (coral reef conditions/health, water quality, and monk seal resting/sea turtle nesting habitat), a small majority of responses fell into the "satisfied" category.

Table 4. – Reported level of satisfaction with the status of resources along the South Kohala coast, in percentages.

Resource/Condition	Not satisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied	I don't know/ Not sure
Coral reef conditions/ health [n = 198]	11.1	24.2	14.1	* 37.4	5.6	7.6
Fish abundance in coral reef areas [n = 197]	20.3	21.8	18.3	* 23.4	5.6	10.7
Fish diversity in coral reef areas [n = 199]	13.6	19.1	* 26.6	24.1	6.5	10.1
Water quality [n = 200]	14.5	21.0	21.0	* 26.0	11.5	6.0
Monk seal resting/ sea turtle nesting habitat [n = 197]	9.6	13.7	26.4	* 29.9	7.1	13.2
Watershed conditions/ health in upland areas [n = 193]	13.5	17.1	* 30.6	9.8	2.6	26.4

Note: Elicited by the question, *How satisfied are you with the existing condition of _____ along the South Kohala coast?;* * indicates the most common response for that condition.

While some level of consensus is noted among the sample in terms of perceived level of satisfaction and dissatisfaction with the status of the resources, there is also extensive variability in this regard. One explanation for such variability is that level of satisfaction with different resource conditions varies according to important contextual factors that are not directly addressed here, such as how often one participates in certain resource use activities, or how vested one is in the status of the resources or resource use activities in question.

Figure 16 depicts survey findings regarding respondents' perceptions of the extent to which natural resource conditions are changing along the South Kohala coast. Notably, there was relatively extensive agreement that fish abundance and the health of coral reefs in the region are in a state of decline. At least 40 percent of all respondents also felt that the level of diversity of fish species and local water quality are declining.

Survey results also indicate a great deal of uncertainty about the status of marine resources in the study area. An average of about 28 percent of all respondents reported that they did not know if local resources were improving, staying the same, or in a state of decline. Once again, uncertainty about the status of the region's watersheds was most extensive, with 43 percent of respondents reporting a lack of awareness of the issue.

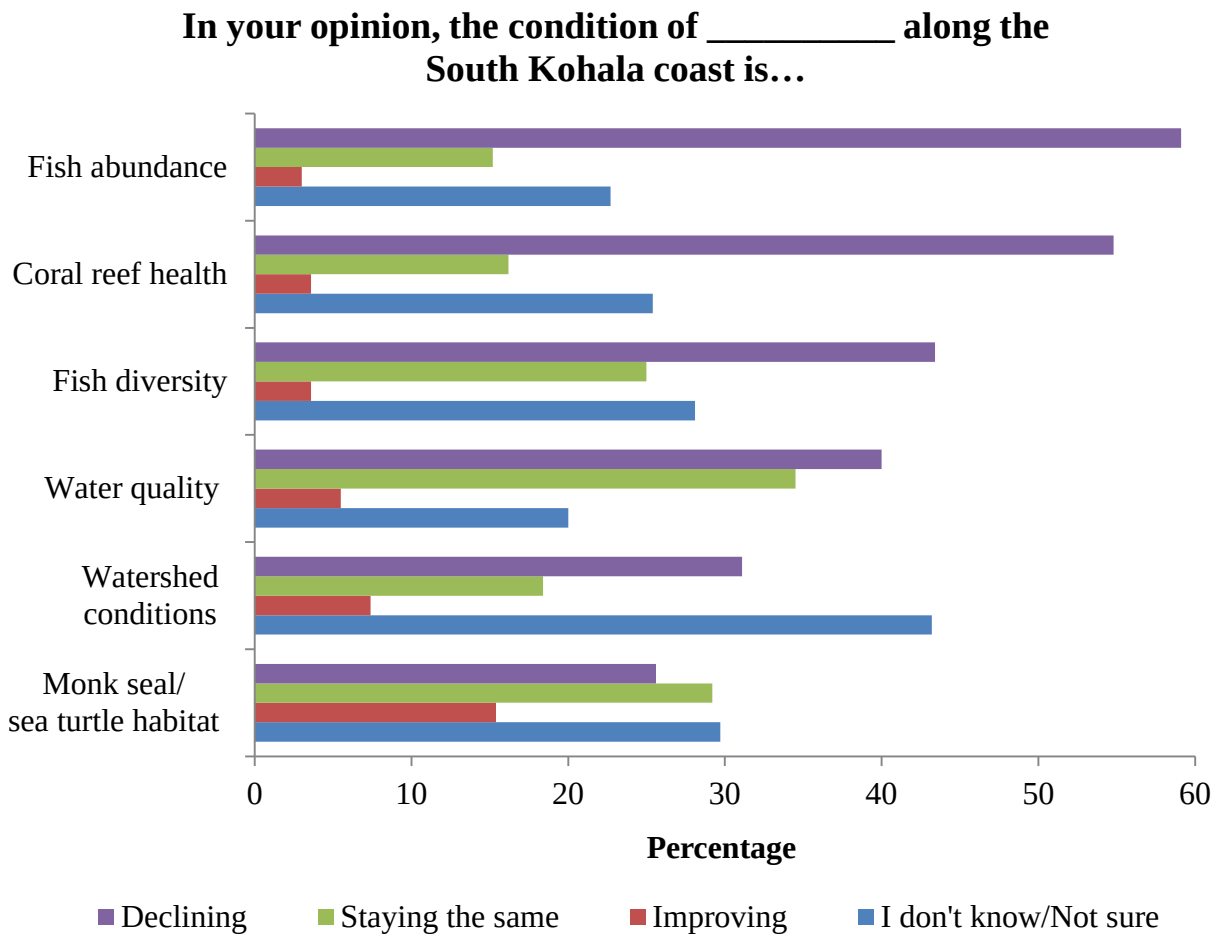

Figure 16. – Reported status of resource conditions along the South Kohala coast.

Conflicts Between Resource Uses

Respondents were asked a series of questions about perceived conflicts between resource uses or users along the South Kohala coast. When asked how much they know about such conflicts (Fig. 17), nearly half (48.2%) selected "I know a little," and nearly 40 percent indicated "I don't know anything." Further, when asked about the existing level of conflict in the region (Fig. 18) and whether such conflicts were decreasing, staying the same, or increasing in number or severity (Fig. 19), the most common response was "I don't know/Not sure." It is important to note that these data do not necessarily indicate an absence of resource use(r) conflict, but rather a lack of awareness of local conflicts among certain respondents.

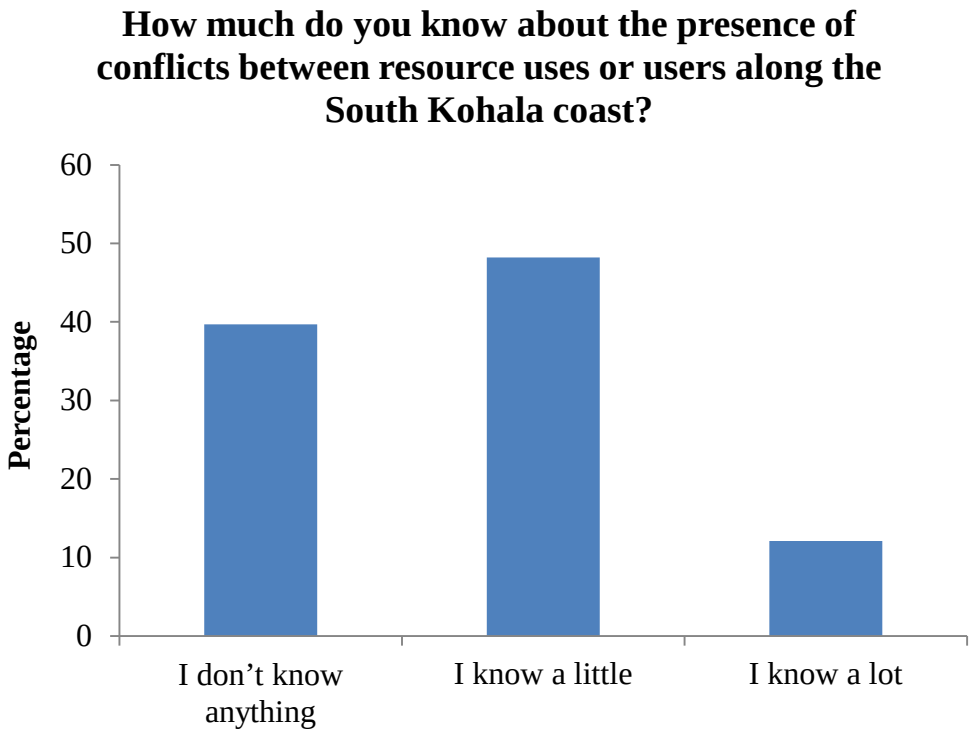

Figure 17. – Self-reported extent of knowledge about marine resource use conflicts along the South Kohala coast [n = 199].

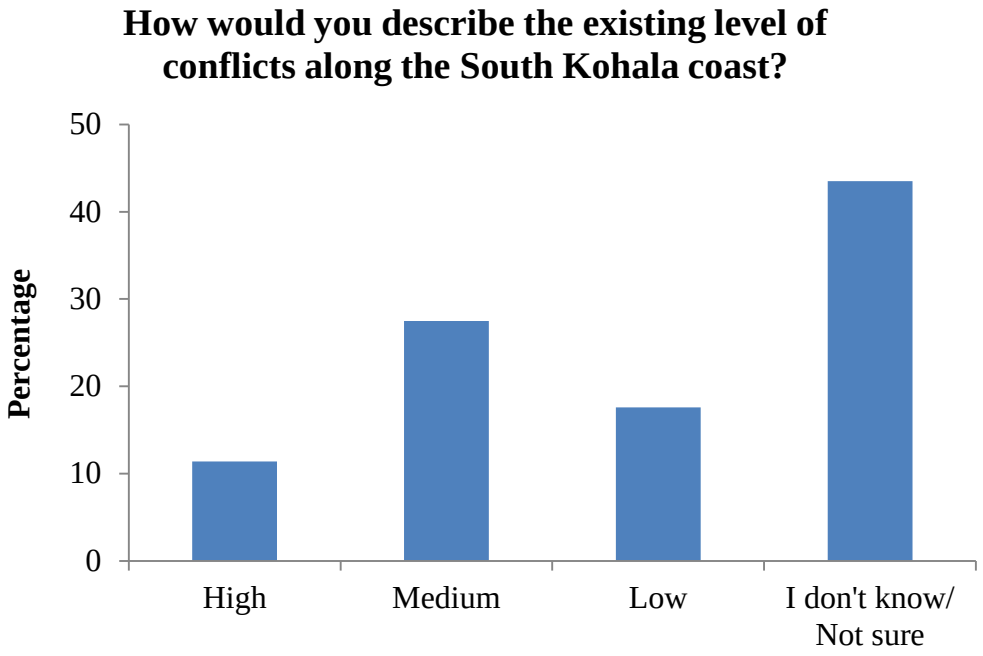

Figure 18. – Perceived extent of marine resource use conflicts along the South Kohala coast [n = 193].

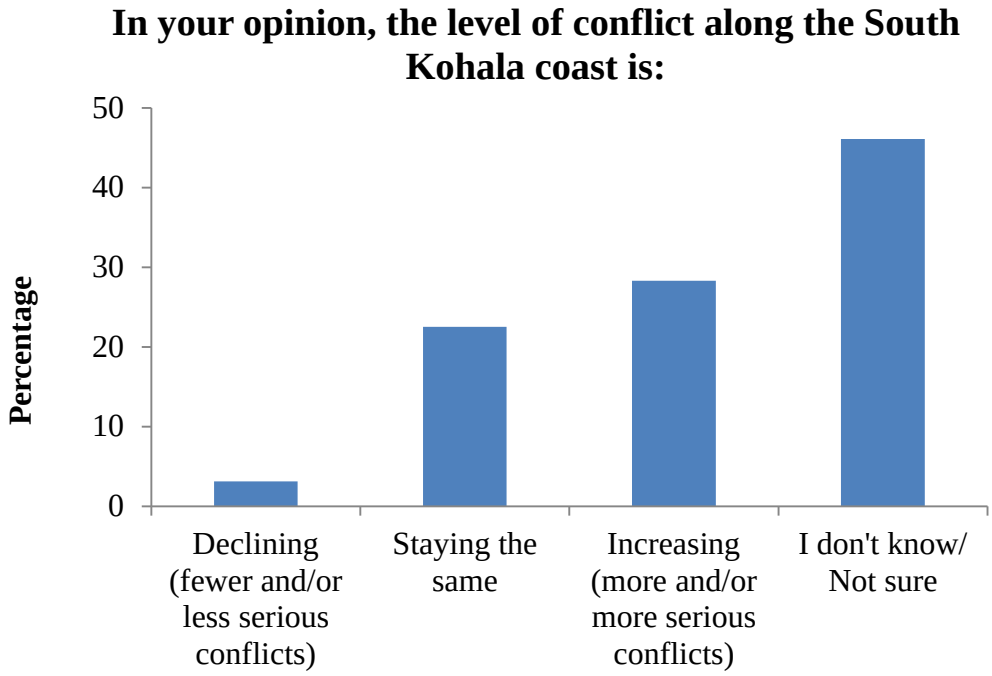

Figure 19. – Perceived rate of change in marine resource use conflicts along the South Kohala coast [n = 191].

Coral Reef Information Sources

Respondents were also asked where they acquire information about South Kohala's coral reefs. The intent of gathering information of this nature is to help resource managers to better understand and potentially improve community outreach and education efforts. As provided in Figure 20, 23.9 percent of respondents reported that they tend to rely most on their own observations as sources of information about the local coral reefs. This naturally held true for individuals who view local reef ecosystems most directly, such as snorkelers, fishermen, and divers. The second most commonly used source of information was newspapers, particularly *West Hawai'i Today*; 17.9 percent of respondents reported using such sources of information. Word of mouth (16.4%), the internet (11.9%), and community groups in general (10.4%) were also important, if indirect, sources of information. Community organizations mentioned specifically by respondents included: Ka Papa Ola o Kawaihae, TNC, Makai Watch, Puakō Community Association, the Kohala Center, Hawai'i Wildlife Fund, Eyes of the Reef, Ocean Conservancy, and the Coral Reef Alliance.

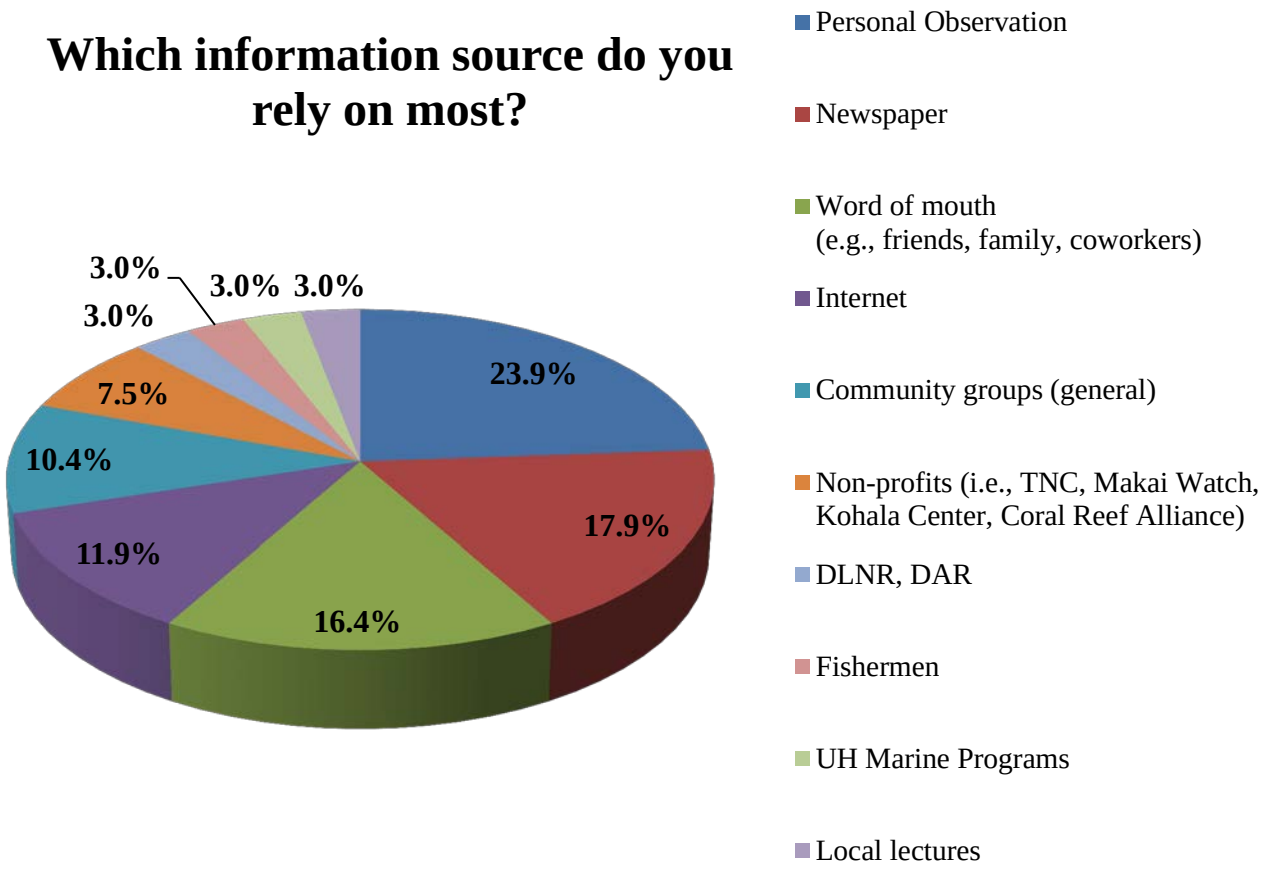

Figure 20. – Sources of coral reef information most relied on by survey respondents [n = 67].

Potential Threats to Resources

The survey instrument also included a set of questions designed to examine respondents' perceptions of potential threats to coral reef ecosystems in the South Kohala region. Data regarding the extent to which resource users believe certain activities are occurring and the extent to which those activities threaten the area's coral reefs can assist resource managers in a variety of ways. For instance, such information can be useful for: (a) assessing public perceptions regarding the relative degree of success of current management efforts and as a means for indicating how such efforts might be adjusted to accommodate changing conditions; (b) designing new management approaches that are readily understood and therefore more likely to be accepted and followed by resource users; and (c) adjusting outreach and educational efforts as per changing local observations about threats to the local marine environment.

Table 5 depicts basic analysis of the extent to which respondents perceived potentially damaging activities and processes are occurring along the South Kohala coast. All of the activities were identified as occurring to some extent along the coast by more than 50 percent of respondents (see the "a little + a lot" column in Table 5). The only exception was fish feeding, with more than 50 percent of respondents selecting "I don't know" regarding the extent it was occurring. The two activities the most respondents indicated were occurring "a lot" were shoreline alteration and development (35.9%) and unsustainable or inappropriate fishing practices (35.7%), and the two activities identified as occurring the most overall ("a little" + "a lot") were shoreline alteration and development (78.0%) and erosion/sedimentation from uplands (69.0%). Again, however, it should be noted that a large percentage of respondents (33.3% average) selected "I don't know/Not sure" for each of these items, expressing uncertainty about the issues.

Respondents were also asked to provide their perspectives on the extent to which such activities and processes comprise a threat to the health status of coral reefs in South Kohala. All of the activities were identified as threats by more than 50 percent of respondents (see the "minor + major" column in Table 6). However, the extent to which they were perceived to be threats varied across the activities. The two activities the most respondents perceived as overall threats ("minor threat" + "major threat") are shoreline alteration and development (84.3%) and chemical pollution from uplands (72.2%). These were also the two activities selected by the most respondents as "major threats" (61.8% and 53.0%, respectively).

Table 5. – Perceived extent of occurrence of threats to coral reef ecosystems along the South Kohala coast, in percentages.

Potential threat	Not at all	A little	A lot	I don't know/ Not sure	A little + a lot
Shoreline alteration and development [n = 195]	8.7	42.1	35.9	13.3	78.0
Fish feeding [n = 193]	9.3	28.5	10.4	51.8	38.9
Introduction or existence of invasive species (such as fish or algae) [n = 195]	4.6	35.9	17.9	41.5	53.8
Climate change effects on ocean conditions (increasing temperatures, sea level, and acidity) [n = 194]	5.2	31.4	34.5	28.9	65.9
Erosion/sedimentation from uplands [n = 194]	3.1	37.6	31.4	27.8	69.0
Chemical pollution from uplands (e.g., from batteries, paints, pesticides, herbicides) [n = 199]	3.5	28.1	29.6	38.7	57.7
Organic pollution from uplands (e.g., animal and human waste) [n = 196]	5.1	36.7	17.3	40.8	54.0
Unsustainable fishing practices [n = 199]	7.5	29.1	35.7	27.6	64.8
Unsustainable coastal and marine recreational use (e.g., poor diving practices or boat operation) [n = 193]	4.7	46.6	19.2	29.5	65.8

Note: Elicited by the question, *To what extent is _____ occurring along the South Kohala coast?*

Table 6. – Perceived severity of threats to coral reef ecosystems along the South Kohala coast, in percentages.

Potential Threat	Not at all	Minor threat	Major threat	I don't know/ Not sure		Minor + major
Shoreline alteration and development [n = 191]	1.0	22.5	61.8	14.7		84.3
Fish feeding [n = 191]	6.8	24.6	27.7	40.8		52.3
Introduction or existence of invasive species (such as fish or algae) [n = 193]	3.6	17.6	47.2	31.6		64.8
Storms (high winds and waves) [n = 192]	14.6	42.2	19.3	24.0		61.5
Climate change effects on ocean conditions (increasing temperatures, sea level, and acidity) [n = 191]	5.2	19.4	45.5	29.8		64.9
Erosion/sedimentation from uplands [n = 190]	3.7	27.9	42.6	25.8		70.5
Chemical pollution from uplands (e.g., from batteries, paints, pesticides, herbicides) [n = 198]	2.5	19.2	53.0	25.3		72.2
Organic pollution from uplands (e.g., animal and human waste) [n = 191]	6.3	32.5	31.9	29.3		64.4
Unsustainable fishing practices [n = 196]	7.1	24.0	46.9	21.9		70.9
Unsustainable coastal and marine recreational use (e.g., poor diving practices or boat operation) [n = 191]	5.2	37.2	31.9	25.7		69.1

Note: Elicited by the question, *To what extent do you feel _____ is a threat to coral reef ecosystems in South Kohala?*

Violations

One component of the survey instrument included questions designed to elicit respondents' observations of regulatory violations occurring along the South Kohala coastline. The resulting information is important in that it is indicative of issues and areas that may deserve the attention of resource managers and enforcement officials active in the region.

About 43 percent of all respondents reported that they had observed other individuals violating a fishing, boating, or resource management law along the South Kohala coast. Of the 73 respondents who stated the nature of the infraction, approximately 70 percent stated that the violation was related to some form of illegal fishing, including: (a) illegal use of various net gear, (b) "spearfishing in illegal areas," (c) aquarium reef fish collection in no-take zones, and (d) capture of undersized fish.[7] Harassment of marine mammals and sea turtles was mentioned by about 20 percent of respondents. This typically involved observation of boats chasing or otherwise approaching the animals too closely. About 16 percent of respondents reported having witnessed illegal dumping of rubbish and other waste into the ocean, and five respondents reported having witnessed illegal anchoring and mooring practices.

About 40 percent of respondents who reported having witnessed an apparent regulatory violation stated that they had reported the incident to a state agency, although some respondents expressed confusion about which agency was the appropriate one to call. Two-thirds of respondents who reported regulatory violations stated that they had contacted DLNR. Some respondents called DAR or the Division of Boating and Ocean Recreation (DOBR), while others notified the Division of Conservation and Resource Enforcement (DOCARE) or local harbormasters. A few individuals reported taking matters into their own hands and telling the violator to stop. Notably, of the 29 respondents who described their efforts to notify agencies about regulatory violations, nearly 80 percent expressed frustration about the process. These frustrations especially focused on the difficulty in determining the ultimate outcome of their call.

Management Strategies

Another section of the survey was designed to gauge respondents' perceptions toward management strategies that could potentially be implemented to ensure the sustainability of natural resources along the South Kohala coastline. Respondents were asked to indicate the extent to which they would support or oppose potential strategies. The resulting information is useful for resource managers with responsibilities in the region, since they can capitalize on the kinds of management approaches residents may already favor.

The majority of survey respondents supported each of the management strategies, although the extent of support varied (Fig. 21). The strategies which received the most conceptual support were related to education and outreach. Indeed, almost 91 percent of respondents supported the possibilities of: (a) increase outreach and education (educate users and area residents regarding regulations, and encourage community involvement), and (b) engage local businesses and hotels in management processes and develop education materials for guests/tourists.

[7] There is no way to verify, however, that the activities respondents believed to be illegal actually are violations.

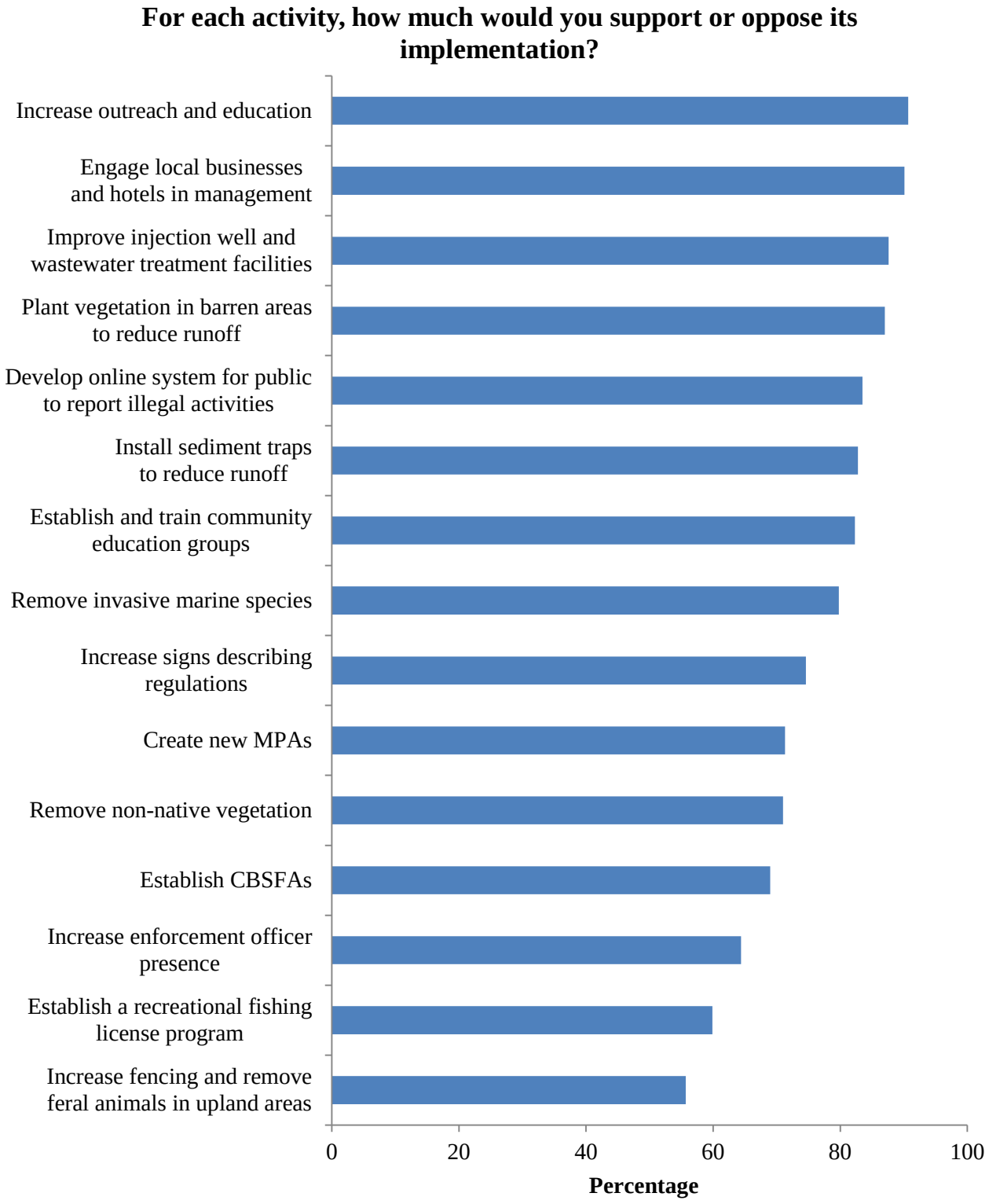

Figure 21. – Frequency of support for prospective natural resource management strategies in South Kohala region. Notes: CBSFA = Community Based Subsistence Fishing Area.

Respondents also expressed extensive support for strategies that could potentially serve to mitigate point and non-point source pollution in the South Kohala region. For instance, nearly 88 percent of all respondents supported improvements to injection well and wastewater treatment facilities in the study area, and 87 percent supported the planting of vegetation in barren areas in order to reduce problems associated with runoff. Fewer respondents supported strategies that would potentially further restrict their activities in the area, such as increased enforcement officer presence (64.4%) and the establishment of a recreational fishing license program with the resulting revenue dedicated to fisheries management efforts (59.9%).

Respondents were also asked to provide their perspectives on hypothetical changes to marine resource management strategies that are currently in place in South Kohala (Table 7). They were asked to indicate the extent to which they would support each change, and were provided with space to discuss the options in specific detail.[8]

When compared with the data depicted in Figure 21, fewer respondents supported making changes to existing marine resource management strategies (Table 7). About 20 percent of respondents indicated they were neutral or unsure about such changes. Slightly less than half of respondents (44.6%) supported making potential changes to the management of existing marine protected areas (MPAs) in the study region, and 51 respondents (26.4%) provided suggestions for what they thought should be changed. Fifteen respondents suggested that additional fishing restrictions should be imposed in association with such areas, such as banning aquarium reef fish collection and night-time spearfishing. Fourteen respondents called for increased enforcement of current MPA-related regulations. Five respondents advocated for enhanced outreach and educational functions as these relate to MPA rules and regulations, including improved signage. Additionally, five respondents asserted a need for reduced restrictions on fishing activities in the region's MPAs.

Table 7. – Level of support for changes to existing marine resource management strategies, in percentages.

Prospective Strategy	Oppose	Neutral	Support	I don't know/ Not sure
Change management of existing MPAs [n = 193]	5.7	29.0	44.6	20.7
Change fishing regulations [n = 192]	11.9	28.6	42.2	17.2
Change regulations for other (non-fishing) recreational activities [n = 185]	14.1	34.6	28.7	22.7

Note: Elicited by the question, *For each activity, how much would you support or oppose its implementation [along the South Kohala coast]?*

[8] The questions were asked in a neutral way ("What would you like to see changed?" as opposed to suggesting the manner of the change) so as to allow respondents to openly suggest a range of possible changes. For example, respondents could write in that they wanted to see *fewer* size restrictions or bag limits on particular fish species.

Just over 40 percent of respondents (42.2%) supported making changes to fishing regulations in south Kohala, and again, about one-quarter of respondents (26.6%) provided suggestions for what they would like to see changed. The suggestions varied extensively. The five most common responses included: implement a non-commercial fishing license program and/or increase the costs of commercial fishing licenses [n = 8]; reduce/remove fishing restrictions and increase fishing access [n = 7]; further restrict or ban aquarium fish collecting [n = 7]; increase use of size and bag limits [n = 5]; and increase research efforts and connect regulations to research outcomes (e.g., implement a closed season during spawning periods, utilize adaptive management strategies based on ongoing research) [n = 4].

Less than 30 percent of respondents supported making changes to regulations for recreational activities not associated with fishing, and only 31 respondents (16.8%) provided suggestions for what they would like to see changed. The resulting suggestions were highly variable. The most common suggestion [n = 5] called for increased restriction on the use of jet skis in the area.

Marine Managed Areas

Respondents were also asked about their knowledge of marine managed areas (MMAs) along the South Kohala coast, and their attitudes and perceptions toward MMAs generally. Four MMAs are located in the South Kohala region. These are: (1) Kawaihae Harbor Fisheries Management Area, (2) Waialea Bay Marine Life Conservation District, (3) Puakō Bay and Puakō Reef Fisheries Management Area, and (4) Puakō-Anaehoʻomalu Fishery Replenishment Area. While these MMAs were not mentioned specifically in the survey, respondents were asked: *How familiar are you with any specially managed marine areas (such as Fishery Replenishment Areas, Fisheries Management Areas, and Marine Life Conservation Districts) in the South Kohala coast area?*

As shown in Figure 22, relatively few respondents indicated a significant level of familiarity with MMAs in the South Kohala region. This necessarily conditions subsequent analysis of respondent's opinions about the MMAs. As shown in Figure 23, when asked about the effectiveness of MMAs in general, 65.8 percent of the respondents agreed MMAs were an effective tool for conserving coral reef fish and associated habitat. However, fewer respondents (58.5%) indicated they would support MMAs if they restricted their own use of the area (Fig. 24). Responses to the third statement (*There are strategies other than marine managed areas that would be more effective for conserving coral reef fish and habitat in the South Kohala coast.*) were evenly distributed across most of the response options (Fig. 25), with 29.2 percent selecting "strongly agree" or "agree," 30.2 percent selecting "neutral," and 33.3 percent selecting "I don't know/Not sure." Only 7.3 percent of respondents selected "strongly disagree" or "disagree," however, suggesting that most people are open to the idea that strategies other than MMAs may be more effective in conserving coral reef ecosystems in South Kohala.

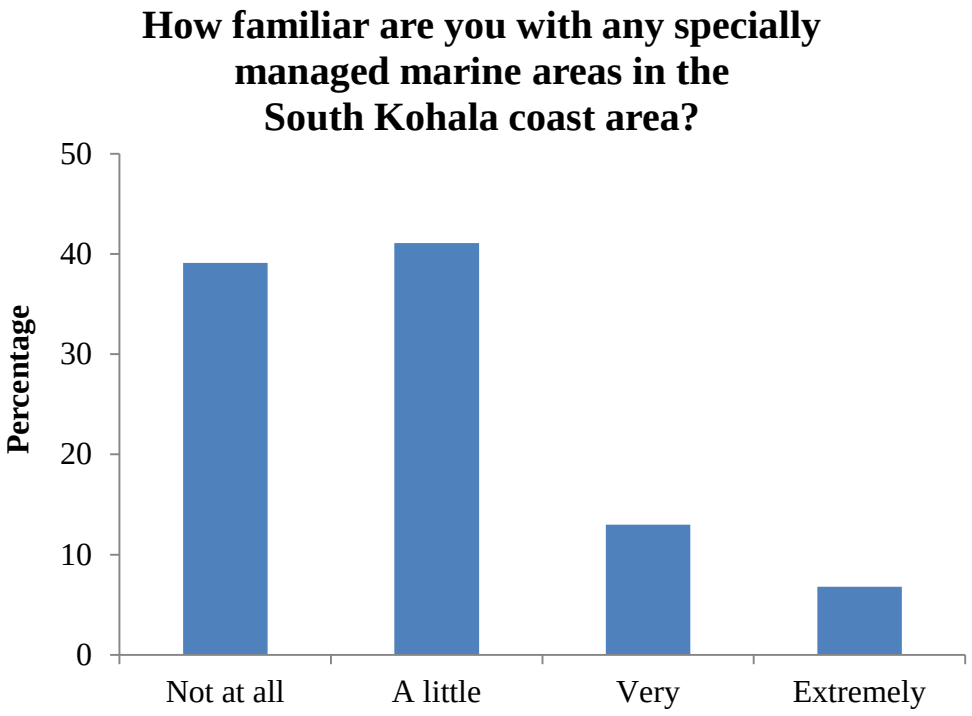

Figure 22. – Reported level of familiarity with MMAs along the South Kohala coast [n = 192].

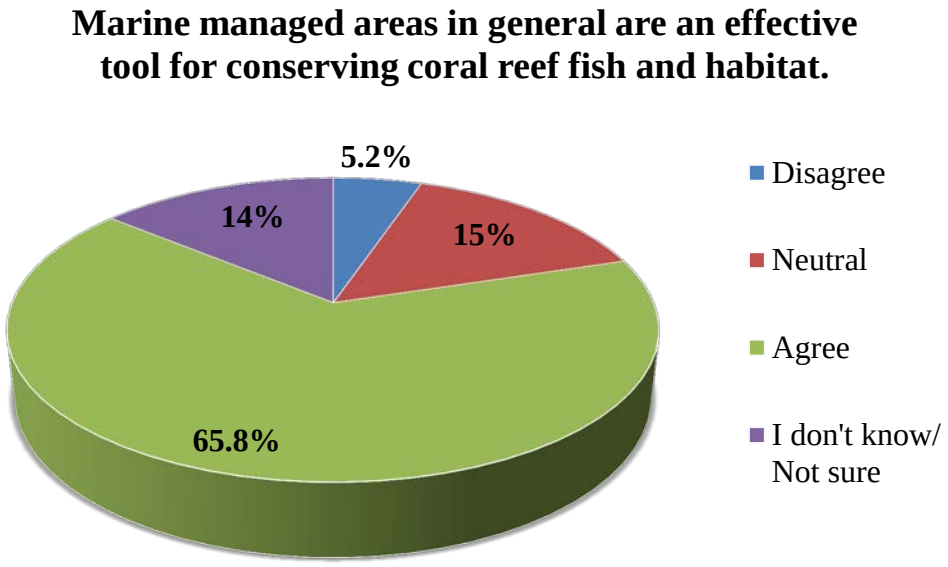

Figure 23. – Perceived effectiveness of MMAs for conserving reef-associated fish and habitat [n = 193].

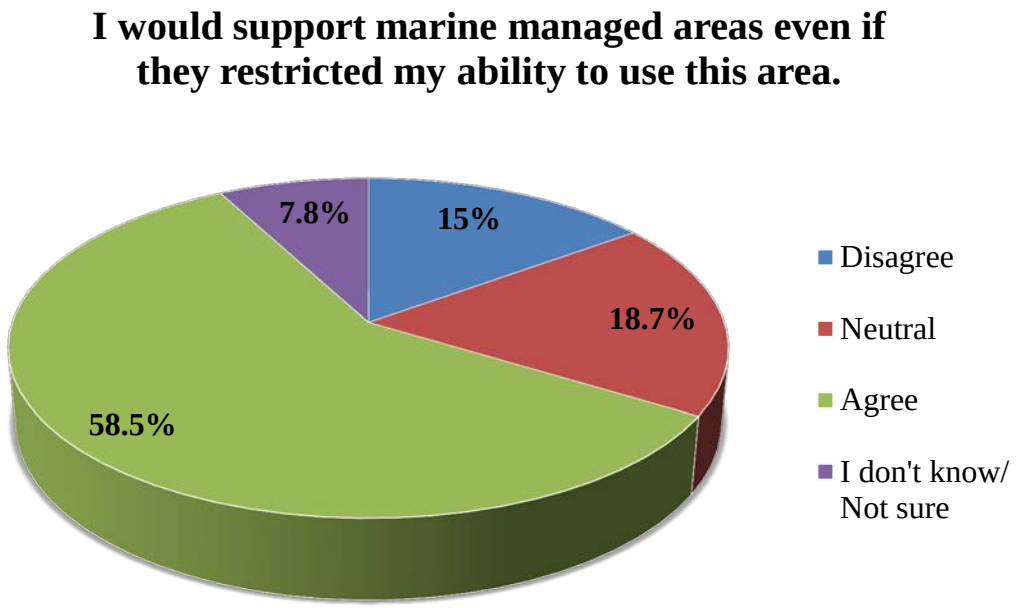

Figure 24. – Respondent support for MMAs when considering potential constraints on personal use [n = 193].

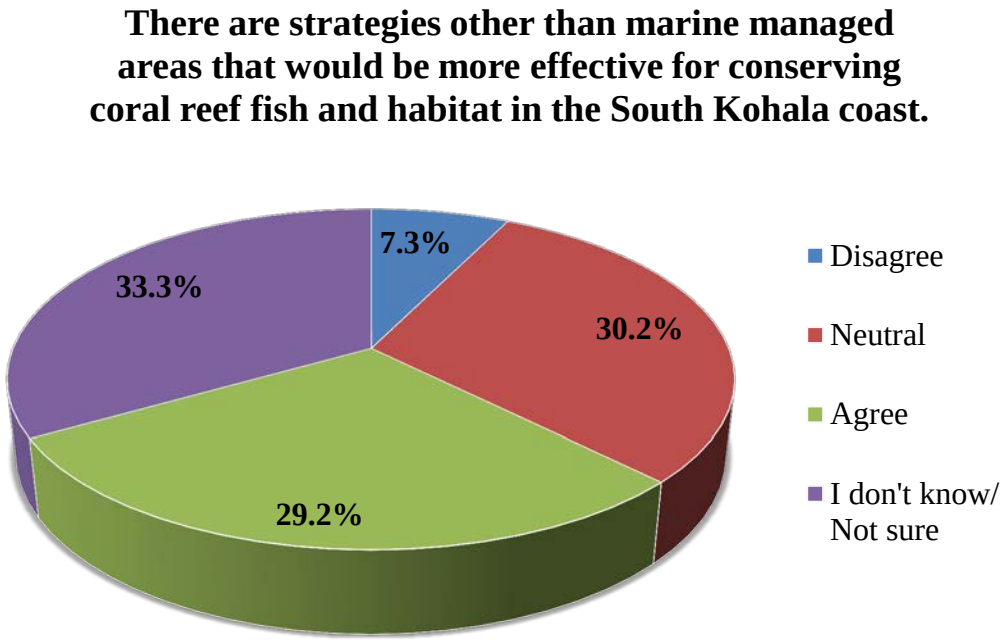

Figure 25. – Respondent perceptions of effectiveness of alternatives to MMAs [n = 192].

Benefits and Services

Another section of the survey was designed to elicit respondents' perspectives on the personal benefits they associated with coral reef ecosystems in the South Kohala region. Respondents were asked to rate the relative degree of importance of a variety of potential benefits and services. This set of survey questions is intended to help resource managers and decision-makers better understand how people use and value coral reef ecosystems in the study region.

As depicted in Figure 26, all of the potential benefits included in the survey instrument were perceived to be important by more than 50 percent of the respondents, and most were perceived to be important by more than 80 percent of all respondents. This indicates that South Kohala resource users perceive coral reefs to be important to them as individuals and as community members in a variety of ways. Notably, non-economic attributes (such as habitat for fish and other species and recreational benefits) were considered to be important by the vast majority of respondents, while the food value and economic attributes of the region's coral reef ecosystems were deemed important by a relatively smaller percentage of respondents. This may be explained in part by the nature of the sample, as relatively few respondents reported personal involvement in commercial fishing, scuba diving tour operations, or other businesses that rely on coral reef ecosystems for commercial gain (see previous section, Site Use Patterns).

Knowledge of Planning Activities

Finally, respondents were asked about their awareness of and participation in conservation planning efforts along the South Kohala coast. Roughly 53 percent of all respondents indicated they were not aware of regional conservation efforts. Of the 91 respondents who indicated they were indeed aware of such efforts, roughly 38 percent stated that they actually participate in conservation-related projects or programs. Although this question was intended to determine if resource users were aware of or participated in the South Kohala CAP process, none of the respondents mentioned the CAP specifically, and only two respondents mentioned TNC. However, other organizations and conservation efforts were mentioned by respondents. These included: the Puakō Community Association, Kailapa Community Association, the National Park Service, and Makai Watch. This finding, however, emphasizes the utility of this survey and reiterates that it represented the greater South Kohala community, rather than the smaller group of stakeholders and managers who made up the CAP process.

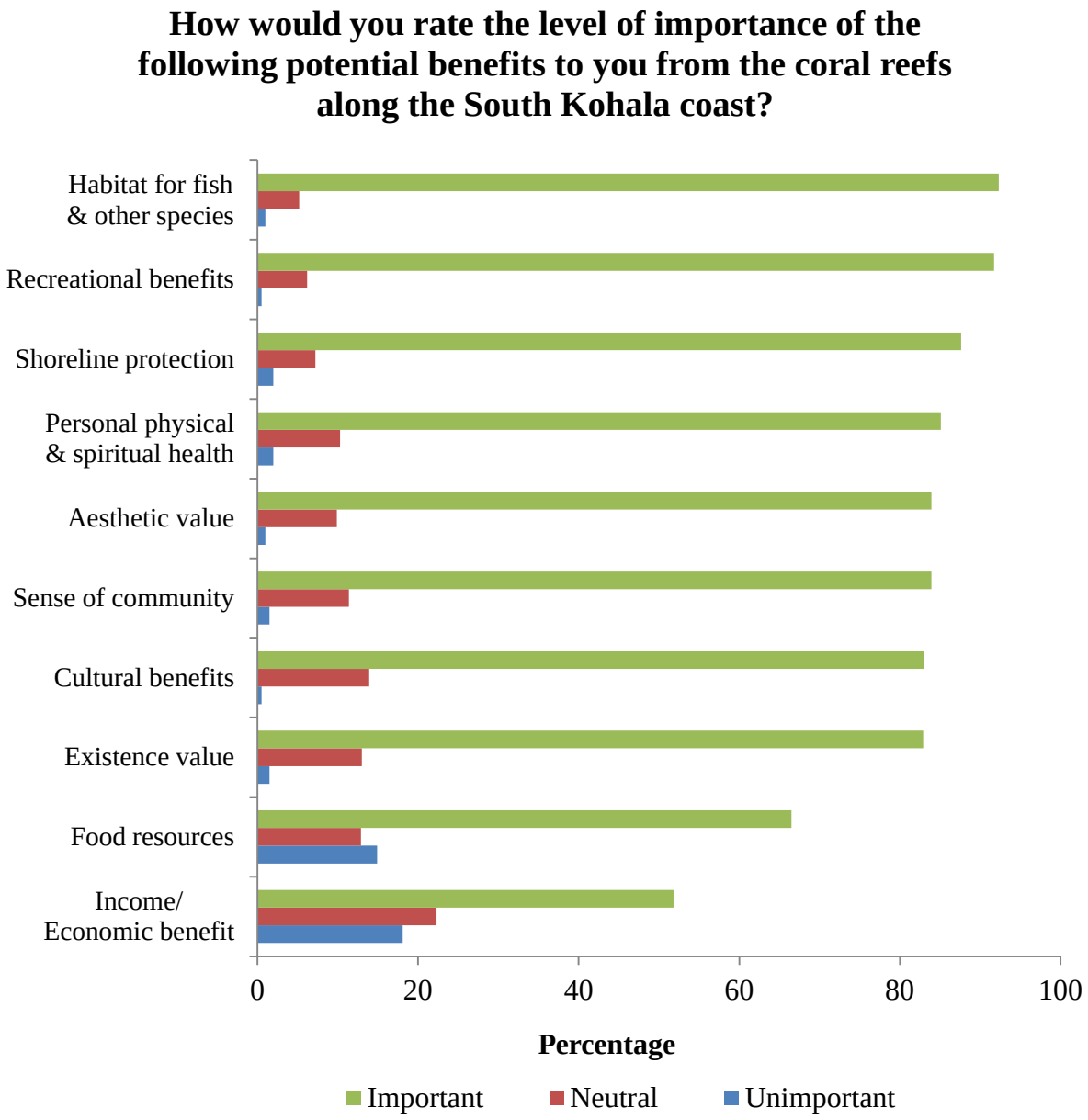

Figure 26. – Respondents' assessment of the relative importance of coral reef-related benefits and services, in percentages.

CONCLUSION AND RECOMMENDATIONS

The principal goal of the survey effort described in this report was to collect and analyze data regarding resource users' knowledge, attitudes, and perceptions about coral reef ecosystems in the South Kohala region of Hawai'i Island. Resource managers and policymakers can use the resulting information in a variety of ways. For example, these data can be used in the design of new management frameworks and can contribute to the refinement of existing strategies. More specifically, data regarding which resource conditions people feel they know most (or least) about can serve to identify which aspects of the coral reef ecosystem or management topics are not well understood by the general public and which are deserving of focused education and outreach campaigns. For example, as mentioned previously in this report, many survey respondents indicated a lack of understanding about watershed conditions and how upland streams and aquifers are connected to the region's coral reef ecosystems. Because many current management strategies in the South Kohala area (and throughout Hawai'i) are scaled to the watershed level, it is important for resource users and the general public to better understand the concepts and the goals of management efforts at this scale of analysis. Further, data regarding respondents' most relied upon sources of coral reef information can help management agencies and other organizations design more effective outreach and education strategies.

Additionally, the information reviewed here can provide managers and decision-makers with a better understanding of which kinds of resource management strategies are most likely to be supported by resource users on a regular basis. For example, most respondents stated conceptual support for community outreach and education efforts, and strategies geared toward the reduction of point and non-point sources of pollution in the South Kohala region. Assuming that the sample of survey respondents has in this case provided reasonably valid and reliable insight into perspectives held by the population of residents and repeat visitors in its entirety, such approaches are likely to receive little resistance in communities across the region.

Finally, it should be kept in mind that individuals who regularly observe, pursue, and use living marine resources for recreational, consumptive, and commercial purposes tend to possess a wealth of understanding about the marine environment. While the current study sought input from a wide variety of resource users (including casual users), it did prioritize the perspectives and observations of regular and repeat visitors to the South Kohala region. The resulting data are therefore of great potential utility to managers who seek to identify: (a) factors that threaten marine resources in the region; (b) resources that are perceived to be in states of decline or improvement; (c) management strategies that are deemed by the public to be relatively effective or ineffective; and (d) potential differences between the observations and perspectives of scientists and those of the various resource user groups. Indeed, such information can be particularly useful for resource managers who must prioritize and fine-tune their efforts in situations of limited time and fiscal resources. Moreover, by acknowledging the value of insight provided by both resource users and scientists, managers can broaden the range of information needed to make the kinds of regulatory decisions that are most likely to be successful and encouraging of public compliance.

Recommendations for Future Research

It is important to incorporate analysis of the knowledge, attitudes, and perceptions of resource users into regional conservation and management planning processes such as the CAP for South Kohala. Such data provide much needed insight into the ways in which humans perceive, use, and value the natural world around them. Collection and analysis of such information provide a means through which individuals who may not typically participate in management activities can contribute to the sustainability of coral reef ecosystems and the human benefits they provide.

However, two important points should be noted regarding the data and analyses provided in this report. First, it should be reiterated that the goal of the survey was not exhaustive representation of the KAPs of all persons who reside in or frequent the South Kohala coastline. Rather, the goal was to develop a generalized understanding of KAPs typically held by a range of resource user groups using an approach that was suitable and appropriate given available time and resources. Thus, the intercept survey generated data that do not necessarily fully represent the KAPs of those who use the coastal zone of South Kohala but who typically are not readily available for contact by a survey specialist at shoreline intercept sites. Spearfishermen or boat-based anglers are good examples of such hard-to-reach groups. Because such persons undoubtedly possess KAPs that are of direct relevance to marine resource planning and management processes, a more focused and purposive sampling approach may well be warranted. This is especially true in situations where new regulatory strategies are likely to disproportionately impact such groups.

Second, it should be kept in mind that KAPs are in no way static. The human experience is one of constant change, and this clearly applies to human interaction with the marine environment, which itself is in a constant state of flux. People continually learn and experience new things; they observe changes in the ocean and its resources on a regular basis. They undertake new recreational, commercial, and consumptive activities, engage new social relationships, and grow in understanding. For this reason, while the information provided in this report is vitally important for current planning efforts, it should be viewed as representative of a point in time – a general snapshot of KAPs as documented in 2012 – 2013. Given the dynamic nature of the ocean and the continually evolving nature of human interactions with marine ecosystems, it is essential that comparable data are collected in the future. Long-term monitoring of this nature is in keeping with the objectives of the CAP and can function as a valid mechanism for assessing the human effects of new resource management measures and outreach efforts as these are implemented in the South Kohala region in the years to come.

ACKNOWLEDGEMENTS

A great number of people were essential to the successful implementation of the project described in this report. Most importantly, the work could not have been completed without the cooperation of the residents and frequent visitors to the South Kohala coast who so graciously agreed to complete the survey. It is our hope that the results of the project will help ensure a positive experience for all resource users in the years to come. We also wish to thank and acknowledge the following individuals and groups: Megan Lamson of Mehana Consulting, who administered the survey; NOAA's Coral Reef Conservation Program, which provided the

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REFERENCES

American Cattlemen
2012. Parker Ranch: Home of the Hawaiian Cowboy. Cover Story. November. Heartland Communications Group. Des Moines, IA. http://www.american cattlemen.com/articles/cover-story-parker-ranch-home-hawaiian-cowboy, accessed February 5, 2014.

Ban, N.C., M. Mills, J. Tam, C.C. Hicks, S. Klain, N. Stoeckl, M.C. Bottrill, J. Levine, R.L. Pressey, T. Satterfield, and K.M.A. Chan
2013. A Social-Ecological Approach to Conservation Planning: Embedding Social Considerations. Frontiers in Ecology and the Environment 11(4):194-202.

Belt, Collins, and Associates, Ltd.
1967. The Kohala Coast Resort Region – Island of Hawai‘i: A Land Development Plan. Honolulu.

Bishop, A.
1826. “Visit of Kaahumanu to Hawaii,” Letter from Mr. Bishop to the Corresponding Secretary, A.B.C.F.M., Nov. 30, 1826, Missionary Herald 23, no. 8 (August 1827):247.

Brock, R.E., J.E. Norris, D.A. Zieman, and M.T. Lee
1987. Characteristics of Water Quality in Anchialine Ponds of the Kona, Hawai‘i, Coast. Pacific Science, Vol. 41, nos. 1-4.

Bryson, G.
1995. “Waimea Remembers Camp Tarawa.” Waimea Gazzette. Waimea, HI.

Capitini, C.A., B.N. Tissot, M.S. Carroll, W.J. Walsh, and S. Peck.
2004. Competing Perspectives in Resource Protection: The Case of Marine Protected Areas in West Hawai‘i. Society and Natural Resources. 17:763-778.

Cesar, H., P. van Beukering, S. Pintz, and J. Dierking
2002. Economic Valuation of the Coral Reefs of Hawaii: Final Report. Cesar Environmental Economics Consulting: Netherlands.

Charles, A., A. Bull, J. Kearney, and C. Milley
2007. Community-based Fisheries in the Canadian Maritimes. In Fisheries Management: Progress Toward Sustainability. T. McClanahan and J.C. Castilla, eds. Pp. 274-304. Blackwell Publishing: Oxford.

Cheesman, O.D.
2004. Environmental Impacts of Sugar Production. CABI Publishing: Oxfordshire.

Clague, D.A. and J.G. Moore.
1991. Geology and petrology of Mahukona Volcano, Hawaii. Bulletin of Volcanology. 53:159-172.

Clark, J.T., and P.V. Kirch (eds.)
1983. Archaeological Investigations of the Mudlane-Waimea-Kawaihae Road Corridor, Island of Hawai‘i: An Interdisciplinary Study of an Environmental Transect. Bernice P. Bishop Museum, Department of Anthropology. Hawaii Historic Preservation Report, No. 83-1. Honolulu.

Cordy, R.H.
2000. Exalted Sits the Chief: The Ancient History of Hawaii Island. Mutual Publishing Co.: Hawaii.

Cuddihy, L.W. and C.P. Stone
1990. Alteration of Native Hawaiian Vegetation-Effects of Humans, Their Activities and Introductions. Cooperative National Park Resources Studies Unit University of Hawaii at Manoa. Honolulu, HI.

Dayton, K.
2004. Big Island Littered With Unexploded Ordinance. Honolulu Advertiser. March 1. Big Island Bureau. http://the.honoluluadvertiser.com/article/2004/Mar/01/ln/ln01a.html, accessed February 12, 2014.

DeMartini, E., P. Jokiel, J. Beets, Y. Stender, D. Minton, E. Conklin, C. Storlazzi
2013. Terrigenous Sediment Impact on Coral Recruitment and Growth Affects the Use of Coral Habitat by Recruit Parrotfishes (F. Scaridae). Journal of Coastal Conservation: Planning and Management, DOI 10.1007/s11852-013-0247-2.

Department of Business, Economic Development, and Tourism
2013. County Social, Business, and Economic Trends in Hawaii: 1990-2011. Hawaii Economic Issues. Data report. http://files.hawaii.gov/dbedt/economic/data_reports/county_report/county-trends-2013.pdf, accessed February 20, 2014.

Dickey T.D., F. Nencioli, V.S. Kuwahara, C. Leonard, W. Black, Y.M. Rii, R.R. Bidigare, and Q. Zhang
2008. Physical and Bio-optical Observations of Oceanic Cyclones West of the Island of Hawai‘i. Deep-Sea Research Part II 55:1195−1217.

Dollar, S.J. and R.W. Grigg
2004. Anthropogenic and Natural Stresses on Selected Coral Reefs in Hawai‘i: a Multidecade Synthesis of Impact and Recovery. Pacific Science 58:281-304.

Doyle, E.L.
1953. Makua Laiana – The Story of Lorenzo Lyons. Advertiser Publishing Co.: Honolulu.

Ellis, W.
2004. A Narrative of an 1823 Tour Through Hawaii: Journal of William Ellis. Mutual Publishing Co.: Honolulu.

Fabricus, K.E.
2005. Effects of Terrestrial Runoff on the Ecology of Corals and Coral Reefs: Review and Synthesis. Marine Pollution Bulletin 50:125-146.

Fletcher, C.H., E.E. Grossman, B.M. Richmond, and A.E. Gibbs
2002. Atlas of Natural Hazards in the Hawaiian Coastal Zone. U.S. Geological Survey, Denver, CO, Geologic Investigations Series I-2761, 182 pp.

Friedlander, A.M.
2004. Status of Hawaii's Coastal Fisheries in the New Millennium: Proceedings of the 2001 Fisheries Symposium. Honolulu, HI: American Fisheries Society, Hawai‘i Chapter.

Friedlander, A., G. Aeby, E. Brown, A. Clark, S. Coles, S. Dollar, C. Hunter, P. Jokiel, J. Smith, B. Walsh, I. Williams, and W. Wiltse
2005. The State of Coral Reef Ecosystems of the Main Hawaiian Islands. In The State of the Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2005. J.E. Waddell, ed. Pp. 219-262. NOAA Technical Memorandum NOS NCCOS 11. Silver Spring, MD.

Friedlander, A., G. Aeby, S. Balwani, B. Bowen, R. Brainard, A. Clark, J. Kenyon, J. Maragos, C. Meyer, P. Vroom, and J. Zamzow
2008. The State of Coral Reef Ecosystems of the Northwestern Hawaiian Islands. In The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2008. J.E. Waddell and A.M. Clarke, eds. Pp. 263-306. NOAA Technical Memorandum NOS NCCOS 73. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD.

Fukunaga, L.
1975. A New Sun in North Kohala. In Finney, B.R, and K.A. Watson. A New Kind of Sugar: Tourism in the Pacific. Honolulu: East-West Culture Learning Institute, p.199-228.

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y. Chen, P. Chu, J.K. Eischeid, and D.M. Delparte
2013. Online Rainfall Atlas of Hawai‘i. Bulletin of the American Meteorological Society 94:313-316.

Glazier, E.W.
1999. Social Aspects of Hawaii's Small Vessel Troll Fishery. Phase II of Social Aspects of Pacific Pelagic Fisheries Program. Prepared by the University of Washington School of Marine Affairs for the University of Hawaii Joint Institute for Marine and Atmospheric Research. September.

_____

2007. Economic Data Report – Spinner Dolphin Tour Operations in the Main Hawaiian Islands. Prepared for NOAA Pacific Islands Regional Office, Protected Species Division. Honolulu.

Greene, L.W.
1993. A Cultural History of Three Traditional Hawaiian Sites on the West Coast of Hawai‘i Island. U.S. Department of the Interior. National Park Service, Denver Service Center.

Group 70 International, Inc.
2007. Pelekane Bay Watershed Sediment Runoff Analysis. Final Report for U.S. Army Corps of Engineers. Contract W9128A–06–D–0001.

Gulko, D., J. Maragos, A. Friedlander, C. Hunter, and R. Brainard
2002. Status of Coral Reefs in the Hawaiian Archipelago. In The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2002. Pp. 155-182. National Oceanic and Atmospheric Administration/National Ocean Service/National Centers for Coastal Ocean Science, Silver Spring, MD.

Hammes, D.L.
1994. Resort Development Impacts on Labor and Land Markets. Annals of Tourism Research 21(4):729-744.

Hawai‘i Tourism Authority.
2006. Hawai‘i Island Tourism Strategic Plan: 2006 – 2015. State of Hawai‘i: Honolulu.

Holt, K.
2009. Parker Ranch – Maintaining the Legacy. Angus Journal. October.

Hoover D.J., and C. Gold
2006. Assessment of Coastal Water Resources and Watershed Conditions at Pu‘ukohola Heiau National Historic Site, Hawai‘i. Technical Report NPS/NRWRD/NRTR-2006/359.

Impact Assessment, Inc.
2011. HO‘OHANOHANO I NĀ KŪPUNA: Proceedings from the Honor Our Ancestors Puwalu Series. Impact Assessment.

International Society for Reef Studies
2004. The Effects of Terrestrial Runoff of Sediments, Nutrients and Other Pollutants on Coral Reefs. Briefing Paper 3, International Society for Reef Studies.

Jokiel, P.L., K.S. Rodgers, W.J. Walsh, D.A. Polhemus, and T.A. Wilhelm
2011. Marine Resource Management in the Hawaiian Archipelago: The Traditional Hawaiian System in Relation to the Western Approach. Journal of Marine Biology (2011), Article ID 151682, 16 pp.

Jupiter, S.
2002. Getting to the Bottom of It: a Paleoreconstruction of the –400 m Drowned Carbonate Platform off Northwestern Hawaii. Monterey Bay Aquarium Research Institute. Intern Papers Series. Monterey,CA.

Kirch, P.V.
1982. The Ecology of Marine Exploitation in Prehistoric Hawai‘i. Human Ecology 10:455-476.

Koebele, A.
1900. Destruction of Forest Trees. Report to the Commissioner of Agriculture and Forestry, Hawaii, 1900. pp. 50-60.

Kumo Pono Associates
1999. Ke Ala Loa-Ala Nui Aupuni. Kawaihae to Anaeho‘omalu, Kohala. http://www.kumupono.com/Kohala/south-kohala-vol-1.pdf, accessed February 7, 2014.

Kuykendall, R.
1967. The Hawaiian Kingdom: 1874-1893, the Kalakaua Dynasty. University of Hawaii Press: Honolulu.

Ladefoged, T.N. and M.W. Graves
2008. Variable Development of Dryland Agriculture in Hawai‘i: A Fine-Grained Chronology from the Kohala Field System, Hawai‘i Island. Current Anthropology. 49(5):771-802.

Langlas, C.
1994. Pu‘u of Mauka Kawaihae and Kalalä Ahupua‘a, District of Kohala, Hawai‘i Island: Report of an Investigation and Assessment of the Hawaiian Cultural Significance of Candidate Sites for the Kamuela Area (Hawai‘i) NEXRAD Installation. Prepared for SRI International, Menlo Park, California.

Lau, L.S., and J.F. Mink
2006. Hydrology of the Hawaiian Islands. University of Hawaii Press: Honolulu.

Levine, A. and M. D'Iorio
2011. Hawai'i Coastal Use Mapping Project: Ocean Uses Map Book. Results from Participatory Ocean Use Mapping Workshops: South Kohala and North Kona Districts. September 23-25, 2010.

Limouzy-Paris, C.B., H.C. Graber, D.L. Jones, A.W. Roepke, and W.J. Richards
1997. Translocation of Larval Coral Reef Fishes via Sub-mesoscale Spin-off Eddies from the Florida Current. Bulletin of Marine Science 60(3):966−983.

Lobel, P.S. and A.R. Robinson
1983. Reef Fishes at Sea: Ocean Currents and the Advection of Larvae. In Reaka, M. (ed) Workshop on Coral Reef Ecology. US Department of Commerce, Philadelphia, PA, p 29-38.

Lumpkin, C.F.
1998. Eddies and Currents of the Hawaii Islands. PhD thesis, University of Hawaii at Manoa, HI.

Maciolek, J.A., and R.E. Brock
1974. Aquatic Survey of the Kona Coast Ponds, Hawaii Island. Sea Grant Advisory Report UNHl:SEAGRANT-AR-74-04: Honolulu, 73 pp.

Maclennan, C.A.
1983. Hawai'i Turns to Sugar: the Rise of Plantation Centers, 1860-1880. The Hawaiian Journal of History 29:33-57.

Maly, K., and O. Maly
2003. Ka Hana Lawai'a A Me Na Ko'a O Na Kai 'Ewalu. A History of Fishing Practices and Marine Fisheries of the Hawai'ian Islands. Kumo Pono Associates. Prepared for The Nature Conservancy and Kamehameha Schools: Hilo.

McDougall, I., and D.A. Swanson
1972. Potassium-argon Ages of Lavas from the Hawi and Pololu Volcanic Series, Kohala Volcano, Hawaii. Bulletin of the Geologic Society of America 83(12):3731-3738.

Minton, D., E. Conklin, C.S. Couch, M. Garren, M.J. Hardt, R. Amimoto, K. Pollack, and C. Wiggins
2011. Survey of the Coral Reefs of Pelekane Bay. Technical Report. The Nature Conservancy: Honolulu.

National Park Service
2014a. Pu'uonua Honaunau National Historic Park. Heleipālala Fishponds. http://www.nps.gov/puho/historyculture/heleipalala-fishponds.htm, accessed February 18, 2014.

_____

2014b. Pu‘ukohola Heiau National Historic Site. U.S. Department of the Interior. http://www.nps.gov/puhe/historyculture/puukohola.htm, accessed February 18, 2014.

Page, C., L. Bony, and L. Schewel

2007. Island of Hawaii Whole System Project. Phase I report. Rocky Mountain Institute. http://www.kohalacenter.org/pdf/hi_wsp_2.pdf, accessed February 24, 2014.

Patzert, W.

1969. Eddies in Hawaiian Waters. University of Hawaii, Hawaii Institute of Geophysics, Honolulu, HI.

Rothstein, J., A. Pilago, F.Y. Fujimoto, and Nansay Hawaii Corp.

1995. Public Access Shoreline Hawaii v. Hawaii County Planning Commission. No. 15460, Certiroari to the Intermediate Court of Appeals (Civ. Number 90-293K). Aug. 31.

Schmitt, R.C.

1977. Historical Statistics of Hawaii. University Press of Hawaii, Honolulu.

SeaWeb

2013. Citizen Engagement in West Maui Watershed Protection. Findings from Focus Group Research. Unpublished Report.

Shade, P.J.

1995. Water Budget for the Kohala Area, Island of Hawaii. U.S. Geological Survey. Water-Resources Investigations Report 95-4114. Prepared in cooperation with the Department of Water Supply, County of Hawaii: Honolulu.

Sohmer, S.H, and R. Gustafson

1987. Plants and Flowers of Hawaii. University of Hawaii Press: Honolulu.

SSFM International, Inc.

2011. Hawai‘i Island Commercial Harbors, 2035 Master Plan Update. Prepared for State of Hawai‘i Department of Transportation Harbors Division.

State of Hawai‘i

1998. Hawai‘i’s Implementation Plan for Polluted Runoff Control. Appendix C: The Hawai‘i Unified Watershed Assessment. Honolulu, HI.

_____

2004. List of Impaired Waters in Hawai‘i. Hawai‘i State Department of Health, Environmental Planning Office. Honolulu, HI.

_____
2006. Planning for Sustainable Tourism, Part I: Summary Report. Honolulu: Department of Business, Economic Development and Tourism.

_____
2010a. Hawai‘i Coral Reef Strategy: Priorities for Management in the Main Hawaiian Islands 2010-2020. Honolulu, HI.

_____
2010b. Report on the Findings and Recommendations of Effectiveness of the West Hawai‘i Regional Fishery Management Area. Department of Land and Natural Resources. Honolulu.

_____
2013. Hawai‘i Ocean Resources Management Plan: July 2013. Hawai‘i Office of Planning, Coastal Zone Management Program: Honolulu.

Stender, Y., P.L. Jokiel, and K.S. Rodgers
2014. Thirty Years of Coral Reef Change in Relation to Coastal Construction and Increased Sedimentation at Pelekane Bay, Hawai‘i. PeerJ 2:e300; DOI 10.7717/peerj.300.

Stevenson, T.C., and B.N. Tissot
2013. Evaluating Marine Protected Areas for Managing Marine Resource Conflict in Hawai‘i. Marine Policy 39(2013):215-223.

Stewart, C., J. Michaud, M. Donoho, and O. Smith
2011. Wai‘ula‘ula Watershed Management Plan. Mauna Kea Soil and Water Conservation District.

The Nature Conservancy
2012. South Kohala Conservation Action Plan Final Report. Prepared for Hawai‘i’s Division of Aquatic Resources, Department of Land and Natural Resources. http://www.hawaiicoralreefstrategy.com/PDFs/3_Priority_Sites_Kohala/skcap_final_report.pdf, accessed November 23, 2013.

The South Kohala Community
2008. South Kohala Community Development Plan: Final. Prepared for the County of Hawai‘i, with the assistance of The County of Hawai‘i Planning Department and Townscape, Inc. Hawai‘i County.

Tissot, B.N, and L.E. Hallacher.
2003. Effects of Aquarium Collectors on Coral Reef Fishes in Kona, Hawai‘i. Conservation Biology 17(6):1759-1768.

Titcomb, M.
1972. Native Use of Fish in Hawai‘i. The University Press of Hawai‘i: Honolulu.
University of Hawai‘i Economic Research Organization
2008. Quarterly Hawai‘i Forecast Update: No Quick Recovery from Hawai‘i Recession. UHERO: Honolulu.

U.S. Army Corps of Engineers
1985. Draft Environmental Impact Statement. U.S. Department of the Army Permit Application. Waikaloa Beach Resort Anchialine Ponds. Waikaloa, South Kona District, Island of Hawaii. Honolulu District.

U.S. Census Bureau
2013. American Factfinder. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml, accessed November 11, 2013.

_____
2014. American Factfinder. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml, accessed July 22, 2014.

Vitousek, P.M., T.N. Ladefoged, P.V. Kirch, A.S. Hartshorn, M.W. Graves, S.C. Hotchkiss, S. Tuljapurkar, O.A. Chadwick
2004. Soils, Agriculture, and Society in Precontact Hawai‘i. Science 304:1665-1669.

Walsh W. J., S.P. Cotton, J. Dierking, I.D. Williams
2004. The Commercial Marine Aquarium Fishery in Hawai‘i: 1976–2003. In: Friedlander A. M., editor. Status of Hawai‘i’s Coastal Fisheries in the New Millennium. American Fisheries Society; 2004. p. 132-158. 230 pp

Western Pacific Regional Fishery Management Council
2009. Fishery Ecosystem Plan for the Hawaii Archipelago. Honolulu.

Williams, I.D., W.J. Walsh, J.T. Claisse, B.N. Tissot, and K.A. Stamoulis
2009. Impacts of a Hawaiian Marine Protected Area Network on the Abundance and Fishery Sustainability of the Yellow Tang, *Zebrasoma flavescens*. Biological Conservation 142(5):1066-1073.

Wolfe, E. W. and J. Morris
1996. Geologic Map of the Island of Hawaii. Number I-2524 in Miscellaneous Investigations Series. U.S. Geological Service: Denver.

APPENDIX 1 – SURVEY INSTRUMENT

Survey # _____
Date _____
Time _____

OMB Control #: 0648-0654
Expiration Date: 10/31/2015

Survey: Knowledge, Attitudes, and Perceptions of Hawaii's South Kohala Coral Reef Priority Site

SITE USE PATTERNS

1. **What is your primary purpose/activity for visiting the South Kohala Coast today? (e.g., fishing, swimming, diving, etc.)?**

   _____

2. **Approximately how many times have you visited the South Kohala Coast?**

   O First time O 2 – 10 times O 11 – 20 times O > 20 times

   a. **If this is not your first time, how long have you been coming to the South Kohala Coast?**

      O 1 year O 2 – 5 years O 6 – 10 years O > 10 years

3. **What times of year do you visit the South Kohala Coast?**

	Rarely or never	Sometimes	Often
a. Winter	O	O	O
b. Spring	O	O	O
c. Summer	O	O	O
d. Fall	O	O	O

4. **What activities do you participate in at the South Kohala Coast?**

	Rarely or never	Sometimes	Often
a. Swimming	O	O	O
b. Surfing	O	O	O
c. Scuba diving	O	O	O
d. Snorkeling	O	O	O
e. Camping	O	O	O
f. Boating (motorized)	O	O	O
g. Canoeing/kayaking	O	O	O
h. Sun bathing/hanging out	O	O	O
i. Picnicking	O	O	O

	Rarely or never	Sometimes	Often
j. Marine mammal watching	O	O	O
k. Thrill craft activities	O	O	O
l. Aquarium fish collecting	O	O	O
m. Shoreline gathering	O	O	O
n. Fishing	O	O	O
If so, which methods/gear types? _____			
o. Other _____	O	O	O

KNOWLEDGE ABOUT SITE CONDITIONS

In this section, please indicate your beliefs and opinions regarding the general condition of each resource along the South Kohala Coast (the area shown on the map). Space is provided below each of the following questions (d) to make additional comments, such as conditions at particular locations along the coast or time frame for changes you've observed.

5. **Coral reef conditions/health along the South Kohala Coast**

   a. **How much do you know about these conditions?**

      O I don't know anything O I know a little O I know a lot

   b. **How satisfied are you with the existing condition of coral reefs here?**

      O Not satisfied O Somewhat dissatisfied O Neutral O Somewhat satisfied O Very satisfied O I don't know/ not sure

   c. **In your opinion, the condition of coral reefs along the South Kohala Coast is:**

      O Declining O Staying the same O Improving O I don't know/not sure

   d. **Additional comments about coral reef conditions/health along the South Kohala Coast.** _____

      _____

6. **Fish abundance (number or quantity of fish) in the coral reef areas along the South Kohala Coast**

   a. **How much do you know about the existing number of fish here?**

      O I don't know anything O I know a little O I know a lot

b. How satisfied are you with the existing number of fish along the South Kohala Coast?

O Not satisfied O Somewhat dissatisfied O Neutral O Somewhat satisfied O Very satisfied O I don't know/ not sure

c. In your opinion, the number of fish along the South Kohala Coast is:

O Declining O Staying the same O Improving O I don't know/not sure

d. Additional comments about fish abundance along the South Kohala Coast:

_____

7. Fish diversity (number of species or types of fish present) in the coral reef areas along the South Kohala Coast

a. How much do you know about the diversity of fish here?

O I don't know anything O I know a little O I know a lot

b. How satisfied are you with the existing diversity of fish along the South Kohala Coast?

O Not satisfied O Somewhat dissatisfied O Neutral O Somewhat satisfied O Very satisfied O I don't know/ not sure

c. In your opinion, fish diversity along the South Kohala Coast is:

O Declining O Staying the same O Improving O I don't know/not sure

d. Additional comments about fish diversity along the South Kohala Coast:

_____

8. Water quality along the South Kohala Coast

a. How much do you know about water quality here?

O I don't know anything O I know a little O I know a lot

b. How satisfied are you with the existing water quality along the South Kohala Coast?

O Not satisfied O Somewhat dissatisfied O Neutral O Somewhat satisfied O Very satisfied O I don't know/ not sure

c. In your opinion, water quality along the South Kohala Coast is:

O Declining O Staying the same O Improving O I don't know/not sure

d. Additional comments about water quality along the South Kohala Coast:

_____

9. Habitat for monk seal resting/sea turtle nesting along the South Kohala Coast

a. How much do you know about these habitats here?

O I don't know anything O I know a little O I know a lot

b. How satisfied are you with the existing condition of these habitats along the South Kohala Coast?

O Not satisfied O Somewhat dissatisfied O Neutral O Somewhat satisfied O Very satisfied O I don't know/ not sure

c. In your opinion, the condition of these habitats along the South Kohala Coast is:

O Declining O Staying the same O Improving O I don't know/not sure

d. Additional comments about habitat for monk seal resting/sea turtle nesting along the South Kohala Coast: _____

_____

10. Watershed conditions/health in areas upland from the South Kohala Coast

a. How much do you know about these watershed conditions here?

O I don't know anything O I know a little O I know a lot

b. How satisfied are you with the existing condition of watersheds along the South Kohala Coast?

O Not satisfied O Somewhat dissatisfied O Neutral O Somewhat satisfied O Very satisfied O I don't know/ not sure

c. In your opinion, the condition of watersheds along the South Kohala Coast is:

O Declining O Staying the same O Improving O I don't know/not sure

d. Additional comments about watershed conditions/health along the South Kohala Coast: _____

_____

11. Conflicts between resource uses or users along the South Kohala Coast

a. How much do you know about the presence of conflicts here?

O I don't know anything O I know a little O I know a lot

b. How would you describe the existing level of conflicts along the South Kohala Coast?

O High O Medium O Low O I don't know/not sure

c. In your opinion, the level of conflict along the South Kohala Coast is:

O Declining (fewer and/or less serious conflicts) O Staying the same O Increasing (more and/or more serious conflicts) O I don't know/ Not sure

d. Additional comments about conflicts along the South Kohala Coast:

_____

12. Facilities along the South Kohala Coast

a. How much do you know about public use facilities along the South Kohala Coast?

O I don't know anything O I know a little O I know a lot

b. How satisfied are you with the existing facilities along the South Kohala Coast?

O Not satisfied O Somewhat dissatisfied O Neutral O Somewhat satisfied O Very satisfied O I don't know/ not sure

c. In your opinion, the number/type/condition of the facilities along the South Kohala Coast is:

O Declining O Staying the same O Improving O I don't know/not sure

d. What changes would you like to see in the number, type, or condition of public use facilities along the South Kohala Coast?

_____

_____

13. Where do you get your information about coral reefs along the South Kohala Coast? (Please be specific: e.g., name of newspaper, web site, specific community group, etc.)

_____

a. Which of these do you rely on most?

_____

POTENTIAL THREATS TO RESOURCES IN THE SOUTH KOHALA COAST

In this section, please indicate your opinions regarding the extent to which each item is a threat to coral reefs along the South Kohala Coast (the area shown on the map). Space is provided below each of the following questions (c) to make additional comments, such as locations where you feel impacts from a threat might be strongest.

14. Shoreline alteration and development

a. What is the level of shoreline alteration and development?

O None/ very little O Moderate O Extensive O I don't know/ Not sure

b. To what extent do you feel it is a threat to the coral reefs in the area?

O Not at all O Minor threat O Major threat O I don't know/not sure

c. If you believe this is a threat, are there any specific locations or types of development that you feel are especially a problem? If so, please specify:

_____

15. Fish feeding

a. To what extent is it occurring?

O Not at all O A little O A lot O I don't know/not sure

b. To what extent do you feel it is a threat to the coral reefs in the area?

O Not at all O Minor threat O Major threat O I don't know/not sure

c. If you believe this is a threat, are there any specific locations where you feel this is especially a problem? If so, please specify:

_____

16. **Introduction or existence of invasive species (such as fish or algae)**

a. **To what extent are they present/being introduced?**

O Not at all O A little O A lot O I don't know/not sure

b. **To what extent do you feel it is a threat to the coral reefs in the area?**

O Not at all O Minor threat O Major threat O I don't know/not sure

c. **If you believe this is a threat, are there any specific locations or species that you feel are especially a problem? If so, please specify:**

_____

17. **Storms (high winds and waves)**

a. **To what extent do you feel they are a threat to the coral reefs in the area?**

O Not at all O Minor threat O Major threat O I don't know/not sure

b. **If you believe this is a threat, are there any specific locations where you feel this is especially a problem? If so, please specify:**

_____

18. **Climate change effects on ocean conditions (Increasing temperatures, sea level, and acidity)**

a. **To what extent is it occurring?**

O Not at all O A little O A lot O I don't know/not sure

b. **To what extent do you feel it is a threat to the coral reefs in the area?**

O Not at all O Minor threat O Major threat O I don't know/not sure

c. **If you believe this is a threat, are there any specific locations where you feel this is especially a problem? If so, please specify:**

_____

19. **Erosion/sedimentation from uplands**

a. **To what extent is it occurring?**

O Not at all O A little O A lot O I don't know/not sure

b. **To what extent do you feel it is a threat to the coral reefs in the area?**

O Not at all O Minor threat O Major threat O I don't know/not sure

c. **If you believe this is a threat, are there any specific locations or sources that you feel are especially a problem? If so, please specify:**

_____

20. **Chemical pollution from uplands (e.g., from batteries, paints, pesticides, herbicides)**

a. **To what extent is it occurring?**

O Not at all O A little O A lot O I don't know/not sure

b. **To what extent do you feel it is a threat to the coral reefs in the area?**

O Not at all O Minor threat O Major threat O I don't know/not sure

c. **If you believe this is a threat, are there any specific locations or sources of pollution that you feel are especially a problem? If so, please specify:**

_____

21. **Organic pollution from uplands (e.g., animal and human waste)**

a. **To what extent is it occurring?**

O Not at all O A little O A lot O I don't know/not sure

b. **To what extent do you feel it is a threat to the coral reefs in the area?**

O Not at all O Minor threat O Major threat O I don't know/not sure

c. **If you believe this is a threat, are there any specific locations or sources of pollution that you feel are especially a problem? If so, please specify:**

_____

22. **Unsustainable or inappropriate fishing practices**

a. **To what extent is it occurring?**

O Not at all O A little O A lot O I don't know/not sure

b. **To what extent do you feel it is a threat to the coral reefs in the area?**

O Not at all O Minor threat O Major threat O I don't know/not sure

c. **If you believe this is a threat, are there any specific locations or practices (whether legal or illegal) that you feel are especially a problem? If so, please specify:** _____

23. Unsustainable or inappropriate coastal and marine recreational use (e.g., poor diving practices or boat operation by individuals and/or commercial operators)

a. To what extent is it occurring?

O Not at all O A little O A lot O I don't know/not sure

b. To what extent do you feel it is a threat to the coral reefs in the area?

O Not at all O Minor threat O Major threat O I don't know/not sure

c. If you believe this is a threat, are there any specific locations or practices that you feel are especially a problem? If so, please specify:

_____

24. Have you ever observed an individual violating a fishing, boating, or resource law along the South Kohala Coast? O YES O NO

a. If yes, what was the infraction? (e.g., dumping, illegal fishing)

_____

b. Did you report it to anyone? O Yes, I reported it to _____

O No, I did not report it

c. What was the outcome of this observation/reporting? _____

_____

25. Do you have any additional comments about these threats?

_____

MANAGEMENT STRATEGIES

Listed below are a number of types of activities that could be undertaken or strengthened to improve resources along the South Kohala Coast and the associated watershed. For each activity, indicate how much you would support or oppose its implementation.

26. Establish community-based subsistence fishing areas for the purpose of reaffirming and protecting fishing practices customarily and traditionally exercised for purposes of native Hawaiian subsistence, culture, and religion

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

27. Create new marine protected areas (no fishing allowed)

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

28. Change management of existing marine protected areas

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

a. What would you like to see changed?

_____

29. Establish and train community education groups, such as Makai Watch

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

30. Increase enforcement officer presence

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

31. Increase signs describing regulations

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

32. Increase fencing and remove feral pigs, goats, and sheep in upland areas

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

33. Improve injection well and wastewater treatment facilities

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

34. Increase outreach and education (educate users and area residents regarding regulations, and encourage community involvement)

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

35. Develop an online system for public to report illegal activities

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

36. **Engage local businesses and hotels in management processes and develop education materials for guests/tourists**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

37. **Remove invasive marine species (such as fish and algae)**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

38. **Remove non-native vegetation in coastal areas**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

39. **Plant vegetation in barren areas to reduce runoff**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

40. **Install sediment traps (and use other strategies) to reduce sediment and nutrient runoff from the land**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

41. **Establish a recreational fishing license program with revenue dedicated to fisheries management**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

42. **Change fishing regulations**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

a. What would you like to see changed?

_____

43. **Change regulations for other (non-fishing) recreational activities**

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

a. What would you like to see changed?

_____

44. **Other:** _____

O Strongly oppose O Oppose O Neutral O Support O Strongly support O I don't know/ not sure

45. **Of these management strategies, which would be your top 3 priorities? Please write the numbers here.**

_____ _____ _____

MARINE MANAGED AREAS

46. **How familiar are you with any specially managed marine areas (such as Fish Replenishment Areas, Fisheries Management Areas, Marine Life Conservation Districts) in the South Kohala Coast area?**

O Not at all O A little O Very O Extremely

47. **Indicate your level of agreement or disagreement with the following statements about marine managed areas in the South Kohala Coast:**

a. **Marine managed areas in general are an effective tool for conserving coral reef fish and habitat.**

O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O I don't know/ not sure

b. **I would support marine managed areas even if they restricted my ability to use this area.**

O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O I don't know/ not sure

c. **There are strategies other than marine managed areas that would be more effective for conserving coral reef fish and habitat in the South Kohala Coast.**

O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O I don't know/ not sure

d. **If you feel there are other strategies that would be more effective for management in this area, please specify**:

_____

BENEFITS/SERVICES

48. How would you rate the level of importance of the following potential benefits to you from the coral reefs in South Kohala Coast?

a. Food resources

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

b. Income/economic benefit

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

c. Sense of community

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

d. Cultural benefits

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

e. Recreational benefits

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

f. Aesthetic value

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

g. Benefits from knowing it exists (existence value)

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

h. Shoreline protection

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

i. Habitat for fish and other species

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

j. Personal physical and spiritual health

O Not at all important O Somewhat unimportant O Neutral O Somewhat important O Extremely important O I don't know/ not sure

KNOWLEDGE OF PLANNING ACTIVITIES

49. Before this survey, were you aware of any conservation planning efforts for the South Kohala Coast being developed by local residents and a number of other agencies? O YES O NO

50. Are you a participant in any of these processes? O YES O NO

a. Which one(s)? _____

DEMOGRAPHIC INFORMATION

51. Where do you live? _____ **Zip code:** _____

52. Are you a member of any local or regional organizations, community groups, or clubs that are involved with marine or watershed resources in the South Kohala Coast? O YES O NO

a. If so, which one(s)? _____

53. What is your age group?

O 18 to 24 years O 25 to 34 years O 35 to 44 years O 45 to 54 years O 55 to 64 years O More than 64 years

54. What is your gender? O Male O Female

55. Are you of Hispanic, Latin, or Spanish origin?

O No, not of Hispanic, Latino, or Spanish origin
O Yes, Mexican, Mexican American, Chicano
O Yes, another Hispanic, Latino, or Spanish Origin
O Yes, Puerto Rican
O Yes, Cuban

56. How would you describe your race background? *(check all that apply)*

O White O Black/African American O Filipino
O Native Hawaiian O Guamanian or Chamorro O Samoan
O Chinese O Japanese O Korean
O Vietnamese O Asian Indian O American Indian or Alaska Native
O Other Asian or Pacific Islander (specify) _____
O Other (specify) _____

57. **Please write any other thoughts or opinions you'd like to share with us regarding the management of the marine and watershed resources in the South Kohala Coast.**

_____

_____

58. **Would you like to receive a copy of the final report of this study?**

O YES O NO

59. **Would you like to be kept informed of opportunities to participate in management activities in the South Kohala Coast?**

O YES O NO

If you answered YES to either of these questions, please write an email or mailing address on the sheet provided by the surveyor, who will keep them separate from your survey responses.

THANK YOU! ☺