



CAPE COD
COMMISSION

Economic Impact of Cape Cod Harbors

OCTOBER 2020

Prepared by the Cape Cod Commission and the Urban Harbors
Institute at UMass Boston.

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Executive Summary

The goal of this project was to estimate the economic impact of the business community located on or near Cape Cod harbors.

The Cape Cod Commission and Urban Harbors Institute at UMass Boston conducted a study to better understand the economic importance of maintaining the functionality of Cape Cod's harbors. A survey was conducted in the spring of 2020 and leveraged the IMPLAN input-output model to evaluate the economic impacts of employment at harbor-adjacent or -dependent businesses.

Although the COVID-19 pandemic impacted the survey response rate, over 100 businesses responded in the four towns that the study focuses on: Chatham, Dennis, Falmouth, and Provincetown. The six harbors within the study areas were Inner Harbor and Great Harbor in Falmouth, Sesuit Harbor in Dennis, Stage Harbor and Aunt Lydia's Cove in Chatham, and Provincetown Harbor.

These survey respondents directly employed 2,328 people across 58 industries, leading to a total employment (direct, indirect, and induced impacts of business and household spending) of 4,446 people. The direct compensation of employees in the top ten industries identified in this study, using survey responses alone, was nearly \$150 million. That number would greatly increase should the compensation of employees in every establishment within the study areas be counted.

The contributions of businesses that are part of the water-dependent "Blue Economy" on Cape Cod, as well as those that self-identify as harbor-dependent, are highlighted in the Results section.

Businesses located along the coast and reliant on access to the harbors are significant economic drivers for Cape Cod. Maintaining and/or enhancing harbor functionality should be a priority for coastal communities in order to secure and improve the economic benefits—including employment—of these industries, and the impacts of climate change must be integrated into capital planning efforts to preserve these facilities into the future.

Introduction

Cape Cod's environment is its economy. The region has long been shaped by our relationship to the water, and the businesses and organizations located near our harbors have economic impacts that echo throughout the region.

Harbors have long served as centers of settlement and then commerce for Cape Cod towns, through the years of the whaling industry to the seasonal tourism industry of today. Their sustainability is challenged today due to short- and long-term changing environmental conditions and constricted municipal budgets, which in turn impact the businesses that rely on these harbors for their operations.

The goal of this project was to collect baseline information on the economic value of harbor-adjacent businesses, which can be used by towns to facilitate harbor capital and maintenance planning across Cape Cod.

PROJECT BACKGROUND

The Cape Cod Commission is the regional land use and planning agency for Barnstable County. In its founding legislation, the Commission is named responsible for supporting balanced economic growth and the provision of adequate capital facilities, among other regional needs.¹ To that end, the Commission develops and implements a regional Comprehensive Economic Development Strategy (CEDS) in collaboration with a broad group of stakeholders, identifying priorities and a five-year action plan to facilitate a balanced economy.

Its coastal environment, commercial fishing fleet, and maritime history and industries are competitive advantages for Cape Cod. Regional harbor planning was named a stakeholder priority in the 2014 CEDS Update to help protect and build on those advantages, and this evaluation of harbors' economic impact was integrated into the Action Plan for the 2019 CEDS Update.

The Commission worked with town staff and elected officials early in the project to identify pilot harbors for this evaluation and researched the key concerns for the region and individual harbors. In 2019, Commission staff visited each of the pilot harbors and met with town staff and elected officials to discuss the project, identifying key challenges, and reviewing past capital investments and efforts in the study area.

Following these meetings and background research on harbor planning and spending, an online survey was conducted to estimate the economic benefits of maintaining functionality of Cape Cod

¹ Cape Cod Commission Act (1990). <https://capecodcommission.org/about-us/ccc-act/>

harbors, focusing on the employment at harbor-proximate businesses. The survey was open from January – March 2020, and survey analysis and report writing was completed by September 2020.

Challenges to Harbor Operations

To better understand the expenditures around waterfront needs, Commission staff reviewed the past five years of Town Meeting articles (Table 1). Of the four pilot towns, Chatham had the highest funding amount approved, including for a major renovation to the Fish Pier, while Dennis had the highest expenditures for dredging, particularly in Sesuit Harbor.

Town	FY	Amount Approved	Description
Chatham	FY2017-2022	\$11,355,000	Waterfront Capital Bond. Approvals over the five-year period include: Fish Pier (\$5.6 million), Eldredge Pier (\$2 million), Ryder's Cove (\$800,000), 90 Bridge Street (\$2,090,000), Old Mill Boat Yard (\$310,000), Crow's Pond Ramp (\$500,000), Little Mill Pond Pier (\$75,000), and Barn Hill Ramp Walkway (\$25,000)
Dennis	FY2018	\$4,008,857	Sesuit Harbor – Dredging
		\$22,706	Bass River – Dredging
		\$215,000	Docks/Piers – Sesuit
	FY2019	\$15,000	Sesuit Infrastructure - Dock Utilities
		\$175,000	Maintenance Dredging
Falmouth	FY2018	\$100,000	Annual Inlet Dredging
		\$200,000	Simpson's Bulkhead
	FY2019	\$200,000	West Falmouth Ramp
		\$300,000	Coastal Erosion
	FY2020	\$100,000	Annual Inlet Dredging
		\$20,000	Dinghy Racks
Provincetown	FY2018	\$200,000	Pier Infrastructure Maintenance
		\$200,000	Marine Department Shoreline Protection Projects

Table 1. Town Meeting approvals on harbor-related investments. Source: FY2017-2020 Town Meeting Articles.

Some common issues in and around the Commonwealth’s coastal harbors include a lack of sufficient berthing, conflicting uses of the shoreline and water, a need for additional parking, potential impacts of climate change, and the need for dredging. Harbors on Cape Cod and the Islands have very dynamic sediment transport processes, resulting in sediment build-up and

navigational issues. Additionally, Cape Cod is exposed to frequent storms and intense wave energy, enhancing the need for frequent maintenance dredging.²

Due to constrained fiscal environments, towns on Cape Cod must constantly balance harbor improvements and maintenance with other necessary priorities. With this study, the Commission seeks to increase local understanding of the economic value of harbors to their communities and the region, providing information to support decisions regarding harbor-related funding. With regular planning and funding, harbors will become more accessible, efficient, economically productive, and climate resilient.

Impacts of Climate Change

Harbor operations face challenges due to climate change, sea level rise, sunny-day flooding, and storm surge from increasingly intense and frequent storms. The need for investments in operations and maintenance is expected to increase as a result of these coastal hazards.

As part of their hazard mitigation planning efforts, towns identify potential impacts to the community and infrastructure from hazards such as hurricanes or severe winter weather. In addition to identifying the extent of these potential hazards locally, communities also inventory the critical facilities that may be impacted by them. Critical facilities are essential to the health and welfare of a community, and are especially important for response and recovery following hazard events. Harbor infrastructure is identified as critical in plans, as it plays a significant role in transportation and economic growth on Cape Cod. Provincetown, for example, named MacMillan Pier, Fishermen's Wharf, Coast Guard Pier, and the Station as Essential Critical Facilities.

The natural hazards for which Massachusetts is most at risk and their interaction with climate change are listed in the Massachusetts State Hazard Mitigation and Climate Adaptation Plan (Table 2).

² Massachusetts State of Our Harbors. Prepared by the Urban Harbors Institute, University of Massachusetts Boston and Apex Companies, LLC for the MA DCR Division of Waterways 2015. <http://archives.lib.state.ma.us/handle/2452/724259>

Primary Climate Change Interaction	Natural Hazard	Other Climate Change Interactions	Representative Climate Change Impacts
Change in Precipitation	Inland Flooding	Extreme Weather	Flash flooding, urban flooding, drainage system impacts (natural and human-made), lack of groundwater recharge, impacts to drinking water supply, public health impacts from mold and worsened indoor air quality, vector-borne diseases from stagnant water, episodic drought, changes in snow-rain ratios, changes in extent and duration of snow cover, degradation of stream channels and wetlands
	Drought	Rising Temperatures, Extreme Weather	
	Landslide	Rising Temperatures, Extreme Weather	
Sea Level Rise	Coastal Flooding	Extreme Weather	Increase in tidal and coastal floods, storm surge, coastal erosion, marsh migration, inundation of coastal and marine ecosystems, loss and subsidence of wetlands
	Coastal Erosion	Changes in Precipitation, Extreme Weather	
	Tsunami	Rising Temperatures	
Rising Temperatures	Average/Extreme Temperatures	N/A	Shifting in seasons (longer summer, early spring, including earlier timing of spring peak flow), increase in length of growing season, increase of invasive species, ecosystem stress, energy brownouts from higher energy demands, more intense heat waves, public health impacts from high heat exposure and poor outdoor air quality, drying of streams and wetlands, eutrophication of lakes and ponds.
	Wildfires	Changes in Precipitation	
	Invasive Species	Changes in Precipitation, Extreme Weather	
Extreme Weather	Hurricanes/Tropical Storms	Rising Temperatures, Changes in Precipitation	Increase in frequency and intensity of extreme weather events, resulting in greater damage to natural resources, property, and infrastructure, as well as increased potential for loss of life
	Severe Winter Storm/Nor'easter	Rising Temperatures, Changes in Precipitation	
	Tornadoes	Rising Temperatures, Changes in Precipitation	
	Other Severe Weather (including Strong Wind and Extreme Precipitation)	Rising Temperatures, Changes in Precipitation	

Table 2. Climate Change Interactions in Massachusetts. Source: Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018), Table 3-1.

The survey conducted for this report included questions related to individual businesses’ past or planned investments to mitigate the impacts of coastal hazards, owners’ awareness of local climate planning efforts, and asked for information on their experiences with these hazards. More information is available in the [Results](#) section below.

Cape Cod’s Blue Economy

In the past several years, Cape Cod has increasingly recognized the importance of water-dependent industries in the region, broadly termed the Cape’s “Blue Economy.” The non-profit Cape Cod Blue Economy Foundation created an Implementation Plan to examine the region’s water-based economy and to propose actions that will advance it. The plan defines North American Industry Classification System (NAICS) codes based on their reliance on the water (“dark blue” versus “light blue”), highlighting these industries’ importance to the region (Appendix A).

Dark blue industries include commercial fishing and aquaculture, seafood processing, port and harbor industries, boat dealers, navigation and nautical systems manufacturing, fish markets, marinas, water-based transportation, and national security such as the US Navy and Coast Guard. Light blue industries include sand and gravel mining, manufacturing that relies on water access,

artists and writers, museums and historical sites, and the hotels, restaurants, and other tourism-related accommodations that locate on Cape Cod because of its miles of coastline.³ Within Barnstable, Dukes, Nantucket, and Plymouth Counties, the Blue Economy encompasses 12% of jobs and 11% of gross revenues..⁴



FISHING AND SHELLFISHING ON CAPE COD

Fishing and shellfishing are an integral part of Cape Cod’s heritage. Cape Cod’s ocean-based industries facilitated the growth of our coastal villages, as the harbors in Hyannis, Chatham, and Provincetown were major ports for whaling and cod fishing. Figure 1 highlights the key fishing grounds for commercial fishermen based in the region.

Figure 1. Commercial Fishing Grounds, Cape Cod. Cape Cod Commercial Fishermen's Alliance.

³ NAICS Codes by Dark and Light Blue Level. Cape Cod Blue Economy Foundation. <https://www.bluecapecod.org>.

⁴ Cape Cod Blue Economy Foundation. <https://www.bluecapecod.org/>

Among the four pilot towns, Chatham had the highest tonnage of landings (and highest ex-vessel value); Provincetown had the next highest value, at nearly \$8.1 million in 2017 (Table 3). The major fisheries for Cape Cod commercial fishermen today include bluefish, dogfish, skate, flounder, monkfish, striped bass, haddock, lobster, sea scallop, oysters, and tuna.⁵

Landings and Value by Port, 2017

PORT	LIVE POUNDS	EX-VESSEL VALUE
Chatham	28,639,557	\$18,687,408
Dennis	8,086,453	\$3,353,213
Falmouth	905,137	\$1,527,604
Provincetown	2,889,599	\$8,095,343

Table 3. Fisheries Landings and Values by Port, 2017. Source: ACCSP Data Warehouse, ED 04/10/2019

Shellfishing dominates the aquaculture industry in Massachusetts, with more than 85% of the state’s aquaculture operations farming oysters and clams as of 2017.⁶ On Cape Cod, there are 265 growers producing shellfish, located over 660 acres. In 2018, over 26 million oysters were landed with a value of \$14.5 million, and over 3.7 million quahogs (hard clams) were landed with a value of just under \$1 million.⁷

Maintaining or growing Cape Cod’s fin-fishing and shellfishing industries is dependent on the provision of adequate infrastructure. Functional harbor infrastructure needs include piers, docks, parking, storage space, and off-loading facilities. Coastal access points, transportation networks, marine supply businesses, and value-added processing facilities also contribute to a vibrant coastal economy.⁸

⁵ Cape Cod Commercial Fishermen’s Alliance. <https://capecodfishermen.org/cape-cod-ports-chart>

⁶ Navigating the Global Economy: A Comprehensive Analysis of the Massachusetts Maritime Economy. 2017. Public Policy Center at UMass Dartmouth.

⁷ Southeastern Massachusetts Aquaculture Center. <https://www.capecodextension.org/marine/semac/production/>; citing 2018 MA Division of Marine Fisheries Report: <http://www.capecodextension.org/wp-content/uploads/2020/05/2018-DMF-Annual-Report.pdf>

⁸ Coastal Use Templates Report, 2011. Cape Cod Commission. https://capecodcommission.org/resource-library/file?url=%2Fdept%2Fcommission%2Fteam%2FWebsite_Resources%2Feconomicdevelopment%2FCEDS_CoastalUseTemplatesRept.pdf

ROLE OF REGIONAL PLANNING

The Cape Cod Commission is the regional planning and regulatory agency for Barnstable County, responsible for balancing the protection of the region's resources with appropriate development and economic progress. In the 2018 Regional Policy Plan (RPP), the Commission set a growth policy for the region that guides regional and local planning decisions:

Growth should be focused in centers of activity and areas supported by adequate infrastructure and guided away from areas that must be protected for ecological, historical, or other reasons.

Development should be responsive to context, allowing for the restoration, preservation and protection of the Cape's unique resources while promoting economic and community resilience.

The Commission also designated "Placetypes" in the 2018 RPP, which allow regional land use policies and regulations to better respond to and enhance local form and context, and support development that complements its surroundings. One such Placetype, Maritime Areas, is defined as clusters of commercial and mixed-use development that contribute to Cape Cod's working waterfronts and harbors. Maritime Areas are areas such as public and private harbors, marinas, and mooring fields, and may extend to nearby commercial activity and historic maritime villages that contribute to the traditional character and economic success of the working waterfronts. Recommended strategies for this area include encouraging towns to develop and regularly update Harbor Plans and identifying harbor use policies that support traditional maritime uses while also accommodating other users (such as tourism, transportation, energy, and marine science-focused operations).⁹

Additionally, the Commission regularly updates the region's Comprehensive Economic Development Strategy (CEDS), which sets a five-year plan for economic development for the region. As part of the strategic direction in the 2019 update, CEDS stakeholders named the expansion of the Blue Economy as one of the regional priorities, leveraging the Cape's unique geographic position to develop new business and employment opportunities that provide livable wages. In the CEDS five-year Action Plan, under Blue Economy Sector Development, CEDS stakeholders identified Regional Harbor and Dredge Services as a key project to help maintain navigation and working harbors.

The RPP and CEDS also describe the key challenges facing the region, especially climate change. The region's 586 miles of vulnerable, tidal shoreline are at risk due to flooding and erosion, and sea level

⁹ 2018 Update to RPP. www.capecodcommission.org/rpp

rise and climate change will further exacerbate these challenges, which will impact Cape Cod's ecosystem functionality as well as our coastal infrastructure. The Commission will develop a Climate Action Plan to address these challenges in the coming months and will continue to support Cape Cod communities through the state's Municipal Vulnerability Planning program and multi-hazard mitigation planning.

This report detailing the economic benefits of harbor-adjacent uses can inform local decision-making around investments in operations and maintenance of harbor infrastructure, especially given increasing impacts of climate change and sea level rise.

Methodology

This study uses an input-output model to estimate the total economic benefit of the employment in coastal businesses, focusing on four pilot towns: Chatham, Dennis, Falmouth, and Provincetown.

Input-output models are economic tools to understand the interconnectedness between different parts of the economy. For example, employment leads to economic benefits for other sectors in a region as residents will purchase goods and services near their center of employment; another example would be the economic benefits of taxes paid by an industry sector to the local, state, and federal government.

For this study, IMPLAN software was leveraged to evaluate the economic impacts of employment in harbor-adjacent businesses. Results are reported as direct, indirect, and induced effects, the combination of which often totals more than the initial economic input.

- **Direct effects** are the production changes or expenditures made by producers/consumers as a result of an activity of policy. For this project, the direct effect is the employment of people in harbor-adjacent businesses.
- **Indirect effects** are the business-to-business purchases in the supply chain that take place in the region, based on the initial industry input purchases or employment. On Cape Cod, that may be the equipment needed to run a commercial fishing vessel, or the food purchased for restaurant consumption.
- **Induced effects** come from employees' household spending of labor income (after taxes, savings, and commuter income). For this project, this is the household expenses the employees spend their income on, such as groceries.¹⁰

The impacts of employment by harbor-adjacent businesses are reported in the [Results](#) section below.

HARBOR SELECTION

Six harbors in four towns were selected to pilot this economic analysis, in consultation with the local harbor masters and town elected officials and staff (Figure 2). These harbors were selected to ensure geographic diversity – each is connected to different major water bodies – as well as diversity in use and infrastructure. Four of the harbors (Great Harbor in Falmouth, Provincetown Harbor, and Chatham and Stage Harbors) were also previously included in case studies compiled by Commission

¹⁰ IMPLAN: Direct, Indirect, and Induced Effects. June 2020. <https://blog.implan.com/understanding-implan-effects>

staff in the Coastal Use Templates project because they represent one or more of the primary regional industry sectors.¹¹

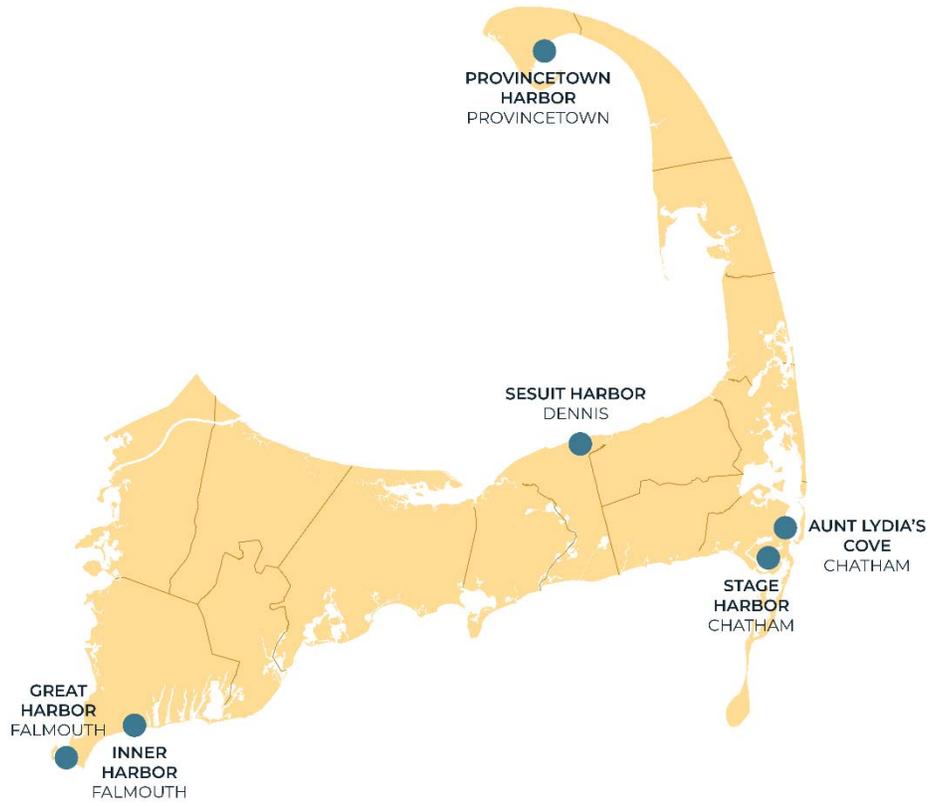


Figure 2. Pilot Harbors for Economic Impacts of Harbor Report.

Chatham

The Town of Chatham, at the southeast tip of Cape Cod, is surrounded on three sides by water. It is comprised of four villages: Chatham, South Chatham, North Chatham, and West Chatham. Historically, Chatham was a quiet fishing and farming village, providing easy access to offshore fishing grounds, and now is a busy seasonal tourist destination.¹²

¹¹ Coastal Use Templates Report, 2011. Cape Cod Commission. https://capecodcommission.org/resource-library/file?url=%2Fdept%2Fcommission%2Fteam%2FWebsite_Resources%2Feconomicdevelopment%2FCEDS_CoastalUseTemplatesRept.pdf

¹² Chatham Chamber of Commerce, Accessed 2020. www.chathaminfo.com

The top three industries in Chatham based on 2018 employment are Accommodation and Food Services (average monthly employment of 1,107), Retail Trade (506 employees), and Health Care and Social Assistance (353 employees).¹³ According to the 2018 American Community Survey, there are 570 self-employed residents in Chatham.¹⁴

In Chatham, Stage Harbor and Aunt Lydia's Cove (also referred to as Chatham Harbor or Fish Pier) were selected because they serve important roles in Cape Cod's commercial fishing industry, and are facing significant impacts due to shoaling closing off Outermost Harbor, which can hinder access to these harbors. These harbors connect fishermen and recreational boaters with the Atlantic Ocean. The wait list for a mooring at Aunt Lydia's Cove lasts approximately 10-14 years, and the wait list for Stage Harbor ranges from 8-14 years.¹⁵ In FY19 the top three shellfish landed in the Town were quahogs, soft-shelled clams, and razor clams, with a total estimated wholesale value of over \$2.5 million.¹⁶

Stage Harbor is located on Nantucket Sound, and is deep enough to serve recreational and commercial vessels fishing the Sound and points further south. The Harbormaster's office and boat ramp are both located in Stage Harbor, identified as critical facilities in the town's Hazard Mitigation Plan.

Aunt Lydia's Cove and the Fish Pier were identified as "the economic focal point of [Chatham Harbor]... where fishermen off-load their catch for packing and shipment to market."¹⁷ The Fish Pier is also a major tourist attraction, and was recently reconstructed to expand its observation deck, reduce long-term maintenance costs, provide a safer workspace to fishermen offloading their catch, and provide emergency and handicapped access.¹⁸ Chatham Bars Inn is also located on Chatham Harbor, a luxury oceanfront resort that is an important economic contributor to the region.

¹³ Employment and Wage data by Industry for Massachusetts (ES202). 2018. Accessed September 2020. <https://www.mass.gov/service-details/employment-and-wages-by-industry>

¹⁴ US Census. American Community Survey, 2018 5-Year Estimates. Table ID: B08128. Link: <https://data.census.gov/cedsci/table?text=self%20employment&t=Class%20of%20Worker&g=0600000US2500116775&tid=ACSDT5Y2018.B08128&hidePreview=false>

¹⁵ Chatham Mooring Wait Lists (as of 8/18/20). <https://www.chatham-ma.gov/harbormaster/pages/mooring-wait-lists>

¹⁶ 2019 Chatham Annual Town Report. https://www.chatham-ma.gov/sites/g/files/vyhlf2926/f/uploads/chatham_2019_annual_report.pdf

¹⁷ Coastal Use Templates Report, 2011. Cape Cod Commission. https://capecodcommission.org/resource-library/file?url=%2Fdept%2Fcommission%2Fteam%2FWebsite_Resources%2Feconomicdevelopment%2FCEDS_CoastalUseTemplatesRept.pdf

¹⁸ Fish Pier Observation Deck Re-Opens. July 2, 2020. Town of Chatham Office of the Selectmen. <https://chambermaster.blob.core.windows.net/userfiles/UserFiles/chambers/2437/File/PressReleaseFPObsDeckReopens07-02-20.pdf>

“Stage Harbor contains some of the most heavily used harbor infrastructure in Chatham. The current harbor infrastructure (town access points, public and private offloading areas, and moorings) are under high stress from high levels of demand)... The Chatham Fish Pier is the Cape’s largest commercial fishing port, making it extremely important for both the local and regional economy, [serving as a] critical off-loading location for Chatham’s commercial fishing fleet.”

– 2015 State of Our Harbors

Dennis

Dennis is comprised of the villages of East Dennis, Dennis, Dennis Port, West Dennis, and South Dennis, and is bordered by Nantucket Sound to the south and Cape Cod Bay to the north.

The top three industries in Dennis based on 2018 employment are Accommodation and Food Services (average monthly employment of 2,087), Retail Trade (1,262 employees), and Construction (546 employees).¹⁹ According to the 2018 American Community Survey, there are 912 self-employed residents in Dennis.²⁰

Sesuit Harbor opens up into Cape Cod Bay and is a federal Harbor of Safe Refuge. The harbor supports public and private marinas, boat launch ramps, and public parking, and has moorings for approximately 400 vessels. Other commercial water-dependent activities in the harbor include commercial fishing, personal watercraft rentals, sightseeing tours, and parasail operations.²¹

The harbor is currently home to two residential communities (Sesuit Neck and Quivet Neck), the municipal marina (including slips, moorings, and boat ramps), the Dennis Yacht Club, Northside Marina (including slips and rack storage), and the Sesuit Harbor Café. There is 100% occupancy of the 252 slips and 33 moorings, and the length of the wait list for Sesuit slips and moorings is over 28 and 30 years, respectively.²²

Sesuit Harbor in Dennis was chosen as pilot harbor because of its important role as a commercial maritime hub for Cape Cod, as well as the significant increase in the need for dredging. The “black

¹⁹ Employment and Wage data by Industry for Massachusetts (ES202). 2018. Accessed September 2020.

<https://www.mass.gov/service-details/employment-and-wages-by-industry>

²⁰ US Census. American Community Survey, 2018 5-Year Estimates. Table ID: B08128. Link:

<https://data.census.gov/cedsci/table?text=self%20employment&t=Class%20of%20Worker&g=0600000US2500116775&tid=ACSDT5Y2018.B08128&hidePreview=false>

²¹ Massachusetts State of Our Harbors. Prepared by the Urban Harbors Institute, University of Massachusetts Boston and Apex Companies, LLC for the MA DCR Division of Waterways 2015. <http://archives.lib.state.ma.us/handle/2452/724259>

²² Waiting List for Slips or Mooring. Accessed September 2020. <https://www.town.dennis.ma.us/harbormaster/pages/waiting-list-slips-or-mooring>

mayonnaise” that covers the bottom of the harbor is unable to be reused, adding the cost of transportation and disposal to the cost of dredging.

Falmouth

Falmouth is the second-largest municipality (after Barnstable) on Cape Cod, and is made up of the villages of East Falmouth, Hatchville, North Falmouth, Teaticket, Waquoit, West Falmouth, Woods Hole, and the downtown village. The town is located at the southwestern tip of Cape Cod.

The top three industries in Falmouth based on 2018 employment are Health Care and Social Assistance (average monthly employment of 3,037), Accommodations and Food Services (2,102 employees), and Professional and Technical Services (1,857 employees).²³ According to the 2018 American Community Survey, there are 2,420 self-employed residents in Falmouth.²⁴

Great Harbor supports recreational and commercial fishing and boating activities, as well as the Steamship Authority ferry terminal that connects Woods Hole and Martha’s Vineyard. It’s most known for supporting the research activities centered in the village of Woods Hole: Woods Hole Oceanographic Institution, Marine Biological Laboratory, and offices for National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service.

Great Harbor in Falmouth was selected as a pilot harbor because of its connection with the marine science and technology research and businesses on Cape Cod. It is the only deep-water port on Cape Cod, which is necessary for the large research vessels associated with the marine science and technology sector in Woods Hold. The harbor is mostly sheltered by Penzance Point, Nonamesset Island, and Juniper Point.

Inner Harbor is a protected, manmade harbor, created when an inlet was cut in the barrier beach separating Deacons Pond from Nantucket Sound.²⁵ The harbor does not require dredging as frequently as some of the harbors included in this study. Inner Harbor is home to MacDougall’s, one of the largest marinas in the state, as well as the town marina and Falmouth marine Park. There are 106 people on the wait list for moorings and 176 for slips currently in Inner Harbor, compared to 129 people on the wait list for moorings for Great Harbor.²⁶

²³ Employment and Wage data by Industry for Massachusetts (ES202). 2018. Accessed September 2020.

<https://www.mass.gov/service-details/employment-and-wages-by-industry>

²⁴ US Census. American Community Survey, 2018 5-Year Estimates. Table ID: B08128. Link:

<https://data.census.gov/cedsci/table?q=falmouth&text=self%20employment&t=Class%20of%20Worker&g=0600000US2500123105&tid=ACSDT5Y2018.B08128&hidePreview=false>

²⁵ New England Boating: Falmouth Inner Harbor. <https://newenglandboating.com/destinations/falmouth-harbor/>

²⁶ Falmouth Mooring and Slips Wait List. Accessed September 2020. <http://www.falmouthmass.us/962/Mooring-and-Slips-Wait-Lists>

Inner Harbor was selected as a pilot harbor as it is the main commercial harbor for the Town of Falmouth, supporting the Town Marina, ferry services to Martha's Vineyard, the Falmouth Yacht Club, and several water-based private businesses, including MacDougall's Cape Cod Marine Service, charter fishing operations, and boat rental services.

“Great Harbor, in Woods Hole, supports recreational and commercial fishing and boating activities as well as ferry service to Martha’s Vineyard. The harbor also supports research activities associated with Woods Hole and NOAA. Falmouth Inner Harbor is used primarily by fishing and recreational craft and is a popular center for charter excursions and sport fishing boats. The harbor supports a federal anchorage and a channel with a 9’ depth, the harbormaster’s office, as well as the terminal for ferry service to the Vineyard.”

– 2015 State of Our Harbors

Provincetown

Provincetown located on the northern tip of Cape Cod, has a small year-round population (3,000 residents) that surges during the summer months (the town sees 35,000-40,000 visitors a day in the summer). The town has a long history as an arts colony, and its maritime history in whaling and commercial fishing is deeply rooted.

The top three industries in Provincetown based on 2018 employment are Accommodation and Food Services (average monthly employment of 1,199), Retail Trade (585 employees), and Health Care and Social Assistance (260 employees).²⁷ According to the 2018 American Community Survey, there are 352 self-employed residents in Provincetown.²⁸

Provincetown Harbor is a natural, protected harbor, featuring a municipal pier (MacMillan Pier) and Fishermen’s Wharf. The harbor supports a commercial fishing fleet, aquaculture activities, recreational fishermen, the US Coast Guard small boat station and pier, harbor cruise boats, passenger ferries (including to Boston), and the local whale watch fleet that sails into Stellwagen

²⁷ MA Department of Unemployment Assistance. Labor Market Information, ES202 data. 2018.

<https://lmi.dua.eol.mass.gov/LMI/EmploymentAndWages>

²⁸ US Census. American Community Survey, 2018 5-Year Estimates. Table ID: B08128. Link:

<https://data.census.gov/cedsci/table?text=self%20employment&t=Class%20of%20Worker&g=0600000US2500155500&tid=ACSDT5Y2018.B08128&hidePreview=false>

Bank.²⁹ Some of the infrastructure managed by the Harbormaster’s office includes four cranes, two ice machines, four vessels, and associated docks, moorings, blocks, and related gear.³⁰

Most commercial development is focused on Commercial Street, which parallels the Provincetown waterfront; north of the commercial area is the Cape Cod National Seashore and Provinceland dunes. The waterfront features many culturally and historically significant places, including Pilgrim Monument, lighthouses, and the Provincetown Historic District.

Provincetown Harbor was selected as a pilot harbor because of its ties to commercial fishing and tourism as well as its proximity to the town’s center of economic activity. The businesses on Commercial Street, as well as cruise ships, ferries, and whale watching ships all rely on Provincetown Harbor for their business, in addition to the approximately 55 boats in the commercial fleet registered in town.³¹ Use of the harbor continues to increase, including moorings (453 rented in 2019 compared to 401 in 2018), cruise ship disembarkations (4,350 people in 2019 from 2,396 in 2018), and ferry ridership (46% growth from 2018 to 2019), so there is also an interest in maintaining functionality for its critical role in tourism and transportation.³²

	Chatham	Dennis	Provincetown	Falmouth
Year-round population ³³	6,115	13,962	2,960	31,177
Median Household Income ²	\$77,878	\$59,805	\$50,741	\$73,201
Median Home Price ³⁴	\$456,900	\$365,500	\$605,000	\$405,700
Average Annual Employment ³⁵	3,211	4,734	2,656	13,716
Land (sq miles) (2010)	16.13	20.51	17.5	44.07
Population per sq. mi. (2010)	379.1	680.7	169.1	707.4
Shoreline (miles)	66	63	21	68
Total Meals Tax (FY20) ³⁶	\$472,000	\$640,100	\$1,000,000	\$686,200
Total Rooms Tax (FY20)	\$1,900,000	\$1,000,000	\$1,500,000	\$3,100,000

²⁹ Coastal Use Templates Report, 2011. Cape Cod Commission. https://capecodcommission.org/resource-library/file?url=%2Fdept%2Fcommission%2Fteam%2FWebsite_Resources%2Feconomicdevelopment%2FCEDS_CoastalUseTemplatesRept.pdf

³⁰ Provincetown 2019 Annual Report. <https://www.provincetown-ma.gov/ArchiveCenter/ViewFile/Item/23936>

³¹ 2018 Provincetown Harbor Plan. <https://www.provincetown-ma.gov/DocumentCenter/View/12794/03-FINAL-Provincetown-MHP-with-EEA-approval-and-executive-summary>

³² Provincetown Annual Report, 2019. <https://www.provincetown-ma.gov/ArchiveCenter/ViewFile/Item/23936>

³³ 20108 ACS 5-Yr Estimates.

³⁴ 2019 CCIOR

³⁵ 2019 ES-202 Annual Employment and Wages by Town.

³⁶ MA Dept of Revenue, Rounded Values. <https://datacapecod.com/local-option-tax-impacts/>

Total value of boat excise tax (FY2019)	Not reported	\$24,617	\$21,462	\$118,753
Commercial fish landed by town, 2017 (Live Pounds) ³⁷	28,639,557	8,086,453	905,137	2,889,599
Total value of commercial fish landed by town, 2017 (Ex-Vessel Value) ³⁸	\$18,687,408	\$3,353,213	\$1,527,604	\$8,095,343

BUSINESS SELECTION

Commission staff engaged with Urban Harbors Institute at the University of Massachusetts Boston (UHI) to jointly issue an online survey to businesses located near each of the pilot harbors.

Following the harbor selection, Commission staff delineated three key areas per harbor: core, contributing, and nearest Community Activity Center (Appendix B). Core areas contain key harbor infrastructure and are where the majority of town spending was expected to occur for operations and maintenance to maintain navigable waterways and support economic activity. Contributing areas were a ¼-mile buffer from the core areas, considered an accessible walking distance from the core area. The Community Activity Centers were identified in the 2018 RPP as “areas with a concentration of business activity, community activity, and a compact built environment.”³⁹ Walkability was an important factor in seeking businesses and organizations that were most likely to leverage harbor infrastructure, and in all cases but one, the nearest Community Activity Center was harbor-adjacent. (The nearest Community Activity Center to Sesuit Harbor in Dennis is 2 miles away.⁴⁰)

Commission staff then leveraged ESRI Business Analyst data (2018) to determine which businesses were located in each harbor’s core area, contributing area, and nearest Community Activity Center. Based on this analysis, 1,063 relevant businesses were identified in the areas proximate to the six pilot harbors. Commission staff conducted a QA/QC review of the 2018 Business Analyst data, eliminating duplicates and closed businesses. UHI staff then researched the list of businesses online to identify email address and online contact forms in preparation for issuing an online survey.

Of the original 1,063 businesses, 109 businesses were closed or relocated outside of the study areas; 23 were duplicate businesses in the dataset; and 337 businesses were not contacted due to a lack of

³⁷ ACCSP Data Warehouse, ED 4/10/2019

³⁸ ACCSP Data Warehouse, ED 4/10/2019

³⁹ For more information on how these locations were identified, please visit <https://capecodcommission.org/our-work/id-acsc/>.

⁴⁰ 2018 Regional Policy Plan. www.capecodcommission.org/rpp

available contact information online. In total, 594 businesses were contacted—475 through email and 88 through online contact forms—to request their participation in our survey; 31 of those emails bounced back or were otherwise undeliverable.

Of the 594 businesses contacted, there were:

- 97 (16.3%) located in Chatham
- 24 (4.0%) located in Dennis
- 229 (38.5%) located in Falmouth (and 45 of these, 7.5%, were in Woods Hole specifically)
- 231 (38.9%) located in Provincetown
 - 13 (2.2%) were primarily located outside those four target areas, but had a satellite or former location in these areas

SURVEY OVERVIEW

Commission and UHI staff undertook an online survey with a focus on employment impacts of businesses proximate to the harbors to estimate their economic impacts.

The survey was issued online through Survey Monkey. The questions are available in Appendix C. The survey started with questions about employment, which was key to facilitating the IMPLAN analysis. Next, the survey asked questions about harbor access and dependency, to evaluate how and how much businesses are reliant on having well-functioning harbor infrastructure. The survey then asked respondents about their past and anticipated experiences with coastal hazards, given their proximity to the water. Finally, the survey asked general background questions related to the business, such as industry, location, seasonality, how long it has been located at its place of business, and whether the business location is owned or leased.

Outreach

After Commission staff identified the list of business names with ESRI Business Analyst, UHI staff compiled contact information from businesses' websites and social media pages as well as other online sources. Through this process, UHI staff determined if businesses were open or closed, and recorded email addresses, phone numbers, and links to contact pages in an Excel workbook.

The survey was distributed through either email or online contact form submissions, between January 2020 and March 2020. The Survey Monkey link was emailed to business contacts through a mass Mail Chimp email. If the email bounced back, email addresses were reviewed and corrected if possible, and a second email was issued. A reminder email was also sent to all addresses, and finally

UHI staff followed up directly via email with any businesses that did not respond (through March 2020).

If the business did not have an email address, but did have a contact form, UHI staff sent the email language to the business through the contact form and also used the contact form to send the reminder.

In order to incentivize participation, respondents were offered the chance to win one of five \$100 VISA gift cards that would be given to five randomly selected participants after the conclusion of the survey.

STUDY LIMITATIONS

The project faced several significant challenges throughout its implementation:

- **Seasonality of business:** Many businesses on Cape Cod are seasonal and are only open during the busy summer tourist season (from May to September). Given that businesses were primarily contacted during the tourist off-season (from January – March), a number of businesses were closed. Some business owners continue to check their emails during the tourist off-season, although several email addresses had “out of office” replies or bounced back, possibly due to full mailboxes. Also, it is possible that business owners may not check email very frequently during the off-season, resulting in emails going unnoticed, thereby impacting our response rate.
- **Rapid nature of openings and closures:** The dataset used to obtain business names and addresses, ESRI Business Analyst, was from 2018. The survey for this study began in late 2019 and was conducted in early 2020, and by that time, 31 of the businesses identified in the dataset had closed. New businesses (those opening after 2018) were also not captured in this survey.
- **COVID-19:** In the middle of March, the COVID-19 virus resulted in state-mandated temporary business closures. Because of this, most businesses on Cape Cod temporarily closed their doors, with some shifting to online and virtual operations. The COVID-19 pandemic likely impacted survey response rates, as some businesses closed down during the survey distribution phase, and others were busy adjusting to new business operations standards set by the state. Additionally, since COVID-19 has greatly impacted the Massachusetts economy, some business owners may have been hesitant to complete an economic survey as conditions changed considerably compared to the prior year. Lastly, due to COVID-19 restrictions, we were unable to implement the second and third phases of our engagement strategy, which included conducting phone calls and in-person visits to businesses that did not respond to our email requests.

- **Limited responses:** Despite multiple outreach attempts, we were unable to obtain a statistically significant sample for businesses located in each study area. The responses were broken down as follows:
 - Falmouth – 33 responses (14.4% of all businesses in study area)
 - Great Harbor – 10
 - Inner Harbor – 23
 - Provincetown – 40 (17.2% of all businesses in study area)
 - Sesuit Harbor (Dennis) – 14 (58.3% of all businesses in study area)
 - Chatham – 26 (26.8% of all businesses in study area)
 - Stage Harbor – 11
 - Aunt Lydia’s Cove – 15

Ultimately, results of the survey and following IMPLAN analysis likely represent an undercount of the impacts of employment from harbor-proximate businesses due to the limited survey response rate.

Survey Results

Out of the 594 businesses contacted through email and online contact forms, there were 127 total responses recorded in Survey Monkey, with 113 responses filled out sufficiently to be included in the IMPLAN analysis.⁴¹

GREAT HARBOR (FALMOUTH)

Eleven businesses responded to the survey; 2 skipped the majority of the questions. Nine answered questions about harbor dependency.



Of the 9 full responses, 3 businesses considered themselves harbor dependent in order to be fully operational, and 5 businesses noted that customers travel to their place of business by vessel. When asked for examples about how their businesses rely on the harbor, responses included:

⁴¹ As noted in the study limitations, the number of responses did not provide a statistically significant sample of the entire employed population in the pilot towns; they do, however, provide insights into economic benefits of harbor-proximate employment even if they represent an undercount.

- Need to operate a boat to get to their island location
- Serves the boating community, and Great Harbor is the main port of call
- Has research facilities with boats docked locally
- Dependence on salt water pumped from Great Harbor for marine organisms
- Business relies on summer tourists arriving in Falmouth for vacation, or continuing on the ferry to Marth's Vineyard

Recommendations for improvements to the harbor were improved harbor infrastructure (2 businesses), improved launch facilities (1), improved signage (1), and improved water quality (1). Another business stressed the need for the harbor to maintain its good water quality. Additionally, the Waterfront Park seawall in Great Harbor was noted as being critical to both the harbor and the businesses surrounding the harbor. Funding is needed to sustain the condition of the seawall, which will become a serious problem in the near future due to damage from large storm waves.

Three businesses noted that the harbor did not need changes or updates to maintain the functionality of the harbor for their business.

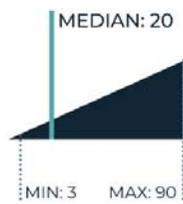
INNER HARBOR (FALMOUTH)

Twenty-three businesses responded to the survey; 1 skipped the majority of the questions. Nineteen answered questions on harbor dependency.



INNER HARBOR
SURVEY RESPONSES

YEARS IN BUSINESS



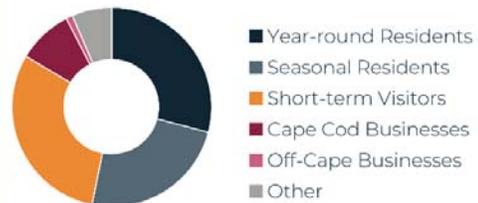
YEAR-ROUND ESTABLISHMENTS



YEAR-ROUND JOBS



SHARE OF CUSTOMERS BY TYPE



Of the 19 responses, 7 businesses considered themselves harbor dependent in order to be fully operational, and 4 businesses noted that customers travel to their place of business by vessel. When asked for examples about how their businesses rely on the harbor, responses included:

- Waterfront harbor views made their location and services more desirable (one restaurateur noted that water quality and boat traffic were as much of a factor in their business' success as the quality of their food and service, as well as proximity to the marina for parking and vessel access.)
- Need to be proximate to the harbor for customers that come from party boats, fishing and sailing vessels, sightseeing trips, the marina, and the clam shack (one business noted that tourists represented 90% of their revenue, and boating and related activities are part of the tourist experience; anything that appeals to seasonal visitors brings revenue to the business)
- Need accessibility for launching boats, and space to park a vehicle and trailer when launched
- Need proximity to ferry service to attract tourists

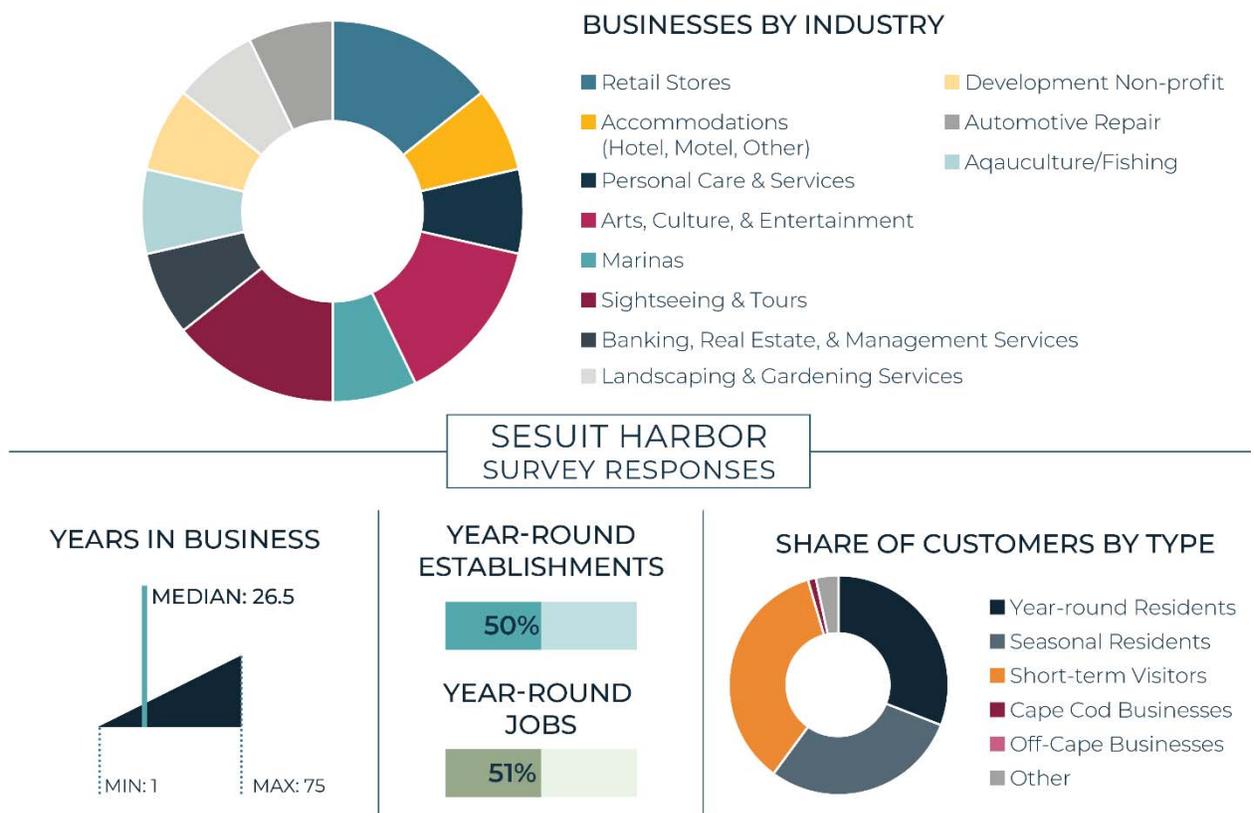
Recommendations for improvements to the harbor were improved water quality (5 businesses), improved harbor infrastructure (2), improved launch facilities (2), improved access to fuel (1), and improved signage (1). Specifically, businesses noted that the harbor needed better “no wake”

signage and continued maintenance of harbor infrastructure, as well as continued occasional dredging in Falmouth Inner Harbor to maintain good water quality.

Nine businesses noted that the harbor did not need changes or updates to maintain the functionality of the harbor for their business.

SESUIT HARBOR (DENNIS)

Fifteen businesses responded to the survey. Thirteen answered questions on harbor dependency.



Of the 13 responses, 7 businesses considered themselves harbor dependent in order to be fully operational, and 3 businesses noted that customers travel to their place of business by vessel. When asked for examples about how their businesses rely on the harbor, responses included:

- The harbor attracts customers who spend money supporting local businesses, even if they are not located adjacent to the harbor
- Charter businesses, marinas, and sailing and beach clubs need access to the harbor

ECONOMIC IMPACT OF CAPE COD HARBORS

- Poor harbor water quality can limit fish availability, impacting commercial fishermen and charter fishing operations
- Proximity to the harbor is desirable for house sales and rentals

Recommendations for improvements to the harbor were improved harbor infrastructure (6 businesses), improved water quality (5), improved signage (5), improved launch facilities (3), increased access to fuel (2), and increased access to seafood processing facilities (2).

Three businesses noted that the harbor did not need changes or updates to maintain the functionality of the harbor for their business.

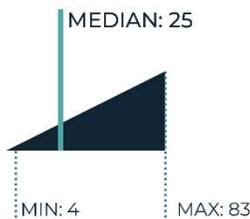
STAGE HARBOR (CHATHAM)

Twelve businesses responded to the survey; 2 skipped the majority of the questions. Seven answered questions on harbor dependency.



STAGE HARBOR SURVEY RESPONSES

YEARS IN BUSINESS



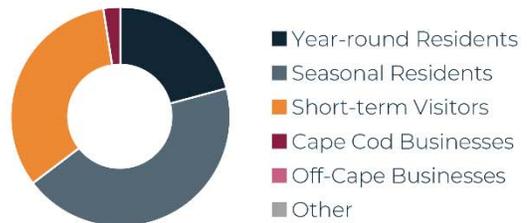
YEAR-ROUND ESTABLISHMENTS



YEAR-ROUND JOBS



SHARE OF CUSTOMERS BY TYPE



Of the 7 responses, 3 businesses considered themselves harbor dependent in order to be fully operational, and 1 business noted that customers travel to their place of business by vessel. When asked for examples about how their businesses rely on the harbor, responses included:

- Connection to clients, as the business provides professional engineering survey services for waterfront facilities
- Commercial fishermen and charter captains use the harbor on a daily basis and would be unemployed without the harbor
- Access to marine vessels

Recommendations for improvements to the harbor were improved harbor infrastructure (5 businesses), improved launch facilities (4), improved signage (4), increased access to fuel (2), increased access to seafood processing facilities (1), improved signage (1), and improved water quality (1). Additionally, one business noted that their business needs access to launching ramps and parking.

One business noted that the harbor did not need changes or updates to maintain the functionality of the harbor for their business.

AUNT LYDIA'S COVE (CHATHAM)

Fifteen businesses responded to the survey; 5 skipped the majority of the questions. Ten answered questions on harbor dependency.



AUNT LYDIA'S COVE SURVEY RESPONSES

YEARS IN BUSINESS



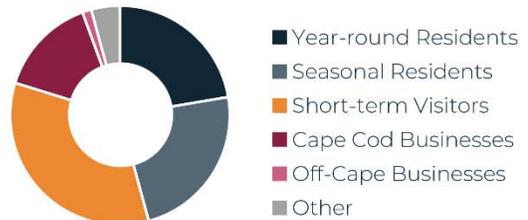
YEAR-ROUND ESTABLISHMENTS



YEAR-ROUND JOBS



SHARE OF CUSTOMERS BY TYPE



Of the 10 responses, 6 businesses considered themselves harbor dependent in order to be fully operational, and 2 businesses noted that customers travel to their place of business by vessel. When asked for examples about how their businesses rely on the harbor, responses included:

- Access to the harbor is necessary as the business offers boats to visitors for harbor cruises, fishing, sailing, etc.
- The harbor brings tourists and fresh seafood to town, especially to the Fish Pier; visitors year-round help businesses stay in businesses
- This area in particular is a great pick-up area for anyone going out on a friend's or family member's boat or to take a charter

Recommendations for improvements to the harbor were improved harbor infrastructure (6 businesses), improved signage (4), increased access to fuel (2), and improved water quality (2).

Additionally, one business noted that infrastructure and pedestrian access are important for this harbor, including sidewalks and handicap access, as well as viewing docks, restrooms, and parking.

Three businesses noted that the harbor did not need changes or updates to maintain the functionality of the harbor for their business.

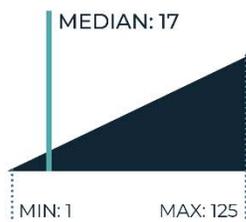
PROVINCETOWN HARBOR

Forty businesses responded to the survey; 1 skipped the majority of the questions. Thirty-three answered questions on harbor dependency.



PROVINCETOWN HARBOR SURVEY RESPONSES

YEARS IN BUSINESS



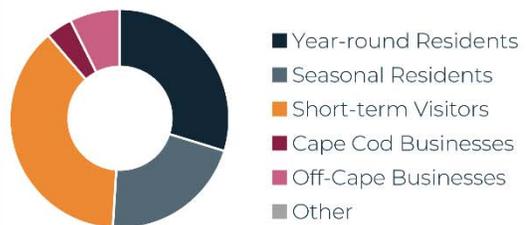
YEAR-ROUND ESTABLISHMENTS



YEAR-ROUND JOBS



SHARE OF CUSTOMERS BY TYPE



Of the 33 responses, 16 businesses considered themselves harbor dependent in order to be fully operational, and 17 businesses noted that customers travel to their place of business by vessel. When asked for examples about how their businesses rely on the harbor, responses included:

- Water views and Provincetown's beauty are a big draw for customers and diners and are an advantage to business owners

- Good water quality attracts more tourists who participate in outdoor activities (e.g., swimming, kayaking) and benefits businesses on the water (aesthetics)
- Commercial and charter fishing businesses, ferry services, and cruise ships operate out of the harbor
- Businesses rely on summer tourists that come to Provincetown by ferry or their own boats
- Ferry service improves connections to Boston

Recommendations for improvements to the harbor were improved harbor infrastructure (15 businesses), improved water quality (10), improved launch facilities (3), and improved signage (4). Businesses also recommended increasing ferry service, especially between towns on Cape Cod and the Islands, and adding or increasing showers, bathrooms, and changing stations at Provincetown beaches. One business noted concerns around the size of cruise ships that wish to dock in Provincetown; as they're getting larger, shuttle boats are needed to bring tourists downtown.

Six businesses noted that the harbor did not need changes or updates to maintain the functionality of the harbor for their business.

IMPACTS OF EMPLOYMENT

Jobs Created

Commission staff used the business survey results to conduct an IMPLAN analysis in order to determine the direct, indirect, and induced impacts of businesses located near the six pilot harbors.⁴²

ECONOMIC INDICATORS FOR ALL SURVEY RESPONSES

IMPACT	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT	TOTAL
DIRECT	2,328	\$163,876,613	\$228,365,542	\$444,043,613	\$836,285,768
INDIRECT	1,219.5	\$53,316,113	\$78,766,318	\$177,561,592	\$309,644,023
INDUCED	917.5	\$42,632,674	\$73,474,148	\$126,928,134	\$243,034,956
TOTAL	4,465	\$259,825,400	\$380,606,008	\$748,533,339	

The number of employees directly employed by survey respondents across all locations and industries was 2,328 people across 58 industries, leading to a total direct labor income of \$164 million. The total employment (direct, indirect, and induced) based on survey responders in all towns and across all regions was 4,446 people.⁴³ The indirect employment of 1,219 additional people generated \$53.3 million in labor income, and the induced employment of 917.5 people generated \$42.6 million in labor income.

The direct employment from survey responders represents a value added to the regional economy of \$228 million (the businesses' contribution to regional Gross Domestic Product, or GDP) this includes the labor income and taxes on production and imports), and an estimated output of \$444 million. (IMPLAN estimates value added and annual production based on the industry mix.)

Although the survey did not capture a majority of the employers in the study area, the employment at those businesses who did respond still provided significant economic benefits to the region.

⁴² All data is reported in 2020 dollars; the input data used is the latest available in 2018. Businesses were asked survey questions about their employment levels in 2018.

⁴³ Indirect and induced employment are the jobs that potentially could be supported by household- and business-spending as a results of the direct employment captured in the survey.

TOP 5 EMPLOYMENT INDUSTRIES FOR ALL SURVEY RESPONSES

IMPACT	SCIENTIFIC RESEARCH & DEVELOPMENT SERVICES	OTHER REAL ESTATE	HOTELS/ MOTELS	FULL-SERVICE RESTAURANTS	SCENIC & SIGHTSEEING TRANSPORTATION	TOTAL
DIRECT	1,281	15	287	89	134	1,806
INDIRECT	131.95	306.63	0.03	24.91	22.08	485.6
INDUCED	3.55	40.40	0.04	46.21	1.8	92

The top employers out of the survey respondents were:

- **Scientific research and development services**

The marine science and technology/research companies located near Great Harbor in Falmouth are major employers for the region. The scientific research and development businesses represent a large percent of the total survey responses. However, they are not only the major employer within the study area, but also within Barnstable County as a whole.

- **Other real estate and hotels and motels**

Representing short-term rentals in addition to more traditional lodging, these businesses have a high indirect impact on the region, as other industries may attract tourists and visitors to the area who then stay in Air BnBs and Vacation Rental by Owner (VRBO) rentals.

- **Full-service restaurants**

Restaurants are a major source of employment in Barnstable County, especially during the peak of tourism season; many of these businesses are located in Community Activity Centers or near harbors as water views increase their appeal.

- **Scenic and sightseeing transportation**

Many of the survey respondents were located proximate to the harbor because they are fishing charters or other types of boat rentals.

Compensation

Based on the employment by industry, IMPLAN estimates the direct, indirect, and induced employment compensation for all survey respondents, using wage and salary data at the industry level from the US Bureau of Labor Statistics Census of Employment and Wages. Employee compensation was defined as “the total payroll cost of the employees, including wages and salaries, all benefits (e.g. health, retirement), and payroll taxes.”⁴⁴

The total direct compensation for the survey respondents is \$157.4 million, with \$149.6 million being attributed to the top ten industries among the survey respondents. The largest total employee compensation out of all survey respondents is attributed to scientific research and development services (approximately \$117.7 million), followed by hotels and motels (\$11.9 million), and scenic and sightseeing transportation (\$6.8 million).

EMPLOYEE COMPENSATION FOR
TOP 10 EMPLOYMENT INDUSTRIES FOR SURVEY RESPONSES

IMPACT	DIRECT	INDIRECT	INDUCED	TOTAL
SCIENTIFIC RESEARCH & DEVELOPMENT SERVICES	\$117,648,592	\$12,118,360	\$325,830	\$130,092,782
HOTELS/MOTELS	\$11,935,794	\$1,110	\$15,227	\$11,952,131
SCENIC & SIGHTSEEING TRANSPORTATION	\$6,768,459	\$1,115,042	\$91,007	\$7,974,508
FULL-SERVICE RESTAURANTS	\$2,934,038	\$821,283	\$1,523,385	\$5,278,706
HOSPITALS	\$0	\$0	\$4,905,695	\$4,905,695
LIMITED-SERVICE RESTAURANTS	\$2,572,161	\$167,369	\$1,049,057	\$3,788,587
BANKS	\$539,009	\$1,955,248	\$1,103,608	\$3,597,865
ARCHITECTURAL, ENGINEERING, & RELATED SERVICES	\$2,257,841	\$951,957	\$49,273	\$3,259,071
OTHER AMUSEMENT & RECREATION INDUSTRIES	\$2,846,582	\$34,033	\$282,541	\$3,163,156
RETAIL (FOOD/ BEVERAGE STORES)	\$2,063,818	\$23,603	\$1,040,987	\$3,128,408
TOTAL	\$149,566,294	\$17,188,005	\$10,386,610	

⁴⁴ IMPLAN Glossary. <https://implanhelp.zendesk.com/hc/en-us/articles/360044986593-Glossary>

Tax Impacts

In addition to the benefits of employment and labor income, the employment in the study area also leads to local, county, state, and federal tax income. IMPLAN describes these as “Taxes on Production & Imports, less Subsidies,” or TOPI, and these include sales and excise taxes, customs duties, property taxes, motor vehicle licenses, severance taxes, other taxes and special assessments. (Social insurance taxes are included in Employee Compensation, not TOPI.)

TAX RESULTS FOR ALL SURVEY RESPONSES

IMPACT	LOCAL (GENERAL)	LOCAL (SPECIAL DISTRICTS)	BARNSTABLE COUNTY	STATE (MA)	FEDERAL	TOTAL
DIRECT	\$7,007,764	\$248,575	\$143,534	\$9,013,131	\$36,405,172	\$52,818,176
INDIRECT	\$3,762,643	\$133,451	\$77,399	\$3,860,017	\$11,323,221	\$19,156,731
INDUCED	\$3,972,211	\$140,877	\$81,855	\$3,669,213	\$9,549,548	\$17,413,704

The direct employment from the survey respondents generates about \$7 million in local taxes; \$248,600 to special districts (such as the Dennis Water District); \$143,500 to Barnstable County; \$9 million in state taxes; and \$36.4 million in federal taxes, for a total of \$52.5 million.⁴⁵

In addition to the taxes directly generated by survey respondents’ employment, \$19.1 million in taxes are generated indirectly (through business-to-business transactions), and \$17.4 million in taxes are induced (because of the spending of those directly employed by the survey respondents).

Blue Economy

Leveraging the NAICS code categorization developed by [The Blue Economy Foundation](#), a second IMPLAN analysis was conducted using only the survey respondents who are considered “dark” or “light” blue industries (see Appendix A).

⁴⁵ The IMPLAN analysis included employment inputs on a county level; therefore, the special districts are not necessarily located within the study area. Other examples of special districts within the County include the five fire districts in the Town of Barnstable, the Bourne Water District, Buzzard’s Bay Water District, North Sagamore Water District (Bourne/Sandwich), Mashpee Water District, and the Sandwich Water District.

ECONOMIC INDICATORS FOR BLUE ECONOMY RESPONSES

IMPACT	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
DIRECT	1,857	\$143,975,956	\$198,631,089	\$390,873,279
INDIRECT	1,108.5	\$48,836,925	\$72,128,194	\$162,353,965
INDUCED	913.2	\$37,802,909	\$65,153,333	\$112,549,820

The Blue Economy (or water-dependent) industries directly employ 1,857 people, or 79.7% of the total employment from survey respondents. These employers indirectly generate 1,108 jobs (91.0%), and lead to 813 (88.6%) in induced employment in the study area.

Scientific research and development services is a key component of the “dark” Blue Economy on Cape Cod, and pays some of the higher wages in the study area: \$117.6 million in direct employee compensation for 1,281 employees leads to about \$91,840 in annual average wages.

Hotels and motels have the next highest number of employees in the study area, which are a significant part of Cape Cod’s “light” Blue Economy: \$10.9 million in direct employee compensation for the 262 employees, which equates to about \$41,590 in annual average wages. The light Blue Economy industry in the study area with the highest wages is scenic and sightseeing transportation: \$2.5 million in direct employee compensation for the 77 employees, which equates to about \$32,970 in annual average wages. (Note: employee totals are based on how survey respondents self-identified their NAICS industry; 99 employees directly employed by scenic and sightseeing transportation businesses were considered part of the Blue Economy, while 35 were not.)

“Value Added” is similar to contribution to regional GDP. The survey respondents in the Blue Economy directly contributed over \$198 million to the region, through Labor Income, TOPI, and Other Property Income. Indirect and induced value added is worth an additional \$72 million and \$65 million, respectively.

Harbor-Dependent Businesses

The survey asked respondents if they considered themselves dependent on the harbor to maintain their current level of business. As mentioned in the project background, many Cape Cod harbors need frequent maintenance dredging due to frequent storms and intense wave energy along the coast. The data on harbor dependency suggests a strong need for investments to maintain and enhance access to and functionality of the harbor.

Overall, 46 of the survey respondents identified their business as dependent on the harbor (out of 93 who responded to the question, or 49.4%). Of the 89 respondents who answered a question about whether customers travel to their place of business by boat, 32 (36.0%) said yes.

The survey respondents that consider themselves harbor dependent directly employ 1,865 people, or 80.1% of the total employment from survey responders; indirectly generate 1,125 jobs (92.4%); and lead to 822 (89.6%) in induced employment in the study area. The labor income for those directly employed by harbor-dependent businesses totaled \$145.3 million, and contributed to a value added of \$199.5 million.

CLIMATE CHANGE IMPACTS

The survey included questions on local business owners' experiences with the challenges of coastal hazards, especially for businesses that lie adjacent to or otherwise rely on Cape Cod harbors.

Out of 80 respondents to this question, nine respondents (11.3%) have experienced flooding at their places of business in the last five years, while two (2.5%) have experienced erosion, and seven (8.8%) have experienced both. Two of the respondents in Chatham, both located by Aunt Lydia's Cove, said they experienced both flooding and erosion. In Falmouth, two businesses that have experienced both were located at Inner Harbor; the five respondents that noted flooding were located at both Inner Harbor (2) and Great Harbor (3). More businesses noted flooding (4) compared to erosion (1) in Provincetown, while in Dennis one business said they experienced erosion and a second business noted both flooding and erosion. Of all the industries surveyed, marinas were most likely to have seen impacts of both erosion and flooding.

Many survey respondents that offered details on these impacts, which included storm and wave damage, pilings washing out, eroded seawalls, water in the basement, flooding from high tide events and ineffective drainage systems, burst pipes, dock planks lifting, water breaching revetments, and business closures.

Nineteen businesses (24.1% of the 79 respondents) have made investments to prevent flooding and erosion in their place of business in the last five years, while 15 businesses (19.0% plan to make similar investments in the next five years. (Note: this survey was conducted prior to COVID-19, which has drastically impacted the financial outlook for many in Cape Cod's business community.)

The types of investments noted by survey respondents included sand bags, infrastructure improvements (docks, seawalls), replacing or reinforcing doors and windows, sump pumps, fencing, purchasing or building sandbags, and building improvements (basement conversion, mold mitigation, dehumidifier, humidity gauge, and other forms of waterproofing). Some businesses noted much larger scale infrastructure investments, including adding sand leftover from dredging, a

wave attenuator, and updates to bulkheads. Another respondent added signage to warn people to stay off eroding dunes.

Thirty-one of the survey respondents (38.8%) agree or strongly agree they are aware of local coastal hazard planning efforts. Harbor-level insights are included in Appendix D.

Researching Economic Contribution of Local Harbors

Many Cape Cod towns face challenges to funding harbor maintenance and improvements, including competing capital investments. Those who wish to advocate for improved funding can use economic data and compelling narrative to increase awareness of the issues facing local harbors, and some of the benefits of maintaining a navigable and accessible waterway.

The NOAA Office of Coastal Management developed a publication on estimating the economic contribution of working waterfronts. A high-level outline of that methodology is provided below. Data relevant to Barnstable County is linked where possible to help policymakers, local business owners, and other leaders better understand the economic contributions of harbors on Cape Cod.

For additional information on data, methodology, and example case studies, the full NOAA report is available here: <https://coast.noaa.gov/data/digitalcoast/pdf/working-waterfronts.pdf>. Additional resources can also be found on the National Working Waterfront Network's website: <https://www.nationalworkingwaterfronts.com/#>.

STEP 1: CHOOSE YOUR BASE DATA

The data sets you choose should be relevant to the message you are trying to convey. Commonly used indicators include the number of business establishments, employment, and wages; these can be obtained through payrolls, federal data sets, business registries, sales records, and tax records. The NOAA report provides examples of indicators, pros, and cons of each data source. The following list highlights some datasets that may be relevant to an analysis of the economic impacts of working waterfronts.

US CENSUS

<https://data.census.gov/cedsci/advanced>

The US Census maintains a data portal so users can access data and digital content, starting with the 2000 Census. In addition to demographic data, the Census provides economic data such as business and owner characteristics, expenses and expenditures, inventories, sales/shipments/production, and small business information.

The Census also maintains data on self-employment, an important component of employment in Cape Cod's working waterfronts. (Table S2407 estimates self-employment in businesses by industry.)

MA DEPARTMENT OF UNEMPLOYMENT ASSISTANCE (DUA) LABOR MARKET INFORMATION ON EMPLOYMENT AND WAGES (ES-202)

<https://lmi.dua.eol.mass.gov/LMI/EmploymentAndWages>

Annual data sources can miss the nuances of Cape Cod's seasonal population. Regional and local employment information by industry and by month is available from the MA DUA Economic Research Department. This Massachusetts-specific data set is derived from reports filed by all employers subject to federal and/or state unemployment compensation laws. The data are available annually and quarterly for the state, labor market areas, workforce development areas (the regional WDA covers Cape Cod as well as Martha's Vineyard and Nantucket), cities, towns, and counties. ES-202 information covers the number of establishments, the number of employees by month (which is especially important to highlight patterns in seasonal employment), total annual wages, average monthly employment, and average weekly wages.

ECONOMICS: NATIONAL OCEAN WATCH (ENOW)

<https://coast.noaa.gov/enowexplorer/>

Maintained by the NOAA Office for Coastal Management, the ENOW Explorer provides county- and state-level economic data for six sectors that are dependent on the ocean and Great Lakes: living resources, marine construction, marine transportation, offshore mineral resources, ship and boat building, and tourism and recreation.

ENOW contains data on four economic indicators: business establishments; employment, including part-time and seasonal employees; annual wages; and gross domestic product (GDP). More information is available in the [ENOW FAQs](#).

US BUREAU OF ECONOMIC ANALYSIS (BEA) OCEAN ECONOMY STATISTICS

<https://www.bea.gov/data/special-topics/ocean-economy>

The US BEA partnered with NOAA to measure the "economic force of the nation's oceans," creating prototype statistics that calculate the GDP contribution of commercial fishing, shipbuilding, seaports, beachfront hotels, and other ocean-dependent economic activity. Five-year estimates from 2018 are available for download on their website, and more information is available in their report, ["Defining and Measuring the U.S. Ocean Economy."](#)

STATE OF OUR HARBORS REPORT AND HARBOR PROFILES

<https://archives.lib.state.ma.us/handle/2452/724259>

The UMass Boston Urban Harbors Institute developed the State of Our Harbors report in 2015, detailing the main activities and characteristics of each of the harbors in Massachusetts. Stakeholders can leverage this report to provide high-level information specific to each harbor or

town, including water-dependent activities, key commercial fishing species, its significance to the town, major issues, and information about its harbor management plan.

FISHERIES DATA

https://safis.accsp.org/accsp_prod/f?p=1490:1:14277420857762

Data on commercial and recreational fisheries landings can be obtained from the Atlantic Coastal Cooperative Statistics Program (ACCSP) Data Warehouse. The database includes information on species, gear, and fishing area, and covers the entire East Coast, from Maine to Florida. Data specific to Massachusetts are maintained by the Massachusetts Division of Marine Fisheries and may include pounds landed (by species), dollar value of landings (by species), and the number of licensed dealers and fishermen in a municipality. Some confidentiality restrictions may apply to local data.

AUTOMATIC IDENTIFICATION SYSTEM (AIS) VESSEL TRACKING DATA

<https://marinecadastre.gov/news/load.php?url=posts/automatic-identification-system.html>

The AIS collects location information on vessels across the coastal and continental US, inland rivers, Hawaii, and Guam, providing helpful trend data on shipping and highlighting which coastal access points are highly valuable to the economic activity in a region. While this tool does not quantify economic activity, it can help illustrate important trends.

MULTI-HAZARD MITIGATION (MHM) PLANS

Many communities in Massachusetts maintain [MHM plans](#) in preparation for hazards, including coastal hazard impacts, outlining a long-term strategy to reduce disaster losses. These plans can be used in an economic analysis to provide town-specific information on critical facilities, identify past and anticipated climate change impacts, and identify vulnerabilities and potential capital needs associated with them.

The MHM plans for the pilot towns in this report are:

- Chatham (2018): https://www.chatham-ma.gov/sites/g/files/vyhlf2926/f/uploads/final_2018_chatham_hazard_mitigation_plan.pdf
- Falmouth (2017): <http://www.falmouthmass.us/DocumentCenter/View/3695/Multi-Hazard-Mitigation-Plan-Final-Report-March-2017>
- Provincetown (2016): <https://www.provincetown-ma.gov/DocumentCenter/View/5622/2016-Hazard-Mitigation-Plan?bidId=>
- The Dennis Multi-Hazard Mitigation Plan was most recently updated in 2011. Efforts to update the plan are currently underway.

- The statewide MHM plan was updated in 2018:
<https://www.mass.gov/files/documents/2018/10/26/SHMCAP-September2018-Full-Plan-web.pdf>

ESRI ARCGIS BUSINESS ANALYST

<https://www.esri.com/en-us/arcgis/products/arcgis-business-analyst/overview>

Business Analyst is proprietary, map-based software that provides parcel-level detail on demographics, businesses (including employment), and other census data. The software combines many different data sources and provides granular, site-specific information; however, it requires a high degree of familiarity with ArcGIS products and a review of parcel-specific outputs by someone with local knowledge is recommended.

DIY DATA COLLECTION

For this report, we were seeking a specific local dataset that would have been difficult to obtain through federal- or state-level data sets. Though it required a higher-level of effort, conducting an online survey increased the specificity of the data and results could be directly linked to local business establishments. For some situations, interviews, workshops, and other strategies may also be useful to gather similar data.

DIGITAL COAST

<https://coast.noaa.gov/digitalcoast/data/home.html>

NOAA's Office for Coastal Management maintains Digital Coast, providing coastal data, tools, training, and contextual information that makes data useful for planning and management. The data portal provides access to some GIS information, such as elevation and land cover, and also links to downloadable public data sets on economic and demographic information.

STEP 2: ORGANIZE THE DATA

The NOAA report recommends using three components to adequately estimate the economic contribution of working waterfronts:

- An ocean economy framework for defining and organizing the data
- Local economic data (researched in step 1)
- Local knowledge

The ENOW program proposes a framework for defining the Ocean Economy, looking at six specific sectors (living resources, marine construction, marine transportation, offshore mineral resources, ship and boat building, and tourism and recreation).

This report leverages the locally-developed Blue Economy framework (with a NAICS code classification for “dark” and “light” blue industries included in Appendix A). Stakeholders should choose the framework that best fits their needs.

Using the selected framework, review the available data sets from Step 1 (though not an exhaustive list of sources), and link economic data to the industries identified in the framework, such as employment, wages, and GDP contribution. Five options for appropriately including economic data are described in the [NOAA report](#).

STEP 3: FILL IN THE GAPS

Supplement the economic data from Steps 1 and 2 with information that provides additional context about the scale of an industry’s impact. The NOAA report suggests diving deeper into commercial fisheries information in particular, such as information from regional statistical cooperatives, license data, and catch-landing data; this information helps illustrate some of the indirect effects of the industry.

As an example, in this report, Commission staff analyzed past Town Meeting articles to better understand town-level expenditures around harbor infrastructure. This information captures capital planning efforts and identifies key challenges to operations and maintenance, while information on approvals and denials could illustrate the difficulty of securing funding for infrastructure projects.

Some harbor-dependent uses on Cape Cod, such as government or education, may not fall into obvious “Blue Economy” categories, and employment data should be reviewed in those categories as well for potential inclusion based on local knowledge. For example, educational research facilities may not always be defined as “Blue Economy” if researchers based their inclusion solely on NAICS codes; this would omit major contributors to Cape Cod’s Blue Economy, however.

Finally, stakeholders can provide qualitative information where quantitative information is not available. This can include information on goods and services that do not have a price – clean water, healthy salt marshes, and robust fish stocks, for example. This information will become essential to building a data story in Step 4.

STEP 4: ANALYZE

Translate the data into a meaningful story by providing context and a cohesive narrative. The NOAA report states the need for communication estimation methods, outputs, and data caveats; this is crucial for transparency and building a data story with integrity.

Conclusion

The harbors of Cape Cod are not only historically and culturally significant, but also lay the groundwork for the region's Blue Economy. Harbors must maintain their functionality to continue providing accessibility and navigability to transportation vessels, research institutions, commercial fishermen, tourists, and residents. The towns that will be most successful in maintaining long-term functionality will also integrate planning for sea level rise, coastal flooding, and increasingly intense storms as climate change continues to impact this fragile coastline.

The economic contributions of harbor-reliant and adjacent businesses suggest the need to continue maintaining and upgrading harbor infrastructure where possible. Funding streams at all levels of governance should be expanded to support the economic vitality of our coastal towns and the businesses that rely on well-functioning, navigable, and resilient harbors.

Additional work is needed in several areas, including data collection related to towns' revenues and expenses and climate change impacts related to harbors. Improved data on the ongoing and future impacts of sea level rise, flooding, erosion, extreme weather events, and other coastal hazards will inform hazard mitigation planning efforts, and can better position communities to address changing infrastructure needs.

Towns may also benefit from a coordinated and/or consistent data collection process related to capital expenditures on, and revenues generated by, harbor infrastructure. Streamlined and comparable data across towns more accurately illustrates the level of investment being made in Cape Cod's harbors. Collecting this information also provides opportunities for collaboration (such as coordinating dredging projects), as well as sharing best practices and lessons learned.

This study helps to provide a basic understanding of some key Cape Cod harbors, but future studies in other harbors on Cape Cod are needed to fully illustrate the regional economic impact of harbors, especially commercially important ones like Hyannis, Orleans, and Wellfleet.



Appendix A

NAICS Codes Categorization by The Blue Economy Foundation

"Dark Blue" Industry Sectors	
NAICS Code	NAICS Description
112511	Finfish Farming And Fish Hatcheries
112512	Shellfish Farming
112519	Other Aquaculture
114111	Finfish Fishing
114112	Shellfish Fishing
114119	Other Marine Fishing
221111	Hydroelectric Power Generation
311712	Fresh and Frozen Seafood Processing
314910	Textile and Canvas
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing
336611	Ship Building and Repairing
336612	Boat Building
424460	Fish and Seafood Merchant Wholesalers
441221	Motorcycle, ATV, and Personal Watercraft Dealers
441222	Boat Dealers
445220	Fish and Seafood Markets
483113	Coastal and Great Lakes Freight Transportation
483114	Coastal and Great Lakes Passenger Transportation
483211	Inland Water Freight Transportation
487210	Scenic and Sightseeing Transportation, Water
488310	Port and Harbor Operations
488320	Marine Cargo Handling
488330	Navigational Services to Shipping
488390	Other Support Activities for Water Transportation
532411	Commercial Air, Rail, and Water Transportation Equipment Rental & Leasing
541360	Geophysical Surveying and Mapping Services
541370	Surveying and Mapping (except Geophysical) Services
541620	Environmental Consulting Services
555555	Fish and Seafood Wholesaler
712190	Nature Parks and Other Similar Institutions
713930	Marinas
777777	Retail
813312	Environment, Conservation And Wildlife Organizations
924110	Administration of Air and Water Resource & Solid Waste Management Programs
924120	Administration Of Conservation Programs
928110	National Security (Navy, Coast Guard)

"Light Blue" Industry Sectors	
NAICS Code	NAICS Description
211111	Crude Petroleum and Natural Gas Extraction
212321	Construction Sand and Gravel Mining
213111	Drilling Oil and Gas Wells
213112	Support Activities for Oil and Gas Operations
237110	Water And Sewer Line And Related Structures Construction
237120	Oil and Gas Pipeline and Related Structures Construction
237990	Other Heavy and Civil Engineering Construction
324110	Petroleum Refineries
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
331221	Rolled Steel Shape Manufacturing
331314	Secondary Smelting and Alloying of Aluminum
331315	Aluminum Sheet, Plate, and Foil Manufacturing
331512	Steel Investment Foundries
332312	Fabricated Structural Metal Manufacturing
332313	Plate Work Manufacturing
332322	Sheet Metal Work Manufacturing
332410	Power Boiler and Heat Exchanger Manufacturing
332420	Metal Tank (Heavy Gauge) Manufacturing
332510	Hardware Manufacturing
332710	Machine Shops
332999	All Other Miscellaneous Fabricated Metal Product Manufacturing
333132	Oil and Gas Field Machinery and Equipment Manufacturing
333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing
333618	Other Engine Equipment Manufacturing
333923	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing
333992	Welding and Soldering Equipment Manufacturing
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing
334290	Other Communications Equipment Manufacturing
334519	Other Measuring And Controlling Device Manufacturing
335314	Relay and Industrial Control Manufacturing
335911	Storage Battery Manufacturing
339920	Sporting and Athletic Goods Manufacturing
423510	Metal Service Centers and Other Metal Merchant Wholesalers

"Light Blue" Industry Sectors	
NAICS Code	NAICS Description
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
423690	Other Electronic Parts and Equipment Merchant Wholesalers
423710	Hardware Merchant Wholesalers
423810	Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers
423830	Industrial Machinery and Equipment Merchant Wholesalers
423840	Industrial Supplies Merchant Wholesalers
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers
423910	Sporting and Recreational Goods and Supplies Merchant Wholesalers
423930	Recyclable Material Merchant Wholesalers
424710	Petroleum Bulk Stations and Terminals
424720	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)
424990	Other Miscellaneous Nondurable Goods Merchant Wholesalers
444190	Other Building Material Dealers
451110	Sporting Goods Stores
486110	Pipeline Transportation of Crude Oil
486210	Pipeline Transportation of Natural Gas
486910	Pipeline Transportation of Refined Petroleum Products
486990	All Other Pipeline Transportation
487990	Scenic and Sightseeing Transportation, Other
488999	All Other Support Activities for Transportation
532412	Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing
532490	Other Commercial and Industrial Machinery and Equipment Rental and Leasing
541330	Engineering Services
541711	Research And Development In Biotechnology
541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)
541990	All Other Professional, Scientific, and Technical Services
611430	Professional and Management Development Training
611513	Apprenticeship Training

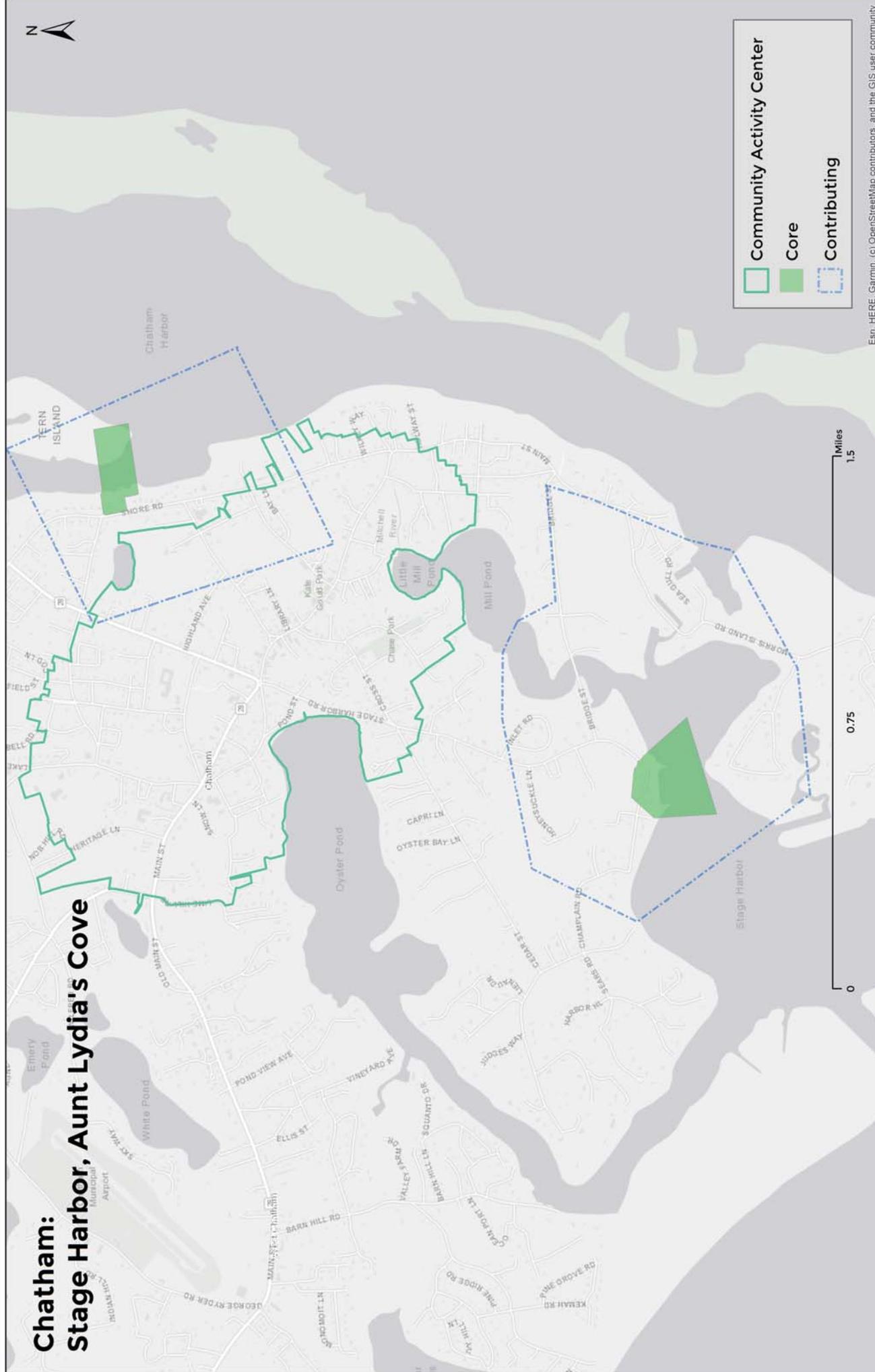
"Light Blue" Industry Sectors	
NAICS Code	NAICS Description
611519	Other Technical and Trade Schools
611620	Sports and Recreation Instruction
611699	All Other Miscellaneous Schools and Instruction
711510	Independent Artists, Writers, and Performers
712110	Museums
712120	Historical Sites
712130	Zoos and Botanical Gardens
713990	All Other Amusement and Recreation Industries
721110	Hotels (except Casino Hotels) and Motels
721110	Hotels/Motels/BnBs
721191	Bed-and-Breakfast Inns; Hotels/Motels/BnBs
722511	Full-Service Restaurants
811213	Communication Equipment Repair and Maintenance
811219	Other Electronic and Precision Equipment Repair and Maintenance
811490	Other Personal And Household Goods Repair And Maintenance

Appendix B

Maps of Pilot Harbors and Their Core Areas, Contributing Areas, and Nearest Community Activity Center

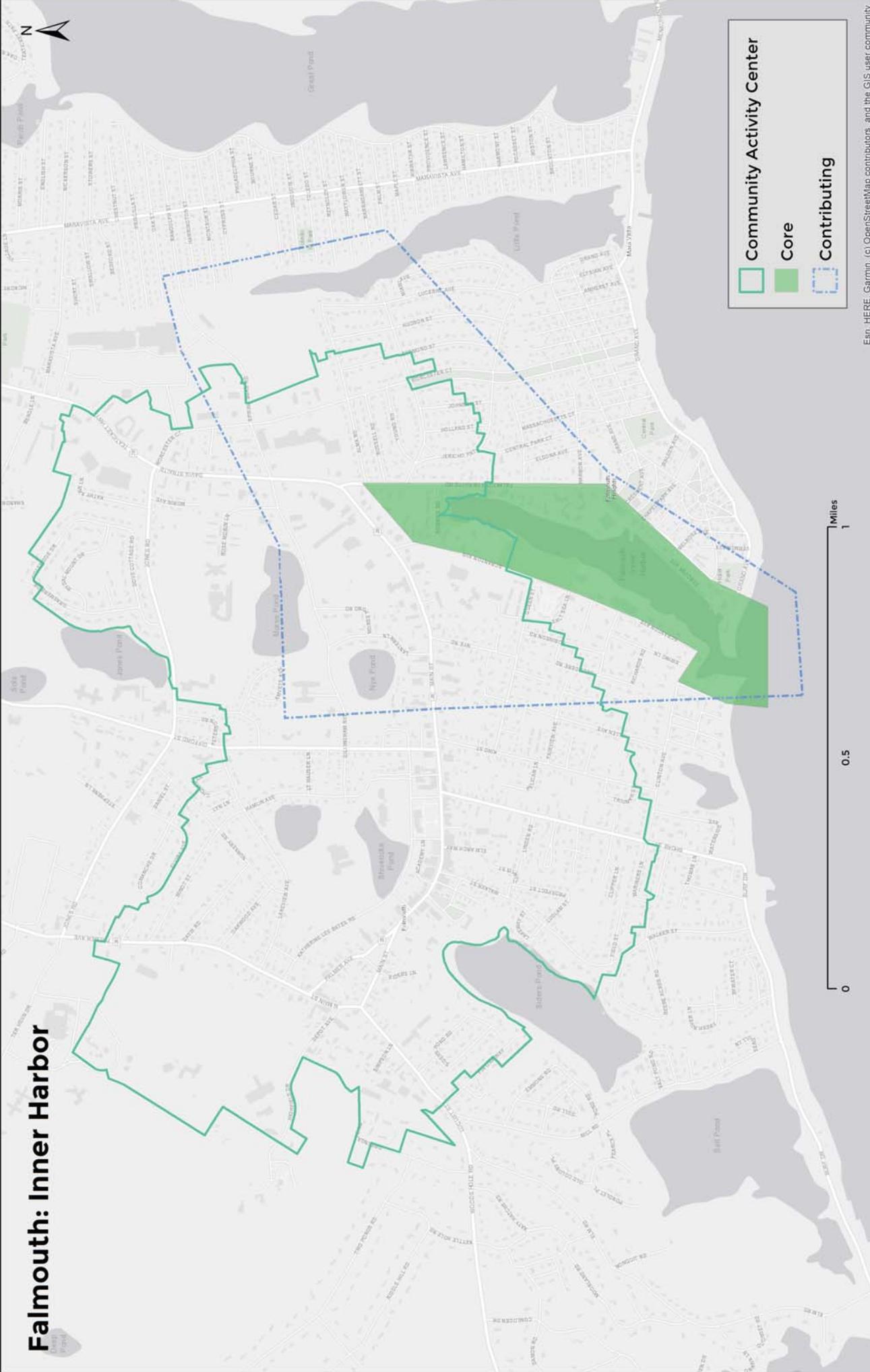


Chatham: Stage Harbor, Aunt Lydia's Cove



Esn, HERE, Garmin, (C)OpenStreetMap contributors, and the GIS user community

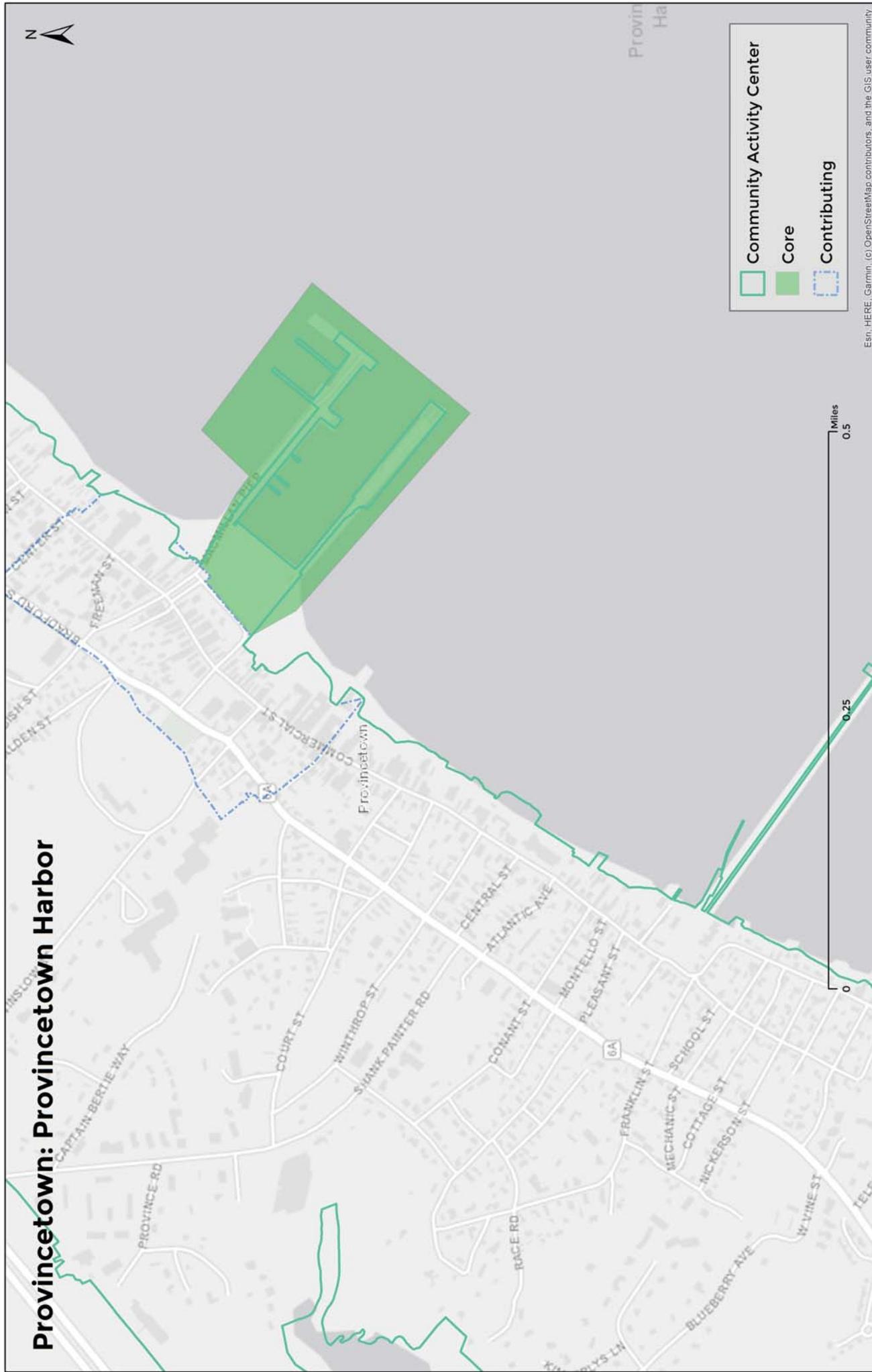
Falmouth: Inner Harbor



Community Activity Center
Core
Contributing

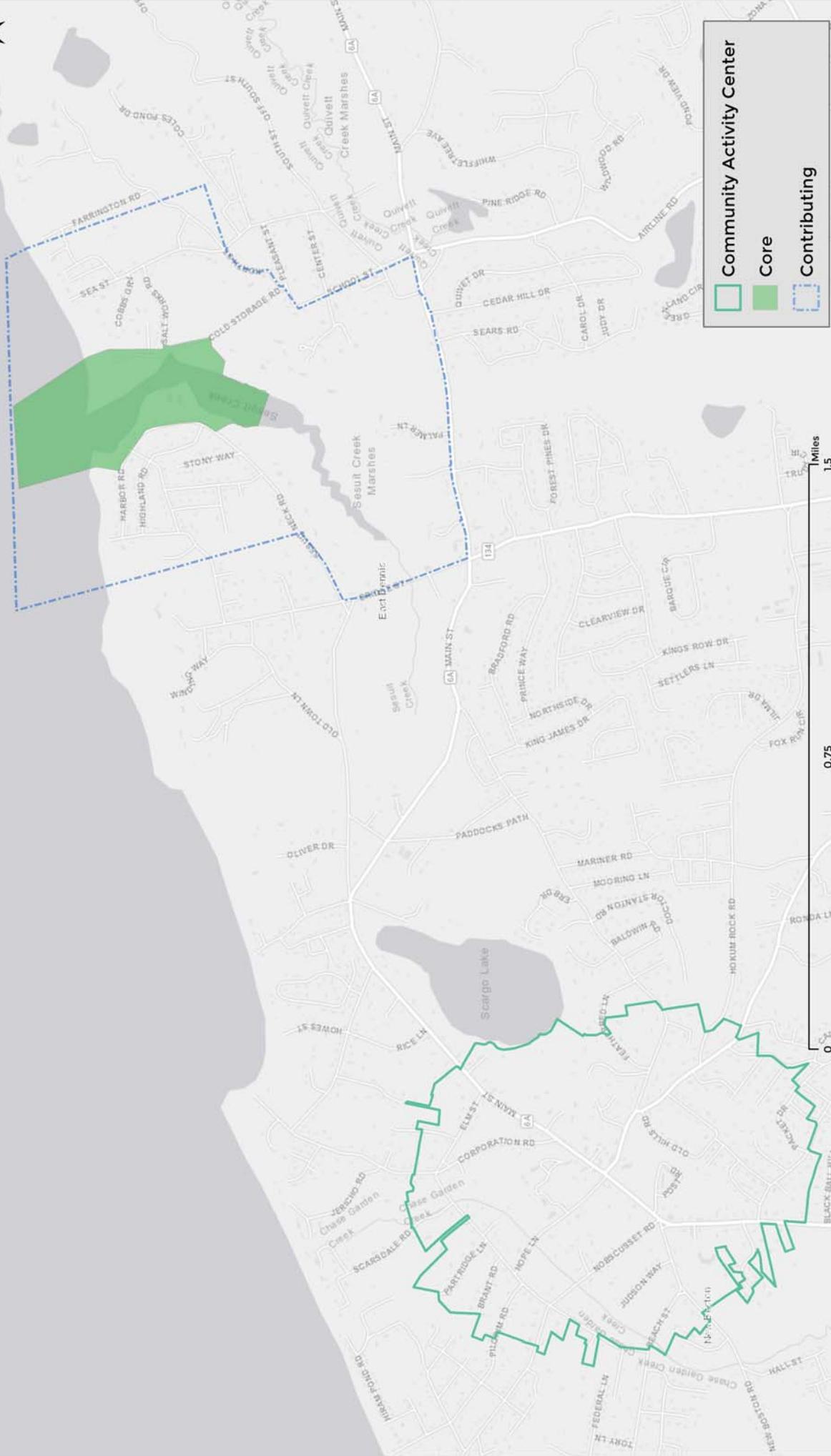
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Provincetown: Provincetown Harbor



Esri, HERE, Garmin, (C) OpenStreetMap contributors, and the GIS user community

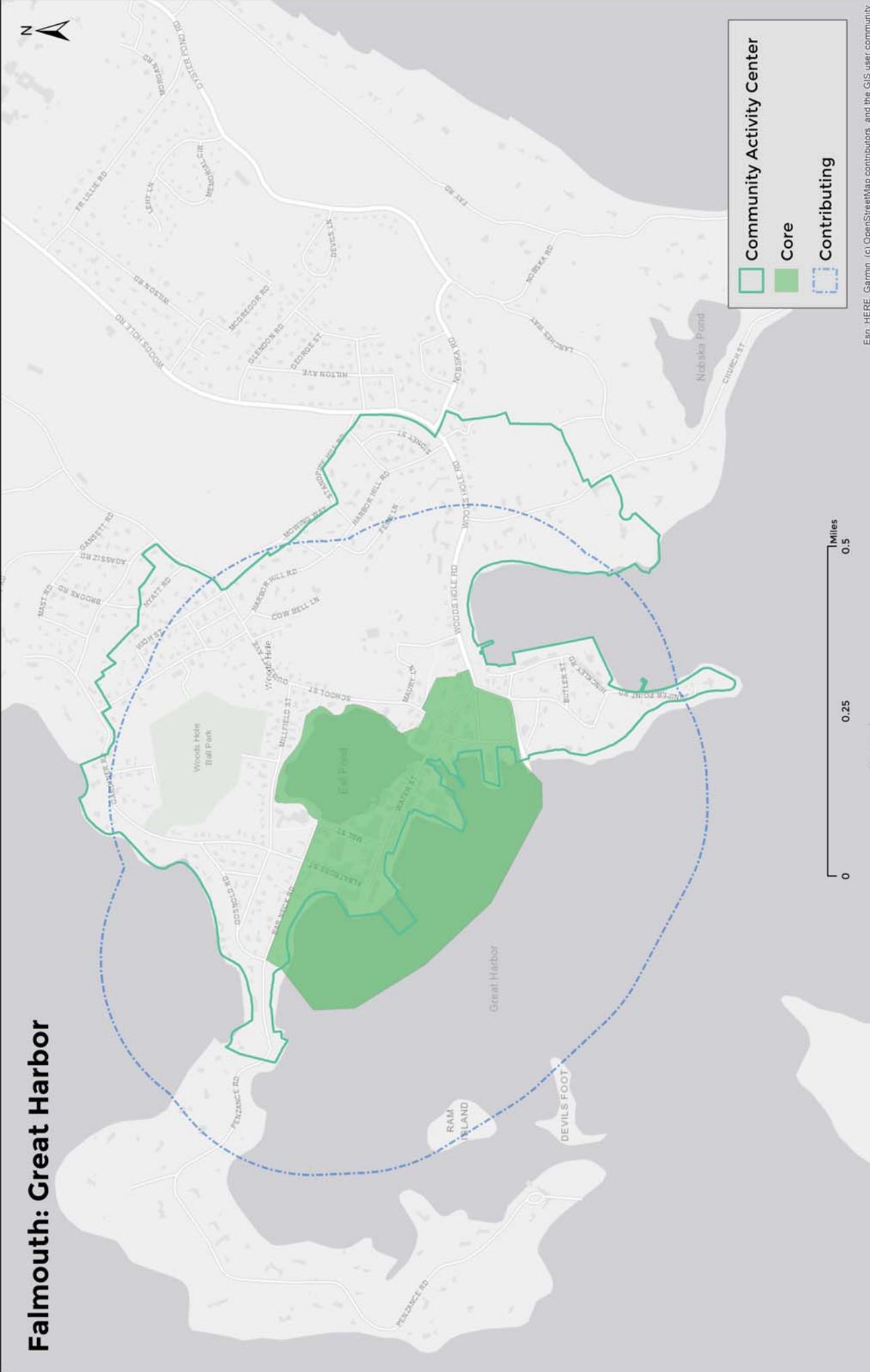
Dennis: Sesuit Harbor



Community Activity Center
Core
Contributing

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Falmouth: Great Harbor



Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community



Appendix C: Survey Questions

Economic Value of Cape Cod Harbors

Introduction

The Cape Cod Commission is researching the economic value of Cape Cod harbors, and how the operations and maintenance of harbors influences these values. This project studies six pilot harbors in four towns: Chatham (Stage Harbor and Fish Pier), Provincetown Harbor, Dennis (Sesuit Harbor), and Falmouth (Inner Harbor and Great Harbor). This survey will inform how the commercial businesses located near the pilot harbors interact with those harbors, including understanding current and potential impacts of coastal hazards and capital planning needs.

This survey is an important component of our research project and your responses are critical to understanding the economic value of Cape Cod harbors. **This survey should take about 10 minutes to complete and your responses will remain confidential. Data will only be reported on the town level and no individual responses will be reported.**

If you have any questions about the survey and our study, please contact Jennifer Clinton, Special Projects Coordinator at the Cape Cod Commission, at jclinton@capecodcommission.org.

Thank you for your participation!

1. What is your business name?
 2. What is the address of your business?
 3. How many years has your business been located at this address (approximately)?*
 - a. Fill in the blank, must be a number
 4. Which harbor is your business located closest to?*
 5. Check all that apply. My business is a/an:*
- a. Restaurant
 - b. Grocery store
 - c. Fish/seafood market
 - d. Liquor store
 - e. Gas station
 - f. Boat dealer
 - g. Boat maintenance and repair
 - h. Marine
 - i. Commercial fishing business

- j. Aquaculture business
 - k. Tourism/recreation business
 - l. Transportation business (land based)
 - m. Shipping business
 - n. Hotel, motel, or bed and breakfast
 - o. Medical/dental office
 - p. Professional office
 - q. Clothing/accessories retail
 - r. Convenience/general store
 - s. Transportation business (water based)
 - t. Art gallery
 - u. Museum/historic site
 - v. Gift shop
 - w. Other (please specify) _____
6. How many months is your business open in a typical year?*
- a. Slider, 1-12
7. Do you own or lease the location of your business?*
- a. Own
 - b. Lease
 - c. Other

Employment

Please respond to the following questions based on your company's work during 2018. Revenue and employment data will only be reported on the town level and no individual responses will be reported.

8. What is your total number of employees (Full Time Equivalents) in 2018?*(Note: your FTE number = (Total hours worked per week, on average, across all part-time employees/30) + # of full-time employees) _____ -
9. Do you expect your number of employees to change in 2019?*
- a. Increase
 - b. Decrease
 - c. Remain about the same
10. Do you hire seasonal employees?*
- a. Yes
 - b. No
11. If yes, how many did you hire in 2018? _____

Harbor Access

Access and proximity to Cape Cod's waters is a crucial need for many local businesses. Maintaining our harbors in turn supports access to coastal amenities, recreation opportunities, and open water.

12. Do you consider your business "harbor-dependent"? Please explain.* (For example, could you relocate away from the harbor or otherwise reduce your harbor access, and maintain your current employment and revenue levels?)

- a. Yes
 - b. No
13. Do customers travel to your place of business by boat?*
- a. Yes
 - b. No
14. Please estimate the share of your customers (percent of total, using whole numbers) that fall into the following groups:*
- a. Year-Round Residents
 - b. Seasonal Residents
 - c. Short-Term Tourists/Visitors
 - d. Other Cape Cod Businesses
 - e. Off-Cape Businesses
 - f. Other
15. If other, please describe this customer sub-group.
16. How is your business directly affected by the functionality of this harbor, including water quality, condition of infrastructure, and accessibility to boats, cars, and pedestrians? If your business is not affected, please enter N/A.* _____ -
17. From your perspective, what changes or updates are needed to maintain the functionality and utility of this harbor for your business?*
- Check all that apply.*
- a. Improved harbor infrastructure
 - b. Improve launch facilities
 - c. Increased access to fuel
 - d. Increased access to seafood processing facilities
 - e. Improved signage
 - f. Improved water quality
 - g. None of the above, no change needed
 - h. Other, please explain _____

Coastal Hazard Impacts

Coastal hazards, such as flooding and erosion, can significantly impact local businesses. Planning efforts and investments by individual businesses, towns, and the region seek to mitigate these impacts and support long term economic resilience for Cape Cod.

18. Have you had any flooding- or erosion-related damage to your place of business in the past five years?*
- a. Flooding
 - b. Erosion
 - c. Both
 - d. Neither
 - e. If yes, please explain when and how your property was damaged.
19. Have you made any investments to prevent flooding or erosion damage to your place of business in the past five years?*
- a. Yes
 - b. No

- c. If yes, please describe your changes, including any approximate costs.
- 20. Do you plan to make any investment to prevent flood or erosion damage to your property in the next five years?
 - a. Yes
 - b. No
 - c. If yes, please describe your anticipate changes, including any cost estimates if available.
- 21. I am aware of local coastal hazard planning efforts.
 - a. Strongly Agree
 - b. Agree
 - c. Neither Agree nor Disagree
 - d. Disagree
 - e. Strongly Disagree
- 22. If you would like to learn more about the Regional Harbor Project, please share your email address below.

Appendix D

Harbor-Level Insights into Climate Change Impacts and Perceptions

GREAT HARBOR

In the past five years, 3/7 businesses have not experienced any flooding or erosion-related damage to their place of business, while 3/7 have experienced flooding and 1/7 have experienced erosion (4 no answer). Those that have experienced damage noted directional rains causing flooding, pipe bursts, storm damage to the Waterfront Park seawall, and loss of use of the business during and after the storm.

3/7 businesses have made investments to prevent flooding and erosion in their place of business in the last five years including mold mitigation; dehumidifier; sump pump; and conducting design studies to determine the cost of protecting critical facilities from sea level rise and storm damage. Additionally, 3/7 businesses plan to make investments to prevent flooding and erosion damage to their facilities in the next five years.

Finally, most businesses (6/7) are aware of local coastal hazard planning efforts.

INNER HARBOR

In the past five years, 12/14 businesses have not experienced any flooding or erosion-related damage to their place of business, while 2/14 have experienced flooding and 2/14 have experienced both flooding and erosion (7 no answer). Those that have experienced damage noted storm waves hitting docks and buildings during storms, excessive stormwater runoff and inadequate storm drains which causes flooding, and yearly storm damage to the flooring and dock plank lift.

3/16 businesses have made investments to prevent flooding and erosion in their place of business in the last five years including dock improvements, improved doors and windows, sandbags, and bulkhead work, and raising some equipment due to sea level rise. Additionally, 2/16 businesses plan to make investments to prevent flooding and erosion damage to their facilities in the next five years including repairing any damages that may occur, a town-wide risk assessment, and raising of some equipment and buildings due to sea level rise.

Finally, half of the businesses (8/16) are aware of local coastal hazard planning efforts (8/16 are not aware, and 7 did not answer).

SESUIT HARBOR

In the past five years, nine of out 11 businesses have not experienced any flooding or erosion-related damage to their place of business, while 1/11 have experienced erosion, and 1/11 have experienced both erosion and flooding (4 no answer). Those that have experienced damage noted high tides and storm-related beach erosion.

3/11 businesses have made investments to prevent flooding and erosion in their place of business in the last five years including bulkhead, fence, and dredging.

Additionally, 2/11 businesses plan to make investments to prevent flooding and erosion damage to their facilities in the next five years, including a new seawall and dredging beneath the docks.

Finally, some businesses (5/11) are aware of local coastal hazard planning efforts.

AUNT LYDIA'S COVE

In the past five years, 8,10 businesses have not experienced any flooding or erosion-related damage to their place of business, while 2/10 have experienced both erosion and flooding (5 no answer). Those that have experienced damage noted the damage was the result of storms.

2/10 businesses have made investments to prevent flooding and erosion in their place of business in the last five years including adding dredged sand to the beaches and adding signage to keep people off banks to prevent erosion.

Additionally, 2/10 businesses plan to make investments to prevent flooding and erosion damage to their facilities in the next five years, including dredging more sand for the beaches.

Finally, some businesses (7/11) are aware of local coastal hazard planning efforts.

STAGE HARBOR

In the past five years, none of the businesses (6) have experienced any flooding or erosion-related damage to their place of business.

1/6 businesses have made investments to prevent flooding and erosion in their place of business in the last five years including waterproofing from storms and flooding.

Additionally, none of the businesses (0/6) plan to make investments to prevent flooding and erosion damage to their facilities in the next five years.

Finally, most businesses (5/6) are aware of local coastal hazard planning efforts.

PROVINCETOWN HARBOR

In the past five years, 9/11 businesses have not experienced any flooding or erosion-related damage to their place of business, while 1/11 have experienced erosion, and 1/11 have experienced both

erosion and flooding (4 no answer). Those that have experienced damage noted high tides and storm-related beach erosion.

3/11 businesses have made investments to prevent flooding and erosion in their place of business in the last five years including bulkhead, fence, and dredging.

Additionally, 2/11 businesses plan to make investments to prevent flooding and erosion damage to their facilities in the next five years, including a new seawall and dredging beneath the docks.

Finally, some businesses (5/11) are aware of local coastal hazard planning efforts.

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