Report I

An Assessment of the Coastal and Marine Economies of Massachusetts

RFR #: ENV 06 CZM 09

Massachusetts Office of Coastal Zone Management (CZM)

Presented by

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June 29, 2006

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Part I – Introduction and Summary of Findings

INTRODUCTION

This three-part study—*An Assessment of the Coastal and Marine Economies of Massachusetts*—provides an analysis of the economic value of the coastal and marine economies as well as an overview of employment, wages, business activities and trends within important sectors of the Massachusetts marine economy. The data used is primarily from 2004, unless otherwise noted.

The study was initiated and funded by the Massachusetts Office of Coastal Zone Management in response to the Massachusetts Ocean Management Task Force's "Use Characterization" recommendation, calling for "a comprehensive understanding of the location, nature and interrelationship of uses and resources," including "socio-economic trends."[1]

The state-level data used for this analysis is accessible online through an employment and wage series of the Bureau of Labor Statistics at the U.S. Department of Labor. Unfortunately, the state of Massachusetts applies specific and unique confidentiality restrictions to this data series and access is restricted.[2] The data limitations create serious methodological challenges to measuring detailed sectors of the economy in Massachusetts. The major goal of the study team was to develop a method that would work for Massachusetts and could be replicated in the future.

This objective required the design of an industry definition using the North American Industry Classification System (NAICS)—a newer system of industry classification which replaced the U.S. Standard Industrial Classification (SIC) system starting in 1997. To proceed with the study, it was first necessary to allocate this new set of industry codes to each of the major sectors of the marine industry. Another component

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[1] Pages 46 and 47,*Waves of Change: The Massachusetts Ocean Management Task Force Report and Recommendations*, March 2004. Available at: http://www.mass.gov/czm/oceanmanagement/waves_of_change/index.htm.

[2] The General Laws of Massachusetts, *Chapter 151A: Section 46. Confidential information; admissibility as evidence; exceptions to disclosure restrictions.*

of the approach included development of formulas to adjust and allocate NAICS-based employment data to correspond to marine sector activity.

Finally, this approach required the development of correspondence tables between marine industry NAICS codes and Impact Analysis for Planning Software (IMPLAN) industry sector codes in order to properly distribute the final data within an input-output model to measure the impact of the coastal and marine economies. Technical discussion and details about the methodology can be found in the appendices of this report.

It was also necessary to shape the model to fit the requirements of the Massachusetts Division of Unemployment Assistance (Mass. DUA), the state agency providing the data. This required a period of close collaboration with the data provider to overcome methodological obstacles.

Study deliverables take the form of three written reports:

- Report I—Analysis of the coastal and marine economies in Massachusetts including discussions of the following: employment and production output resulting from the economic activity; employment, establishment and payroll summaries for each of the major sectors; discussion of major trends and issues within the marine economy; and technical appendices detailing the methodology.
- Report II—Discussion of data limitations and methodological challenges, as well as potential solutions to these challenges.
- Report III—A tabular report containing master data and summary tables used in the economic analysis.

SUMMARY OF KEY FINDINGS

Findings related to the coastal economy:

- 71,160 coastal economy establishments directly employ 1,161,326 persons (ES-202 basis, 2004) in Massachusetts, representing close to 37 percent of employment in the state.
- Seventeen percent of coastal employment is in the Health Care and Social Assistance sector, the largest sector of coastal employment. This sector is followed by the Trade—Wholesale and Retail—with 14 percent of employment, followed by Arts, Entertainment, Accommodation and Food Services with 11 percent of employment and Finance, Insurance and Real Estate with 10 percent of employment.
- Payroll within the coastal economy totals over $60 billion with an average annual wage in the region of close to $52,000.
- Annual Gross State Product (GSP), 2004, of the coastal economy is approximately $117 billion or 37 percent of Massachusetts GSP in 2004.
- Secondary employment impacts – jobs created in the rest of the state through the functioning of the coastal economy—total almost 147,000 additional jobs created within Massachusetts.

Findings related to the marine economy:

- The marine economy is comprised of five major sectors: Commercial Seafood, Marine Transportation, Coastal Tourism and Recreation, Marine Science and Technology, Marine-related Construction and Infrastructure.
- The marine economy directly employs 152,440 persons (ES-202 basis) in Massachusetts with an annual average wage of $28,263.
- More than 78 percent of the cluster's[3] total employment in Massachusetts is in the Coastal Tourism and Recreation sector, followed by Marine-related Construction and Infrastructure employment with 14,956 jobs or 10 percent of marine

[3] The marine economy is a *horizontally-integrated industrycluster:* an industry which includes sectors which might share a common market for the end products, use a common technology or labor force skills, or require similar natural resources. See http://www.planning.unc.edu/courses/261/leveen/.

employment, Commercial Seafood sector employment of 11,270 or 7 percent, Marine Science and Technology employment of 5,055 or 3 percent, and Marine Transportation employment of 2,099 or one percent of employment.

- Total payroll within the marine economy totals more than $4.3 billion.
- Secondary employment impacts of the coastal economy total 30,072 indirect and 41,324 induced jobs for a total of 223,836 additional jobs created within the region, an employment multiplier of 1.47.
- Total annual output (2004) of the marine economy was $14.8 billion. This includes $6.1 billion in secondary output impacts ($2.9b indirect and $3.2b induced).

Findings related to major sectors of the marine economy:

Commercial Seafood

- The Commercial Seafood sector directly employs 11,270 persons. This includes 7,661 covered employees and 3,609 individual proprietors.
- Commercial fishing activities and seafood processing and wholesaling employment comprise the majority of jobs.
- Payroll within the sector totals $509 million annually, with average annual wages of $45,229 per employee.
- Secondary employment impacts of the sector create over 11,000 additional jobs within the region, an employment multiplier of 1.99.
- Annual production output (2004) totals about $1.6 billion including about $638 million in secondary impacts.

Marine Transportation

- The Marine Transportation sector directly employs 2,099 persons.
- Deep sea and coastal transportation, as well as support activities for water transportation, comprise the majority of jobs.
- Payroll within the sector totals $93 million annually, with average annual wages of $44,228 per employee.
- Secondary employment impacts of the sector create over 3,833 additional jobs within the region, an employment multiplier of 2.83.

- Annual production output (2004) totals about $529 million including about $239 million in secondary impacts.

Coastal Tourism and Recreation

- The Coastal Tourism and Recreation sector in the coastal zone directly employs 119,420 persons.
- Within the sector, 73 percent of employment (87,499 jobs) is related to food services, 15 percent (18,296 jobs) is related to accommodations, and 11 percent (13,625 jobs) is related to entertainment and recreation.
- Payroll within the sector totals $2.3 billion annually, with average annual wages of $19,580 per employee.
- Secondary employment impacts of the sector create over 38,011 additional jobs within the region, an employment multiplier of 1.32.
- Annual production output (2004) totals about $8.7 billion including about $3.6 billion in secondary impacts.

Marine Science and Technology

- The Marine Science and Technology sector directly employs 5,055 people.
- Within this total, 59 percent of employment (2,985 jobs) is related to marine engineering and technical services, 29 percent (1,441 jobs) is related to production of instrumentation and equipment, and about 10 percent (490 jobs) is related to ship and boat building and repair.
- Supplemental research determined that an additional 1,530 people work in academic programs and research institutions dedicated to marine science.
- Payroll to employees within the sector totals $419 million annually, with average annual wages of $82,829 per employee.
- Secondary employment impacts of the sector create over 6,426 additional jobs within the region, an employment multiplier of 2.27.
- Annual production output (2004) totals about $1.2 billion including about $568 million in secondary impacts. The output multiplier for this sector—1.96— is the highest output multiplier of all sectors in the marine economy.

Marine-Related Construction and Infrastructure

- The Marine-Related Construction and Infrastructure sector in directly employs 14,596 persons.
- Within the sector, 77 percent of employment (11,181 jobs) is related to coastal real estate development and an additional 23 percent (3,415 jobs) is related to marine construction.
- Payroll within the sector totals $949 million annually, with average annual wages of $65,014 per employee.
- Secondary employment impacts of the sector create over 11,940 additional jobs within the region, an employment multiplier of 1.82.
- Annual production output (2004) totals $2.8 billion including about $1 billion in secondary impacts, an output multiplier of 1.56.

Findings from survey of marine economy businesses:

- Business conditions in the marine economy are stable and generally positive. Approximately one-quarter of businesses increased employment during the past 12 months (24.5 percent) and over one-quarter of businesses expect to increase employment during the next 12 months (26.6 percent).
- In general, businesses reported stable or positive sales/revenue growth conditions, with 37.5 percent of those interviewed reporting stable sales or revenue during the past 12 months. Two-thirds of businesses expect revenues or sales to increase during the next 12 months.
- The vast majority of marine and coastal businesses purchase supplies primarily from businesses located in Massachusetts (80.3 percent).
- Marine and coastal businesses draw a significant percentage of their customers from outside of their region and out-of-state. Close to 47 percent of businesses attract customers primarily from within a 25 mile radius of the business. However, close to 54 percent of businesses draw customers primarily from outside their region and out-of-state.
- The marine economy businesses interviewed for the survey overwhelmingly recruit workers from within their community (70 percent) and the region (17.2 percent).

- A minimum of 30 percent of businesses across sectors report problems recruiting sufficiently-skilled employees, including sectors that do not demand a high-number of skilled workers. In fact, 10.5 percent of all businesses surveyed reported that it is a "big problem" finding skilled workers.
- The cost of real estate is by far the most significant issue facing marine and coastal tourism businesses. A related issue, the availability of suitable land for expansion, was the next most significant problem.
- Nearly one-half of the businesses surveyed (47.9 percent) reported some problem with government regulations and permitting. In general, firms did not report significant problems gaining access to capital and broadband services or customers and suppliers.

Part II– METHODOLOGY: IMPACT ANALYSIS

Overview

The overarching goal was to utilize the best available economic information to analyze the marine and coastal economies in Massachusetts. To accomplish this goal, we designed an approach to achieve the following objectives:

- Develop comprehensive and detailed industry definitions of sectors that comprise the coastal and marine economies of the Commonwealth.
- Develop an economic impact methodology to allow the economic activities of these sectors to be quantified both for the purposes of this report and in future analyses by the Massachusetts Office of Coastal Zone Management.

Industry Definitions

We define the coastal economy as all economic activities within the coastal communities of Massachusetts; the marine economy is comprised only of those commercial activities related to and/or having inputs from the sea. It is important to note that economic activity within the coastal economy is not necessarily dependent on— or even related to— the presence of the ocean.

Technical Details about IMPLAN

The basis of this economic impact study is an input-output model. Input-output models are used by economists and planners to describe and predict commodity flows between industry sectors. [4] The input-output models in this study were developed using IMPLAN (Impact Analysis for PLANning) Software, a package that performs the calculations necessary to create the model.[5] Specifically, we used IMPLAN Professional 2.0 model building software and data packages. The primary inputs used in the model for

[4] According to IMPLAN, "Input-output accounting describes commodity flows from producers to intermediate and final consumers." Olson, Doug and Scott Lindall, "IMPLAN Professional Software, Analysis, and Data Guide"; Minnesota IMPLAN Group, Inc., 1725 Tower Drive West, Suite 140, Stillwater, MN 55082, www.implan.com

[5] *Data and software:* Minnesota IMPLAN Group, Inc., IMPLAN System (data and software), 1725 Tower Drive West, Suite 140, Stillwater, MN 55082 www.implan.com

this study are 2004 employment and payroll data; therefore, model outputs are reported in 2004 dollars.

The IMPLAN modeling system combines the U.S. Bureau of Economic analysis' Input-Output Benchmarks with other data to construct quantitative models of trade flow relationships between businesses and between businesses and final customers.[6] From these data, one can examine the effects of a change in one or several economic activities to predict its effect on a specific state, regional or local economy (impact analysis). The IMPLAN input-output accounts capture all monetary market transactions for consumption in a given time period.

IMPLAN's Regional Economic Accounts and Social Accountings matrices are used to construct local, county or state-level multipliers specified to an impact area. Multipliers describe the response of an economy to a change in demand or production. Each industry that produces goods or services generates demand for other goods and services and this demand is multiplied through a particular economy until it dissipates through "leakage" to economies outside the specified area. Multipliers calculate the response of the economic area to a change in demand or production in an industry sector. For example, a multiplier of 1.32 can be interpreted to mean that for every 100 jobs in a particular sector, an additional 32 jobs are generated from activities in that sector.

Coastal Economy Method

The coastal economy is defined as the sum total of economic activity in the coastal zone region. Therefore, its economic impact on the state economy is best expressed as its total contribution to gross state product (GSP).

In order to calculate this share, we obtained employment and wage data— from the Massachusetts Division of Unemployment Assistance ES-202 series— at the two digit North American Industry Classification System (NAICS) code level.[7] ES-202 data is derived from reports filed by all employers subject to unemployment compensation laws and thus represents 'covered' employment only.

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[6] The IMPLAN modeling system draws on a variety of statistical sources, including the Bureau of Labor Statistics Growth Model, Bureau of the Census, ES-202 employment and earnings data, the Regional Economic Information System (REIS), and the Bureau of Economic Analysis Gross State Product data.
[7] For description of the NAICS system see the U.S. Census Bureau website at http://www.census.gov/epcd/www/naics.html.

We obtained data for the individual Massachusetts Coastal Zones as defined by the CZM, for the coastal zone in aggregate, as well as for the remaining 'inland' region. We also obtained data at the two digit level for the five coastal zones: Boston Harbor, Cape and Islands, North Shore, South Coastal, and South Shore.

In addition to discussing coastal zone activity in aggregate, we present summary tables describing business establishments,[8] employment and wages for the coastal zone economy by two digit NAICS sector, the broadest division of industry available.[9] We also analyzed subregional data in order to develop sector-level summary tables for individual coastal zone subregions.

Marine Economy Method

To conduct an economic impact analysis of the marine economy we developed a methodology using employment and payroll data as inputs. Employment numbers were used as primary inputs to the model to calculate sector impacts on employment growth and production output. Payroll data were used to adjust assumptions within the model to correspond directly with actual wages paid by marine sectors.

Data Used in the Method

We obtained employment and payroll data from the ES-202 series managed by the Massachusetts Division of Unemployment Assistance. Due to the larger geographic area being measured, we were able to obtain detailed sector-level data (e.g. at the four, five and six digit NAICS code levels) to measure the marine economy of Massachusetts.

In one sector, the commercial seafood industries sector, we chose to supplement ES-202 data with additional data. Commercial seafood industries are not well measured by a covered—e.g. benefited— employment series like the ES-202 series. The sector is known to have a high level of self-employed individuals. In fact, commercial fishing employment counts in the ES-202 series are far lower than other data suggest.

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[8] An establishment is "a single-location business unit, which may be independent--called a single-establishment enterprise--or owned by a parent enterprise." http://www.investordictionary.com/definition/establishment.aspx

[9] Tables covering NAICS code industry categories can be found at the U.S. Census Bureau website at: http://www.census.gov/epcd/www/naics.html.

Furthermore, we believe this sector may employ a large number of undocumented workers who go undetected.

Consequently, in order to measure self-employed commercial fishing activity, we added employment and revenue figures from the nonemployer series available from the U.S. Bureau of the Census. This series provides business activity data for individual proprietor businesses and other firms who have no unemployment assistance-covered employees. Additional employment numbers were added from aquaculture license data from the Massachusetts Division of Fisheries, Shellfish Sanitation and Management Program. Finally, we cross-checked our final numbers with commercial license data from the MA Division of Fisheries, with trends observed in the field,[10] and also with market research data from private sources.

Time Frame

Due to variations in the way public data has been collected—including the shift from the SIC system to the NAICS system and subsequent revisions of NAICS system codes between 1997 and 2002—it is very difficult to obtain a comparable set of data between 1997 and 2004 at the level of detail we needed for this study.

Consequently, we chose to develop our economic impact analysis to measure the most current annual data available—e.g. 2004 annual data— rather than measuring comparative years. Nevertheless, the method could be used this way in the future as further NAICS-based employment data become available.

Sector definitions and industry codes

To obtain data specific to the marine industry, we developed a set of detailed NAICS codes corresponding directly to marine economy activities studied in two earlier reports done by the study team to quantify and describe the marine economy: *The Massachusetts Marine Economy* (Georgianna, 2000) and *The Marine Science and Technology Industry in New England* (Barrow, Loveland, Terkla, 2005). The table of

[10] Numbers were consistent with observations made by Dr. Dan Georgianna and colleagues, cited in various reports. See *Appendix 6. References* for titles of reports.

NAICS codes comprising the Marine Economy appears in *Appendix 1. Marine Economy Definition by NAICS Code*.

In the commercial fishing sector, known to have a high level of self-employed individuals, we supplemented covered employment numbers with employment and revenue figures from the nonemployer series available from the U.S. Bureau of the Census. This series provides business activity data for individual proprietor businesses and other firms without unemployment assistance-covered employees. We also added employment inputs in this sector based on aquaculture license data from the Massachusetts Division of Fisheries, Shellfish Sanitation and Management Program.

We ran the economic impact analysis to develop output tables to quantify direct, indirect, and induced impacts for the state as a whole and for the major sectors of the marine economy. The report discusses establishment, employment, and payroll data for each major sector of the state marine economy.

Use of Other Data Sets

Economic impact assessment models based on employment and payroll provide only a part of the picture of economic activity within the marine and coastal economies of the Commonwealth. To fill in the picture at the sector level, additional important data sets were analyzed and discussed using descriptive statistics to provide insight into trends and issues impacting the various sectors of the marine economy.

The team made a special effort to access and utilize additional data sets within two sectors – Coastal Tourism and Recreation and Marine Science and Technology. The reasoning, along with the approaches is discussed below.

Method Used to Quantify Impacts Related to Coastal Tourism

It is difficult to quantify the economic effects of tourism using employment and payroll numbers because there are no NAICS categories for the coastal tourism industry, per se. Consequently, we developed and applied a methodology related to NAICS codes and coastal region geography.

We conducted a literature review to confirm relevant industry codes and geographic definitions used to measure coastal tourism impacts[11]. We collected employment and payroll in the identified NAICS codes for coastal communities of Massachusetts as defined by the Massachusetts CZM regions. We used average annual employment and payroll data so that covered seasonal and part-time employment is included as a part of the analysis.

In addition to the impacts based on employment and payroll, we used additional data sets to help quantify economic impacts related to spending by coastal tourists. These methods are discussed within the report and the method is explained in detail in *Appendix 4. Methodology: Supplemental Spending Analysis*.

Method Used to Quantify Non-Profit Marine Science and Technology Research Impacts Using Supplemental Data

Another challenge appeared in measuring the impact of educational institutions. We were not able to estimate the employment and payroll of this sector using SIC codes, NAICS codes, or previous research, so we were not able to use our other methodologies to adequately measure employment and payroll in this sector. We do know, from previous research, that non-profit marine science institutions in Massachusetts receive major amounts of research money each year to conduct marine science research.

We decided to develop a method with annual research expenditures as the primary input. As there is no consolidated source of data on marine science research awards by institution, the study team went directly to departments of marine science and technology[12] to collect research expenditure figures and employment information.

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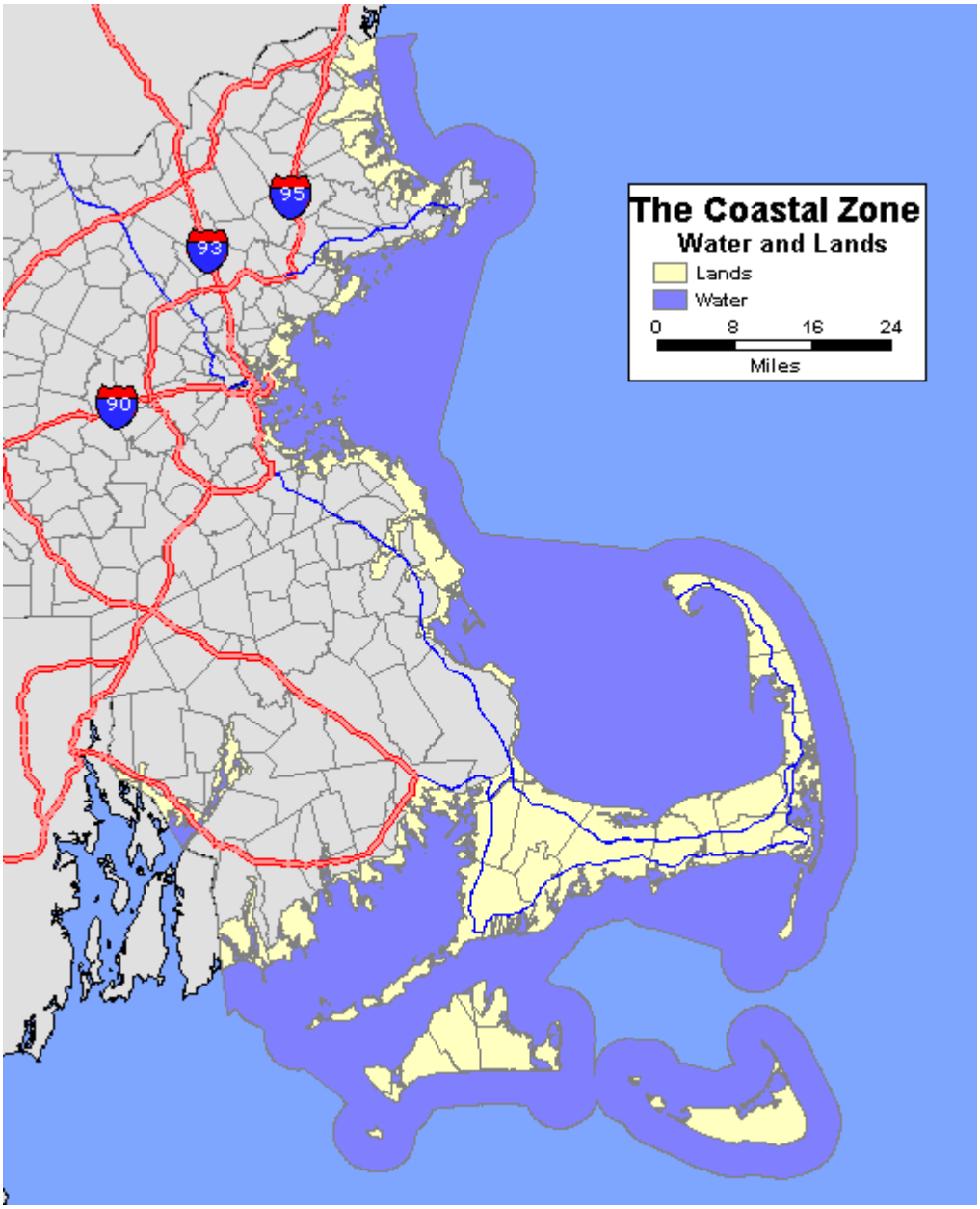
[11] For references see *Appendix 5. Key Data Sets for Measuring Massachusetts Marine Sectors*.

[12] Key MST institutions identified in *Appendix 7 – MST Educational Programs*, in *The Marine Science and Technology Industry in New England*. Clyde Barrow, Rebecca Loveland and David Terkla. UMass Donahue Institute, 2005. http://www.massbenchmarks.org/publications/studies/descriptions/marinesci05app.htm.

Part III– The Coastal Economy of Massachusetts

Figure 1—The Massachusetts Coastal Zone: Water and Lands



Source: MassGIS, *The Massachusetts Coastal Zone, April 1997*

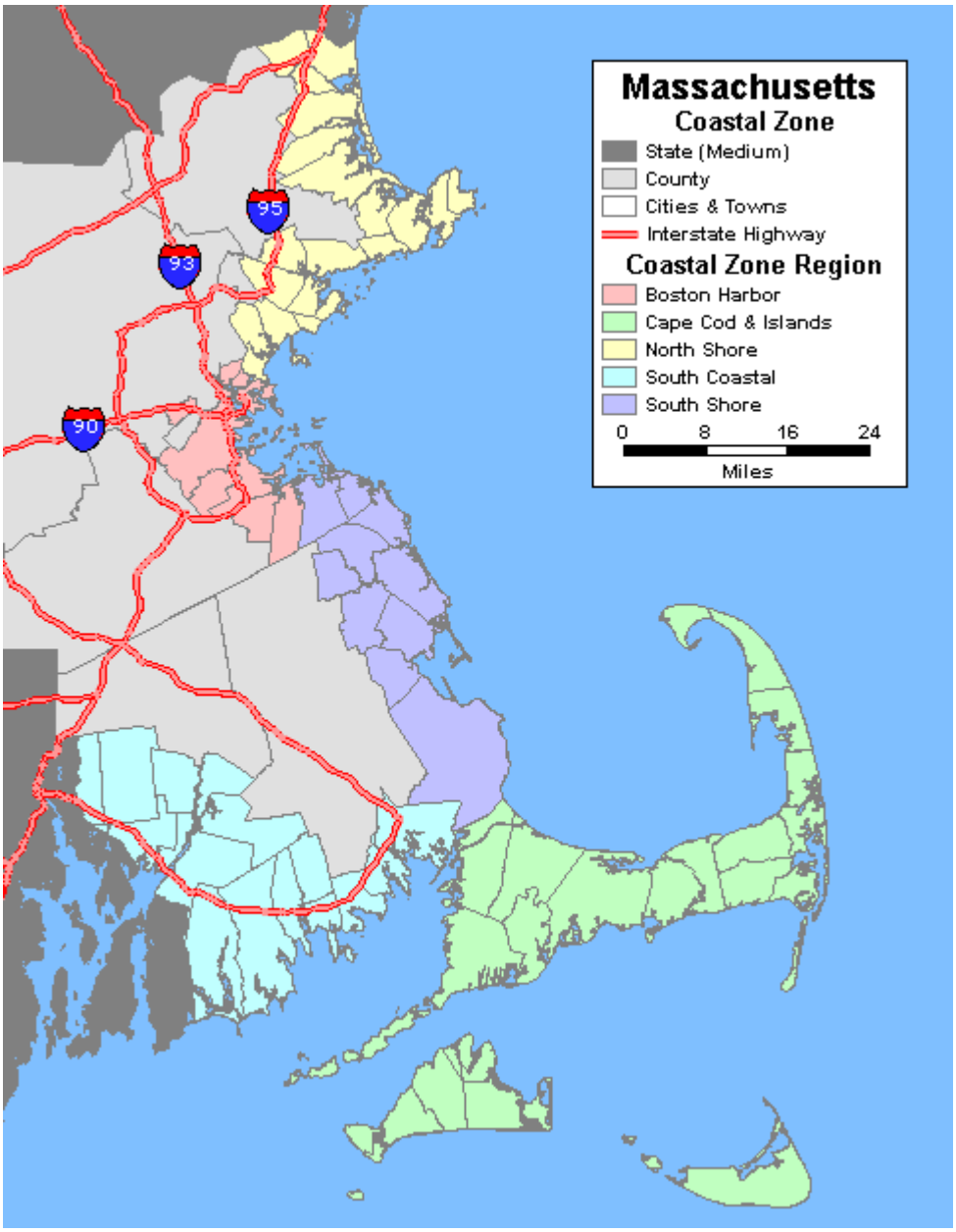
MASSACHUSETTS COASTAL ZONE AND SUBREGIONS

The coastal economy is defined as economic activity within the coastal zone of Massachusetts. The coastal zone used in the study comprises Massachusetts coastal communities as defined by the Massachusetts Office of Coastal Zone Management[13]. The communities are grouped by region in the following ways: North Shore, Boston Harbor, South Shore, Cape Cod and the Islands, and South Coastal. The five regions are defined as follows:

- North Shore**.** Amesbury, Beverly, Danvers, Essex, Gloucester, Ipswich, Lynn, Manchester, Marblehead, Nahant, Newbury, Newburyport, Peabody, Revere, Rockport, Rowley, Salem, Salisbury, Saugus, and Swampscott.
- Boston Harbor. Boston, Braintree, Chelsea, Everett, Milton, Quincy, Weymouth, and Winthrop.
- South Shore. Cohasset, Duxbury, Hanover, Hingham, Hull, Kingston, Marshfield, Norwell, Pembroke, Plymouth, and Scituate.
- Cape Cod and Islands. Aquinnah, Barnstable, Bourne, Brewster, Chatham, Chilmark, Dennis, Eastham, Edgartown, Falmouth, Gosnold, Harwich, Mashpee, Nantucket, Oak Bluffs, Orleans, Provincetown, Sandwich, Tisbury, Truro, Wellfleet, West Tisbury, and Yarmouth.
- South Coastal. Acushnet, Berkley, Dartmouth, Dighton, Fairhaven, Fall River, Freetown, Marion, Mattapoisett, New Bedford, Rehoboth, Seekonk, Somerset, Swansea, Wareham, and Westport.

[13] According the Massachusetts CZM website, "the Massachusetts coastal zone extends from the three-mile limit of the state territorial sea to 100 feet beyond the first major land transportation route encountered (a road, highway, rail line, etc.). In addition, all of Cape Cod, Martha's Vineyard, Nantucket, and Gosnold are included in the coastal zone." <http://www.mass.gov/czm/zone.htm>

Figure 2—Massachusetts Coastal Zone Cities and Towns



Source: Coastal zone regions from Massachusetts Office of Coastal Zone Management.

COASTAL ZONE EMPLOYMENT

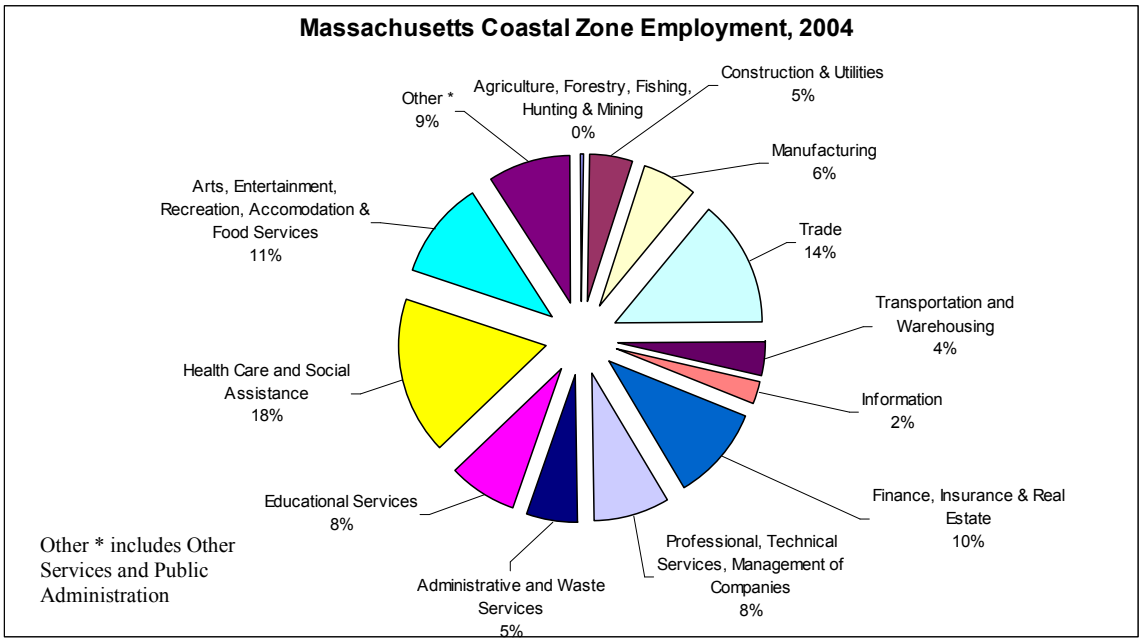
Coastal employment represents close to 37 percent of employment in the state. As in the state as a whole, Massachusetts coastal employment is significantly diversified among various industries. The top sectors on the coast, however, differ from the top sectors in the state.

Figure 3—Coastal Zone Employment and Wages, 2004

Coastal Economy, 2004, All ownerships		Employment	Wages
11-21	Agriculture, Forestry, Fishing, Hunting & Mining	3,244	$ 159,836,616.00
22-23	Construction & Utilities	54,142	$ 3,105,799,143.00
31-33	Manufacturing	71,371	$ 3,784,431,323.00
42-45	Trade	160,457	$ 5,291,938,175.00
48-49	Transportation and Warehousing	43,465	$ 2,082,300,965.00
51	Information	28,248	$ 1,775,050,746.00
52-53	Finance, Insurance & Real Estate	120,950	$ 14,012,859,640.00
54-55	Professional, Technical Services, Management of Companies	96,234	$ 7,460,549,835.00
56	Administrative and Waste Services	62,497	$ 2,160,852,469.00
61	Educational Services	89,864	$ 4,171,774,542.00
62	Health Care and Social Assistance	198,153	$ 8,967,958,115.00
71-72	Arts, Entertainment, Recreation, Accomodation & Food Services	126,098	$ 2,705,376,954.00
81-92	Other *	106,603	$ 4,520,064,080.00
	Total	1,161,326	60,198,792,603

Source: Massachusetts Division of Unemployment Assistance (Mass. DUA), ES-202, 2004

Figure 4—Massachusetts Coastal Zone Employment, 2004



Source: Mass. DUA, ES-202, 2004

The top three employment sectors in the state as a whole are Wholesale and Retail Trade (17 percent of employment), Health Care (14 percent) and Manufacturing (10 percent). On the coast, the top three employment sectors are Health Care and Social Assistance (18 percent of total coastal employment), Wholesale and Retail Trade (14 percent of employment) and Accommodation and Food Services with 11 percent of total coastal employment—a slightly higher proportion than in the state as a whole.

COASTAL ZONE SUBREGIONAL EMPLOYMENT

In terms of relative employment levels, the Boston Harbor region is the largest subregion in the coastal zone. Fifty-six percent of all coastal zone unemployment insurance-covered jobs are found in the Boston Harbor subregion, followed by the North Shore, which contains only 15 percent of coastal zone employment.

Figure 5—Massachusetts Coastal Zones: Establishments, Employment and Wages, 2004

Coastal Regions	Establishments	Employment	Wages
Boston Harbor	28,383	659,611	$41,722,286,361
Cape & Islands	11,441	106,770	$3,730,218,817
North Shore	13,877	181,068	$7,249,900,683
South Coastal	10,723	139,617	$4,641,570,648
South Shore	6,736	74,208	$2,854,816,077
Coast Total	**71,160**	**1,161,274**	**$60,198,792,586**

Source: Mass. DUA, ES-202, 2004

ECONOMIC IMPACT OF THE COASTAL ECONOMY

The coastal economy is defined as the sum total of economic activity in the coastal zone region. Therefore, its economic impact on the state economy is best expressed as its total contribution to gross state product (GSP). According to the U.S. Bureau of Economic Analysis:

> GSP is the state counterpart of the Nation's gross domestic product (GDP), the Bureau's featured and most comprehensive measure of U.S. economic activity. GSP for a state is derived as the sum of the GSP originating in all the industries in the state. Real GSP is an inflation-adjusted measure of each state's gross product that is based on national prices for the goods and services produced within that state. The estimates of real GSP and of quantity indexes with a base year of 2000 are derived by

applying national implicit price deflators to the current-dollar GSP estimates for the 81 NAICS industries for years 1997 forward and for the 63 SIC industries for years 1977-1997. Then, the chain-type index formula that is used in the national accounts is used to calculate the estimates of total real GSP and of real GSP at more aggregated industry levels. (U.S. Bureau of Economic Analysis, < http://www.bea.gov>)

The 71,160 establishments based in the coastal zone employed 1,161,274 workers with an annual payroll of over 60 billion dollars in 2004. These workers represent 37% of the Massachusetts workforce and 39% of total state payroll. If one assumes that the total coastal zone economic product is proportional to its share of total state employment, then it follows that the gross regional product[14] for the coastal zone in Massachusetts is approximately 117 billion dollars or 37 percent of Massachusetts GSP in 2004.

[14] Gross regional product is "a measure of total income in a given area. The GRP includes employee compensation, property income, and proprietary income plus indirect business taxes. The GRP is equal to total value added and is the local or regional equivalent of the national measure of economic growth, the Gross Domestic Product."www.srs.fs.usda.gov/sustain/data/authors/glossary.htm

Part IV - THE MARINE ECONOMY IN MASSACHUSETTS AND THE COASTAL ZONE

MARINE ECONOMY OVERVIEW AND MAJOR SECTORS

The marine economy comprises commercial activities related to and/or having inputs from the sea. The marine economy is categorized into specific sectors of marine activity. Our definition of the Commonwealth's marine economy draws from previous analytical work on the industry in the state including *The Massachusetts Marine Economy* (Georgianna, 2000) and *The Marine Science and Technology Industry in New England* (Barrow, Loveland, and Terkla, 2005).

Major industry sectors of the marine economy in Massachusetts are as follows:

- Commercial Seafood Industries: Commercial fishing and fishing supplies, marine aquaculture, seafood processing and wholesaling, and retail and food service seafood sales.
- Marine Transportation: Transportation of foreign and domestic freight, water passenger transportation, cargo handling, towing and tugboat services, marine pipelines and natural gas transmission.
- Coastal Tourism and Recreation: Entertainment, food and lodging, recreational fishing, and recreational boating.[15]

[15] The methodology in this report uses tourism activities within the coastal zone as a proxy for marine industry-related tourism. However, it must be noted that a significant proportion of entertainment, and food and lodging in the coastal zone is not necessarily related to the sea nor uses inputs of production from the sea.

- Marine Science and Technology: Instrumentation and equipment, marine services, for-profit research, non-profit marine research and education, marine materials and supplies, and ship and boat building.
- Marine-Related Construction and Infrastructure: Ports, coastal and offshore infrastructure, and coastal real estate development.[16]

The distribution of marine employment among sectors in Massachusetts is quite uneven. For instance, while the Coastal Tourism and Recreation sector employs 79 percent of workers in the marine economy, the Marine Transportation sector employs only 1 percent. But this is not surprising since the transportation and warehousing industry in the state is also a relatively small part of the state industrial mix, comprising only 3 percent of all Massachusetts employment.

The Coastal Tourism and Recreation sector is the largest sector of marine-related business, containing 70 percent of all marine businesses and 79 percent of marine employment in the state. At the same time, this sector pays the lowest wages, averaging $19,580 per employee annually. In contrast, the most highly paid marine sector in Massachusetts is Marine Science and Technology, which pays an average of $82,821 per employee annually. However, this is one of the smallest sectors in terms of number of establishments and employment. It contains 184 businesses, less than 2 percent of all marine businesses in the state, and about 5,000 people, which is 3 percent of all marine employment in Massachusetts.

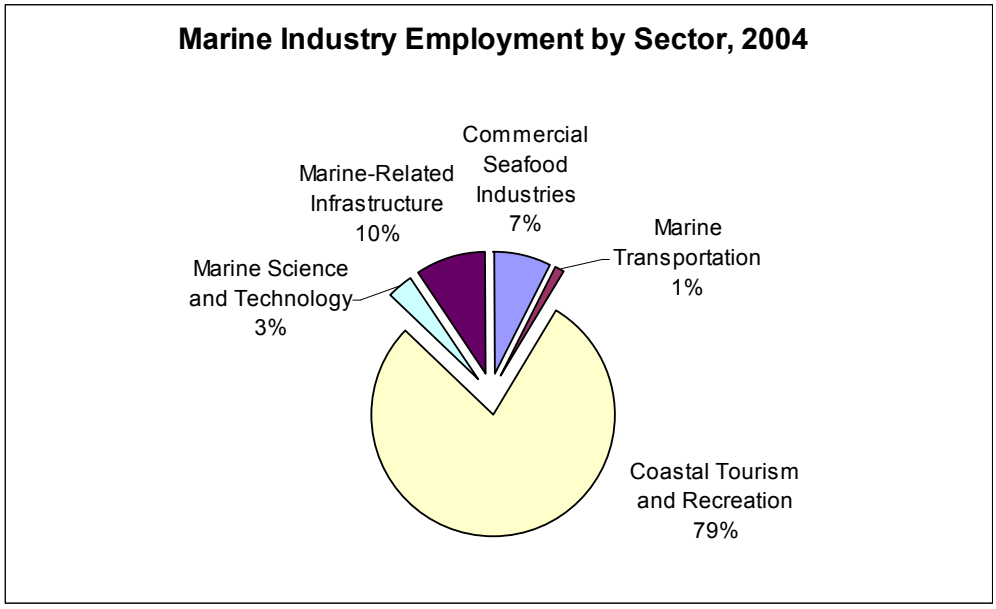
[16] The methodology in this report uses real estate-related activities within the coastal zone as a proxy for coastal real estate development. However, it must be noted that a proportion of real estate activity in the coastal zone is not necessarily related to proximity to the sea.

Figure 6—Marine Industry by Sector, Massachusetts 2004

Sectors	Businesses	Jobs	Wages	Wages per employee
Commercial Seafood Industries	1,110	11,270	$509,727,058	$45,227
Marine Transportation	171	2,099	$92,835,244	$44,230
Coastal Tourism and Recreation	7,640	119,420	$2,338,200,556	$19,580
Marine Science and Technology	184	5,055	$418,699,680	$82,821
Marine-Related Construction and Infrastructure	1,851	14,596	$948,937,697	$65,013
Total Marine Industry	**10,955**	**152,440**	**$4,308,400,235**	**$28,263**

Source: Mass. DUA, ES-202, 2004; U.S. Bureau of the Census, Nonemployer Series, 2003; Mass. Division of Marine Fisheries.

Figure 7—Marine Industry Employment by Sector, 2004



Source: Mass. DUA, ES-202, 2004; U.S. Bureau of the Census, Nonemployer Series, 2003; Mass. Division of Marine Fisheries.

ECONOMIC IMPACT OF THE MARINE ECONOMY IN MASSACHUSETTS

Economic impacts of the marine economy across Massachusetts were measured through an economic impact program allowing us to model and predict how business activity affects economic relationships throughout the region. For the analysis used in this study, the model examines the relationship between employment, paid wages and business expenditures, to estimate total impacts on the regional economy.

Three different types of impact estimates are generated by the economic impact model: direct, indirect, and induced. A *direct* impact is the impact of what remains in the local economy and does not "leak" outside of the region. The *indirect* impact is the subsequent number of employees generated by direct employment within the region. For example, 10,000 jobs in the fishing industry (a direct impact) would lead to spending of salaries on goods and services in other industries within the economy, thus creating new employment. *Induced* impact measures economic effects of employment created in regional industries due to the additional employees indirectly generated in the region.

Using this model, we can see that a job in a particular region has impacts with three particular consequences, a job in a marine industry sector has a direct impact on the region, the position creates jobs in industries related to the sector, and other secondary economic relationships in the region create additional employment. Conceptually, impacts of a job that remains in the region "flow" through the economy and have a multiplicative effect on the economy.

Employment Impact

The table below presents the employment impacts of Massachusetts marine industry employment in Massachusetts. Marine economy employment has a moderate impact on job creation. Its multiplier effect is 1.47, which means that the Massachusetts marine economy generates 0.47 jobs for every one job in the region. The highest multiplier effects are generated by the Marine Transportation and Marine Science and Technology sectors. Every job created in the Marine Transportation sector creates 1.83 new jobs and every job created in the Marine Science and Technology sector generates an additional 1.27 jobs.

Figure 8—Employment Impact of Marine Industry, Massachusetts, 2004

	Input*	Output**				
Marine Sectors	**Employment**	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Commercial Seafood Industries	11,270	11,270	5,025	6,159	22,454	1.99
Marine Transportation	2,099	2,099	2,125	1,708	5,932	2.83
Coastal Tourism and Recreation	119,420	119,420	15,536	22,475	157,431	1.32
Marine Science and Technology	5,055	5,055	2,348	4,078	11,481	2.27
Marine-Related Construction and Infrastructure	14,596	14,596	5,038	6,903	26,537	1.82
Total Marine Industry	**152,441**	**152,441**	**30,072**	**41,324**	**223,836**	**1.47**

Source: Mass. DUA, ES-202, 2004; U.S. Bureau of the Census, Nonemployer Series, 2003; Mass. Division of Marine Fisheries. IMPLAN analysis by the authors.
* Input: for details see Methodology
** Direct measures the employment in the marine industry in Massachusetts. Indirect measures the amount of additional employment generated by existing marine industry employment in the region. Induced measures the employment created in Massachusetts industries due to additional employees indirectly generated in the state by the marine workforce.

Economic Output Impact

Economic relationships between industries impact the amount of money generated within the local economy. Figure 9 below shows the economic output generated by the Massachusetts marine industry.

Output impacts are defined as the dollar amount of the value of an industry's total production. Data assumptions for the model were derived from a number of sources including the Economic Censuses from the U.S. Bureau of the Census, U.S. Bureau of Economic Analysis output estimates, and U.S. Bureau of Labor Statistics employment projections. Figure 9 shows output impacts for all five sectors of the Massachusetts marine economy. For example, we see that employment in the commercial seafood industry directly adds over $916 million to the local economy. This money is spent in industries directly tied to the commercial seafood industry (such as equipment manufacturers supplying the industry) which creates an additional $329 million in revenues. Additional secondary relationships generated by this sector –induced changes resulting from all other economic interactions of institutions - create an additional impact

of $307 million. In total, for every dollar spent in the commercial seafood industry, 0.70 dollars are further generated within the economy. In Figure 9, we see that the sectors returning the most value for every dollar spent are the Marine Science and Technology sector (generating $0.96 for every dollar spent), and Marine Transportation (generating $0.82 for every dollar spent), as denoted by the multipliers 1.96 and 1.82.

Figure 9—Output Impact of Marine Industry, Massachusetts, 2004

Marine Sector	Input*	Output ($)**				
	Employment	Direct	Indirect	Induced	Total	Multi plier
Commercial Seafood Industries	11,270	916,823,281	329,842,336	307,891,314	1,554,556,931	1.70
Marine Transportation	2,099	289,755,957	134,830,261	104,036,340	528,622,558	1.82
Coastal Tourism and Recreation	119,420	5,069,549,937	1,705,687,021	1,943,492,974	8,718,729,932	1.72
Marine Science and Technology	5,055	589,664,057	257,942,625	309,937,261	1,157,543,943	1.96
Marine-Related Construction and Infrastructure	14,596	1,823,174,648	457,212,492	563,115,087	2,843,502,227	1.56
Total Marine Industry	**152,441**	**8,688,967,880**	**2,885,514,735**	**3,228,472,976**	**14,802,955,591**	**1.70**

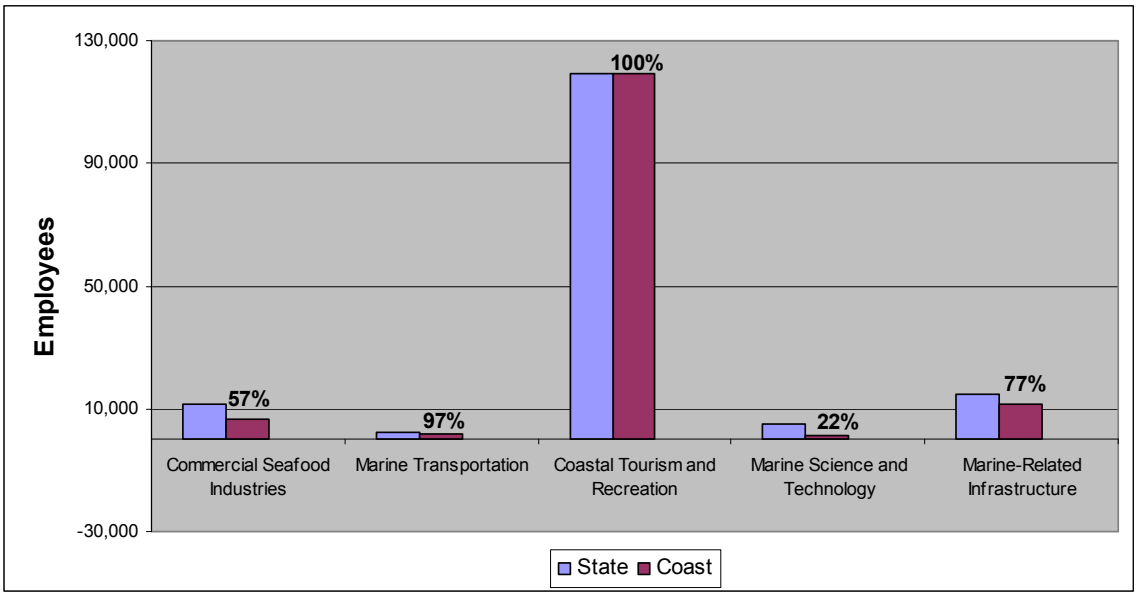
Source: Mass. DUA, ES-202, 2004; U.S. Bureau of the Census, Nonemployer Series, 2003; Mass. Division of Marine Fisheries. IMPLAN analysis by the authors.
** Direct measures the economic effects of the employment of marine industry in Massachusetts. Indirect measures the economic effects of additional employment generated by existing marine industry employment in the region. Induced measures the economic effects on Massachusetts industries that are supported by the indirectly created employees.

MARINE ECONOMY WITHIN THE COASTAL ZONE

The marine economy as a whole includes all economic activity in Massachusetts related to the sea, while the marine economy in the coastal zone represents this same economic activity contained within the geographic communities bordering the sea. Figure 10 shows the percentage of coastal zone marine economy employment as a percentage of overall marine employment in the state. All people employed in the

Coastal Tourism and Recreation sector and almost all people employed in the Marine Transportation sector are employed in the coastal region. However, only slightly more than 20 percent of the people employed by the Marine Science and Technology sector are employed in the coastal region.

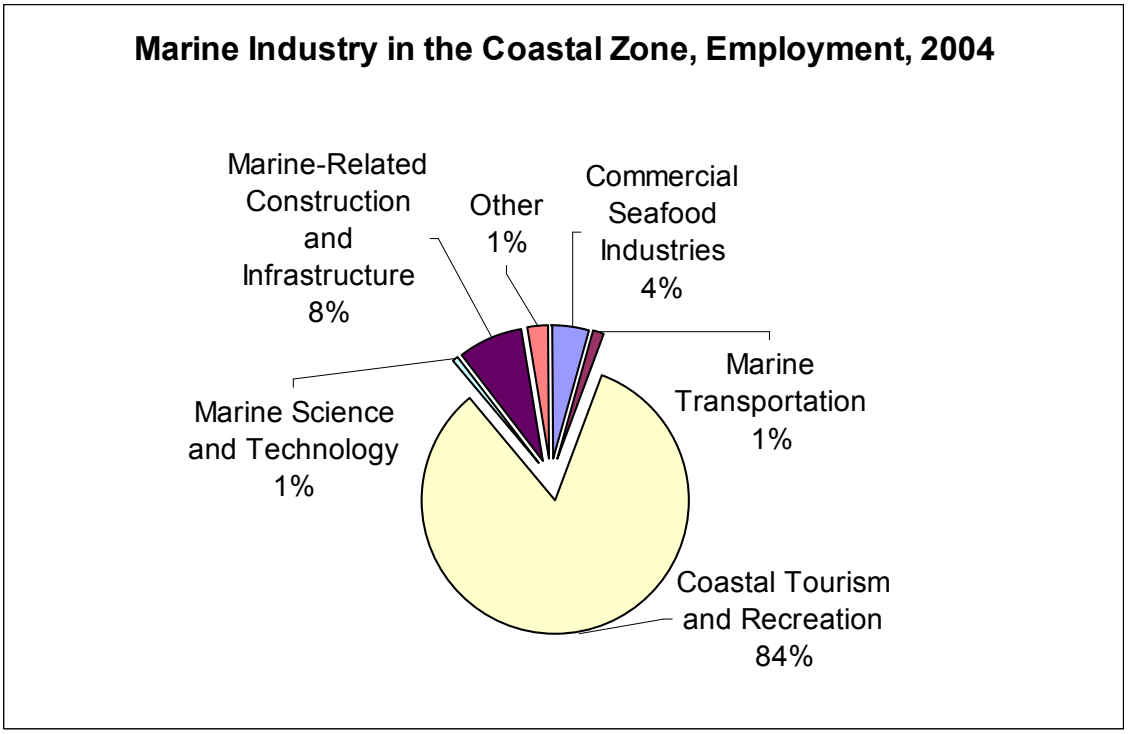
Figure 10—Coastal Zone Marine Employment as a Percentage of Marine Industry in the State, 2004



Source: Mass. DUA, ES-202, 2004

The employment mix in the marine industry along the coast is similar to that in the state as a whole. The highest concentration of employment is in the Tourism sector (84 percent), while the remaining 16 percent is split among the other sectors. Among those, the largest employers are the Marine-Related Construction and Infrastructure and Commercial Seafood sectors. Not surprisingly, marine-related infrastructure employment is concentrated mostly in the coastal zone. This sector represents the second largest sector after Tourism in terms of the number of establishments and employment. Marine-Related Construction and Infrastructure comprises 18 percent of marine economy businesses and 8 percent of marine economy employment in the Coastal region.

Figure 11—Marine Industry in the Coastal Zone, Employment, 2004



Source: Mass. DUA, ES-202, 2004

As in the Massachusetts marine economy as a whole, the lowest wages paid are in the Coastal Tourism sector, $19,580 per employee annually. One difference in the coastal zone is that the highest wages are paid by the Marine-Related Construction and Infrastructure sector rather than the Marine Science and Technology sector. Because so much of the Marine Science and Technology industry is located outside the coastal zone, the average wage of the industry located in the zone is lower than what might be expected.

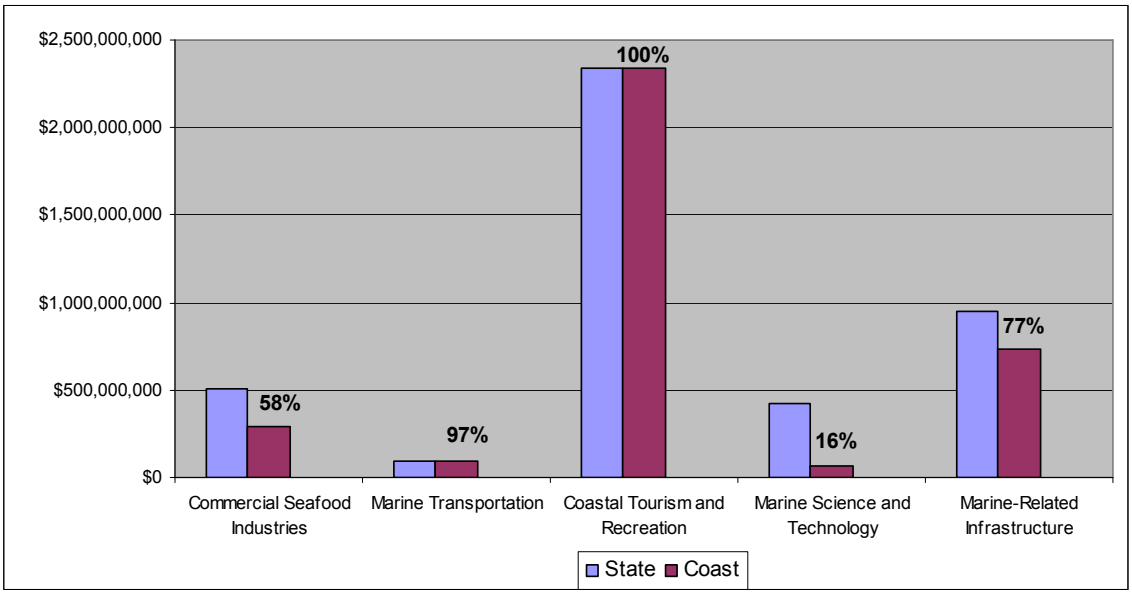
Figure 12—Marine Industry in the Coastal Zone, 2004

Sectors	Businesses	Jobs	Wages	Wages per employee
Commercial Seafood Industries	979	6,594	$296,954,695	$45,031
Marine Transportation	148	2,045	$90,302,416	$44,156
Coastal Tourism and Recreation	7,640	119,420	$2,338,200,556	$19,580
Marine Science and Technology	66	1,120	$65,062,330	$58,067
Marine-Related Infrastructure	1,809	11,246	$731,287,167	$65,029
Total Marine Industry, Coast	**10,642**	**140,426**	**3,521,807,164**	**$25,080**
Other Coast (see methodology):	63	3,396	$200,833,993	$59,138.40

Source: Mass. DUA, ES-202, 2004

Figure 13 compares wages earned in the coastal region as a percentage of the total wages earned in the marine industry. Overall, the total earnings in the regions match well with the employment in the coastal region, except for those in the Marine Science and Technology sector.

Figure 13—Coastal Zone Wages as a Percentage of Marine Industry Wages Statewide, 2004



Source: DUA, ES-202, 2004

Part V – Marine Economy Sectors

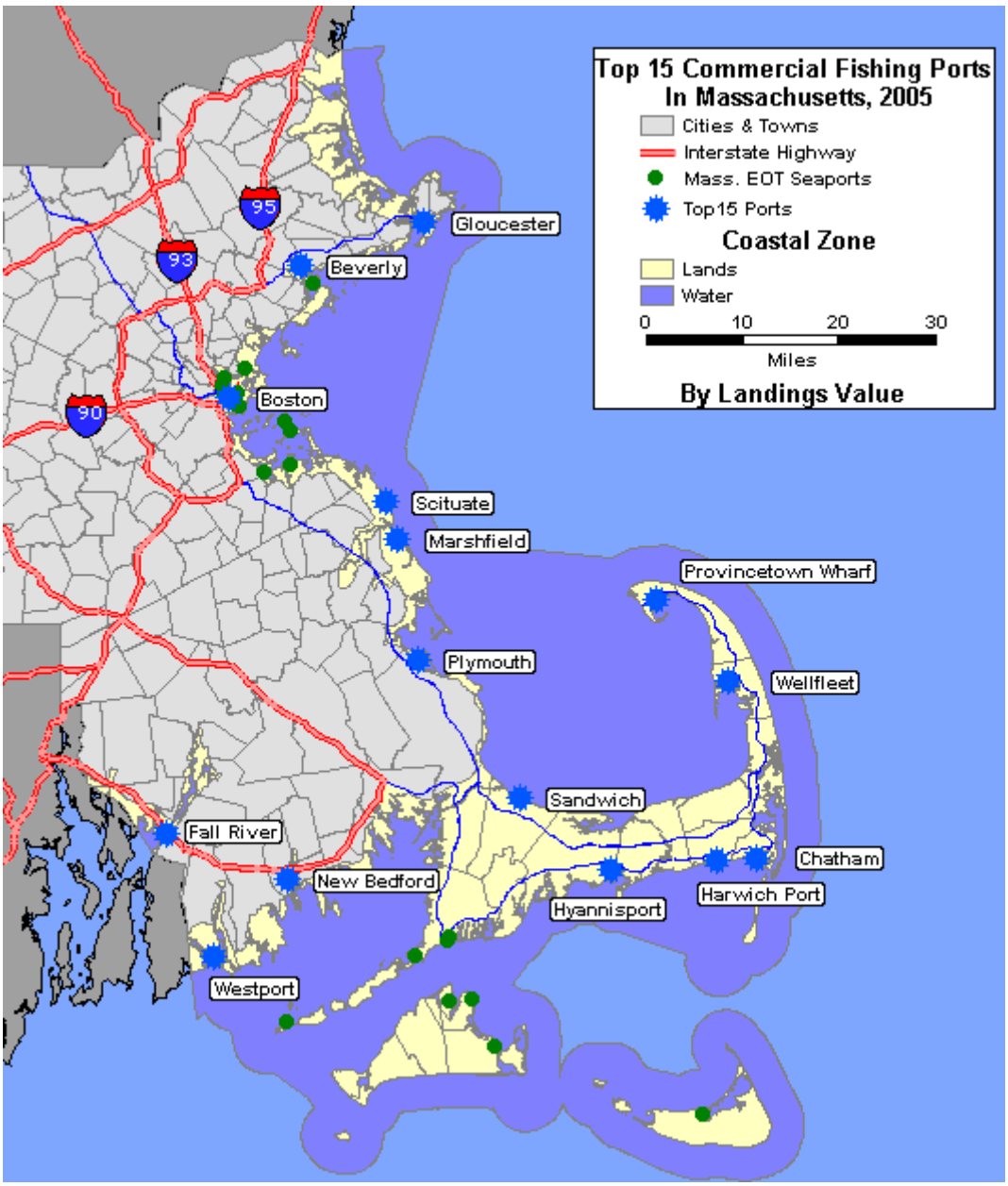
COMMERCIAL SEAFOOD INDUSTRIES IN MASSACHUSETTS

Background

Since 1614, when Captain John Smith sailed down the coast of Massachusetts to Cape Cod, catching and salting codfish that he later sold in England for a small fortune, the Commercial Seafood Industry has played an important role in the economy of the Commonwealth. In the 18th and 19th centuries, Gloucester led the state in landings[17] with its long-distance fleet of 400 schooners that long-lined codfish to salt on board during two- to three-month trips to the Grand Banks off Newfoundland. While fresh fish—haddock, cod, mackerel, herring, and flounders from Georges Bank—had long been a staple for cities and towns along the coast, only in the 20th century did fresh fish from Georges Bank replace salted cod from the Grand Banks as Massachusetts' major commercial product. Boston, with the completion of the Fish Pier in 1914, surpassed Gloucester as the major fishing port in the state. Following World War II, New Bedford used federal funding to improve the harbor infrastructure, including a dike to protect the harbor, dredging to allow large fishing vessels to tie up and off-load at several points in the harbor, and a highway to connect processing plants to the interstate highway. During the 1960s and 1970s, New Bedford grew into the state's major port in terms of the value of landings with the development of its flounder and scallop industries.

[17] Landings are the part of the fish catch that is put ashore. "The distinction between catch and landings is important when considerable quantities of fish are discarded at sea." <http://www.nefsc.noaa.gov/techniques/tech_terms.html>

Figure 14—Massachusetts Commercial Fishing Ports



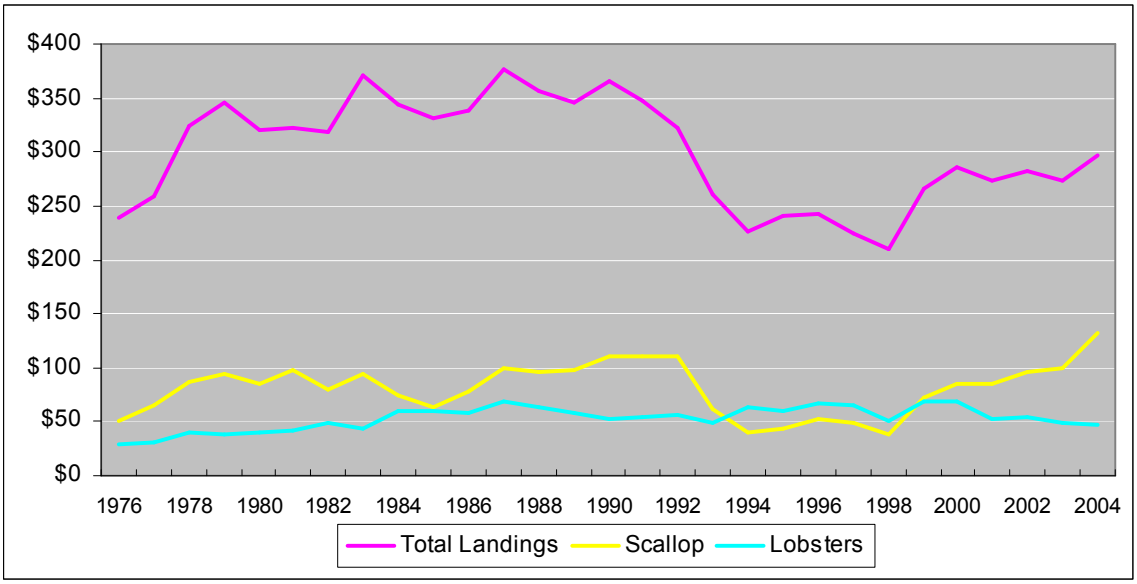
Source: Massachusetts Division of Marine Fisheries.

After the passage of the Fishery Conservation and Management Act that extended U.S. waters to 200 miles off shore in 1976, the real value of landings in Massachusetts (adjusted for inflation using the Producer Price Index in 2000 dollars) climbed from $239 million to the peak value of Massachusetts landings of $377 million in 1987 (see Figure

15—Value of Massachusetts Landings). From 1987 through 1990, the real value of landings remained relatively constant at or near its peak, and then dropped sharply until it reached its low of $210 million in 1998. Since then, the real value of Massachusetts landings has climbed steadily to $296 million in 2004.

Shellfish, specifically sea scallops, mostly landed in New Bedford, and lobsters, landed along the state's coastline, produced the most landed value between 1976 and 2004 with scallops usually in the lead. The value of lobsters landed in the state actually surpassed scallops in the mid to late 1990s when scallop landings were at their lowest point, but scallop landings have surged over the past five years, from landings of $37 million in 1998 to $133 million in 2004 in 2000 dollars, while lobster landings and value have remained roughly constant at $50 million per year over the same period. The value of the commercial catch in New Bedford and in the state varies mostly with the landing of scallops.

Figure 15—Value of Massachusetts Landings
Based on the Producer Price Index Using 2000 as a Base Year



Source: National Marine Fisheries Service (NMFS)

With the sharp increase in scallop landings, New Bedford (the leading port in the U.S. in terms of value) prospered while the other ports in Massachusetts declined. New Bedford landed about 40 percent of the state's value in 1976 and 63 percent in 2004. As recently as 1995, New Bedford landed less than 40 percent of the state's total.

In 2004, scallops and lobsters recorded over one half of the total value of commercial landings in the Commonwealth. Scallops landings led the field in value at $146 million (current dollars) with lobster landings at $52 million. Cod, the main commercial species from Colonial times to the beginning of the 20 century, trailed far behind at $16 million. This historic change is due to the abundance of scallops and lobsters relative to cod, the increase in the price of scallops relative to cod, and the fishing regulations that restricted access to cod in an attempt to rebuild cod stocks. Space in this publication limits the explanation of fishery regulations in federal and state waters, but suffice it to say that the management of scallops stocks has been far more successful than the management of cod and other fish stocks.[18]

These values may be underestimated because they leave out a significant amount of commercial fish and shellfish landed in state waters. There is no one consolidated database of finfish and shellfisheries statistics that combines landings from state and federal waters. Many different government agencies record and maintain finfish and shellfish data. For example, shellfish permits are issued at the local level with primary data collected at the local level, if at all. Commercial fishing permit data is managed at the state level by the Massachusetts Division of Marine Fisheries (DMF), but the

[18] Additional information on fishery management is available at: New England Fishery Management Council: http://www.nefmc.org/. and the Atlantic States Marine Fisheries Commission: http://www.asmfc.org/.

complexities of the permitting process make activities difficult to differentiate between local and state landings. Landings data in federal waters is collected and maintained by the National Marine Fisheries Service (NMFS). Data comparisons across states are also difficult due to lack of funding for data collection and inconsistencies due to varied reporting regulations and measurement methodologies. Using preliminary data from the DMF's 2005 dealer reporting program, the DMF believes that NMFS underestimates the value of commercial landings by thirty to forty percent because NMFS focuses on landings of species from offshore or federal waters[19]

Wholesale and retail value of commercial fishery products is much more difficult to track than landings because sales at the wholesale and retail levels are not recorded by either NMFS or DMF. Almost all the fish landed in Massachusetts is probably processed here, and processors buy unprocessed and semi-processed fish from other New England states, from the Southeast, the West Coast of the U. S., and from Canada and other countries. These inputs are further processed and sold into wholesale and retail markets.[20]

NMFS reports employment for processing plants and wholesale plants by state in their annual publication, *Fisheries of the United States*. For the first few years after the 200-mile limit was established, processing employment increased, then started a continual decline, and finally recovered somewhat in recent years, which tracks similar to the pattern of landings (see Figure 16—Fish Processing and Wholesaling Employment).

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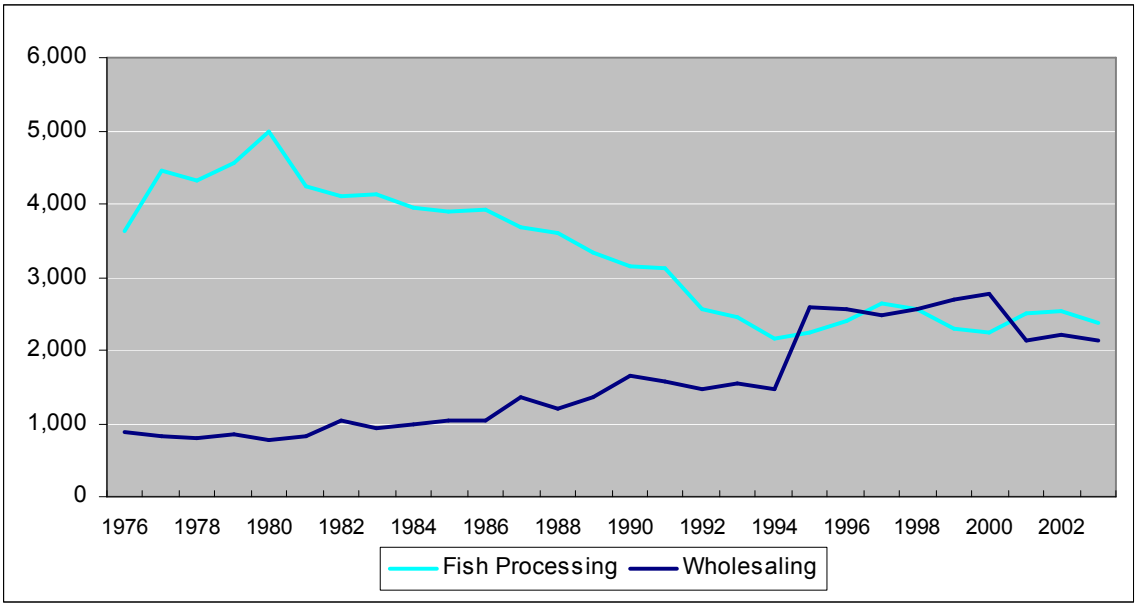
[19] Personal communication with Management Information Systems & Fisheries Statistics project staff at Mass. Division of Marine Fisheries, Spring 2006.

[20] Georgianna, D. and J. Dirlam, *The Effect of Reduced Supply on Fish Processing in New England*, presented at International Institute of Fishery Economics and Trade Biennial Conference, Corvallis, OR, 2000, p 3.

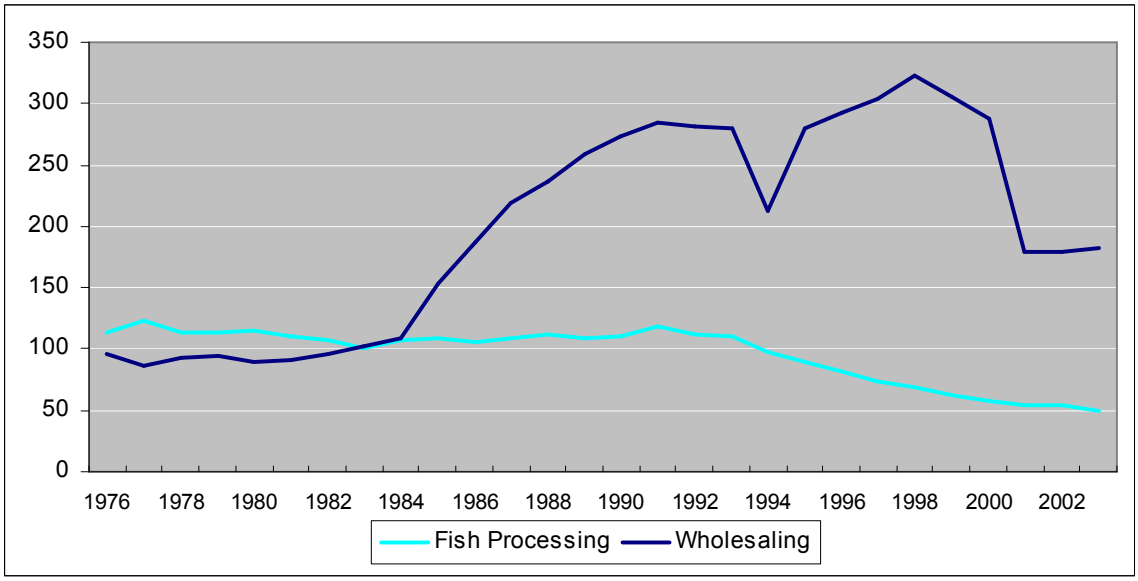
Figure 16—Fish Processing and Wholesaling Employment



Source: National Marine Fisheries Service, *Fisheries of the United States*

Wholesale employment, on the other hand, more than tripled from 868 in 1976 to 2,778 in 2000, when it began to drift back down. The number of fish processing plants dropped steadily from 144 in 1976 to 50 in 2003, and wholesaling businesses doubled from 96 to 182 over the same period. (See Figure 17—Fish Processing and Wholesaling, Numbers of Manufacturing Plants).

Figure 17—Fish Processing and Wholesaling, Numbers of Manufacturing Plants



Source: National Marine Fisheries Service, *Fisheries of the United States*

This follows the pattern of fish processors switching to wholesaling fish products when local landings were not sufficient to supply their customers. These firms, often in their third or fourth generation of family ownership, maintained their customer list by either importing from other countries or bringing in product from other U.S. ports.[21]

The commercial fishing industry depends upon many shore-side businesses. The vessels in the Massachusetts' fleet require fuel, ice, bait, food for the crew, water, and other operating supplies. Their owners also buy insurance, other financial services, gear, and pay for boat repair and other overhead costs. Each of these expenses is paid to shore-side businesses, usually either from the local or from nearby ports. Processing plants also buy operating supplies and pay overhead expenses. These expenditures and the employment and income that they generate are considered as indirect effects because they constitute purchases by the primary businesses within the marine economy.

[21] Georgianna, D. and J. Dirlam. *The Effect of Reduced Supply on Fish Processing in New England*, p 5.

The Commercial Seafood industry also includes aquaculture, a sector that goes back almost as far back in time as fishing. Planting and harvesting oysters, clams, quahogs began in the 19th century or earlier in Massachusetts. Cultivated scallops and mussels are more recent additions to the state's supply of seafood. Raising finfish such as tilapia, flounders, and sea bass are even more recent. Aquaculture is quite small relative to commercial fishing in the state and faces significant challenges that hinder its success. Some of these specific challenges include waste and discharge issues, limited available space, variation in New England weather, water quality issues relating to placement of facilities and facility operations, and competition with wild harvesters.[22]

Recreational fishing is not part of the commercial fishing industry because the catch is not sold into the seafood market. This subsector is discussed in the analysis of Coastal Tourism and Recreation. Some indirect effects from recreational fishing, however, accrue to the same businesses that supply products and services to the commercial fishing industries.

Employment and Income

As shown in Figure 18—Sector Establishments, Employment and Wages by NAICS, employment in Commercial Seafood Industries in 2004 was 11,270[23], who were paid a total of $509,727,058 or an average of $45,229 per full-time employee. Less than half of this employment was in fishing (5,286), but slightly more than half of income went to these employees ($276,336,890). There was considerable variation in income,

[22] For more information on these issues please see the following sources: Massachusetts Aquaculture White Paper:< http://www.mass.gov/czm/wpmaraqu.htm>; Aquaculture—UMass Extension <http://www.umass.edu/aquaculture/resources/index.htm>.
[23] Employment includes covered employment and individual proprietors.

with commercial fishermen, especially scallopers, paid higher than the average for this industry, and with significantly lower wages prevailing in the retail and aquaculture sectors. Most of those in commercial fishing were self-employed, which reflects the large number of small firms, often a single family-owned vessel with one or two crewmen.

Figure 18—Sector Establishments, Employment and Wages by NAICS, Massachusetts 2004

Commercial Seafood Industries by NAICS, 2004				
2002 NAICS	Description	Establ	Empl	Wages
	Total Marine in Massachusetts	10,955	152,441	$4,308,400,235
Commercial Seafood Industries		**1,110**	**11,270**	**$509,727,058**
Sub-sector 1 - Fishing Supplies and Services		**267**	**267**	**$3,691,183**
11251	Animal Aquaculture	267	267	$3,691,183
Sub-sector 2 - Commercial Fishing		**421**	**5,286**	**$276,336,890**
1141	Commercial Fishing (Nonemployer Series, 2003)	n/a	3,586	$170,721,000
114111	Finfish Fishing	248	897	$41,381,249
114112	Shellfish Fishing	170	803	$64,212,641
114119	Other Marine Fishing	3	n/a	$22,000
Sub-sector 3 - Seafood Processing and Wholesaling (3117)		**237**	**4,552**	**$196,497,901**
3117	Seafood Processing and Wholesaling (Nonemployer Series, 2003)	n/a	23	$676,000
311711	Seafood Canning	7	118	$4,376,717
311712	Fresh and Frozen Seafood Processing	51	2,311	$91,240,549
424460	Fish and Seafood Merchant Wholesalers	179	2,100	$100,204,635
Sub-sector 4 - Retail and Food Service Seafood Sales		**185**	**1,165**	**$33,201,085**
445220	Fish and Seafood Markets	154	916	$24,141,879
454390	Other Direct Selling Establishments (part)	31	249	$9,059,206

Source: DUA, ES-202, 2004; U.S. Bureau of the Census, Nonemployer Series, 2003; Mass. Division of Fisheries
Note: See *Part II Methodology: Impact Analysis* for information on the data used for this table.

Fishermen are paid a share of the catch according to a schedule of payments that varies by fishery, port, and vessel. Called the lay system; it usually divides the value of the catch roughly equally between the crew (including the skipper) and the vessel owner. Total income to fishermen, however, is more than half the value of the catch because skippers are also paid from the owners' share. Payments for operating costs and overhead are paid from either the crew's share or the owners' share. In other cases, depending on the fishery, boat expenses are covered before the crew is paid. Also, sometimes the owner and the skipper are the same person.

NMFS reports that the value of the catch for Massachusetts in 2004 was $326,067,000, which indicates income less than reported wages paid to covered employees by Massachusetts DUA. As stated above, we believe that NMFS data

underestimates landings for the state because it does not include the catch in state waters. (See *Next Steps* section for discussion.)

An independent estimation of employment and income in New Bedford for 2002 shows employment and income that is roughly consistent with these data.[24] This study, which compares employment and income in 1993 and in 2002, shows a declining trend in employment in both the groundfish and scallop fisheries and increases in income in both fisheries, especially for scallopers. This study concludes that these trends were caused by management regulations aimed at making fishing more efficient.

Employment in seafood processing and wholesaling (4,552) was roughly split between these two activities. As stated above, the current trend shows declining employment in both these sectors. Both employment and average income are less for the retail sector than for the processing and wholesale sector. Retailing in fishery products probably requires less skill than processing and wholesaling, as with most other products.

Aquaculture is the smallest sector in the Commercial Seafood Industries with employment of 267, who were paid an average of $13,825 per person. Aquaculture has never reached its full potential, especially compared to farming on land, which supplanted hunting over 10,000 years ago. There are several reasons for this. Farmers control their environment; they plant, water, fertilize, weed, and take steps to reduce diseases and predators. These improvements in production are very difficult to replicate at sea. For example, millions of hatchlings of cod and haddock were dispersed into the sea during the 19th century until scientists discovered that virtually all of these hatchlings were quickly eaten by predators. Farmers also have clear property rights to the land used

[24] Georgianna, Daniel and Debra Shrader. *Employment, Income and Working Conditions in New Bedford's Offshore Fisheries*. Saltonstall-Kennedy NA03-NMF-4270265, NMFS/NOAA, U.S. Department of Commerce, 2005.

for their farms, which aquaculturists do not. Even in estuaries or other near-shore waters, clear title to submerged lands, or the seafloor, is rarely possible. Courts have generally ruled that ownership of waters and the resources in them are public trusts rather than private property.[25] In Massachusetts, towns control their estuaries and submerged lands, but leasing is subject to local politics, which is difficult terrain for small, under-funded businesses. Finally, farming reduced costs significantly through economies of scale. Currently, marketing and feed costs are prohibitive for many aquaculture species and products because the industry has not reached sufficient size.[26]

Only a few NAICS codes measure direct employment and income in the Commercial Seafood Industry. Indirect or shore-side businesses are far more complicated and generally form only a small share of several different NAICS codes. We estimated the employment for this sector from our IMPLAN model as indirect employment of 5,025, mostly reflecting spending on operating supplies such as fuel, ice, and food for the crew, and overhead services such as finance and insurance. Induced employment of 6,159 reflects spending by these industries. The multiplier for Commercial Fishing of 1.99 is higher than the multiplier for tourism but lower than those for Marine Transportation and Marine Science and Technology probably because commercial fishing is less labor-intensive than tourism but more labor-intensive than the other two sectors.

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[25] McCay, Bonnie., *Oyster Wars and the Public Trust: Property, Law, and Ecology in New Jersey History*. University of Arizona Press, 1998.

[26] Georgianna, D. *Feasibility Study for Raising Tilapia in Recirculating Tanks in Massachusetts*, Prepared for Massachusetts Department of Food and Agriculture, 1998.

Economic Output

In 2004, the Commercial Seafood Industry produced almost $1 billion in fresh, frozen, and canned seafood products. Almost all of the locally landed seafood went into fresh products, such as lobsters, scallops, other shellfish, and fresh fillets, because fresh products add the most value. Fresh products are also produced from semi-processed inputs from other states and countries, mainly because local landings are no longer sufficient to supply the market. Almost all inputs for frozen and canned products produced in Massachusetts are shipped into the state.[27]

Figure 20—Economic Impacts of the Sector, 2004

Commercial Seafood Industries Impacts						
Employment Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Commercial Seafood Industries	11,270	11,270	5,025	6,159	22,454	1.99
Total Marine Industry	**152,441**	**152,441**	**30,072**	**41,324**	**223,836**	**1.47**
Output Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Commercial Seafood Industries	11,270	916,823,281	329,842,336	307,891,314	1,554,556,901	1.70
Total Marine Industry	**152,441**	**8,688,967,880**	**2,885,514,735**	**3,228,472,976**	**14,802,955,591**	**1.70**

Source: DUA, ES-202, 2004; U.S. Bureau of the Census, Nonemployer series;
Mass. Division of Fisheries, Shellfish Sanitation Management Project.

Seafood processors and wholesalers sell most of their fresh products to restaurants, food services, and supermarkets, in that order. They sell most of their frozen and canned seafood to supermarkets and fast food restaurants, and food services.[28]

These sales generated indirect purchases of $329,842,336 and induced purchases of $307,891,314.

[27] Georgianna, D. and J. Dirlam, *The Effect of Reduced Supply on Fish Processing in New England*, p 4.
[28] H.M. Johnson & Associates, *2005 Annual Report on the United States Seafood Industry*, p 93-99.

Prospects for the Future

In general, the outlook for the Massachusetts seafood production is good. Since 1980, per capita consumption of commercial fish and shellfish in the U.S. has grown slowly but steadily from 12.5 to 16.6 pounds per year, with most of the growth in fresh and frozen products, the major products of the Massachusetts Commercial Seafood Industry. The value of fishing landings in Massachusetts, aside from sea scallops, has remained relatively flat for the past 10 years, following the sharp declines from their peaks in the 1980s. For the U.S. in general, retail seafood prices have increased far less than retail prices for all foods, beef, pork and poultry over the past 10 years. These relative decreases in retail prices will eventually percolate back to suppliers reducing employment and income.[29]

Trouble is brewing for the industry in the Federal management of fishing stocks that is trying to balance environmental concerns with employment and income. Amendment 13 to the Multispecies Management Plan that went into effect in 2004 calls for cutbacks in Days at Sea from 88 days at sea per year in 2004 to 47 days a year in 2006 for most of New England's groundfish industry, which will further curtail groundfish landings in Massachusetts. The rising catch and value of scallop landings, however, may offset this loss, at least for the next few years. Scallops, lobsters, and other high valued products are the main hope for the Massachusetts commercial seafood industry.

Massachusetts processors and wholesalers continue to buy all that they can at the docks and bring in products from around the world to fill their customers' orders.

[29] H.M. Johnson & Associates, *2005 Annual Report on the United States Seafood Industry*, p 86-87.

Employment in both fishing and processing, however, has fallen and will probably continue to fall due to increasing efficiency and the lower value added from semi-processed inputs that are brought in from other areas.

Shore side industries in Massachusetts, especially in New Bedford, will almost certainly continue to grow, not only to service the currently successful scallop fleet but also the growing pleasure boat sector. The spillovers from commercial fishing to recreational boating show the agglomerations of scale between fishing and recreation (included in tourism) that result from a healthy commercial fishing industry.

Increasing the value-added to fishery products through branding and product improvements has proved elusive to the Massachusetts Commercial Seafood Industry. Most Massachusetts fishery products are still sold as homogeneous commodities without the kind of brand name that would increase their value. The marketing campaign for Maine lobster has proven far more successful in increasing its value than other New England and specifically Massachusetts products. Examples of successful marketing of Massachusetts products include the Ipswitch clam and the Wellfleet oyster.

Next Steps for Further Study

Much of the primary data collected on the Massachusetts Commercial Seafood Industry probably underestimates its true value. Part-time employment in the commercial fishing industry, especially in harvesting shellfish, is substantial and usually not included in any measure of the industry. In Massachusetts, cities and towns require permits for commercial shell fishing and employ full-time and part-time staff to enforce state and local shellfish regulations, but estimating their catch and income is not easy.

In 2005, the Fisheries Statistics Program of the Massachusetts Division of Marine Fisheries (DMF) began requiring all primary buyers in Massachusetts to report their purchases of any marine species (including those intended for bait purposes) from fishermen. This data set will be extremely beneficial in supplementing fishery employment data, providing more accurate state landings data, and allowing for a more accurate determination of full-time and part-time employment in the industry. The DMF believes that NMFS estimates of the value of commercial landings probably underestimates the actual value of landings by 30 to 40 percent using preliminary data from the 2005 dealer reporting program, because NMFS focuses on landings of species from offshore or federal waters[30].

Missing data is probably more of a problem for processors and wholesalers. They report employment to the Massachusetts Division of Unemployment Assistance, but these data are probably underreported because many employees in this sector are temporary or hired from employment services rather than permanent employees. There is no reliable measure of production from this sector.

Aside from missing data, there is little information on linkages between the Commercial Seafood Industries and the other sectors of the Massachusetts Coastal Economy, which muddies the effects of public policy on Massachusetts' fisheries. Current federal management plans, for example, are required to estimate the effects of regulations on fishing communities, but do little to estimate either the direct effects or the indirect effects of regulations due to missing data and missing information on linkages to other sectors.

[30] Personal communication from Thomas Hoopes, MIF & Fisheries Statistics Project Leader, MA Division of Marine Fisheries, Spring 2006.

MARINE TRANSPORTATION SECTOR

General Description

The marine transportation industry has historically played a dominant role in the economic development of the entire New England region, including Massachusetts. Today, transportation is not the marine industry's largest sector; however, it still remains an important contributor. Specifically, this sector includes the transportation of foreign and domestic freight, water passenger transportation, cargo handling, towing and tugboat services, and marine pipelines and natural gas transmission.

State-wide, Marine Transportation had the fewest establishments, least employment, and lowest total wages, and made up about 1.6 percent of the state's total marine industry establishments. Also, only about 1.4 percent of the state's total marine industry employment was generated by marine transportation. Moreover, the sector paid out less than 1 percent of the industry's total wages. Yet, while the numbers of establishments, and employees plus total wages were relatively low, the wages per employee were above the marine industry's average.

Figure 21—Sector Establishments, Employment and Wages by NAICS, Massachusetts 2004

Marine Transportation Industry by NAICS, 2004				
2002 NAICS	Description	Establ	Empl	Wages
	Total Marine in Massachusetts	10,955	152,441	$4,308,400,235
Marine Transportation		**171**	**2,099**	**$92,835,244**
48311	Deep Sea, Coastal, and Water Lakes Transportion	28	870	$55,398,557
483211	Inland Water Freight Transportation	8	18	$504,717
483212	Inland Water Passenger Transportation	7	13	$255,836
487210	Scenic and Sightseeing Transportation, Water	60	736	$14,383,648
4883	Support Activities for Water Transportation	54	411	$16,708,053
532411	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing	14	51	$5,584,433

Source: Mass. DUA, ES-202, 2004.

Marine transportation in Massachusetts is dominated by scenic and sightseeing transportation establishments as well as support activities for water transportation. However, in terms of employment, passenger transportation is dominant. More than 100 additional people are employed by passenger transport (870) in half the number of establishments (28) than scenic and sightseeing transportation (736 people and 60 establishments). In addition, the wages are about four times as high.

In coastal communities, marine transportation appears to play a slightly larger role in the economy, relative to other sectors. About 87 percent of the sector's establishments were located in the state's coastal communities. Nearly 100 percent of the sector's employment and wages were generated in the state's coastal communities. In comparison to another sector, there were about twice as many establishments dedicated to marine transportation as to marine science, technology and education. In addition, the Marine Transportation sector supported about twice as many employees as the science, technology and education sector.

Figure 22—Sector Establishments, Employment and Wages by NAICS, Coastal Zone, Massachusetts, 2004

Coastal Marine Industry by NAICS, 2004				
2002 NAICS	Description	Establishments	Employment	Wages
	Total Marine in Massachusetts	10,384	140,206	$3,520,506,174
Marine Transportation		**148**	**2,045**	**$90,302,416**
48311	Sea, Coastal & Great Lakes Transport	20	851	$54,268,763
483211	Inland Water Freight Transportation	6	13	$309,824
483212	Inland Water Passenger Transportation	7	14	$255,836
487210	Scenic and Sightseeing Transportation, Water	58	723	$13,968,529
4883	Support Activities for Water Transportation	49	400	$16,353,497
532411	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing	8	44	$5,145,967

Source: Mass. DUA, ES-202, 2004.

Neither inland freight nor passenger water transport had many establishments or employees, relative to other types of marine transportation. There were only seven establishments for inland passenger transport, all located in coastal communities. All but two of the establishments for inland freight transport were also located in coastal communities. In contrast, only about 50 percent of the establishments (8 of 14) which rent and lease commercial transportation equipment were located in coastal communities. Yet, 86 percent of the employment as well as 92 percent of the wages related to equipment rental and leasing were located in those eight coastal community establishments.

Water Dependence

Marine Transportation is generally a water-dependent sector. Transportation of foreign and domestic freight, water passenger transportation, cargo handling, towing and tugboat services, and marine pipelines and natural gas transmission all require direct access to the water. However, while most of the sector is necessarily concentrated along the water, establishments for renting commercial transportation equipment are not.

Having rental and support establishments located close to ports and other transportation establishments is advantageous but they are not water-dependent, maybe the only such component of the marine transportation sector.

Employment and Economic Impact

Employment in Marine Transportation indirectly generated more additional employment (2,125 jobs) for the state than it supported itself (2,099 jobs). The payroll from these 2,125 jobs induced an additional 1,708 jobs for Massachusetts' industries as well. Still, in numbers, the total employment generated by the marine transportation sector was far less than by other marine industry sectors.

Figure 23—Economic Impacts of the Sector, Massachusetts, 2004

Marine Transportation Impacts						
Employment Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Marine Transportation	2,099	2,099	2,125	1,708	5,932	2.83
Total Marine Industry	**152,441**	**152,441**	**30,072**	**41,324**	**223,836**	**1.47**
Output Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Marine Transportation	2,099	289,755,957	134,830,261	104,036,340	528,622,555	1.82
Total Marine Industry	**152,441**	**8,688,967,880**	**2,885,514,735**	**3,228,472,976**	**14,802,955,591**	**1.70**

Source: Mass. DUA, ES-202, 2004. IMPLAN analysis by the authors.

Marine transportation contributed only about 3 percent of the state's total marine industry employment. For comparison, commercial seafood, which is the next largest contributor to marine employment, contributed 10 percent of the state's marine industry employment. Of the employment in marine transportation, about 75 percent came from only two of the sector's six components: passenger transportation (41 percent) and scenic and sightseeing transportation (35 percent).

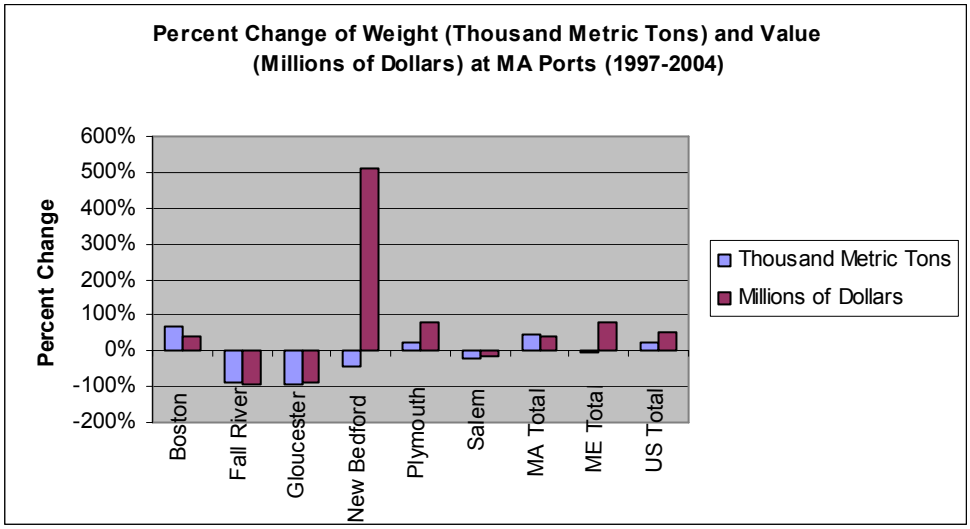
Despite the sector's relatively small contribution to the industry's total employment, the Marine Transportation sector had the highest multiplier in the marine industry (2.83). The impact of losing jobs in the marine transportation sector would have a larger effect on state employment levels than a job loss in any of the other sectors. With the loss of one Marine Transportation job, 1.83 jobs would be potentially lost from other industries in the state economy.

Marine Transportation was only responsible for about 3.5 percent of the marine industry's total economic output. This was the smallest sector in the marine industry in terms of economic output ($528,622,555), but it did have the second largest multiplier for economic output impact (1.82). However, relative to the entire marine industry, the multiplier was only slightly higher than other sectors. The economic impact of changes in any of the sectors would be roughly the same, but Marine Transportation is slightly above the industry average. For every $1 of economic output produced by employment in the Marine Transportation sector, the state economy would produce another $0.82.

Additional Port Trends

There are seven major customs ports in Massachusetts: Boston, Fall River, Gloucester, New Bedford, Plymouth, Provincetown, and Salem. Waterborne trade saw a large percentage increase in both exports and imports, state-wide, between 1997 and 2004. The exports increased more than the national average for weight, volume, and value. However, port calls and port capacity both decreased in Massachusetts between 2002 and 2004.

Figure 24—Percent Change of Weight and Value at Massachusetts Ports, 1997—2004

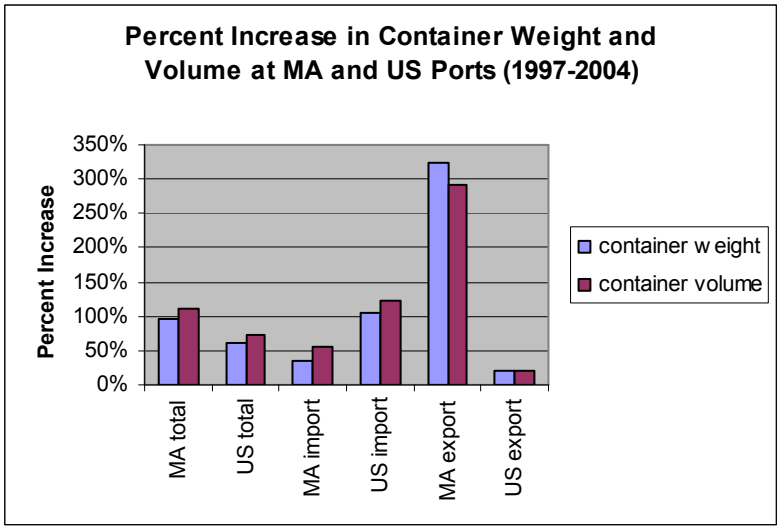


Source: U.S. Department of Transportation Maritime Administration.

Total foreign container exports, for example, increased only about 20 percent in volume nationally, but almost 300 percent in Massachusetts. In contrast, since 1997, total

foreign container imports have increased by over 100 percent in volume nationally, but only increased by 40 percent to 50 percent in the state. The reason that imports were not increasing as much at Massachusetts ports could have been that the capacity of Massachusetts' ports for both foreign and domestic trade decreased by almost 50 percent in only two years.

Figure 25—Percent Increase in Container Weight and Volume at Mass. and U.S. Ports, 1997—2005



Source: U.S. Department of Transportation Maritime Administration.

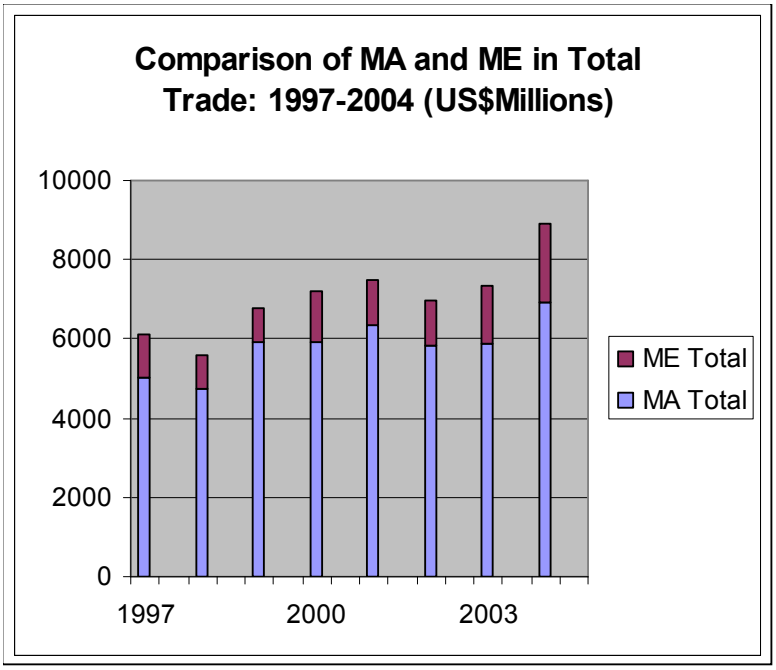
In 2002, Boston's port ranked 24th in the nation for port capacity and only two years later, it had dropped to 40. In Boston, as well as the entire state, there was an overall decrease in port capacity. However, while the capacity for general cargo increased only 26 percent nationally, it rose 600 percent at Boston's port.

Not all of the state ports followed the same overall trends that were seen in Massachusetts ports on average. The state imports and exports increased by 48 percent in terms of weight and by 38 percent in term of value, between 1997 and 2004. Yet, at the ports of Fall River and Gloucester, decreases of 90 percent were seen for both weight and value. Furthermore, in New Bedford, while change in trade by weight was down 50 percent, the value of this trade was up 500 percent.

Also, while Boston, the top-ranked port in Massachusetts, did see increases in its exports since 1997, the increase paled in comparison to increases at other state ports. At

Fall River, New Bedford, and Salem, for example, the weight of exported goods increased by about 450 percent, 250 percent and 30,000 percent respectively. Yet, the value of these exports did not increase at all of the ports. For comparison, in Maine, another New England state with several customs ports, less was traded in recent years than in Massachusetts, but the products traded were more valuable.

Figure 26—Comparison of Massachusetts and Maine, in Total Trade, 1997—2004



Source: U.S. Department of Transportation Maritime Administration.

Conditions Impacting the Sector

Two main conditions impact the Marine Transportation sector in Massachusetts. First, the sector is affected by the landside transportation cost of getting goods to and from the port. Second, the changing fleet characteristics can impact a fleet's ability to maneuver into certain ports.

Increases in the volume traded at Massachusetts ports have been greater than the general increases seen in volumes traded at all the nation's North Atlantic ports. Specifically, the volume of goods traded through Boston's port has increased 100 percent since 1997. However, the increase cannot be explained by an increase in international trade alone. The landside transportation costs for New England's traders to get their

goods to or from Boston's port are significantly cheaper than the next best option, which would be New Jersey's port.[31].

The channel depth at a port limits future growth in volumes and weight traded at the Boston port. When vessel sizes increase, each vessel is able to transport a larger volume of goods. The vessels coming in now are carrying the maximum load possible given the channel depth.[32]

Method and Data Limitations

The level of detail available in the six digit NAICS codes is probably more comprehensive for Marine Transportation than for other sectors. This sector has been part of the economy for a long time and has established traditional and definable NAICS codes. For such components as commercial transportation equipment rentals, an allocation formula was applied to ensure that only marine-related establishments and employment are counted. This formula is described in *Appendix 3*.

Scenic and sightseeing transportation already has two separate NAICS codes; one for land-based transportation and one for water-based transportation. Since there are separate codes, an allocation formula is not needed to separate the different components. However, while the water-based component may already be easily distinguished, it is not as easy to assign it to a sector. Water-based scenic and sightseeing transportation is currently included in the Marine Transportation sector, although it seems that it could just as easily, and maybe more appropriately, fall under the tourism and recreation sector of marine industry.

Although scenic and sightseeing transportation is obviously a form of transportation, the scenic and sightseeing portion of the definition seems dominant. Transportation just describes what type of sightseeing is happening. For example, whale watching would appear to fall under water-based scenic and sightseeing transportation. Tourism and recreation would be undervalued in the state's economy if water-based

[31] David Miller and Associates. *Boston Harbor Channel Deepening Project, Economic Benefits Analysis*. August 2005.
[32] Ibid.

scenic and sightseeing transportation is not included. If it is included in both sectors it would be double-counted in the state's total.

COASTAL TOURISM AND RECREATION

The Sector and Subsectors

In this study, coastal tourism activities qualify as such by their geographic proximity to water (e.g. location within a town with a coastline). The methodology in this report uses tourism activities within the coastal zone as a proxy for marine industry-related tourism. However, it must be noted that a significant proportion of entertainment, food, and lodging in the coastal zone is not necessarily related to the sea nor uses inputs of production from the sea.

The Coastal Tourism and Recreation sector is made up of 7,640 establishments. These create jobs for 119,420 people and the annual wages within the sector are almost $2.34 billion. Therefore the Coastal Tourism and Recreation sector is by far the largest of the marine and coastal economy sectors in Massachusetts.

The sector comprises three subsectors:

- Food;
- Entertainment and Recreation;
- Accommodations.

The largest of these subsectors is *food*, which comprises 5,819 establishments, employing 87,499 people. The average wage for this subsector is the lowest of the three that make up the Coastal Tourism and Recreation economic sector ($16,871 per year). The total wages for those employed in the food subsector is over $1.47 billion.

The food subsector includes: full-service restaurants, limited-service restaurants, cafeterias, snack and nonalcoholic beverage bars, food service contractors, caterers and drinking places (alcoholic beverages).

The second largest subsector is *entertainment and recreation*. This subsector comprises 1,064 establishments, employing 13,625 people with an average wage of $23,703. The entertainment and recreation subsector includes: marinas, fitness and recreational sports centers, other amusement and recreation industries, theater companies and dinner theaters, performing arts companies, promoters of performing arts, sports, and

similar events, recreational goods rental, sports and recreation instruction, other miscellaneous schools and instruction, and boat dealers. Wages for those employed in this sector total almost $323 million.

The smallest subsector is *accommodations*, comprising 757 establishments that employ 18,296 people. While this is the smallest subsector in terms of number of establishments, it has the highest average wage within the sector ($29,461). The total wages paid to those employed in this subsector are over $539 million. The subsector is made up of: traveler accommodation, rooming and boarding houses, recreational and vacation camps, recreational vehicle parks and campgrounds, land-based scenic and sightseeing transportation, and other travel arrangement and reservation services.

Of all the sectors of the marine and coastal economy, this sector is by far the largest in terms of the number of establishments, number of employees, and the total wages paid to these employees. However, the average wage paid to employees is by far the lowest of all sectors ($19,580 compared to the average salary across all sectors of $28,263).

While all the categories of establishments or business types within each subsector—and within the sector as a whole—are associated with Coastal Tourism and Recreation, there may well be little dynamic interaction between them. Within the accommodations subsector, the business types are unlikely to have a direct interaction (such as a flow of goods or services) as the business activities are largely competitive in nature. Traveler accommodation, rooming and boarding houses, recreational and vacation camps, and recreational vehicle parks and campgrounds are all offering similar services. As such, they are competing for the same resources—in this case, visitors.

Within the accommodations subsector there are possible dynamic interactions between those establishments offering accommodation and those businesses offering travel arrangement and reservation services, and/or those businesses involved in scenic and sightseeing transportation.

Those businesses in the food subsector are likely to be in direct competition with each other as, once again, they are potentially competing for the same pool of customers.

The potential for interactions between those categories in the entertainment and recreation subsector is greater than within the other subsectors. For example, it is not uncommon for boat dealers and marinas to develop a mutually beneficial relationship. Boat dealers may rent a number of slips within a marina where they can berth new vessels to display to potential customers. The marina benefits directly by receiving rental fees on the slips and boat dealers benefit by increasing their chance of sales by having their product on the water. Another potential benefit for the marina comes from such boat buyers needing berthing slips. Having already visited the marina during the purchasing process, they may decide to rent a slip there.

It is also common for marinas to have a mutually beneficial relationship with businesses that rent recreational equipment (e.g., boats, canoes, and kayaks) and those that offer sports and recreation instruction (e.g., sailing instructors).

Potential interactions also exist between those who promote performing arts or sports events and those that are directly involved in staging such events (theater companies, dinner theaters and other performing arts companies). Additionally, potential interactions exist between fitness and recreational sports centers and those that offer sports and recreation instruction.

The three subsectors within the Coastal Tourism and Recreation economic sector are intrinsically linked. The factors that clearly link the three are the needs of those who are participating in the activities that the sector promotes. Tourists or visitors will need somewhere to stay (the accommodations subsector), as well as sustenance (the food subsector) while they enjoy the attractions that they have come to see or experience (the entertainment and recreation subsector). Coastal Tourism and Recreation is clearly a "full service" sector where no one subsector can thrive without the other two.

The Sector as Part of the Marine Economy

As the geographical focus of this sector is the coast of Massachusetts, it is clear that Coastal Tourism and Recreation are a significant part of the marine and coastal economy within the Commonwealth.

While this sector is clearly associated with the coastal area of Massachusetts, this does not necessarily mean that the subsectors, and the categories within these, require waterfront locations. In fact, the only businesses that usually do require a waterfront location are marinas. The majority of marinas consists of docks and slips for vessel berthing and therefore must be located on the water. Some marinas may offer dry stack storage. While dry-stack facilities themselves do not necessarily need to be located on the waterfront, it is essential that there is water access to allow for the launching of boats. Therefore, even if such facilities are not directly on the water, they still require access to the waterfront to launch vessels..

Many boat dealers are located on the waterfront and, as such, would be considered water-dependent. In the past, almost all boat dealers would also have been considered water-dependent businesses. However, the climbing value of waterfront property and the development of hydraulic trailers that facilitate the transportation of boats have led to more and more boat dealers relocating inland. These businesses would no longer be considered water-dependent.

The following categories of Coastal Tourism and Recreation businesses may or may not be classified as water-dependent: amusement and recreation industries, recreational goods rental, sports and recreation instruction, miscellaneous schools and instruction. The degree of water-dependency will depend on the exact nature of the business. For example, a business that is classified as recreational goods rental would be water-dependent if it rented out canoes and kayaks but would not be water-dependent if it rented bicycles. Similarly, a sailing school would be classified as a sports and recreation instruction facility and would be water-dependent. But if the facility were focused on a non water-dependent activity, it would not require a waterfront location. And as such, would not be water-dependent.

Sports centers, theaters, other performing arts companies or those involved in promoting the performing arts or sporting events would not be considered water-dependent.

No category of businesses in the food and accommodations subsectors is water-dependent. However, any of these businesses may be enhanced by having a waterfront location.

The Impacts on Coastal Tourism and Recreation on the Massachusetts Economy

The Coastal Tourism and Recreation sector is by far the largest of the marine economy sectors in terms of both the number of establishments and the number of employees. There are 7,640 establishments within this sector. This is almost 70 percent of the total number of establishments across all the sectors of the state's marine and coastal economy. Employment within the Coastal Tourism and Recreation sector (119,420) accounts for over 78 percent of the total number of employees across all the sectors. However, the average wage within the Coastal Tourism and Recreation sector is far lower than those for any of the other sectors ($19,580; compared to $44,230 in Marine Transportation; $45,227 in Commercial Seafood; $65,013 in Marine-Related Infrastructure; and $82,821 in Marine Science and Technology). The sector's average wage is also well below the state average wage of $48,934 and is also below the marine sector average of $28,263. However, despite the low average wage, the total wages for the Coastal Tourism and Recreation sector are the highest for all sectors (almost $2.34 billion). This is over 54 percent of the wages for all sectors and is almost 2.5 times the total wages for the next highest sector (Marine Related Infrastructure at $949 million).

Figure 27—Sector Establishments, Employment and Wages by NAICS, Massachusetts, 2004

Coastal Tourism and Recreation Industry by NAICS, 2004				
2002 NAICS	Description	Establ	Empl	Wages
	Total Marine in Massachusetts	10,955	152,441	$4,308,400,235
Coastal Tourism and Recreation		**7,640**	**119,420**	**$2,338,200,556**
Sub-sector 1 - Entertainment and Recreation		**1,064**	**13,625**	**$322,954,736**
713930	Marinas	154	1,514	$55,097,974
713940	Fitness and Recreational Sports Centers (part)	363	6,045	$99,075,908
713990	All Other Amusement and Recreation Industries (part)	198	2,724	$57,635,621
711110	Theater Companies and Dinner Theaters (part)	52	1,242	$36,049,829
711190	Other Performing Arts Companies (part)	7	11	$270,022
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities (pt	29	212	$12,429,491
532292	Recreational Goods Rental	35	87	$2,059,431
611620	Sports and Recreation Instruction	86	491	$8,659,321
611699	All Other Miscellaneous Schools and Instruction (part)	53	527	$20,634,907
441222	Boat Dealers	87	772	$31,042,232
Sub-Sector 2 - Food		**5,819**	87,499	**$1,476,224,108**
722110	Full-Service Restaurants	2,359	46,240	$832,422,368
722211	Limited-Service Restaurants	1,814	18,242	$259,547,588
722212	Cafeterias	24	414	$6,695,904
722213	Snack and Nonalcoholic Beverage Bars (part)	769	10,240	$152,609,739
722310	Food Service Contractors	232	5,738	$120,686,377
722320	Caterers	177	2,072	$38,357,842
722410	Drinking Places (Alcoholic Beverages)	444	4,553	$65,904,290
Sub-Sector 3 - Accommodations		**757**	18,296	**$539,021,712**
7211	Traveler Accommodation	587	16,453	$484,373,091
721310	Rooming and Boarding Houses (part)	43	232	$4,820,131
721214	Recreational and Vacation Camps (except Campgrounds)	30	241	$5,517,002
721211	RV (Recreational Vehicle) Parks and Campgrounds	29	188	$4,461,234
487110	Scenic and Sightseeing Transportation, Land (part)	23	472	$13,786,626
561599	All Other Travel Arrangement and Reservation Services (part)	45	710	$26,063,628

Source: Mass. DUA, ES-202, 2004
NOTE - In rows marked "part" allocation formulas have been used to adjust original data. See *Appendix 3* for details.

Within the Coastal Tourism and Recreation sector, the entertainment and recreation subsector accounts for almost 14 percent of establishments, over 11 percent of the number of employees, and almost 14 percent of the total wages for the sector. The accommodations subsector accounts for almost 10 percent of establishments, over 15 percent of employees and 23 percent of the total sector wages. By far the largest subsector in terms of number of establishments, number of employees, and total wages is the food subsector (76 percent, 73 percent and 63 percent respectively). However, the food subsector has the lowest average wage ($16,871 per year), as compared to $23,703 for the entertainment and recreation subsector and $29,461 for the accommodations subsector.

Within the entertainment and recreation subsector, average wages range from a high of $58,630 for promoters of performing arts, sports, and similar events to a low of $17,636 for those employed in sports and recreation instruction. This category also accounts for over 44 percent of those employed in this subsector.

Within the food subsector, wages range from an average high of $21,033 for food service contractors to a low of $14,228 for those employed in limited-service restaurants. The majority of employees (almost 53 percent) are employed in full-service restaurants where the average wage is $18,002.

Average wages within the accommodations subsector range from $36,709 for those working in travel arrangement and reservation services to $20,776 for those working in rooming and boarding houses. The vast majority of employees in this subsector (almost 90 percent) are involved in traveler accommodation. The average wage in this category is $29,440 per year.

The Coastal Tourism and Recreation sector has the lowest employment multiplier of all the sectors (1.32). So, for every job generated in this sector, an additional 0.32 jobs are generated elsewhere within the state. The total number of jobs created by this sector (direct, indirect, and induced) is 157,431. Therefore, Coastal Tourism and Recreation is a relatively low-paying subsector that does not generate significant amounts of local buying power and therefore generates little additional demand for goods and services within the state. As a result, only a small number of additional jobs are generated to meet the demand for these additional goods and services. However, given the very size of this sector, the total number of jobs it creates still accounts for over 70 percent of the total jobs generated by all sectors.

Figure 28—Economic Impacts of the Sector, 2004

Coastal Tourism and Recreation Impacts						
Employment Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Coastal Tourism and Recreation	119,420	119,420	15,536	22,475	157,431	1.32
Total Marine Industry	**152,441**	**152,441**	**30,072**	**41,324**	**223,836**	**1.47**
Output Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Coastal Tourism and Recreation	119,420	5,069,549,937	1,705,687,021	1,943,492,974	8,718,730,008	1.72
Total Marine Industry	**152,441**	**8,688,967,880**	**2,885,514,735**	**3,228,472,976**	**14,802,955,591**	**1.70**

Source: Mass. DUA, ES-202, 2004. IMPLAN analysis by the authors.

The spending multiplier for this sector is the third highest (1.72) of all the sectors (after Marine Science and Technology and Marine Transportation). This reflects the moderately high value added products produced by this sector. However, almost 59

percent of the total output value of all sectors is generated by the Coastal Tourism and Recreation sector with a value of almost $8.72 billion for the Commonwealth.

Supplemental Impacts for Coastal Tourism Activity Spending

Supplemental IMPLAN models were run for spending associated with a number of subcategories or activities associated with the Coastal Tourism and Recreation sector. These subcategories were:

- Recreational Boating
- Saltwater Angling
- Oceanside Wildlife Watching
- Day Trip Beach Visits
- Overnight Beach Visits

Recreational Boating Spending Impacts

It is estimated that 75 million Americans participate in recreational boating. Clearly, the Massachusetts weather means that such activity is much more seasonal than in some other states. However, data from the Massachusetts Marine Trades Association (MMTA) suggests that there are approximately 186,000 registered and documented recreational boats in Massachusetts and up to 195,000 Massachusetts residents may be out boating on a typical summer weekend. Therefore it is clear that boating is an important form of recreation in Massachusetts, and as such, is likely to have a significant economic impact in the state.

Our assessment estimates that direct spending associated with recreational boat ownership is almost $182 million annually and over 77 percent of this—or $140.3 million— is spent within Massachusetts. We project that recreational boat ownership results in direct employment of 2,283 people and that their wages are over $50 million. The average wage for direct employees is $22,047. The model also concludes that the direct employment generates an additional 851 indirect and induced jobs within the state (employment multiplier = 1.37) and these account for an additional $33 million in wages (in-state spending multiplier = 1.72; overall spending multiplier = 1.33). The average

wage for the generated position is $38,766. The model estimates that recreational boat ownership has a significant economic impact within the state, creating 3,134 jobs, of which almost 73 percent are directly employed within the subsector. Additionally, recreational boat ownership generates a total output value of over $241 million annually.

Figure 30—Massachusetts Tourism Activity Spending and Its Economic Impact: Recreational Boat Ownership

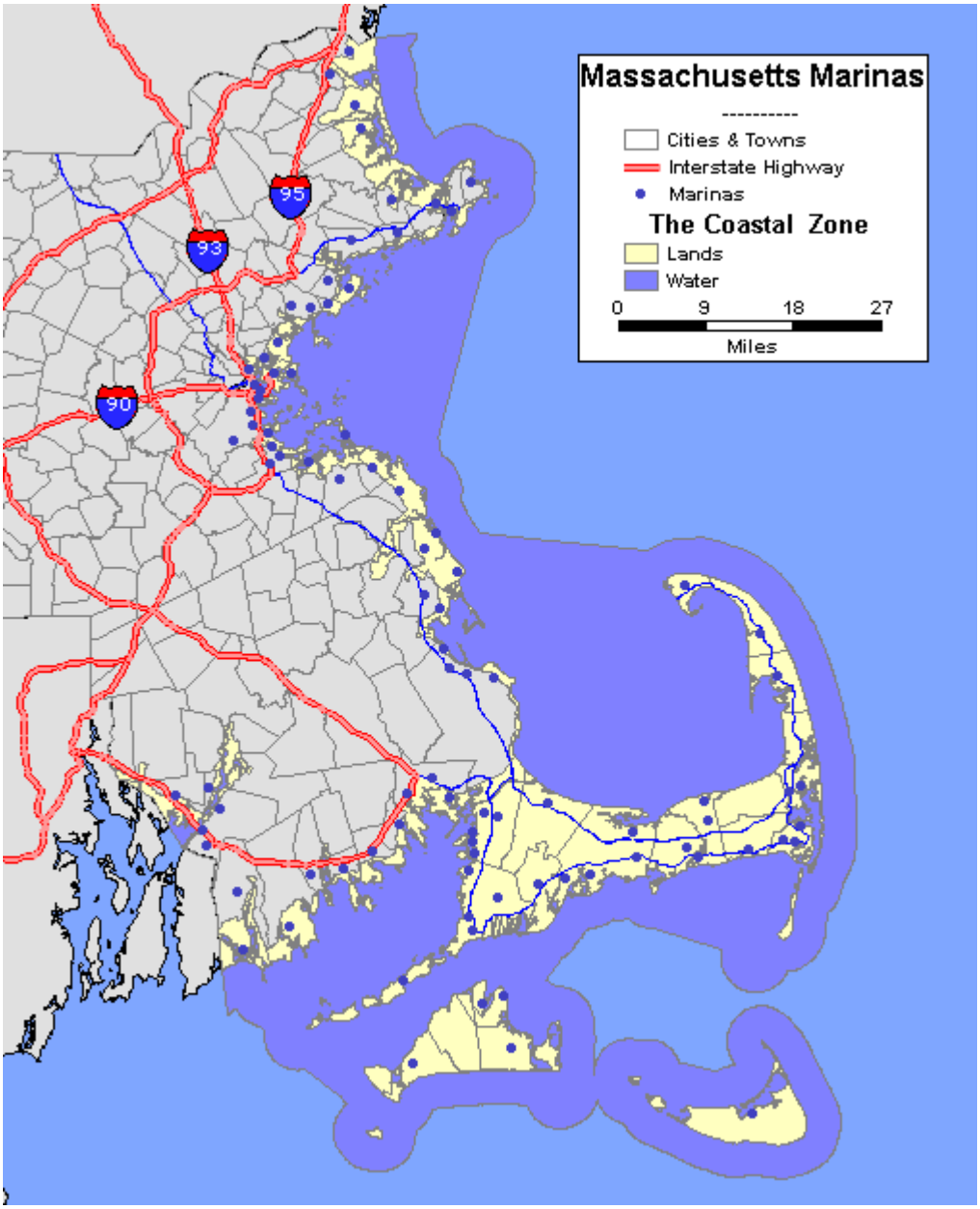
Summary of Economic Impacts

MA Tourism Activity Spending: Recreational Boat Ownership

Mean annual trip-related expenditures per boat:		
Marine and yatch clubs		$359.00
Gas stations		$214.00
Restaurants and bars		$184.00
Grocery and convenience type stores		$148.00
Bait and tackle shops		$62.00
Boat launching and mooring fees		$58.00
Lodging		$58.00
Entertainment and other expenses		$56.00
All other retail purchases		$55.00
Tournament fees		$12.00
Total		$1,206.00
Registered Boats	Number of Boats	150,683
Total All Categories	Total x Number of Boats	$181,723,698
	Total Amount Spent in Region (Massachusetts)	$140,377,869
	Total Amount Spent Outside of Massachusetts	$41,345,829
Direct Employment	Total	2,283
Direct Payroll	Total Payroll	$50,325,390
	Average Annual Payroll per Employee	$22,047
Employment Generated (Indirect and Induced)	Total	851
Annual Payroll Generated (Indirect and Induced)	Total	$33,002,105
	Average Annual Payroll per New Employee	$38,767
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	3,134
	Total (Direct, Indirect, and Induced)	$241,177,491
Multiplier Effects	In-State Spending Muliplier	1.72
	All Spending Multiplier	1.33

Source: Authors' calculations based on data from U.S. Coast Guard and expenditure estimates in *Recreational Boating Expenditures in 2003 in New York State and Their Economic Impacts* by Nancy A. Connelly, Tommy L. Brown, David L. Kay, September 2004.
For methodological details see *Appendix-Supplemental Spending Analysis*

Figure 29—Massachusetts Marinas



Source: D&B MarketPlace

One aspect of recreational boat ownership that is of major importance in Massachusetts is the marine industry associated with recreational boating. In 2001 the MMTA estimated that there were 1,260 businesses and individuals that worked in marine trades directly associated with recreational boating. These trades include:

- Boatyards

- Marinas
- Boat manufacturing and sales
- Boat trade shows
- Boat Transportation
- Canvas makers
- Charters and excursions
- Dock management
- Harbormasters
- Manufacturer representatives
- Marine surveyors
- Yacht brokers

MMTA estimated that these businesses employed over 17,500 full-time personnel with a total annual payroll of over $508 million. MMTA also estimated that there were over 9,500 additional part-time positions. In 2005, the Urban Harbors Institute (UHI) of the University of Massachusetts Boston surveyed marine trades in the South Coastal region of Massachusetts and found that on average, each business employed approximately 9 people and that 78 percent of these were full-time employees. Of particular interest was the fact that 77 percent of those surveyed felt that their ability to expand their business was being hampered by a lack of qualified marine technicians, in particular master technicians as well as diesel, inboard, outboard, and sterndrive technicians. Clearly, the lack of qualified technicians is having a significant economic impact on these marine businesses, and therefore on the Commonwealth as a whole.

Saltwater Angling Spending Impacts

The 2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation (U.S. Fish and Wildlife Service, 2001) concluded that throughout the U.S. there were 9.1 million saltwater anglers who undertook nearly 72 million trips. In 2001 they spent an estimated $8.4 billion on trips and equipment. It is therefore clear that nationally, saltwater fishing is of economic importance. The report also found that 76 percent of saltwater anglers fished within their home states.

The supplemental IMPLAN model for Coastal Tourism and Recreation in Massachusetts concluded that the direct spending by saltwater anglers is $50.95 per person, per trip (Figure 31) and the total number of person trips is 4,244,280. Therefore, the direct spending associated with saltwater angling is over $216 million. The model suggests that 72 percent of this is spent within Massachusetts. The model also shows that saltwater angling results in direct employment of 2,819 people and that their wages are over $62 million. The average wage for direct employees is $22,175. The model also concludes that the direct employment generates an additional 941 indirect and induced jobs within the state (employment multiplier = 1.33) and these account for almost $36 million in additional wages (in-state spending multiplier = 1.69, overall spending multiplier = 1.21). The average wage for the generated position is $38,068. It is therefore clear that saltwater angling has a significant economic impact within the state. It creates 3,759 jobs, of which almost 75 percent are directly employed in the subsector. Additionally, saltwater angling generates a total output value of over $262 million.

Figure 31—Massachusetts Tourism Activity Spending and Its Economic Impact: Saltwater Angling Trips

Summary of Economic Impacts
MA Tourism Activity Spending: Saltwater Angling Trips

Direct Spending by Category Per Person Trip:		
Food and lodging		$8.90
Transportation		$4.13
Fees		$6.22
Boating costs		$16.95
Bait		$3.37
Ice		$0.77
Equipment		$10.61
Total per trip		$50.95
Person Trips	Number of Trips	4,244,280
Total All Categories	Total x Trips	$216,246,066
	Total Amount Spent in Region (Massachusetts)	$155,730,212
	Total Amount Spent Outside of Massachusetts	$60,515,854
Direct Employment	Total	2,819
Direct Payroll	Total Payroll	$62,502,818
	Average Annual Payroll per Employee	$22,175
Employment Generated (Indirect and Induced)	Total	941
Annual Payroll Generated (Indirect and Induced)	Total	$35,806,551
	Average Annual Payroll per New Employee	$38,068
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	3,759
	Total (Direct, Indirect, and Induced)	$262,666,800
Multiplier Effects	In-State Spending Muliplier	1.69
	All Spending Multiplier	1.21

Source: Authors' calculations based on data from National Marine Fisheries Service, U.S. Department of the Interior, and U.S. Department of Commerce.
For methodological details see *Appendix-Supplemental Spending Analysis*

Oceanside Wildlife Watching Spending Impacts

The supplemental IMPLAN model for Coastal Tourism and Recreation concluded that the direct spending by oceanside wildlife watching[33] participants is $28.44 per person, per trip (Figure 32) and the total number of person trips annually is 6,091,200. Therefore, the direct spending associated with wildlife watching associated with the sea is over $173 million. The model suggests that almost 81 percent of this total is spent within Massachusetts. The model also shows that oceanside wildlife watching results in direct employment of almost 2,550 people and that their wages are over $55 million. The average wage for direct employees is $21,703. The model also concludes that the direct employment generates an additional 857 indirect and induced jobs within the state (employment multiplier = 1.34) and these account for over an additional $33 million in

[33] The term oceanside wildlife watching refers to wildlife watching in public oceanside areas as reported in *2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts.* U.S. Department of the Interior and U.S. Department of Commerce, revised 2003.

wages (in-state spending multiplier = 1.72, overall spending multiplier = 1.39). The average wage for the generated position is $39,277. It is therefore clear that oceanside wildlife watching has a significant economic impact within the state. It creates 3,407 jobs, of which almost 75 percent are directly employed in the subsector. Additionally, oceanside wildlife watching generates a total output value of over $240 million.

Figure 32—Massachusetts Tourism Activity Spending and Its Economic Impact: Wildlife Watching

Summary of Economic Impacts
MA Tourism Activity Spending: Oceanside Wildlife Watching Trips

Direct Spending by Category Per Person Trip:		
Food		$8.37
Lodging		$4.16
Transportation		$8.10
Other trip costs		$7.81
Total per trip		$28.44
Person Trips	Number of Trips	6,091,200
Total All Categories	Total x Trips	$173,233,728.00
	Total Amount Spent in Region (Massachusetts)	$139,879,671.00
	Total Amount Spent Outside of Massachusetts	$33,354,057.00
Direct Employment	Total	2,550
Direct Payroll	Total Payroll	$55,342,971
	Average Annual Payroll per Employee	$21,703
Employment Generated (Indirect and Induced)	Total	857
Annual Payroll Generated (Indirect and Induced)	Total	$33,652,264
	Average Annual Payroll per New Employee	$39,277
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	3,407
	Total (Direct, Indirect, and Induced)	$240,582,691
Multiplier Effects	In-State Spending Muliplier	1.72
	All Spending Multiplier	1.39

Source: Authors' calculations based on data from U.S. Department of the Interior, and U.S. Department of Commerce.
For methodological details see *Appendix-Supplemental Spending Analysis*

Day Trip Beach Visit Spending Impacts

The supplemental IMPLAN model for Coastal Tourism and Recreation concluded that the direct spending on day trips to the beach is $17.00 per person, per trip (Figure 33) and the total number of person trips is 1,324,899. Therefore, the direct spending associated with day trips to the beach is over $22 million. The model suggests that over 82 percent of this total is spent within Massachusetts. The model also shows that day trips to the beach result in direct employment of 325 people and that their wages are over $7 million. The average wage for direct employees is $22,090. The model also concludes that the direct employment generates an additional 110 indirect and induced jobs within the state (employment multiplier = 1.34) and these account for more than an additional $4 million in wages (in-state spending multiplier = 1.70, overall spending multiplier = 1.40).

The average wage for the generated position is $38,813. It is therefore clear that day trips to the beach have an economic impact within the state. Such activity creates 435 jobs, of which almost 75 percent are directly employed in the subsector. Additionally, day trips to the beach generate a total output value of over $31 million.

Figure 33—Massachusetts Tourism Spending and Its Economic Impact: Day Beach Visits

Summary of Economic Impacts
MA Tourism Activity Spending: Beach Visitors Day Trips

Direct Spending by Category Per Person Trip:		
Gas and auto		$3.42
Parking and entrance Fees		$0.98
Food and Drink from stores		$4.66
Restaurants		$4.89
Equipment rental		$0.78
Beach sporting goods		$0.73
Incidentals		$1.54
TOTAL per Trip		$17.00
Person Trips	Number of Trips	1,324,899
Total All Categories	Total x Trips	$22,523,283
	Total Amount Spent in Region (Massachusetts)	$18,470,757
	Total Amount Spent outside of Massachusetts	$4,052,526
Direct Employment	Total	325
Direct Payroll	Total Payroll	$7,176,893
	Average Annual Payroll per Employee	$22,090
Employment Generated (Indirect and Induced)	Total	110
Annual Payroll Generated (Indirect and Induced)	Total	$4,253,885
	Average Annual Payroll per New Employee	$38,813
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	435
	Total (Direct, Indirect, and Induced)	$31,483,881
Multiplier Effects	In-State Spending Muliplier	1.70
	All Spending Multiplier	1.40

Source: Authors', calculations based on data from Massachusetts Office of Travel and Tourism, and expenditure estimates from *The Fiscal Impact of Beaches in California* , by Philip King, Ph.D, September 1999.

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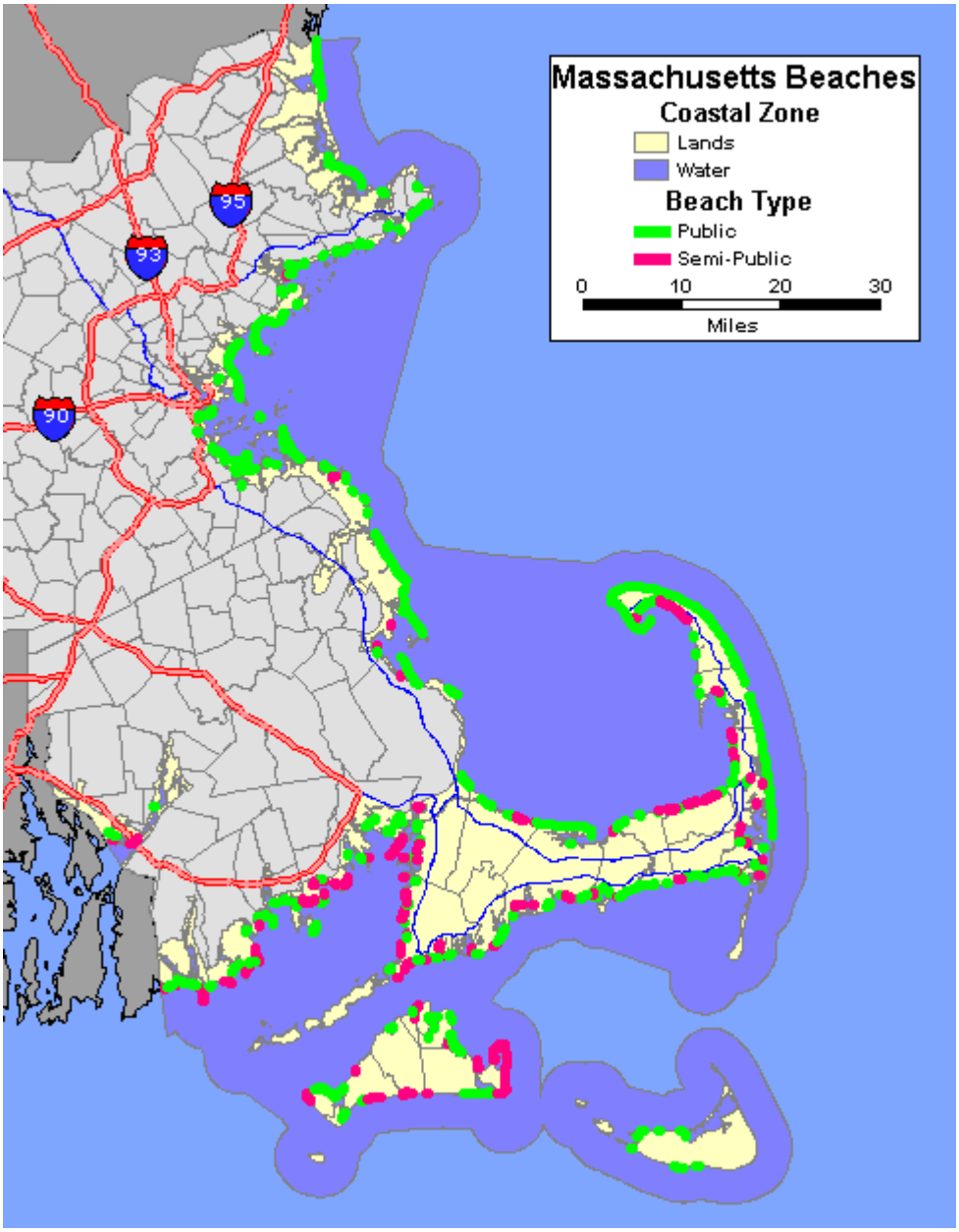
Figure 34—Massachusetts Beaches



Source: MassGIS

Overnight Beach Visit Results

The supplemental IMPLAN model for Coastal Tourism and Recreation concluded that the direct spending by overnight beach visits is $70.20 per person, per trip (Figure 35) and the total number of person trips is 2,702,151. Therefore, the direct spending associated with overnight beach visits is over $189 million. The model suggests that

almost 69 percent of this total is spent within Massachusetts. The model also shows that overnight beach visits result in direct employment of almost 2,108 people and that their wages are almost $50 million. The average wage for direct employees is $23,661. The model also concludes that the direct employment generates an additional 768 indirect and induced jobs within the state (employment multiplier = 1.36) and these account for almost an additional $30 million in wages (in-state spending multiplier = 1.70, overall spending multiplier = 1.17). The average wage for the generated position is $38,822. It is therefore clear that overnight beach visits have a significant economic impact within the state. They create 2,876 jobs, of which over 73 percent are directly employed in the subsector. Additionally, overnight beach visits generate a total output value of over $222 million.

Figure 35—Massachusetts Tourism Activity Spending and Its Economic Impact: Overnight Beach Visits

Summary of Economic Impacts
MA Tourism Activity Spending: Beach Visitors Overnight Trips

Direct Spending by Category Per Person Trip:		
Gas and auto		$10.08
Beach related lodging		$25.84
Parking and entrance Fees		$1.32
Food and Drink from stores		$11.27
Restaurants		$15.25
Equipment rental		$2.60
Beach sporting goods		$0.67
Incidentals		$3.17
Total per trip		$70.20
Person Trips	Number of Trips	2,702,151
Total All Categories	Total x Trips	$189,691,000
	Total Amount Spent in Region (Massachusetts)	$130,985,551
	Total Amount Spent out of Massachusetts	$58,705,449
Direct Employment	Total	2,108
Direct Payroll	Total Payroll	$49,871,002
	Average Annual Payroll per Employee	$23,661
Employment Generated (Indirect and Induced)	Total	768
Annual Payroll Generated (Indirect and Induced)	Total	$29,807,577
	Average Annual Payroll per New Employee	$38,822
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	2,876
	Total (Direct, Indirect, and Induced)	$222,231,373
Multiplier Effects	In-State Spending Muliplier	1.70
	All Spending Multiplier	1.17

Source: Authors' calculations based on data from Massachusetts Office of Travel and Tourism, and expenditure estimates from The Fiscal Impact of Beaches in California, by Philip King, Ph.D, September 1999.
For methodological details see *Appendix 4. Methodology: Supplemental Spending Analysis*

While the multipliers associated with this sector of the marine economy are not as significant as those for some other sectors, Coastal Tourism and Recreation is of significant importance due to the number of people employed within the sector and the fact that the output impact accounts for more than all the other sectors combined.

There is little to suggest that the importance of this sector of the marine economy will not remain critical to the economic health of the Commonwealth.

Conditions and Trends Impacting the Coastal Tourism Sector

The economic impacts of tourism in general are particularly difficult to calculate as NAICS categories do not specifically identify jobs in the tourism industry. This makes state employment data difficult to use for estimating the economic effects of tourism. Additionally, differentiating between general tourism and *marine-related* tourism is also frequently difficult. While any tourism that occurs in a small, coastal town may be assumed to be almost entirely marine-related, the same is not true in larger municipalities that offer a wide range of attractions. For example, when tourists visit Gloucester, it may be safe to assume that they are doing so because of the many marine-related attractions. Some of these may be very directly marine-related (e.g. whale watching, deep sea fishing, casino boats, beach activities), while others may be more indirectly marine-related. For some, the attraction to the area may be the Gloucester's history and for others it may be the artist colony on Rocky Neck. However, Gloucester's history is inextricably linked to the fishing industry and many might argue that the historic and picturesque character of Gloucester is what attracted the artists in the first place. As there are few attractions that are not marine-related, it is reasonable to assume that all Gloucester's tourism is marine-related. However, the same cannot be said for tourists who visit Boston. While Boston also offers many marine-related attractions, they are not the only attractions within the city. Attractions such as the museums and numerous sporting events are not marine-related. It is therefore extremely difficult to determine what fraction of the economic impact of tourists within Boston can be directly attributed to marine-related tourism. To assume that all Boston's tourism is marine-related would greatly overestimate the economic impacts of marine and coastal tourism on the state.

Next Steps for Further Study

One key aspect of the Coastal Tourism and Recreation sector that requires further study is the economic impact of the marine trades associated with recreational boating. While the Massachusetts Marine Trades Association has, and continues to undertake surveys to gauge the status of the industry, there is little hard economic data available. There is a clear feeling within the industry that there is significant room for growth but that this potential is being hampered by a lack of skilled technicians. If this issue were to be resolved, any potential growth in the industry could result in a significant increase in indirect and induced employment and economic output impact.

MARINE SCIENCE AND TECHNOLOGY SECTOR

A Sector Often Ignored

The marine science and technology industry is not a sector traditionally associated with the ocean economy, partly because it is just beginning to be identified as an industry sector and partly because it is very difficult to separate out activities belonging to the industry from more traditional industrial groupings that involve substantial non-marine-related activities. The major components of the sector consist of instrumentation and equipment, marine services, materials and supplies, and ship and boat building and repair. While ship and boat building and repair and some components of instrumentation have been used in other studies of the ocean economy[34], the only other study to combine these sectors into a single industry is the recently released report on the industry (Barrow, Loveland, and Terkla, 2005).

Massachusetts has been identified as one of the top ten states in the nation with a high concentration of the marine science and technology industry (Barrow, Loveland, and Terkla, 2005). Moreover, it is the dominant state in New England in terms of the concentration of employment and economic activity related to this sector.

Despite the difficulties in identifying this industry using traditional datasets, it is an important industry for the ocean economy. All its components are key factors in several marine activities and industries, so omitting this sector underestimates economic activity related to the ocean. The marine instrument and equipment sub-sector consists of a number of cutting-edge, high-technology components that are important to marine activities. This includes instruments for use in oceanographic and geophysical research, such as current meters and magnetometers, and for use in remote sensing activities. This sector also includes the electronic instruments and platforms used for ship navigation, underwater research, and communications.

Another key sub-sector of this industry, and one often left out of ocean economy estimates, includes firms involved in marine services. They also include the design of the

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[34] Charles S. Colgan. *Employment and wages for the U.S. ocean and coastal economy* Monthly Labor Review, November 2004. U.S. Department of Labor, Bureau of Labor Statistics. < http://www.bls.gov/opub/mlr/mlrhome.htm>

software and systems required to run marine navigation equipment and for conducting marine monitoring. It also includes the marine engineering and consulting groups that involve both applied engineering and design related to particular marine research efforts or problems, as well as Geographic Information Systems (GIS) services, and testing and evaluation of instrumentation and other equipment used in the ocean environment.

The other two sub-sectors are more traditional industry sectors with fewer high-technology components, but these are still critical to the overall marine science and technology industry. Marine materials and supplies cover a variety of materials, such as paints, engines, riggings, and machinery that outfit seagoing vessels designed for commercial and research purposes. This sub-sector also includes supplies for onshore marine activities involving the offloading of vessels, such as packing and crating materials, as well as dockside maintenance materials. Another sub-sector, shipbuilding and design, is traditionally captured in estimates of the ocean economy because traditional SIC (and now NAICS) codes adequately separate out much of the economic activity in this sector.

Another sector that belongs to the marine science and technology cluster is marine research and education. Many higher education institutions in Massachusetts as well as a variety of research institutes are actively engaged in studying the marine environment. This involves research in disciplines such as oceanography, physics, marine engineering, and chemistry, as well as teaching in these areas and some interaction with the private sector involving technology transfer and problem solving. Much of the support for these activities comes from government grants and contracts; however, since most of this activity is subsumed within the university sector or the general category of "consulting," it is very difficult to separately identify economic activity for which marine research is largely responsible. As a result, this sector is not identified in the estimates produced for the input-output analysis, but it will be discussed as a separate sector based on a survey conducted by the Donahue Institute in late winter of 2006.

Interactions among the Sub-Sectors

Each of these sub-sectors has been identified as a cluster of industries that are closely related to one another, but there is also some interaction among the sub-sectors. Marine materials are important for the shipbuilding sector and also can be involved with the instrumentation and equipment sector, particularly as a source of component parts for some of the complex marine research equipment. The instrumentation sector is a key supplier to the onboard ship equipment sector and also interacts with the marine research and education sector by developing niche instruments for particular niche research tasks or activities related to defense or commerce, and by using the research sector to help test new equipment ideas. Finally, marine services often interact with the instrumentation and equipment sector on projects involving research and design and this also sometimes involves the marine research and education sector.

These interactions reinforce the perception of this sector being an industrial cluster. There are interdependencies among firms in different industries within the cluster as well as competition among some firms in this sector.

Lack of Water Dependence

While all of the sub-sectors of the marine science and technology sector are closely connected with ocean economic activities, none of them is particularly dependent on a waterfront location. The shipbuilding sub-sector benefits the most from immediate access to coastal waters. However, most of the research and manufacturing activities in the sector can be conducted anywhere, although in some cases the closeness of a natural marine laboratory is a benefit. There are no major water dependent components of the two largest sub-sectors, instrumentation and equipment and marine services, and therefore their importance to the state's coastal economy is not likely to be as high as their overall connection with the state's ocean economy.

Size of the Sector and Sub-Sectors

The Marine Science and Technology sector is the second smallest of the marine economy sectors in terms of number of firms (184) and number of employees (5,055), but it generates the highest average wages. Average wages are $82,829 compared to a state

average wage of $48,934 (see Figure 36 – Sector Establishments, Employment and Wages by NAICS) and an average wage in the marine industry of $28,263 (see Figure 36). It is the Instrument and Equipment and Marine Services sub-sectors that are responsible for the high wages. The other two sub-sectors have average wages that are below the state average.

Figure 36—Sector Establishments, Employment and Wages by NAICS, Massachusetts 2004

Marine Science and Technology Industry by NAICS, 2004					
2002 NAICS	Description	Establ	Empl	Wages	Ave. Wages
	Total Marine in Massachusetts	10,955	152,441	$ 4,308,400,235	$28,263
Marine Science and Technology		**184**	**5,055**	**$ 418,699,680**	**$ 82,821**
Sub-sector 1 - Instrumentation and Equipment		**11**	**1,441**	**$ 126,465,634**	**$87,786**
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing (part)	10	1,393	$ 123,234,690	$88,485
334519	Other Measuring and Controlling Device Manufacturing (part)	1	48	$ 3,230,944	$67,452
Sub-sector 2 - Marine Services		**107**	**2,985**	**$ 265,399,985**	**$88,914**
541330	Engineering Services (part)	33	445	$ 34,957,444	$78,549
541710	Research and Development in the Physical, Engineering, and Life Sciences (part)	74	2,540	$ 230,442,541	$90,730
Sub-sector 3 - Marine Materials and Supplies		**10**	**140**	**$ 6,596,269**	**$47,109**
325510	Paint and Coating Manufacturing (part)	2	62	$ 3,564,550	$57,234
336399	All Other Motor Vehicle Parts Manufacturing (part)	7	75	$ 2,935,535	$39,036
333120	Construction Machinery Manufacturing (part)	0	3	$ 96,184	$37,868
Sub-sector 4 - Ship and Boat Building and Repair		**56**	**490**	**$ 20,237,793**	**$41,308**
326199	All Other Plastics Product Manufacturing (part)	0	2	$ 107,181	$42,874
336611	Ship Building and Repairing	13	195	$ 8,155,194	$41,822
336612	Boat Building	38	250	$ 8,788,168	$35,153
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers (part)	5	42	$ 3,187,251	$75,136

NOTE - In rows marked "part" allocation formulas have been used to adjust original data. See Appendix 3 for details.
Source: Mass. DUA, ES-202, 2004

Of the 5,055 employees in the sector, 59 percent is employed in the Marine Services sub-sector, which also includes 58 percent of the firms and 29 percent is employed in the Instrument and Equipment sub-sector, which only includes 6 percent of the firms. The next largest sector in terms of employment is Ship and Boat Building and Repair (9 percent) followed by Marine Material and Supplies (3 percent).

Impact of the Sector on the State Economy

The Marine Science and Technology sector has the second highest employment multiplier of all the sectors (2.27). Thus, for every job generated in this sector, an additional 1.27 jobs are generated in the state economy. This is reflective of the significant high value-added, high-wage sub-sectors, which generate large amounts of local buying power and thus additional demand for goods and services within the state, which in turn results in additional jobs to provide these goods and services. Thus, this sector creates 11,481 jobs in the state, including the 5,055 directly employed by the industry. Also, the overall output multiplier for this sector is the highest of any (1.96)

again reflecting the high value-added products produced by this sector (Figure 37). This sector generates a total output value of almost $1.16 billion for the Commonwealth.

Figure 37—Economic Impacts of the Sector, Massachusetts, 2004

Marine Science and Technology Impacts						
Employment Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Marine Science and Technology	5,055	5,055	2,348	4,078	11,481	2.27
Total Marine Industry	**152,441**	**152,441**	**30,072**	**41,324**	**223,836**	**1.47**
Output Impact	**Input**	**Output**				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Marine Science and Technology	5,055	589,664,057	257,942,625	309,937,261	1,157,543,944	1.96
Total Marine Industry	**152,441**	**8,688,967,880**	**2,885,514,735**	**3,228,472,976**	**14,802,955,591**	**1.70**

Source: Mass. DUA, ES-202, 2004. IMPLAN analysis by the authors.

The Marine Research and Education Sub-Sector

As noted below, the estimates of output are very conservative because the ES-202 datasets are not able to capture all of the economic activity in most of the sub-sectors without including a lot of non-marine related activity. Therefore, only the NAIC sectors that are almost entirely marine-related are included in the analysis. These estimates are also quite conservative because they do not include the marine research and education sub-sector. This is because this sector is largely subsumed in higher education institutions and other research centers. The NAICS data for these sectors include all the activity generated in these sectors, which extends far beyond marine research. Therefore, there are no ES202 data that can accurately measure, or even approximate, the size of this sector.

However, by contacting all of the major higher education research institutions in the Commonwealth, we were able to identify specific marine research activities that were taking place in the institutions and the amount of grant monies and employees that were supporting this work as displayed in Figure 38 below.

Figure 38— Massachusetts Marine Science Research Awards 2004-2005 by Institution

Massachusetts Marine Science Research Awards 2004-2005 by Institution				
Organization	**Sponsored research awards 2004**	**Sponsored research awards 2005**	**# of Employees Current Full-Time**	**# of Employees Current Part-Time**
Massachusetts Institute of Technology	$32,593,624	$15,538,433	34	0
Woods Hole Oceanographic Institute	$108,600,000	$104,500,000	677	80
Northeastern University	$54,759	$274,889	23	
University of Massachusetts, Lowell	$96,000	$0	A	A
University of Massachusetts, Dartmouth; School for Marine Science and Technology (SMAST)	$4,000,000	$4,000,000	A	A
University of Massachusetts, Boston	$1,750,000	$1,750,000	A	A
University of Massachusetts, Amherst	N/A	N/A	A	A
University of Massachusetts Intercampus Graduate School of Marine Science and Technology	N/A	N/A	91	0
New England Aquarium	$2,240,617	$2,116,052	196	66
Harvard University	$447,553	$724,628	9	0
Boston University	$1,926,304	$694,391	13	43
Southeastern Massachusetts Aquaculture Center	$17,500	$35,000	4	0
Northeastern Massachusetts Aquaculture Center	N/A	N/A	4	0
Marine Biological Laboratory (B)	$18,650,555	$18,650,555	261	29
TOTAL	**$170,376,912**	**$148,283,948**	**1,312**	**218**

Source: Original Research by the UMass Donahue Institute, February / March 2006

A - Faculty in marine science at the four campuses of the University of Massachusetts are counted under the inter-campus Marine Science program.

B - The funding amount for Marine Biological Laboratories - $37,301,110 - represents two years of funding. Separate data for 2004 and 2005 were unavailable The amount reported is the average for each year.

Note—The study team made every effort to obtain data from the departments listed in this table. Given that there is no centralized source of information on marine science department funding in Massachusetts and no list of appropriate administrative contacts for this information, it is possible, that we missed accounting for some marine research funding.

Overall, the sponsored marine research[35] ranged from over $170 million in 2004 to around $148 million in 2005, and involved the employment of 1,312 full-time and 218 part-time workers. When the grant money for 2004 generating this activity is run through the IMPLAN model, it indicates that this sector generates over $250 million in state economic activity and accounts for total employment of 2,361. This reflects an employment multiplier of 1.75 and an output multiplier of 1.46. Interestingly, based on the amount of direct grant activity generated, the model predicts the number of direct employees in this sector based to be 1,348, remarkably close to the number of employees we determined to be in this sector from survey data.

[35] 'Sponsored research' refers to outside grants received by the campuses from federal, state or private sources.

Trends in the Sector and Future Prospects

Although part of the Marine Science and Technology sector is dependent on federal grant monies and demands for defense products, much of the sector is somewhat insulated from the vagaries of federal expenditures. Much of the Instrument and Equipment sub-sector is built on an extremely diverse base of high-technology production in the Commonwealth.[36] Many of the firms engaged in marine applications of these materials are also able to serve many other sectors requiring similar products and many of them are diversified into other sectors. Likewise, the other major sub-sector, marine services, also has a much diversified clientele. Both of these sub-sectors are made up of many firms that service worldwide markets, thus insulating them from fluctuations in regional and national demands for their products. Some firms in the marine materials sub-sector are also involved in international markets, but most firms are fairly closely tied to domestic or regional firms that purchase their products and thus are more vulnerable to demand fluctuations. The most vulnerable sector is shipbuilding and repair because the producers of larger vessels are heavily dependent on navy contracts. Some firms are involved in the recreational sector; however, their business tends to fluctuate with national economic cycles, falling during recessions when people spend less on recreational activities and rising during expansionary periods.

Future prospects are looking quite bright for the more high technology-oriented firms in the industry as homeland security needs and funding expand. There are many applications to coastal security issues that are likely to require new instruments, underwater vehicles, and research and analysis of ocean currents and mapping of the sea floor. Foreign expansion of naval military forces has also increased demand for many of these firms' services. Likewise, many of these industries are involved in supplying the oil and gas industries and offshore production and research is increasing around the world. In addition, there is an expanding interest on the part of many governments in better understanding ocean processes, particularly their interaction with meteorological

[36] We know from previous research that a number of high-tech business sectors develop products and services for marine and non-marine markets. The most common industry codes of these businesses are, in the SIC system: 3812 – Search and navigation equipment; 3699 Electrical equipment and supplies, not elsewhere classified; 3663 Radio and TV communications equipment; 3625 Relays and industrial controls.

processes, and their impact on the world environment, particularly global warming issues. The Massachusetts sector is particularly well-positioned to garner much of the research dollars directed at these issues and the eventual commercial applications of equipment and instruments developed in the process of carrying out this research.

Limitations of Methodology/Data

As briefly noted earlier, ES202 data, even at the six-digit NAIC level, is unable to fully capture the Commonwealth's Marine Science and Technology Industry. This is because many of the firms in this sector are quite new and have developed marine applications of their products that were initially designed for non-marine markets. As a result, many firms that have some involvement in the Marine Science and Technology sector still have NAICS classifications that apply to non-marine areas or more generic high technology applications. This is a particular problem with the instrument and equipment sub-sector. In addition to this problem of fully identifying all marine related activity, as noted previously, it is not possible using six-digit NAIC classifications to identify marine research and education activity carried out within universities or other research institutions.

Therefore, the only way to develop a comprehensive view of this sector is to conduct a separate industry study, such as was recently completed by the Donahue Institute (Barrow, Loveland, and Terkla, 2005). Such a study involved developing a comprehensive list of all firms in a variety of sectors that had some aspect of their production related to Marine Science and Technology. This required the use of a proprietary database that enabled eight-digit industry designations. Even then, this study was forced to categorize firms by their relative intensity of involvement in the Marine Science and Technology sector based on interviews, examination of web pages, and other primary sources, in order to weight the overall employment figures to reflect a more accurate count of employment involved in marine activities. Thus, firms were divided into those with greater than 50 percent of marine related activity, those with 50 to 25 percent of their businesses devoted to marine activity, and those with less than 25 percent of their businesses involved in marine-related production.

The end result was an estimate of Massachusetts employment in the Marine Science and Technology sector of 8,863. Note that this is approximately 61 percent above the more conservative estimates used in this study from available ES-202 data and almost 40 percent greater than the estimate used in this study for the input-output analysis combined with the marine research and education sector estimate. Therefore, the estimates of the impact this industry on the state's economy developed here are very conservative and considerably below the more comprehensive estimates of 22,396 jobs and $2.9 billion in annual output developed in the Donahue Institute study (Barrow, Loveland, and Terkla, 2005).

MARINE-RELATED CONSTRUCTION AND INFRASTRUCTURE

General Sector Description

Marine-Related Construction and Infrastructure is the second largest sector of the Massachusetts marine industry after Coastal Tourism and Recreation. The sector includes heavy construction like coastal and offshore infrastructure, administration of management programs, as well as the development of coastal real estate. As the state's needs change, the sector's role in the economy will also change. Current trends suggest that Marine-Related Construction and Infrastructure will likely continue to be a larger sector in the marine-related economy. However, the actual market value of this development is not directly included in the assessment, only the impacts of related establishments, employees and wages are included.[37]

Even though Marine Construction and Infrastructure is the industry's second largest sector, it only accounts for 17 percent of the industry's establishments state-wide. In addition, it only generates about 10 percent of the state's entire marine industry employment. However, the wages per employee ($65,013) are about twice the industry average ($28,263).

Offices of real estate agents and brokers are the largest piece of the Marine Construction and Infrastructure sector. This component of the sector has the most establishments (985), most employment (5,025) and highest wages ($400,384,476); it comprises almost half of the whole sector's establishments (1,851), employees (14,596) and wages ($948,937,697). On the other end of the spectrum, there is no sector component that can be defined as the smallest contributor in terms of establishment, employment, and wages.

[37] The methodology in this report uses real estate-related activities within the coastal zone as a proxy for coastal real estate development. However, it must be noted that a proportion of real estate activity in the coastal zone is not necessarily related to proximity to the sea. See *Part II Methodology: Impact Analysis* for details.

Figure 39—Marine-Related Construction and Infrastructure Establishments, Employment and Wages by NAICS, Massachusetts, 2004

Marine-Related Constrction and Infrastructure Industry by NAICS, 2004				
2002 NAICS	Description	Establishments	Employment	Wages
	Total Marine in Massachusetts	10,955	152,441	$4,308,400,235
Marine-Related Construction and Infrastructure		**1,851**	**14,596**	**$948,937,697**
237990	All Other Heavy Construction (part)	23	147	$7,941,805
924110	Administration of Air and Water Resource and Solid Waste Management Programs (part)	28	3,268	$213,541,624
Coastal Real Estate Development		**1,800**	11,181	**$727,454,268**
531210	Offices of Real Estate Agents and Brokers	985	5,025	$400,384,476
531311	Residential Property Managers	371	3,578	$151,562,415
531312	Nonresidential Property Managers	161	1,517	$122,809,332
531320	Offices of Real Estate Appraisers	79	236	$15,425,300
531390	Other Activities Related to Real Estate	60	142	$15,286,369
812220	Cemeteries and Crematories (part)	39	310	$12,276,997
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)	105	373	$9,709,379

NOTE - In rows marked "part" allocation formulas have been used to adjust original data. See *Appendix 3* for details.
Source: Mass. DUA, ES-202, 2004

Water resources and solid waste management programs represent the second smallest piece of the sector in terms of establishments (28). Yet, the number of people that the programs employs (3,268) is almost equal to that of residential property managers (3,578), which is among the top three contributors to this sector. Moreover, total wages paid to the employees of these programs is about $50 million more than the wages paid to residential property managers.

Not surprisingly, the coastal communities support more of the marine-related infrastructure than inland communities. About 98 percent of the sector's establishments and 75 percent of the sector's employment and wages are generated in the state's coastal communities. Heavy construction as well as water resource and solid waste management programs are the only two components of this sector that are not part of the state's coastal economy in their entirety.

Coastal real estate development is the only sub-sector of marine-related infrastructure. The coastal real estate development sub-sector accounts for almost 100 percent of the sector's establishments and 76 percent of its state-wide employment. All of the coastal real estate development's establishments and employment are found in the state's coastal communities.

Figure 40—Marine-Related Construction and Infrastructure, Establishments, Employment and Wages in the Coastal Zone, Massachusetts, 2004

Costal Marine-Related Construction and Infrastructure Industry by NAICS, 2004				
2002 NAICS	Description	Establishments	Employment	Wages
	Total Marine in Massachusetts	10,384	140,206	$3,520,506,174
Marine-Related Construction and Infrastructure		**1,809**	**11,246**	**$731,287,167**
234990	All Other Heavy Construction	9	65	$3,832,899
Coastal Real Estate Development		**1,800**	**11,181**	**$727,454,268**
531210	Offices of Real Estate Agents and Brokers	985	5,025	$400,384,476
531311	Residential Property Managers	371	3,578	$151,562,415
531312	Nonresidential Property Managers	161	1,517	$122,809,332
531320	Offices of Real Estate Appraisers	79	236	$15,425,300
531390	Other Activities Related to Real Estate	60	142	$15,286,369
812220	Cemeteries and Crematories (part)	39	310	$12,276,997
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)	105	373	$9,709,379

Source: DUA, ES-202, 2004

Dynamics within the Sector and Among Other Sectors

Marine-Related Construction and Infrastructure is the backbone for much of the marine industry. Homes where people live, the channels which allow vessels to bring in goods, and beaches for people to vacation on are created by this sector. This sector provides the capacity for other areas of the marine economy to grow.

As the coast becomes more and more developed, local municipalities as well as private property owners will want to protect their real estate. Infrastructure and armoring projects like beach nourishment and construction of sea walls or jetties will become even more popular. In addition, dredging projects like the proposed deepening of Boston Harbor's channel would allow the port to accommodate larger vessels carrying a larger volume of goods.

General Water Dependence

As noted above, this sector generally includes heavy construction activities like coastal and offshore infrastructure, administration of management programs as well as the development of coastal real estate. It is not necessary for all of the sector's establishments to be located along the water. Coastal infrastructure and construction, such as pipelines, are definitely water dependent, but components of coastal real estate development are not necessarily water dependent. Ironically, only about half of the sector's heavy construction establishments and employment are located in coastal communities. In this study, coastal real estate qualifies as such by its geographic

proximity to water (e.g. location within a town with a coastline), but real estate itself does not have to be directly adjacent to the water to benefit from increased value due to coastal proximity. Likewise, real estate offices and property managers are not dependent on a location adjacent to the water. But while offices and managers may not be dependent on a waterfront location, they may benefit from enhanced business by locating in a coastal community near the development.

Impacts on the Economy

Marine-Related Infrastructure and Construction is the second largest contributor to the marine industry's employment. However, its employment contribution only accounts for 12 percent of total employment generated by the industry. Almost half (11,941) of the total employment (26,537) is indirect and induced. The state's employment is not particularly sensitive to changes in Marine-Related Infrastructure, relative to other marine sectors. A sector multiplier of 1.82 predicts that with the loss of one job in the sector, the state would lose 0.82 jobs in another industry.

Figure 41—Economic Impacts of the Sector, Massachusetts, 2004

Marine-Related Construction and Infrastructure Impacts						
Employment Impact	**Input***	**Output****				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Marine-Related Construction and Infrastructure	14,596	14,596	5,038	6,903	26,537	2
Total Marine Industry	**152,441**	**152,441**	**30,072**	**41,324**	**223,836**	**1.47**
Output Impact	**Input***	**Output****				
	Employment	**Direct**	**Indirect**	**Induced**	**Total**	**Multiplier**
Marine-Related Construction and Infrastructure	14,596	1,823,174,648	457,212,492	563,115,087	2,843,502,266	2
Total Marine Industry	**152,441**	**8,688,967,880**	**2,885,514,735**	**3,228,472,976**	**14,802,955,591**	**1.70**

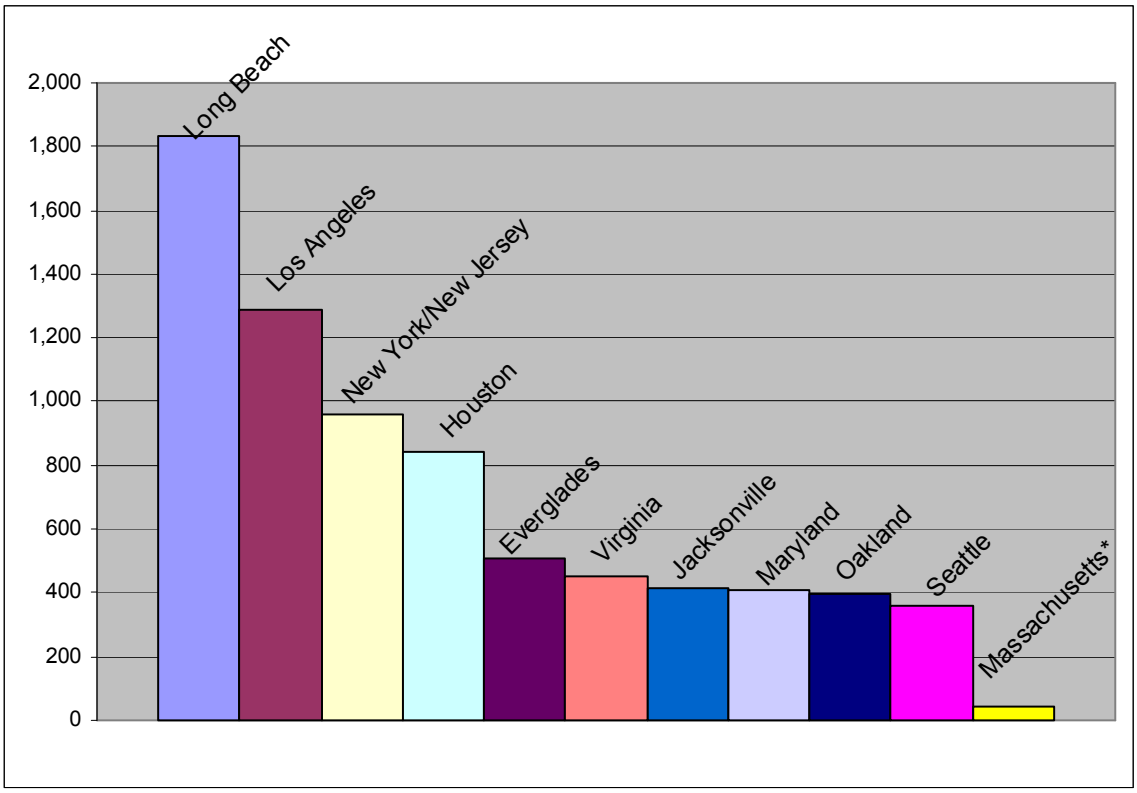
Source: DUA, ES-202, 2004; Mass. Division of Fisheries, Shellfish Sanitation Management Project

Marine-Related Construction is the second largest sub-sector in terms of total economic output, but only contributes 19 percent of the total marine industry's economic output. The state is least responsive to changes in this sectors economic output or production. The sector's multiplier predicts that for one dollar lost in the sector, the state economy will lose 0.56 dollars, which is below the marine industry average loss of 0.70 dollars.

Additional Trends

The Massachusetts Port Authority will spend a projected $42 million dollars of capital on marine expenditures between 2004 and 2008. Among the nation's largest ports is Long Beach in California. For a comparison, this port is projected to spend almost $1,800 more than Massachusetts between 2004 and 2008 on its marine expenditures. Most of the $42 million will go towards buying a crane and installing runways at Conley Container Terminal along Boston Harbor. With the new crane and runways, the terminals capacity and efficiency will increase.[38] (Massport Bonds Report 2005)

Figure 42—United States Port Capital Expenditures FY 2004-2008 ($ millions)

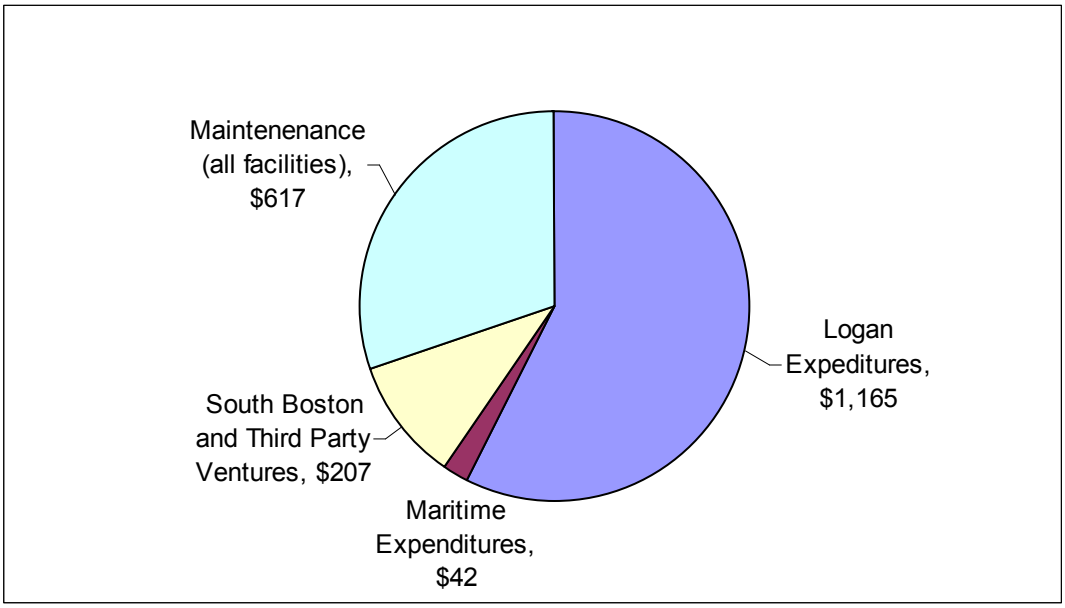


*Massachusetts Data is for FY2005-2009

Sources: Massport "2005 Bonds, Series A, B and C -- Official Statement", http://www.massport.com/about/pdf/c_2005os.pdf
US Port Development Expenditures Report, November 2005, http://www.marad.dot.gov/publications/ports.htm

[38] Massport "*2005 Bonds, Series A, B and C – Official Statement*" http://www.massport.com/about/pdf/c_2005os.pdf

Figure 43—Massport Capital Projects, FY2005-2009 ($ millions)



Source: Source: Massport "2005 Bonds, Series A, B and C -- Official Statement"

In the coming years, the Massachusetts Port Authority expects to see an increase in revenues from port real estate as well as an increase in operating expenses at port facilities. Both increases are expected to be slightly higher than the average rate of increases. In 2004, the Massachusetts Port Authority saw significant increases in rent from some of its coastal real estate properties. These increases stemmed from the renewal of old leases as well as more intensive uses of the land[39] (Massport Bonds Report, 2005).

Trends Impacting the Sector's Future

Available funding for construction and maintenance will greatly influence this sector. Funding for port development comes from a wide variety of sources including proceeds from passenger facility charge bonds, federal grants, transportation security admonition grants, private capital sources, and cash flow from port operations[40] (Massport Bonds Report, 2005). Since the Massachusetts Port Authority does not have

[39] Massport *"2005 Bonds, Series A, B and C – Official Statement"* http://www.massport.com/about/pdf/c_2005os.pdf
[40] Massport *"2005 Bonds, Series A, B and C – Official Statement"* http://www.massport.com/about/pdf/c_2005os.pdf

the authorization to use tax money or in any way create debt for the state, its funding sources are very important.

In the future, storms and other natural hazards may also influence this sector. More and more people are moving to coastal communities. As more people settle along the coast, there is more construction and infrastructure for storms to damage. The occurrence of natural hazards could induce a surge of construction. The heavy construction component of this sector refers to new construction, reconstruction, rehabilitation, and repairs. The number of establishments and employees in the heavy construction component may not change, but they may be transferred from construction to reconstruction or rehabilitation. While the type of construction may not matter in terms of quantification, it could be important to understanding changes in the quantification.

Lastly, when coastal communities begin to reach their build-out potential, Marine-Related Construction and Infrastructure may be impacted. On Cape Cod, for example, an analysis conducted in 2000 revealed that with no additional growth or land management efforts and current population growth rates, the Cape would reach its build-out potential by 2030[41] (Barnstable County Regional Policy Plan 2003). Although many communities have undertaken both growth and land management efforts, when they do finally reach their build-out potential, the coastal real estate development sub-sector will undoubtedly be affected.

In future, the Marine-Related Infrastructure sector will likely assume a stronger role in shore protection projects. Of the many types of shore protection projects, beach nourishment and the construction of seawalls, groins, and jetties – for example – are already popular. Regardless of their efficiency, with a rising sea level and increases in coastal development, an increase these protection projects such as replacement and armoring techniques is likely.

With an increase in beach nourishment projects, there will likely be an increase in offshore dredging research as well as tourism and recreation. As noted above, dredging already plays a role in the Marine Transportation sector, as it allows for the continued

[41] *Cape Cod Regional Policy Plan: Barnstable County, MA.* Approved by the Cape Cod Commission. Effective September 10, 2003. <http://www.capecodcommission.org/RPP/RPPrev2003.pdf>

functioning of and increasing capacity of ports. Beach nourishment requires not only clean sediment, but also aesthetically pleasing sources similar in grain size to the site's original grain safe for recreation. Therefore, increases in beach nourishment could indirectly create and induce employment as well as economic output in other marine sectors.

As nonrenewable natural resources are used up and traditional energy becomes more expensive, there could be an increase in the construction and infrastructure related to renewable energy sources. Also, construction and infrastructure related to alternative water sources may become more prevalent as aquifers are polluted or depleted. Already, a wind farm has been proposed for Nantucket Sound. In addition, a proposal for a desalination plant on the Taunton River in Dighton was currently in the permitting process at the time of writing.

Method and Data Limitations

One limitation is that there is not enough detail in the six-digit NAICS codes to accurately differentiate between marine-related and other categories. In some cases, like the All Other Heavy Construction and Administration of Management Program categories, multipliers will be used to calculate the proportions that are marine-related. However, in categories like All Other Heavy Construction, it may be useful in the future to know the proportion that is related to shore protection, for example.

A second limitation is that the origination of employment is not known. This would be important in looking at the economic output from the Marine-Related Construction and Infrastructure sector. It is likely that at least a measurable amount of the employment generated by construction and engineering in coastal communities sustains commuters from inland communities. When the direct economic output from construction employees is used in the IMPLAN model for coastal Massachusetts, the economic output may be overestimated.

Part VI – Survey of Marine Economy Businesses

In May 2006, the study team conducted a survey of marine economy businesses to provide additional insight into the economic conditions and impact of the marine-related sectors on the Massachusetts economy.

For the survey, UMDI interviewed 548 businesses from marine-related establishments located throughout Massachusetts including coastal tourism and recreation establishments located within the coastal zone (as defined in the methodology section of *Report I*). Businesses were interviewed by telephone between May 18 and May 24, 2006. The establishments were randomly selected from lists of businesses by sector, with the final proportion of sectors in the sample representative of the actual distribution of marine and coastal tourism establishments in the state.

Methodology

The survey was conducted by telephone from May 18 to May 24, 2006. The survey includes a total of 548 valid responses from a total number of 3,503 phone calls, a response rate of 15.6%[42]. The survey respondents were randomly chosen from a list of contacts organized by sector. The total number of respondents needed from each sector was based on the distribution of businesses by sector in the total marine economy in Massachusetts. In other words, if 14 percent of all marine economy businesses are in the *Commercial Seafood Industries* sector, every attempt was made to ensure that approximately 14 percent of survey respondents would be from the *Commercial Seafood Industries* sector. UMDI prepared the list of business contacts by drawing lists of businesses by sector from the Dun and Bradstreet MarketPlace database.

The survey results are scientifically-valid at a 95 percent confidence interval, though a word or two about the interpretation of the results is in order. Overall, the survey has a margin of error of plus or minus 4.7 percent. This is within the standard margin of error of most professional surveys and should be interpreted as meaning that the survey results, when generalized to the total population of marine economy businesses in Massachusetts, fall into a range from 4.7 percent below the reported figure to 4.7 percent above the reported figure.

[42] A breakdown of the disposition of these phone calls can be found in Appendix 7.

Description of Businesses Surveyed

The establishments included in this survey conduct business in five sectors: *Coastal Tourism and Recreation, Commercial Seafood Industries, Marine Transportation, Marine Science and Technology, and Marine-Related Construction and Infrastructure*. As in the marine and coastal economy as a whole, the majority of establishments in the sample were in the *Coastal Tourism and Recreation* sector (74.8 percent of all businesses). The *Commercial Seafood* sector was the next largest, with 13.3 percent of the sample, followed by the *Marine Science and Technology* sector (8.2 percent), the *Marine Transportation* sector (2.9 percent) and the *Marine-Related Construction and Infrastructure* (.7 percent or four establishments).

The surveyed businesses are primarily small businesses with fewer than 50 employees. Over 90 percent of businesses reported employing fewer than 50 people, with 51 percent reporting fewer than 10 employees. The sample included 36 businesses with 50 to 99 employees and 15 businesses with 100 to 499 employees. The larger establishments were distributed between the *Coastal Tourism and Recreation*, *Commercial Seafood Industries* and *Marine Sciences and Technology* sectors.

Description of Business Conditions

UMDI asked two sets of questions regarding the economic condition of marine economy businesses. The first set of questions explored how employment has changed over the past 12 months and is likely to change over the next 12 months. The second set of questions asked how revenue has changed over the past 12 months and how it is expected to change over the next 12 months. According to the survey, the employment expectations of marine economy businesses are stable and consistent across sectors. Over two-thirds of businesses report no employment growth for the past 12 months (67.2 percent) while nearly two-thirds of businesses have no expectation of increased employment over the next 12 months (63.3 percent). Nearly one-quarter of businesses increased employment during the past 12 months (24.5 percent) while over one-quarter of businesses expect to increase employment during the next 12 months (26.6 percent).

While most businesses did not expect employment to change appreciably during the next 12 months, the majority of businesses are quite optimistic that revenues will

increase during the next 12 months. Nearly two-thirds of businesses (65.5 percent) expect revenues or sales to increase during the next 12 months. In contrast, only 32.6 percent of businesses reported revenue or sales growth during the past 12 months. In general, businesses reported stable or positive sales/revenue growth conditions, with 37.5 percent of those interviewed reporting stable sales or revenue during the past 12 months. Very few businesses (6 percent of the total) expect revenues or sales to decline over the next 12 months, with 20.5 percent of businesses expecting sales/revenue to stay the same. There was no significant variation in the recent sales or revenue experience between sectors or the expectation of revenue growth.

Supplier, Customer and Labor Markets Conditions

The next series of questions in the survey dealt with the geographic distribution of supplier and customer relationships, as well as the primary labor market from which businesses recruit employees. The purpose of the questions was to explore manner in which businesses in the marine economy support and rely upon the local and state businesses and workers.

Supplier Relationships

The vast majority of marine and coastal businesses purchase supplies primarily from businesses located in Massachusetts (80.3 percent). Only 19.7 percent of businesses purchase goods primarily from outside of Massachusetts, while 44.1 percent of businesses purchase supplies primarily from within 25 miles of their location (23.8 percent in their community, 20.3 percent outside of the community but within 25 miles).

The high percentage of local and state business relationships should not be over-interpreted: many firms no doubt purchase supplies from local companies that are, in fact, grown or produced out-of-state. The *Marine Science and Technology* and *Commercial Seafood Industries* sectors were far more reliant on out-of-state suppliers than the other marine and coastal sectors. A majority of *Marine Science and Technology* companies (54.8 percent) primarily rely upon out-of-state suppliers while 31.1 percent of *Commercial Seafood* companies primarily rely upon out-of-state suppliers. No marine and coastal sectors reported a significant problem gaining access to suppliers.

Customer Relationships

If their supplier relationships are primarily local and regional, the marine and coastal economy businesses draw a significant percentage of their customers from outside of their region and out-of-state. Close to 30 percent of the respondents reported primarily drawing their customers from the community in which the business is located, while 16.5 percent of customers came from within a 25 mile radius of the business, 18.6 percent from outside of the region but within Massachusetts, and 35 percent outside the state.

Though all sectors rely upon out-of-state or international markets to some extent for sales, the *Marine Sciences and Technology* sector was notably reliant on national and international customers for sales. Overall, 66.6 of *Marine Science and Technology* businesses primarily rely on out-of-state or international customers, with 9.5 percent primarily relying upon international customers. The survey respondents did not report any significant problems gaining access to customers.

Labor Market Conditions

The marine economy businesses interviewed for the survey overwhelmingly recruit workers from within their community (70 percent) and the region (17.2 percent). The majority of businesses in all sectors reported recruiting workers locally. Over two-thirds of establishments (68.5 percent) did not report any problem finding skilled workers, though there is significant variation between sectors. Between 63 and 70 percent of businesses in the *Coastal Tourism and Recreation*, *Commercial Seafood Industries* and *Marine Transportation* sectors reported no problem finding skilled workers. The *Marine Science and Technology* and *Marine-Related Construction and Infrastructure* sectors were roughly evenly divided between companies that reported having problems recruiting skilled workers and those that did not report a problem.

It is significant that a minimum of 30 percent of businesses across sectors report problems recruiting sufficiently-skilled employees, including sectors that do not demand a high-number of skilled workers. In the survey questions, "skilled worker" was self-defined by respondents. In fact, 10.5 percent of all businesses surveyed reported that it is a "big problem" finding skilled workers. Companies in the *Marine Science and Technology* (19 percent) and *Coastal Tourism and Recreation* (11.2 percent) sectors

reported particular problems finding skilled workers. Most businesses attributed recruiting issues to the lack of skilled-labor or "other" factors. Most businesses did not attribute their difficulty recruiting workers to the cost of housing.

Potential Business Issues or Problems

The final section of the survey assessed the impact of a set of potential business issues and problems on marine economy businesses. The questions, summarized below, asked the respondents to rate on a scale of 1 to 5 a series of potential problems that the business might have, with 1 being no problem and a 5 being a major problem. The potential problems included: access to capital; access to marine resources or submerged land; having suitable land for expansion; the cost of real estate; access to suppliers or partners; access to customers; having adequate harbor or port infrastructure; government regulations and permitting; access to broadband services; and availability of skilled workers. The table below summarizes these response sorted in rank order from the problem area with the highest number of respondents identifying the issue as a significant or major problem (the sum of the 4 and 5 ratings).

Figure 44 – Survey Results: Business Problems

	Percentage of Respondents by Level of Concern with Problem Area					
Problem Area	Not at all a problem (1)	Slight Problem (2)	Moderate Problem (3)	More than Moderate Problem (4)	Major Problem (5)	Sum of 4 and 5
The Cost of Real Estate	36.1	6.3	12.3	7	38.3	45.3
Having Suitable Land for Expansion	57.6	7.3	8.2	4.1	22.7	26.8
Government Regulations and Permitting	52.1	12.5	12.7	7	15.6	22.6
Availability of Skilled Workers	55.3	10.4	16.5	6.1	11.8	17.9
Adequate Harbor or Port Infrastructure	67	10.4	8.1	4.9	9.6	14.5
Access to Marine Resources or Submerged Land	72.5	7.8	7.6	2.4	9.6	12
Access to Broadband Services	76.6	8.8	7.2	1.4	6.1	7.5
Access to Capital	68	12.4	12.8	2.4	4.3	6.7
Access to Customers	71.1	11.7	12.3	2.1	2.7	4.8
Access to Suppliers or Partners	73.6	13.3	9.6	1.6	2	3.6

Source: UMDI

Real Estate and Land Issues

As may be seen in the table, the cost of real estate is by far the most significant issue facing marine and coastal tourism businesses. A related issue, the availability of suitable land for expansion, was the next most significant problem for the survey respondents. The *Coastal Tourism and Recreation*, *Marine Transportation* and

Commercial Seafood sectors reported the biggest problem finding suitable land for expansion.

Marine Resources, Submerged Land and Harbor Infrastructure

In general, few businesses reported significant problems accessing marine resources or submerged land or finding adequate harbor or port infrastructure. A higher percentage of *Marine Transportation* businesses reported "more than a moderate problem" finding adequate harbor or port infrastructure or accessing marine resources or submerged land (25.1 and 18.8 percent, respectively). While the relatively small sample size for this sector means that this finding should be interpreted cautiously, it is suggestive. Additional outreach to *Marine Transportation* businesses would be required to confirm that these issues present major challenges for this sector.

Government Regulations and Permitting

Nearly one-half of the businesses surveyed (47.9 percent) reported some problem with government regulations and permitting. Companies in the *Marine Transportation* and *Commercial Seafood* sectors reported particular problems with government regulations and permitting. In general, firms did not report significant problems gaining access to capital and broadband services or customers and suppliers.

Methodological details and tabular results of the telephone survey can be found in *Appendix 7. Survey of Marine Economy Businesses: Methodology and Tabular Results*.

Part VII – Conclusion

The research presented in this report examines economic trends, issues and impacts of the coastal and marine economies in Massachusetts. In order to enhance the readability of the discussion in the main body of the report technical details related to the methodology are presented in *Part VIII—Appendices*. The research team hopes that this information is useful to our clients, the Massachusetts Office of Coastal Zone Management, and other persons interested in these sectors of the Massachusetts economy.

The time frame of this study presented some limitations to our ability to fully explore questions and methodological challenges that emerged over the course of the research. Certain questions emerging from the data findings would benefit from more in-depth and focused attention. Likewise, issues related to data availability and gaps, future application of methods used to determine allocation formulas, and additional methodological issues encountered in the study would benefit from additional attention. *Report II: Next Steps for Further Study* addresses these various issues and suggests approaches which might be taken in the future.

Part VIII– Appendices

APPENDIX 1. MARINE ECONOMY DEFINITION BY NAICS CODE

2002 NAICS Code	Description
Commercial Seafood Industries	
Sub-sector 1 - Fishing Supplies and Services	
11251	Animal Aquaculture
Sub-sector 2 - Commercial Fishing	
1141	Commercial Fishing
114111	Finfish Fishing
114112	Shellfish Fishing
114119	Other Marine Fishing
Sub-sector 3 - Seafood Processing and Wholesaling	
3117	Seafood Processing and Wholesaling
311711	Seafood Canning
311712	Fresh and Frozen Seafood Processing
424460	Fish and Seafood Merchant Wholesalers
Sub-sector 4 - Retail and Food Service Seafood Sales	
445220	Fish and Seafood Markets
454390	Other Direct Selling Establishments (part)
Marine Transportation	
48311	Deep Sea, Coastal, and Water Lakes Transportation
483211	Inland Water Freight Transportation
483212	Inland Water Passenger Transportation
487210	Scenic and Sightseeing Transportation, Water
4883	Support Activities for Water Transportation
532411	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing
Coastal Tourism and Recreation (all codes in this sector are measured within coastal zone geography only)	
Sub-sector 1 - Entertainment and Recreation	
713930	Marinas
713940	Fitness and Recreational Sports Centers
713990	All Other Amusement and Recreation Industries
711110	Theater Companies and Dinner Theaters
711190	Other Performing Arts Companies
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities
532292	Recreational Goods Rental

611620	Sports and Recreation Instruction
611699	All Other Miscellaneous Schools and Instruction
441222	Boat Dealers
Sub-sector 2 - Food	
722110	Full-Service Restaurants
722211	Limited-Service Restaurants
722212	Cafeterias
722213	Snack and Nonalcoholic Beverage Bars
722310	Food Service Contractors
722320	Caterers
722410	Drinking Places (Alcoholic Beverages)
Sub-sector 3 - Accommodations	
7211	Traveler Accommodation
721310	Rooming and Boarding Houses
721214	Recreational and Vacation Camps (except Campgrounds)
721211	RV (Recreational Vehicle) Parks and Campgrounds
487110	Scenic and Sightseeing Transportation, Land
561599	All Other Travel Arrangement and Reservation Services
Marine Science and Technology	
Sub-sector 1 - Instrumentation and Equipment	
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing (part)
334519	Other Measuring and Controlling Device Manufacturing (part)
Sub-sector 2 - Marine Services	
541330	Engineering Services (part)
541710	Research and Development in the Physical, Engineering, and Life Sciences (part)
Sub-sector 3 - Marine Materials and Supplies	
325510	Paint and Coating Manufacturing (part)
336399	All Other Motor Vehicle Parts Manufacturing (part)
333120	Construction Machinery Manufacturing (part)
Sub-sector 4 - Ship and Boat Building and Repair	
326199	All Other Plastics Product Manufacturing (part)
336611	Ship Building and Repairing
336612	Boat Building
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers (part)
Marine-Related Construction and Infrastructure	
237990	All Other Heavy Construction (part)
924110	Administration of Air and Water Resource and Solid Waste Management Programs (part)
Coastal Real Estate Development (all codes within this subsector measured within coastal zone geography	

only)	
531210	Offices of Real Estate Agents and Brokers
531311	Residential Property Managers
531312	Nonresidential Property Managers
531320	Offices of Real Estate Appraisers
531390	Other Activities Related to Real Estate
812220	Cemeteries and Crematories (part)
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)

* NAICS codes marked *part* are measured using an allocation formula (See Appendix 3. Methodology: Industry Code Conversion)

APPENDIX 2. ECONOMIC IMPACT ANALYSIS DEFINITIONS

The method used in this study to calculate economic impacts is an input-output analysis, conducted using IMPLAN Professional software[43]. Input-output models estimate the level of economic exchange between various industries in a local economy. This type of analysis measures the importance of an economic activity primarily in terms of output, employment, and personal (labor) income generated by that activity:

- *Output* is the value (sales) of goods and services produced.
- *Employment* is the number of people employed in the industry including wage and salary employees, full-time and part-time employees, and self-employed individuals.
- *Labor income* is the wages, benefits and proprietors' income derived from employment that is linked geographically to establishments in the marine industry.

Types of Impacts

Economic impacts include direct impacts, indirect impacts, induced impacts and total impacts. *Direct impacts* are the economic activities carried out at a business establishment or construction project and are therefore an immediate consequence of the economic activity that would not have occurred in the absence of the business establishment or construction project.

Indirect impacts derive primarily from off-site economic activities that are attributable to the identified business establishment. These economic activities occur mainly as a result of non-payroll expenditures by the business within a defined local area (e.g. town, city, county, metropolitan statistical area). Local expenditures include a range of operating expenses such as maintenance and repairs, business machines, etc. Indirect impacts differ in that they originate entirely off-site, although the indirect impacts would not have occurred in the absence of the identified business establishment. *Induced impacts* are the multiplier effects of the direct and indirect impacts created by successive

[43] Minnesota IMPLAN Group, Inc., IMPLAN System (data and software), 1725 Tower Drive West, Suite 140, Stillwater, MN 55082 www.implan.com

rounds of spending by employees and proprietors. *Total impacts* are the sum of direct, indirect and induced impacts.

Multipliers

The economic impact of new spending in an industry is typically a multiple of the actual investment because a portion of the dollars that are spent locally are then re-spent locally. Dollars that are not spent locally, but on goods and services produced elsewhere, are said to have "leaked" out of the local economy. These dollars do not have an opportunity to be locally re-spent and to create a "ripple" effect in the local economy.

In non-technical terms, "multipliers are …estimators of the 'ripple' effect". In more technical terms, "they are numerical coefficients which relate a change in (a component of aggregate) demand (or employment) to a consequent change in total income (or total employment).[44] The ratio of new income and spending dollars generated within the region to each initial new dollar of spending in the region is used to calculate a *multiplier*. A multiplier is a quantitative expression of the total amount of new spending generated in a local economy from each initial new dollar of spending. For example, in an industry sector with a multiplier of 1.38, $1.38 in new spending is generated from each initial new dollar spent in the industry.

Two types of multipliers are calculated in this study: *income multipliers* and *employment multipliers*. The employment multiplier works the same way as the income multiplier. If the number of new jobs created by an industry sector, is multiplied by the employment multiplier the result is the total new employment generated in the local economy.[45]

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[44] Analysis of Interdependence Structures: Input-Output
< http://faculty.washington.edu/~krumme/207/inputoutput.html#multiplier>

[45] Dr. Michael L. Walden. *Measuring How Much Economic Change Will Come to Your Community*. North Carolina State Cooperative Extension. < http://www.ces.ncsu.edu/resources/economics/change/>

APPENDIX 3. METHODOLOGY: INDUSTRY CODE CONVERSION AND ALLOCATION FORMULAS

Allocation Methodologies

The methodology for this study required the use of three different types of industry classification codes—SIC codes and NAICS codes as well as IMPLAN sector codes. The method required a sequence of translation from SIC code to equivalent NAICS code, and, finally, to equivalent IMPLAN code. The reasons necessitating this translation along with the process of translation are described in the sections below.

Conversion from SIC to NAICS Codes

To obtain data specific to the marine industry, we identified a set of four-, five- and six-digit NAICS codes corresponding to marine economy activities studied in two earlier reports done by the study team to quantify and describe the marine economy: *The Massachusetts Marine Economy* (Georgianna, 2000) and *The Marine Science and Technology Industry in New England* (Barrow, Loveland, and Terkla, 2005).

The coding system in these earlier studies was based on the dominant coding system at the time, the Standard Industrial Classification (SIC) system. For the current study, however, the study team decided to convert the previous definition to one based on the North American Industrial Classification System (NAICS), the system currently used to classify public data sets. For a number of reasons, this newer system provides a more accurate measure of current industries. For instance, the SIC system, developed in the 1930s and revised periodically over the past 50 years, is not based on a consistent economic concept: some industries are demand based while others are production based. The NAICS system, however, uses a consistent economic concept: establishments are grouped together based on their use of the same or similar processes to produce goods or services.

The SIC system had 1,004 industries of which 416 were service-related industries. The NAICS system includes 1,170 industries of which 565 are service-based industries. The NAICS system recognizes 358 new industries, 250 of which are service producing industries. This expansion of classification codes has created problems with 'cross-

walking' older SIC-based definitions to NAICS-based ones. Many NAICS codes cannot be closely matched with SIC and allocation formulas had to be developed from correspondence tables available at the U.S. Bureau of the Census website.

Method to Insure 70-100% Correspondence Between SIC and NAICS Codes

While translating between SIC and NAICS codes, we needed to ensure a close correspondence between the initial SIC codes and the new NAICS code. We consulted official SIC / NAICS 'bridge' tables to insure that the NAICS codes correspond closely—between 70 and 100 percent—with the SIC codes used in the previous studies.

The Census Bureau illustrates the correspondence between NAICS and SIC to facilitate efforts of statisticians and research teams. Bridge tables illustrate visually and mathematically the proportion of SIC codes within the new NAICS codes.[46]

Some NAICS codes match SIC codes exactly but other NAICS codes include only some part of a corresponding SIC code. For example, NAICS 334519 'Other Measuring and Controlling Equipment Manufacturing' corresponds with two SIC codes—a part of 3699 Electrical Equipment and Supplies, Not Elsewhere Classified and a part of 3829 Measuring and Controlling Devices, Not Elsewhere Classified. According to the Census Bureau Bridge Tables, a part of SIC 3699 is noted as D, which means that data for this code was withheld to avoid a disclosure. However, a part of 3829 SIC code is noted as 99%, which means that 99 percent of SIC code 3829 correspond with 334519 NAICS code.

Sometimes only a small percent of an SIC code corresponds with a NAICS code. In these cases, it is difficult to argue a direct correspondence between the two. Consequently, the study team made a decision to include in calculations only those SIC codes which correspond with NAICS codes in the range of 70 and 100 percent.

[46] U.S. Bureau of the Census bridge tables can be found through the following link: http://www.census.gov/epcd/ec97brdg/.

Method Used for Measuring Marine-Related Employment in NAICS Sectors Not Detailed Enough to Specify Marine-Related Activity

In some cases, NAICS codes were unable to provide the level of detail necessary to measure marine employment. For example, NAICS code 237990, 'All Other Heavy Construction', does not provide enough detail to specify marine construction activities within this broader code[47]. In cases like this one, we developed allocation formulas to estimate marine-related employment.

To create the allocation formulas, we used a private sector database which does provide detail on Massachusetts marine-related business activity within broader industry codes by using a classification system of eight-digit SIC codes[48]. We determined the allocation formula for marine employment in a NAICS code using the following process:

a) We identified Massachusetts marine businesses using D&B MarketPlace proprietary, marine-related eight-digit industry codes
b) We calculated the proportion of these marine-related business within the corresponding, broader four-digit SIC codes.
c) We applied the same ratio to the corresponding six-digit NAICS code and adjusted the employment data in that code according to the ratio.[49]

For example, the private database shows that SIC code 1629—Heavy construction, not elsewhere classified —has 2,313 employees in the state. Within that code, 364 employees (that is, 0.16 percent of employment in the four-digit code) work in SIC 1629-

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[47] **237990 Other Heavy and Civil Engineering Construction**
This industry comprises establishments primarily engaged in heavy and engineering construction projects (excluding highway, street, bridge, and distribution line construction). The work performed may include new work, reconstruction, rehabilitation, and repairs. Specialty trade contractors are included in this group if they are engaged in activities primarily related to engineering construction projects (excluding highway, street, bridge, distribution line, oil and gas structure, and utilities building and structure construction). Construction projects involving water resources (e.g., dredging and land drainage), development of marine facilities, and projects involving open space improvement (e.g., parks and trails) are included in this industry. Source: U.S. Census Bureau, 2002 NAICS Definitions at the following web link: http://www.census.gov/epcd/naics02/def/ND237990.HTM.

[48] We use Dun & Bradstreet's MarketPlace data set, a tool widely used for marketing and business research purposes in the private sector and in some public sector agencies. We have tested this data set against public data sets and have found it to match public data findings comparably and data are replicable over time.

49 In the data tables, NAICS codes in which such allocation formulas are used are marked 'part.'

0110—Marine construction. We apply the same ratio (0.16) to employment in the primary corresponding NAICS code, 237990, All Other Heavy Construction.

Method Used for Measuring Marine-Related Employment in Marine Science and Technology Sector

In cases where there was not enough detail in the MarketPlace database, we used findings from our previous research to determine allocation formulas.

We know from previous research that a number of high-tech business sectors develop products and services for marine and for non-marine markets. The most common industry codes of businesses producing marine technologies are, in the SIC system: 3812 Search and navigation equipment; 3699 Electrical equipment and supplies, not elsewhere classified; 3663 Radio and t.v. communications equipment; 3625 Relays and industrial controls. For these sectors, marine-specific activity codes do not exist. In these cases, we used employment data from a marine technology business list created in 2005[50] to calculate the proportion of marine-related business within broader four-digit SIC codes. We then applied these ratios to the corresponding NAICS codes to calculate employment numbers.

Translation of NAICS codes to IMPLAN sector codes

Finally, data categorized according to NAICS codes had to be translated into IMPLAN sector codes in order to be added to the modeling program. This process, along with our method of cross-walking between SIC and NAICS codes is summarized in the tables below.

1. **SIC-based Marine Economy Definition (uses four-, six-, eight-digit SIC codes)**

	SIC Code	Description
Commercial Seafood Industries		
Commercial Fishing		
	0912	Finfish
	0913	Shellfish
	0919	Miscellaneous marine products
Fishing Supplies and Services		
	0921	Fishing hatcheries and preserves

[50] *The Marine Science and Technology Industry in New England* (Barrow, Loveland, and Terkla, 2005).

Marine Aquaculture		
	0273	Animal aquaculture
Seafood Processing and Wholesaling		
	2077-00	Animal fats, oils, and meals
	2077-02	Marine fats, oils, and meals
	2091	Canned and cured fish and seafood
	2092	Prepared fresh or frozen fish and seafood
	5146	Fish and seafood
Retail and Food Service Seafood Sales		
	5421-00	Meat and fish markets
	5421-01	Fish and seafood markets
	5812-07	Seafood restaurants
Ship and Boat Building and Repairing		
	3731	Shipbuilding and repairing
	3732	Boatbuilding and repairing
Marine Transportation		
	4412	Deep sea foreign transportation of freight
	4424	Deep sea domestic transportation of freight
	4432	Freight transportation on the great lakes
	4449	Water transportation of freight
	4481	Deep sea passenger transportation, except ferry
	4482	Ferries
	4489	Water passenger transportation
	4491	Marine cargo handling
	4492	Towing and tugboat services
	4499	Water transportation services, not elsewhere classified
	4612	Crude petroleum pipelines
	4922	Natural gas transmission
Coastal Tourism and Recreation		
	4493	Marinas
	5551	Boat dealers
	5812-00	Eating places
	5812-01	Ethnic food restaurants
	5812-02	Ice cream, soft drink and soda fountain stands
	5812-03	Fast food restaurants and stands
	5812-04	Lunchrooms and cafeterias
	5812-05	Family restaurants
	5812-06	Pizza restaurants
	5812-08	Steak and barbecue restaurants
	5812-99	Eating places, not elsewhere classified
	5813	Drinking places
	7011	Hotels and motels
	7021	Rooming and boarding houses
	7032	Sporting and recreational camps

	7033	Trailer parks and campsites
	7041	Membership-basis organization hotels
Recreational Fishing	7999	Amusement and recreation, not elsewhere classified
Recreational Boating		
Marine Science, Technology and Education		
Instrumentation and Equipment		
Search And Navigation Instruments and Equipment		
	3812-04	Nautical instruments
	3812-0116	Gyroscopes
	3812-0307	Sonar systems and equipment
Electronic and Electrical Equipment, Except Computers		
	3625-9910	Marine and navy auxiliary controls
	3663-0106	Marine radio communications equipment
	3699-0405	Underwater sound equipment
Marine Services		
Commercial Marine Research / Consulting		
Systems Design for Marine Operations		
Marine Engineers, Technicians and Specialists		
	7699-06	Nautical repair services
	8711-9908	Marine engineering
	8711-9904	Designing: ship, boat, machine, and product
Marine Research and Education (Non-Profit)	Refer to list of mass. Marine education programs	
Marine Materials and Supplies		
Marine Materials		
	2851-0103	Marine paints
Industrial and Commercial Machinery		
	3519-0100	Diesel, semi-diesel, or duel-fuel engines, including marine
	3519-0103	Marine engines
	3531-02	Marine related equipment
Marine-Related Infrastructure		
Marine-Related Construction		
	1629-01	Dams, waterways, docks, and other marine construction
Ports, Coastal and Offshore Infrastructure		
Coastal Real Estate Development	6331-00	Fire, marine, and casualty insurance
	6331-02	Fire, marine and casualty insurance and carriers
	6331-9900	Fire, marine, and casualty insurance, not elsewhere classified
	6331-9901	Assessment associations: fire, marine and casualty insurance
	6331-9908	Reciprocal interinsurance exchanges: fire,

		marine, casualty
	6531	Real estate agents and managers

Notes: When necessary we used D+B MarketPlace data to determine share of 4-digit SIC codes, developing an allocation method based on these proportions.
*Yellow color highlights SIC categories where coastal zone geographic screen was applied.

2. Conversion to NAICS-based Definition of Marine Industry (uses 6-digit NAICS codes)

NAICS Code	NAICS Code Description
Commercial Seafood Industries	
Fishing Supplies and Services	
112511	Finfish Farming and Fish Hatcheries
112512	Shellfish Farming
112519	Other Animal Aquaculture
Commercial Fishing	
114111	Finfish Fishing
114112	Shellfish Fishing
114119	Other Marine Fishing
Seafood Processing and Wholesaling	
311711	Seafood Canning
311712	Fresh and Frozen Seafood Processing
424460	Fish and Seafood Merchant Wholesalers
Retail and Food Service Seafood Sales	
445220	Fish and Seafood Markets
454390	Other Direct Selling Establishments (part)
Marine Transportation	
483111	Deep Sea Freight Transportation
483112	Deep Sea Passenger Transportation
483113	Coastal and Great Lakes Freight Transportation
483114	Coastal and Great Lakes Passenger Transportation
483211	Inland Water Freight Transportation
483212	Inland Water Passenger 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 and Leasing (part)
Coastal Tourism and Recreation	
423910	Sporting and Recreational Goods and Supplies Merchant Wholesalers
441222	Boat Dealers
451110	Sporting Goods Stores
561510	Travel Agencies
561520	Tour Operators
561591	Convention and Visitors Bureaus
561599	All Other Travel Arrangement and Reservation Services

712110	Museums
712120	Historical Sites
712130	Zoos and Botanical Gardens
712190	Nature Parks and Other Similar Institutions
713930	Marinas
721110	Hotels (except Casino Hotels) and Motels
721191	Bed-and-Breakfast Inns
721199	All Other Traveler Accommodation
721211	RV (Recreational Vehicle) Parks and Campgrounds
721214	Recreational and Vacation Camps (except Campgrounds)
339920	Sporting and Athletic Goods Manufacturing
487110	Scenic and Sightseeing Transportation, Land (part)
487210	Scenic and Sightseeing Transportation, Water (part)
487990	Scenic and Sightseeing Transportation, Other (part)
532292	Recreational Goods Rental
611620	Sports and Recreation Instruction
611699	All Other Miscellaneous Schools and Instruction (part)
711110	Theater Companies and Dinner Theaters (part)
711190	Other Performing Arts Companies (part)
711219	Other Spectator Sports (part)
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities (part)
713210	Casinos (except Casino Hotels)
713290	Other Gambling Industries (part)
713920	Skiing Facilities
713940	Fitness and Recreational Sports Centers (part)
713990	All Other Amusement and Recreation Industries (part)
721120	Casino Hotels
721310	Rooming and Boarding Houses (part)
722110	Full-Service Restaurants
722211	Limited-Service Restaurants
722212	Cafeterias
722213	Snack and Nonalcoholic Beverage Bars (part)
722310	Food Service Contractors
722320	Caterers
722410	Drinking Places (Alcoholic Beverages)
Marine Science, Technology and Education	
Instrumentation and Equipment	
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing (part)
334519	Other Measuring and Controlling Device Manufacturing (part)
Electronic and Electrical Equipment, except computers	
333618	Other Engine Equipment Manufacturing (part)
334419	Other Electronic Component Manufacturing (part)
Marine Services	
541370	Surveying and Mapping (except Geophysical) Services (part)
811213	Communication Equipment Repair and Maintenance (part)

811219	Other Electronic and Precision Equipment Repair and Maintenance (part)
813312	Environment, Conservation and Wildlife Organizations (part)
541330	Engineering Services (part)
54171	Research and Development in the Physical, Engineering, and Life Sciences (part)
Marine Materials and Supplies	
Marine Materials	
325510	Paint and Coating Manufacturing (part)
Industrial and Commercial Machinery	
336399	All Other Motor Vehicle Parts Manufacturing (part)
333120	Construction Machinery Manufacturing
333923	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing (part)
Ship and Boat Building and Repair	
326199	All Other Plastics Product Manufacturing (part)
326299	All Other Rubber Product Manufacturing (part)
336611	Ship Building and Repairing
336612	Boat Building
421860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers (part)
Marine-Related Infrastructure	
234990	All Other Heavy Construction (part)
924110	Administration of Air and Water Resource and Solid Waste Management Programs (part)
Coastal Real Estate Development	
524128	Other Direct Insurance (except Life, Health, and Medical) Carriers (part)
531210	Offices of Real Estate Agents and Brokers
531311	Residential Property Managers
531312	Nonresidential Property Managers
531320	Offices of Real Estate Appraisers
531390	Other Activities Related to Real Estate
812220	Cemeteries and Crematories (part)
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)

* Yellow color highlights SIC categories where coastal zone geographic screen was applied to the original ES-202 data.
** Green color or the word "part" highlights NAICS sectors where the original ES-202 data was adjusted using an allocation formula.

3. NAICS Definition of Marine Industry with Allocation Formulas

NAICS Code	Description	Allocation Share	Notes
Commercial Seafood Industries			
Fishing Supplies and Services			
112511	Finfish Farming and Fish Hatcheries		
112512	Shellfish Farming		
112519	Other Animal Aquaculture		
Commercial Fishing			
114111	Finfish Fishing		
114112	Shellfish Fishing		
114119	Other Marine Fishing		
Seafood Processing and Wholesaling			
311711	Seafood Canning		
311712	Fresh and Frozen Seafood Processing		
424460	Fish and Seafood Merchant Wholesalers		
Retail and Food Service Seafood Sales			
445220	Fish and Seafood Markets		
454390	Other Direct Selling Establishments (part)	Corresponds to 5421-01 Fish and seafood markets; 43 percent of employment in 5421 is marine-related.	
Marine Transportation			
483111	Deep Sea Freight Transportation		
483112	Deep Sea Passenger Transportation		
483113	Coastal and Great Lakes Freight Transportation		
483114	Coastal and Great Lakes Passenger Transportation		
483211	Inland Water Freight Transportation		
483212	Inland Water Passenger 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 and Leasing (part)	Corresponds to 4499-00 Water transportation services; 76 percent of employment in 4499 is marine-related.	
Coastal Tourism and Recreation			
423910	Sporting and Recreational Goods and Supplies Merchant Wholesalers		
441222	Boat Dealers		
451110	Sporting Goods Stores		
561510	Travel Agencies		
561520	Tour Operators		
561591	Convention and Visitors Bureaus		

561599	All Other Travel Arrangement and Reservation Services		
712110	Museums		
712120	Historical Sites		
712130	Zoos and Botanical Gardens		
712190	Nature Parks and Other Similar Institutions		
713930	Marinas		
721110	Hotels (except Casino Hotels) and Motels		
721191	Bed-and-Breakfast Inns		
721199	All Other Traveler Accommodation		
721211	RV (Recreational Vehicle) Parks and Campgrounds		
721214	Recreational and Vacation Camps (except Campgrounds)		
339920	Sporting and Athletic Goods Manufacturing		
487110	Scenic and Sightseeing Transportation, Land (part)		
487210	Scenic and Sightseeing Transportation, Water (part)		
487990	Scenic and Sightseeing Transportation, Other (part)		
532292	Recreational Goods Rental		
611620	Sports and Recreation Instruction		
611699	All Other Miscellaneous Schools and Instruction (part)		
711110	Theater Companies and Dinner Theaters (part)		
711190	Other Performing Arts Companies (part)		
711219	Other Spectator Sports (part)		
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities (part)		
713210	Casinos (except Casino Hotels)		
713290	Other Gambling Industries (part)		
713920	Skiing Facilities		
713940	Fitness and Recreational Sports Centers (part)		
713990	All Other Amusement and Recreation Industries (part)		
721120	Casino Hotels		
721310	Rooming and Boarding Houses (part)		
722110	Full-Service Restaurants		
722211	Limited-Service Restaurants		
722212	Cafeterias		
722213	Snack and Nonalcoholic Beverage Bars (part)		
722310	Food Service Contractors		
722320	Caterers		
722410	Drinking Places (Alcoholic Beverages)		
Marine Science and Technology			
Instrumentation and Equipment			
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing (part)	4 percent share of employment of 3812 in this NAICS	
334519	Other Measuring and Controlling Device Manufacturing (part)	90 percent of this NAICS in 3829	Note: 3829 appears only in marine tech business list several times and is not included in

			SIC definition of MST industry
Electronic and Electrical Equipment, except computers			
333618	Other Engine Equipment Manufacturing (part)	.4 percent share of employment of 3699 and 80 percent share of employment of 3519 in this NAICS	
334419	Other Electronic Component Manufacturing (part)	27 percent of this NAICS in 3679	Note: 3679 appears only in marine tech business list several times and is not included in SIC definition of MST industry
Marine Services			
541370	Surveying and Mapping (except Geophysical) Services (part)	84 percent of this NAICS in 8713	Note: 8713 appears only in marine tech business list several times and is not included in SIC definition of MST industry
811213	Communication Equipment Repair and Maintenance (part)	47 percent of this NAICS in 7622	7622 does not appear in marine tech business list
811219	Other Electronic and Precision Equipment Repair and Maintenance (part)	36 percent of this NAICS in 7629	7629 does not appear in marine tech business list
813312	Environment, Conservation and Wildlife Organizations (part)	7 percent of this NAICS in 8399	8398 does not appear in marine tech business list
541330	Engineering Services (part)	1 percent share of employment in this NAICS	
54171	Research and Development in the Physical, Engineering, and Life Sciences (part)	8731 entirely and 84 percent of this NAICS in 8733	8731 and 8733 appear only in marine tech business list several times and is not included in SIC definition of MST industry
Marine Materials and Supplies			
325510	Paint and Coating Manufacturing (part)	4 percent share of employment in this NAICS	
Industrial and Commercial Machinery			
336399	All Other Motor Vehicle Parts Manufacturing (part)	80 percent share of employment of 3519 in this NAICS and 28 percent of this NAICS in 3714	3714 does not appear in marine tech business list

333120	Construction Machinery Manufacturing (part)	0.02 share of employment of 3531 in this NAICS	
333923	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing (part)	3536 and 3531—4 percent of this NAICS in 3531	3536 does not appear in marine tech business list and 3531 appears twice in marine tech business list
Ship and Boat Building and Repair			
326199	All Other Plastics Product Manufacturing (part)	3089-05 Plastics boats and other marine equipment	99 percent of this NAICS in 3089
326299	All Other Rubber Product Manufacturing (part)	3069, 96 percent of this NAICS in 3069	3069 is almost entirely not related to marine products and services
336611	Ship Building and Repairing		
336612	Boat Building		
421860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers (part)	5088 entirely	5088-01 Marine crafts and supplies
Marine-Related Construction and Infrastructure			
234990	All Other Heavy Construction (part)	16 percent share of employment of 1629 in this NAICS	7353 does not appear in marine tech business list
924110	Administration of Air and Water Resource and Solid Waste Management Programs (part)	9511	
Coastal Real Estate Development			
524128	Other Direct Insurance (except Life, Health, and Medical) Carriers (part)	6399, 92 percent of this NAICS in 6399	6399 appears once in marine tech business list
531210	Offices of Real Estate Agents and Brokers		
531311	Residential Property Managers		
531312	Nonresidential Property Managers		
531320	Offices of Real Estate Appraisers		
531390	Other Activities Related to Real Estate		
812220	Cemeteries and Crematories (part)		
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)		

Source: Authors' calculations based on U.S. Bureau of the Census correspondence or "bridge" tables. See <http://www.census.gov/epcd/ec97brdg/>.

* Yellow color highlights SIC categories where coastal zone geographic screen was applied to original ES-202 data.

** Green color highlights NAICS which were measured using an allocation formula to adjust original ES-202 data.

4. Method to Finalize the NAICS Definition of the Marine Industry

SIC codes which did not appear in the marine technology business list[51] and whose SIC six-digit and eight-digit codes do not identify them as marine-related were eliminated from the NAICS allocation formula.

SIC codes with correspondence to NAICS codes of more than 70 percent and which were mentioned in the marine technology business list were used in CZM NAICS definition.

SIC codes with correspondence to NAICS codes of less than 70 percent—even if they were mentioned in the marine technology business list—were eliminated from CZM NAICS definition.

SIC codes with six-digit codes appropriate for the NAICS allocation, were adjusted with a share methodology using D&B employment numbers. The share methodology is illustrated in the table below.

[51] *The Marine Science and Technology Industry in New England* (Barrow, Loveland, and Terkla, 2005).

5. Final NAICS Definition of Marine Industry and Allocation Formulas

NAICS	Description	Allocated Share of NAICS
Commercial Seafood Industries		
Fishing Supplies and Services		
112511	Finfish Farming and Fish Hatcheries	
112512	Shellfish Farming	
112519	Other Animal Aquaculture	
Commercial Fishing		
114111	Finfish Fishing	
114112	Shellfish Fishing	
114119	Other Marine Fishing	
Seafood Processing and Wholesaling		
311711	Seafood Canning	
311712	Fresh and Frozen Seafood Processing	
424460	Fish and Seafood Merchant Wholesalers	
Retail and Food Service Seafood Sales		
445220	Fish and Seafood Markets	
454390	Other Direct Selling Establishments (part)	43 percent share of employment of 5421 SIC in this NAICS
Marine Transportation		
483111	Deep Sea Freight Transportation	
483112	Deep Sea Passenger Transportation	
483113	Coastal and Great Lakes Freight Transportation	
483114	Coastal and Great Lakes Passenger Transportation	
483211	Inland Water Freight Transportation	
483212	Inland Water Passenger 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 and Leasing (part)	76 percent share of employment of 4499 SIC in this NAICS
Coastal Tourism and Recreation		
Entertainment and Recreation		
713930	Marinas	
713210	Casinos (except Casino Hotels)	
713290	Other Gambling Industries (part)	
713920	Skiing Facilities	
713940	Fitness and Recreational Sports Centers (part)	
713990	All Other Amusement and Recreation	

	Industries (part)	
713110	Amusement and Theme Parks	
711110	Theater Companies and Dinner Theaters (part)	
711190	Other Performing Arts Companies (part)	
711219	Other Spectator Sports (part)	
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities (part)	
532292	Recreational Goods Rental	
611620	Sports and Recreation Instruction	
611699	All Other Miscellaneous Schools and Instruction (part)	
712190	Nature Parks and Other Similar Institutions (part)	
441222	Boat Dealers	
Food		
722110	Full-Service Restaurants	
722211	Limited-Service Restaurants	
722212	Cafeterias	
722213	Snack and Nonalcoholic Beverage Bars (part)	
722310	Food Service Contractors	
722320	Caterers	
722410	Drinking Places (Alcoholic Beverages)	
Accommodations		
721120	Casino Hotels	
721191	Bed-and-Breakfast Inns	
721199	All Other Traveler Accommodation	
721310	Rooming and Boarding Houses (part)	
721110	Hotels (except Casino Hotels) and Motels (part)	
721214	Recreational and Vacation Camps (except Campgrounds)	
721211	RV (Recreational Vehicle) Parks and Campgrounds	
487110	Scenic and Sightseeing Transportation, Land (part)	
487990	Scenic and Sightseeing Transportation, Other (part)	
561599	All Other Travel Arrangement and Reservation Services (part)	
Marine Science and Technology		
Instrumentation and Equipment		
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing (part)	28 percent share of employment of 3812 in this NAICS
334519	Other Measuring and Controlling Device Manufacturing (part)	2 percent share of employment of 3829 in this NAICS
Electronic and Electrical Equipment, except computers		
333618	Other Engine Equipment Manufacturing (part)	23 percent share of employment of 3699
Marine Services		

541330	Engineering Services (part)	2 percent share of employment of 8711 in this NAICS
541710	Research and Development in the Physical, Engineering, and Life Sciences (part)	2 percent share of employment of 8731 & 5 percent share of employment of 8733 in this NAICS
Marine Materials and Machinery		
325510	Paint and Coating Manufacturing (part)	9 percent share of employment of 2851 in this NAICS
336399	All Other Motor Vehicle Parts Manufacturing (part)	80 percent share of employment of 3519 in this NAICS
333120	Construction Machinery Manufacturing (part)	2 percent share of employment of 3531 in this NAICS
Ship and Boat Building and Repair		
326199	All Other Plastics Product Manufacturing (part)	.03 percent share of employment of 3089 SIC in this NAICS
336611	Ship Building and Repairing	
336612	Boat Building	
421860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers (part)	14 percent share of employment of 5088 in this NAICS
Marine-Related Construction and Infrastructure		
234990	All Other Heavy Construction (part)	16 percent share of employment of 1629 in this NAICS
924110	Administration of Air and Water Resource and Solid Waste Management Programs (part)	
Coastal Real Estate Development		
531210	Offices of Real Estate Agents and Brokers	
531311	Residential Property Managers	
531312	Nonresidential Property Managers	
531320	Offices of Real Estate Appraisers	
531390	Other Activities Related to Real Estate	
812220	Cemeteries and Crematories (part)	
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)	

Source: Authors' calculations based on U.S. Bureau of the Census correspondence or "bridge" tables. See <http://www.census.gov/epcd/ec97brdg/>.

* Yellow color highlights SIC categories where coastal zone geographic screen was applied to original ES-202 data.

** Green color or the word "part" highlights NAICS which were measured using an allocation formula to adjust original ES-202 data.

6. Final NAICS Codes Requested in ES-202 Data Request to the Mass. Division of Unemployment Assistance

2002 NAIC Codes	Description
112511	Finfish Farming and Fish Hatcheries
112512	Shellfish Farming
112519	Other Animal Aquaculture
114111	Finfish Fishing
114112	Shellfish Fishing
114119	Other Marine Fishing
234990	All Other Heavy Construction
311711	Seafood Canning
311712	Fresh and Frozen Seafood Processing
325510	Paint and Coating Manufacturing (part)
326199	All Other Plastics Product Manufacturing
333120	Construction Machinery Manufacturing
333618	Other Engine Equipment Manufacturing
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing
334519	Other Measuring and Controlling Device Manufacturing
336399	All Other Motor Vehicle Parts Manufacturing (part)
336611	Ship Building and Repairing
336612	Boat Building
421860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers
422460	Fish and Seafood Merchant Wholesalers
441222	Boat Dealers
445220	Fish and Seafood Markets
454390	Other Direct Selling Establishments (part)
483111	Deep Sea Freight Transportation
483112	Deep Sea Passenger Transportation
483113	Coastal and Great Lakes Freight Transportation
483114	Coastal and Great Lakes Passenger Transportation
483211	Inland Water Freight Transportation
483212	Inland Water Passenger Transportation
487110	Scenic and Sightseeing Transportation, Land (part)
487210	Scenic and Sightseeing Transportation, Water
487210	Scenic and Sightseeing Transportation, Water (part)
487990	Scenic and Sightseeing Transportation, Other (part)
488310	Port and Harbor Operations
488320	Marine Cargo Handling
488330	Navigational Services to Shipping
488390	Other Support Activities for Water Transportation

531210	Offices of Real Estate Agents and Brokers
531311	Residential Property Managers
531312	Nonresidential Property Managers
531320	Offices of Real Estate Appraisers
531390	Other Activities Related to Real Estate
532292	Recreational Goods Rental
532411	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing
541330	Engineering Services (part)
541370	Surveying and Mapping (except Geophysical) Services
541710	Research and Development in the Physical, Engineering, and Life Sciences
561599	All Other Travel Arrangement and Reservation Services (part)
611620	Sports and Recreation Instruction
611699	All Other Miscellaneous Schools and Instruction (part)
711110	Theater Companies and Dinner Theaters (part)
711190	Other Performing Arts Companies (part)
711219	Other Spectator Sports (part)
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities (part)
712190	Nature Parks and Other Similar Institutions (part)
713110	Amusement and Theme Parks
713210	Casinos (except Casino Hotels)
713290	Other Gambling Industries (part)
713920	Skiing Facilities
713930	Marinas
713940	Fitness and Recreational Sports Centers (part)
713990	All Other Amusement and Recreation Industries (part)
721110	Hotels (except Casino Hotels) and Motels (part)
721120	Casino Hotels
721191	Bed-and-Breakfast Inns
721199	All Other Traveler Accommodation
721211	RV (Recreational Vehicle) Parks and Campgrounds
721214	Recreational and Vacation Camps (except Campgrounds)
721310	Rooming and Boarding Houses (part)
722110	Full-Service Restaurants
722211	Limited-Service Restaurants
722212	Cafeterias
722213	Snack and Nonalcoholic Beverage Bars (part)
722310	Food Service Contractors
722320	Caterers
722410	Drinking Places (Alcoholic Beverages)
812220	Cemeteries and Crematories (part)
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)

924110	Administration of Air and Water Resource and Solid Waste Management Programs

These NAICS codes were requested for both the state as a whole and for the coastal region, defined by coastal towns. The study team worked with the Mass. Division of Unemployment Assistance to insure data confidentiality. In some cases, the data requested still fell within the parameters that required the data to remain confidential. As a solution, Mass. DUA aggregated data from all of these codes into the category 'Other.'

7. Final ES-202 Data Received from the Mass. Division of Unemployment Assistance

The data were delivered several times with a few revisions resulting from the process of obtaining a final data set containing only unsuppressed data. The following tables present the final set of ES-202 data for the state and for the coastal zone. These numbers were adjusted for the model using allocation formulas described in the next section.

Statewide Marine Industry, All Ownerships, 2004
(BEFORE APPLICATION OF ALLOCATION FORMULAS)

NAICS Code	NAICS Title	Firms	Estab-lishments	Employ-ment	Wages
11251	Animal Aquaculture	10	10	52	$2,586,559
114111	Finfish Fishing	208	248	897	$41,381,249
114112	Shellfish Fishing	147	170	803	$64,212,641
114119	Other Marine Fishing	3	3	0	$22,000
237990	Other Heavy Construction	104	143	919	$49,636,280
311711	Seafood Canning	6	7	118	$4,376,717
311712	Fresh and Frozen Seafood Processing	47	51	2,311	$91,240,549
325510	Paint and Coating Manufacturing	25	25	692	$39,606,107
326199	All Other Plastics Product Manufacturing	174	191	8,333	$357,268,940
333120	Construction Machinery Manufacturing	7	7	127	$4,809,189
33361	Engine, Power, and Turbine Manufacturing	25	29	1,339	$68,075,807
334511	Search, Detection & Navigation Instrument	33	36	4,974	$440,123,892
334519	Other Measuring and Controlling Devices	59	62	2,395	$161,547,191
336399	All Other Motor Vehicle Parts Mfg	9	9	94	$3,669,419
336611	Ship Building and Repairing	8	13	195	$8,155,194
336612	Boat Building	31	38	250	$8,788,168
423860	Transportation Equipment Supplies (except motor vehicle) merchant wholesalers	31	34	303	$22,766,075
424460	Fish and Seafood Merchant Wholesalers	159	179	2,100	$100,204,635
441222	Boat Dealers	104	122	1,128	$43,373,713
445220	Fish and Seafood Markets	127	154	916	$24,141,879
454390	Other Direct Selling Establishments	61	72	580	$21,067,920
48311	Deep Sea, Coastal, and Water Lakes Transportation	28	28	870	$55,398,557
483211	Inland Water Freight Transportation	7	8	18	$504,717
483212	Inland Water Passenger Transportation	6	7	13	$255,836
487110	Scenic/Sightseeing Transportation, Land	21	33	704	$20,689,866
487210	Scenic/Sightseeing Transportation, Water	48	60	736	$14,383,648
4883	Support Activities for Water Transport	44	54	411	$16,708,053
531210	Offices of Real Estate Agents & Brokers	1,895	2,419	10,161	$658,385,436
531311	Residential Property Managers	559	880	6,557	$269,763,396
531312	Nonresidential Property Managers	322	420	3,715	$259,540,882
531320	Offices of Real Estate Appraisers	202	220	687	$38,516,529
531390	Other Activities Related to Real Estate	124	150	303	$26,702,111
532292	Recreational Goods Rental	30	45	165	$3,352,584

532411	Transportation Equipment Rental/Leasing	14	18	67	$7,347,938
541330	Engineering Services	1,364	1,662	22,252	$1,747,872,179
541370	Other Surveying and Mapping Services	198	224	1,379	$65,037,469
541710	Physical/Engineering/Biological Research	847	1,057	36,284	$3,292,036,302
561599	All Other Travel Arrangement Services	62	110	1,837	$71,644,499
611620	Sports and Recreation Instruction	266	314	1,754	$31,379,295
611699	Miscellaneous Schools and Instruction	131	173	1,181	$41,294,693
711110	Theater Companies and Dinner Theaters	91	116	1,832	$49,283,057
711190	Other Performing Arts Companies	16	20	50	$1,523,508
71121	Spectator Sports	70	88	2,366	$429,896,133
711320	Promoters without Facilities	58	83	316	$15,954,421
713920	Skiing Facilities	14	16	1,110	$17,077,236
713930	Marinas	145	168	1,561	$56,212,235
713940	Fitness and Recreational Sports Centers	882	1,061	16,238	$249,535,594
713990	All Other Amusement and Recreation Industries	473	564	7,184	$143,741,556
7211	Traveler Accommodation	840	1,035	31,506	$858,756,472
721211	RV Parks and Campgrounds	52	65	456	$8,423,383
721214	Recreational and Vacation Camps	48	76	580	$14,563,781
721310	Rooming and Boarding Houses	60	73	612	$12,230,360
722110	Full-Service Restaurants	4,483	5,446	106,862	$1,770,584,501
722211	Limited-Service Restaurants	3,158	4,588	48,500	$660,722,451
722212	Cafeterias	43	64	1,268	$25,768,090
722213	Snack and Nonalcoholic Beverage Bars	1,223	1,762	26,390	$376,123,427
722310	Food Service Contractors	105	714	14,405	$290,331,314
722320	Caterers	277	512	5,576	$104,006,135
722410	Drinking Places (Alcoholic Beverages)	960	1,080	8,683	$116,510,453
812220	Cemeteries and Crematories	103	110	782	$27,168,699
813990	Other Similar Organizations	193	241	784	$22,070,351
924110	Air, Water and Waste Program Admin	19	28	3,268	$213,541,624
	OTHER CATEGORY TOTAL	29	46	1,482	$32,639,252
		20,888	27,441	399,431	$13,674,532,147

Source: Massachusetts Division of Unemployment Assistance, ES-202 series.

OTHER CATEGORY INCLUDES:

712190	Nature Parks & Other Similar Institution
713110	Amusement and Theme Parks
7132	Gambling Industries
487990	Scenic/Sightseeing Transportation, Other

Technical note on data labeled "Other":

NAICS codes in the category "Other" apply only to the Coastal Tourism sector and thus would require the coastal zone geographic screen for further analysis. The share of employment is already very small compared to the whole Marine Industry. Thus we excluded the category "Other" data as inputs to the final IMPLAN model.

Total Value of State "Other" data is:

Establishments	Firms	Employment	Wage
29	46	1,482	32,639,252

Coastal Zone Marine Industry, All Ownerships, 2004
(BEFORE APPLICATION OF ALLOCATION FORMULAS)

NAICS Code	NAICS Title	Firms	Establish-ments	Employment	Wage
11251	Animal Aquaculture	9	9	47	2,390,192
114111	Finfish Fishing	204	242	886	40,983,122
114112	Shellfish Fishing	142	163	787	63,245,865
237990	Other Heavy Construction	41	59	404	23,955,620
311712	Fresh and Frozen Seafood Processing	44	46	2,259	88,196,573
325510	Paint and Coating Manufacturing	8	8	181	9,781,704
326199	All Other Plastics Product Manufacturing	26	31	1,340	53,201,045
334511	Search, Detection & Navigation Instruments	10	11	542	37,535,944
334519	Other Measuring and Controlling Devices	12	12	164	11,616,688
336399	All Other Motor Vehicle Parts Mfg	4	4	75	2,757,199
336612	Boat Building	27	33	194	7,208,858
424460	Fish and Seafood Merchant Wholesalers	129	145	1,754	83,124,396
441222	Boat Dealers	82	87	772	31,042,232
445220	Fish and Seafood Markets	89	109	586	16,641,229
454390	Other Direct Selling Establishments	21	17	129	2,493,784
483211	Inland Water Freight Transportation	5	6	13	309,824
483212	Inland Water Passenger Transportation	6	7	14	255,836
487110	Scenic/Sightseeing Transportation, Land	18	23	472	13,786,626
487210	Scenic/Sightseeing Transportation, Water	47	58	723	13,968,529
4883	Support Activities for Water Transport	41	49	400	16,353,497
531210	Offices of Real Estate Agents & Brokers	800	985	5,025	400,384,476
531311	Residential Property Managers	277	371	3,578	151,562,415
531312	Nonresidential Property Managers	140	161	1,517	122,809,332
531320	Offices of Real Estate Appraisers	74	79	236	15,425,300
531390	Other Activities Related to Real Estate	47	60	142	15,286,369
532292	Recreational Goods Rental	21	35	87	2,059,431
532411	Transportation Equipment Rental/Leasing	7	10	58	6,771,009
541330	Engineering Services	375	436	5,333	389,268,453

541370	Other Surveying and Mapping Services	74	81	628	31,587,845
541710	Physical/Engineering/Biological Research	173	216	8,027	495,334,704
561599	All Other Travel Arrangement Services	38	45	710	26,063,628
611620	Sports and Recreation Instruction	72	86	491	8,659,321
611699	Miscellaneous Schools and Instruction	44	53	527	20,634,907
711110	Theater Companies and Dinner Theaters	43	52	1,242	36,049,829
711190	Other Performing Arts Companies	4	7	11	270,022
711320	Promoters without Facilities	22	29	212	12,429,491
713930	Marinas	135	154	1,514	55,097,974
713940	Fitness and Recreational Sports Centers	312	363	6,045	99,075,908
713990	All Other Amusement and Recreation	158	198	2,724	57,635,621
721110	Hotels (except Casino Hotels) and Motels	373	435	16,030	476,169,093
721211	RV Parks and Campgrounds	24	29	188	4,461,234
721214	Recreational and Vacation Camps	17	30	241	5,517,002
721310	Rooming and Boarding Houses	34	43	232	4,820,131
722110	Full-Service Restaurants	2,097	2,359	46,240	832,422,368
722211	Limited-Service Restaurants	1,435	1,814	18,242	259,547,588
722212	Cafeterias	24	24	414	6,695,904
722213	Snack and Nonalcoholic Beverage Bars	549	769	10,240	152,609,739
722310	Food Service Contractors	104	232	5,738	120,686,377
722320	Caterers	138	177	2,072	38,357,842
722410	Drinking Places (Alcoholic Beverages)	389	444	4,553	65,904,290
812220	Cemeteries and Crematories	35	39	310	12,276,997
813990	Other Similar Organizations	81	105	373	9,709,379
423860	Other Transport Goods Merchant Whsle	12	13	187	11,072,879
48311	Sea, Coastal & Great Lakes Transport	20	20	851	54,268,763
	other total	49	63	3,396	200,833,993
		9,153	11,127	159,109	4,718,218,185

Source: Massachusetts Division of Unemployment Assistance, ES-202 data.

OTHER COASTAL DATA INCLUDES:

487990	Scenic/Sightseeing Transportation, Other
712190	Nature Parks & Other Similar Institution
713110	Amusement and Theme Parks

7132	Gambling Industries
713920	Skiing Facilities
924110	Air, Water and Waste Program Admin
114119	Other Marine Fishing
333120	Construction Machinery Manufacturing
336611	Ship Building and Repairing
311711	Seafood Canning
711219	Other Spectator Sports

Technical note on data labeled "Other":

NAICS codes in the category "Other" all apply to the Coastal Tourism sector and thus would require the coastal zone geographic screen for further analysis. The share of employment is already very small compared to the whole Marine Industry. Thus we excluded the category "Other" data from the IMPLAN analysis.

Total Value of Coastal "Other" data is:

Establishments	Firms	Employment	Wage
49	63	3,396	200,833,993

The share of employment is very small compared to the whole Marine Industry. Thus we excluded the category "Other" data from the IMPLAN analysis.

8. Final NAICS Definition with Allocated ES-202 Data and Nonemployer Data by Marine Sectors (does not include aquaculture license data)

2002 NAICS	Description	Employment	Wages
	Total Marine in Massachusetts	**152,174**	**4,304,709,052**
Commercial Seafood Industries		**11,003**	**506,035,876**
Sub-sector 1 - Fishing Supplies and Services			
11251	Animal Aquaculture	52	2586559
Sub-sector 2 - Commercial Fishing		**5,286**	**276,336,890**
114111	Finfish Fishing	897	$41,381,249
114112	Shellfish Fishing	803	$64,212,641
114119	Other Marine Fishing	**0**	**$22,000**
Sub-sector 3 - Seafood Processing and Wholesaling		**4,552**	**196,497,901**
311711	Seafood Canning	118	$4,376,717
311712	Fresh and Frozen Seafood Processing	2,311	$91,240,549
424460	Fish and Seafood Merchant Wholesalers	2,100	$100,204,635
Sub-sector 4 - Retail and Food Service Seafood Sales		**1,165**	**33,201,085**
445220	Fish and Seafood Markets	916	$24,141,879
454390	Other Direct Selling Establishments (part)	249	$9,059,206
Marine Transportation		**2,099**	**92,835,244**
48311	Deep Sea, Coastal, and Water Lakes Transportation	870	55398557
483211	Inland Water Freight Transportation	18	$504,717
483212	Inland Water Passenger Transportation	13	$255,836
487210	Scenic and Sightseeing Transportation, Water	736	$14,383,648
4883	Support Activities for Water Transportation	411	$16,708,053
532411	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing (part)	51	$5,584,433
Coastal Tourism and Recreation		**119,420**	**2,338,200,556**
Sub-sector 1 - Entertainment and Recreation		**13,625**	**322,954,736**
713930	Marinas	1,514	$55,097,974
713210	Casinos (except Casino Hotels)	other	
713290	Other Gambling Industries (part)	other	
713920	Skiing Facilities	other	
713940	Fitness and Recreational Sports Centers (part)	6,045	$99,075,908
713990	All Other Amusement and Recreation Industries (part)	2,724	$57,635,621
713110	Amusement and Theme Parks	other	
711110	Theater Companies and Dinner Theaters (part)	1,242	$36,049,829
711190	Other Performing Arts Companies (part)	11	$270,022
711219	Other Spectator Sports (part)	no data	
711320	Promoters of Performing Arts, Sports, and Similar Events without Facilities (part)	212	$12,429,491
532292	Recreational Goods Rental	87	$2,059,431
611620	Sports and Recreation Instruction	491	$8,659,321
611699	All Other Miscellaneous Schools and Instruction (part)	527	$20,634,907
712190	Nature Parks and Other Similar Institutions (part)	other	

441222	Boat Dealers	772	$31,042,232
Sub-Sector 2 - Food		**87,499**	**1,476,224,108**
722110	Full-Service Restaurants	46,240	$832,422,368
722211	Limited-Service Restaurants	18,242	$259,547,588
722212	Cafeterias	414	$6,695,904
722213	Snack and Nonalcoholic Beverage Bars (part)	10,240	$152,609,739
722310	Food Service Contractors	5,738	$120,686,377
722320	Caterers	2,072	$38,357,842
722410	Drinking Places (Alcoholic Beverages)	4,553	$65,904,290
Sub-Sector 3 - Accommodations		**18,296**	**539,021,712**
7211	Traveler Accommodation	16,453	$484,373,091
721310	Rooming and Boarding Houses (part)	232	$4,820,131
721214	Recreational and Vacation Camps (except Campgrounds)	241	$5,517,002
721211	RV (Recreational Vehicle) Parks and Campgrounds	188	$4,461,234
487110	Scenic and Sightseeing Transportation, Land (part)	472	$13,786,626
487990	Scenic and Sightseeing Transportation, Other (part)	other	
561599	All Other Travel Arrangement and Reservation Services (part)	710	$26,063,628
Marine Science, Technology and Education		**4,566**	**398,461,887**
Sub-sector 1 - Instrumentation and Equipment		**1,441**	**126,465,634**
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing (part)	1,393	$123,234,690
334519	Other Measuring and Controlling Device Manufacturing (part)	48	$3,230,944
Sub-sector 2 - Electronic and Electrical Equipment, except computers			
33361	Engine, Power, and Turbine Manufacturing (part)	307.97	15657435.61
Sub-sector 3 - Marine Services		**2,985**	**265,399,985**
541330	Engineering Services (part)	445	$34,957,444
541710	Research and Development in the Physical, Engineering, and Life Sciences (part)	2,540	$230,442,541
Sub-sector 4 - Marine Materials and Supplies		**140**	**6,596,269**
325510	Paint and Coating Manufacturing (part)	62	$3,564,550
336399	All Other Motor Vehicle Parts Manufacturing (part)	75	$2,935,535
333120	Construction Machinery Manufacturing (part)	3	$96,184
Ship and Boat Building and Repair		**490**	**20,237,793**
326199	All Other Plastics Product Manufacturing (part)	2	$107,181
336611	Ship Building and Repairing	195	$8,155,194
336612	Boat Building	250	$8,788,168
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers (part)	42.42	3187250.5
Marine-Related Infrastructure		**14,596**	**948,937,697**
237990	All Other Heavy Construction (part)	147	$7,941,805
924110	Administration of Air and Water Resource and Solid	3,268	$213,541,624

	Waste Management Programs (part)		
Coastal Real Estate Development		**11,181**	**727,454,268**
531210	Offices of Real Estate Agents and Brokers	5,025	$400,384,476
531311	Residential Property Managers	3,578	$151,562,415
531312	Nonresidential Property Managers	1,517	$122,809,332
531320	Offices of Real Estate Appraisers	236	$15,425,300
531390	Other Activities Related to Real Estate	142	$15,286,369
812220	Cemeteries and Crematories (part)	310	$12,276,997
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations) (part)	373	$9,709,379

Source: Mass. DUA, ES-202, 2004; Nonemployer Series, 2003; Mass. Division of Marine Fisheries; Authors' calculations were applied to all rows highlighted in yellow and green.
* Yellow color highlights SIC categories where geographical screen was applied.
** Green color or the word "part" highlights NAICS which were measured using an allocation formula.

9. IMPLAN Industry Codes and Corresponding NAICS Codes

IMPLAN Code	IMPLAN Description	Corresponding NAICS Code	Available NAICS Code
13	Animal production except cattle and poultry and eggs	1125, 1122, 1124, 1129	1125
16	Fishing	1141	1141
71	Seafood product preparation and packaging	3117	3117
161	Paint and coating manufacturing	32551	325510
177	Plastics plumbing fixtures and all other plastics products	326199, 326191	326199
259	Construction machinery manufacturing	33312	333120
286	Other engine equipment manufacturing	333618	333618
314	Search, detection, and navigation instruments	334511	334511
321	Watch, clock, and other measuring and controlling device manufacturing	334519, 334518	334519
350	Motor vehicle parts manufacturing	3363	336399
357	Ship building and repairing	336611	336611
358	Boat building	336612	336612
390	Wholesale trade	42	421860
			422460
393	Water transportation	483	4831
			4832
397	Scenic and sightseeing trans and support activities for transportation	487	4871
			4872
			4879
		488	4883
401	Motor vehicles and dealers	441	441222
405	Food and beverage stores	445	445220
412	Nonstore retailers	454	454390
431	Real estate	531	5312
			5313
434	Machinery and equipment rental and leasing	5324	532411
435	General and consumer goods rental except video tapes and discs	53221, 53222, 53229, 5323	532290
439	Architectural and engineering services	5413	541330
446	Scientific research and development services	5417	541710
456	Travel arrangement and reservation services	5615	561599
463	Other educational services	6114, 6115, 6116, 6117	611620
			611699
471	Performing arts companies	7111	711110

			711190
472	Spectator sports	7112	711219
474	Promoters of performing arts and sports and agents for public figures	7113, 7114	711320
475	Museums, historical sites, zoos, and parks	712	712190
478	Other amusement, gambling, and recreation industries	7131, 71391	713110
		7132	7132
		71392	713920
		71393	713930
		71399	713990
476	Fitness and recreational sports centers	71394	713940
479	Hotels and motels, including casino hotels	72111	721110
		72112	7211
480	Other accommodations	72119	
		7212	7212
		7213	7213
481	Food services and drinking places	722	7221
			7222
			722310
			722320
			7224
484	Electronic equipment repair and maintenance	8112	811220
493	Civic, social, professional and similar organizations	8139, 8134	813990

Source: Minnesota IMPLAN Group, Inc., IMPLAN System, 1725 Tower Drive West, Suite 140, Stillwater, MN 55082 <www.implan.com>.

- commercial seafood industries
- marine transportation
- coastal tourism & recreation
- marine science, technology & education
- ship and boat building and repair
- marine-related infrastructure

10. IMPLAN Industrial Codes, Corresponding NAICS Codes, and Adjusted NAICS Data

IMPLAN Code	IMPLAN Description	Corresponding NAICS Code	Marine NAICS Code	Employ-ment	Payroll	Payroll per worker
Commercial Seafood Industries						
13	Animal production except cattle and poultry and eggs	1125, 1122, 1124, 1129	1125	52	$2,586,559	n/a
16	Fishing	1141	1141	5,286	$276,336,890	$52,277
71	Seafood product preparation and packaging	3117	3117	4,552	$196,497,901	$43,167
390	Wholesale trade	42	421860	42	$3,187,251	n/a
			422460	2,100	$100,204,635	$47,716
405	Food and beverage stores	445	445220	916	$24,141,879	$26,356
412	Nonstore retailers	454	454390	249	$9,059,206	$36,382
Marine Transportation						
393	Water transportation	483	48311	870	$55,398,557	n/a
			4832	31	$760,553	$24,534
397	Scenic and sightseeing transportation and support	487, 488	4883	411	$16,708,053	
434	Machinery and equipment rental and leasing	5324	532411	51	$5,584,433	$109,499
Coastal Tourism and Recreation						
456	Travel arrangement and reservation services	5615	561599	710	$26,063,628	$36,709
463	Other educational services	6114, 6115, 6116, 6117	611620	491	$8,659,321	$17,636
			611699	527	$20,634,907	$39,155
471	Performing arts companies	7111	711110	1,242	$36,049,829	$29,026
			711190	11	$270,022	$24,547
472	Spectator sports	7112	711219	n/a	n/a	n/a
474	Promoters of performing arts and sports and agents for public figures	7113, 7114	711320	212	$12,429,491	$58,630
475	Museums, historical sites, zoos, and parks	712	712190	other	other	other
478	Other amusement, gambling, and recreation industries	7131, 71391	713110	other	other	other
		7132	7132	other	other	other
		71392	713920	other	other	other
		71393	713930	1,514	$55,097,974	$36,392
		71399	713990	2,724	$57,635,621	$21,158
476	Fitness and recreational sports centers	71394	713940	6,045	$99,075,908	$16,390
479	Hotels and motels, including casino hotels	72111	721110	16,030	$476,169,093	$29,705
		72112	7211	16,453	$484,373,091	$29,440
480	Other accommodations	72119				
		7212	7212	429	$9,978,236	$23,259
		7213	7213	232	$4,820,131	$20,776

481	Food services and drinking places	722	7221	46,240	$832,422,368	$18,002
			7222	28,896	$418,853,231	$14,495
			722310	5,738	$120,686,377	$21,033
			722320	2,072	$38,357,842	$18,512
			7224	4,553	$65,904,290	$14,475
Marine Science and Technology						
161	Paint and coating manufacturing	32551	325510	62	$3,564,550	$57,493
259	Construction machinery manufacturing	33312	333120	3	$96,184	$32,061
286	Other engine equipment manufacturing	333618	333618	n/a	n/a	n/a
314	Search, detection, and navigation instruments	334511	334511	1,393	$123,234,690	$88,467
321	Watch, clock, and other measuring and controlling device manufacturing	334519, 334518	334519	48	$3,230,944	$67,311
350	Motor vehicle parts manufacturing	3363	336399	75	$2,935,535	$39,140
439	Architectural and engineering services	5413	541330	445	$34,957,444	$78,556
446	Scientific research and development services	5417	541710	2,540	$230,442,541	$90,725
Ship and Boat Building and Repair						
177	Plastics plumbing fixtures and all other plastics products	326199, 326191	326199	2	$107,181	$53,590
357	Ship building and repairing	336611	336611	195	$8,155,194	$41,822
358	Boat building	336612	336612	250	$8,788,168	$35,153
Marine Related Construction and Infrastructure						
431	Real estate	531	5312	5,025	$400,384,476	$79,679
			5313	5,473	$305,083,416	$55,743
484	Electronic equipment repair and maintenance	8112	811220	310	$12,276,997	$39,603
493	Civic, social, professional and similar organizations	8139, 8134	813990	373	$9,709,379	$26,031

Source: Authors' calculations based on: Minnesota IMPLAN Group, Inc., IMPLAN System; Mass. DUA, ES-202, 2004; Nonemployer Series, 2003; Mass. Division of Marine Fisheries.

11. Final IMPLAN Industrial Codes with Corresponding NAICS Codes by Sector (adjusted data ready for input into the IMPLAN software), Massachusetts

IMPLAN Code	IMPLAN Description	Corresponding NAICS Code	Marine NAICS Code	Establish-ments	Employment	Payroll	Payroll per worker
Commercial Seafood Industries				**1,133**	**11,270**	**$509,727,058**	
13	Animal production except cattle and poultry and eggs	1125, 1122, 1124, 1129	1125	267	267	$3,691,183	$13,825
16	Fishing	1141	1141	421	5,286	$276,336,890	$52,277
71	Seafood product preparation and packaging	3117	3117	81	2,452	$96,293,266	$39,271
390	Wholesale trade	42	422460	179	2,100	$100,204,635	$47,716
405	Food and beverage stores	445	445220	154	916	$24,141,879	$26,356
412	Nonstore retailers	454	454390	31	249	$9,059,206	$36,382
Marine Transportation				**170**	**2,099**	**$92,835,244**	
393	Water transportation	483	48311	28	870	$55,398,557	$63,677
			4832	15	31	$760,553	$24,534
397	Scenic and sightseeing transportation and support	487, 488	4883	53	411	$16,708,053	$40,652
			487210	60	736	$14,383,648	
434	Machinery and equipment rental and leasing	5324	532411	14	51	$5,584,433	$109,499
Coastal Tourism and Recreation				**7,640**	**119,420**	**$2,338,200,556**	
397	Scenic and sightseeing transportation and support	487, 488	487111	23	472	$13,786,626	$29,209
401	Motor vehicle and parts dealers	441	441222	87	772	$31,042,232	$40,210
435	General and consumer goods rental except video tapes	53221, 53222, 53229, 5323	532292	35	87	$2,059,431	$23,672
456	Travel arrangement and reservation services	5615	561599	45	710	$26,063,628	$36,709
463	Other educational services	6114, 6115, 6116, 6117	611620	86	491	$8,659,321	$17,636
			611699	53	527	$20,634,907	$39,155
471	Performing arts companies	7111	711110	52	1,242	$36,049,829	$29,026
			711190	7	11	$270,022	$24,547
474	Promoters of performing arts and sports and agents for public figures	7113, 7114	711320	29	212	$12,429,491	$58,630
478	Other amusement, gambling, and recreation industries	7131, 71391					
		7132					
		71392					

		71393	713930	154	1,514	$55,097,974	$36,392
		71399	713990	198	2,724	$57,635,621	$21,158
476	Fitness and recreational sports centers	71394	713940	363	6,045	$99,075,908	$16,390
479	Hotels and motels, including casino hotels	72111					
		72112	7211	587	16,453	$484,373,091	$29,440
480	Other accommodations	72119					
		7212	7212	59	429	$9,978,236	$23,259
		7213	7213	43	232	$4,820,131	$20,776
481	Food services and drinking places	722	7221	2,359	46,240	$832,422,368	$18,002
			7222	2,607	28,896	$418,853,231	$14,495
			722310	232	5,738	$120,686,377	$21,033
			722320	177	2,072	$38,357,842	$18,512
			7224	444	4,553	$65,904,290	$14,475
Marine Science and Technology				**183**	**5,055**	**$418,699,680**	
161	Paint and coating manufacturing	32551	325510	2	62	$3,564,550	$57,493
259	Construction machinery manufacturing	33312	333120	0	3	$96,184	$32,061
314	Search, detection, and navigation instruments	334511	334511	10	1,393	$123,234,690	$88,467
321	Watch, clock, and other measuring and controlling device manufacturing	334519, 334518	334519	1	48	$3,230,944	$67,311
350	Motor vehicle parts manufacturing	3363	336399	7	75	$2,935,535	$39,140
439	Architectural and engineering services	5413	541330	33	445	$34,957,444	$78,556
446	Scientific research and development services	5417	541710	74	2,540	$230,442,541	$90,725
177	Plastics plumbing fixtures and all other plastics products	326199, 326191	326199	0	2	$107,181	$53,590
357	Ship building and repairing	336611	336611	13	195	$8,155,194	$41,822
358	Boat building	336612	336612	38	250	$8,788,168	$35,153
390	Wholesale trade	42	421860	5	42	$3,187,251	
Marine Related Construction and Infrastructure				**1,851**	**14,596**	**$948,937,697**	
431	Real estate	531	5312	985	5,025	$400,384,476	$79,679
			5313	671	5,473	$305,083,416	$55,743
488	Death Care Services	8122	812220	39	310	$12,276,997	$39,603
493	Civic, social, professional and similar organizations	8139, 8134	813990	105	373	$9,709,379	$26,031
41	Other new construction	23	237990	23	147	$7,941,805	$26,031
506	Federal non-military		924110	28	3,268	$213,541,624	$26,031
	Total Massachusetts Marine Industry			**10,955**	**152,440**	**$4,308,400,235**	**$28,263**

Source: Authors' calculations based on: Minnesota IMPLAN Group, Inc., IMPLAN System; Mass. DUA, ES-202, 2004; Nonemployer Series, 2003; Mass. Division of Marine Fisheries.

APPENDIX 4. METHODOLOGY: SUPPLEMENTAL SPENDING ANALYSIS

In some sectors, important spending activity was not captured by the employment and payroll-based economic impact methodology that formed the basis for this study. The team developed additional, custom models to measure impacts of this spending.

Findings of the spending impact analyses are reported separately from discussions of employment and payroll impacts of each sector. The sections that follow give details on the spending impact models used in this study.

Coastal Tourism: Visitor Spending Impacts

For the purposes of this study, we measure the impacts of visitor spending within distinct types of tourist activities: day beach visits, overnight beach visits, recreational boat trips, saltwater angling trips, and oceanside wildlife watching trips. The sections that follow describe data and methods used for calculating these spending impacts.

Day Beach Visitor Spending

Data Summary:

Beach Visitor Tourism Data[52]:

- Total person trip volume, 2004—29,830,000
- Overnight trip—67.1 percent; Day trip—32.9 percent
- Percentage of visits to beaches—13.5 percent
- Person beach trips, 2004 = total trips x .135 = 4,027,050
- Day Visits to Massachusetts Beaches—32.9 percent of all person beach trips = 1,324,899

Day Visit Spending Estimates:

In order to calculate estimates, our model uses a calculation of per person spending for beach day trips determined by a study done in California[53], adjusted to 2004 dollars. No such detailed information exists for beach day trip visitors to Massachusetts.

[52] Except where noted otherwise, Massachusetts visitor data assumptions and calculations based on *Massachusetts Domestic Visitor Profile, Calendar Year 2004*, Mass. Office of Travel and Tourism, April 29, 2005.

Figure 45 – Beach Day Trip Spending Estimates

Mean Expenditures on Typical Beach Day Trip (from CA Study)	1995 Dollars	Household Size	Per Person	CPI Multiplier	2004 Dollars
Gas & Auto	$11.05	4	$2.76	1.2395	$3.42
Parking & Entrance Fees	$3.15	4	$0.79	1.2395	$0.98
Food & Drinks from stores	$15.04	4	$3.76	1.2395	$4.66
Restaurants	$15.78	4	$3.95	1.2395	$4.89
Equipment Rental	$2.53	4	$0.63	1.2395	$0.78
Beach Sporting Goods	$2.35	4	$0.59	1.2395	$0.73
Incidentals	$4.97	4	$1.24	1.2395	$1.54
All Items	$54.87	4	$13.72	1.2395	$17.00

Source: Philip King, Ph.D. *The Fiscal Impact of Beaches in California A Report Commissioned by The California Department of Boating and Waterways.* Public Research Institute, San Francisco State University, September 1999. Authors' calculations.

2004 CPI	1995 CPI
188.9	152.4
Source: U.S. Bureau of Labor Statistics	

Analysis and Discussion of Impacts

In Massachusetts, using 2004 dollars, there were 1,324,899 day beach trips. Each spending activity generated a cost per person, that, when summed, amounts to $17 a person per trip. Figure 46 below shows the inputs into the model and the corresponding economic impact that this spending has for the Massachusetts economy.

As Figure 46 below illustrates, the main costs associated with day beach trips are spending on restaurants, food and drinks from stores, and the costs of gas and auto. Other smaller impacts are also associated with day trips to the beach. The total amount of expenditures estimated from day beach trips is $22.5 million dollars, of which $18.5 million will be spent in Massachusetts.

The effects of this spending can be seen in its impact on employment and total revenue generated. A total of 435 jobs are created (including the direct, indirect, and induced impacts) as well as total revenue generated of $31.5 million. Each job created as the direct result of day beach spending has an average salary of $22,090. The average

[53] Beach visitor spending estimates assumptions and calculations based on: Philip King, Ph.D. *The Fiscal Impact of Beaches in California A Report Commissioned by The California Department of Boating and Waterways.* Public Research Institute, San Francisco State University, September 1999.

salary of the jobs created in other areas of the economy by this spending (the indirect and induced effects) has an average salary of $38,813. The multiplier effect shows that every dollar spent on day trips in Massachusetts generated 1.7 dollars in total revenue.

Figure 46 -Massachusetts Tourism Activity Spending and Its Economic Impact: Beach Visitors Day Trips

Summary of Economic Impacts
MA Tourism Activity Spending: Beach Visitors Day Trips

Direct Spending by Category Per Person Trip:		
Gas and auto		$3.42
Parking and entrance Fees		$0.98
Food and Drink from stores		$4.66
Restaurants		$4.89
Equipment rental		$0.78
Beach sporting goods		$0.73
Incidentals		$1.54
TOTAL per Trip		$17.00
Person Trips	Number of Trips	1,324,899
Total All Categories	Total x Trips	$22,523,283
	Total Amount Spent in Region (Massachusetts)	$18,470,757
	Total Amount Spent outside of Massachusetts	$4,052,526
Direct Employment	Total	325
Direct Payroll	Total Payroll	$7,176,893
	Average Annual Payroll per Employee	$22,090
Employment Generated (Indirect and Induced)	Total	110
Annual Payroll Generated (Indirect and Induced)	Total	$4,253,885
	Average Annual Payroll per New Employee	$38,813
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	435
	Total (Direct, Indirect, and Induced)	$31,483,881
Multiplier Effects	In-State Spending Muliplier	1.70
	All Spending Multiplier (in and out of state)	1.40

Source: Authors', calculations based on data from Massachusetts Office of Travel and Tourism, and expenditure estimates from *The Fiscal Impact of Beaches in California* , by Philip King, Ph.D, September 1999.

Overnight Beach Visitor Spending

Data Summary:

Beach Visitor Tourism Data[54]:

- Total person trip volume, 2004—29,830,000
- Overnight trip—67.1 percent; Day trip—32.9 percent

[54] Except where noted otherwise, Massachusetts visitor data assumptions and calculations based on *Massachusetts Domestic Visitor Profile, Calendar Year 2004*, Mass. Office of Travel and Tourism, April 29, 2005.

- Percentage of visits to beaches—13.5 percent
- Person beach trips, 2004 = total trips x .135 = 4,027,050
- Overnight visits to Massachusetts beaches—67.1 percent of all person beach trips = 2,702,151
- Average Massachusetts stay, all types of visits—3.9 nights
- Average California beach visit stay in 1995[55]—2.65 days

Overnight Visit Spending Estimates:

There is no available estimate on the average length of Massachusetts beach visits, only that the average Massachusetts stay is 3.9 nights. Consequently, our model uses the average number of days determined by the study done on California beach visits[56]—a more conservative estimate that using the average Massachusetts stay. Our model used the California beach study's determination of per person spending for beach overnight trips, adjusted to 2004 dollars.

Figure 47 – Beach Overnight Trip Spending Estimates

Mean Expenditures on Typical Beach Overnight Trip	1995 Dollars	Household Size	Per Person	CPI Multiplier	2004 Dollars
Gas & Auto	$35.28	4.34	$8.13	1.239501312	$10.08
Beach Related Lodging	$90.47	4.34	$20.85	1.239501312	$25.84
Parking & Entrance Fees	$4.63	4.34	$1.07	1.239501312	$ 1.32
Food & Drinks from stores	$39.45	4.34	$9.09	1.239501312	$11.27
Restaurants	$53.39	4.34	$12.30	1.239501312	$15.25
Equipment Rental	$9.11	4.34	$2.10	1.239501312	$ 2.60
Beach Sporting Goods	$2.34	4.34	$0.54	1.239501312	$ 0.67
Incidentals	$11.11	4.34	$2.56	1.239501312	$ 3.17
All Items	$246.83	4.34	$56.87	1.239501312	$70.20

Source: Philip King, Ph.D *The Fiscal Impact of Beaches in California A Report Commissioned by The California Department of Boating and Waterways.* Public Research Institute, San Francisco State University, September 1999. Author's calculations.

[55] Data assumptions and calculations based on: Philip King, Ph.D. *The Fiscal Impact of Beaches in California A Report Commissioned by The California Department of Boating and Waterways.* Public Research Institute, San Francisco State University, September 1999.

[56] Ibid.

Analysis and Discussion of Impacts

The calculation of overnight beach trips in Massachusetts is 2,702,151. The amount of spending per person per trip is calculated at $70.20. The breakdown per input shows that the highest costs include beach-related lodging, restaurants, food and drink from stores, and costs associated with transportation. The total amount of expenditures associated with overnight beach trips is $189.7 million dollars, of which nearly $131 million is being spent in Massachusetts.

A total of 2,876 total jobs result from this amount of spending, including 2,108 that are a direct result of the overnight beach trip activities. The direct jobs created have an average salary of $23,661 and the induced or indirect jobs created have an average salary of $38,822. The total amount of revenue generated from this spending is estimated at $222.3 million dollars. Also, for every dollar spent on overnight beach trips in Massachusetts, 1.7 dollars are being generated for the economy.

Figure 48 - Massachusetts Tourism Activity Spending and Its Economic Impact: Beach Visitors Overnight Trips

Summary of Economic Impacts
MA Tourism Activity Spending: Beach Visitors Overnight Trips

Direct Spending by Category Per Person Trip:		
Gas and auto		$10.08
Beach related lodging		$25.84
Parking and entrance Fees		$1.32
Food and Drink from stores		$11.27
Restaurants		$15.25
Equipment rental		$2.60
Beach sporting goods		$0.67
Incidentals		$3.17
Total per trip		$70.20
Person Trips	Number of Trips	2,702,151
Total All Categories	Total x Trips	$189,691,000
	Total Amount Spent in Region (Massachusetts)	$130,985,551
	Total Amount Spent out of Massachusetts	$58,705,449
Direct Employment	Total	2,108
Direct Payroll	Total Payroll	$49,871,002
	Average Annual Payroll per Employee	$23,661
Employment Generated (Indirect and Induced)	Total	768
Annual Payroll Generated (Indirect and Induced)	Total	$29,807,577
	Average Annual Payroll per New Employee	$38,822
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	2,876
	Total (Direct, Indirect, and Induced)	$222,231,373
Multiplier Effects	In-State Spending Muliplier	1.70
	All Spending Multiplier	1.17

Source: Authors' calculations based on data from Massachusetts Office of Travel and Tourism, and expenditure estimates from The Fiscal Impact of Beaches in California, by Philip King, Ph.D, September 1999.

Recreational Boat Trip Spending

Due to limitations of the available data, we could not model a cost per trip day for the state of Massachusetts, nor could we specifically calculate the exact number of boating trips per registered boat. Recent data on these topics was not available for the state of Massachusetts. Consequently, for this analysis, we used data supplied from a New York study estimating the mean annual expenditure per boater and applied that to the overall number of Coast Guard registered motorboats in Massachusetts[57]. Our default assumption is that the average annual expenditures would apply to all registered

[57] Nancy A. Connelly, Tommy L. Brown, and David L. Kay. *Recreational Boating Expenditures in 2003 in New York State and Their Economic Impacts.* Prepared for New York Sea Grant. Cornell University Department of Natural Resources (New York), NYSGI-S-04-001, September 2004.

motorboats and this would generate an impact. Our assumption may overestimate participation rates as we know that some registered boats will make no trips in the year. A survey assessing the participation rates and mean expenditures of Massachusetts recreational boaters would be a good next step to provide a more accurate estimate of impacts.

Data Summary:

Calendar Year 2004 Registered Motorboats for Massachusetts: 150,683[58]

Figure 49 - Recreational Boat Trip Spending Estimates[59]-

Mean and total statewide trip-related expenditures at the boating location and en-route in 2003	
Expenditure Category	Mean expenditure per boater
At-site expenditures	
Marinas and yacht clubs	$359
Gas stations	214
Restaurants and bars	184
Grocery and convenience type stores	148
Bait and tackle shops	62
Boat launching and mooring fees	58
Lodging	58
Entertainment and all other expenses	56
All other retail purchases	55
Tournament fees	12
TOTAL AT-SITE EXPENDITURES	1,206
En-route expenditures	174
TOTAL EXPENDITURES	$1,380

Source: *Recreational Boating Expenditures in 2003 in New York State and Their Economic Impacts.* Nancy A. Connelly, Tommy L. Brown, David L. Kay, September 2004.

In the reference study, en-route expenditures are not broken down by type of spending, so we could not know to what IMPLAN category they should be assigned. Therefore, we excluded these impacts from the analysis.

Analysis and Discussion of Impacts

[58] *Boating Statistics 2004.* Commandant Publication P16754.18. U.S. Department of Homeland Security, U.S. Coast Guard. September 2005.
[59] Connelly, Brown and Kay, September, 2004.

In total, we assume that each of the 150,683 Coast Guard registered recreational boats in Massachusetts spend about as much per year as each boat in New York State (the New York State amount from our model study is $1,206 mean annual expenditures per recreational boat). Thus, as seen in Figure 50, the amount of money spent on recreational boating activities totals over $181.7 million and the model estimates that close to $140.4 million of this are spent in Massachusetts.

The highest spending categories associated with recreational boating trips are the costs associated with marinas and yacht clubs, gas stations, restaurants and bars, and grocery and convenience stores.

The total amount of jobs created by recreational boating trips in Massachusetts is estimated to be 3,134 jobs with a total contribution to the economy of close to $241.2 million. The average salary created as a direct result of recreational boat ownership is $22,047, while the average salary of the induced/ indirect jobs created is $38,767.

We can see from the table below that the total amount of money generated in the economy is over $241 million dollars. The multiplier effects show us that every dollar spent on recreational boat ownership creates 1.72 dollars in the state.

Figure 50 - Massachusetts Tourism Activity Spending and Its Economic Impact: Recreational Boat Ownership

Summary of Economic Impacts
MA Tourism Activity Spending: Recreational Boat Ownership

Mean annual trip-related expenditures per boat:		
Marine and yatch clubs		$359.00
Gas stations		$214.00
Restaurants and bars		$184.00
Grocery and convenience type stores		$148.00
Bait and tackle shops		$62.00
Boat launching and mooring fees		$58.00
Lodging		$58.00
Entertainment and other expenses		$56.00
All other retail purchases		$55.00
Tournament fees		$12.00
Total		$1,206.00
Registered Boats	Number of Boats	150,683
Total All Categories	Total x Number of Boats	$181,723,698
	Total Amount Spent in Region (Massachusetts)	$140,377,869
	Total Amount Spent Outside of Massachusetts	$41,345,829
Direct Employment	Total	2,283
Direct Payroll	Total Payroll	$50,325,390
	Average Annual Payroll per Employee	$22,047
Employment Generated (Indirect and Induced)	Total	851
Annual Payroll Generated (Indirect and Induced)	Total	$33,002,105
	Average Annual Payroll per New Employee	$38,767
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	3,134
	Total (Direct, Indirect, and Induced)	$241,177,491
Multiplier Effects	In-State Spending Muliplier	1.72
	All Spending Multiplier	1.33

Source: Authors' calculations based on data from U.S. Coast Guard and expenditure estimates in *Recreational Boating Expenditures in 2003 in New York State and Their Economic Impacts* by Nancy A. Connelly, Tommy L. Brown, David L. Kay, September 2004.

Saltwater Angling Trip Spending

Data Summary:

Total person trip volume of saltwater angler trips to Massachusetts in 2004[60]: 4,569,119

Spending Estimates for Recreational Saltwater Angling Trips[61]:

To standardize the 2001 spending data for Massachusetts to the 2004 MRFSS trip data numbers we did the following:

[60] *Marine Recreational Fisheries Statistics Survey – Effort Data (Angler Trips).* NOAA Office of Science and Technology. < http://www.st.nmfs.gov/st1/recreational/index.html.>

[61] *2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts*. U.S. Department of the Interior and U.S. Department of Commerce. Revised 2003.

a. Multiplied the total number of salt water fishing trip spenders from Table 17 in the *2001 National Survey* report (339,000) by the average number of fishing days per angler (12.52 days per angler—calculated using the numbers found on page 8—7.7 million fishing days divided by 615 thousand total anglers) to get 4,244,280 salt water fishing days (proxy for trips) in Massachusetts in 2001.
b. Divided the total amount of salt water expenditures for various categories to obtain a per-trip average.
c. Added data from Table 19 in the *2001 National Survey* to create percentages that could add detail to the "other trip costs" category in Table 17.
d. Adjusted 2001 dollars to 2004 dollars using the U.S. Consumer Price Index.

Resulting spending estimates are seen in the table below.

Figure 51 - Saltwater Angler Spending per Trip

	Amount in 2001 Dollars	Number of Spending Anglers 2001	Fishing Days Per Angler 2001	Total Angler Days (Proxy for Trips) 2001	Spending Per Trip, 2001	CPI Multiplier	Angler Spending Per Trip in 2004 Dollars
Total	**$202,870,000**	**339,000**	**12.52**	**4,244,280**	**$47.80**	**1.066629**	**$50.98**
Food and lodging	$35,426,000	339,000	12.52	4,244,280	$8.35	1.066629	$8.90
Transportation	$16,435,000	339,000	12.52	4,244,280	$3.87	1.066629	$4.13
Other Trip Costs	*$108,780,000*	*339,000*	*12.52*	*4,244,280*	*$25.63*	*1.066629*	*$27.34*
Fees	$24,747,092	339,000	12.52	4,244,280	$5.83	1.066629	$6.22
Boating costs	$67,446,304	339,000	12.52	4,244,280	$15.89	1.066629	$16.95
Bait	$13,399,870	339,000	12.52	4,244,280	$3.16	1.066629	$3.37
Ice	$3,044,377	339,000	12.52	4,244,280	$0.72	1.066629	$0.77
Equipment	$42,229,000	339,000	12.52	4,244,280	$9.95	1.066629	$10.61

Sources: Marine Recreational Fisheries Statistics Survey – Effort Data (Angler Trips). NOAA Office of Science and Technology. < http://www.st.nmfs.gov/st1/recreational/index.html.>; 2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts. U.S. Department of the Interior and U.S. Department of Commerce. Revised 2003. Authors' calculations.

Breakdown of Other Costs[62]

	Cost	Percent
Other Trip Costs	136,780	100.0%
Fees	31,117	22.7%
Boating Costs	84,807	62.0%
Bait	16,849	12.3%
Ice	3,828	2.8%

Inflation Multiplier, 2001 to 2004

Year	CPI Index
2004	188.9
2001	177.1
Change	1.07
Source: U.S. Bureau of Labor Statistics	

Analysis and Discussion of Impacts

As seen in the data table below, expenditures related to saltwater angling trips in Massachusetts are over $216 million dollars. Of this money, close to $156 million dollars is spent in Massachusetts and $60.5 million is spent outside of the state.

The outcome of this spending creates a total of 3,759 new jobs. Jobs created as a direct result of the spending on angling trips number 2,819. Since spending on angling trips creates interrelationships with other economic sectors, the total of indirect and induced jobs created is estimated at 941 (because of rounding, the sum of the direct and induced / indirect is slightly off from the total). The average annual salary of those jobs created as a direct result of spending on saltwater angling is $22,175 compared to an average salary of $38,068 for jobs created by indirect and induced effects.

The total amount of money generated as a result of spending on saltwater angling trips is close to $263 million. For every dollar that is spent on saltwater angling trips in Massachusetts, 1.69 dollars is being generated.

[62] From Table 17 and Table 19, *2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts,* 2003.

Figure 52 - Massachusetts Tourism Activity Spending and Its Economic Impact: Saltwater Angling Trips

Summary of Economic Impacts
MA Tourism Activity Spending: Saltwater Angling Trips

Direct Spending by Category Per Person Trip:		
Food and lodging		$8.90
Transportation		$4.13
Fees		$6.22
Boating costs		$16.95
Bait		$3.37
Ice		$0.77
Equipment		$10.61
Total per trip		$50.95
Person Trips	Number of Trips	4,244,280
Total All Categories	Total x Trips	$216,246,066
	Total Amount Spent in Region (Massachusetts)	$155,730,212
	Total Amount Spent Outside of Massachusetts	$60,515,854
Direct Employment	Total	2,819
Direct Payroll	Total Payroll	$62,502,818
	Average Annual Payroll per Employee	$22,175
Employment Generated (Indirect and Induced)	Total	941
Annual Payroll Generated (Indirect and Induced)	Total	$35,806,551
	Average Annual Payroll per New Employee	$38,068
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	3,759
	Total (Direct, Indirect, and Induced)	$262,666,800
Multiplier Effects	In-State Spending Muliplier	1.69
	All Spending Multiplier	1.21

Source: Authors' calculations based on data from National Marine Fisheries Service, U.S. Department of the Interior, and U.S. Department of Commerce.
For methodological details see *Appendix-Supplemental Spending Analysis*

Oceanside Wildlife Watching Trips

Data Summary:

According to the U.S. Department of the Interior, the total person trip volume for oceanside wildlife watching trips in Massachusetts in 2001 was 324,000[63]. This number represents both in-state and out-of-state watchers.

Method to estimate participant days for oceanside wildlife watchers:

Multiplied the total number of oceanside wildlife watching participants from Table 26 in the report (324,000) by the average number of watching days per participant (18.8 days per watcher—10.2 million days divided by 324 thousand total participants) to get 6,091,200 oceanside wildlife watching participant days (proxy for trips) in Massachusetts in 2001.

[63] The term oceanside wildlife watching refers to wildlife watching in public oceanside areas as reported in *2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts.* U.S. Department of the Interior and U.S. Department of Commerce, revised 2003.

Method to standardize 2001 spending data of oceanside wildlife watching trips[64] to 2004 dollars:

Divided the total amount of wildlife watching expenditures for various categories to obtain a per-trip average. Used the U.S. CPI to adjust to 2004 dollars.

Resulting spending estimates are seen in the table below.

Figure 53 - Recreational Oceanside Wildlife Watching Spending per Trip

	Amount in 2001 Dollars	Number of Oceanside Wildlife Watching Participants in 2001	Average Days Per Participant 2001	Total Participant Days (Proxy for Trips) 2001	Spending Per Trip, 2001	CPI Multiplier	Amount in 2004 Dollars
Total Trip-Related	$162,433,000	324,000	18.8	6,091,200	$26.67	1.066629	$28.44
Food / lodging	$71,543,000	324,000	18.8	6,091,200	$11.75	1.066629	$12.53
Food	$47,784,000	324,000	18.8	6,091,200	$7.84	1.066629	$8.37
Lodging	$23,759,000	324,000	18.8	6,091,200	$3.90	1.066629	$4.16
Transportation	$46,264,000	324,000	18.8	6,091,200	$7.60	1.066629	$8.10
Other Trip Costs	$44,625,000	324,000	18.8	6,091,200	$7.33	1.066629	$7.81

Source: *2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts.* U.S. Department of the Interior and U.S. Department of Commerce, revised 2003. Authors' calculations.

Inflation Multiplier, 2001 to 2004

Year	CPI Index
2004	188.9
2001	177.1
Change	1.066629
Source: U.S. Bureau of Labor Statistics	

Analysis and Discussion of Impacts

The total amount of money spent on oceanside wildlife watching trips was over $173 million dollars and over 80 percent of that money was spent in Massachusetts (close to $140 million). The amount of spending on oceanside wildlife watching trips directly created 2,550 jobs and, indirectly, created an additional 857 jobs. The jobs that were

[64] *2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts*. 2003.

created as a direct result of spending for this tourist activity had an average salary of $21,703 while the indirect jobs created had an average salary of $39,277.

The table below shows that the total amount of money generated by oceanside wildlife watching spending generated total revenue of $240.6 million dollars. The multiplier effects show that every dollar spent on this tourist activity generated 1.72 dollars in revenue.

Figure 54 - Massachusetts Tourism Activity Spending and Its Economic Impact: Oceanside Wildlife Watching Trips

Summary of Economic Impacts MA Tourism Activity Spending: Oceanside Wildlife Watching Trips		
Direct Spending by Category Per Person Trip:		
Food		$8.37
Lodging		$4.16
Transportation		$8.10
Other trip costs		$7.81
Total per trip		$28.44
Person Trips	Number of Trips	6,091,200
Total All Categories	Total x Trips	$173,233,728.00
	Total Amount Spent in Region (Massachusetts)	$139,879,671.00
	Total Amount Spent Outside of Massachusetts	$33,354,057.00
Direct Employment	Total	2,550
Direct Payroll	Total Payroll	$55,342,971
	Average Annual Payroll per Employee	$21,703
Employment Generated (Indirect and Induced)	Total	857
Annual Payroll Generated (Indirect and Induced)	Total	$33,652,264
	Average Annual Payroll per New Employee	$39,277
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	3,407
	Total (Direct, Indirect, and Induced)	$240,582,691
Multiplier Effects	In-State Spending Muliplier	1.72
	All Spending Multiplier	1.39

Source: Authors' calculations based on data from U.S. Department of the Interior, and U.S. Department of Commerce.
For methodological details see *Appendix-Supplemental Spending Analysis*

Marine Science Institutions: Research Spending Impacts

In addition to modeling visitor spending impacts within the Coastal Tourism sector we also modeled impacts of marine science research expenditures on the Massachusetts economy.

It was impossible to use ES-202 employment and payroll figures for marine science research institutions because of the generic nature of the industry codes used to describe higher education employment. Marine science-specific employment and payroll data is reported in aggregate with all other types of higher education employment.

At the same time, we know that marine science institutions in Massachusetts receive major amounts of research money each year to conduct marine science research—funding that contributes significantly to the regional economy. Unfortunately, there is no consolidated source of data on marine science research awards by institution.

Given the data limitations, we developed a method using hand-collected annual research expenditures as the primary input. The study team went directly to departments of marine science and technology[65] to collect research expenditure figures and employment information. We found that total marine science and technology research expenditures for 2004 were $170,376,912.

Analysis and Discussion:

The effect of spending on research for the marine science and technology sector is estimated in the table below. For this analysis, there are two inputs for spending: the amount of money spent by colleges and universities and the amount of money spent by other research institutions. The table below shows that money spent in these two sectors totaled over $170 million dollars, of which $133.6 million was spent in Massachusetts.

The effect of this research spending created a direct employment of 1,348 jobs and indirect employment of 1,013 jobs (2,361 in total). Interestingly, the average salary as a direct effect of this spending is $53,708 dollars a year, while the salary from the indirect and induced effects averages $37,371 dollars.

Research spending in Massachusetts created total revenue of $249.5 million dollars. For every dollar spent in Massachusetts on marine science and technology research, 1.87 dollars are created in the economy.

[65] Key marine science and technology research institutions are identified in Appendix 7 – MST Educational Programs, *The Marine Science and Technology Industry in New England*. Clyde Barrow, Rebecca Loveland and David Terkla. UMass Donahue Institute, 2005. <http://www.massbenchmarks.org/publications/studies/descriptions/marinesci05app.htm.>

Figure 55 - Massachusetts Marine Science and Technology Research Spending and Its Economic Impact

Summary of Economic Impacts
MA Marine Science and Technology Research Spending

Direct Spending	All Spending	$170,376,912
	Total Amount Spent in Region (Massachusetts)	$133,598,886
	Total Amount Spent outside of Masschusetts	$36,778,026
Direct Employment	Total	1,348
Direct Payroll	Total Payroll	$72,409,642
	Average Annual Payroll per Employee	$53,708.38
Employment Generated (Indirect and Induced)	Total	1,013
Annual Payroll Generated (Indirect and Induced)	Total	$37,860,321
	Average Annual Payroll per New Employee	$37,371
Overall Impact (Total Output)	Employment (Direct, Indirect, and Induced)	2,361
	Total (Direct, Indirect, and Induced)	$249,507,137
Multiplier Effects	In-State Spending Muliplier	1.87
	All Spending Multiplier	1.46

Source: UMass Donahue Institute.

Conclusion

When interpreting the spending estimates in this Appendix it is important to keep in mind the data limitations inherent in the process. As discussed previously, many coastal tourism and recreation activities are not well measured in Massachusetts and so, in proxy, the team used data from studies done in other states. The most ideal solution for future studies of this sector would be to obtain data for Massachusetts focused on areas specific to coastal-tourism and recreation. For example, it would be very useful to have data for major coastal tourism and recreation activities in the following areas: visitor activity preferences, numbers of visitors for each type of activity; visitor demographics, trip lengths, and spending patterns within each activity. This might happen through focused coordination with groups like MOTT to insure that coastal tourism activities are adequately and regularly measured.

APPENDIX 5. KEY DATA SETS FOR MEASURING MASSACHUSETTS MARINE SECTORS

I. **Commercial Seafood:** commercial fishing and fishing supplies, marine aquaculture, seafood processing and wholesaling, and retail and food service seafood sales.

- **Commercial fishing industry, non-employer data**
  Source—U.S. Bureau of the Census, Nonemployer series <http://www.census.gov/epcd/nonemployer/2003/ma/MA000.HTM>
  Variables—based on selected NAICS codes for the fishing industry; numbers of individual proprietors; total annual revenues.
- **Commercial fishing industry, business data**
  Source—D+B MarketPlace.
  Variables—based on selected SIC codes; establishments; employment; sales; zip code; proprietary eight-digit SIC codes.
- **Commercial aquaculture data, Massachusetts**
  Source— Massachusetts Division of Marine Fisheries (DMF), Shellfish Sanitation and Management Program
  Data set—Annual aquaculture figures—in Mass., these are mostly shellfishing operations.
  Variables—by town: license holders, licenses, acres, percent of total acres, $ total.
- **Commercial shellfishing data, Massachusetts**
  Source— Massachusetts Division of Marine Fisheries (DMF), Shellfish Sanitation and Management Program
  Data set—Shellfish Landings—Shellfish Catch Reports by Town, by Year.
  Variables—by town: permits by permit type (commercial; non-residents; recreational); catch reports (in pounds) by species.
- **Commercial shellfish value data, Massachusetts**
  Source— Massachusetts Division of Marine Fisheries (DMF), Sanitation and Management Program.
  Data set—Annual Shellfish Landed Values.
  Variables—Mass. landed values by species; by pound; by bushel; by piece.
- **Commercial fishing data, Massachusetts**
  Source—Massachusetts Division of Marine Fisheries (DMF), MIS and Fisheries Statistics Division Online summary—
  <http://www.mass.gov/dfwele/dmf/dealers/.>
  Data Set—Annual MA Commercial Permit Holders
  The DMF database on commercial permit holders is a relational database by commercial permit types. Its complexity makes it difficult to discern actual activities; for example, lobster permits can have multiple additional endorsements (gill netting, fish pots etc.).

Variables—Last or business name, first name, street address, city, state, zip code, permit type, permit ID, vessel name, vessel length, doc number, port town.

- **Commercial lobstering data, Massachusetts**
  Source—Massachusetts Division of Marine Fisheries (DMF), MIF and Fisheries Statistics Division. Online summary—
  http://www.mass.gov/dfwele/dmf/dealers/
  Data Set—Annual MA Commercial Permit Holders
  The DMF database on commercial permit holders is a relational database by commercial permit types. Its complexity makes it difficult to discern actual activities; for example, lobster permits can have multiple additional endorsements (gill netting, fish pots etc.).
  Variables—Last or business name, first name, street address, city, state, zip code, permit type, permit ID, vessel name, vessel length, doc number, port town
- **Technical report on Mass. lobstering**
  Massachusetts Division of Marine Fisheries Technical Report TR-23: *2003 Massachusetts Lobster Fishery Statistics*, by Micah J. Dean, Kimberly A. Lundy, Thomas B. Hoopes (released March 2005).
  Web Address:
  <http://www.mass.gov/dfwele/dmf/publications/lobster_report_2003_tr23.pdf.>
- **Fisheries data, Atlantic Coast states**
  Source—Atlantic Coastal Cooperative Statistics Program (ACCSP)
  <http://www.accsp.org/.>
  Data Set—This will be the repository for Mass. DMF dealer reporting information. It aims to provide standardized fisheries data for the entire Atlantic Coast—from Maine to Florida—including all state and federal programs. Operating for about ten years, it is still working to bring the data sets from each state up online in a standard form using a standard identification mechanism—trip-based data. Lack of funding and varied reporting regulations have made things difficult. The goal is for all of the partner state divisions to get their information into the ACCSP website. Registration is needed for access to data. Register at the following link:
  <http://smack.accsp.org:8080/webdav/myJSPs/accspreg.html>
- **Commercial fishing buyers data, Massachusetts**
  Source—Massachusetts Division of Marine Fisheries, Fisheries Statistics Division. Online summary—
  <http://www.mass.gov/dfwele/dmf/dealers/dealer_reporting.htm>
  Data Set—DMF Dealer Reporting Program: Annual MA Primary Buyers
  The DMF dealer reporting program is the only system at present designed to capture 'the universe' of fishing landings. The program, with data collected from 2005 on, will contain data collected from every primary buyer in Massachusetts on an annual basis.

Variables—Permit type, last or business name, first name, street address, city, state, zip code, permit ID number. More variables will be available when 2005 data set is fully analyzed.

II. **Marine Transportation:** transportation of foreign and domestic freight; water passenger transportation; cargo handling; towing and tugboat services.

- **Foreign trade by customs port, Massachusetts**
  Source—U.S. Customs Service
  Data set—U.S. Waterborne Foreign Trade by U.S. Customs Port, 1997 – 2004.
  Web address: U.S. Department of Transportation Maritime Administration—http://www.marad.dot.gov/Marad_Statistics/index.html.
  Variables—imports, exports, trade, metric tons; value; U.S. ports by rank
- **Port calls by vessel type, Massachusetts**
  Source—U.S. Customs Service
  Data set—U.S. Port Calls by Port and Vessel Type, 2002 – 2004
  Web address—U.S. Department of Transportation Maritime Administration—http://www.marad.dot.gov/Marad_Statistics/index.html
  Variables—by vessel type; capacity; and number of calls; by port

III. **Coastal Tourism and Recreation:** coastal tourism, recreational fishing, and recreational boating.

- **Coastal tourism, visits and expenditures**
  Source—Massachusetts Office of Travel and Tourism (MOTT)
  Study—Massachusetts Domestic Visitor Profile: Calendar Year 2004. Released April 29, 2005.
  Variables—the study provides base data on number of person trips by trip activity – relevant trip activities to this study include: beach activities and water sports/boating.
- **Recreational boating, registered Mass. Motorboats**
  Source—U.S. Coast Guard;
  Publication—Boating Statistics 2004. Commandant Publication P16754.18. U.S. Department of Homeland Security, U.S. Coast Guard. September 2005.
  Variables—Registration counts; a short time series
- **Additional registered boat statistics**
  Source—Massachusetts Marine Trades Association, Leona Roach, Executive Director, 155 Edgewater Drive, Pembroke, MA 02359
  (781)826-1570
  Leona.roach@boatma.com
- **Marine recreational fishing, effort data (angler trips), Massachusetts**
  Source—NOAA Office of Science and Technology.
  <http://www.st.nmfs.gov/st1/recreational/index.html>

Data Set—Marine Recreational Fisheries Statistics Survey—Effort Data (Angler Trips). We used these data to calculate impacts to supplement the main IMPLAN analysis.

- **Marine recreational fishing, participation data (number of people), Massachusetts**
  Source—NOAA Office of Science and Technology <http://www.st.nmfs.gov/st1/recreational/queries/participation/par_time_series.html.>
  Data Set—Marine Recreational Fisheries Statistics Survey – Participation Time Series
  Variables—by year and state: in-state coastal and non-coastal visitor counts and out-of-state participant counts through 2004.
- **Marine recreational fisheries, expenditures and impacts, 2006– to be released.**
  Source—NOAA Office of Science and Technology; <http://www.st.nmfs.gov/st1/recreational/New2006.html>
  Data Set—2006 Marine Recreational Fisheries Statistics Survey Daily Expenditure Estimates—will be used to calculate economic impacts. The data set for 2006 was being collected during the course of the study. A program note from the web link read as follows:
  Beginning in January 2006, every fisherman who is interviewed dockside by the Marine Recreational Fisheries Statistical Survey (MRFSS) will receive a series of questions about the money they spent on that trip. They will also be asked to participate in a longer follow-up mail survey that collects information on annual expenditures and durable goods, like boats, trailers, rods and reels. When completed, these data will allow NOAA Fisheries to estimate daily expenditures by fishing mode (i.e. private boat, charter, shore) and resident type (resident and non-resident). These expenditure estimates are then used to estimate the economic impacts of saltwater recreational fishing. (NOAA Office of Science and Technology; <http://www.st.nmfs.gov/st1/recreational/New2006.html>.)
- **Marine recreational fisheries, expenditures and impacts, 2001**
  Source—U.S. Department of the Interior and U.S. Department of Commerce.
  Data—2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts. Revised 2003.
  Variables –For different types of wildlife-associated recreation: numbers of participants (state residents and non-residents); days of participation; trips; demographic information; thousands of dollars of expenditures in Massachusetts by type of expenditure; numbers of spenders by type of expenditure.
- **Recreational lobstering statistics**
  Source—Massachusetts Division of Marine Fisheries, MIS and Fisheries Statistics Project.
  Publication—Massachusetts Division of Marine Fisheries Technical Report TR-23: *2003 Massachusetts Lobster Fishery Statistics*, by Micah J. Dean, Kimberly A. Lundy, Thomas B. Hoopes (released March 2005). Web Address:<http://www.mass.gov/dfwele/dmf/publications/lobster_report_2003_tr23.pdf>

Note from this reference report on data collection—"Recreational fishermen are asked to report on their permit renewal application form the number of lobsters taken during the previous year, hours dived and the maximum number of traps fished. Project personnel sort, edit, tabulate and interpret data from all reports received."

- **Recreational shellfish landings**
  Source—Massachusetts Division of Marine Fisheries, Shellfish Sanitation and Management Program
  Data Set—Shellfish Landings—Shellfish Catch Reports by Town, by Year.
  Variables—by town: permits by permit type (commercial; non-residents; recreational); catch reports (in pounds) by species.

IV. **Marine Science, Technology and Education:** instrumentation and equipment, marine services, research, non-profit marine research and education; marine materials and supplies; ship and boat building.

- **Key funding organizations of marine science research**
  Source—Dr. David Terkla, University of Massachusetts Boston
  There is no consolidated source of data on research expenditures or employment of marine science institutions in Massachusetts. However, key marine science research institutions and key funding agencies are identifiable as follows: National Science Foundation, U.S. Environmental Protection Agency; National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Sea Grant, National Marine Fisheries Service, U.S. Department of Transportation, U.S. Navy, U.S. Coast Guard, Army Corps of Engineers.
- **Key marine science institutions and programs, Massachusetts**
  Source— The Marine Science and Technology Industry in New England (Barrow, Loveland, Terkla, 2005)
  Woods Hole Oceanographic Institute (WHOI), Marine Biological Laboratory (MBL), University of Massachusetts Intercampus Graduate School of Marine Science and Technology, The School for Marine Science and Technology at University of Massachusetts Dartmouth (SMAST), The New England Aquarium, departmental programs at Massachusetts Institute of Technology, Harvard University, Boston University, Northeastern University, UMass Boston, UMass Lowell, UMass Amherst, Southeastern Massachusetts Aquaculture Center and Northeastern Massachusetts Aquaculture Center.

V. **Marine-Related Construction and Infrastructure:** Ports, coastal and offshore infrastructure and coastal real estate development.

- **Port capital expenditures, U.S.**
  Source—U.S. Department of Transportation, Maritime Administration
  Data Sets—Publications and Statistics at

<http://www.marad.dot.gov/publications/ports.htm>

- **Port capital expenditures, Massachusetts**
  Source—Massport; <http://www.massport.com/about/pdf/c_2005os.pdf>
  Publication—2005 Bonds, Series A, B and C—Official Statement. Massport

APPENDIX 6. REFERENCES

This section identifies resources consulted in the development of this study. These reference materials were used in addition to those identified in the Appendix of Data Sets.

I. Commercial Seafood

2003 Massachusetts Lobster Fishery Statistics
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The Annual Report on the United States Seafood Industry.
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The Effect of Reduced Supply on Fish Processing in New England
Daniel Georgianna, Ph.D. and Joel Dirlam. Presented at International Institute of Fishery Economics and Trade Biennial Conference, Oregon State University, Corvallis, Oregon, 2000.

Employment, Income and Working Conditions in New Bedford's Offshore Fisheries
Daniel Georgianna, Ph.D. and Debra Shrader. Final Report for Saltonstall-Kennedy NA03-NMF-4270265, NMFS/NOAA, U. S. Department of Commerce, 2005.

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National Oceanic and Atmospheric Administration and National Marine Fisheries Service, U.S. Department of Commerce, various years.

O*yster Wars and the Public Trust: Property, Law, and Ecology in New Jersey History*
Bonnie J. McCay, Bonnie J. University of Arizona Press, 1998.

II. Marine Transportation

Boston Harbor Channel Deepening Project, Economic Benefits Analysis
David Miller and Associates, August 2005.

Economic Impact Report 2006— Massport Connecting

Massachusetts Port Authority (Massport) and the Greater Boston Chamber of Commerce. 2006.

Guide to Market Research for Marine Transportation Services
Prepared by Market Scope, Inc for the Office of Statistical and Economic Analysis, U.S. Maritime Administration. November 2002.

III. Coastal Tourism and Recreation

2001 National Survey of Fishing, Hunting and Wildlife Associated Recreation, Massachusetts
U.S. Department of the Interior and U.S. Department of Commerce, revised 2003.

Boating Statistics 2004
Department of Homeland Security, U.S. Coast Guard, September 2005.

Boating's Economic Impact
Massachusetts Marine Trades Association (MMTA)
<www.boatma.com/boating_in_ma.html.>

The Economic Impact of Travel on Massachusetts Counties, 2004
Prepared by the Research Department of the Travel Industry Association of America for the Massachusetts Office of Travel and Tourism, January 2006.

The Fiscal Impact of Beaches in California
Philip King, Ph.D., Public Research Institute, San Francisco State University. Prepared for the California Department of Boating and Waterways, September 1999.

Marine Recreational Fisheries Statistics Survey—Effort Data (Angler Trips)
National Oceanic and Atmospheric Administration, Office of Science and Technology, 2006.

MOTT TravelStats Newsletter—January 2006
Massachusetts Office of Travel and Tourism, January 2006.

MOTT TravelStats Newsletter—February 2006
Massachusetts Office of Travel and Tourism, February 2006.

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Massachusetts Office of Travel and Tourism, April 2005.

Recreational Boating Expenditures in 2003 in New York State and Their Economic Impacts

Tommy L. Brown, Nancy A. Connelly, David L. Kay, Cornell University Department of Natural Resources. Prepared for New York Sea Grant, September 2004.

Tourism and Community Development: Resources and Applied Research Clearinghouse:Economic Impact Analysis in Tourism
Wisconsin Department of Urban and Regional Planning.
<http://www.wisc.edu/urpl/people/marcouiller/projects/clearinghouse.>

IV. Marine Sciences and Technology

2004 Annual Report
Carolyn A. Bunker, Vice President for Finance and Administration
Woods Hole Oceanographic Institution, 2004.

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Dianne Claydon. *Mass High Tech: The Journal of New England Technology*, March 20, 2006.

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Necati Aydin, Ph.D. and Tim Lynch, Ph.D.
Leadership Board for Applied Research and Public Service, Florida State University, May, 2004.

The Marine Science and Technology Industry in New England
Clyde Barrow, Rebecca Loveland and David Terkla
University of Massachusetts Donahue Institute, 2005.

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U.S. Public Port Development Expenditure Report
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VI. Coastal and Marine Industry

California's Ocean Economy: report to the Resources Agency, State of California
Professor Judith Kildow and Professor Charles S. Colgan. The National Ocean Economics Program. July, 2005.

Employment and wages for the U.S. ocean and coastal economy
Charles S. Colgan. *Monthly Labor Review*, November 2004. U.S. Department of Labor, Bureau of Labor Statistics. < http://www.bls.gov/opub/mlr/mlrhome.htm>

APPENDIX 7. SURVEY OF MARINE ECONOMY BUSINESSES: METHODOLOGY AND TABULAR RESULTS

Methodology

The survey was conducted by telephone from May 18 to May 24, 2006. The survey includes a total of 548 valid responses from a total number of 3,503 phone calls, a response rate of 15.6%[66]. The survey respondents were randomly chosen from a list of contacts organized by sector. The total number of respondents needed from each sector was based on the distribution of businesses by sector in the total marine economy in Massachusetts. In other words, if 14 percent of all marine economy businesses are in the *Commercial Seafood Industries* sector, every attempt was made to ensure that approximately 14 percent of survey respondents would be from the *Commercial Seafood Industries* sector. UMDI prepared the list of business contacts by drawing lists of businesses by sector from the Dun and Bradstreet MarketPlace database.

The survey results are scientifically-valid at a 95 percent confidence interval, though a word or two about the interpretation of the results is in order. Overall, the survey has a margin of error of plus or minus 4.7 percent. This is within the standard margin of error of most professional surveys and should be interpreted as meaning that the survey results, when generalized to the total population of marine economy businesses in Massachusetts, fall into a range from 4.7 percent below the reported figure to 4.7 percent above the reported figure.

[66] A breakdown of the disposition of these phone calls can be found at the end of this Appendix.

Description of Businesses Surveyed

The establishments included in this survey conduct business in five sectors: *Coastal Tourism and Recreation, Commercial Seafood Industries, Marine Transportation, Marine Science and Technology, and Marine-Related Construction and Infrastructure*. As in the marine and coastal economy as a whole, the majority of establishments in the sample were in the *Coastal Tourism and Recreation* sector (74.8 percent of all businesses). The *Commercial Seafood* sector was the next largest, with 13.3 percent of the sample, followed by the *Marine Science and Technology* sector (8.2 percent), the *Marine Transportation* sector (2.9 percent) and the *Marine-Related Construction and Infrastructure* (.7 percent or four establishments).

The surveyed businesses are primarily small businesses with fewer than 50 employees. Over 90 percent of businesses reported employing fewer than 50 people, with 51 percent reporting fewer than 10 employees. The sample included 36 businesses with 50 to 99 employees and 15 businesses with 100 to 499 employees. The larger establishments were distributed between the *Coastal Tourism and Recreation*, *Commercial Seafood Industries* and *Marine Sciences and Technology* sectors.

Tabular Results

2006 Massachusetts Marine Economy Business Survey Results

1. Business sector breakdown (existing business sector definitions).

	Number	Percent
Coastal Tourism and Recreation	410	74.8
Commercial Seafood	73	13.3
Marine Transportation	16	2.9
Marine Science and Technology	45	8.2
Marine Related Infrastructure	4	.7
Total	548	100

2. How many people work at this business location?

	Number	Percent
1 – 9	275	24.5
10 – 49	206	38.7
50 – 99	36	6.8
100 – 499	15	2.8
500 or more	0	0
Total	532	100

3. In the past 12 months, did the number of your employees:

	Number	Percent
Increase	127	24.5
Decrease	26	5.0
Stay the Same	349	67.2
Don't Know	17	3.3
Total	519	100

4. In the past 12 months, did your sales or revenue:

	Number	Percent
Increase	170	32.6
Decrease	82	15.7
Stay the Same	196	37.5
Don't Know	74	14.2
Total	522	100

5. Looking forward, in the next 12 months do you expect the number of your employees to:

	Number	Percent
Increase	137	26.6
Decrease	24	4.7
Stay the Same	326	63.3
Don't Know	28	5.4
Total	515	100

6. In the next 12 months, do you expect your sales or revenue to:

	Number	Percent
Increase	336	65.5
Decrease	31	6.0
Stay the Same	105	20.5
Don't Know	41	8.0
Total	513	100

7. Where does your business primarily purchase its supplies? Are they located:

	Number	Percent
In the community in which your business is located	123	23.8
Within a 25 mile radius of your location	105	20.3
Within Massachusetts	187	36.2
Throughout the United States	85	16.4
Outside of the United States	17	3.3
Total	517	100

8. Where does your business primarily draw its customers? Are they located:

	Number	Percent
In the community in which your business is located	154	29.9
Within a 25 mile radius of your location	85	16.5
Within Massachusetts	96	18.6
Throughout the United States	162	31.5
Outside of the United States	18	3.5
Total	515	100

9. Where do you recruit most of your employees? Are most of your employees hired from:

	Number	Percent
In the community in which your business is located	359	70.0
Within a 25 mile radius of your location	88	17.2
Within Massachusetts	31	60.0
Throughout the United States	28	5.5
Outside of the United States	7	1.4
Total	513	100

10. Do you have difficulty finding skilled labor to staff your business?

	Number	Percent
Yes	162	31.5
No	352	68.5
Total	514	100

11. If yes, how big a problem do you have finding workers? Is it a:

	Number	Percent
Big Problem	54	10.5
Problem	31	6.0
Modest Problem	83	16.1
Not a Problem	310	60.3
Don't Know	36	7.0
Total	514	100

12. What factors, if any, make recruiting difficult for your company:

	Number	Percent
Lack of labor with required skills/ expertise	115	22.5
Not enough local workers who are skilled	36	7.0
High cost of local housing	37	7.2
Immigration restrictions are too strict	15	2.9
Other	309	60.4

13. I'm going to read to you a list of potential obstacles to growth that your business may be facing. Thinking about your business, I'd like you to tell me how much of a problem each item is on a scale of one to five, with one meaning it is not at all a problem and five meaning it is a major problem for your business:

Figure 56 – Business Problems As Ranked by Survey Respondents

Problem Area	1	2	3	4	5	Sum of 4 and 5
The Cost of Real Estate	36.1	6.3	12.3	7.0	38.3	45.3
Having Suitable Land for Expansion	57.6	7.3	8.2	4.1	22.7	26.8
Government Regulations and Permitting	52.1	12.5	12.7	7.0	15.6	22.6
Availability of Skilled Workers	55.3	10.4	16.5	6.1	11.8	17.9
Adequate Harbor or Port Infrastructure	67.0	10.4	8.1	4.9	9.6	14.5
Access to Marine Resources or Submerged Land	72.5	7.8	7.6	2.4	9.6	12.0
Access to Broadband Services	76.6	8.8	7.2	1.4	6.1	7.5
Access to Capital	68.0	12.4	12.8	2.4	4.3	6.7
Access to Customers	71.1	11.7	12.3	2.1	2.7	4.8
Access to Suppliers or Partners	73.6	13.3	9.6	1.6	2.0	3.6

Disposition of Calls Report

Code	Disposition	Total	Group
1100	Complete	516	**Complete Interview**
1200	Partial	33	**Partial Interview**
2110	Eligible: Refusal	490	
2115	Eligible: Refusal (Do Not Call)	0	
2120	Eligible: Break-Off	0	
2210	Eligible: Resp Never Available	0	
2221	Eligible: Ans Machine, No Message	432	
2222	Eligible: Ans Machine, Message	0	
2310	Eligible: Dead	0	
2320	Eligible: Phys/Mentally	0	
2330	Eligible: Languange Unable	45	
2340	Eligible: Misc Unable	0	
3120	Busy/callback	183	
3130	No Answer	850	
3140	Ans Mach (Don't Know if HU)	0	
3150	Technical Phone Problems	0	
3210	HU, Unknown Eligible: No Scrnr	0	
3220	HU, Unkown Eligible: Other	0	
4100	Out of Sample	0	
4200	Fax/Data Line	44	
4310	Non-working Number	14	
4320	Disconnected Number	196	
4410	Number Changed	20	
4420	Cell Phone	11	
4430	Call Forwarding	0	
4510	Business/Government/Other Organization	2	
4520	Institution	1	
4530	Group Quarter	0	
4700	No Eligible Respondent	161	
4800	Quota Filled	0	
5100	Callback, Resp Not Selected	0	
5200	Callback, Respondent Selected	505	

This report uses disposition codes recommended by the American Association of Public Opinion Research.
See http://www.aapor.org/pdfs/standarddefs_4.pdf for a description of these codes and their interpretation.