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NATIONAL OCEAN ECONOMICS PROGRAM

State of the U.S. Ocean and Coastal Economies
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Center for the Blue Economy
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Definitions and Terminology

The following terms and definitions regarding economic indicators and valuation categories are presented in the beginning of this report to avoid repetition and for purposes of clarity so that the reader can understand fully the intent of the authors.

Coastal Economy

The sum of all economic activity occurring in counties defined by states as part of their coastal zone management program or part of a coastal watershed as defined by the U.S. Geological Survey. For purposes of analyzing the Florida coastal economy, counties are divided between shore-adjacent and inland counties more clearly to illuminate the differences between the shoreline and inland regions.

Consumer Surplus

Non-market values reflected in the difference between what consumers pay for a good and the maximum that they would be *willing* to pay for the same good.

Dead Zones

"Dead zones" in this context are areas where the bottom water (the water at the sea floor) is anoxic—meaning that it has very low (or completely zero) concentrations of dissolved oxygen. Because very few organisms can tolerate the lack of oxygen in these areas, they can destroy the habitat in which numerous organisms make their home (NASA 2009).

Dollar Values

Values are expressed in constant dollars with 2005 as the base year unless otherwise stated. Wages are adjusted using the U.S. Consumer Price Index (CPI). The Gross State Product (GDP-S) is estimated using U.S. Bureau of Economic Analysis (BEA) estimates of real GDP (Landefeld 1997).

Direct values are those activities associated only with the designated ocean sectors such as recreation & tourism and living resources (examples include labor and capital costs associated with fish processing or ship building).

"Chain weighted dollars" are a method of computing the difference in value arising solely from changes in price. This is done by first estimating changes in the quantities of goods and services produced at different time periods and then separating overall changes in value into price and quantity changes. The result is a more accurate method of estimating the effects of inflation on changes in output than using multipliers. (For more information, see Yuskavage, Robert 1996 Improved Estimates of Gross Product by Industry 1959-1994. Survey of Current Business August 1996.)

Unless otherwise indicated, all measures are stated as direct values.

Employment

Annual average wage and salary employment (excluding self-employment) as reported in the Quarterly Census of Employment and Wages (formerly known as the ES-202 employment series). This definition covers about 90% of employment in the United States. It excludes farm employment, the military, railroads, and self-employment. Wage and salary employment measures employment by place of work, not by place of residence. It also measures jobs, not people. It does not distinguish between full- and part-time work, or year-round and part-year jobs. The data in the NOEP database are annual average employment.

Gross Domestic Product (GDP)

GDP-S is a measure of the contribution of the sector to the value of goods and services in the economy. GDP is a measure of value-added, or sales, minus the cost of inputs. Using this measure eliminates "double counting," among sectors. GDP data are published only at the state level and for industry aggregations greater than used in the ocean economy definition. In order to estimate a share of GDP in an ocean or coastal economy industry, the proportion of the GDP for a given sector is calculated based on the proportion of total wages paid in that sector by a given establishment. Since wages often account for as much as 60% of GDP, this method is a reasonable approximation of individual establishments' contribution to GDP.

Geography

"County" means a county or a county-equivalent area as defined by the Census. In most states, the county is an administrative unit of local government; this includes parishes in Louisiana. In Massachusetts and Connecticut the county has little or no administrative function, and historical county boundaries are used. In Alaska, the borough or the Census-designated area is used. In Virginia, counties

and cities are separate administrative units, and both are included as "counties" in the NOEP data. In Florida, the City of Miami consolidated with Dade County to create Miami-Dade County; this consolidated unit is used in all NOEP data.

North American Industrial Classification System (NAICS)

NOEP Economic statistics are grouped by a classification system known as the North American Industrial Classification System (NAICS), which imperfectly reflects the relationship between economic activity and the ocean. The NAICS is the successor to the Standard Industrial Classification. It was developed in the 1990s as a part of the North American Free Trade Agreement (NAFTA) to provide a common basis for the United States, Canada, and Mexico to measure their economic activity. The definition of the ocean economy industries is derived from the NAICS classification codes for the industries. The definitions can be found in Table 3.1.

The sectors marine construction**,** marine living resources**,** offshore minerals, ship & boat building and repair, coastal tourism & recreation, and marine transportation include specific industries that contribute to the ocean economy. Those industries shown in *italics* are considered ocean-related only when they are located in near-shore areas, which is defined by location in a shore-adjacent zip code. The use of NAICS codes and geography provides the best means of measuring the ocean economy. This methodology is based on available data consistent across all states and can provide information from the national to the local level.

National Ocean Economics Program (NOEP)

The National Ocean Economics Program is the core research activity of the Center for the Blue Economy at the Monterey Institute of International Studies. Funded by a private donoration from the Loker Foundation and other generous donors, The NOEP compile, analyse and distribute data at www.oceaneconomics.org, to provides users with accurate and timely estimates of changes in the nature and value of the ocean and coastal-based economy.

Non-market Values

Values attributed to goods and services which are not exchanged in normal market transactions, but which have economic value nonetheless.

Ocean Economy

The concept of the ocean economy derives from the ocean (or Great Lakes) and its resources being a direct or indirect input of goods and/or services to an economic activity: a) an industry whose definition explicitly ties the activity to the ocean, or b) which is partially related to the ocean and is located in a shore-adjacent zip code. This is defined in part by the definition of an industry in the North American Industrial Classification System1 (for example, deep sea freight transportation) and partly by geographic location (for example, a hotel in a coastal town).

Wages and Salaries

Total wages and salaries paid; all wages are shown in year 2005 dollars. Self-employed is included.

1 As of 2000, all industries are classified using the North American Industry Classification System (NAICS) rather than the Standard Industrial Classification (SIC by BLS). NAICS focuses on how products and services are created, as opposed to SIC which focuses on what is produced. Using NAICS yields significantly different industry groupings from those produced using SIC.

Executive Summary

ES.1. Introduction

The nation's coasts and oceans contribute much to the United States economy. For the past 14 years, the National Ocean Economics Program (NOEP), now a program of the Center for the Blue Economy at the Monterey Institute of International Studies, has compiled time-series data that track economic activities, demographics, ports and cargo volume and value, natural resource production and value, non-market values, and federal expenditures in the U.S. coastal zone both on land and in the water. A report on the ocean and coastal economies of the United States was released by NOEP in 2009 covering data through 2005. This report is an update of that study covering the period 2007–2012. State summaries from this report are available on the NOEP website under publications. The major conclusions of the report are summarized here.

All of the data discussed in this report are available on the NOEP website at www.oceaneconomics.org. In 2010, the Coastal Services Center of the National Oceanic and Atmospheric Administration (NOAA) took over production of the Ocean Economy data series using a methodology developed by NOEP that combines existing federal data from the U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis, and the U.S. Census Bureau. Therefore, the Ocean Economy data are also available from NOAA's Coastal Services Center in a different format, at http://www.csc.noaa.gov/digitalcoast/data/enow.

To understand the economy of the ocean and coasts, we distinguish three different approaches to measurement:

- The coastal economy—total amount of economic activity originating in coastal regions. We measure this as employment, wages, and output in 10 sectors located in coastal states, in counties that are adjacent to the shoreline of the oceans and Great Lakes, those counties considered part of State Coastal Management Programs, in those counties located in coastal watersheds, and in inland counties that are not in watersheds.
- The ocean economy—we measure employment, wages, and output from 6 sectors and 21 industries whose goods and services derive in one way or another from the oceans and Great Lakes.
- The non-market values measured by the value people place on coastal and ocean resources above and beyond what they buy in markets but which are often quite significant.

The chapters in this report cover each of these elements, using 4 indicators: employment, wages, number of establishments, and Real Gross Domestic Product (RGDP). In addition to these indicators, the Ocean Economy section (Chapter 3) also includes additional information that NOEP compiles related to several of the sectors: port and cargo information under "Marine Transportation", beach nourishment data under Marine Construction, and Production and Value data under both "Marine Minerals" and "Fishing Industries."

ES.2. The Coastal Economy

The coastal economy of the United States is big by any absolute or relative standard, and the economy of the coastal states largely drives the U.S. economy. Coastal states contributed 81% of U.S. employment in 2012 and 84% of total U.S. GDP. Within these states, the shore-adjacent counties comprise 37% of overall employment on just 17.5% of US land area, indicating that the concentration of the nation's economy is found near the oceans and Great Lakes.

Coastal waters are the great mixing zones of salt and fresh water, and thus the ecological definition of the coasts extends inland to include adjacent watersheds. By extension, the economic definition follows the ecological definition. When watershed counties are included (i.e., counties covered by the Federal Coastal Zone Management Program), 2012 values for employment rise to 67 million employees, representing just over half (51%) of all employment in the U.S. and two-thirds (56.1%) of U.S. GDP (see Figure ES.1).

The coastal economy is primarily an urban economy and the distribution of economic activity along the coasts is driven significantly by forces affecting urban regions, most notably the spread of population and economic activity away from the city centers in the pattern that has come to be known as "urban sprawl." Over the past 20+ years, population growth has generally been faster away from the shore while employment growth has been faster nearest the shore, though employment growth has somewhat accelerated inland in recent years.

Recent changes in the coastal economy have been driven by a national economy that has undergone a significant recession followed by a slow recovery. Between 2007 and

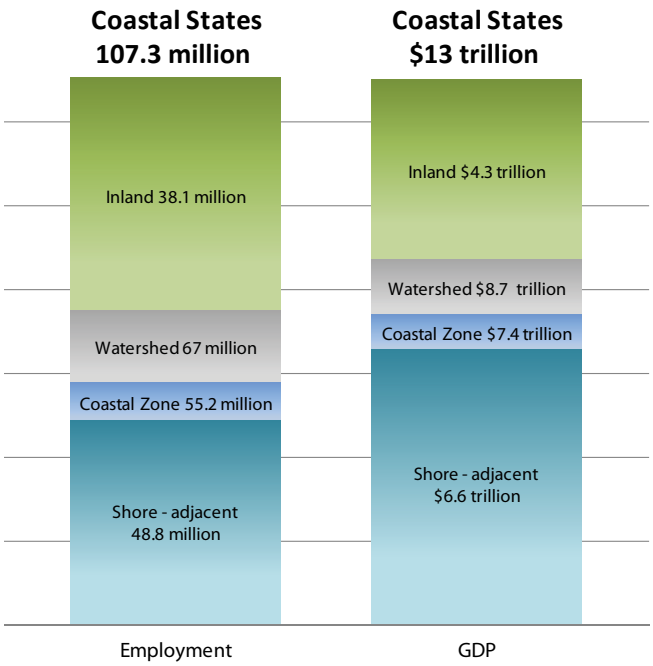

Figure ES.1. Components of the coastal states economy in 2012.

2012, coastal states lost 3.8 million jobs, accounting for 80.5% of national job losses, but contributed an additional $260 billion to GDP, reflecting the faster recovery in GDP and slower recovery in employment. Shore-adjacent counties lost 1.6 million jobs, (44% of U.S. losses), while coastal watersheds lost 2.2 million jobs (61% of U.S.).

Employment growth in shore-adjacent areas has generally been fastest in the Gulf Coast states and slowest in the Great Lakes states. Growth in the shore-adjacent counties of the Gulf of Mexico has been variable, ranging from moderate growth in Louisiana, Mississippi, and Texas to a major decline in Florida. Alaska and New York were the only other states to show some recovery in their shore-adjacent counties between 2007 and 2012, while the other coastal states have not yet recovered from employment losses.

The geography of America's coasts is enormously varied, and reflecting this, coastal states exhibit great variety in the size and role of their coastal economies. Three states (Rhode Island, Delaware, and Hawaii) are entirely comprised of shore adjacent counties, though they are small, ranking 18th, 17th, and 20th respectively in shore-adjacent county employment. At the other extreme are the large states with large urban areas. California is the largest state in overall employment as well as the largest in employment in shore-adjacent counties. New York and Florida are also at the top of employment and near the top of the proportion of state employment in shore-adjacent economies. Other states such as Alaska and Maine can be characterized as smaller in size, but the coastal economy is more essential to the state. On the other hand, states like Pennsylvania and Virginia rank highly in the size of their coastal economy, but much lower in the proportion of the state's economy in shore-adjacent economies (See Table ES.1).

Table ES.1 Coastal state and shore-adjacent counties employment, 2012

	Coastal State Employment		Shore-adjacent Counties	
State	Employment	Rank	% of State	Rank
Alabama	224,090	26	12.3%	26
Alaska	279,771	24	85.5%	4
California	11,607,875	1	77.6%	5
Connecticut	951,307	14	58.4%	10
Delaware	405,214	20	100.0%	1
Florida	5,368,259	3	73.1%	7
Georgia	208,528	27	5.4%	29
Hawaii	604,874	17	100.0%	1
Illinois	2,727,015	5	48.4%	14
Indiana	285,786	23	10.2%	27
Louisiana	685,462	16	36.6%	16
Maine	322,929	21	55.4%	11
Maryland	1,277,132	10	50.8%	13
Massachusetts	1,712,214	9	52.8%	12
Michigan	1,731,046	8	44.0%	15
Minnesota	113,634	30	4.3%	30
Mississippi	143,874	29	13.3%	25
New Hampshire	180,304	28	29.4%	19
New Jersey	2,519,037	6	66.8%	9
New York	6,506,129	2	76.0%	6
North Carolina	321,477	22	8.2%	28
Ohio	1,170,118	13	23.2%	22
Oregon	249,700	25	15.2%	24
Pennsylvania	1,213,178	12	21.7%	23
Rhode Island	450,687	18	100.0%	1
South Carolina	422,718	19	23.4%	21
Texas	2,851,906	4	26.6%	20
Virginia	1,219,575	11	33.7%	18
Washington	2,078,302	7	71.8%	8
Wisconsin	947,724	15	35.2%	17

ES.3. The Ocean Economy

In 2010 the ocean economy comprised over 2.7 million jobs and contributed over $258 billion to the GDP of the United States. The largest sector by both employment and GDP is the Tourism & Recreation sector, accounting for 1.9 million jobs and $89 billion in economic output (Table ES.2).

The size of the ocean economy can be appreciated by comparing it to employment and GDP in other regions and industries. In 2010:

- In terms of states, the ocean economy would be the 25th largest state by employment and the 20th largest state by GDP, the same size as Colorado.
- In terms of coastal states, the ocean economy would be the 14th largest coastal state by employment and the 18th largest coastal state by GDP.

Table ES.2. Ocean Economy by Sector 2010

Ocean Sector	Ocean Industry
Construction	Marine Related Construction
Living Resources	Fish Hatcheries & Aquaculture
	Fishing
	Seafood Markets
	Seafood Processing
Minerals	Sand & Gravel
	Oil & Gas Exploration and Production
Ship & Boat Building	Boat Building & Repair
	Ship Building & Repair
Tourism & Recreation	*Amusement and Recreation Services*
	Boat Dealers
	Eating & Drinking Places
	Hotels & Lodging Places
	Marinas
	Recreational Vehicle Parks & Campsites
	Scenic Water Tours
	Sporting Goods Retailers
	Zoos, Aquaria
Transportation	Deep Sea Freight Transportation
	Marine Passenger Transportation
	Marine Transportation Services
	Search and Navigation Equipment
	Warehousing

The multiplier effects of the ocean economy

The people and organizations in the ocean economy affect the total U.S. economy to a greater extent than is indicated by the employment and output measures discussed so far. The firms in the industry buy inputs from other industries whose sales are thus indirectly dependent on the ocean economy's success. The employees in the ocean industries spend their incomes and these sales to employees are said to be induced activity from the ocean economy. Together these effects are known as the "multiplier effect."

Multiplier effects are estimated using economic models that trace the purchases of firms and employees in the ocean economy (the "direct" effects) throughout indirect and induced effects. For the ocean economy, IMPLAN, one of the major economic models of this type, was used in this study. The resulting estimates indicate that the ocean economy has an employment multiplier of 1.92, meaning that the 2.8 million jobs in the ocean industry in 2010 were associated with indirect and induced jobs totaling 2.6 million. Thus the total employment associated with the ocean economy was 5.4 million jobs. The multiplier effect estimates for GDP is 2.45, meaning that an additional $375 billion is generated on top of the $258 billion that was directly generated. The total contribution of the ocean economy is thus estimated at $633 billion or 4.4% of national GDP (Figure ES.2).

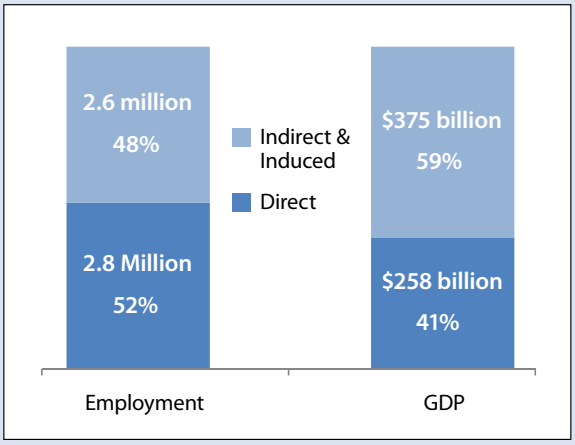

Figure ES.2. Ocean employment and GDP with multipliers, 2010

Table ES.3 Ocean economy sectors

Sector	Employment	"GDP (Billions of Dollars)*"
Construction	46,390	$5.51
Living Resources	59,354	$6.02
Minerals	143,995	$87.37
Ship & Boat Building	144,066	$10.84
Tourism & Recreation	1,931,746	$89.25
Transportation	443,934	$58.73
Total	**2,770,000**	**$258.00**

- In terms of metropolitan areas, the ocean economy would be the 39th largest metropolitan area by employment, about the same size as Atlanta, and the 17th largest metropolitan area by GDP in the United States, slightly smaller than San Diego.
- In terms of industries, the ocean economy supports employment almost two and a half times larger than other natural resource industries such as farming, mining, and forest harvesting, which together employed 1.15 million in 2010.

These estimates likely understate the size of the ocean economy, as the limitations on government data series exclude some important ocean-related economic activities in inland states.

Taking into account the jobs supported indirectly by the ocean economy, the total jobs related to the ocean economy are estimated at 5.4 million in 2010, and the total 2010 GDP including indirect effects is $633 billion (see sidebar).

Ocean Economy Sectors

Ocean sectors and related ocean industries are outlined in Table ES.3. Employment in the ocean economy grew from 2005 to 2008 in most sectors (except for living resources), but employment then declined in all sectors during the following recessionary period from 2008 to 2010. The largest employment declines came in transportation (-34,650) and in tourism & recreation (-34,620). The largest rates of decline in real GDP were in the ship & boat building (-26.6%), minerals (-11.7%) and construction (-6.1%) industries. Minerals had the largest growth in employment relative to 2005 and a large decline relative to its peak.

Recent trends in the ocean economy also reflect important long-term trends, the most significant of which is the rise of tourism & recreation as the defining sector of ocean economy employment. Domestic travel and recreation remains affordable to most people, and the oceans and Great Lakes have been a center for U.S. vacations and leisure since the nineteenth century. At the same time, increasing productivity in sectors such as transportation and minerals allowed increases in per capita output with fewer employees. In the fishing industries that make up the majority of the living resources sector, tighter resource management restrictions and natural changes have reduced the significance of what was once a dominant ocean economy activity.

The ocean economy is distributed across the coastal states in ways that are both consistent with the distribution of the national economy as a whole and also unique to certain features of the ocean economy (Table ES.4). For example, four of the five largest states in terms of ocean economy employment are also the four largest states in terms of total employment. These are Texas, California, Florida, and New York. California is the only state ranked in the top five states by employment for five of the six ocean economy sectors and also in the top five in ocean economy overall. The state of Washington ranks highly among states in living resources and ship & boat building because it is the center for the Northwest Pacific fisheries.

Table ES.4. Top five GDP states by employment in ocean sectors and total ocean economy, 2010

Ocean Economy	Tourism & Recreation	Marine Construction	Living Resources	Minerals	Ship & Boat Building	Marine Transportation
Texas	New York	Texas	Washington	Texas	Washington	California
California	California	California	Alaska	Louisiana	Virginia	New Jersey
Florida	Florida	New York	Virginia	Alaska	Connecticut	Texas
New York	Hawaii	Louisiana	Massachusetts	California	Louisiana	New York
Louisiana	Washington	Florida	Louisiana	Michigan	California	Maryland

ES.4. Sector Highlights

Construction

Marine construction was severely affected by the recession, declining more than 13% in employment and 6% in output between 2008 and 2010. Both the decline in overall construction and a drop in oil exploration after the oil price decline in 2008 contributed to this decline. Marine construction is strongly connected to offshore oil activity and ports, which means that the changes in marine construction were greatest in Texas and Louisiana. Together, Texas, Louisiana, Florida, New York, and California accounted for 51% of total marine construction employment in the 27 states for which 2010 industry data are available.

Beach nourishment is another important part of marine construction that has been occurring for more than fifty years, with average annual national expenditures increasing from $256,800 in the 1960s (in 2005 dollars) to over $1.3 million a year in this decade. The volume of sand moved has increased in the past two decades, and the cost of each cubic yard of sand used for beach nourishment has increased by nearly 600% in real dollars since the 1960s. California has had the least expensive cost per volume of sand of all states.

Living Resources

Employment in the sector declined throughout the 2005–10 period, with the most severe drop occurring in 2007–08, when consumer demand fell dramatically during the onset of the recession. This drop in demand translated into sharp drops in both employment and GDP for the sector. Output had shown some recovery by 2010.

Measuring employment in the living resources sector is difficult because most fisheries employment is not included in standard employment data. Commercial fish harvesters are considered self-employed in most cases and not included in the Quarterly Census of Employment and Wages. Using data from the Census Non-employer Series, about half the living resources sector employment is comprised of self-employment, with an estimated 59,618 jobs in 2010. Both types of employment declined from 2005–2009.

The Northwest Pacific (i.e., AK, CA, HI, OR, and WA) fisheries remain the largest source of fish landings; this share increased from 68% to 72% between 1990 and 2011. After the Pacific, the two most important fisheries regions are the Gulf of Mexico and New England, both of which experienced a more than 10% decline in landings and employment over the past decade.

Minerals

The oil & gas exploration and production industries dominate the minerals sector, accounting for 94% of employment and 99% of sectoral GDP. Because of the dominance of oil and gas in this sector, employment and output growth are closely tied to world oil prices. Employment and output growth have risen and fallen with oil prices usually with a one-year lag in an inverse relationship. For example, in both 2008 and 2010, an increase in the price of crude oil corresponded to a decrease in GDP; in 2009, a drop in price corresponded to an increase in GDP.

Between 2005 and 2010, offshore (state & federal) crude production decreased in all regions except the Central Gulf region (Louisiana). This region accounted for 85% of 2012 production and generated a 35% increase for the period.

It appears that state offshore production has decreased in all states except Texas, offsetting the drop in the outer continental shelf (OCS). However, estimating Texas state production has been difficult and unreliable. In general, offshore production, both state and OCS has dropped in all states except in the Louisiana OCS.

Ship & Boat Building

Ship building, primarily for the U.S. Navy, comprises 85% of the employment in this sector. The boat building industry in the U.S. primarily serves the recreational market and demand in virtually all segments of the recreational boating market collapsed with the onset of the financial crisis and the recession. Therefore, while ship building remained fairly steady throughout the recession, the boat building industry suffered a significant decline, losing 57% of employment (28,095 jobs) from 2005 to 2010.

Tourism & Recreation

Eating and drinking establishments along with hotels and other lodging located in shore-adjacent zip codes make up the vast majority of both employment and output in this sector. These two sectors comprise 94% of employment (eating establishments are 74%) and 92% of GDP (eating establishments are 56%). Unlike other ocean economy sectors, tourism & recreation employment and GDP grew in all coastal states despite the economic effects of the recession. This continued growth is rather remarkable because much of the U.S. coast has already been intensively developed for tourism. While growth in new establishments varied greatly from state to state, overall eating and drinking establishments grew by about 12.4%, while hotels and lodging had only 0.5% growth between 2005 and 2010.

As with fish harvesting, the tourism and recreation sector is also characterized by a number of employees being self-employed, particularly in industries outside the lodging and eating industries. The Census Non-employer data series indicates that there are about 27,500 self-employed jobs in the tourism and recreation sector, accounting for 1.4% of overall sectorial employment.

Marine Transportation

The Marine Transportation sector comprises five industries: deep sea freight, marine passenger, marine transportation services, warehousing (when located in a shore-adjacent county), and search and navigation equipment. The industries are approximately equal in size in terms of employment. However, the search & navigation equipment industry dominates the share of GDP, comprising just over half of the sector. This distribution reflects the high output of the electronics equipment industry during this period, of which search & navigation equipment is part.

Employment in the marine transportation sector rose during the end of the last expansion period, but fell throughout the recession by nearly 8%. Meanwhile, GDP growth was consistent through the period, though it too fell sharply during 2008–09. This trend of GDP contribution rising faster than employment reflects long-term productivity improvements throughout this sector.

Data on cargo departing and arriving in US ports indicated a 2.4% (35 million ton) increase in volume and 30.9% ($340 billion) increase in value of cargo during the period 2005–2008. During the recession (2008–2010), shipping weight declined by 5% (74 million tons) and shipping value declined by 12.7% ($183 billion). Reflecting recovery after the recession (i.e., in 2010–2012), shipping weight increased by 0.4% (5 million tons) and shipping value increased by 21.5 % ($270 billion).

The Non-Market Ocean Economy

Economists refer to the values realized from the use of resources that is in excess of the values directly paid for as "non-market values". Unlike other measures of the ocean economy, measurement of non-market values is done through many different studies of specific resources using a variety of measurement approaches to different resources, geographies, and time frames. In order to provide access to this array of measurements, the NOEP has developed a database that brings together key information from a large number of individual studies carried out by researchers around the U.S. available through the website at http://oceaneconomics.org/nonmarket.

Non-market values are critical to an increasing number of management decisions about resource management. For example, one of the most significant coastal resource management issues concerns wetlands, particularly in Louisiana and the Gulf of Mexico where development, hurricanes, and pollution threats like the Deepwater Horizon oil spill have resulted in significant degradation. Examples of studies of the economic value of Gulf of Mexico wetlands include an analysis of the value of restoring wetlands in the Barataria-Terrebonne estuary which measured at between $105 million to $201 million. Other studies have looked at the values of restoring barrier islands off Mississippi. Residents stated a willingness to pay of $22 per household to maintain the current state of the islands for 30 years, but restoration to pre 1969's Hurricane Camille was valued even higher at $152 per household. Respondents indicated the most important reason to invest in barrier island restoration was hurricane protection.

ES.5. The Future: Measuring the Ocean Economy

The development of the measurements of the ocean and coastal economies that has made this report possible is still in its early stages. A number of efforts are underway in the U.S. by NOEP and NOAA to improve these measurements. In addition, a number of countries have undertaken to measure their ocean economies using approaches based in part on the methods developed by NOEP. The next several years could see significant expansion in our understanding of ocean and coastal regions and resources. Among the changes under development at NOEP:

- Measuring the ocean economy in inland states.
- Measuring new industries and improving the measurement of existing industries. Examples of new industries to be assessed include marine research and education, ocean-related financial industries, marine technology industries, tidal and wind energy, and coastal real estate.
- Improved measurement of the fisheries harvesting sector.
- Improved measurement of the ocean-related GDP through the construction of an ocean "satellite account" to the national income accounts.
- Improving the measurement of non-market values through constructing time series; broadening the geographic areas where nonmarket values have been estimated.

- Improved understanding of recreational non-market values and linking market and non-market values to improve decision making.

Ultimately, the ocean economy should be understood through an integration of the market values and the non-market values of coastal and ocean resources. Such an integrated view can be provided by incorporating "environmental accounting" into national income accounting. This has been done in several countries and the European Community, but Congress has limited the ability of federal agencies to make these modifications in the U.S. accounts. The development of an ocean satellite account noted above is an important step to both improving our current market estimation methods and to a more complete picture of the economic value of coastal and ocean resources.

Finally, the Center for the Blue Economy is creating a global network of researchers interested in improving our understanding of the economics of coastal regions and ocean resources through the establishment of a new peer-reviewed *Journal of Ocean and Coastal Economics*, and the organization of a series of workshops, symposia, and conferences.

Chapter 1
Introduction

At 3.8 million square miles, the United States is the third largest country in the world. But the waters contained within the U.S. Exclusive Economic Zone cover an additional 1.4 million square miles, making the U.S. the country with the largest ocean area in the world, and this does not include the U.S. share of the Great Lakes. The counties along America's ocean and Great Lakes comprise only 18% of the land area of the U.S., but they are home to 37% of U.S. employment and 42% of the total U.S. GDP.

The oceans and Great Lakes have always been an essential part of the United States and its economy, but the actual contributions of the nation's richness of coastal and ocean resources to economic well-being have remained obscure, particularly in comparison with other economic sectors grounded in natural resources such as agriculture and forests. That obscurity has not served the nation well, as recent events have revealed.

Hurricane Katrina in 2005 and Hurricane Sandy in 2012 are among the largest natural disasters in the nation's history. The Deepwater Horizon oil spill in 2010 was the largest oil spill in more than seven decades of offshore oil and gas production. The economic impacts of these events are still being investigated. Less visible, but no less important, are the major changes underway in America's ports to adjust to the widening of the Panama Canal, as well as the development of renewable energy projects in coastal waters, including tidal, wave, and wind power.

As these and many other examples indicate, the ocean is becoming more important to the national economy, and will continue to do so. Some of the changes will be positive additions, but already-rising sea levels and degradation of critical resources like coastal wetlands threaten to significantly diminish the resources and values that the nation has historically relied on. Understanding these changes in the economy is thus more important than it has ever been.

Shedding light on the economic value of ocean and coastal resources is the principal mission of the Center for the Blue Economy (CBE) at the Monterey Institute of International Studies in Monterey, California. The Center was established in 2011 to serve as a focal point for the collection and distribution of data related to both market and non-market economic values in the U.S. and globally. CBE is now the home for the National Ocean Economics Program (NOEP), which was established in 1999 to develop data series measuring the contributions of the ocean to the U.S. economy using existing economic data series.

This report is the second national assessment of the U.S. ocean and coastal economies. The NOEP published the first report in 2009. This report updates the data through 2010 for the ocean economy and through 2012 for the coastal economy, and outlines the effects of the significant national recession on both. This chapter introduces the major concepts and methods used to measure the ocean and coastal economies. It is followed by chapters that examine trends in the coastal economy (total economic activity in coastal states and counties organized by geographic relationship to the shorelines of the oceans and Great Lakes) and the ocean economy (that portion of U.S. economic activity directly connected in some way to the oceans or Great Lakes). The importance of measuring economic values as more than market indicators like employment or output is discussed in Chapter 4. Chapter 5 discusses some of the limitations of the current measurement of the ocean economy and charts a course for significant improvements that may be made in the future by the CBE and by other researchers in the U.S. and other countries.

1.1. About the Data

Government datasets are not configured to easily measure the contributions of oceans. Therefore, the NOEP has created a unique methodology that uses government data to measure key economic indicators of value for the oceans and coasts. The NOEP methods begin with nationally consistent data in order to allow comparability across geographies and sectors over time.

The principal data source for the ocean and coastal economies is the Quarterly Census of Employment and Wages (QCEW), a data series collected at the state level according to standards set by the Bureau of Labor Statistics. The national QCEW data series is accessed at the individual establishment level and at the publicly available county-level to construct the data series. This dataset provides the information on employment, wages, and the number of establishments.

From the QCEW data, estimates of output are generated using the Gross Domestic Product-State data from the Bureau of Economic Analysis (BEA). This dataset mea-

sures output on the basis of the location of production and is thus the appropriate measure for geographic and industry-based measurements of contribution to the U.S. economy.

The coastal economy data series measures all economic activity in coastal states and divides the economy into twelve "super sectors" consistent with Bureau of Labor Statistics definitions. NOEP further organizes the data by county region. Moving inland from the shore, these regions include shore-adjacent counties, coastal watershed counties (including a designation for upland counties that included in watersheds but are not shore adjacent) and inland counties (i.e., those outside of coastal watersheds). In addition, the coastal economy data are also organized for all counties included by states under the federal Coastal Zone Management Program (and defined as coastal zone counties by NOEP).

The NOEP ocean economy data series reports on economic indicators for six private industrial sectors in the ocean economy dataset, but they represent only part of the ocean-dependent industries. These six sectors—coastal tourism & recreation (T&R), marine transportation, ship & boat building and repair, coastal construction, offshore minerals, and living marine resources—were selected because federal datasets provide consistent information that permits an estimated separation of ocean-related industries from others.

The research and development that led to the creation of the ocean economy data series was undertaken by the NOEP in 1999. Responsibility for production of the ocean economy data now rests with the Coastal Services Center of the National Oceanic and Atmospheric Administration as part of their Digital Coast data series. For more details on the construction of the ocean economy data series, including the limitations on the use of confidential data, see Colgan (2013).

Beyond the measurement of employment, wages, establishments, and GDP, the NOEP data series includes a number of datasets related to the ocean economy. These include fisheries landings and values (from the National Marine Fisheries Service), offshore oil and gas production and value (from the Department of Interior and state agencies); a number of data series from the Census including population and housing in coastal areas, data on U.S. maritime trade, and estimates of self-employment. Data from these series are also discussed in this report. The NOEP data also include estimates of ocean-related federal government expenditures from the Office of Management and Budget.

Measurement of economic values needs to extend beyond the information contained in employment and GDP. A day at the beach is worth a great deal to people, even if they spend no money to visit the beach and contribute nothing to the GDP. Wetlands provide essential flood control or wildlife habitat benefits that no one pays for. Unfortunately, there are no standard methods to understand this very important part of the economics of ocean resources. Nor is there any consistent application of methods to resources around the country.

The result is that those who wish to learn more about these values must access a large number of studies conducted around the country. The NOEP database contains over 400 such studies whose bibliographic information is accessible by such categories as author, publication, subject, methods, environmental asset and geography. The importance of understanding these resources is discussed in Chapter 4.

All of these data discussed in the ocean and coastal economy sections of this report, plus the non-market studies bibliographic database, are available at www.oceaneconomics.org. Ocean economy data may also be accessed at http://www.csc.noaa.gov/digitalcoast/data/enow.

1.2. The Program

About the Center for the Blue Economy (CBE)

The Center for the Blue Economy, established in 2011 at the Monterey Institute of International Studies, a graduate school of Middlebury College, is part of the International Environmental Policy Program. The CBE has three major activities: research, education, and outreach. Originally funded by a generous grant from the Loker Foundation, the Center for the Blue Economy promotes ocean and coastal sustainability by providing the best available information to empower governments, NGOs, businesses, and concerned citizens to make educated decisions about the marine environment.

About the National Ocean Economics Program (NOEP)

The National Ocean Economics Program (NOEP) began in 1999 at MIT. It has been in its new permanent home as the research arm of the CBE since 2011. Its primary mission is to provide useful data that demonstrates the interdependence between the health of the U.S. economy and the health of the coasts and coastal ocean. NOEP provides a full range of the most current economic and socioeconomic information available on changes and trends along the U.S. coast and in coastal waters.

The NOEP research program compiles information about economic and social patterns along the coast and in coastal oceans. Researchers, primarily economists, policy analysts, and computers scientists, identify, collect, and formulate primary and secondary source information, then analyze and interpret it. This information undergoes a rigorous review process for accuracy and utility, and is delivered in a range of formats through a publicly available, web-based information system. Additional products such as customized trends analyses, and forecasting are provided at a negotiated fee.

Chapter 2
The Coastal Economy

2.1. Introduction

The United States was founded on the coast and moved inland; the coastal regions, more than ever, remain key to the U.S. economy. The coasts may be commonly thought of as the areas nearest the shore, but an understanding of coastal ecosystems carries the definition of coasts well inland through estuaries and watersheds. The coastal zone includes fishing grounds, parts of Silicon Valley, the forests of Maine, and the vacation centers of Hawaii. It contains some of America's largest cities and some of its smallest and most remote towns.

The coastal states are a starting point to understand the diversity and geographic spread of the economic activities affecting the ocean, as they are the political jurisdictions most commonly used to analyze the regional dimensions of the American economy.

The thirty ***coastal states*** (Figure 2.1) are divided into those counties immediately adjacent to the shoreline of an ocean, the Gulf of Mexico, or a Great Lake (the ***shore-adjacent counties***); the ***coastal zone counties***, which are the counties that states include in their Coastal Management Programs; the ***watershed counties***, which encompass coastal watersheds as defined by the U.S. Geological Survey; and the ***inland counties***, which are located outside the coastal watersheds (Table 2.1). Additional geographic detail and definition of the regions within the coastal economy are available on the NOEP web site at www.oceaneconomics.org.

Figure 2.2 shows the importance of the GDP and employment in each of these regions within coastal states.

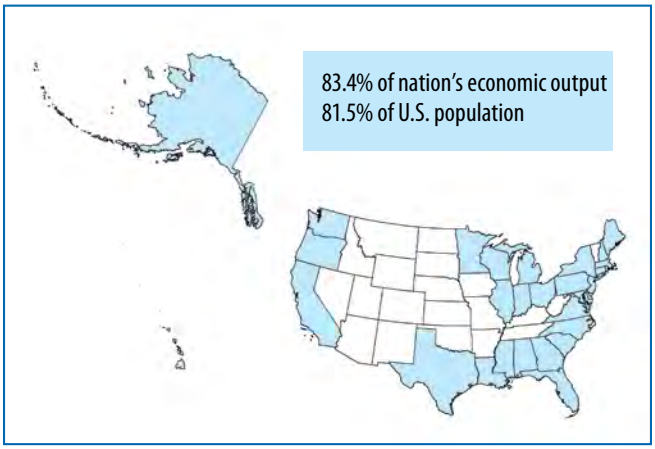

Figure 2.1. The coastal states

Table 2.1. County designations in coastal states

Designation	Definition	Included in
Shore-adjacent	County is immediately adjacent to the shoreline of an ocean, the Gulf of Mexico or a Great Lake	Coastal zone and watershed
Coastal zone	County is included by a state in its Coastal Management Program	Watershed
Watershed	County is in a coastal watershed as defined by the USGS for NOAA	No other designation
Inland	County is not in a coastal watershed	No other designation

An analysis of the coastal economy reveals three major themes:

- Size: The coastal economy of the United States is big by any absolute or relative standard, and the economy of the coastal states largely drives the U.S. economy.
- Sprawl: The coastal economy is primarily an urban economy and the distribution of economic activity along the coasts is driven significantly by forces affecting urban regions, most notably the spread of population and economic activity away from the city centers

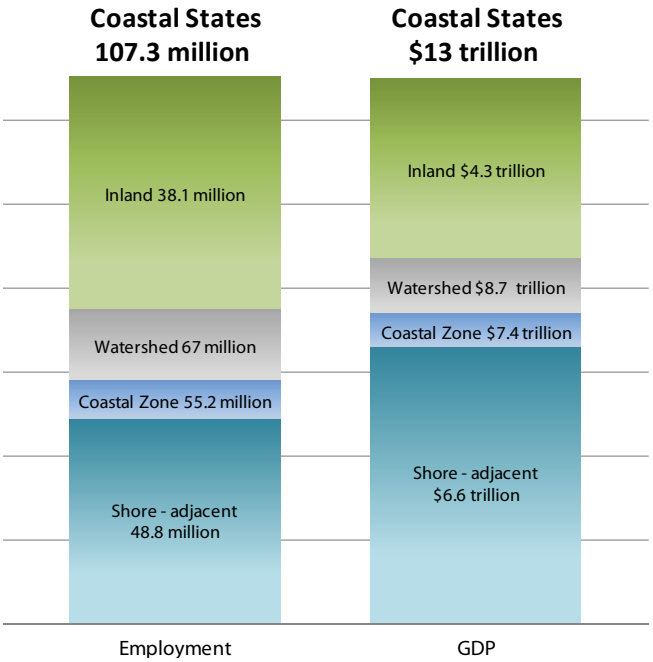

Figure 2.2. Components of the coastal states economy in 2012.

See Table 2.1 regarding definitions of inland, watershed, coastal zone and shore-adjacent areas.

Table 2.2. Economic growth in coastal regions, 2007 to 2012

Region	Employment Change		Real GDP Change	
	Jobs	Annual Average Percentage Change	GDP	Annual Average Percentage Change
Coastal states	-2,965,050	-0.5%	$259,594,000,000	0.5%
Shore-adjacent counties	-1,619,687	-0.7%	$61,860,735,813	0.2%
Coastal zone counties	-1,004,207	-0.6%	$90,456,065,776	0.3%
Watershed counties	-2,245,515	-0.7%	$97,232,028,142	0.3%

Defining the coastal zone economy

In 1972, The U.S. Congress passed the Coastal Zone Management Act (CZMA), which put in place the basic framework for cooperative management of coastal resources by federal, state, and local governments. Under the Act, states participating in the Coastal Zone Management Program were given the freedom to define their coastal zones as they deemed appropriate for their individual management regimes, subject to federal approval.

The coastal zone thus defined varies significantly from shoreline regions to municipalities to counties to whole states. As such it is difficult to define a "coastal zone" economy. For this report, the NOEP uses the 446 counties that contain any geographic elements of the federally approved coastal zone management programs as part of the "coastal zone economy."

In 2012, the ***coastal zone counties*** accounted for

- 51% of employment in coastal states
- 42% of total national employment
- 57% of GDP in coastal states
- 48% of national GDP

The Coastal Zone Management Program thus touches about half of the national economy. The variety in coastal zone geographies means there is also variety in the portion of state economies found in the coastal zone.

in the pattern that has come to be known as urban sprawl.

- Services: The coastal economy had been the core of much of U.S. manufacturing in the past, but this has changed, and the coastal economy now produces primarily services.

The coastal zone counties have been affected by the 2007–2010 recession, as has the rest of the nation, and therefore display trends in employment and GDP similar to those in the watershed and shore-adjacent counties, with employment decline averaging about 0.7% a year and real GDP growth averaging just over 0.3% a year from 2007 to 2012 (Table 2.2). Interestingly, although employment decreased in all coastal geographies, the GDP continued to grow, albeit at a lower rate than before the recession.

As in other parts of the coastal economy, there is a great variety in growth trends among the coastal states (see Section 2.7 Appendix; Table 2.1A). Only two states (Alaska and Texas) showed employment growth in all coastal regions between 2007 and 2012, driven primarily by the oil industry. Two states (Louisiana and New York) had employment growth in the coastal regions and state totals, with a decline in inland county employment for the period. In most states, the coastal zone and shore-adjacent regions experienced the greatest employment declines, both in percentage and number of jobs.

Between 2007 and 2012, 17 states (Alabama, Alaska, Hawaii, Indiana, Louisiana, Maryland, Massachusetts, Minnesota, New Hampshire, New York, North Carolina, Oregon, Pennsylvania, South Carolina, Texas, Virginia, and Washington) experienced GDP growth in all of the coastal regions. California and Georgia had GDP growth in shore-adjacent and coastal zone counties with declines for the state and inland GDP. Maine showed growth in its shore-adjacent counties only.

In the same period, 7 coastal states (Connecticut, Delaware, Florida, Michigan, New Jersey, Ohio, and Rhode Island) had both employment and GDP declines in all regions. This is not surprising for small states like Connecticut, Delaware, and Rhode Island, but the widespread drops in employment and output in large states like Florida, Michigan, and Ohio points to the depth and breadth of the recession in these coastal states.

2.2. The Size of the Coastal Economy in 2012

In the thirty coastal states

- Population was 255.8 million (82% of the U.S.)
- Employment was over 107.3 million (82% of the U.S.)
- GDP was $13 trillion (83% of the U.S.)

In the watershed counties of the coastal states

- Population was 162.3 million (52% of the U.S.)
- Employment was 67 million (51% of the U.S.)
- GDP was $8.7 trillion (56% of the U.S.)

The watershed counties account for less than 1/3 of the land area of the United States, but are home to more than half the population and employment, and generated 56% of the total U.S. economic output in 2012.

In the shore-adjacent counties of the coastal states

- Population was 116.5 million people (37% of the U.S.)
- Employment was 48.8 million (37% of the U.S.)
- GDP was $6.6 trillion (42% of the U.S. GDP)

This is where the real concentration of economic activity occurs. With 18% of the land area, the shore-adjacent counties account for 37% of the U.S. population and 42% of the national economic output (Table 2.3).

Table 2.3. U.S. employment, GDP, population and land area compared to coastal areas, 2012

Region	Employment (million)	GDP ($trillion)	Population (million)	Land Area (million sq. miles)
United States (national)	131.7	$15.57	313.9	3.54
All coastal states	107.3	$12.99	255.8	2.02
Coastal States % U.S.	81.5%	83.4%	81.5%	57.0%
Shore-adjacent counties	48.8	$6.60	116.5	0.62
Shore-adjacent % U.S.	37.0%	42.4%	37.1%	17.5%
Watershed counties	67.0	$8.73	162.3	1.06
Watershed % U.S.	50.9%	56.1%	51.7%	30.0%

There is great variety in the size and configuration of counties in the United States. This is particularly the case with coastal counties. A coastal county may be small, with the majority of its land adjacent to a shore, or it may extend inland from the shore a few miles or a significant distance. The differences among shore-adjacent, coastal zone, watershed, and inland counties, and their varying sizes of economies, manifest themselves in different ways across the varied geographies of America's coasts. This can be illustrated by looking at the way employment for each

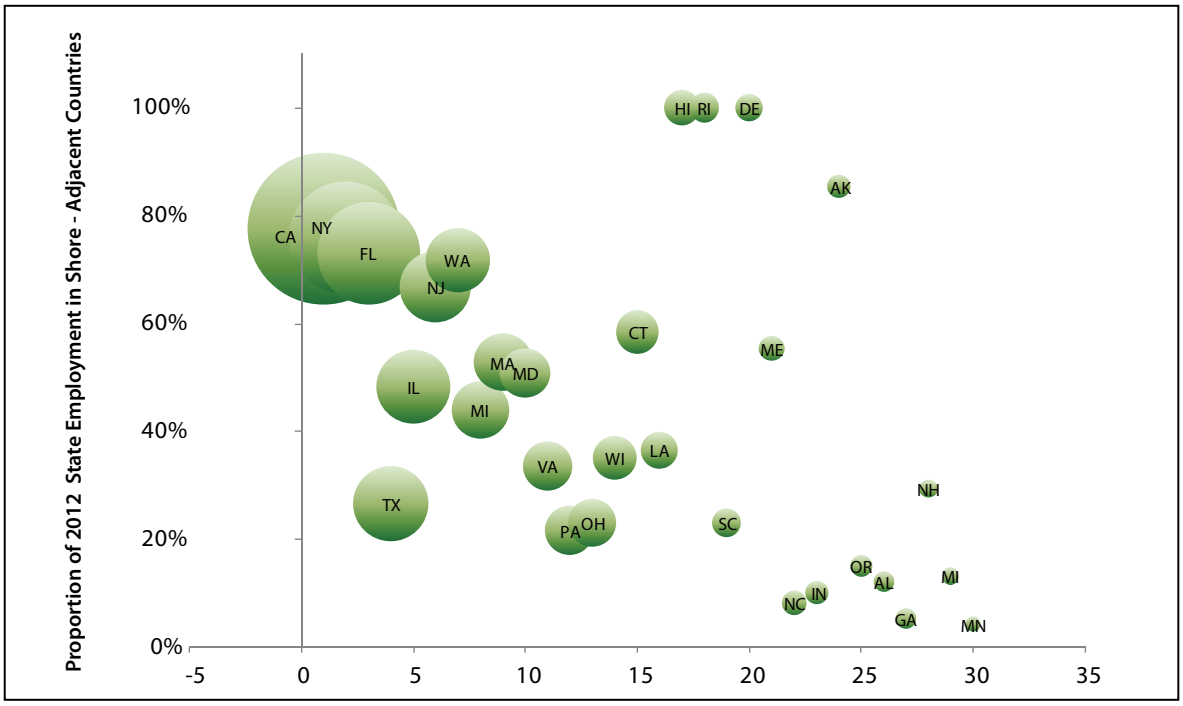

Figure 2.3. Shore-adjacent economy by rank (horizontal axis) compared to percentage of state economy in shore-adjacent counties (vertical axis). Bubble size indicates 2012 employment in shore-adjacent counties. (Associated data in Appendix Table 2.2A with GDP data in Table 2.3A.)

coastal state is distributed across the shore-adjacent counties (Figure 2.3). Depending on geography, the states tend to fall into several broad groups based on the size of their employment and economy.

Focus on shore-adjacent counties

- Three states with relatively small economies (Rhode Island, Delaware, and Hawaii) are comprised entirely of shore-adjacent counties.
- A group of large-economy states including California, Florida, New Jersey, Washington, Massachusetts, and Illinois have between 50% and 90% of their employment in shore-adjacent counties, while other large population states such as New York, Michigan, Texas, Wisconsin, and Ohio have between 25% and 50% of employment in shore-adjacent counties.
- Of the other states with small economies and both shore and inland counties, Alaska and Maine have the highest proportion of their economy in shore-adjacent counties, while most others with smaller economies have less than 30% of their economy in shore-adjacent counties. Shore-adjacent counties are a subset of coastal zone counties; Table 2.4 shows the coastal states ranked by the percentage of their employment that is in coastal zone counties.

The U.S. economy is primarily a service economy. In 2012,

- 84% of private-sector employment and 79% of private-sector GDP were in service-producing sectors

These figures have not changed much since 2007, when:

- 82% of private-sector employment and 78% of private-sector GDP were in service-producing sectors

Table 2.4. Percentage of each state's employment in coastal zone counties, 2012

Percent	States
90-100%	DE FL HI RI
70-90%	AK CA MA ME NJ NY WA
40-70%	CT IL LA MD MI VA
20-40%	OH OR NH PA SC TX WI
4-20%	AL IN GA MN MS NC

How big is the GDP of coastal regions?

To get a sense of how large is the economy of the coastal states, a comparison of the size of the GDP shows that:

- U.S. coastal states together produce a GDP larger than that of any other single country.
- Watershed counties of coastal states produce a GDP that is larger than the combined GDPs of France and Japan.
- On the basis of GDP, shore-adjacent counties alone would be the third largest economy in the world after the European Union and the United States.
- The shore-adjacent counties' economies combined are more than twice the size of the United Kingdom's economy.

Source: International Monetary Fund data for international comparisons

In the watershed areas, the dominance of service industries was even greater:

- 86% of private-sector employment and 82%of GDP were in services
- 14% of private-sector employment and 18% of GDP were in goods.

Specialization is measured by the location quotient, which is the ratio of the percentage of employment in a given sector in a region compared with the percentage of employment in the same sector nationally. In 2012, both shore-adjacent and watershed counties were more specialized than the United States as a whole in four major sectors: professional and business services, information, financial activities (including real estate), and leisure & hospitality[2] (Figure 2.4).The concentration of the economy in these sectors reflects national trends, including the importance of financial activities and the fact that the coastal areas are also where the nation's major cities, and the types of jobs found in cities, are concentrated.

2 The U.S. Bureau of Labor Statistics aggregates industries by Supersector. See http://www.bls.gov/sae/saesuper.htm for a full description.

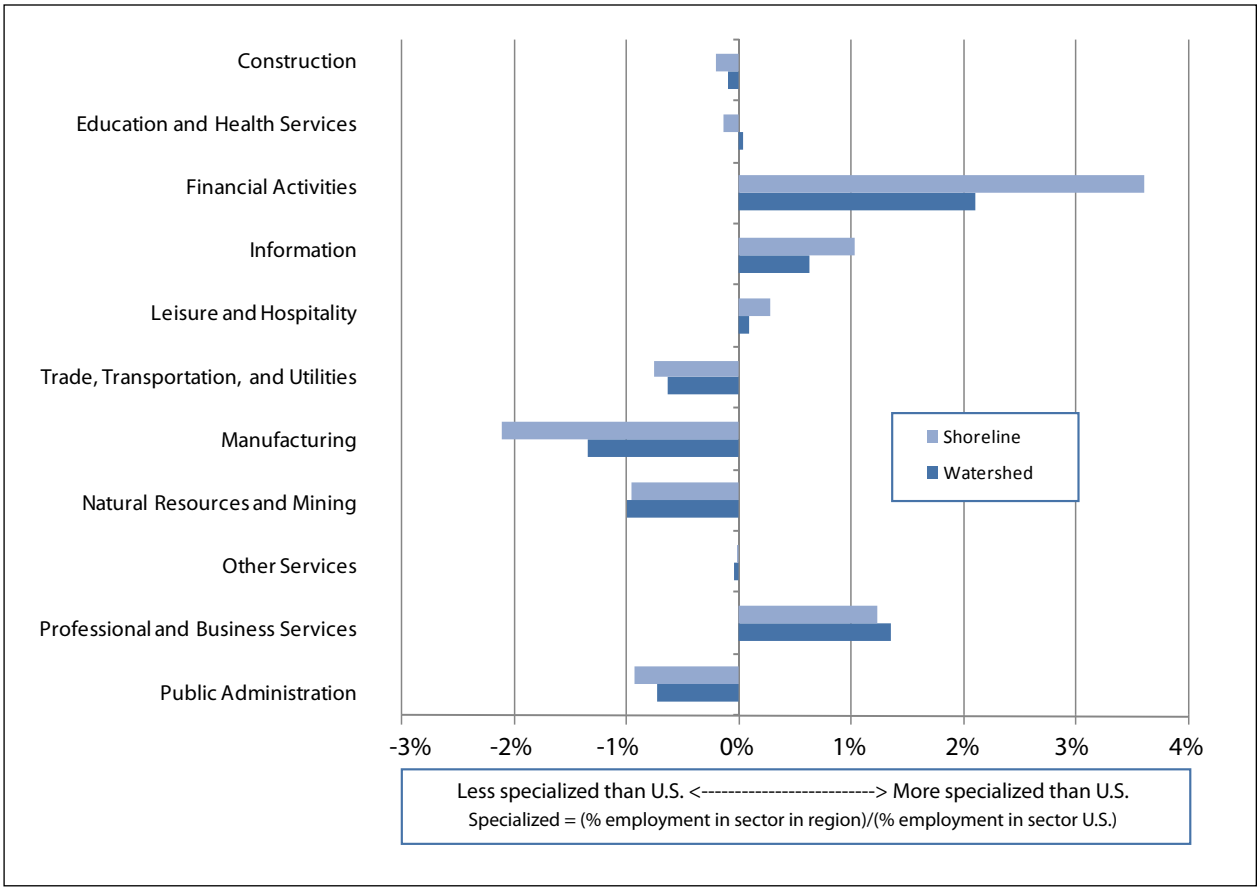

Figure 2.4. Specialization of coastal area based on location quotient of employment, 2012

2.3. Changes in the Coastal Economy: 2007–2012

Recent changes in the coastal economy have been driven by the national economy, which has undergone a significant recession followed by a slow recovery. The period 2007 to 2012 covers the recession (which lasted from the end of 2007 to the middle of 2009) and the early years of the recovery. More than three quarters of U.S. growth over this period was in the coastal states, whether measured by population or GDP. The coastal states' share of population growth (83.9%) exceeded the coastal states' share of real GDP growth (79.3%) (Figure 2.5).

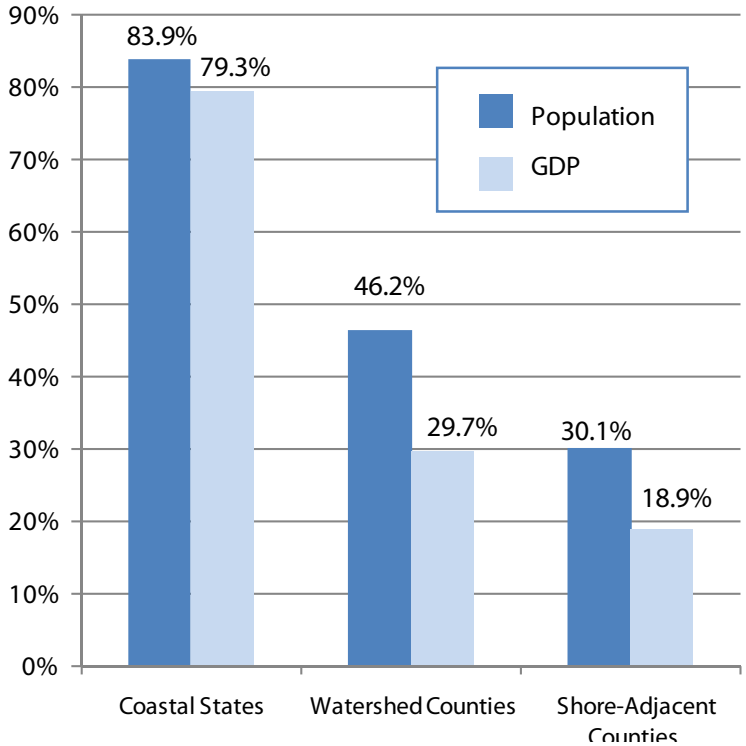

Figure 2.5. Coastal economy share of the national growth 2007–2012

Table 2.5. Economic growth in coastal regions, 2007–2012

Region	Employment Change (million)	RGDP Change ($billion $2005)	Population Change (million)	Land Area (million sq. miles)
United States (national)	-3.7	$327.2	12.3	3.54
Coastal states	-3.0	$259.6	10.3	2.02
Coastal states % U.S.	80.5%	79.3%	83.9%	57.0%
Shore-adjacent Counties	-1.6	$61.9	3.7	0.62
Shore-adjacent % U.S.	44.0%	18.9%	30.1%	17.5%
Coastal zone Counties	-1.8	$90.5	4.5	0.67

The coastal economy in recession and recovery, 2007–2012

Output (GDP) fell from the first quarter of 2008 to the second quarter of 2009, during which GDP declined at an average of 2.8% per quarter. From the middle of 2009 to the end of 2012, GDP grew by an average of 2.3% per quarter.

Employment fell from the first quarter of 2008 to the third quarter of 2010, a year after output growth began. Employment fell at an annual average rate of 1.9%, and to the end of 2012 grew at a rate of only 1.5% per year.

Annual changes in the coastal economy during the recessionary period from 2007 to 2009 (measured by GDP) and from 2007 to 2010 (measured by employment) and the beginning of the recovery are shown in Figure 2.6. While there were differences among regions within the coastal states over the entire period, the pattern of recession and recovery was consistent among the regions, with slightly larger recession-related GDP and employment declines closer to the shore than in the inland counties, and slightly faster growth in the recovery in inland counties. However, the differences are not large, with no more than a 1.4% difference in GDP decline rates among the regions and a range of 1.6% in employment declines. These trends in both recession and recovery reflect the depth of the recession and the very slow recovery in employment that is characteristic of the U.S. economy during this period.

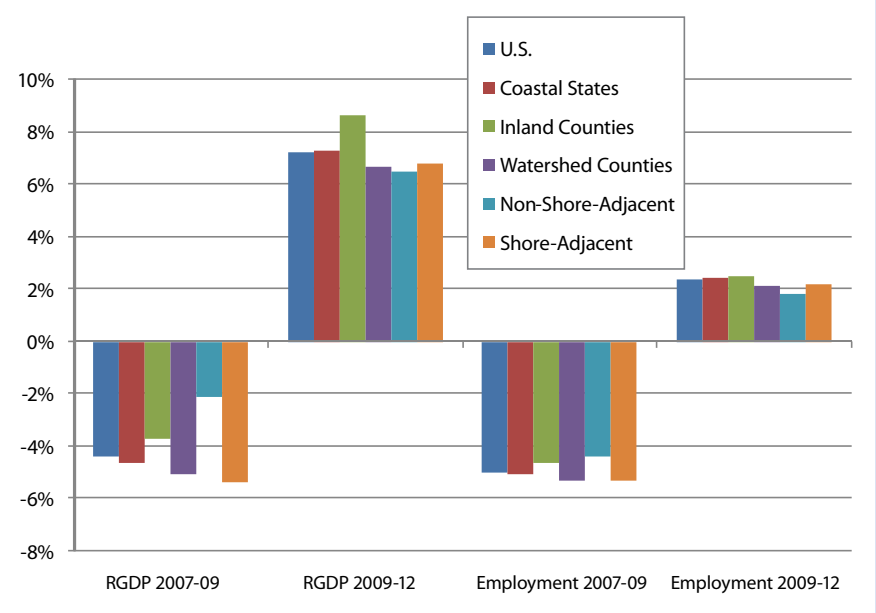

Figure 2.6. RGDP and employment changes by region type; 2007–2009 and 2009–2012

Note: Coastal zone counties are comprised of shore-adjacent counties plus non-shore-adjacent counties.

Between 2007 and 2012 (Table 2.5)

- **Coastal states** lost 3 million jobs, accounting for 80.5% of national job losses
- **Coastal states contributed an additional** $260 billion to GDP
- **Shore-adjacent counties** lost 1.6 million jobs, accounting for 44% of U.S. losses for the period
- **Watershed counties** lost 2.2 million jobs, accounting for 61% of U.S. employment decline

Within coastal states (Figure 2.7), employment losses from 2007 to 2012 were greatest in watershed counties, particularly the shore-adjacent counties, while population growth was highest in coastal states and watershed counties.

While coastal and shore-adjacent areas maintained the strongest growth in population and GDP, these regions have experienced the greatest decline in employment. Job losses were greatest in the shore-adjacent counties with a 4.1% drop between 2007 and 2012.

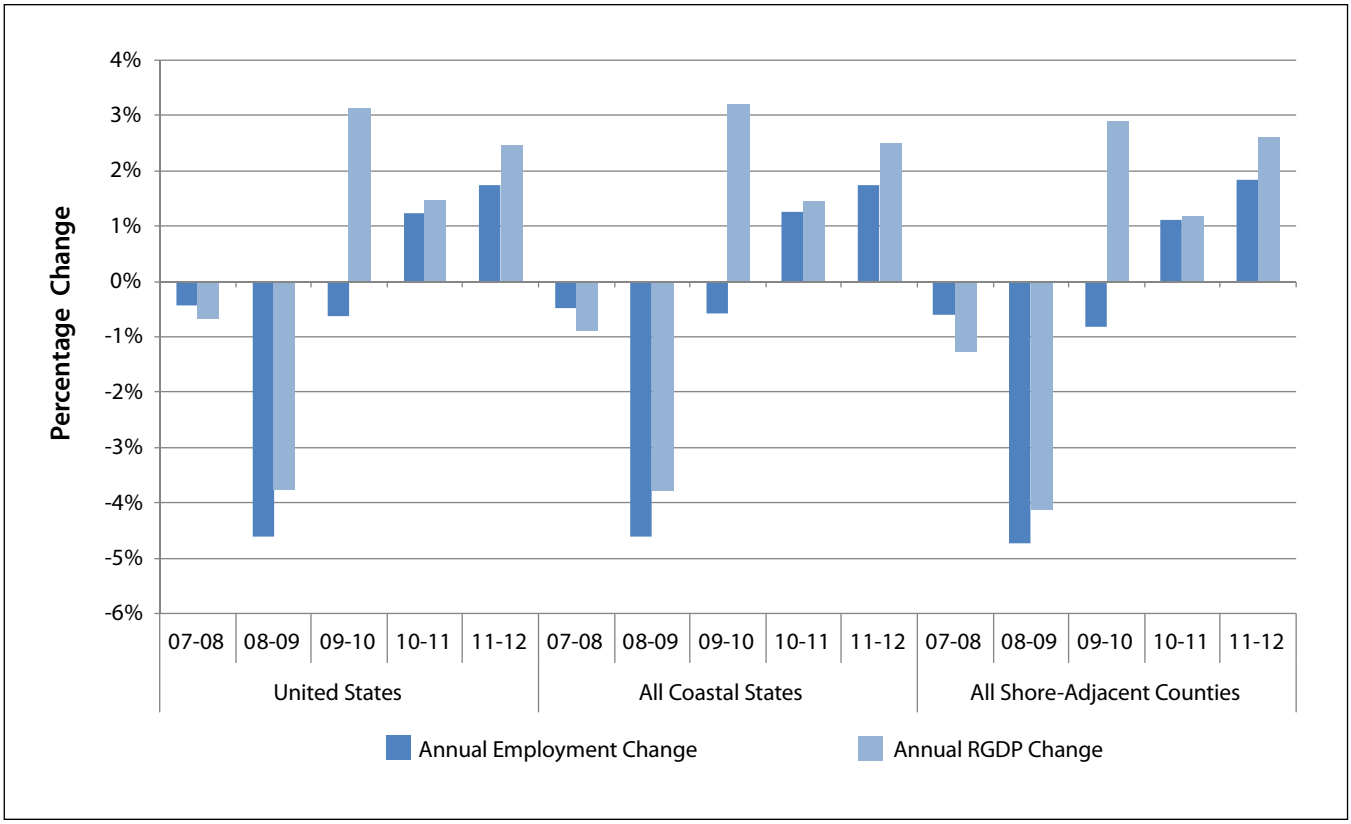

Figure 2.7. Annual changes in national shore-adjacent economy, 2007–2012.

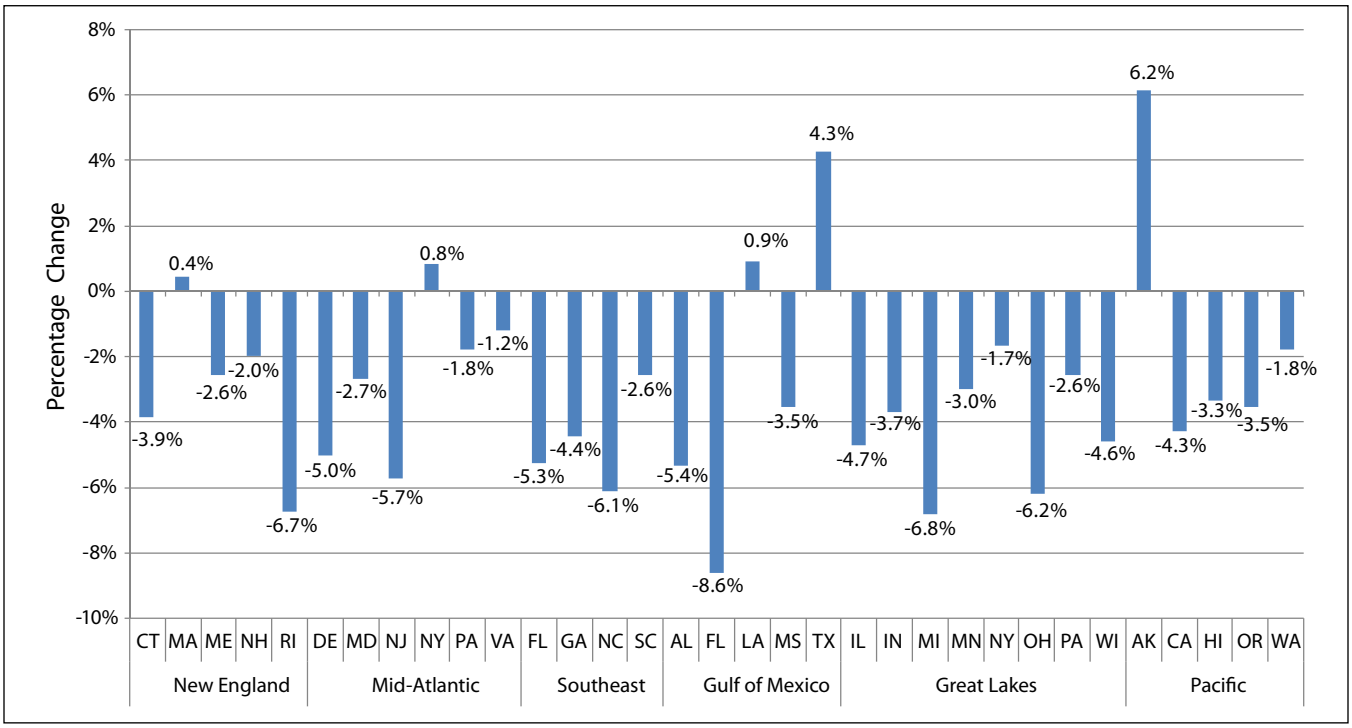

Figure 2.8. Employment growth in shore-adjacent counties, 2007–2012

Economic decline and growth in coastal areas has been uneven over the five-year period. Employment growth in shore-adjacent areas has generally been fastest in the Gulf Coast states and slowest in the Great Lakes states (Figure 2.8). Growth in the shore-adjacent counties of the Gulf of Mexico has been variable, ranging from moderate growth in Louisiana and Texas to major declines in Alabama, Mississippi, and Florida. **Alaska and New York were the only other states to show some recovery in their shore-adjacent counties between 2007 and 2012, while the other coastal states have not yet recovered from employment losses** (Section 2.7 Appendix Table 2.2A and Table 2.3A).

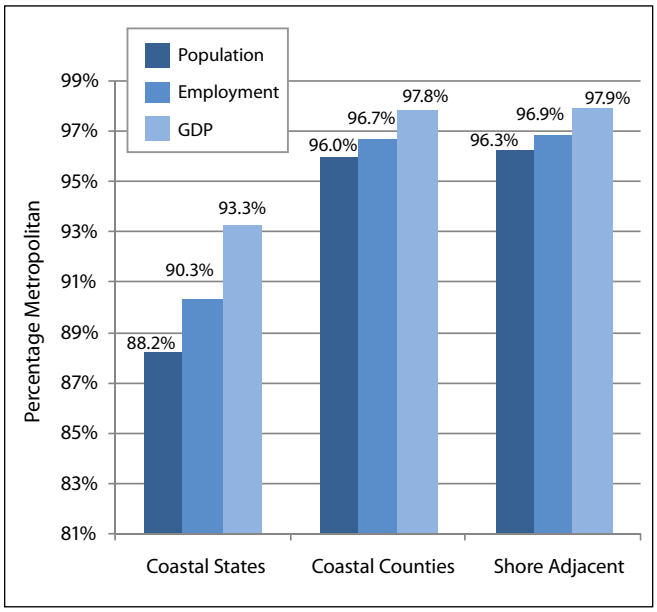

Figure 2.9. Proportion of coastal economy in metropolitan areas, 2012

2.4. Urban Sprawl and the Coastal Economy

The most popular images of coastal America remain those of undeveloped areas such as the Big Sur Coast of California or the Bold Coast of Downeast Maine; but the reality is that most of the coasts are urban (Figure 2.9). More than eight in ten residents of coastal states live in a Metropolitan Statistical Area as defined by the Office of Management and Budget (OMB).[3]

More than nine in ten residents and jobs in watershed counties and shore-adjacent counties are in metropolitan areas, and almost all of the economic output of shore-adjacent counties occurs in metropolitan regions (Figure 2.10). The issues of America's urban areas are, therefore, the issues of America's coasts.

This is particularly clear in the geographic pattern of economic and population growth, which provides evidence of the overall "sprawl" pattern of American population and employment growth in urban regions. Throughout most of the nation, the shore-adjacent regions of the coasts are

3 U.S. Office of Management and Budget; http://www.census.gov/population/metro

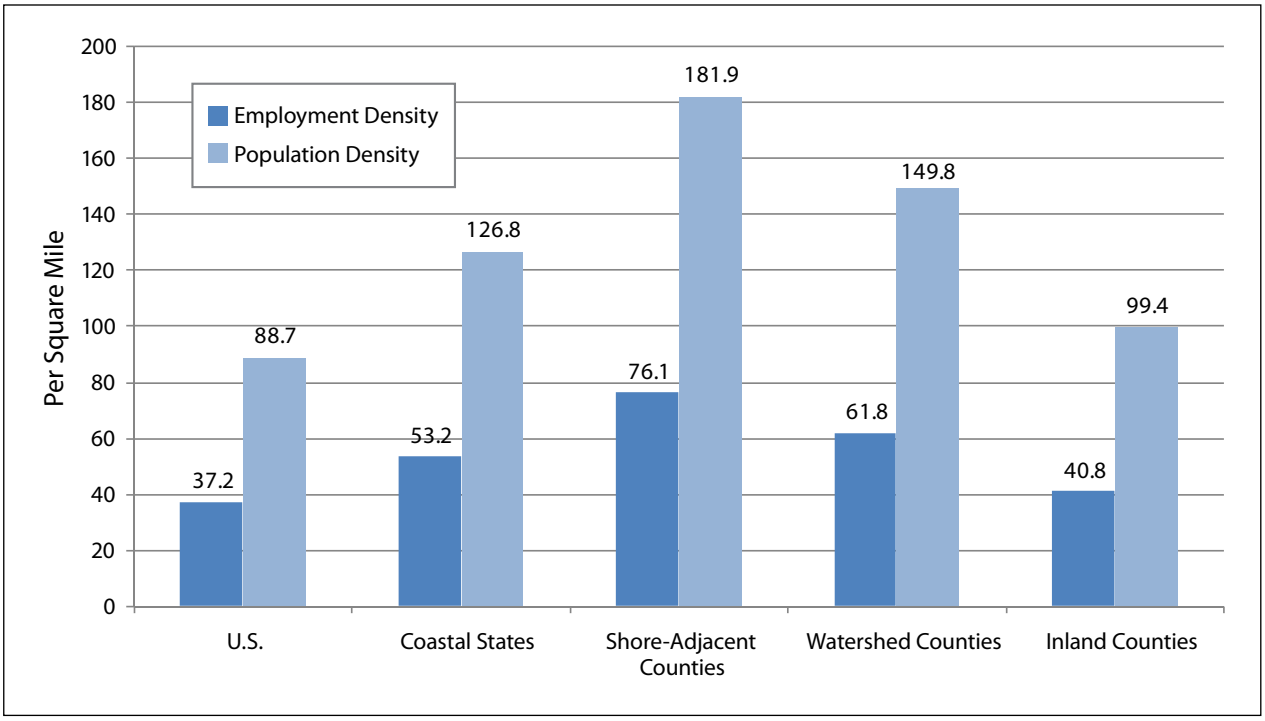

Figure 2.10. Employment and population densities in the coastal economy, 2012

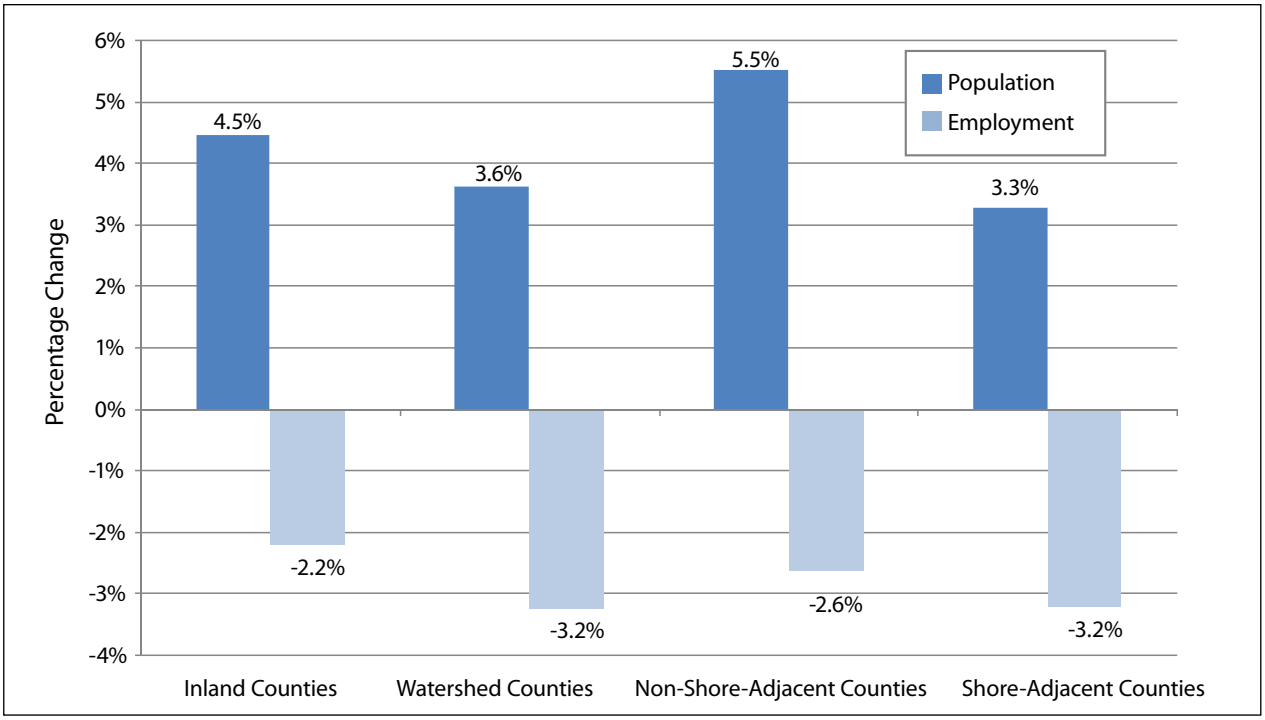

Figure 2.11. Regional growth rates in coastal states 2007-2012

already heavily built with residences, both year round and seasonal. **The core of a coastal urban area is its shore-adjacent counties, where population and employment densities are more than twice the national average, and significantly higher than those of the coastal states as a whole.**

Within coastal states, a distinct pattern of economic and population growth has emerged.

- Population growth is generally faster away from the shore
- Economic change is generally faster along the shore (Figure 2.11)

This long-term trend, which has been underway for more than twenty years, continued during the recession. From 2007 to 2012,

- Non-shore-adjacent counties (those inland from the shoreline) showed a 5.5% population growth rate
- Watershed and shore-adjacent counties had the greatest decline in employment (-3.2%)
- Population growth rate in non-shore-adjacent counties was almost twice that in shore-adjacent counties.[4]

The heavily developed nature of the areas near the shore means that expansion, particularly for residential development, is pushed further and further inland. At the same time, the size of the populations near the shore and the attractiveness of shoreline locations provide incentives for businesses to expand in those areas, even as the workforce commute from inland areas lengthens.

2.5. Conclusion

Geographically, coastal regions are defined by the complex relationships among shorelines, estuaries, watersheds, and upland areas. The coastal economy is large, complex, primarily urban, and dynamic. Whether measured at the state, watershed, or county level, the coastal economy makes up a disproportionately large share of the American economy. The spatial dimensions of the coastal economy have pushed population inland, while jobs move closer to the shore. The coastal economy mirrors the national economy in diversity of economic activity, yet also contains industries unique to the oceans and coasts. These industries are discussed in Chapter 3.

2.6. References

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4 Due to a smaller population base, growth rate can be greater though absolute changes are smaller.

2.7. Appendix

Table 2.1A. Regional state employment and RGDP percentage changes, 2007–2012

State	All Regions		Inland Counties		Watershed Counties		Coastal Zone Counties		Shore-adjacent Counties	
	Employment % Change	RGDP % Change	Employment % Change	RGDP % Change	Employment % Change	RGDP % Change	Employment % Change	RGDP % Change	Employment % Change	RGDP % Change
Alabama	-6.35%	1.21%	-6.48%	1.08%	-6.63%	2.00%	-5.36%	3.20%	-5.36%	3.20%
Alaska	5.32%	9.92%			5.40%	9.87%	5.95%	10.53%	5.83%	10.46%
California	-4.36%	-0.71%	-3.87%	-1.88%	-4.74%	-0.61%	-4.29%	0.12%	-4.25%	0.14%
Connecticut	-3.44%	-5.58%			-3.33%	-5.58%	-3.86%	-6.89%	-3.86%	-6.89%
Delaware	-4.30%	-0.83%			-4.30%	-0.83%	-4.30%	-0.83%	-4.30%	-0.83%
Florida	-7.61%	-5.93%			-7.61%	-5.93%	-7.61%	-5.93%	-7.09%	-6.20%
Georgia	-5.77%	-0.93%	-6.00%	-1.08%	-5.94%	0.97%	-4.43%	2.31%	-4.18%	2.66%
Hawaii	-3.35%	3.91%			-3.35%	3.91%	-3.35%	3.91%	-3.35%	3.91%
Illinois	-3.99%	0.95%	-3.72%	3.53%	-4.73%	-0.97%	-4.73%	-0.97%	-4.73%	-0.97%
Indiana	-3.22%	2.97%	-2.23%	3.40%	-5.95%	1.44%	-3.71%	7.13%	-3.71%	7.13%
Louisiana	0.09%	6.37%	-2.36%	4.42%	0.09%	6.77%	1.14%	6.16%	1.08%	5.41%
Maine	-3.20%	-0.39%	-7.65%	-3.28%	-3.00%	-0.24%	-2.56%	-0.06%	-2.32%	0.44%
Maryland	-1.39%	7.67%	-1.50%	6.80%	-1.84%	7.73%	-2.69%	5.90%	-2.11%	7.04%
Massachusetts	0.20%	6.12%	0.94%	4.02%	0.04%	6.16%	0.44%	6.75%	-0.04%	4.75%
Michigan	-5.84%	-5.11%	-6.14%	-6.06%	-5.07%	-5.01%	-6.84%	-6.80%	-6.84%	-6.80%
Minnesota	-1.59%	6.09%	-1.88%	6.15%	-2.98%	4.48%	-2.98%	4.48%	-2.98%	4.48%
Mississippi	-4.37%	0.51%	-4.03%	0.89%	-4.40%	-0.90%	-3.55%	-1.11%	-3.55%	-1.11%
New Hampshire	-2.82%	3.50%	-3.64%	6.02%	-3.20%	2.99%	-1.99%	4.53%	-1.99%	4.53%
New Jersey	-4.81%	-1.21%	-6.64%	-3.77%	-5.39%	-1.19%	-5.30%	-1.27%	-6.15%	-2.95%
New York	0.11%	2.86%	-2.96%	6.33%	0.18%	2.68%	0.43%	2.55%	0.85%	2.33%
North Carolina	-3.87%	3.72%	-4.27%	3.68%	-5.55%	3.91%	-6.12%	1.71%	-6.09%	1.68%
Ohio	-4.89%	-1.30%	-5.05%	-0.16%	-6.62%	-3.05%	-6.19%	-2.20%	-6.56%	-1.91%
Oregon	-5.00%	15.07%	-5.04%	16.91%	-5.01%	13.61%	-4.97%	17.79%	-9.31%	7.37%
Pennsylvania	-1.30%	2.81%	-1.16%	5.12%	-2.71%	1.03%	-1.86%	2.89%	-1.86%	2.89%
Rhode Island	-6.13%	-1.48%			-6.13%	-1.48%	-6.13%	-1.48%	-6.13%	-1.48%
South Carolina	-4.30%	1.78%	-3.51%	2.74%	-4.21%	0.24%	-2.58%	1.57%	-2.42%	1.50%
Texas	4.83%	13.07%	3.96%	11.63%	4.94%	15.68%	4.33%	15.46%	4.33%	15.46%
Virginia	-1.48%	5.16%	-3.04%	3.23%	-1.25%	5.74%	-1.17%	5.83%	-1.60%	5.03%
Washington	-1.07%	6.36%	1.33%	7.52%	-1.95%	6.14%	-1.79%	6.53%	-1.79%	6.53%
Wisconsin	-3.09%	0.58%	-2.71%	1.88%	-4.36%	-0.90%	-4.59%	-1.33%	-4.59%	-1.33%
All Coastal States	-2.69%	2.37%	-2.21%	4.62%	-3.24%	1.30%	-3.14%	1.43%	-3.22%	1.10%

Table 2.2A. Employment change in shore-adjacent counties 2007–2012 by state

State	2007	2012	Change	Percentage Change
Alabama	236,774	224,090	-12,684	-5%
Alaska	264,361	279,771	15,410	6%
California	12,123,274	11,607,875	-515,399	-4%
Connecticut	989,478	951,307	-38,171	-4%
Delaware	417,151	396,132	-21,019	-5%
Florida	5,778,209	5,368,259	-409,950	-7%
Georgia	217,622	208,528	-9,094	-4%
Hawaii	625,078	604,229	-20,849	-3%
Illinois	2,862,418	2,727,015	-135,403	-5%
Indiana	296,793	285,786	-11,007	-4%
Louisiana	678,168	685,462	7,294	1%
Maine	1,712,937	1,712,214	-723	0%
Maryland	1,304,652	1,277,132	-27,520	-2%
Massachusetts	330,607	322,929	-7,678	-2%
Michigan	1,858,049	1,731,046	-127,003	-7%
Minnesota	117,124	113,634	-3,490	-3%
Mississippi	149,167	143,874	-5,293	-4%
New Hampshire	342,322	321,477	-20,845	-6%
New Jersey	183,956	180,304	-3,652	-2%
New York	2,684,085	2,519,037	-165,048	-6%
North Carolina	6,451,180	6,506,129	54,949	1%
Ohio	1,252,330	1,170,118	-82,212	-7%
Oregon	275,323	249,700	-25,623	-9%
Pennsylvania	1,236,215	1,213,178	-23,037	-2%
Rhode Island	473,380	441,464	-31,916	-7%
South Carolina	433,183	422,718	-10,465	-2%
Texas	2,733,589	2,851,906	118,317	4%
Virginia	1,239,348	1,219,575	-19,773	-2%
Washington	2,116,228	2,078,302	-37,926	-2%
Wisconsin	993,271	947,724	-45,547	-5%
Total All Shore-adjacent Counties	50,376,272	48,760,915	-1,615,357	-3%

Table 2.3A. RGDP change in shore-adjacent counties 2007–2012 by state

State	GDP ($billion - $2005)			Percentage Change
	2007	2012	Change	
Alabama	$18.3	$18.8	$0.6	3.2%
Alaska	$35.0	$38.7	$3.7	10.5%
California	$1,490.7	$1,492.8	$2.1	0.1%
Connecticut	$133.9	$124.7	($9.2)	-6.9%
Delaware	$56.6	$56.1	($0.5)	-0.8%
Florida	$553.2	$518.9	($34.3)	-6.2%
Georgia	$17.6	$18.1	$0.5	2.7%
Hawaii	$59.5	$61.9	$2.3	3.9%
Illinois	$337.3	$334.1	($3.3)	-1.0%
Indiana	$25.9	$27.8	$1.8	7.1%
Louisiana	$74.0	$78.1	$4.0	5.4%
Maine	$27.1	$27.2	$0.1	0.4%
Maryland	$127.3	$136.2	$9.0	7.0%
Massachusetts	$181.4	$190.1	$8.6	4.8%
Michigan	$167.2	$155.9	($11.4)	-6.8%
Minnesota	$8.5	$8.9	$0.4	4.5%
Mississippi	$13.5	$13.4	($0.1)	-1.1%
New Hampshire	$16.2	$17.0	$0.7	4.5%
New Jersey	$298.6	$289.8	($8.8)	-2.9%
New York	$854.9	$874.8	$20.0	2.3%
North Carolina	$26.5	$26.9	$0.4	1.7%
Ohio	$111.1	$108.9	($2.1)	-1.9%
Oregon	$21.7	$23.3	$1.6	7.4%
Pennsylvania	$122.9	$126.4	$3.6	2.9%
Rhode Island	$44.4	$43.8	($0.7)	-1.5%
South Carolina	$34.2	$34.7	$0.5	1.5%
Texas	$335.2	$387.0	$51.8	15.5%
Virginia	$127.3	$133.7	$6.4	5.0%
Washington	$240.7	$256.5	$15.7	6.5%
Wisconsin	$86.6	$85.4	($1.2)	-1.3%
Total All Shore-adjacent Counties	$5,647.4	$5,709.3	$61.9	1.1%

Table 2.4A. Changes in employment, wages, RGDP by supersector, 2005–2012

States	Supersector	Employment			Wages			RGDP		
		2005 (million)	2012 (million)	Percent Change	2005 ($billion)	2012 ($billion)	Percent Change	2005 ($billion)	2012 ($billion)	Percent Change
Unites States	Construction	7.5	5.8	-22.8%	$313.4	$261.0	-16.7%	$612.5	$463.7	-24.3%
	Financial Activities	8.1	7.6	-6.6%	$521.3	$526.8	1.1%	$2,598.8	$2,823.0	8.6%
	Education and Health Services	27.7	30.8	11.1%	$1,043.3	$1,211.6	16.1%	$953.5	$1,105.6	15.9%
	Information	3.2	2.8	-12.0%	$196.0	$194.7	-0.7%	$586.5	$711.6	21.3%
	Leisure and Hospitality	13.2	14.2	7.8%	$228.9	$253.8	10.9%	$485.4	$530.2	9.2%
	Manufacturing	14.2	12.0	-16.0%	$702.2	$629.2	-10.4%	$1,569.3	$1,683.7	7.3%
	Natural Resources and Mining	1.7	2.0	15.2%	$67.7	$97.0	43.2%	$319.4	$360.8	13.0%
	Other Services	4.4	4.6	4.7%	$113.9	$120.3	5.7%	$313.0	$298.2	-4.8%
	Professional and Business Services	17.1	18.1	5.9%	$847.0	$1,012.9	19.6%	$1,460.2	$1,655.3	13.4%
	Public Administration	7.1	7.3	1.7%	$336.6	$357.7	6.3%	$1,502.1	$1,545.8	2.9%
	Trade, Transportation, and Utilities	27.1	26.5	-2.2%	$971.7	$970.8	-0.1%	$2,138.5	$2,267.3	6.0%
	Total, all industries	131.6	131.7	0.1%	$5,351.9	$5,644.0	5.5%	$12,539.1	$13,430.6	7.1%
Coastal States	Construction	5.9	4.6	-22.1%	$253.5	$213.0	-16.0%	$504.4	$379.0	-24.9%
	Financial Activities	6.7	6.2	-7.3%	$456.7	$458.5	0.4%	$2,238.0	$2,404.9	7.5%
	Education and Health Services	22.7	25.1	10.7%	$871.1	$1,008.3	15.8%	$799.8	$922.1	15.3%
	Information	2.6	2.3	-11.0%	$169.7	$170.5	0.4%	$505.1	$615.2	21.8%
	Leisure and Hospitality	10.5	11.4	8.4%	$185.4	$206.7	11.5%	$391.5	$429.6	9.8%
	Manufacturing	11.6	9.7	-16.4%	$588.6	$525.8	-10.7%	$1,315.9	$1,418.8	7.8%
	Natural Resources and Mining	1.3	1.5	11.8%	$51.0	$70.1	37.6%	$228.0	$265.8	16.6%
	Other Services	3.7	3.9	5.0%	$97.4	$102.8	5.5%	$261.6	$248.3	-5.1%
	Professional and Business Services	14.3	15.1	5.5%	$733.8	$875.1	19.3%	$1,263.1	$1,429.1	13.1%
	Public Administration	5.8	5.8	1.4%	$281.3	$298.9	6.2%	$1,232.3	$1,264.9	2.6%
	Trade, Transportation, and Utilities	22.0	21.4	-2.5%	$804.7	$799.6	-0.6%	$1,765.0	$1,865.2	5.7%
	Total, all industries	107.4	107.3	-0.1%	$4,508.7	$4,740.8	5.2%	$10,504.8	$11,219.9	6.8%

Chapter 3
The Ocean Economy

3.1. Defining and Measuring the Ocean Economy

The goal of measuring the ocean economy is to be able to answer such questions as:

- What do the oceans and Great Lakes contribute to the national economy?
- What are the important trends in ocean-related economic activities that affect the national economy?

To answer questions such as these requires thinking about the ocean as an input to the production of goods and services. However, almost all economic data are about what is made (the final product), not how it is made, where it is made or its inputs. In some marine-related economic activities, the two approaches overlap: deep-sea freight transportation and commercial fishing are examples where the industry alone defines the connection to the ocean. Other industries have no such inherent connection. A beachfront hotel in Florida is in the same industry classification as a hotel at a ski resort in Colorado or a hotel in midtown Manhattan.

Thus, defining the ocean economy requires a combination of industrial and geographic perspectives. Certain industries will be included by definition, as they directly use the ocean. For other industries, the choice of which establishments in that industry are selected for inclusion in the ocean economy will depend on their location in proximity to the oceans, the Gulf Of Mexico (GOM), or the Great Lakes. Proximity here is determined by either location in a shore-adjacent county or, for employment in the tourism & recreation sector, location in a shore-adjacent zip code. The reason for this distinction is that the shore-adjacent zip code is the location identifier encompassing the largest number of employment locations at a scale small enough to measure proximity to the shore.

Another important consideration in defining the ocean economy is to use data that permit the ocean economy to be compared to other parts of the economy on a consistent basis across time and space. To properly manage ocean resources, we need to understand the size of the ocean economy, how it compares with other parts of the economy, and how it has changed over time. These requirements mean that the ocean economy needs to be defined using existing data to assure consistency. However, using government datasets that are not configured for these purposes means that while the NOEP estimates of the ocean economy are as accurate as they can be with available tools, their accuracy could be improved through refining existing datasets to reveal connections to the oceans.

In addition, using available public datasets requires that data be presented in such a way that prevents the possibility of disclosure of employment or related data for any single establishment. This means that data about industries and locations with a very small number of employment establishments or those in which one or two establishments make up the vast majority of employment in an area cannot be shown. In the ocean economy, there are many situations where small industries exist in small counties, or where a single very large employer dominates an industry (for example ship building). This creates unavoidable gaps

The NOEP Ocean Economy Methodology

To delineate the NOEP Ocean Economy, we compiled data from the Quarterly Census of Employment and Wages (QCEW) for the 30 coastal states for the industries shown in Table 3.1.

Industries in the Tourism & Recreation sector include only those establishments located in a ZIP code adjacent to an ocean or Great Lake. The definition of ocean for this purpose includes major estuaries and bays such as Puget Sound, San Francisco Bay, and Chesapeake Bay. The industries are aggregated to the six ocean economy sectors.

Annual average employment and annual total wages are used as measures of the ocean economy. Gross Domestic Product (GDP) is allocated to each establishment in the dataset based on that establishment's proportion of its industry's wages in the state. Ocean economy totals are establishment level data summed to the industry and sectoral levels.

As a result of Federal employment laws, the QCEW data do not include certain types of employment, notably self-employment (primarily in tourism & recreation) and thus most employment in the fish harvesting sector. The section at the end of this chapter, "Beyond the NOEP Ocean Economy," discusses sector limitations and exclusions in the ocean economy data series.

in all public datasets, including those of the NOEP, to protect the confidential data of businesses.

The primary data source for the ocean economy is the Quarterly Census of Employment and Wages (QCEW), a national federal–state cooperative program that measures employment and wages in almost all employment establishments in the United States. The QCEW data are accessed at the establishment level through the cooperation of the U.S. Department of Labor Bureau of Labor Statistics. The data for industry output measured as Gross Domestic Product (GDP) by state is taken from data estimated by the Bureau of Economic Analysis of the U.S. Department of Commerce. The terms and definitions at the beginning of this report explain in greater detail how the ocean economy is defined, and a full description of the methodology is available at www.oceaneconomics.org. Detailed data can be found in the appendix at the end of this chapter.

Table 3.1. Ocean industries by sector

Ocean Sector	Ocean Industry
Construction	Marine Related Construction
	Fish Hatcheries & Aquaculture
Living Resources	Fishing
	Seafood Markets
	Seafood Processing
Minerals	Sand & Gravel
	Oil & Gas Exploration and Production
Ship & Boat Building	Boat Building & Repair
	Ship Building & Repair
Tourism & Recreation	Amusement and Recreation Services
	Boat Dealers
	Eating & Drinking Places
	Hotels & Lodging Places
	Marinas
	Recreational Vehicle Parks & Campsites
	Scenic Water Tours
	Sporting Goods Retailers
	Zoos, Aquaria
Transportation	Deep Sea Freight Transportation
	Marine Passenger Transportation
	Marine Transportation Services
	Search and Navigation Equipment
	Warehousing

The ocean economy in 2010

In 2010, the ocean economy comprised over 2.7 million jobs and contributed over $258 billion (1.8%) to the GDP of the United States (Table 3.2). The largest sector by both employment and GDP is the Tourism & Recreation sector; however, there are large and important differences among the sectors in terms of their contributions to the economy.

3.2. The National Ocean Economy

Table 3.2. Ocean economy by sector, 2010

Sector	Employment	GDP (Billions of Dollars)
Construction	46,390	$5.51
Living Resources	59,354	$6.02
Minerals	143,995	$87.37
Ship & Boat Building	144,066	$10.84
Tourism & Recreation	1,931,746	$89.25
Transportation	443,934	$58.73
Total	**2,770,000**	**$258.00**

While tourism & recreation is the largest employment sector in the ocean economy, comprising over 1.9 million jobs or 70% of all marine-related employment (Figure 3.1), the other sectors account for 65% of contribution to GDP but only 30% of employment (Figure 3.2).

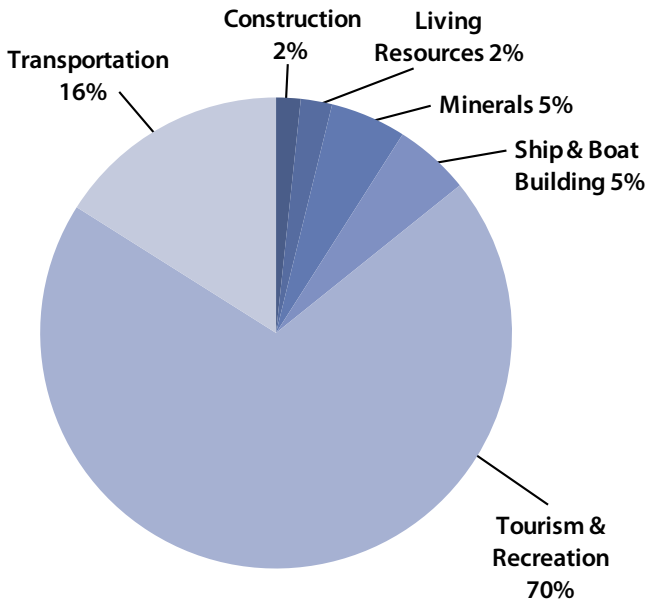

Figure 3.1. Ocean sector employment, 2010

The relative size of the ocean economy

The size of the ocean economy can be appreciated by comparison to employment and GDP in other regions and industries. In 2010:

- In terms of states, the ocean economy would be the 25th largest state by employment and the 20th largest state by GDP, the same size as Colorado.
- In terms of coastal states, the ocean economy would be the 14th largest coastal state by employment and the 18th largest coastal state by GDP.
- In terms of metropolitan areas, the ocean would be the 39th largest metropolitan area by employment, about the same size as Atlanta, and the 17th largest metropolitan area by GDP in the United States, slightly smaller than San Diego.
- In terms of industries, the ocean economy supports employment almost two and half times larger than other natural resource industries such as farming, mining, and forest harvesting, which together employed 1.15 million in 2010.

These likely understate the size of the ocean economy, as the limitations on government data series exclude some important activities, such as most of the fisheries harvesting sector and much self-employment associated with tourism & recreation. In addition, the ocean economy data do not include economic activity in inland states, where portions of these industries are located.

The largest difference is in the minerals sector, whose contribution to ocean economy GDP (33%) is more than six times its share of ocean economy employment (5%). This difference between shares of employment and GDP output highlights an important feature of the ocean economy: the sectors make different types of contributions to the national economy. Tourism & recreation industries are the largest contributors of jobs, while the other sectors contribute more to total output. Understanding the relationship between employment and output in each sector is critical to understanding the ocean economy. In 2010, the average employee in tourism & recreation contributed $46,000 to the GDP, while the average employee in the minerals sector contributed over $606,000 to the GDP. The average employee in the living resources sector contributed nearly $102,000 to the GDP (Table 3.3).

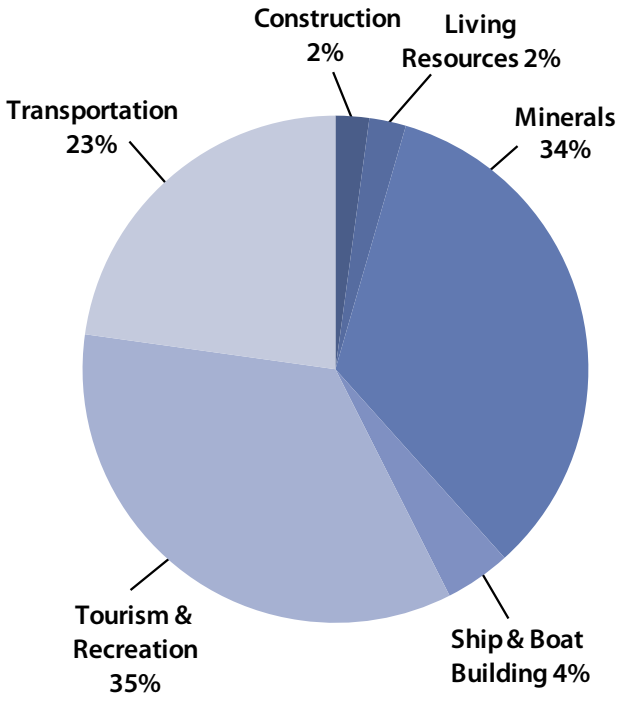

Figure 3.2. Ocean sector GDP, 2010

Table 3.3. Ocean economy average wage contribution, 2010

Sector	Wages per Employee	GDP per Employee
Construction	$65,233.04	$118,771.03
Living Resources	$36,777.99	$101,501.40
Minerals	$129,092.38	$606,755.70
Ship & Boat Building	$60,028.31	$75,273.49
Tourism & Recreation	$20,946.52	$46,199.24
Transportation	$65,175.83	$132,283.97
Total Ocean Sector	**$36,823.10**	**$93,140.79**

An examination of recent trends in the ocean economy is inevitably shaped by the turmoil in the U.S. economy as a whole. The Great Recession, the sharpest drop in output and employment since The Great Depression, shaped the period considered here and so the story of the ocean economy in recent years is the story of how that economy was in turn shaped by the Great Recession. There are many different parts to this story, but a starting point is to consider where the economy was before the recession began and after it was over. A future report will have to consider how the ocean economy fared in the recovery from the Great Recession.

Table 3.4. Changes in ocean sectors and U.S. employment & wages, 2005-2010

Sector	Employment 2005	Employment 2010	Employment Change	Employment % Change	GDP 2005 ($billion $2005)	GDP 2010 ($billion $2005)	GDP Change ($billion)	GDP % Change
Construction	49,871	46,390	(3,481)	-7.0%	$5.7	$4.8	$0.89	-15.8%
Living Resources	65,551	59,354	(6,197)	-9.5%	$5.3	$5.4	$0.05	0.9%
Minerals	131,730	143,995	12,265	9.3%	$77.7	$94.4	$16.71	21.5%
Ship & Boat Building	164,894	144,066	(20,828)	-12.6%	$13.0	$10.0	$2.99	-23.1%
Tourism & Recreation	1,859,927	1,931,746	**71,819**	3.9%	$77.9	$78.5	$0.65	0.8%
Transportation	457,075	443,934	(13,141)	-2.9%	$44.8	$73.7	$28.88	64.5%
Transportation Less Search & Navigation	331,893	327,227	(4,666)	-1.4%	$28.4	$35.7	$7.33	25.9%
All Ocean Sectors	2,729,050	2,770,000	40,950	1.5%	$224.3	$266.7	$42.40	18.9%
All Ocean Sectors Less Search & Navigation	2,397,157	2,442,773	45,616	1.9%	$196.0	$231.0	$35.07	17.9%
United States (national total)	131,571,623	127,820,442	(3,751,181)	-2.9%	$12,539	$12,919	$379.82	3.0%

To begin, from 2005 to 2010, 41,000 jobs were added to the ocean economy, but these new jobs were offset by 43,647 jobs lost in the marine construction, ship & boat building, transportation and living resources sectors. Overall employment over this period grew only 1.5%, and the tourism & recreation sector accounted for 85% of the new jobs (Table 3.4). (Note, however, that Tourism & Recreation self-employment jobs are not valued as FTEs, as are jobs in the other sectors. This means that growth in jobs in this sector is inflated relative to other sectors.)

During the period from 2005 to 2010, the ocean economy as a whole grew by $42.4 billion (measured in 2005 dollars), or more than a quarter in terms of its contribution to U.S. GDP. Transportation accounted for much of this increase, with a growth of $28.9 billion (see sidebar). The Living Resources, Minerals, and Tourism & Recreation sectors also increased their contribution to national GDP. Due to the continued growth in the transportation, minerals and tourism & recreation industries, the ocean economy grew by 1.5% in employment while the national economy shrunk by 2.9% over 2005–2010 (Figure 3.4).

Employment in the ocean economy grew from 2005 to 2008 in most sectors (except for living resources), but employment declined in all sectors during the recessionary period from 2008 to 2010 (Figure 3.3). In that period, the largest employment declines were seen in Transportation (-34,650 in total; -29,262 excluding search & navigation equipment)and Tourism & Recreation (-34,615)(Table 3.1A). Minerals had the largest growth in employment relative to 2005 and the largest decline relative to peak values.

The growth in ocean economy GDP from 2005 to 2010 is somewhat distorted by a very large increase in the transportation sector, which includes the search & navigation equipment industry, whose GDP is estimated as a share of the larger computer and electronic equipment industry. As discussed in the section on transportation in this chapter, this estimation method likely yields an overestimate of GDP growth for this sector. For this reason, we have estimated the GDP of the transportation sector with and without the search & navigation equipment industry. Without that industry, the transportation sector nevertheless still showed significant growth of nearly 26% in GDP. The overall ocean economy GDP without the search & navigation equipment industry grew by 18%, still outpacing the U.S. economy over the period.

The largest rates of decline in real GDP were in the Ship & Boat Building (-23.1%), and Construction (-15.8%) industries.

The decline in minerals reflects a drop in exploratory and production activity resulting from price drops after the sharp increases of 2007–2008. The decline in construction activity was similar to the broad decline in all construction activities during the recession, while the decline in ship & boat building was concentrated in boat building.

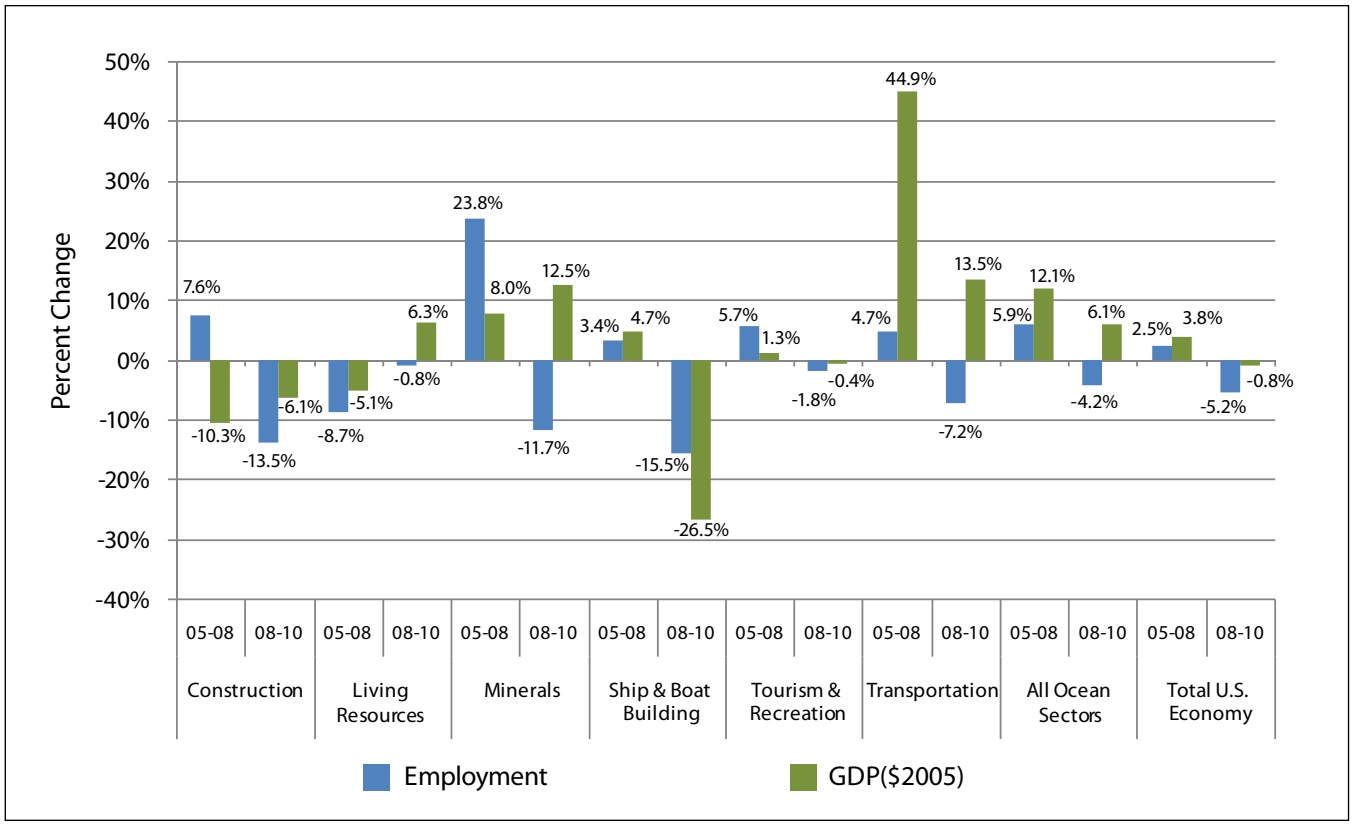

Figure 3.3. Ocean sector employment and GDP recession and recovery

Associated data in Appendix Table 3.1A, Ocean sector employment and GDP changes, 2005–08 and 2008–10

Boat building in the U.S. is primarily for the recreational boating market, and sales of recreational boats, a high-cost discretionary purchase, dropped by more than half with the decline in incomes and the stock market in 2009–10.

The ocean economy's role relative to the overall economy is indicated in Figure 3.4. While the effects of the recession on the broader economy are clearly visible in the coastal states and shore-adjacent counties, where many of the nation's largest urban areas are located, the ocean economy as a whole showed a small but positive growth of 1.5%. This was primarily due to the relatively strong employment growth in the ocean minerals, construction, and tourism & recreation sectors over 2005–2008 coupled with relatively mild declines in the recessionary period from 2008–10.

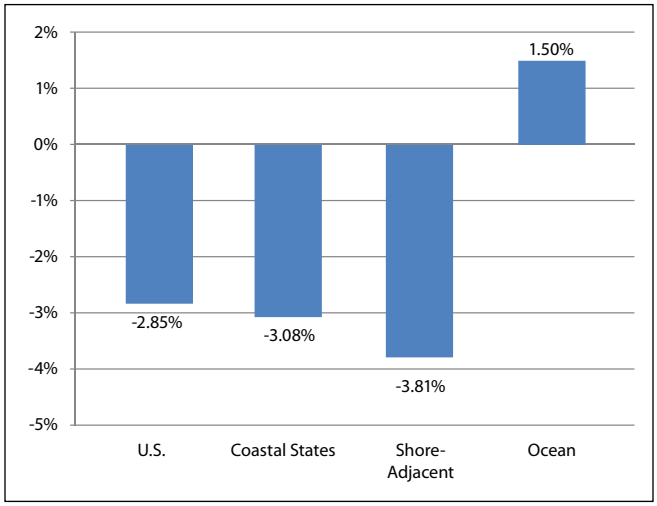

Figure 3.4. Employment growth in coastal and ocean economies 2005–2010

Associated data in Appendix Table 3.2A, Ocean economy employment by region, 2005–2010

Recent trends in the long-term context

Recent trends in the ocean economy also reflect important long-term trends, the most significant of which is the rise of tourism & recreation as the defining sector of the ocean economy (Figure 3.5 and Figure 3.6). This has occurred for several reasons:

- Despite the decline in real income, domestic travel and recreation has still been affordable to most people, and the oceans and Great Lakes have been a center for U.S. vacations and leisure since the nineteenth century. The concentration of major metropolitan areas in coastal areas also contributes to the growth in components of tourism & recreation related to business travel.
- Increasing productivity in sectors such as transportation and minerals generated increases in per capita output with fewer employees. As a personal service industry, increases in labor productivity are much slower in tourism & recreation and so growth in output is accompanied by stronger growth in overall (but not FTE) employment.
- In the fishing industries that make up the majority of the living resources sector, tighter resource management restrictions and natural changes have reduced the significance of what was once a dominant ocean economy activity.

The growth in importance of tourism & recreation is somewhat stronger than is apparent from Figure 3.5. For example, the marine passenger transportation industry is included in the transportation sector, but this industry is primarily comprised of the cruise ship industry, which has grown to be one of the most significant ocean industries. (NOEP data measure the shore-side employment of the cruise ship industry; the ships are largely registered outside the U.S. so their crews do not appear in U.S. employment data.) In ship & boat building, the output of the *ship building* industry has been almost entirely for the U.S. Navy, but naval ship construction reached its peak in 1990, and has been declining in terms of employment since then. Growth in the ship & boat building sector has been almost entirely in *boat building*, primarily for recreation and therefore more vulnerable to economic downturns.

The growing importance of tourism & recreation in the ocean economy is also supported by studies in other countries, which have found that tourism & recreation activities and supporting industries have been the dominant part of the ocean economy. In France, tourism is "by far the largest sector of the marine and coastal economy in terms of turnover and employment" (Kalaydjian *et al*. 2005). The cruise ship industry in France is not only a major part of French ocean recreation, it is also a significant part of its

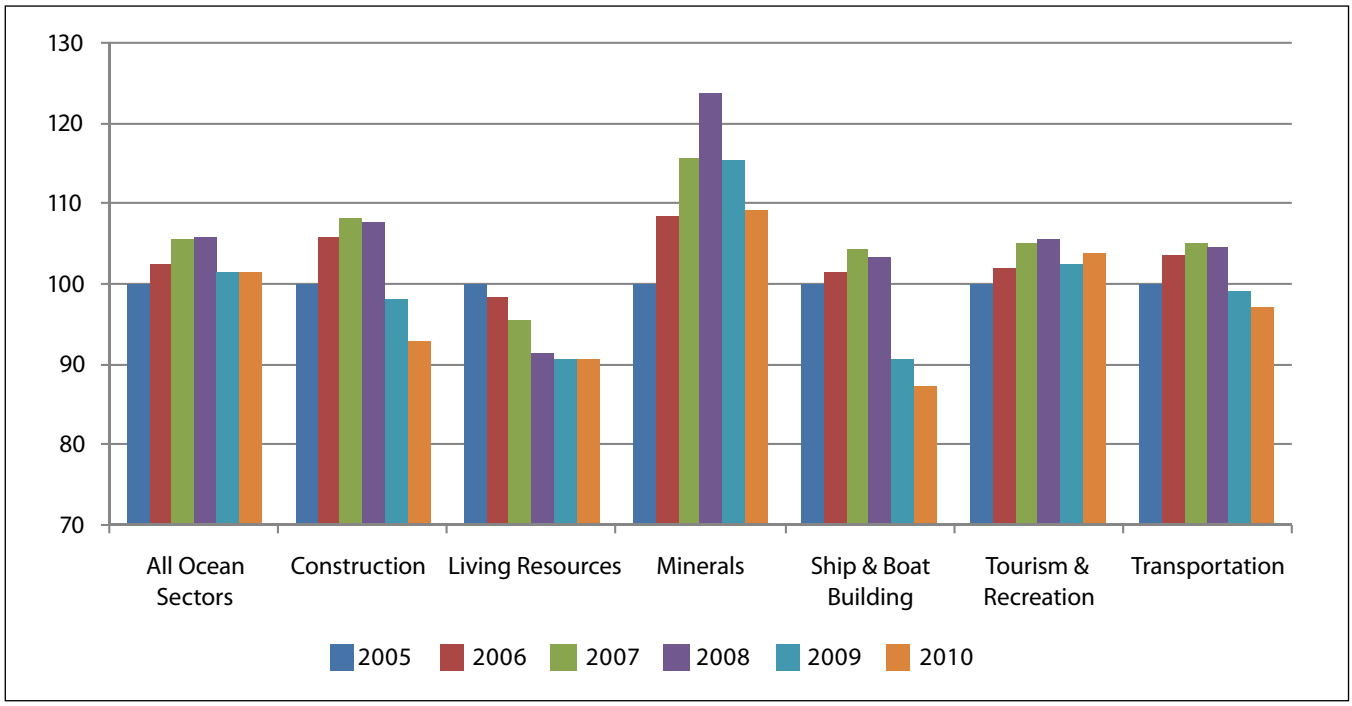

Figure 3.5. Ocean economy sector employment growth index 2005–2010

Associated data in Appendix Table 3.4A, Indexed sector employment changes, 2005–2010

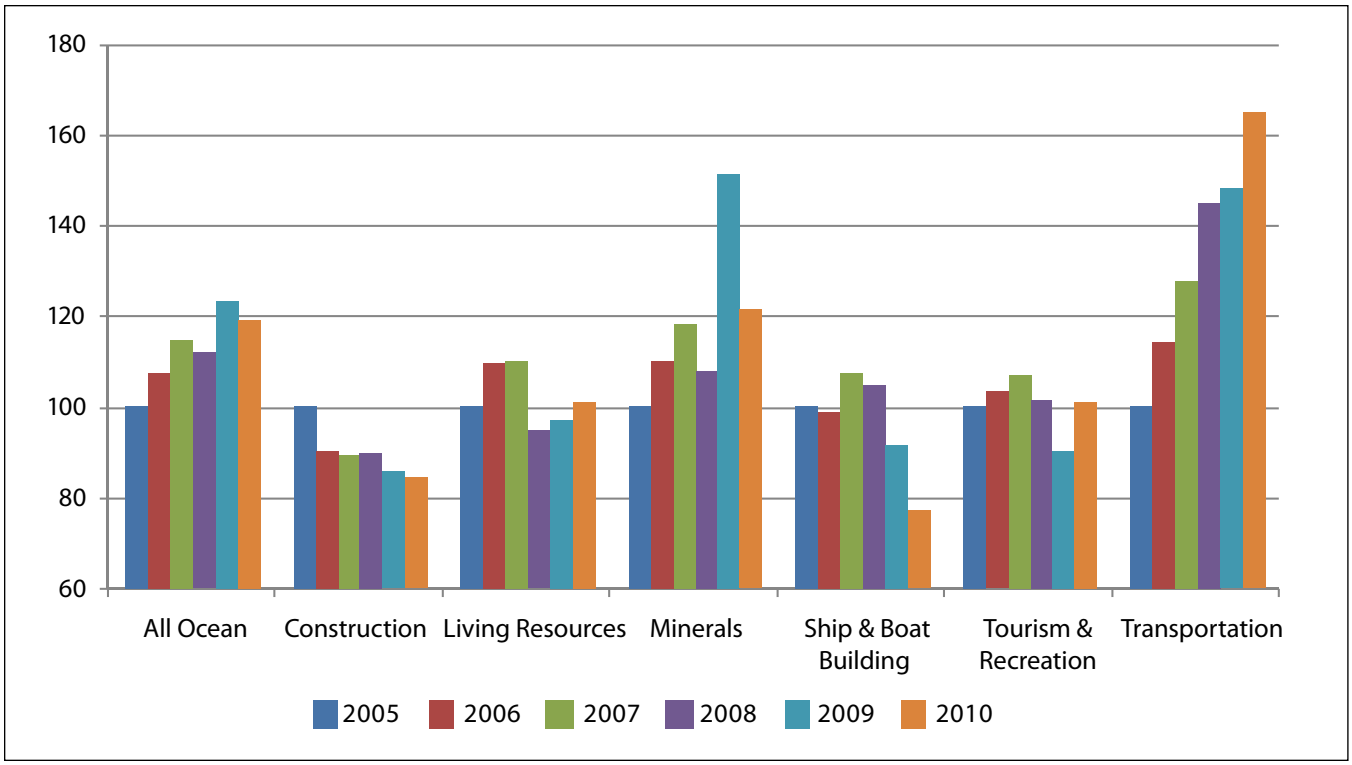

Figure 3.6. Ocean economy real GDP change 2005-2010

ship building industry; a quarter of the large cruise ships built in 2005 were built in France.

At the same time, the growth in tourism & recreation in the ocean economy reflects a number of characteristics distinct to the United States. Most of the nation's major cities are in coastal locations, giving the tourism & recreation industries an important role in America's cities that is not found in countries where major urban areas are distributed throughout the nation rather than directly along the coasts (for example, Canada and England). As a result, sectors such as living resources and minerals play larger roles in those countries' ocean economies than they do in the U.S. economy (Pugh and Skinner 2002, Gislason and Associates 2007).

The multiplier effects of the ocean economy

The people and organizations in the ocean economy affect the total U.S. economy to a greater extent than is indicated by the employment and output measures discussed so far. The firms in the industry buy inputs from other industries whose sales are thus indirectly dependent on the ocean economy's success. The employees in the ocean industries spend their incomes and these sales to employees are said to be "induced" activity from the ocean economy. Together these effects are known as the "multiplier effect".

Multiplier effects are estimated using economic models that trace the purchases of firms and employees in the ocean economy (the "direct" effects) through associated indirect and induced effects. For the ocean economy, IMPLAN, one of the major economic models of this type, was used in this study. The resulting estimates indicate that the ocean economy has an employment multiplier of 1.92, meaning that the 2.8 million jobs in the ocean industry in 2010 were associated with indirect and induced

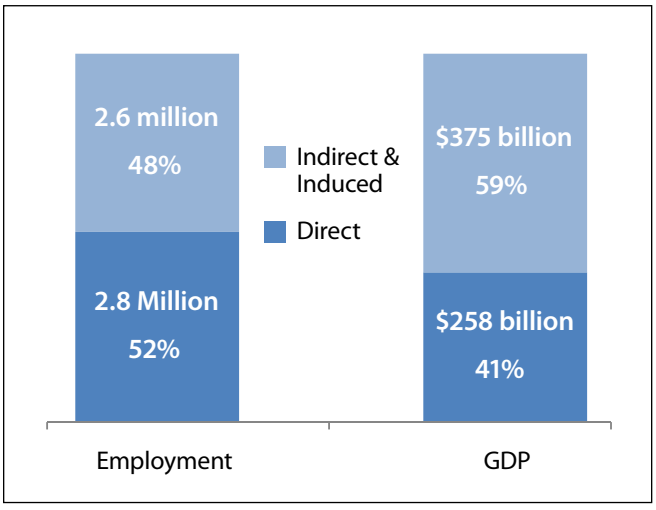

Figure 3.7. Ocean employment and GDP with multipliers, 2010

jobs totaling an additional 2.6 million. Thus the *total* employment associated with the ocean economy was 5.4 million jobs. The multiplier effect estimates for GDP is 2.45, meaning that an additional $375 billion is generated on top of the $258 billion that was directly generated. The total contribution of the ocean economy is thus estimated at $633 billion or 4.4% of national GDP (Figure 3.7).

3.3 The Ocean Economy in the Coastal States

The ocean economy is distributed across the coastal states in ways that are both consistent with the distribution of the national economy as a whole and unique to the features of the *ocean economy*. For example, four of the five largest states in terms of ocean economy employment are also the four largest states in terms of *total* employment. These are Texas, California, Florida, and New York (Table 3.4). California is the only state ranked in the top five states by employment for five of the six ocean economy sectors. It is also in the top five overall. The state of Washington ranks highly among states in the ocean economy because of the population and because it is the center for the Northwest Pacific Fisheries.

Washington is the largest state in terms of the living resources sector largely due to the shellfish industry. However, in this study this is partly the result of a statistical anomaly because of the way we collect our data. Much of the fish-harvesting industry employment in Washington is included in the QCEW because of the unique organization of the Northwest Pacific fishing industry. This is not true in most other states where the fish harvesting industry is not included in the living resources sector. If it were, states such as Louisiana, Texas, and Alaska would rank at or near the top in terms of employment in the living resources sector.

New York, California, and Florida are the three leading states in tourism & recreation employment; New York and Washington State are third and fifth, reflecting tourism & recreation in the urban areas. Hawaii, where tourism & recreation is by far the dominant industry, is fourth of the top five states.

More populous states are dominant in terms of marine construction. The offshore oil and gas industry is concentrated almost entirely in the states of Louisiana, Texas, Alaska, and California. Michigan's large sand & gravel industry places it in the top five in the minerals sector.

The top five states cited for ship & boat building are somewhat misleading. While Virginia is clearly the leading state, with the Newport News shipyards and related facilities, Mississippi should also be on the list, probably in the third or fourth positions. Mississippi is not included because it has exactly one major ship yard, the Ingalls Shipyard in Pascagoula, Mississippi. This is a very large shipyard, but confidentiality rules prevent disclosing its employment. While their employment is included in the national totals, they are not visible in federal government statistics at the state level.

Another perspective on the states is provided by examining the ocean economy's share of each state's economy. Not surprisingly, Hawaii leads all states with 17% of its total employment in ocean economy sectors, followed by Alaska with 14%. These are the only two states in which the ocean economy comprises more than 10% of employment. Maine and Rhode Island are next with 8%, followed by Delaware, Florida and Louisiana, each with 5 to 6% of their total 2010 employment in the ocean economy. Washington, New York and South Carolina have 3 to 4% in the ocean economy, while seven states have 2 to 3%, nine states have 1 to 2% and two of the Great Lakes states, Indiana and Minnesota, have less than 1%.

Table 3.5. Top five GDP states by employment in ocean sectors and total ocean economy, 2010

Ocean Economy	Tourism & Recreation	Marine Construction	Living Resources	Minerals	Ship & Boat Building	Marine Transportation
Texas	New York	Texas	Washington	Texas	Washington	California
California	California	California	Alaska	Louisiana	Virginia	New Jersey
Florida	Florida	New York	Virginia	Alaska	Connecticut	Texas
New York	Hawaii	Louisiana	Massachusetts	California	Louisiana	New York
Louisiana	Washington	Florida	Louisiana	Michigan	California	Maryland

The State Ocean Economies 2005-2010

Change in the ocean economy among the states has also been highly variable. These changes can be measured as total growth(or reduction) in employment or as the growth rate in terms of percent change. Each measure produces a different perspective on growth: changes in total employment tend to be greater in the largest states, while growth rates (positive or negative) can be larger in the smaller states (Table 3.6).

Similar rankings in both growth and growth rate. New York, Texas, and Alaska ranked high on both measures and near the top of the list. These states, along with Pennsylvania, reflect much of the growth in the ocean economy that has been taking place in urban areas. At the other end, states such as Michigan, Delaware, Hawaii, and Illinois had similar rankings reflecting decline in both total ocean economy employment growth and growth rate, indicating the severity of their employment contractions.

States ranked high in one measure, but low in the other. Alabama has a relatively small ocean economy and so its growth rate tends to be high relative to larger states. Massachusetts and New Jersey are states that ranked higher in total employment growth, but lower in growth rates.

Mixed ranking states in which neither measure predominates. This analysis suggests that a state's ocean economy employment growth or decline is relative to its rank in size among the coastal states. While Michigan lost over 4 times as many ocean related jobs as Delaware, its employment declined at nearly the same rate.

Table 3.6. Ocean economy growth rank by state 2005 to 2010

Associated data in Appendix Table 3.5A, Employment ranking by growth and growth rate.

State	Ranked Employment Growth Rate	Ranked Total Employment Change
Michigan	29	30
Delaware	28	25
Hawaii	25	28
Indiana	30	23
Illinois	23	27
North Carolina	26	24
California	20	29
Minnesota	27	21
Louisiana	21	26
Ohio	24	22
Rhode Island	22	20
Georgia	19	18
Virginia	18	19
Maryland	17	17
Washington	16	15
New Hampshire	14	16
Wisconsin	15	14
Oregon	12	13
Mississippi	11	12
Florida	13	9
Maine	9	11
Connecticut	8	10
New Jersey	10	5
South Carolina	7	8
Pennsylvania	6	7
Alabama	2	6
Massachusetts	5	3
Alaska	3	4
Texas	4	2
New York	1	1

Note: Colors in red reflect states with negative employment growth and black those with positive employment growth.

3.4 The Ocean Economy Sectors

Marine Construction

The *Marine Construction* sector includes firms in heavy construction, which are engaged primarily in activities such as the construction of piers, harbor dredging, and the building of marine structures such as offshore oil platforms.

As is the case with most construction activity, the marine-related construction industry is highly volatile over time (Figure 3.8). Growth rates are affected by overall economic growth and by government spending on projects such as beach nourishment and harbor dredging. Marine construction activity tends to be centered where the oil and gas industries are located. In 2010, the states with the largest employment in marine construction were Texas (6,948) and Louisiana (6,435). Together, Texas, Louisiana, Florida, New York, and California accounted for 51% of the total

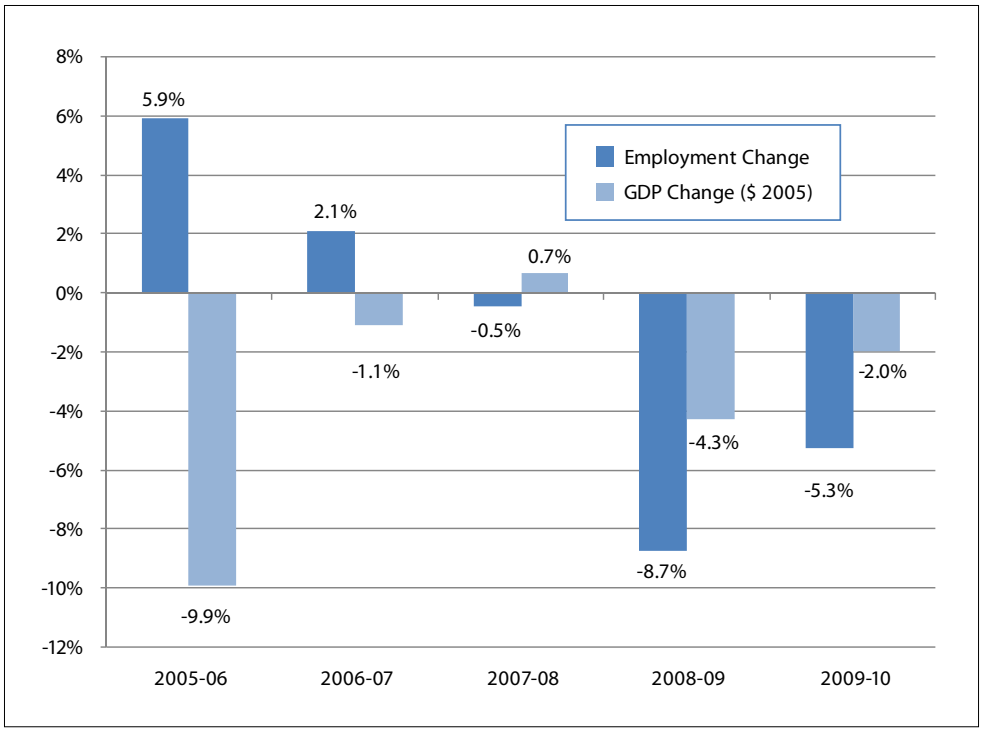

Figure 3.8. Marine construction economic change, 2005 to 2010

Associated data in Appendix table 3.6A.

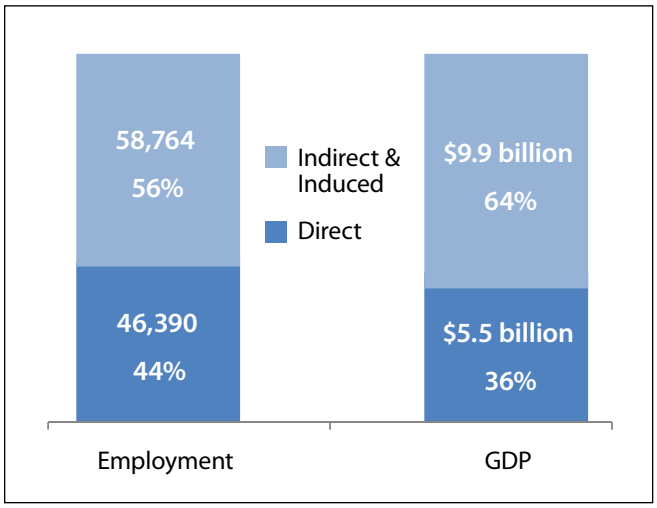

Figure 3.9. Marine construction with multipliers, 2010

Table 3.7. Beach nourishment expenditures in $1000s.

Source: Western Carolina University Program for the Study of Developed Shorelines.

	Annual Average Expenditures ($2005)	Annual Average Beach Nourishment (cubic yards)	Average Cost Per Yard ($2005)
1960s	$256.81	168.74	$1.52
1970s	$468.79	160.14	$2.93
1980s	$816.26	182.37	$4.48
1990s	$1,442.68	241.75	$5.96
2000s	$1,415.45	177.32	$7.98
2010-present	$1,307.25	145.99	$8.95

marine construction employment in the 27 states for which 2010 industry data are available.

The estimated employment multiplier for marine construction of 1.27 yields an estimate of 58,764 additional jobs for a total employment impact of 105,153. The GDP multiplier of 1.8 yields an estimated $9.9 billion in output for a total contribution to the national economy of $15.4 billion (Figure 3.9).

One of the major activities in marine construction is the nourishment of beaches with sand to counteract the effects of erosion. Beach nourishment has been occurring for more than fifty years, with average national expenditures increasing from $256,800 in the 1960s (in 2005 dollars) to over $1.3 million a year in this decade (Table 3.7). The volume of sand moved has increased in the past two decades, and the cost of each cubic yard of sand used for beach nourishment has increased by nearly 600% in real dollars since the 1960s.

Beach nourishment activity and expenditure

- Over three-quarters of beach nourishment activity and four-fifths of funding comes from the federal government, with state, local, and private funding picking up the balance[5] (Figure 3.10).
- Over the past 50-plus years, more beach nourishment money has been spent in Florida than in any other state. More than three of every ten dollars spent on beach nourishment has gone to Florida (Figure 3.11). New Jersey and North Carolina combined have accounted for almost the same as Florida in expenditures.
- In contrast, more sand is moved in California than any other state (Figure 3.12). Almost half of the sand deployed for beach nourishment has been in California, with Florida a distant second at 18.3%. The differences reflect the differing relative unit costs of nourishment.

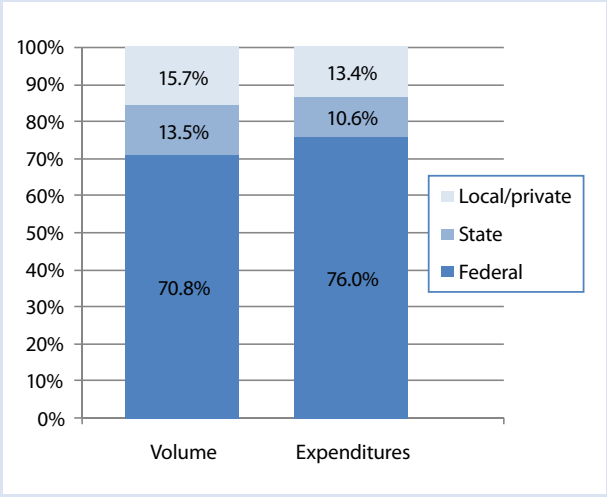

Figure 3.10. Source of funding for beach nourishment, cumulative 2000 to 2012.

Source: Western Carolina University Beach Nourishment Database (http://beachnourishment.psds-wcu.org)

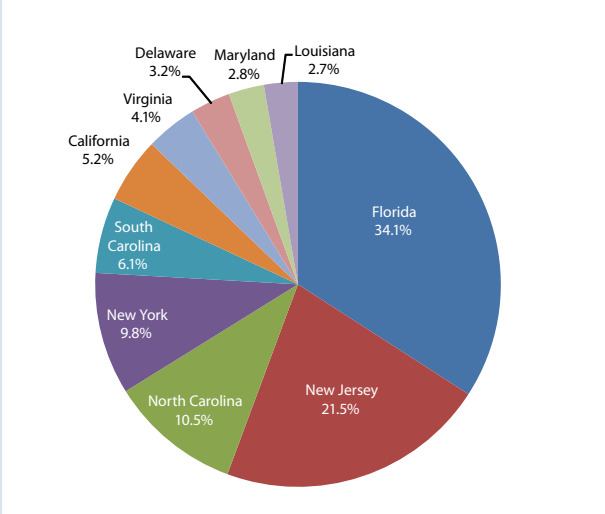

Figure 3.11. Top ten beach nourishment states by expenditure 1960 to 2013.

Source: Western Carolina University.
Associated data in Appendix table 3.7A.

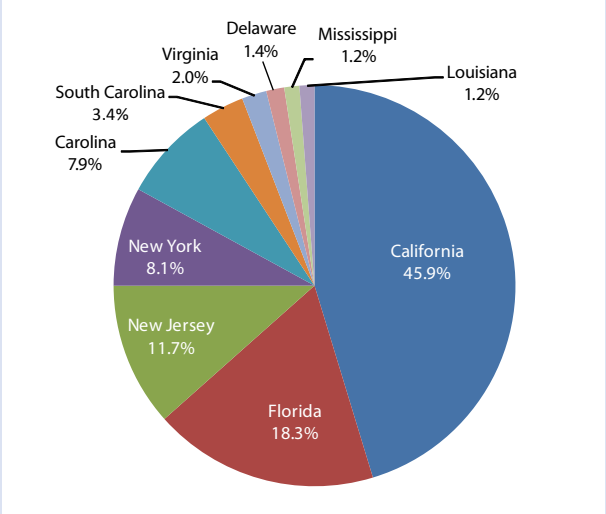

Figure 3.12. Top ten beach nourishment states by volume 1960 to 2013.

Source: Western Carolina University.
Associated data in Appendix table 3.8A.

5 Western Carolina University, Program for the Study of Developed Shorelines: http://www.psds-wcu.org/beach-nourishment.html

Living Resources

The *Living* Resources sector has been highly volatile over time due to fishing pressure, environmental changes and the economy, as well as regulatory policies (Figure 3.13). The sector is comprised of industries related to commercial fishing, seafood markets and aquaculture (Figure 3.14, Figure 3.15). Employment in the sector declined throughout the 2005-10 period, with the most severe drop occurring in 2007-08, which consumer demand fell dramatically during the onset of the recession. This drop in demand translated into sharp drops in both employment and GDP for the sector. Output had shown some recovery by 2010, but employment tended to fall during the recession though at a slower pace.

Measuring employment in the living resources sector is difficult because a major part of that sector, fish harvesting, is not included in standard employment data. Commercial fish harvesters are considered self-employed unless they work for a legal entity such as a corporation that is covered by federal employment laws (as is most common in the Pacific Northwest), so most commercial fish harvesters are exempted by law from coverage in the employment data series used to measure employment. To estimate the approximate size of the self-employment in the sector, the "Non Employer Statistics" compiled by the Bureau of the Census can be used (http://www.census.gov/econ/nonemployer/index.html). These show that about half of employment in the sector is self-employment, with an estimated 59,618 people self-employed in 2010 (Figure 3.16). Both types of employment declined from 2005-2009, but self-employed harvesters increased slightly in 2010.

The seafood processing industries (frozen and canned) make up more than half of both employment and GDP (Figure 3.15). The output of the fish harvesting and aquaculture industries substantially exceeds employment in these industries, indicating the value added in these industries, while the share of output of seafood markets (the last step in the value added chain) is smaller than the share of employment.

The employment multiplier for the living resources sector is 0.53, yielding an estimated additional employment of 31,462 (using the QCEW data as the basis) for a total employment of 90,816. The GDP multiplier is 1.05, yielding a multiplier estimate of $6.3 billion and a total output impact of $12.3 billion (Figure 3.17).

Marine aquaculture, primarily of finfish such as salmon and of shellfish such as mussels and oysters, has grown significantly as a source of fish; however, its rapid growth has not offset decreases in wild seafood harvest, which are

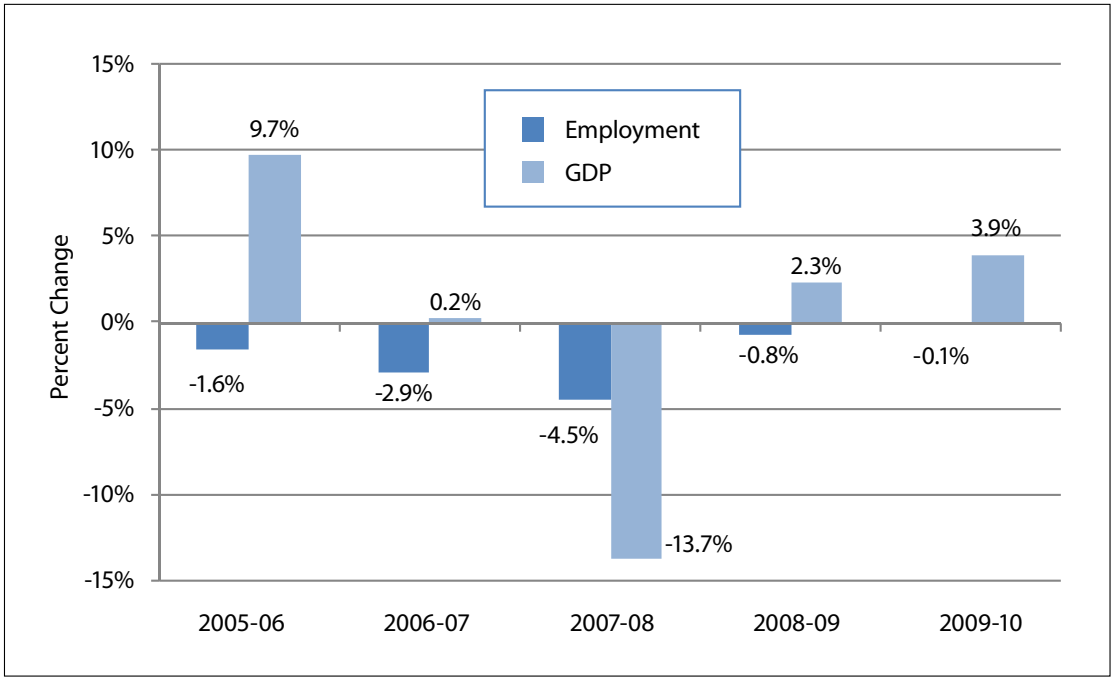

Figure 3.13. Economic change in the living resources sector 2005 to 2010.

Associated data in Appendix table 3.9A.

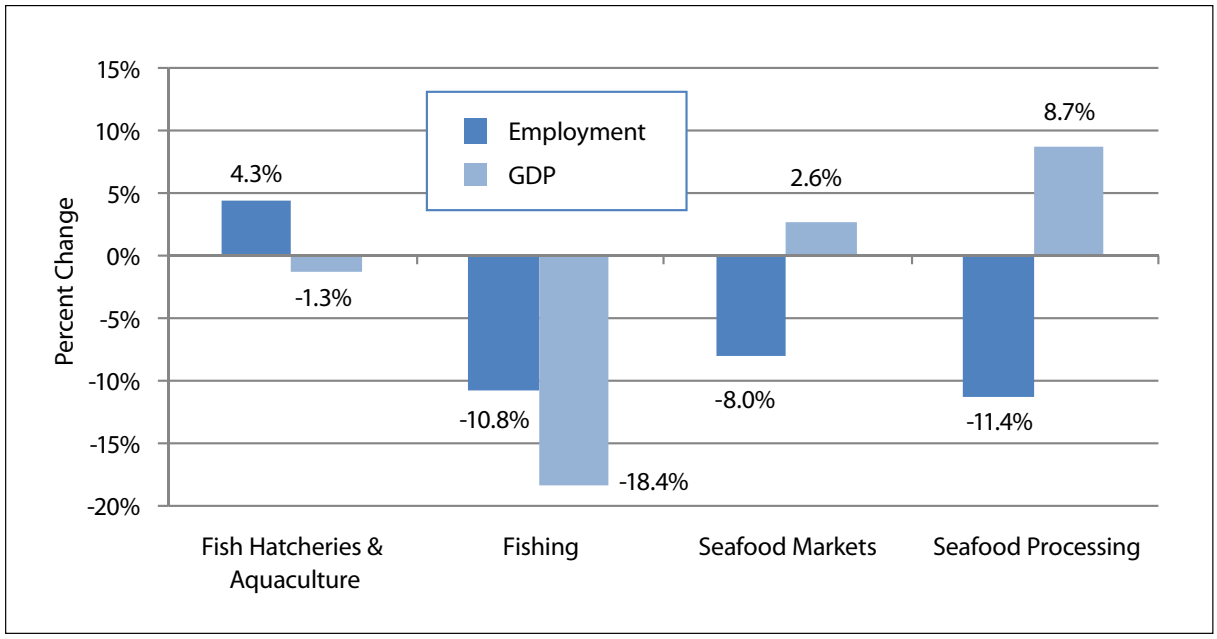

Figure 3.14. Living resources industries' economic growth 2005 to 2010.

Associated data in Appendix table 3.10A.

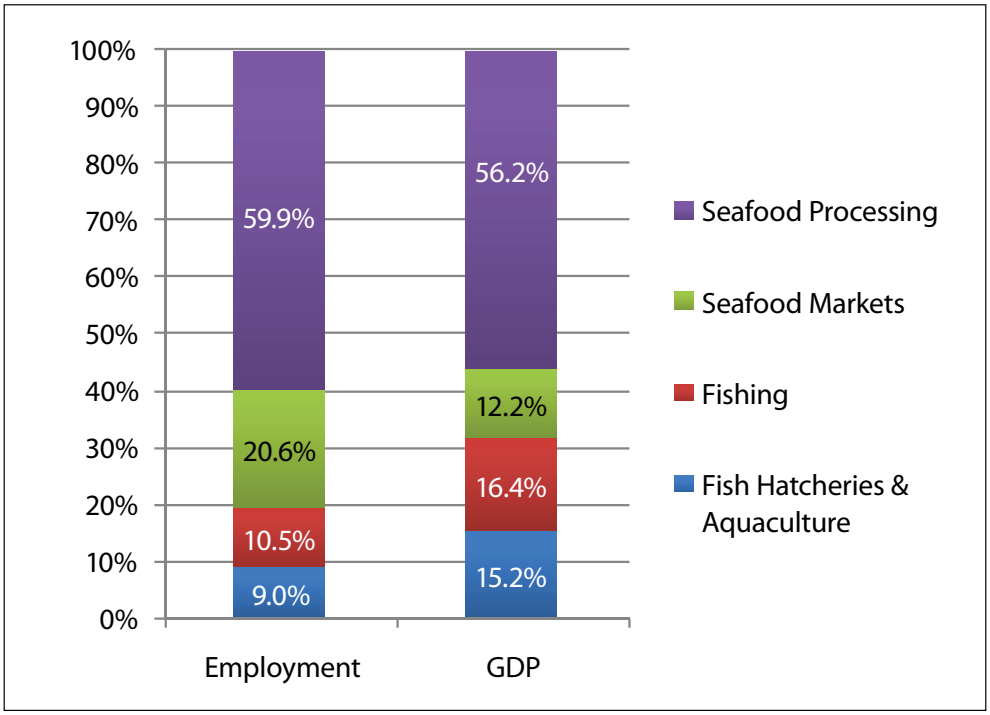

Figure 3.15. Living resources industries' Employment and GDP as a percent of sector, 2010

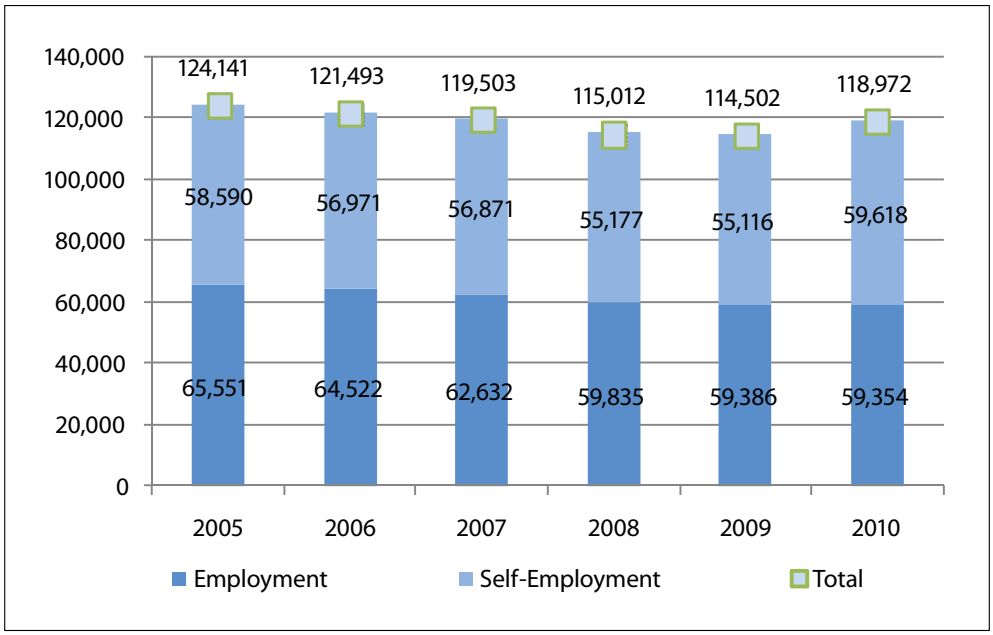

Figure 3.16. Living resources employment and self-employment, 2005 to 2010

Source: NOAA Digital Coast; www.csc.noaa.gov/digitalcoast

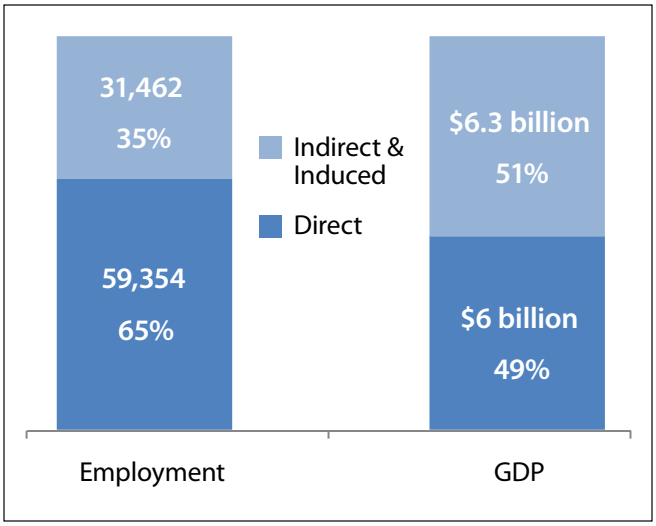

Figure 3.17. Living Resources with multipliers, 2010

reflected in the declines in the seafood processing industries. The declines in the fishing industry indicated in the NOEP data may understate the actual declines that have taken place in commercial fisheries. U.S. fish landings peaked in 1994 at 10.4 billion pounds (Figure 3.18). Since then, landings have declined to 9.3 billion pounds, a decline of nearly 11%. During that time, the nominal value of landings increased by 31.5%, but adjusted for inflation[6], the value of landings declined by more than 13%.

With regard to regional differences, the Pacific fisheries, particularly the Pacific Northwest fisheries off Alaska, increased landings; as a result, the Pacific region's share of national fisheries landings value increased from 14% to 19.3% between 2000 and 2010 (Figure 3.19). After the Pacific, the two most important fisheries regions are the Gulf of Mexico and New England, both of which experienced a more than 10% decline in landings and associated decline in their share of the national fishing industry. All other regions saw landings decline, led by the South Atlantic and the Great Lakes, which had very large decline rates, but these are relatively small fisheries regions. The result of this decline in landings is that all but four states had a decline in living resources employment over 2000 to 2010, particularly in seafood processing.

The only four states to see growth in this sector were Texas, Hawaii, Massachusetts and Oregon. Despite increases in landings, both Alaska (-1%) and Washington (-23%) declined in employment in the living resources sector. Not surprisingly, the largest decline has been in states on the Great Lakes and in the South Atlantic states (for example, Georgia and South Carolina). California also had a sharp drop in employment in this sector.

Seafood remains popular, but imported fish products have supplemented much of that growth by replacing declining domestic production. A decade sample of U.S. landings and values compared with foreign imports indicates much

6 Inflation adjustment done using the BLS Producer Price Index for Unprocessed Fish.

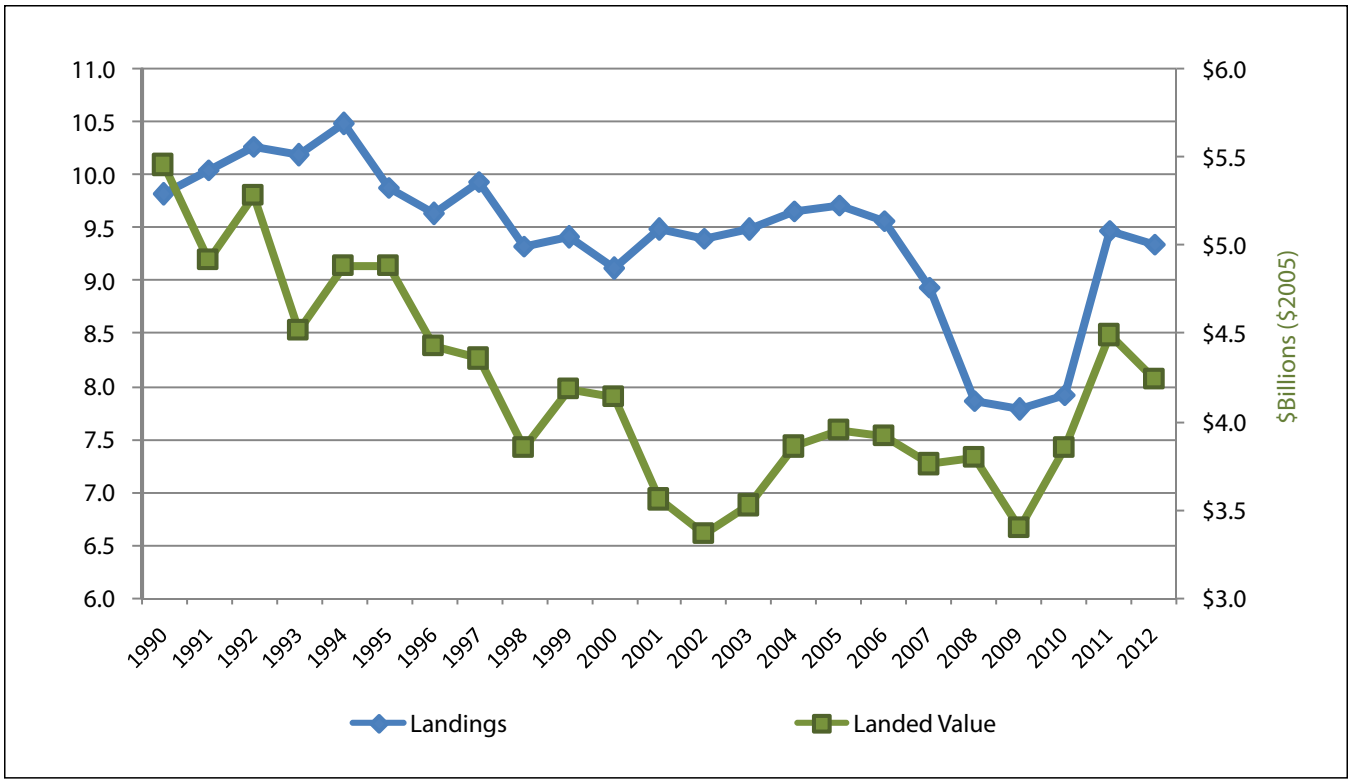

Figure 3.18. U.S. fisheries landings and landed value 1990 to 2012.
Associated data in Appendix table 3.11A

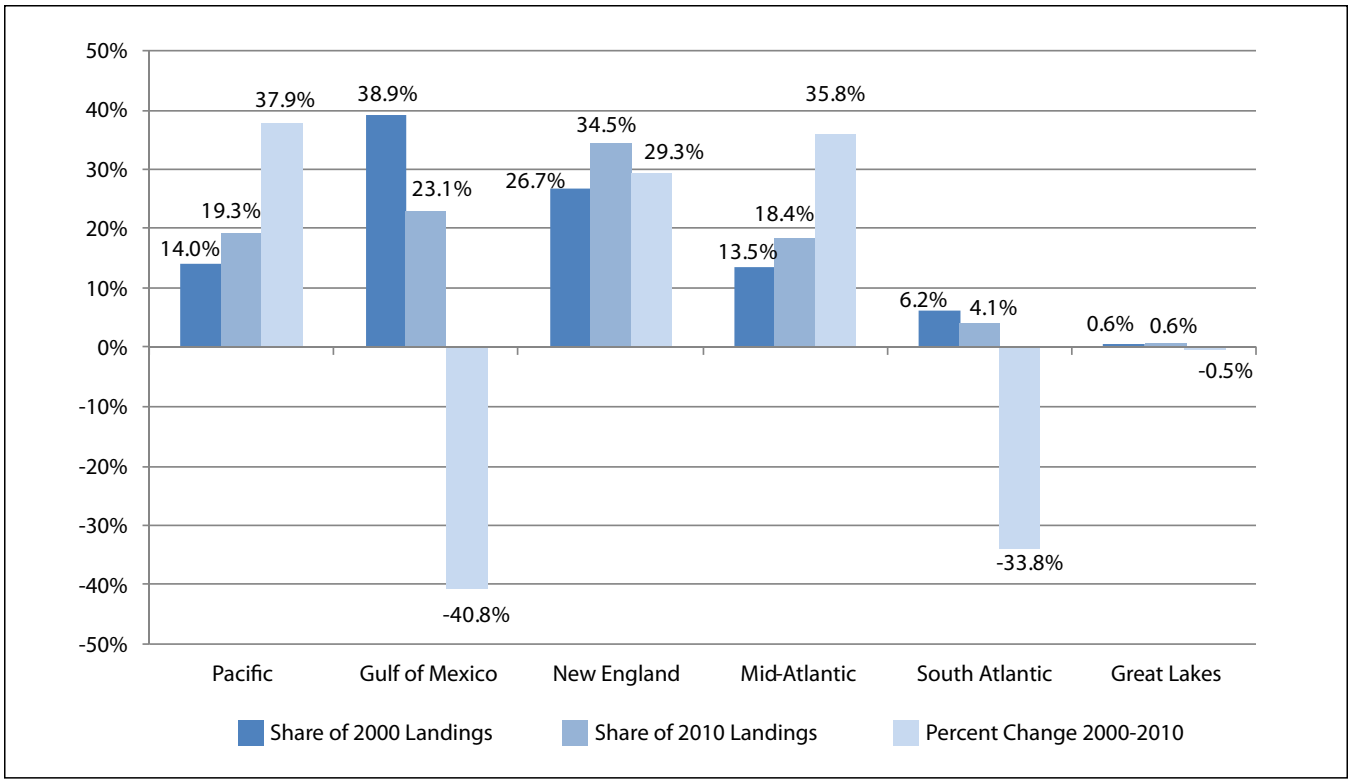

Figure 3.19. Change in fishery landings by major region 2000 to 2010

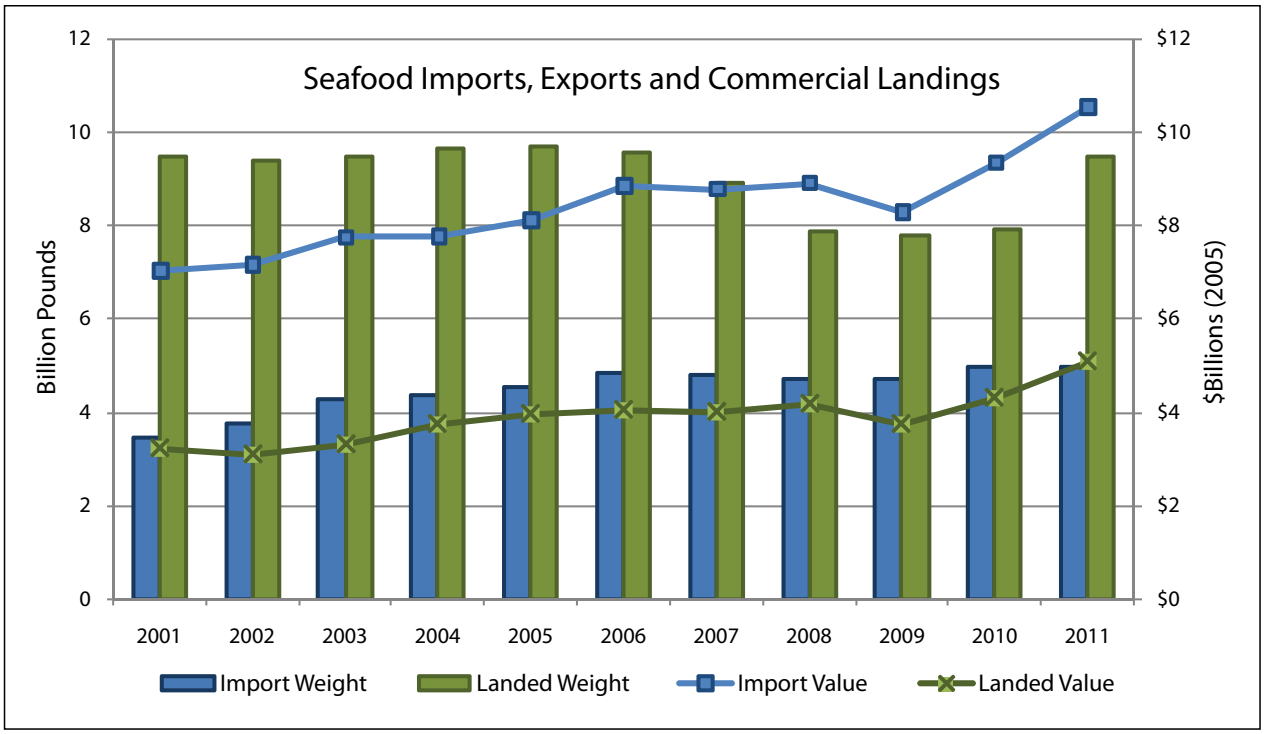

Figure 3.20. Comparison of U.S. domestic fish landings with foreign imported fish 2001 to 2011.

Source: Department of Commerce, NOAA National Marine Fisheries Service; U.S. Census Bureau, Foreign Trade Data.
Associated data in Appendix table 3.12A

higher values for imported fish than for domestic (landed) fish relative to weight (Figure 3.20). However, imported seafood is generally preprocessed while U.S. landing weights include unprocessed wastes.

Both the value of domestic and imported seafood suffered from the downturn of the recession and was a major factor in the drop in landed weights during the 2007 to 2009 period. The low volume of U.S. fish landings has been offset by U.S. imports of foreign seafood to meet the nation's demand. These imports had positive effects on employment and output in the marine cargo and related industries of the ocean economy transportation sector. 2011-2012 landings indicated a recovery, consistent with changes elsewhere in the economy.

Minerals

The ocean economy *Minerals* sector comprises the sand & gravel industry and the oil & gas exploration and production industries located in both state and federal coastal waters (Figure 3.21).

The oil & gas exploration and production industries dominate this sector; these two industries account for 94% of the employment and 99% of the GDP in this sector (Figure 3.22). Because of the dominance of oil and gas in this sector, employment and output growth are closely tied to world oil prices. Employment and output growth have risen and fallen with oil prices usually with a one-year lag (Figure 3.24). In both 2008 and 2010, an increase in the price of crude oil corresponded to a decrease in GDP; in 2009, a drop in price corresponded to an increase in GDP.

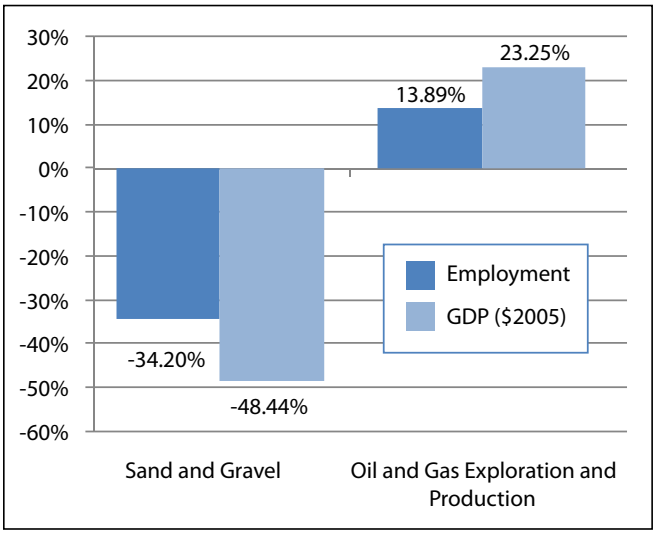

Figure 3.21. Ocean minerals industries economic growth 2005 to 2010.

Associated data in Appendix table 3.13A

The offshore oil and gas industry, with its high level of capital inputs from other industries, has traditionally had a high multiplier, which is estimated to be 1.98, which links the direct employment in the industry to 285,188 indirect and induced jobs and a total employment estimate of 429,183. The GDP multiplier of 1.16 yields an additional impact of $101.4 billion and a total impact of $188.8 billion in 2010.

The offshore oil & gas industry is dominated by the Gulf of Mexico, which accounted for 70% of U.S. offshore production in 1990 and 90% in 2010 (Figure 3.25). Growth in the Central Gulf of Mexico (the area off Louisiana) is the reason the industry and sector show modest growth in employment and output over the period. This region alone accounted for 63% of production in 1990 and 80% in 2010.

Outside the Gulf of Mexico, the other two producing regions are Alaska and California. Both of these regions peaked in output in 1996, and both have seen declining output since, as reserves have been depleted. Alaskan output declined 40% between 1996 and 2010, while California output dropped by more than half, primarily in state waters. Louisiana, Texas, Alaska, and California account for 90% of the employment and 95% of the output in this sector.

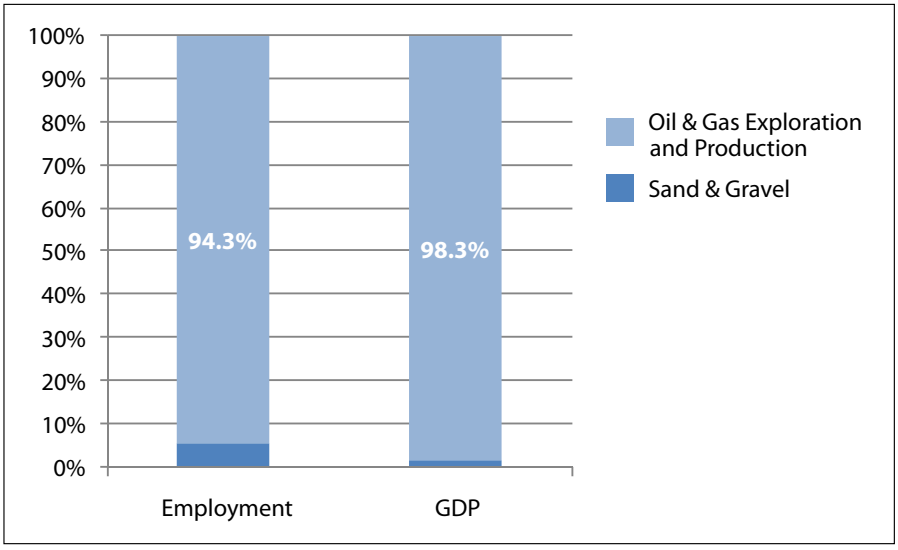

Figure 3.22. Mineral industries' Employment and GDP as a percent of sector, 2010

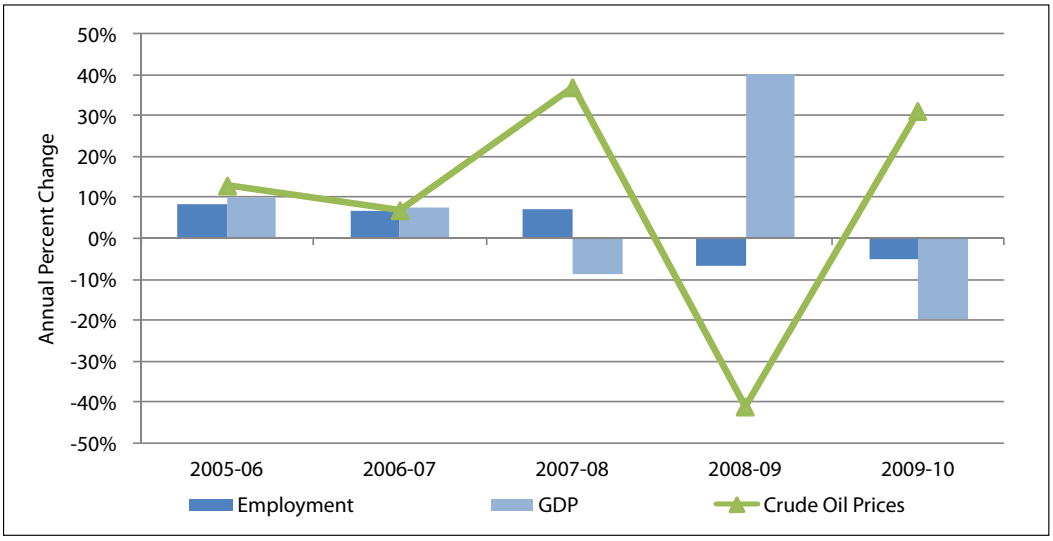

Figure 3.23. Economic growth in minerals sector 2005 to 2010.

Associated data in Appendix table 3.14A

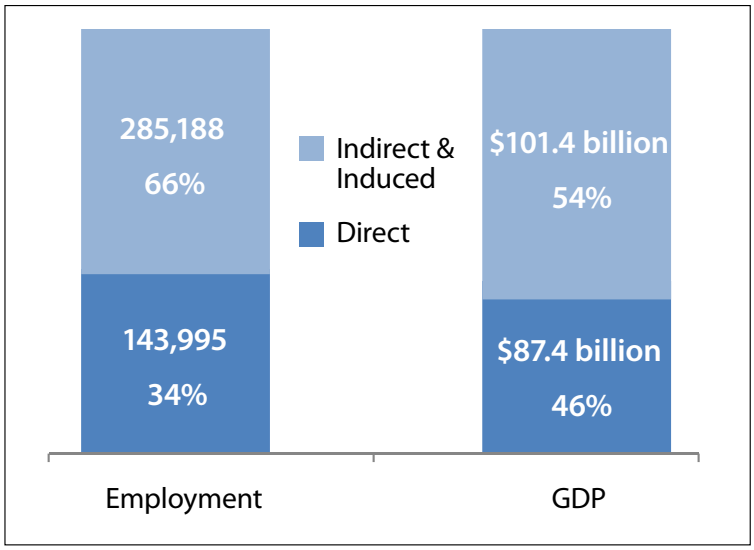

Figure 3.24. Offshore Minerals with multipliers, 2010

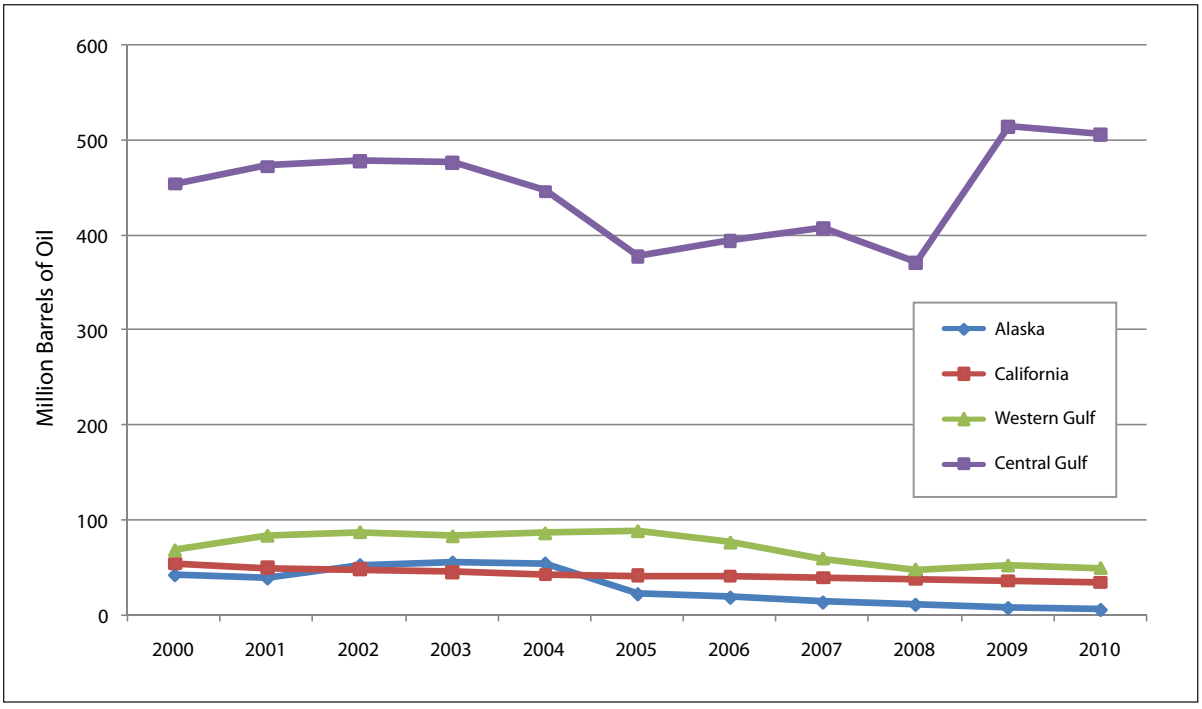

Figure 3.25. Offshore oil production in state and federal waters 2000 to 2010.

Associated data in Appendix table 3.15A

Ship & Boat Building & Repair

There are two industries comprising the *Ship and Boat Building and Repair* sector. Ship building in the United States is primarily oriented towards building, maintaining, and repairing ships for the U.S. Navy. A relatively small number of companies located in Virginia, Connecticut, Maine, Mississippi, Louisiana, and California undertake most of this work. The majority of the activity in boat-building is for the recreational boating market, although there is also activity building and repairing commercial vessels such as fishing vessels, ferries and tugboats.

Not surprisingly, the ship building industry is the much larger of the two industries, comprising more than 80% of both employment and GDP in 2010 (Figure 3.26). The proportion of activity attributed to ship building in this sector represents a shift from historical levels because of the sharp decline in boat building discussed below. Between 2000 and 2007, boat building & repair averaged 28% of employment and output.

Ship building activity declined significantly between 1990 (the peak of the Reagan era defense buildup) and the late 1990s, but showed modest increases in employment in 1997 and 2004. However, between 2005 and 2010 employment in the industry declined by over 30%, even as the construction of larger and more complex vessels caused the value of output to grow by 12% (Figure 3.27).

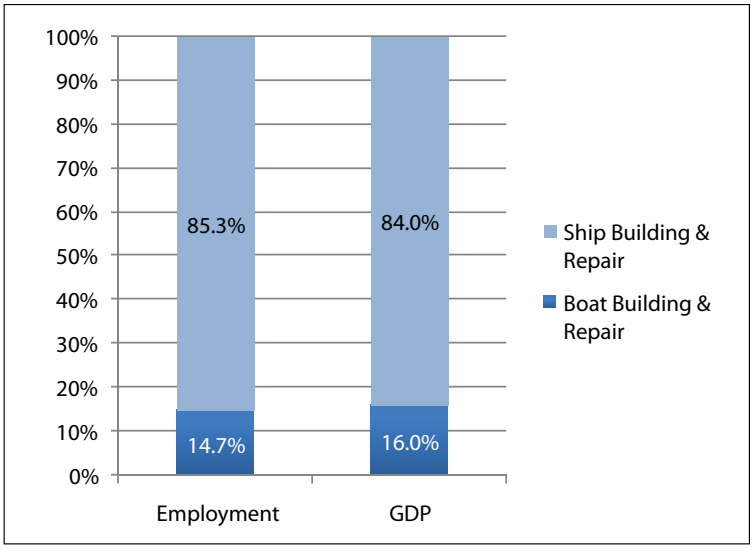

Figure 3.26. Ship and boat building & repair Employment and GDP as a percent of sector, 2010

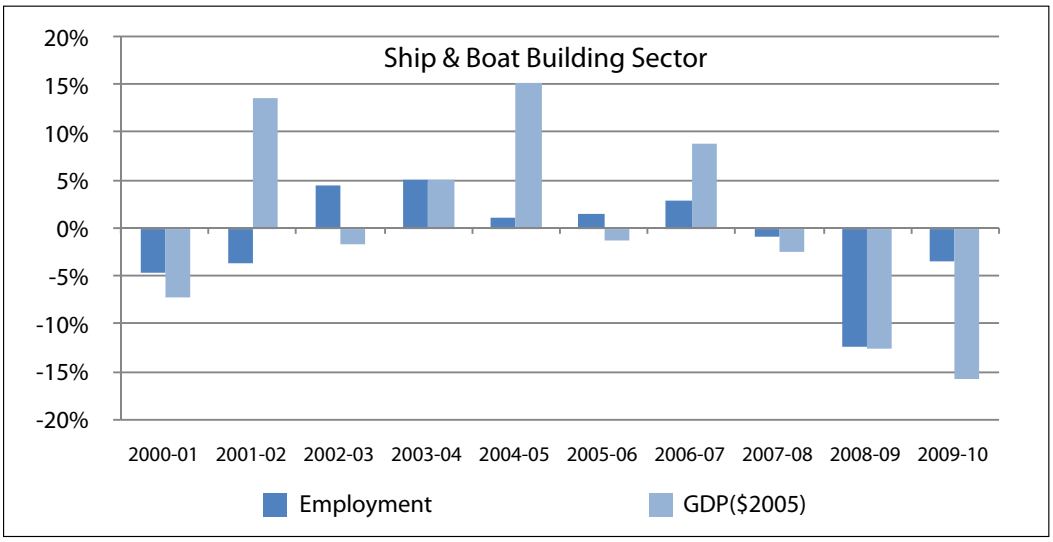

Figure 3.27. Economic change in the ship & boat building sector 2000 to 2010.

Associated data in Appendix table 3.16A

Although the majority of the boat building market serves the recreational boating industry, boat building behaved very differently from the ocean tourism & recreation sector during the recession. While tourism & recreation showed only modest effects, boat building suffered a significant decline during the recession, losing more than half of 2005 employment (21,000 jobs or -57.3%) during the period (Figure 3.30).Boat building, particularly in the Pacific Northwest, continued to provide for the fishing industry, and boat yards throughout the country served other commercial boat markets such as ferries. Florida, Washington, South Carolina, and Maine are the leading non-military boat-building states in terms of employment, with Florida by far the largest.

Like the oil and gas industry, the ship and boat building industry has a high employment multiplier, estimated here at 2.42. This high multiplier is driven by the complex construction of the naval vessels that comprise the majority of ships built in the U.S.; the actual final construction of the ship can be only one third of the cost of the completed vessel once weapons systems and electronics are included. The multiplier effect adds 348,559 jobs to the direct employment, for a total employment impact from ship and boat building of 492,665. The output multiplier is also high at 1.91, which yields indirect and induced GDP of $20.6 billion. The total GDP impact of the sector is $31.4 billion (Figure 3.29).

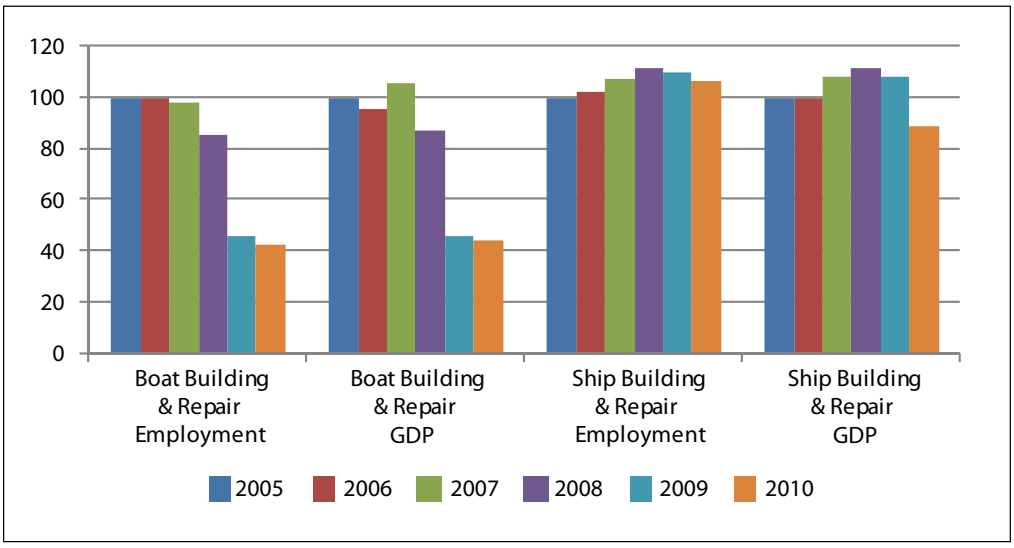

Figure 3.28. Economic growth in the ship & boat building industries 2005 to 2010.

Associated data in Appendix table 3.17A

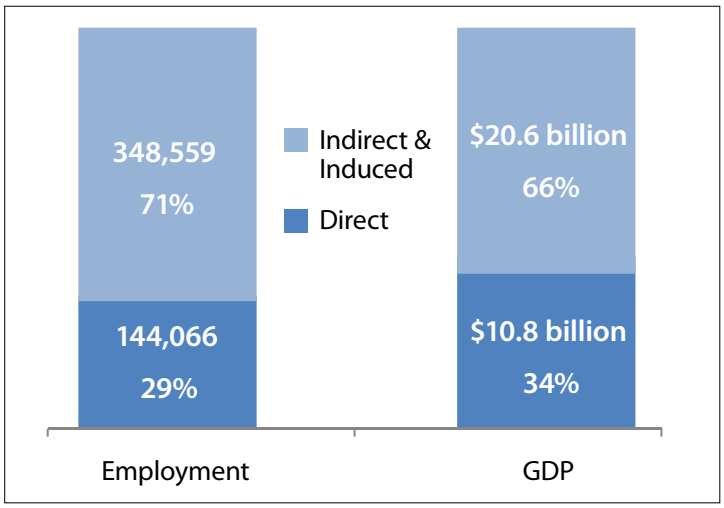

Figure 3.29. Ship & Boat Building with multipliers, 2010

Tourism & Recreation

The *Tourism and Recreation* sector has exhibited the most consistent growth of all the ocean economy sectors. Though affected by the recession, particularly in 2008-09, the sector still averaged nearly 7% growth in employment and over 7% growth in GDP between 2000 and 2010 (Figure 3.30).

Coastal tourism & recreation employment and GDP grew in all coastal states despite the economic effects of the recession (Table 3.8). This continued growth is somewhat remarkable because much of the U.S. coast is already intensively developed for tourist purposes. This has been true of regions such as New England and the Mid-Atlantic states for more than a century, and Florida and the Gulf Coast for most of the last half century. There are some places, such as Dare County, North Carolina and parts of Hawaii (for example, Kona on the Big Island or Princeville on Kauai), where major stretches of relatively undeveloped coast were transformed over the past thirty years. However, for the most part, tourism & recreation growth has increased the density of uses near the shoreline to accommodate an increasing flow of visitors.

The tourism & recreation sector has nine industries, with eating & drinking places and hotels & lodging places by far the largest, accounting for 94% of 2010 sector employment and 92% of the GDP (Figure 3.31). Of the other industries in this sector, amusement & recreation services not elsewhere classified (NEC) and marinas are the next largest, accounting together for 3% of employment and 3% of GDP. Hotels and restaurants grew rapidly on both measures, but there was also rapid growth in other industries, notably boat dealers (reflecting the growth in boat

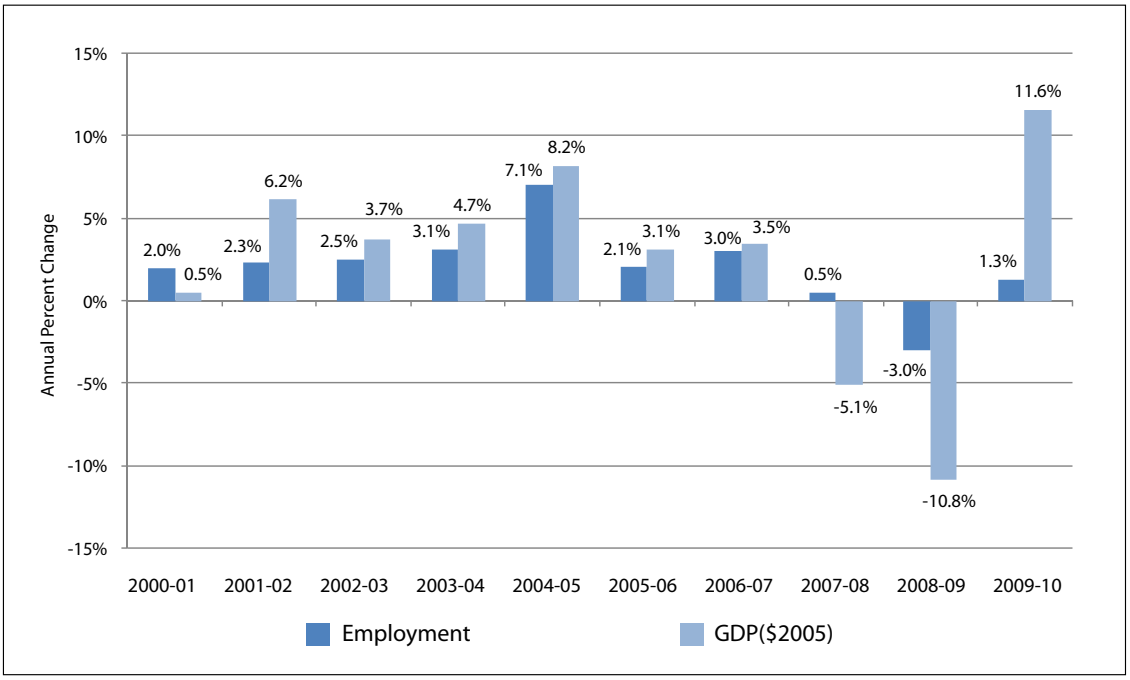

Figure 3.30. Economic change in the ocean tourism & recreation sector 2000 to 2010.

Associated data in Appendix table 3.18A

Table 3.8. Employment and GDP changes in Tourism & Recreation, 2000 to 2010

	Employment & GDP			Percent Change		
	2000	2005	2010	2000-2005	2005-2010	2000-2010
Employment	1.6 Million	1.9 Million	1.9 Million	18.1%	3.9%	22.7%
GDP	$62.1 Billion	$77.9 Billion	$78.5 Billion	25.4%	0.8%	26.5%

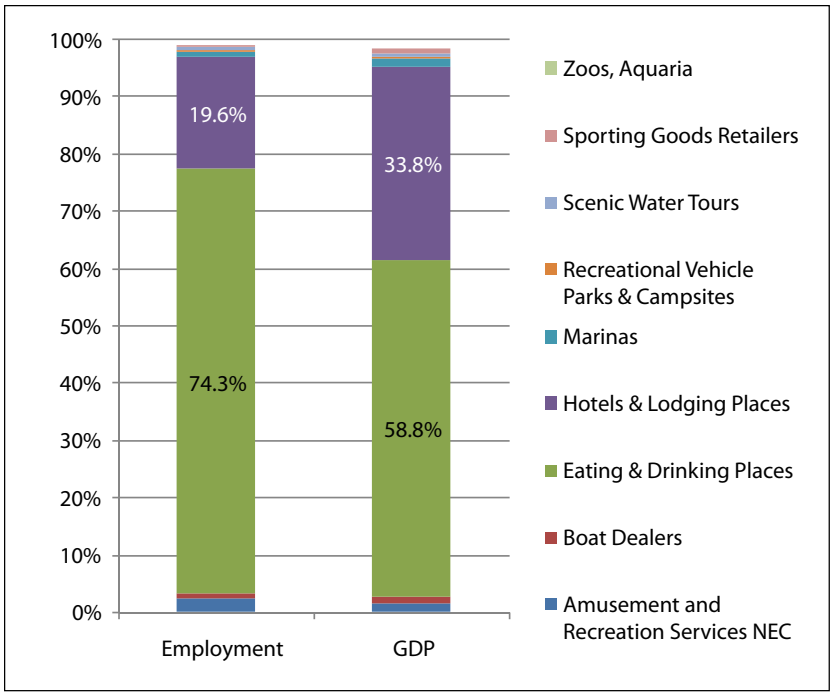

Figure 3.31. Tourism and Recreation Employment and GDP as a percent of sector, 2010

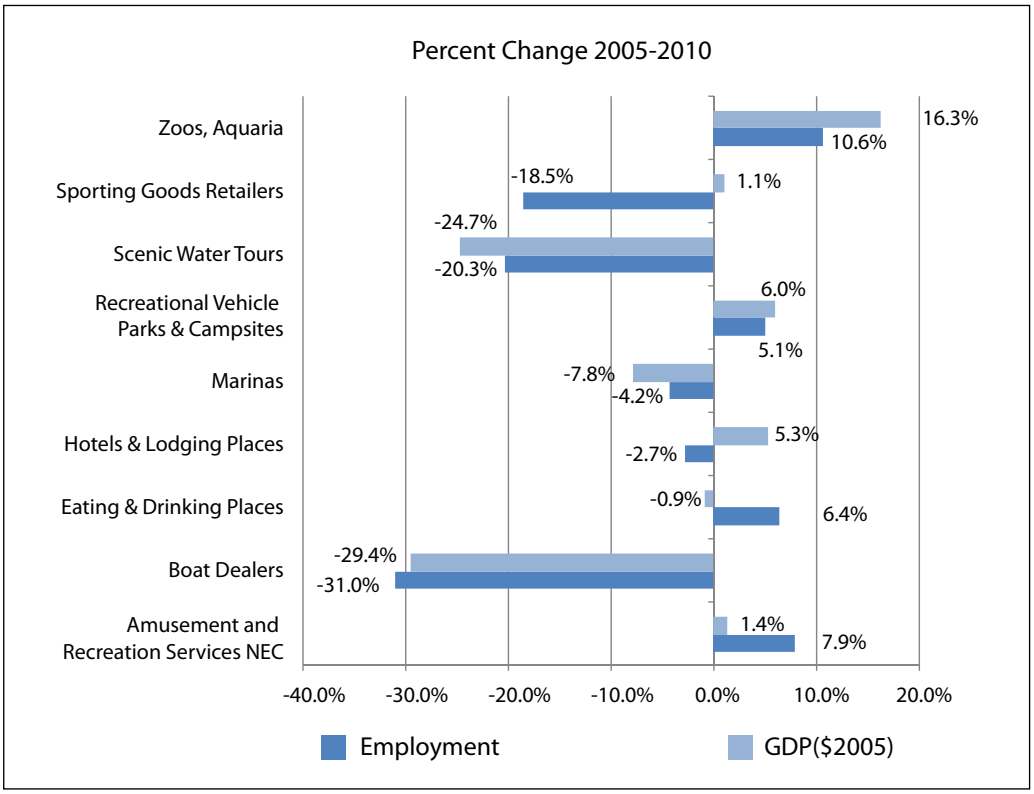

Figure 3.32. Economic change in tourism & recreation sector 2005 to 2010.

Associated data in Appendix table 3.19A

building (discussed under ship building & repair), zoos and aquaria, and RV parks.

Over 2005-2010, the large sectors of hotels and restaurants saw relatively little change, with employment continuing to grow in restaurants and output continuing to grow in hotels. But other sectors were severely affected by the recession. The largest decline was in boat dealers, which was consistent with the trend noted above in the recreational boating market. There were also sharp declines in marinas and scenic water tours (Figure 3.32).

The tourism and recreation industry, like the fishing industry, has a large number of people engaged in the industry who are not covered by unemployment laws and thus are missing from the basic data from which the ocean economy measures are constructed. Data on those engaged in self-employment in these industries from the Census "Non-Employer" series (http://www.census.gov/econ/non-employer/index.html) provides an approximate measure of the self-employed in tourism & recreation as shown in Figure 3.33. The data show that the self-employed in tourism & recreation generally follows the same pattern as overall employment.

Tourism and recreation is a service- and labor-oriented sector and thus has a smaller multiplier than sectors like minerals or ship & boat building. The employment multi-

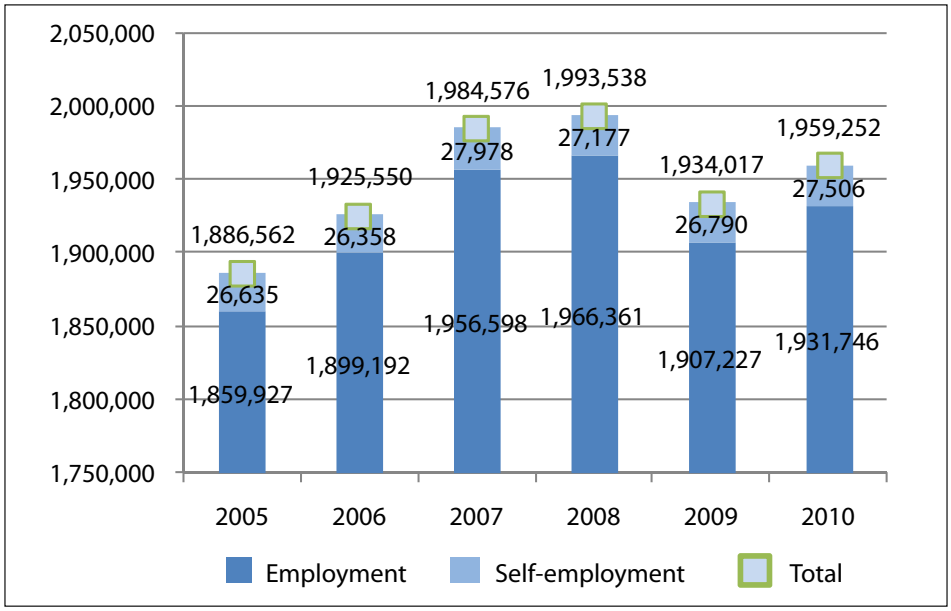

Figure 3.33. Employment and self-employment in tourism & recreation, 2005 to 2010

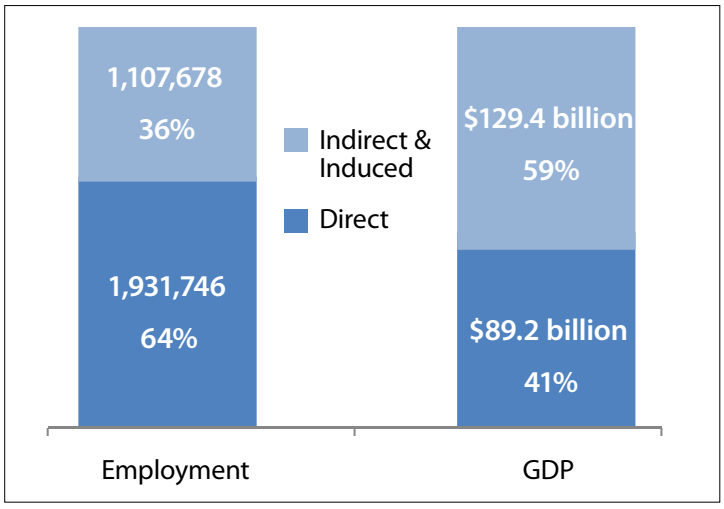

Figure 3.34. Tourism & Recreation with multipliers, 2010

plier is 0.57, resulting in total employment impacts (excluding self employment) of 3,039,404. The GDP multiplier is somewhat larger at 1.45, resulting in an additional $129.4 billion impact, for a total contribution to the U.S. economy of $218.6 billion (Figure 3.34).

This discussion of tourism & recreation activities has focused on the economic activity measured by employment and output associated with this sector. The measurement of the actual activities that people engage in is another key part of understanding ocean tourism & recreation. Studies that measure the participation in different types of travel and recreational activities are produced by the Travel and Tourism Association[7] and by state offices of tourism, though these studies are usually proprietary and use different approaches to sampling and surveying. The National Survey on Recreation and the Environment[8] is conducted by the federal government, primarily to measure recreational activity on public lands. An early version of the NSRE did consider coastal recreational activities, and was discussed in the 2009 report.

Marine Transportation

The *Marine Transportation* sector is made up of five industries: 1) freight transportation, 2) passenger transportation, 3) marine transportation services, 4) warehousing (when located in a shore-adjacent county), and 5) search and navigation equipment. In terms of employment, the warehousing industry comprises nearly 45% of the sector (Figure 3.35). However, the search & navigation equipment industry dominates the shares of GDP, comprising 42.5% of the sector's output. This distribution reflects the high output of the electronics equipment industry during this period, of which the search & navigation equipment is part. (The effects of including this industry are discussed below.)

Employment and output in the deep sea passenger industry appears to be something of an anomaly with a significant share of employment but a much smaller share of output. This industry includes ferry services, where both employment and output are counted, and the much larger cruise ship industry, where only employment on the shore is counted. Cruise ship crews are generally made up of foreign nationals and are counted in the country of ship registry, as are most of the elements of GDP in the cruise ship industry. A similar distribution of employment and output measures exists in the deep sea freight industry.

Employment in the marine transportation sector was rising during the end of the last expansion, but fell through the recession by nearly 8% (Figure 3.36). At the same time,

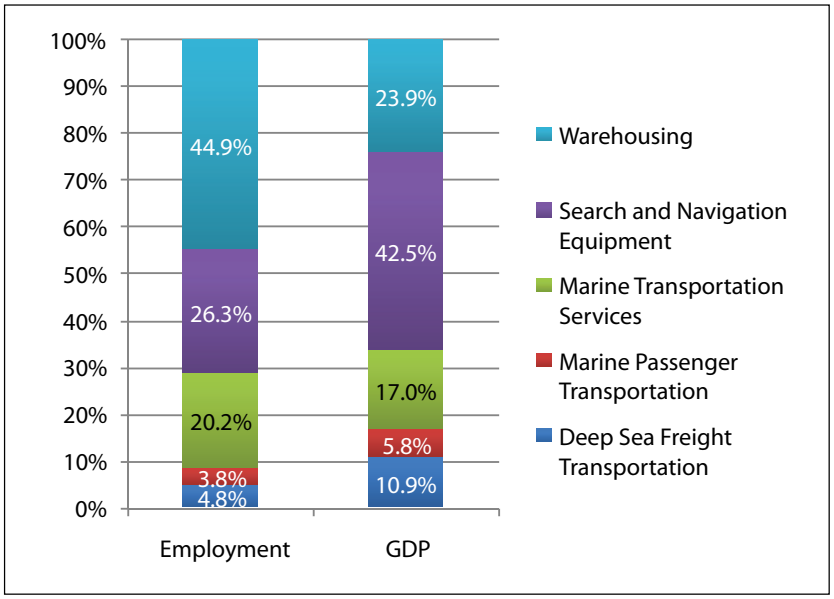

Figure 3.35. Marine transportation industries' Employment and GDP as a percent of sector, 2010

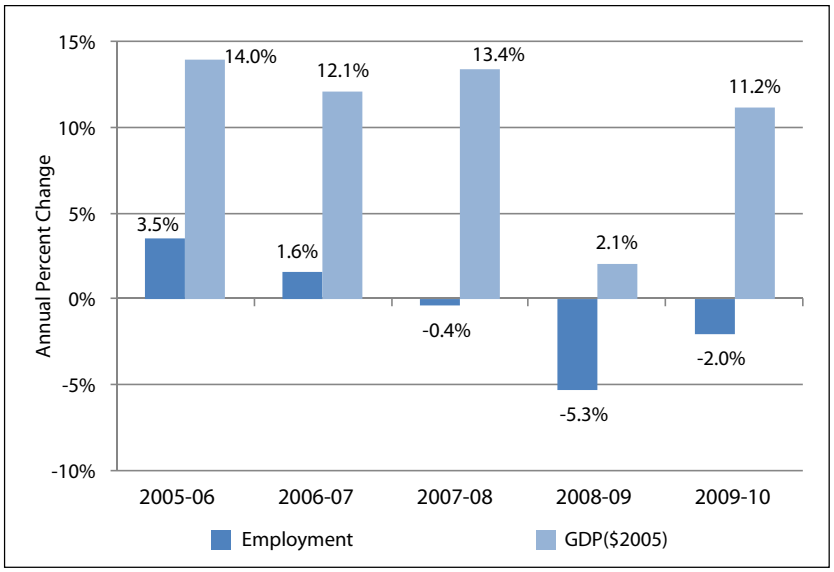

Figure 3.36. Economic change in the marine transportation sector 2005 to 2010.
Associated data in Appendix table 3.20A

7 http://www.ttra.com
8 http://www.srs.fs.usda.gov/trends/nsre-directory

GDP growth was consistent through the period, though it too fell sharply during 2008-09. This trend of GDP contribution rising much faster than employment reflects the long term trend of productivity improvements throughout this sector.

As noted, the measurement of the GDP in the marine transportation sector is affected by the inclusion of the search & navigation equipment industry. This industry is critical to modern marine transportation with the widespread use of technologies such as global positioning systems and automated vessel identification systems, along with new generations of radar and sonar. Despite this, the output of this industry is not directly measured in the GDP data; rather it is indirectly measured as a share of the larger computer and electronic information industry. This industry nearly doubled in output between 2005 and 2010 and this substantial increase is a major factor in the search & navigation equipment industry and thus is the marine transportation sector. California is the principal location for the search and navigation equipment industry.

To adjust for this measurement effect, Figure 3.37 shows the changes in employment and GDP in the transportation sector each year from 2005 to 2010, both including and excluding the search & navigation equipment industry; Figure 3.38 shows search & navigation employment from 2005 to 2010.

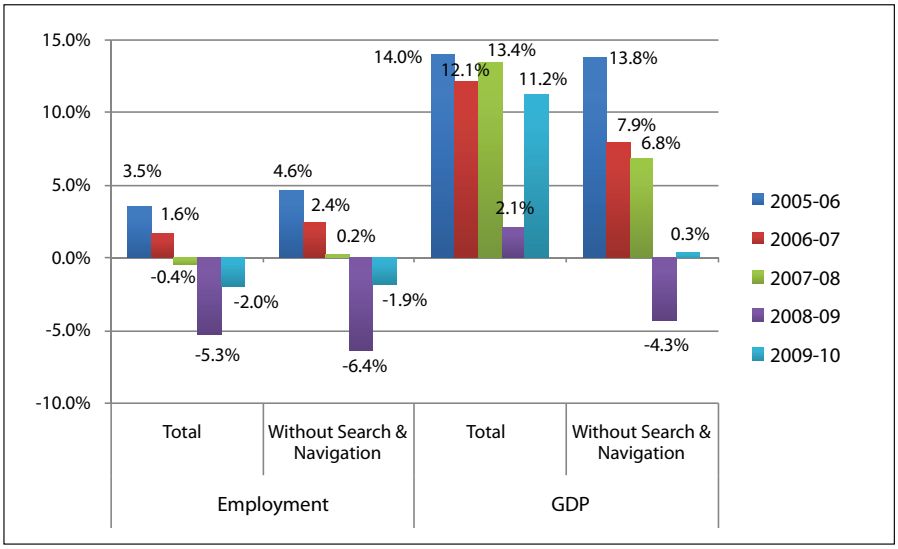

Figure 3.37. Employment and GDP in the marine transportation sector including the Search & Navigation industry and excluding it

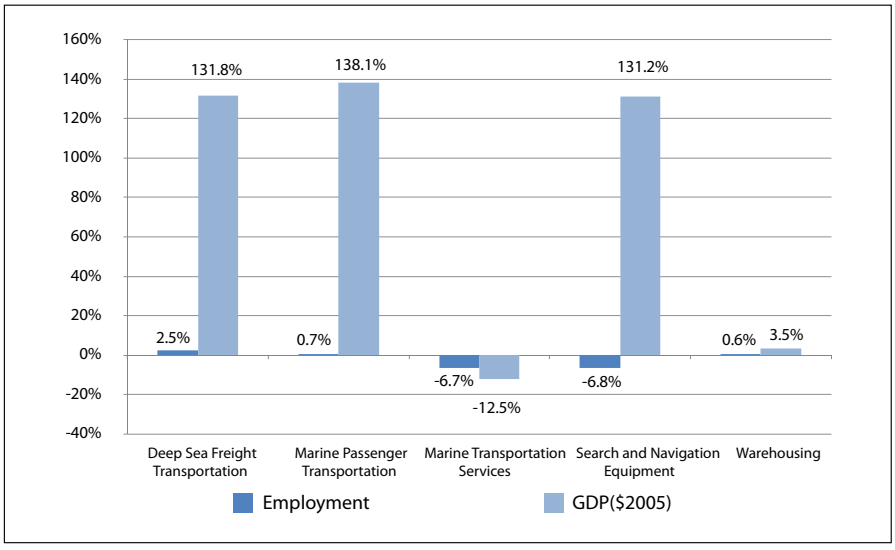

Figure 3.38. Economic growth in marine transportation industries 2005 to 2010.

Associated data in Appendix table 3.21A

The transportation sector without search & navigation equipment is comprised of freight and passenger transportation, transportation services and warehousing. Employment in the sector was clearly negatively affected by the recession with or without search & navigation equipment; the employment drop in the period 2008 to 2009 is larger in the "without" case, but the difference is not large. On the other hand, the GDP shows growth in the periods 2008 to 2009 and 2009 to 2010 for the sector as a whole; when only the direct transportation-related industries are measured, there is a decline from 2008 to 2009 and almost no growth in the period 2009 to 2010. It is also noteworthy that GDP growth in the direct transportation industries in the period 2005 to 2008 was quite robust, led by both the marine passenger and freight transportation industries.

Employment in freight transportation has declined since its peak in 2007, while GDP continues to make gains, which reflects long-term improvements in productivity in the marine freight industry. Containerization and port operations that handle ever larger container ships with more mechanization account for most of this change in the freight industry.

South Carolina and Michigan experienced the highest rates of employment change between 2005 and 2010. Employment in marine transportation in California was as large as that in the next three states (Florida, Texas and New York) combined. Not all states lost employment in marine transportation: Georgia, Maine, Alabama, Massachusetts, and Wisconsin all had significant employment growth rates between 2005 and 2010.

California has the largest marine transportation sector with the large port centers in Los Angeles/Long Beach and

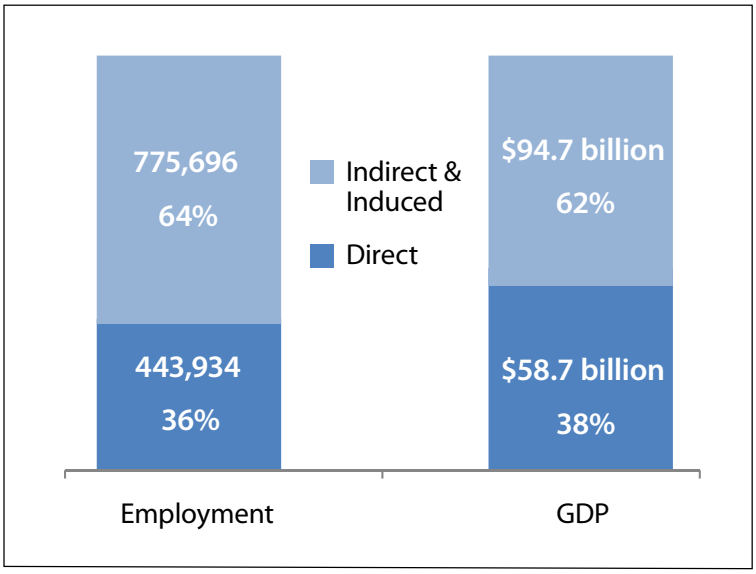

Figure 3.39. Marine Transportation with multipliers, 2010

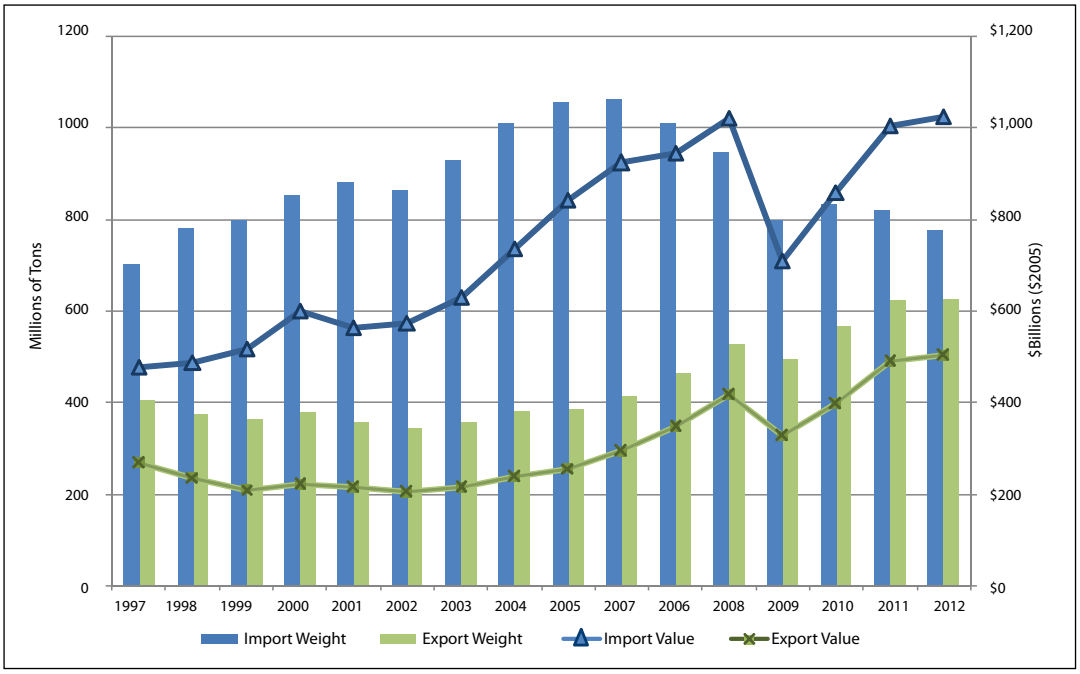

Figure 3.40. Marine transportation waterborne freight 1997 to 2012

Source: Data Foreign Trade Statistics, U. S. Census Bureau; Note: For data, see Table 3.22A in Appendix

the Bay area. Of the five marine transportation industries, marine passenger transportation, deep sea freight transport and search and navigation equipment exhibited GDP growth over 130% (Figure 3.38). From 2002 to 2012, the total value of waterborne freight through U.S. ports increased by 96%, but over the same period employment moving that freight fell by 2.5%. Wisconsin, Delaware, South Carolina and Michigan had the largest percentage of GDP decline.

The employment multiplier for marine transportation of 1.75 reflects the connections in this industry to many other industries and yields an estimated total employment of 1,219,630. The GDP multiplier of 1.62 yields a total GDP impact for the marine transportation sector of $153.4 billion (Figure 3.39).

Trade drives much of the marine transportation sector, which has been more heavily weighted towards imported goods than exported goods for more than a decade (Figure 3.40). From 1997-2012, the total volume of goods imported by water was substantially higher than goods exported, as was the value of imports. The recessionary impacts on imports, which collapsed along with consumption and investment, are clearly visible, although imports had begun to fall in 2007 in volume. Exports began to show more steady growth in 2004, at least until the recession's bottom in 2009, but have continued to grow in the years since 2009. The growth in exports reflects a gradual shift towards higher competitiveness of U.S. products in world markets partly from changes to more export-promoting exchange rates.

The marine passenger transportation industry includes ferries and related types of transportation, but by far the most important driver of growth in this industry is the cruise ship industry. This part of the marine transportation sector is also an important part of the tourism & recreation sector. The United States dominates the global cruise ship industry (Figure 3.41). In 2010, three of every four cruise ship passengers embarked from a U.S. port.

From 2000 to 2010, the number of global cruise passengers roughly doubled. Both the number of U.S. residents taking a cruise and the number of embarkations from U.S. ports grew by more than a third. Between 2000 and 2013, 187 new cruise ships were added to the North American fleet, bringing the total to 212; the recent trend has been toward smaller ships with fewer berths (Business Research and Economic Advisors 2011).

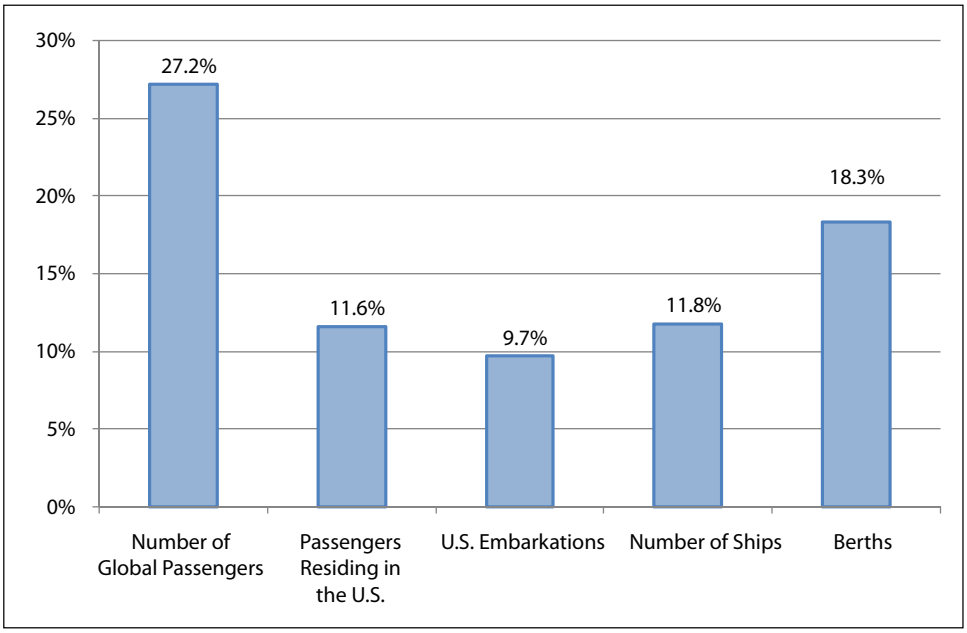

Figure 3.41. Cruise ship industry growth 2008 to 2011

Source: Cruise Lines International Association

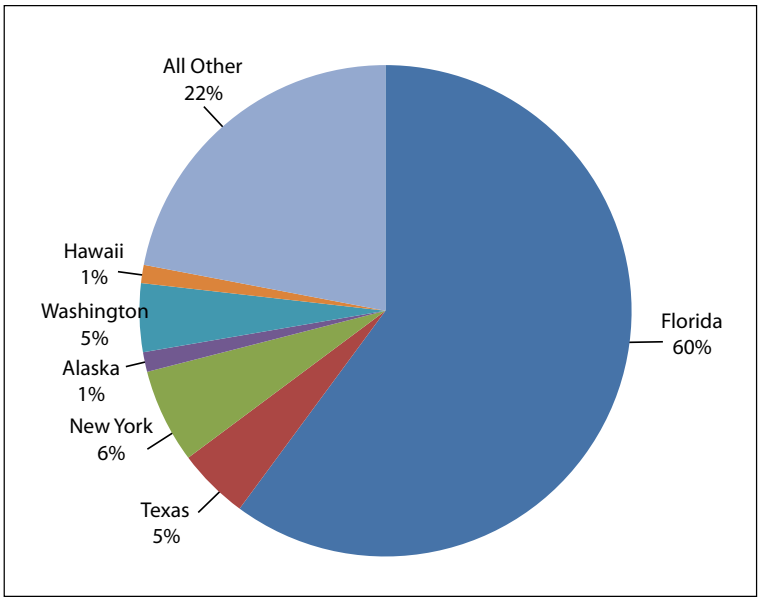

Figure 3.42. Cruise ship embarkations by state, 2011

Source: Cruise Lines International Association

Florida is the nation's leader for the cruise ship industry (Figure 3.42), with 60% of U.S. embarkations and 40% of world cruise ship traffic; California is second with 10%of embarkations (Business Research and Economic Advisors 2011).

3.5 Conclusion

The ocean economy of the United States is large, diverse, and dynamic. It has been significantly affected by the Great Recession of 2007-2009, but has also proved resilient and, through 2010, showed signs of supporting the national recovery from the recession. The long-term ocean economic trend of the shift towards tourism & recreation was apparent even with the recession, as were continued challenges to the living resources sector. The minerals sector showed volatility driven by world oil markets, but also remained the major contributor to GDP. It is important to keep in mind that the measurement of the activity of the ocean economy provides only part of the economic picture of the oceans, for there are large and very important economic values that analysis of market activity does not fully capture. Those values are discussed in Chapter 4.

Appendix: Tables Related to the Ocean Economy

Table 3.1A. Ocean sector employment and GDP changes, 2005-08 and 2008-10

Sector	Employment			Employment Change		Employment % Change	
	2005	2008	2010	2005-08	2008-10	2005-08	2008-10
Construction	49,871	53,654	46,390	3,783	-7,264	7.6%	-13.5%
Living Resources	65,551	59,835	59,354	-5,716	-481	-8.7%	-0.8%
Minerals	131,730	163,073	143,995	31,343	-19,078	23.8%	-11.7%
Ship & Boat Building	164,894	170,514	144,066	5,620	-26,448	3.4%	-15.5%
Tourism & Recreation	1,859,927	1,966,361	1,931,746	106,434	-34,615	5.7%	-1.8%
Transportation	457,075	478,584	443,934	21,509	-34,650	4.7%	-7.2%
Transportation less Search and Navigation Equipment	331,893	356,489	327,227	24,596	-29,262	7.4%	-8.2%
All Ocean Sectors	2,729,050	2,890,000	2,770,000	160,950	-120,000	5.9%	-4.2%
All Ocean Sectors less Search and Navigation Equipment	2,603,868	2,767,905	2,653,293	164,037	-114,612	6.3%	-4.1%
Sector	**GDP ($billions $2005)**			**GDP Change ($billions $2005)**		**GDP % Change**	
	2005	2008	2010	2005-08	2008-10	2005-08	2008-10
Construction	$5.7	$5.1	$4.8	-$0.6	-$0.3	-10.3%	-6.1%
Living Resources	$5.3	$5.1	$5.4	-$0.3	$0.3	-5.1%	6.3%
Minerals	$77.7	$83.9	$94.4	$6.2	$10.5	8.0%	12.5%
Ship & Boat Building	$13.0	$13.6	$10.0	$0.6	-$3.6	4.7%	-26.5%
Tourism & Recreation	$77.9	$78.9	$78.5	$1.0	-$0.3	1.3%	-0.4%
Transportation	$44.8	$64.9	$73.7	$20.1	$8.8	44.9%	13.5%
Transportation less Search and Navigation Equipment	$28.4	$37.2	$35.7	$8.8	-$1.5	31.1%	-4.0%
All Ocean Sectors	$224.3	$251.4	$266.7	$27.1	$15.4	12.1%	6.1%
All Ocean Sectors less Search and Navigation Equipment	$207.9	$223.7	$228.8	$15.8	$5.1	7.6%	2.3%

Table 3.2A. Ocean economy employment by region, 2005-2010

Region	2005	2010	Change	Percent Change
United States (national)	131,571,623	127,820,442	-3,751,181	-2.9%
All Coastal States	107,434,802	104,121,862	-3,312,940	-3.1%
Shore-adjacent Counties	49,212,856	47,339,198	-1,873,658	-3.8%
Ocean Economy	**2,729,050**	**2,770,000**	**40,950**	**1.5%**

Table 3.3A. Ocean economy employment by sector, 2005-2010

	All Ocean Sectors	Construction	Living Resources	Minerals	Ship & Boat Building	Tourism & Recreation	Transportation
2005	2,729,050	49,871	65,551	131,730	164,894	1,859,927	457,075
2006	2,799,723	52,814	64,522	142,724	167,322	1,899,192	473,147
2007	2,880,000	53,904	62,632	152,354	171,988	1,956,598	480,617
2008	2,890,000	53,654	59,835	163,073	170,514	1,966,361	478,584
2009	2,770,000	48,973	59,386	151,943	149,317	1,907,227	453,183
2010	2,770,000	46,390	59,354	143,995	144,066	1,931,746	443,934
Change							
2006	70,673	2,943	-1,029	10,994	2,428	39,265	16,072
2007	80,277	1,090	-1,890	9,630	4,666	57,406	7,470
2008	10,000	-250	-2,797	10,719	-1,474	9,763	-2,033
2009	-120,000	-4,681	-449	-11,130	-21,197	-59,134	-25,401
2010	0	-2,583	-32	-7,948	-5,251	24,519	-9,249
Percent Change							
2006	2.6%	5.9%	-1.6%	8.3%	1.5%	2.1%	3.5%
2007	2.9%	2.1%	-2.9%	6.7%	2.8%	3.0%	1.6%
2008	0.3%	-0.5%	-4.5%	7.0%	-0.9%	0.5%	-0.4%
2009	-4.2%	-8.7%	-0.8%	-6.8%	-12.4%	-3.0%	-5.3%
2010	0.0%	-5.3%	-0.1%	-5.2%	-3.5%	1.3%	-2.0%

Table 3.4A. Sector employment changes, 2005-2010

	All Ocean Sectors	Construction	Living Resources	Minerals	Ship & Boat Building	Tourism & Recreation	Transportation
2005	100	100	100	100	100	100	100
2006	102.59	105.90	98.43	108.35	101.47	102.11	103.52
2007	105.53	108.09	95.55	115.66	104.30	105.20	105.15
2008	105.90	107.59	91.28	123.79	103.41	105.72	104.71
2009	101.50	98.20	90.60	115.34	90.55	102.54	99.15
2010	101.50	93.02	90.55	109.31	87.37	103.86	97.12

Table 3.5A. Ocean Economy Employment ranking by growth and growth rate, 2005-2010

Employment Growth Rate		
State	Growth Rate	Rank
New York	14.46%	1
Alabama	14.12%	2
Alaska	12.11%	3
Texas	10.44%	4
Massachusetts	7.70%	5
Pennsylvania	7.28%	6
South Carolina	4.06%	7
Connecticut	3.61%	8
Maine	3.05%	9
New Jersey	2.54%	10
Mississippi	2.20%	11
Oregon	1.24%	12
Florida	0.57%	13
New Hampshire	0.44%	14
Wisconsin	0.27%	15
Washington	0.07%	16
Maryland	-0.04%	17
Virginia	-0.36%	18
Georgia	-0.65%	19
California	-1.37%	20
Louisiana	-2.33%	21
Rhode Island	-2.41%	22
Illinois	-3.67%	23
Ohio	-4.08%	24
Hawaii	-5.37%	25
North Carolina	-5.63%	26
Minnesota	-10.94%	27
Delaware	-12.02%	28
Michigan	-14.75%	29
Indiana	-15.00%	30

Change in Total Employment				
State	2005	2010	Change 2005-2010	Rank
New York	259,556	297,081	37,525	1
Texas	155,168	171,374	16,206	2
Massachusetts	74,121	79,827	5,706	3
Alaska	39,576	44,367	4,791	4
New Jersey	116,098	119,042	2,944	5
Alabama	20,237	23,094	2,857	6
Pennsylvania	39,090	41,936	2,846	7
South Carolina	60,554	63,011	2,457	8
Florida	403,389	405,676	2,287	9
Connecticut	43,084	44,638	1,554	10
Maine	42,419	43,712	1,293	11
Mississippi	32,253	32,964	711	12
Oregon	30,542	30,922	380	13
Wisconsin	37,971	38,074	103	14
Washington	112,594	112,674	80	15
New Hampshire	8,664	8,702	38	16
Maryland	84,521	84,489	-32	17
Georgia	22,180	22,036	-144	18
Virginia	116,986	116,568	-418	19
Rhode Island	38,578	37,649	-929	20
Minnesota	13,150	11,711	-1,439	21
Ohio	43,425	41,652	-1,773	22
Indiana	14,124	12,005	-2,119	23
North Carolina	40,461	38,183	-2,278	24
Delaware	20,516	18,049	-2,467	25
Louisiana	106,549	104,071	-2,478	26
Illinois	86,577	83,397	-3,180	27
Hawaii	105,901	100,215	-5,686	28
California	480,792	474,189	-6,603	29
Michigan	79,960	68,166	-11,794	30

Table 3.6A. Change in marine construction, 2005-2010

Year	Employment	GDP ($2005)	Employment % Change	GDP % Change
2005	49,871	$5,650,717,285		
2006	52,814	$5,091,744,203	5.9%	-9.9%
2007	53,904	$5,035,236,320	2.1%	-1.1%
2008	53,654	$5,068,446,938	-0.5%	0.7%
2009	48,973	$4,852,955,396	-8.7%	-4.3%
2010	46,390	$4,757,638,240	-5.3%	-2.0%

Table 3.7A. Top ten beach nourishment states by expenditure, 1960-2013

State	Cost ($2012)	Volume
Florida	$1,984,410,080	249,025,339
New Jersey	$1,252,752,124	159,003,422
North Carolina	$610,223,415	106,783,059
New York	$567,318,306	109,668,886
South Carolina	$353,134,348	46,665,688
California	$302,224,939	622,554,853
Virginia	$238,927,665	27,379,441
Delaware	$185,086,113	19,864,564
Maryland	$165,167,060	15,166,391
Louisiana	$156,835,781	16,583,975
Massachusetts	$72,448,390	3,610,953
Alabama	$71,299,418	16,325,400
Mississippi	$55,817,748	16,655,443
Connecticut	$54,512,167	5,322,272
Texas	$50,503,791	6,147,369
Georgia	$37,377,458	8,460,000
Maine	$17,705,916	999,818
Washington	$14,939,161	1,199,820
Rhode Island	$1,276,743	114,990

Table 3.8A. Top ten beach nourishment states by volume, 1960-2013

State	Cost ($2012)	Volume
California	$302,224,939	622,554,853
Florida	$1,984,410,080	249,025,339
New Jersey	$1,252,752,124	159,003,422
New York	$567,318,306	109,668,886
North Carolina	$610,223,415	106,783,059
South Carolina	$353,134,348	46,665,688
Virginia	$238,927,665	27,379,441
Delaware	$185,086,113	19,864,564
Mississippi	$55,817,748	16,655,443
Louisiana	$156,835,781	16,583,975
Alabama	$71,299,418	16,325,400
Maryland	$165,167,060	15,166,391
Georgia	$37,377,458	8,460,000
Texas	$50,503,791	6,147,369
Connecticut	$54,512,167	5,322,272
Massachusetts	$72,448,390	3,610,953
Washington	$14,939,161	1,199,820
Maine	$17,705,916	999,818
Rhode Island	$1,276,743	114,990

Table 3.9A. Economic changes in the living resources sector, 2005-2010

Year	Employment	GDP ($2005)	Employment % Change	GDP % Change
2005	65,551	$5,346,313,874		
2006	64,522	$5,866,890,822	-1.6%	9.7%
2007	62,632	$5,880,318,429	-2.9%	0.2%
2008	59,835	$5,073,221,581	-4.5%	-13.7%
2009	59,386	$5,189,610,847	-0.8%	2.3%
2010	59,354	$5,394,342,923	-0.1%	3.9%

Table 3.10A. Living resources industries economic growth, 2005-2010

Industry	Employment			GDP		
	2005	2010	% Change	2005 ($billion)	2010 ($billion)	% Change
All Living Resources	65,551	59,354	-9.5%	$5,346	$5,394	0.90%
Fish Hatcheries & Aquaculture	5,111	5,328	4.3%	$833	$822	-1.31%
Fishing	6,961	6,207	-10.8%	$1,085	$886	-18.37%
Seafood Markets	13,318	12,248	-8.0%	$640	$656	2.55%
Seafood Processing	40,160	35,570	-11.4%	$2,789	$3,031	8.67%

Table 3.11A. U.S. fisheries landings and landed values, 1990-2011

Year	Landings (pounds)	Landed Value (Nominal)	Landed Value ($2005)
1990	9,816,470,610	$3,649,285,313	$5,454,836,043
1991	10,041,355,304	$3,429,317,863	$4,920,111,712
1992	10,272,674,887	$3,793,013,497	$5,282,748,603
1993	10,185,881,235	$3,344,494,084	$4,519,586,600
1994	10,479,948,820	$3,706,313,015	$4,883,152,852
1995	9,876,251,962	$3,809,269,435	$4,883,678,763
1996	9,627,424,297	$3,555,975,588	$4,428,363,123
1997	9,936,541,105	$3,581,879,152	$4,357,517,217
1998	9,327,202,731	$3,214,780,196	$3,850,036,163
1999	9,408,279,742	$3,571,615,443	$4,187,122,442
2000	9,111,062,023	$3,653,096,424	$4,141,832,680
2001	9,479,402,212	$3,225,693,701	$3,556,442,890
2002	9,399,697,157	$3,094,936,785	$3,360,409,104
2003	9,479,663,537	$3,320,182,231	$3,524,609,587
2004	9,659,211,187	$3,731,790,502	$3,859,142,194
2005	9,709,547,407	$3,949,589,912	$3,949,589,912
2006	9,568,145,624	$4,040,197,301	$3,914,919,865
2007	8,936,729,032	$3,991,103,335	$3,758,101,069
2008	7,867,060,890	$4,185,076,994	$3,797,710,521
2009	7,781,836,683	$3,730,983,347	$3,397,981,190
2010	7,918,881,786	$4,305,291,587	$3,854,334,456
2011	9,477,446,853	$5,084,894,726	$4,487,991,815
2012	9,339,714,609	$4,873,281,215	$4,237,635,839

Table 3.12A. U.S. domestic fish landings with foreign imported fish, 2001-2012

Year	Imports		Exports		Landed	
	Billion Pounds	Value ($Billions)	Billion Pounds	Value ($Billions)	Billion Pounds	Value ($Billions)
2001	3.5	$7.0	2.3	3.5	9.5	$3.2
2002	3.7	$7.2	2.1	3.4	9.4	$3.1
2003	4.3	$7.7	2.1	3.5	9.5	$3.3
2004	4.4	$7.8	2.6	3.9	9.7	$3.7
2005	4.6	$8.1	2.6	4.1	9.7	$3.9
2006	4.9	$8.8	2.7	4.1	9.6	$4.0
2007	4.8	$8.8	2.6	4.0	8.9	$4.0
2008	4.7	$8.9	2.4	3.9	7.9	$4.2
2009	4.7	$8.3	2.3	3.6	7.8	$3.7
2010	5.0	$9.3	2.6	4.0	7.9	$4.3
2011	5.0	$10.5	3.1	4.9	9.5	$5.1
2012	5.0	$10.4	3.0	4.8	9.3	$4.2

Table 3.13A. Offshore minerals industries growth, 2005-2010

Industry	Employment			GDP		
	2005	2010	% Change	2005 ($million)	2010 ($million)	% Change
Sand & Gravel	12,533	8,247	-34.20%	$1,875	$967	-48.44%
Oil & Gas Exploration and Production	119,197	135,748	13.89%	$75,801	$93,422	23.25%

Table 3.14A. Economic growth of the minerals sector, 2005-2010

Year	Employment	% Employment Growth	GDP	% GDP Growth	Crude Oil Prices *	% Price Growth
2005	131,730		$77,676,353,668		$59.59	
2006	142,724	8.3%	$85,501,544,108	10.1%	$67.30	12.9%
2007	152,354	6.7%	$91,849,784,241	7.4%	$71.94	6.9%
2008	163,073	7.0%	$83,867,426,051	-8.7%	$98.58	37.0%
2009	151,943	-6.8%	$117,467,000,000	40.1%	$57.92	-41.2%
2010	143,995	-5.2%	$94,389,362,816	-19.6%	$76.01	31.2%

* http://inflationdata.com/Inflation/Inflation_Rate/Historical_Oil_Prices_Table.asp

Table 3.15A. Offshore oil production in state and federal waters, 2000-2010

Year	Alaska	California	Western Gulf	Central Gulf
2000	42,391,458	54,242,417	68,722,064	454,397,227
2001	38,961,593	50,163,037	84,297,660	472,929,120
2002	52,613,861	48,357,251	88,169,317	478,186,782
2003	55,361,243	45,647,073	83,703,769	476,456,887
2004	54,467,103	43,139,823	86,892,870	448,168,873
2005	22,421,810	41,755,462	89,157,608	377,755,116
2006	18,877,180	41,324,459	76,958,222	394,939,423
2007	13,877,294	39,374,808	59,816,686	408,098,806
2008	11,440,587	38,109,992	48,165,194	374,151,179
2009	7,981,272	35,644,554	52,397,819	515,292,073
2010	6,085,126	34,738,946	49,700,904	507,611,054

bbl (barrels of oil)
Note: The Western Gulf primarily refers to Texas waters and the Central Gulf to Louisiana waters.

Table 3.16A. Economic change in the ship & boat building sector, 2000-2010

Year	Employment	% Employment Change	GDP ($billion-$2005)	% GDP Change
2000	162,218		$10.4	
2001	154,534	-4.7%	$9.6	-7.3%
2002	148,754	-3.7%	$10.9	13.6%
2003	155,414	4.5%	$10.7	-1.7%
2004	163,164	5.0%	$11.3	5.2%
2005	164,894	1.1%	$13.0	15.2%
2006	167,322	1.5%	$12.8	-1.4%
2007	171,988	2.8%	$13.9	8.8%
2008	170,514	-0.9%	$13.6	-2.4%
2009	149,317	-12.4%	$11.9	-12.7%
2010	144,066	-3.5%	$10.0	-15.9%

Table 3.17A. Economic growth in the ship & boat building industries, 2005-2010

Year	Boat Building & Repair		Ship Building & Repair	
	Employment	Employment Growth (100=2005)	GDP	Value ($Billions)
2005	164,894	100.0	$13.0	100.0
2006	167,322	101.5	$12.8	98.6
2007	171,988	104.3	$13.9	107.3
2008	170,514	103.4	$13.6	104.7
2009	149,317	90.6	$11.9	91.4
2010	144,066	87.4	$10.0	76.9

Table 3.18A. Economic changes in the tourism & recreation sector, 2000-2010

Year	Employment	% Employment Change	GDP	GDP % Change
2000	1,574,886		$62.1	
2001	1,605,912	2.0%	$62.4	0.5%
2002	1,643,318	2.3%	$66.3	6.2%
2003	1,684,674	2.5%	$68.7	3.7%
2004	1,737,156	3.1%	$72.0	4.7%
2005	1,859,927	7.1%	$77.9	8.2%
2006	1,899,192	2.1%	$80.3	3.1%
2007	1,956,598	3.0%	$83.1	3.5%
2008	1,966,361	0.5%	$78.9	-5.1%
2009	1,907,227	-3.0%	$70.4	-10.8%
2010	1,931,746	1.3%	$78.5	11.6%

Table 3.19A. Economic changes in the tourism & recreation industries, 2005-2010

Industry	Employment			GDP		
	2005	2010	% Change	2005 ($million)	2010 ($million)	% Change
All	1,859,927	1,931,746	3.86%	$77,885.4	$78,538.5	0.84%
Amusement and Recreation Services NEC	43,875	47,359	7.94%	$1,259.9	$1,277.8	1.42%
Boat Dealers	18,115	12,509	-30.95%	$1,435.8	$1,013.7	-29.40%
Eating & Drinking Places	1,348,653	1,435,406	6.43%	$44,043.5	$43,659.8	-0.87%
Hotels & Lodging Places	389,704	379,023	-2.74%	$27,381.2	$28,839.9	5.33%
Marinas	18,652	17,867	-4.21%	$1,140.3	$1,051.0	-7.84%
Recreational Vehicle Parks & Campsites	5,532	5,816	5.13%	$299.4	$317.4	6.03%
Scenic Water Tours	11,513	9,180	-20.26%	$517.6	$389.7	-24.72%
Sporting Goods Retailers	6,311	5,146	-18.46%	$741.7	$749.7	1.08%
Zoos, Aquaria	17,568	19,437	10.64%	$1,065.9	$1,239.5	16.29%

Table 3.20A. Economic changes in the transportation sector, 2005-2010

Year	Employment	% Employment Change	GDP ($billion-$2005)	% GDP Change
2005	457,075		$44.8	
2006	473,147	3.5%	$51.0	14.0%
2007	480,617	1.6%	$57.2	12.1%
2008	478,584	-0.4%	$64.9	13.4%
2009	453,183	-5.3%	$66.2	2.1%
2010	443,934	-2.0%	$73.7	11.2%

Table 3.21A. Economic growth in the marine transportation industries, 2005-2010

Industry	Employment			GDP		
	2005	2010	% Change	2005 ($million)	2010 ($million)	% Change
All Marine Transportation	457,075	443,934	-2.9%	$44.8	$73.7	64.5%
Deep Sea Freight Transportation	20,937	21,458	2.5%	$4.0	$9.3	131.8%
Marine Passenger Transportation	16,844	16,962	0.7%	$2.1	$4.9	138.1%
Marine Transportation Services	96,022	89,591	-6.7%	$9.7	$8.5	-12.5%
Search and Navigation Equipment	125,182	116,707	-6.8%	$16.4	$38.0	131.1%
Warehousing	198,087	199,215	0.6%	$12.6	$13.0	3.5%

Table 3.22A. U.S. Marine transportation waterborne freight, 1997-2012

Year	Imports		Exports	
	Billion Tons	Value ($billion)	Billion Tons	Value ($billion)
1997	699.4	$477.7	403.9	$268.1
1998	779.9	$486.9	373.5	$236.2
1999	797.4	$517.4	364.2	$209.9
2000	852.2	$601.2	377.6	$221.9
2001	878.8	$562.8	357.5	$215.5
2002	862.0	$574.6	344.9	$204.1
2003	928.8	$630.7	359.2	$215.3
2004	1009.6	$735.9	381.2	$237.1
2005	1055.2	$842.8	385.1	$256.5
2006	1062.4	$922.9	415.5	$293.4
2007	1007.3	$944.6	464.6	$347.2
2008	946.9	$1,021.5	528.0	$417.5
2009	795.8	$709.6	492.7	$326.3
2010	832.6	$859.7	568.0	$396.7
2011	820.3	$1,004.2	624.0	$489.1
2012	778.5	$1,023.6	627.3	$502.8

Appendix: NAICS

Table 3.23A. Ocean Economy Sectors and Industries with NAICS Codes

Sector	Industry	NAICS Code	NAICS Industry
Marine Construction	Marine Related Construction	237120	Oil and Gas Pipeline and Related Structures
		237990	Other Heavy and Civil Engineering Construction
Living Resources	Fish Hatcheries and Aquaculture	112511	Finfish Farming and Fish Hatcheries
		112512	Shellfish Farming
	Fishing	114111	Finfish Fishing
		114112	Shellfish Fishing
	Seafood Markets	445220	Fish and Seafood Markets
	Seafood Processing	311711	Seafood Canning
		311712	Fresh and Frozen Seafood Processing
Offshore Mineral Resources	Sand and Gravel	212321	Construction Sand and Gravel Mining
		212322	Industrial Sand Mining
	Oil and Gas Exploration and Production	211111	Crude Petroleum and Natural Gas Extraction
		211112	Natural Gas Liquid Extraction
		213111	Drilling Oil and Gas Wells
		213112	Support Activities for Oil and Gas Operations
		541360	Geophysical Exploration and Mapping Services
Ship and Boat Building	Boat Building and Repair	336612	Boat Building and Repair
	Ship Building and Repair	336611	Ship Building and Repair
Tourism and Recreation	Amusement and Recreation Services	487990	Scenic and Sightseeing Transportation, Other
		611620	Sports and Recreation Instruction
		532292	Recreation Goods Rental
		713990	Amusement and Recreation Services Not Elsewhere Classified
	Boat Dealers	441222	Boat Dealers
	Eating and Drinking Places	722110	Full Service Restaurants
		722211	Limited Service Eating Places
		722212	Cafeterias
		722213	Snack and Nonalcoholic Beverage Bars
	Hotels and Lodging	721110	Hotels (except Casino Hotels) and Motels
		721191	Bed and Breakfast Inns
	Marinas	713930	Marinas
	Recreational Vehicle Parks and Campsites	721211	RV Parks and Recreational Camps
	Scenic Water Tours	487210	Scenic and Sightseeing Transportation, Water
	Sporting Goods	339920	Sporting and Athletic Goods Manufacturing
	Zoos, Aquaria	712130	Zoo and Botanical Gardens
		712190	Nature Parks and Other Similar Institutions

Table 3.23A. Ocean Economy Sectors and Industries with NAICS Codes (continued)

Sector	Industry	NAICS Code	NAICS Industry
Marine Transportation	Deep Sea Freight	483111	Deep Sea Freight Transportation
		483113	Coastal and Great Lakes Freight Transportation
	Marine Passenger Transportation	483112	Deep Sea Passenger Transportation
		483114	Coastal and Great Lakes Passenger Transportation
	Marine Transportation Services	488310	Port and Harbor Operations
		488320	Marine Cargo Handling
		488330	Navigational Services to Shipping
		488390	Other Support Activities for Water Transportation
	Search and Navigation Equipment	334511	Search, Detection, Navigation, Guidance, Aeronautical and Nautical System and Instrument Manufacturing
	Warehousing	493110	General Warehousing and Storage
		493120	Refrigerated Warehousing and Storage
		493130	Farm Product Warehousing and Storage

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Chapter 4
The Non-Market Ocean and Coastal Economy

4.1. Introduction

The thousands of miles of coastline in America, with majestic beaches and diverse marine wildlife, are some of the nation's most enduring treasures. They have provided both wonder and tremendous economic value to generations of Americans. Unfortunately, much of this value is not captured in the normal exchange of buying and selling goods and services in the market economy. These market exchanges are measured in the kind of data discussed in Chapter 3; the Gross Domestic Product is defined as the sum of the output of all goods and services in the economy measured at market prices. But markets do not reflect all the values that people place on the resources of the oceans and coasts, which can distort choices about how to manage the array of resources. To plan for the future in this era of rapid environmental change and associated impacts, it is imperative that we broaden our understanding of the values of our natural ocean and coastal capital, both the market and non-market aspects.

4.2. The Challenge of Measuring Non-market Values

Unlike the NOEP ocean and coastal market data, which are generated using standardized and consistent datasets produced annually by the U.S. government, the measurement of non-market values is done through many different studies of specific resources using a variety of measurement approaches. There is, in fact, little consistency in terms of measurement, resources, geography, or time frames. In order to provide access to this array of measurements, the NOEP has developed a database (available at www.oceaneconomics.org) that brings together key information from a large number of individual studies carried out by disparate researchers in the academic community, consultancies, non-governmental organizations (NGOs), and various government agencies. The problem with a lack of consistent measurement has been exacerbated by reductions in key research funding and activities by the federal government, which has recently experienced large budget cuts.

Nevertheless, diversity of studies still allows important conclusions:

- The current body of research indicates that non-market values for many ocean and coastal assets (particularly coastal wetlands and estuaries) are significant, totaling at least tens of billions of dollars per year.
- These non-market values can rival the market value of ocean and coastal extractive industries or coastal development projects.
- It is likely that non-market values for ocean and coastal resources will increase as people continue to move to the coasts, and as we gain a more thorough understanding of the many important ecosystem services the oceans and coasts provide.

The NOEP database currently includes 420 studies spanning from 1975 to the present (See Table 4.1). A breakdown of studies by asset class and geography is illustrated in Figure 4.1. Beaches and recreational fishing are the most studied natural assets. The Southeast continues to be the source of most studies, followed by the Pacific/West Coast. This makes sense, given the size of the ocean-related economies of the coastal environment in these geographies, but it also leaves out detailed investigation of resources in other areas of the country, particularly in the Northeast and Great Lakes regions (studies of the Gulf Coast since the BP Oil Spill have increased but are not publicly available during the legal proceedings).

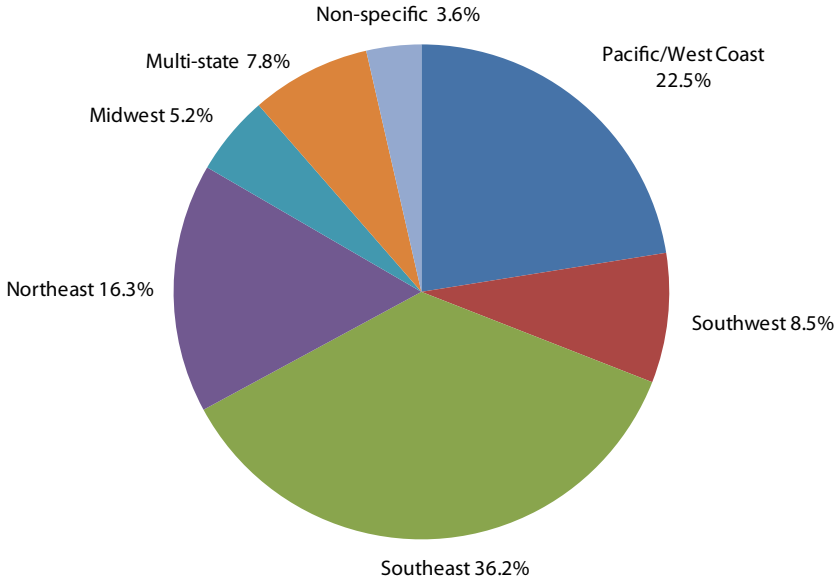

Figure 4.1. Geographic distribution of U.S. non-market study sites

Table 4.1.
Number of U.S. non-market study sites by region

Region	Number of Study Sites	Percentage of Sites
Pacific/West Coast	69	22.5%
Southwest	26	8.5%
Southeast	111	36.2%
Northeast	50	16.3%
Midwest	16	5.2%
Multi-state	24	7.8%
Non-specific	11	3.6%
Total	307	100.0%

The sum total of the non-market values for ocean and coastal resources in the United States is tremendous: at minimum, tens of billions of dollars per year and likely much more. For example, Southern California's beaches accounted for $3.56 billion in total annual expenditures in 2009 (Dwight *et al.*, 2012). Furthermore, natural assets not associated with tourist activities can be even more valuable. In 2010, the natural capital of Thurston County on Washington State's Puget Sound was valued at over $60 billion (Flores *et al.*, 2012) for its contribution to water quality, flood control, and other ecosystem services. In 2010, the Delaware Estuary watershed across Delaware, New Jersey and Pennsylvania provided an estimated $12.1 billion in ecosystem services, from wildlife viewing to flood protection, which would equate to $392 billion in net present value over the next 100 years, assuming a 3% discount rate (Kauffman *et al.*, 2011).

The diversity of studies of non-market values and the difficulties of compiling aggregate figures on this key way of understanding the economic value of coastal and ocean resources makes summative analysis of the type discussed in Chapters 2 and 3 almost impossible with current knowledge. But the role of non-market values in understanding the importance of ocean and coastal resources can be illustrated in the stories of two recent events in the Gulf of Mexico— Hurricane Katrina and the Deepwater Horizon oil spill. These stories and the measurement of changes in non-market assets and services associated with them are still incomplete. The impacts of these events are long lasting and will take years to be fully understood, as will the examination of the economic consequences. Some of the economic studies will also take years to complete and others related to the Deepwater Horizon event are currently caught in the complex litigation that is still ongoing. But even incomplete stories can serve to help understand what non-market values are, how they are measured, their magnitude, and how they can help manage key resources.

4.3. Non-market Valuation in Action in the Gulf of Mexico: Hurricane Katrina and the Deepwater Horizon

Hurricane Katrina

Hurricane Katrina formed over the Bahamas in late August 2005 and made landfall as a Category 3 hurricane in Louisiana on August 29 of that year. Its direct impact on the New Orleans region ultimately resulted in Katrina's becoming the costliest hurricane in U.S. history, as well as the second most deadly and the third most intense in terms of atmospheric pressure according to the National Oceanic and Atmospheric Administration (NOAA) (Blake *et al.*, 2011). Human fatalities and economic damages were primarily a result of the hurricane's massive storm surge, rather than strong winds, and the inability of physical barriers such as levees, to protect coastal areas . Direct property losses exceeded $108 billion (Knabb *et al.*, 2005). Katrina was followed by another major storm, Rita, in September 2005 which came ashore in Texas, but also affected Louisiana.

Katrina revealed the importance of wetlands for storm mitigation. McKinney (2011) writes that "Katrina and Rita were like hammer blows to these already staggered wetlands. Some 217 square miles (139,000 acres) disappeared almost overnight because of the storms."

The storm and its aftermath quickly came into focus as a major event in U.S. disaster preparedness and environmental economics (Farley *et al.*, 2007). The hurricane sparked research on the economic drivers of unsustainable coastal development, such as subsidies for dredging, channel and canal construction, flood insurance, and the lack of full-cost accounting that includes non-market values (Bagstad *et al.*, 2007, Gaddis *et al.*, 2007). Researchers have endorsed wetlands conservation and restoration as sound public policy, recognizing the non-market value they provide for storm impact mitigation (Association of State Floodplain Managers, 2005).

In the hurricane's aftermath, it has become clear that if the value of wetlands for storm mitigation had been incorporated into earlier city and regional planning efforts, wetlands preservation would have had a higher priority.

Instead, these values were ignored and the costs from the storm demonstrated that many elements of New Orleans's decades of largely unchecked coastal development, e.g. digging hundreds of canals through the wetlands for support boats to service offshore oil rigs, were in fact uneconomic. The economic gains from the oil industry were dwarfed by the lost storm mitigation services that ultimately resulted in great and lasting damage to the city and surrounding areas.

Fortunately, the recognition that wetlands preservation is key to the sustainability of New Orleans has reached the highest levels of both federal and state government. According to the government of the State of Louisiana, the federal Coastal Wetlands Planning Protection and Restoration Act of 1990 (CWPPRA, Title III, Public Law 101-646, 16 USC 3951-3956) was intended to identify, prepare, and fund construction of coastal wetlands restoration projects. Since its inception, 151 coastal restoration or protection projects have been authorized, benefiting over 110,000 acres in Louisiana. The annual budget for CWPPRA restoration has varied since its inception from approximately $30 million per year to nearly $80 million per year. The projects funded in Louisiana provide for the long-term conservation of wetlands and dependent fish and wildlife populations.

Data are sometimes often not enough to protect high resource values.

A recent decision by the Army Corps of Engineers (New York Times, 2013) to divert polluted water into the Indian River Lagoon Estuary in Florida endangers an estuary that was estimated in 2007 to provide $3.7 billion dollars in economic benefits to five surrounding Florida counties (Hazen and Sawyer, 2008). The decision was made in order to protect nearby agricultural land and to divert it from flowing into the Florida Everglades.

The lesson: It's always up to policymakers to decide what to do with non-market values—they can inform decisions but not determine them.

At the state level, in 2012 the Louisiana legislature unanimously approved the Louisiana Comprehensive Master Plan for a Sustainable Coast (www.coastalmasterplan.la.gov/"), which outlines a $50 billion, 50-year effort to restore hundreds of square miles of wetlands. The plan was approved after two years of intensive study and cooperation among numerous state agencies. It puts wetlands preservation at the center of the region's coastal protection efforts, incorporating non-market values into public policy.

The Deepwater Horizon

After the Exxon Valdez spill, the federal Oil Pollution Act (1990, 33 USC Chapter 40) was passed. It dictates that assessments of natural resource damages should include non-market values of lost ecosystem services. These can include the lost *existence value* of ecosystems, even to people not directly impacted by a spill (i.e. by residents far away who nonetheless have suffered a loss since part of their natural heritage has been destroyed). The law greatly increases the potential liability for companies that despoil the natural environment, especially if negligence or criminal conduct is demonstrated. In addition to mandating that companies pay all cleanup costs and compensate individuals and businesses for their damages and lost revenue, the law allows for punitive damages to be levied. These punitive penalties are often in line with estimates of the lost non-market values to society, so that companies are required to pay for the full range of costs they impose on society.

The Deepwater Horizon oil platform owned by Transocean exploded on April 20, 2010 and continually released oil into the Gulf of Mexico until September of that year. Over that period, a total of 4.9 million barrels (205.8 million gallons) of oil were released into the Gulf, making the spill both the largest and costliest in history (Landry, 2011). By late 2010, published academic and government research began to quantify the economic impact of the disaster. As is the case with all disasters of this magnitude, the impacts are complex, far reaching, and difficult to quantify. Unlike the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska, which despoiled a virtually pristine ecosystem, the Deepwater Horizon spill occurred in an area that had experienced decades of intense offshore oil and coastal development, as well as tremendous amounts of agricultural run-off. This makes quantifying the impacts of the Deepwater Horizon spill all the more challenging, albeit not impossible.

The damages (from both hurricanes and from oil spills) to wetlands, which are for the most part in the public domain and thus are not sold to anyone for the services they perform, can be assessed in terms of their non-market values. A series of studies has been performed by researchers in the Gulf to assess the non-market value of coastal ecosystems, as measured by the willingness to pay (WTP)

of the region's residents for restoration and conservation. These value estimates include:

- The WTP for a restoration project in the Barataria-Terrebonne estuary was measured at between $909 to $1,751 per household for ecosystem services that include protection of wildlife habitat, storm surge protection, and fisheries productivity. This total value of $105 billion to $201 billion exceeds the $100 billion estimated cost of the project (Petrolia, 2013).
- In a statewide survey, Louisiana citizens were willing to pay $5,313 per household for a short-run wetland loss prevention program (Petrolia, 2011). This study concluded that the public has a preference for short-term restoration efforts with more immediate results. However, WTP varied greatly depending on income, race, knowledge level, and confidence in government.
- The WTP to prevent land loss in Louisiana was estimated at $825 per household per year (Petrolia & Kim, 2011).
- Petrolia and Kim (2009) also applied contingent valuation to restoration of the barrier islands off Mississippi. Residents stated a willingness to pay of $22 per household to maintain the current state of the islands for 30 years; $152 to restore to pre-1969 conditions; and $277 to restore to pre-1900 conditions. Respondents indicated the most important reason to invest in barrier island restoration was hurricane protection.

Writing in the *Boston College Environmental Affairs Law Review*, Itzchak Kornfield (2011) argues that agencies with authority over the mitigation and cleanup effort should employ a holistic ecosystem valuation approach, rather than attempting to value individual wildlife losses. In 2010, John Talberth and Stephen Posner of the World Resources Institute (WRI) also weighed in with a meta-study of value estimates for wetlands, coastal property, and fisheries affected by the oil spill.

Although visitors typically do not buy tickets or pay a use fee to enjoy many coastal amenities, the amenities are nonetheless valuable aspects of the coastal economy. According to Dr. Larry McKinney (2011) of the Harte Research Institute at Texas A&M, the "economic impact of recreational fishing in Louisiana exceeds $757 million annually and creates 7,733 jobs…Wildlife-viewing alone generates over $517 million of economic impact annually."

Coastal ecosystems also support property values by improving the overall quality of life and providing aesthetically pleasing residential locations. According to commercial real estate analysts at the CoStar Group, the oil spill likely cost property owners along the 600 miles of affected coastline a collective $4.3 billion in lost real estate values (Drummer, 2010).

4.4. Conclusion

At a time of increasing pressures on America's ocean and coastal resources, the government must have the most up-to-date information on the full range of values these resources provide in order to make decisions that best reflect the public interest.

Over many decades, researchers have clearly and definitively established that ecosystem goods and services in the nation's oceans and coasts provide tremendous value to a broad swath of society. However, persistent knowledge gaps still prohibit us from developing precise estimates at this time as to the overall magnitude and distribution of those values. Nonetheless, even with the limited data currently available, it is possible to get a snapshot of the tremendous non-market economic value that the nation's ocean and coastal resources provide, conferring a consumer surplus of at minimum hundreds of billions of dollars per year. These values will only increase as the nation's coastal population grows and these resources are under greater pressure.

Equipped with this knowledge, policymakers will have up-to-date data and scientific evidence to make much more informed decisions about the fate of the nation's ocean and coastal resources, and better balance the demands of extractive industries, agriculture, industrial emitters, land developers, and the tens of millions of citizens who recreate at the coasts every year.

(Note: much of the following material appeared in Chapter 4 of the 2009 NOEP report *State of the U.S. Ocean and Coastal Economies*)

Appendix A: Non-market Values for Environmental Goods and Services

Economists make a fundamental distinction between *market* and *non-market* goods and services. Some environmental goods and services, such as fish and seaweed, are traded in markets, so their values are reflected directly in their price. However, some goods and services are not bought and sold directly, so they do not have a simply observable monetary value. Examples of this include beach visits, wildlife viewing, or snorkeling at a coral reef (NOAA Coastal Services Center, 2009). These are referred to as "non-market" goods and service because their economic value is not reflected in market transactions.

Although the prices for these goods and services are not obvious, their values are no less real than those attributed to traditional market goods such as fish or boats. For example, people are willing to pay significant sums of money to conserve biodiversity (U.S. Forest Service, 2005) or to live close to the oceans (Kildow, 2007), even if precise monetary values for these goods and services are difficult to establish.

It is possible to make reasonable and defensible estimates of these non-market values by using various economic and statistical methods that have been developed over decades. Very often these non-market values are linked to recreational benefits of ocean and coastal environments, or the ecosystem and environmental services they supply. These values reflect direct use of the resources. Values also extend beyond any benefits derived only from using a resource; some value comes from simply knowing that a species is healthy and protected.

Non-market values frequently represent *consumer surplus*, which is the difference between the maximum that consumers are willing to pay for a good and what they actually pay for it. For example, visitors to California beaches do not pay admission, but most would certainly be willing to pay *some amount of money*, if asked to do so, for the opportunity to recreate on the beach. Currently, these beach users receive a consumer surplus equal to their maximum willingness to pay each time they visit the beach for free.

There are many instances when citizens receive recreational benefits from coastal and ocean resources at costs lower than they truly value them, resulting in consumer surplus. The total value of this surplus can be significant, especially in areas frequented by large numbers of people or for environmental resources that people put at a high premium.

If citizens experience a decrease in the quality of coastal and ocean resources, they will experience a loss in consumer surplus directly related to the diminished quality of life; the magnitude of this loss can be estimated in dollars. Conversely, improvements in coastal and ocean resources increase consumer surplus and lead to measurable increases in economic value for the citizenry.

Unlike market values of the type discussed in Chapters 2 and 3, non-market values are not estimated by any standard methodology nor are they kept in any government data series. Rather, non-market values have been estimated in a wide variety of studies by different researchers on different resources. The result is a highly diverse array of estimates, which are derived by four primary methods. The methodology for each is explained in detail at http://OceanEconomics.org/nonmarket/methodologies.asp.

Travel-Cost Method estimating non-market values based on people's willingness to travel to enjoy them.

Hedonic Valuation estimating the value of environmental resources that may be contained within market values such as real estate values.

Cost-Based Method estimating the value of environmental services by comparing them to the costs of other ways of providing similar services.

Contingent Valuation Method using surveys to ask people what they are willing to pay for improvements in environmental resources using hypothetical scenarios.

Using a technique called *benefit transfer*, it is sometimes possible to extrapolate the non-market values derived from one study site to another study site if the two sites' characteristics are reasonably similar. For example, the value of Florida beach recreation could potentially be applied to beach recreation in the Carolinas, taking into account regional differences in order to make a reasonable value estimate. Benefit transfer studies do not require expensive and time-consuming data collection efforts, rather they require careful scrutiny of the sites to ensure comparability. However, benefit transfer studies are not as accurate as original research based on region or site-specific data.

A complete guide to the non-market valuation studies of ocean and coastal resources can be found in the NOEP Non-market Valuation Database and Value Estimates Tables at http://OceanEconomics.org/nonmarket/valEstim.asp.

Appendix B: Non-market Recreational and Leisure Values

Tens of millions of U.S. citizens participate in outdoor coastal recreation every year (Pendleton, 2007). From going to the beach to fishing to snorkeling and wildlife viewing, we spend many billions of dollars each year on these forms of leisure. Americans highly value coastal and marine environments, and are willing to pay significant sums of money to enjoy them, including money above and beyond what they currently pay (the consumer surplus).

Since beaches are extremely popular recreational destinations for millions of Americans, they have been relatively well-studied by economists trying to estimate consumer surplus in states such as California and Florida. Lew and Larson (2005) estimated the average daily consumer

surplus for visiting select California beaches at $11.13 per trip; Bin *et al.* (2005) estimated a consumer surplus of $11.98 to $84.49 per trip to North Carolina beaches; while Leeworthy and Bowker (1997) found a very high consumer surplus of $95.85 to $120.74 for visits to Florida beaches.

Saltwater recreational fishing is another leisure activity popular in the coastal environment. It too provides a significant amount of consumer surplus to the millions of Americans who partake in this sport. It is important to remember that, while the amount of money spent on fishing gear, tourism, and boating can be observed, those values alone *do not* capture the total value of the fishing resources, because people are not charged for their maximum willingness to pay for fishing access, which results in consumer surplus.

Hamel *et al.* (2000) estimated average consumer surplus from $99.39 to $146.14 per fishing trip day in Alaska; Kling and Herriges (1995) estimated average consumer surplus per fishing trip of from 10.84 to $44.45 per person per day in California.

Wildlife viewing (including bird watching, whale watching, and viewing sea otters), surfing, snorkeling, and scuba diving are popular leisure activities that attract millions of Americans each year. They also generate significant amounts of consumer surplus.

Appendix C: Ecosystem and Environmental Services

There is a growing recognition among economists and natural scientists that ecosystems provide a wide range of environmental services that confer tremendous value to society. These values are usually not reflected in the market, so they are another source of non-market value. Examples of environmental services include coastal storm protection from storms to wetlands, estuaries, and mangroves, which produce such services as water filtration and spawning grounds for commercially important fish, filtering pollutants, maintaining water tables, and providing habitat, especially for waterfowl.

To estimate these values, we often calculate the costs that society avoids because these ecological resources are providing services at no monetary cost to society. If wetlands and mangroves help protect adjacent areas from storm damage, the non-market value of their environmental services could be determined by estimating how much additional storm damage would result if they were removed.

Focusing solely on the Puget Sound Basin of Washington state, Batker *et al.* (2008) found the value of salt marshes for storm protection to be $97,227.52 per acre and the value of freshwater wetlands for water supply to be $38,801.50. Similarly, the sea grass of the Indian River Lagoon on the Atlantic coast of Florida has been valued at $4,837.70 per acre per year for its role in supporting fisheries and recreation (Johns, 2008).

There is another category of non-market values called *non-use* (or passive use) values, which attempts to measure the values people receive *indirectly* from coastal and ocean resources. For example, even those who live in the interior of the country may receive some value from simply knowing that coastal resources are being preserved (this is called *existence value*). Perhaps they plan to visit these areas one day, or they may want to pass a healthy environment along to the next generation (this is referred to as *bequest value*).

Appendix D: Other Sources of Non-market Values

Non-market values can also be obtained by estimating how much the values of other assets change depending on the quality or quantity of adjacent coastal resources. For example, by comparing home prices along coastal areas with those inland, the premium paid for ocean views and coastal access can be determined. As anyone who lives near the coast can attest, these premiums can be very high, when we consider all of the nation's coastal real estate (Kildow, 2007). From a policy perspective, it is important to understand the extent to which the value of coastal property is sensitive to changes in the quality of the adjacent environmental resources. For example, if nearby water quality deteriorates, property values will likely decrease as well (Leggett and Bockstael, 2000).

4.5. The Total Non-market Value of the Nation's Ocean and Coastal Resources

As noted, most non-market valuation studies calculate the per person non-market value for a particular use of coastal and ocean resources for a representative sample in a specific region. To calculate the non-market value of this activity for the region as a whole, the per-person estimates are multiplied by the total number of participation days for that activity (and if necessary, converted to current dollars).

With total participation days for coastal recreation in the billions, and estimated per-person consumer surplus in the range of $10 to over $100 per participation day for many popular activities, the total non-market value of ocean recreation alone is likely to exceed $100 billion. These esti-

mates do not include the estimated tens of billions in non-market values for environmental services, or the billions more in non-use values.

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Chapter 5
The Future

5.1. Frontiers of Measuring the Value of Oceans and Coasts

Efforts to estimate the size and change in the ocean economy are limited by the type of data that are already available or can be cost-effectively collected. Estimates are also influenced by choices about what to include and exclude from the definition of the ocean economy, which is inevitably somewhat arbitrary. But there has been significant progress over the past decade in developing measures of the market-based ocean economy and making them widely available.

The measurement approach developed by the NOEP has now become a regular output of data from the NOAA Coastal Services Center through its Economy-National Ocean Watch (E-NOW) data system. NOAA is working with the U.S. Bureau of the Census and U.S. Bureau of Economic Analysis to create improved estimates of self-employment and of the GDP related to the ocean economy. These improvements will be built into the U.S. ocean economy data in coming years providing for increased accuracy in the estimates of the ocean economy.

The U.S. is not the only country seeking to develop estimates of the ocean economy. At the same time that the U.S. data have been under development, others such as Ireland, the United Kingdom, France, Canada, China, South Korea and the European Union have been working on their own approaches to measuring the ocean economy. Their approaches are similar in many ways to the NOEP approach, but there are numerous differences in the underlying national data systems that provide the basis for estimates. The Center for the Blue Economy is currently working to incorporate industry and geographic definitions and estimates from other countries into the U.S. data to create a single taxonomy of ocean industries from which a global database of ocean economy measures can be constructed.

Experience with the U.S. data and those in other countries indicates that a broader definition of the ocean economy is possible and beneficial. Areas that have been identified for improvement include:

- **The Ocean Economy beyond the Coastal States**

Some components of the ocean economy are actually located well away from the coasts. Examples include seafood markets in Colorado or Nebraska, or boats and other recreational-equipment-manufacturing firms inland but sold to users at the coast. Much of the warehousing for the Port of Los Angeles/Long Beach is located more than 20 miles inland in various parts of Los Angeles County. Better methods for measuring the geographic spread of the ocean economy throughout the country would show both a larger amount of economic activity overall as well as the ties between the oceans/GOM/Great Lakes and the rest of the nation.

- **Existing Industries Not Now Included and New Industries**

A number of economic activities associated with the ocean are not included in the NOEP ocean or coastal economies, nor in the Natural Resources section of our site, because it has not been possible to develop consistent estimates across all states. Individual studies of specific states cover some of these areas, but consistent national estimates have been beyond the scope of what NOEP could collect. Industries and economic activities and assets that can and should be incorporated into future estimates include:

- Marine research and education
- Ocean-related activities of state and local governments
- Financial industries including marine and coastal flood insurance
- Marine engineering and design
- Coastal restoration including restoration of habitat such as wetlands in the Gulf of Mexico, estuarine restoration in San Francisco Bay, and shoreline stabilization through beach nourishment in Florida and California
- Offshore energy production: The primary activity here would be the generation of electricity using wind, tidal, or wave energy as resources. The U.S. lags significantly behind other countries in developing this type of electricity production, but it is likely that a major expansion will take place this decade. The first commercial tidal power project is already functioning in Eastport, Maine, and there are numerous offshore wind power projects pending in the permit process in both state and federal jurisdictions.
- Industries that use ocean water including desalinization plants and algal farms for biofuels
- Ocean-based pharmaceuticals

- Highly specialized ocean industries: Those related to the ocean would include the Hawaiian tropical fish collection industry, for example.
- Real estate: The development and building of properties for both year-round and seasonal use in shoreline and near-shore areas has clearly been a major economic activity in coastal areas, but property records are highly variable in quality across the different state and local jurisdictions.
- Fisheries harvesting: Employment reporting in the commercial fishing industry has been shown to be sporadic at best when using standard employment data. BEA and NOAA's Coastal Services Center now collect self- employment data, which includes fishermen and fish harvesters. This allows this industry to be much better represented in estimates of the ocean economy.
- Refineries: These are not currently included in the minerals sector because records do not distinguish between offshore and land-based sources of oil and gas.
- Marine Technology: This industry is now embedded in several sectors. It could be considered a separate sector as it has been in other nations' accounts, reflecting the contribution of the "innovative" portion of the ocean economy such as robotics, navigation equipment, and ocean-monitoring devices.
- Coastal agriculture: This has been an overlooked industry, but has unique qualities that tie it to the oceans. Particular crops, such as strawberries, artichokes, and Brussels sprouts thrive on cool salt air from the oceans, and much of coastal land is nutrient rich as a result of sediment flows from healthy watersheds.

5.2. The Coastal Economy

The NOEP began estimating the coastal economy several years after it began reporting on the ocean economy, because its importance became clear as shoreline issues grew. Most other nations do not collect these data, but we encourage them to do so because of the importance of this information to planners. In the past, perceptions of what went on along the coasts were primarily based on population estimates and rates of growth over time. Rarely had anyone looked at the size and scope and rate of growth of the coastal economy according to geographic boundaries ranging from zip codes along the coast to coastal counties, watershed counties, and inland counties. What has become apparent over time is that population growth rate has slowed along the coast since 1991, although it is still growing, and economic growth along the coast in shore-adjacent counties has continued to grow at a faster rate than population. We believe that growth rate merits attention because there is an obvious feedback between population distribution and economic growth and jobs. As population growth accelerates inland and economic growth continues to climb along the coast, implications emerge for increased transportation needs for commuting as well as quality-of-life issues. In addition, and perhaps even more important, are the risks that increased economic growth pose for climate change impacts that have become increasingly visible and costly in the face of the increased intensity of storms such as Hurricanes Sandy and Katrina, and most recently in the Philippines. Public and private sector infrastructure continues to grow along coastlines, while research studies indicate their increased vulnerability.

As a result of these issues, vulnerability indices have emerged from many quarters, but the data to inform these indices regarding population and economic indicators need more attention. We hope to compile the data on coastal economies that would help to inform those planning for impacts of climate changes and shoreline impacts, including:

- Public infrastructure data about value, risks, and options for protecting such service industries as sewage treatment and power plants, and desalinization as well as transportation facilities such as ports, airports, highways, and railroads and other critical services that support coastal populations and economies
- Demographic information about households in high-risk areas, such as income, age, and education that could inform planners
- Types of businesses in high-risk areas and their value

It appears that the greatest need is for economic information at the local level, but that is the most difficult to obtain because of disclosure rules that protect business competition. Hence, this will likely be a labor-intensive task that will take time and money but is nonetheless one that needs to be done to help local communities prepare for the future.

5.3. Improving Our Ability to Use and Understand Non-Market Values

Several decades of studies of the non-market values of ocean and coastal as well as other natural resources demonstrate that these values are often simply too large to be ignored (See Table 5.1). But the research that develops non-market estimates remains inconsistent across studies in methodology, geographic coverage, and the type of

Table 5.1. Number of study sites by region by select categories

Region	Beaches	Recreational Fishing	Coastal and Marine Wildlife Viewing	Scuba Diving	Snorkeling	Environmental Services	Non-Use Values	Total
Pacific/West Coast	22	26	14	6	3	11	17	99
Southwest	3	16	1	4	0	6	1	31
Southeast	52	42	6	15	7	9	11	142
Northeast	30	15	6	1	1	5	11	69
Midwest	4	7	1	1	0	2	3	18
Multi-state	7	11	4	2	1	7	7	39
Non-specific	1	5	2	1	1	4	3	17
Total	119	122	34	30	13	44	53	415

resource studied. Bibliographic resources such as the non-market database of the NOEP and the EPA's National Center for Environmental Economics provide a useful way of organizing and providing access to the data, but there is much that could be done to improve the development and access to our understanding of non-market values. Included among these steps would be;

1. *Constructing time series*, where possible. Many areas of the country, such as beaches in Florida and California, have been repeatedly studied over the years. While there are methodological differences across studies, these differences may not be so great as to represent complete non-comparability. Constructing time series of non-market values would allow us to understand how society's values change over time and how these values may be affected by changes in both the environment and the larger economy.

2. *Broaden the geographic areas where nonmarket values have been estimated*. Northern coastal states in the Pacific, Great Lakes, and Atlantic regions have been relatively under-studied in terms of non-market values. This bias means that information about these areas is even and that information is lacking on key resources such as wetlands.

3. *Improved Understanding of Recreational Non-Market Values*. Most studies of non-market values in ocean and coastal contexts have focused on recreational use values, as these tend to be the ones that affect the largest populations. But there is inconsistent treatment of the characteristics of recreational resources that are most important in shaping peoples' valuation. Many studies only examine non-market values after a disaster such as an oil spill or a storm, leaving unexamined questions about the values of ordinary use.

   Moreover, there are often very weak estimates of the size of the populations that use coastal recreation resources, as visits are often casual and intermittent. While the market data provide good estimates of activities in hotels and restaurants, there is little measurement of the recreational activities of seasonal homeowners (and renters) or of day-trippers. Accurate population estimates of use may be as or even more important to understanding the total values at stake than the values themselves.

4. *Linking Market and Non-Market Values*. There are two aspects to this linkage: The first is at the national accounts level, where the concept of national income and assets needs to better reflect those values not traded in markets (see point 5). The second linkage is at the individual resource level. For example, we need to know how changes in the values that people place on beach recreation affect tourism and recreation spending in a region, or how the value of coastal wetlands' buffering protection from storms may affect real estate values.

5. *Better understanding how to use non-market values for decision making*. Economic impact studies that discuss how pending decisions may affect jobs are widely used and readily understood by most people. But changes in consumer surplus are understood by very few. If non-market values are to play a useful role in making management decisions, they must be made accessible to a wide variety of expert and non-expert participants in the ocean and coastal management process.

5.4. The Complete Picture: Merging Market and Non-Market Measures

Gross Domestic Product, and the related National Income Accounts, have been one of the most important innovations in economics. The concept of GDP was developed by Simon Kuznets in 1934 and was recognized by the third Nobel Prize in Economics in 1971. It has become the standard measure of economic performance and relative wealth over time and across areas. But as a measure of market-based transactions, it has long been known to be deficient as a measure of overall welfare. As a consequence, many economists in the U.S. and around the world have sought to broaden the GDP to include measures of the type captured by non-market values.

The logic is simple: by incorporating the full range of environmental values into our economic accounts, we can identify areas where investments in natural capital can provide the greatest returns to society as well as areas where certain industrial activities actually make society worse off. National accounts that incorporate ecosystem values provide a framework for collecting and organizing information on the status, use, and value of a nation's natural resources and environmental assets, as well as for expenditures on environmental protection and resource management.

Efforts are currently underway to mainstream non-market values into national accounts so that they can be reflected in GDP figures. Thus, "natural capital" would be added as a new category to complement existing data on physical capital (such as machinery and infrastructure). Most of the progress in merging market and non-market values in the national accounts systems has been made in other countries (Boyd and Banzhaf, 2007). The 1992 United Nations Conference on the Environment in Rio de Janeiro produced Agenda 21, which called for the UN to begin a handbook for "green accounting." The finished product was based on numerous approaches to environmental accounting,pioneered by a series of workshops sponsored by the United Nations Environment Program (UNEP) in collaboration with the World Bank. Due to the embryonic nature of this work, the discussion of concepts and methods did not reach a final conclusion, and the UN handbook including its System of Integrated Environmental-Economic Accounts (SEEA) was issued as an interim version of work in progress.

The SEEA was subsequently tested in Canada, Colombia, Ghana, Indonesia, Japan, Mexico, Papua New Guinea, the Philippines, South Korea, Thailand, and the United States. In response to the issuance of the UN handbook, the U.S. Bureau of Economic Analysis (BEA) in the Department of Commerce began to develop a system for including market and non-market estimates of ecosystem values into national accounts. Members of Congress were informed of this work in 1995 and held hearings. Some in Congress believed that the methods for valuing the environment were still developing and therefore not ready to be fully incorporated in the U.S. national accounts. They were also responding to pressures from the coal and other extraction industries that feared that a new green accounting system would trigger further industry regulation. Some members of Congress also felt that it was inappropriate to change an economic accounting system to which many had grown accustomed.

As a result, Congress withdrew funding for this BEA experiment, imposed a ban on any additional work until further notice, and asked the National Academy of Sciences National Research Council to review and report on the BEA strategies. The resulting report, "Nature's Numbers" (NRC, 1999), provided an unequivocal endorsement of green accounting and a call for a comprehensive assessment of market and non-market values of ecosystem services. The authors expressed concern that the U.S. might lag behind other nations if a system of green accounts were not developed quickly, and noted that it was in the best interests of U.S. policymakers and investors to have this information.

The ten-year Congressional ban on BEA green accounting activities ended in 2005. In 2006, sufficient progress toward an international system of green accounts prompted an interagency meeting between the U.S. Government Accounting Office (USGAO) and the National Academy of Sciences to once again discuss the topic of environmental accounts. In 2010, a report by the U.S. General Accounting Office described the status of environmental accounting around the world, indicating that many nations were now using some form of it and that there was a strong effort to standardize the accounts. The absence of U.S. participation to date was cited negatively because it has prevented the U.S. from having a voice in setting international green accounting standards.

Since 2010, The European Commission has instituted regulations for the entire European Community on green accounts, which are described in detail in a report issued by the European Commission Statistical Bureau (Eurostat, 2010). The World Bank is doing more practical work on green accounts through the *Wealth Accounting and the Valuation of Ecosystem Services* (WAVES) program. Through the UN work and the European Community efforts,

many nations have now implemented an official system of environmental accounting. However, the U.S. government has yet to follow suit, and there are no indications of immediate plans to do so. The most relevant effort at the U.S. Federal level is the 2011 report from the President's Council of Advisors on Science and Technology (PCAST), *Sustaining environmental capital: protecting society and the economy* (Holdren and Lander 2011).

The stage is thus set for a renewed effort to adapt more explicit measures of natural resource values into the national accounts. The first step in this process will be the development of a "satellite account" of the ocean economy, which is an adaptation of existing data systems to create a more accurate and detailed picture of GDP for the existing market economy data series. The next step, which will require a broader agreement among policy makers and some commitment of funding, will begin to shift the U.S. national accounts toward the developing international standard to integrate environmental and economic accounts. This will involve much more than ocean resources and take several years, but it will also provide the most complete picture to date of the ocean's role in the national economy.

5.5. The Community of Ocean and Coastal Economy Investigators

Efforts in the U.S. and around the world to better understand the role of the ocean in national and regional economies and to more fully understand the values that people place on these resources have now reached sufficient momentum. The community of investigators now needs to be tied together with a common set of vehicles to exchange research and findings. Toward this end, the Center for the Blue Economy (CBE) has established a new journal, the *Journal of Ocean and Coastal Economics*, which will begin publication in 2014. The journal will publish peer-reviewed papers that address the measurement and understanding of both market and non-market aspects of ocean and coastal resources. In addition to publishing papers that advance the state of the art, the journal will publish results of studies that often appear only in the "grey" literature in order to more widely disseminate this important work. The journal will be published online and will include access to datasets used in research when available. The CBE will augment the journal as a community asset through regular symposia, workshops, and conferences.

In addition, the NOEP will continue to serve its users in the coastal and ocean communities with major expansions of domestic U.S. data as well as extensions in 2014 of its data collections into the international realm. As soon as the expansion is underway, all registered NOEP users will receive notification regarding the new features.

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