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Abstract

This paper supplements reports and data released on the coastal and ocean economy of the United States by the National Ocean Economics Project. It provides a discussion of the relevant literature involved in the investigation of the ocean and coastal related economy, the theoretical background of measures such as gross domestic and gross state product, and provides details on sources, methods, assumptions, and limitations of the data provided by NOEP.

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1. Introduction

The goals of the National Ocean Economics Project are 1) to compile a comprehensive collection of data on the economic value of the ocean and coastal resources of the United States; 2) and to define and describe the ocean and coastal economies. By "ocean economy" we use the definitions in the Coastal Zone Management Act which includes the Great Lakes in the concept of "coast" and thus oceans.

A major part of this data collection is the creation of data sets that permit consistent measurement of the contribution of the ocean to the U.S. economy across time, and regions including the nation, states, and counties. Contributions can be measured in terms of output (gross domestic product or its related measures), employment, and wages. Thus a key product of the NOEP is the creation of a nationally and regionally consistent data set that measures employment, output and wages for the ocean and coastal economy.

Data on population and housing growth in the coastal areas are also critical to understanding the overall socio-economic dimensions of the coastal and ocean areas. This data is available from the U.S. Census, and relevant data is included in the database constructed by the NOEP. Since this data is presented as reported by the Census, the methodological issues involved in this data are the same as those of all census data. For more information on these issues, see (Census 2000).

This paper supplements reports and data released on the coastal and ocean economy of the United States by the National Ocean Economics Project. It provides a discussion of the relevant literature involved in the investigation of the ocean and coastal related economy, the theoretical background of measures such as gross domestic and gross state product, and provides details on sources, methods, assumptions, and limitations of the data provided by NOEP.

Data and analysis produced by the National Ocean Economics Project are part of an ongoing research project to measure the coastal and ocean economy of the United States. As such, this information is not to be construed as official data of the National Oceanic and Atmospheric Administration, the Bureau of Labor Statistics, the Bureau of Economic Analysis, or any other state or federal agency.

As the product of research, data are subject to revisions as refinements to the methodology are developed. Users should check the website of the project (www.oceaneconomics.org) for regular updates of the data and methodology.

2. Previous Studies

The concept of an "Ocean GDP" is not new. In 1974, the Bureau of Economic Analysis, the agency responsible for maintaining the National Income and Product Accounts, undertook a special study for the Assistant Secretary of Commerce for Policy to identify the contribution of the ocean to the Gross National Product[1] (Nathan Associates

1974).   In that study, BEA developed estimates for Gross Product Originating from the Ocean using the economic census data for 1972. Two follow-up studies used a similar approach to estimate the values for 1977 and 1987. (Pontecorvo *et al.* 1980; Pontecorvo 1988) All of these studies focused on the most clearly identifiable industries and economic activities, those activities that either, as defined in the Nathan Associates study, "utilized an ocean resource in a production process" or "produced a product or service that was demanded because of some quality attributable to the ocean". Sixty-six sectors from the national income accounts were selected for analysis based on these criteria.

Other studies have focused attention on the coast rather than the ocean. Following Pontecorvo, Luger developed a methodology for measuring coast-dependent, coast-linked, and coastal-service activities. (Luger 1991) This approach significantly expanded the types of economic activities brought into the measurement process. By focusing on the coastal zone, Luger also brought the Great Lakes into the analysis, since they are defined for federal management purposes as part of the coastal zone.

The last decade has seen increasing attention to the concept of extending the national income accounts to incorporate the kind of resource-related sources of economic value that were attempted in the earlier studies cited above. This attention has stemmed in part from long-standing concerns that the national income accounts are a good, but imperfect, measure of economic well-being. Thus, there have been new attempts to include important aspects of economic welfare that were traditionally excluded from the systems of national accounts used by various nations (Eisner 1989)

In 1992, the Bureau of Economic Analysis began work to extend the national income accounts to include assessment of natural resource values. However, in 1995, the United States Congress directed the Commerce Department to suspend further work and to obtain an external review of environmental accounting. The National Academy of Sciences, through a panel formed by the National Research Council, examined the experience in European countries and Canada in trying to incorporate the role of natural resources in the economy and affirmed both the desirability and possibility of integrating economic and environmental accounts. (National Research Council 1999)

Another group of studies on the economic value of the oceans has focused on the economy of various regions as influenced by the oceans. Some of these studies have been done at the state level (Moeller and Fitz 1994) while others have been done at the multi-state and international level (Colgan and Plumstead 1993). Studies of the ocean economy in Canadian provinces have also been undertaken (Mandale *et al.* 1998; Mandale *et al.* 2000). These studies have tended to rely on employment in specific industries or estimates of output from regional econometric models, and have thus focused on the market-related activities that are the most easily measured

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3. Defining the Ocean and Coastal Economy

Two concepts underlie the data on economic activity associated with the ocean: the coastal economy and the ocean economy. The two are related, but not identical.

- The **coastal** economy consists of all economic activity in the coastal region, and is thus the sum of employment, wages, and output in the region. Some of the coastal economy is the ocean economy, but the coastal economy incorporates a broader set of economic activity.

- The **ocean** economy consists of all economic activity which derives all or part of its inputs from the ocean or Great Lakes. The definition of the ocean economy is a function of both industry and geography and is described in detail below. While most of the ocean economy is located in coastal regions, some of the ocean economy (for example, some boat building and seafood retailers) is located in non-coastal regions.

A major issue in this field is the definition of the coastal region. The term "coast" has taken on a wide variety of physical definitions ranging from the strip of land immediately adjacent to the shoreline of the oceans and Great Lakes to the headwaters of the watersheds of major rivers. The term has different meanings depending on whether one approaches the coast from a geological, biological, hydrological, ecological or political perspective.

The offshore boundaries of the "coast" vary with activities, depending on legal definitions, such as 200 mile exclusive economic zones for fisheries and outer continental margin definitions for offshore minerals development. The inland boundaries of the coast for economic and demographic analysis are even less clear. Definitions have included arbitrary distances such as 100km from the shore (which begs the question of the shore boundary in estuarine areas), or a "days drive" from the shore, which could easily change depending on transportation systems and their capacity.

For purposes of the analysis of the coastal economy, three tiers of "coast" are selected based on the boundaries of administrative and political jurisdictions. These regional tiers are imperfectly related to geographic or ecological features, but are selected to at least roughly coincide with natural features. In general, the administrative and political boundaries include more land than a strict ecological or geographic interpretation would probably support. For example, coastal watersheds include the Santa Ana River in California, which rises in San Bernardino County, a county which extends all the way to the Nevada border. Similarly, the coastal zone in New York State extends as far up the Hudson River as Albany, which is some 200 miles from the sea.

The three tiers of coast are:

- Near Shore region. This is defined by zip codes adjacent to the shores of the oceans, Great Lakes, and major bays. The selection of these zip

codes is discussed in greater detail in the section below on the ocean economy.

- Coastal Zone Counties. Coastal zone counties are any county which includes in whole or part the area under the jurisdiction of the Coastal Zone Management Act of 1972 as defined for that purpose by each state participating in the program. Four states include the entire state in the coastal zone (Rhode Island, Delaware, Florida, and Hawaii). Nine states (Washington, Alaska, Texas, Louisiana, Georgia, South Carolina, North Carolina, Virginia, and Maryland) define their coastal zones using county or county-equivalent boundaries. Other states use various combinations of political (e.g. town boundaries) and geographic features (adjacency to tidal waters) to define their coastal zones for purposes of the CZMA. All counties which include territory defined as the coastal zone in such circumstances are included in this category.

  Coastal zone counties were identified using geographic information systems. Data showing the boundaries of each state's coastal zone were obtained from NOAA's Office of Coastal Resource Management and overlaid on Bureau of the Census county boundary data to determine the intersection. In the case of Illinois, which does not participate in the CZM program, Cook County was included to provide for nationally consistent totals.

- Coastal Watershed Counties. These are defined by NOAA as the coastal zone counties plus counties that include the headwaters of coastal rivers. This definition excludes major continental river systems such as Mississippi-Missouri-Ohio system.

The accompanying document, *Coastal and Watershed Counties used by the National Ocean Economics Project* lists the counties defined in each group by state.

All population and housing data reported by NOEP is from the Census of Population and Housing for 1970, 1980, 1990 and 2000. All calculations of population and housing density were made using the Census Bureau's data on land area for each jurisdiction. Land area excludes water bodies and wetlands.

In the summary of trends by ocean/Great Lakes region, the Atlantic region includes counties from Washington County, Maine to Miami-Dade County, Florida. The Gulf of Mexico includes counties from Monroe County, Florida to Cameron County, Texas. The Great Lakes region includes counties from St. Lawrence County, New York to Cook County, Illinois. The Pacific region includes all shore counties in California, Oregon and Washington; all shore boroughs in Alaska, including those bordering the Arctic Ocean, and all of Hawaii.

Rural and urban counties were identified using the Department of Agriculture's Urban Influence Codes, for all counties. For a definition of these codes, see (Ghelfi and Parker 2001)

4. Issues in Defining the Ocean Economy

Although the problem of defining an ocean economy appears at first glance to be a problem of defining the economic value of a natural resource, it is perhaps more properly thought of as a problem in defining the characteristics of a regional economy whose boundaries are tied to the ocean (and Great Lakes). A regional approach requires the use of such data as employment, income, and output. It leaves open the question of the marginal value of the natural resources of the ocean for additional studies within a traditional resource economic framework. The current approach may thus be considered the measure of economic activity *associated with* the ocean. Both types of information are necessary for a full understanding of the economy of the ocean, but the economy of an "ocean region" is the place to start given available data.

The estimation of the economic activity associated with the ocean is inherently limited by data availability, conceptual difficulties, and the need to make some arbitrary choices about what to include and exclude. The choices that must be made in the design of statistical measures of ocean economic activity should be informed by clear objectives for the system. The NOEP methodology has the following objectives:

- *Comparability across industries and space* The data should be consistent from the national to the local level and across all states. The measure of employment in one location should be the same as all other locations.

- *Comparability across time* The data should be sufficiently consistent over time that changes can be observed and measured with the same data at all points

- *Theoretical and accounting consistency* The data should reflect standard economic theory describing the measurement of economic activity. It should not permit double counting of economic activity, meaning all measures can be summed across industries and geography.

- *Replicability* The assembly of the data should be done using a methodology that can be replicated by other researchers and that can form the basis for continued generation of data series into the future in order to establish long term time series measures of the ocean economy.

5. The Basic Data: ES-202 Employment and Wages

The methodology developed to do this is based on using the ES-202 employment data which is collected monthly by each state's department of labor and reported to the U.S. Department of Labor. The ES-202 data is used as the basis for administering the nation's unemployment insurance laws, and covers about 90% of all employees. The data series excludes farm and self employment. It also excludes almost all employment in the commercial fishing harvesting industry. Fisheries harvesting employment is ~~also~~ excluded from this analysis, since the fish harvesting industry is not covered by the federal law requiring reporting of employment.

 ES-202 data is at the establishment level. Any single place of business is an establishment, regardless of who owns it. A business firm may have many establishments or only one. Nonprofit organizations and government also report their employment through this system.

All ES-202 data is reported to the Bureau of Labor Statistics of the U.S. Department of Labor, which compiles the state reports into a longitudinal data base (LDB) of all reporting establishments in the U.S. Because of differences in revisions of the data between the LDB and state labor agencies own records, there may be minor differences between totals reported here and those available from state departments of labor or publications of the Bureau of Labor Statistics or Bureau of Economic Analysis.

Except where noted, all reported employment data is annual average data from monthly reports. All wage data is annual totals from monthly reports.

All data derived from the ES-202 data series are subject to confidentiality screening. Federal law prohibits the release of data at any level of aggregation which could reveal the employment or wages of a single firm. The estimates for employment and wages were developed using the original data series, which includes all establishments and is thus not restricted by confidentiality. However, all reported data are screened for confidentiality by the Bureau of Labor Statistics before being released. This screening includes comparing the released data with other published data sources to be certain that no confidential data could be imputed based on combining this data series with any other data.

In all tables, totals of the sectors, regions, and the state include all data from all establishments selected as above. Industry level totals may be suppressed to prevent disclosure of confidential data. In any sector where one industry's data is suppressed, a second industry's data will also be suppressed to prevent complementary disclosure.

6. Industrial Definitions

The NOEP methodology defines the ocean economy as comprised of nine sectors. Currently, data is available from for six of these categories, noted in Table 1 . Data on ocean related activities of federal, state, and local governments, as well as on the real estate industry and research and development values are not available. Their values are not easily extracted from these data sources, and will be compiled using different methods in later phases of the project.

For purposes of the NOEP methodology, establishments (see table 1) are defined as ocean related based on their SIC (Standard Industrial Classification) code and, for certain industries (shown in italics in Table 1), on the location of a given establishment in a zip code adjacent to the shore.

Table 1

Construction	***Tourism & Recreation***
Marine Construction	*Amusement and Recreation Services not elsewhere classified*
Living Resources	*Zoos and Aquaria*
Fish Harvesting	
Aquaculture	*Boat Dealers*
Seafood Processing	*Eating and Drinking Places*
Minerals	*Hotels and Motels*
Limestone, Sand, and Gravel	*Marinas*
Oil and Gas Exploration	*Recreational Vehicle Parks and Campgrounds*
Oil and Gas Production	*Sporting Goods*
	Transportation
	Deep Sea Freight Transportation
	Marine Passenger Transportation
Ship & Boat Building	Marine Transportation Services
Boat Building	Search and Navigation Equipment
Ship Building	*Warehousing*

Most of the industries defined in this table are single 4-digit SIC codes. Some 4-digit SIC industries have been combined to create the industries as shown in order to minimize the disclosure of data for single firms, which is prohibited. Table 2 shows the industries and corresponding SIC codes (1987 Revision). Table 2 also shows the correspondence between the SIC and NAICS codes.

The choice of industries to include in the ocean sector is inherently arbitrary. This list was based in part on prior studies such as those of Pontecorvo et al (1980) and Pontecorvo (1988) and Luger et. Al (1990) and Luger (1991) present the most complete list of ocean and coast related sectors. The NOEP industries basically follow the definitions used in these previous studies, with some differences. Table 3 compares the NOEP

industries as defined above with the Pontecorvo et. al. and Luger studies, showing which NOEP industries were included in the previous work.

Sector	Industry	NAICS Code	NAICS Industry (1997 NAICS)	SIC Code	SIC Industry (1987 SIC)
Table 2 **Ocean Economy Sectors and Industries by SIC and NAICS Codes**					
Construction	Marine Related Construction	237120	Oil and Gas Pipeline and Related Structures	1629	Heavy Construction Not Elsewhere Classified
		237990	Other Heavy and Civil Engineering Construction		
Living Resources	Fish Hatcheries & Aquaculture	112511	Finfish Farming and Fish Hatcheries	0273	Animal Aquaculture
		112512	Shellfish Farming	0921	Fish Hatcheries and Preserves
	Fishing	114111	Finfish Fishing	0912	Finfish Fishing
		114112	Shellfish Fishing	0913	Shellfish Fishing
	Seafood Processing	311711	Seafood Canning	2077	Animal and Marine Fats and Oils
		311712	Fresh and Frozen Seafood Processing	2091	Canned and Cured Fish and Seafoods
				2092	Fresh and Frozen Fish and Seafoods
Minerals	Limestone, Sand & Gravel	212321	Construction Sand and Gravel Mining	1422	Crushed and Broken Limestone
		212322	Industrial Sand Mining	1442	Construction Sand and Gravel
	Oil & Gas Exploration and Production	211111	Crude Petroleum and Natural Gas Extraction	1446	Industrial Sand
		213111	Drilling Oil and Gas Wells	1311	Crude Petroleum and Natural gas
		213112	Support Activates for Oil and Gas Operations	1321	Natural gas liquids
		541360	Geophysical Exploration and Mapping Services	1381	Drilling Oil and Gas Wells
				1382	Oil and Gas Field Exploration Services
				1389	Oil and Gas Field Services Not Elsewhere Classified
Ship & Boat Building	Boat Building & Repair	336612	Boat Building & Repair	3732	Boat Building & Repair
	Ship Building & Repair	336611	Ship Building & Repair	3731	Ship Building & Repair
Tourism & Recreation	Boat Dealers	441222	Boat Dealers	5551	Boat Dealers
	Eating & Drinking Places	722110	Full Service Restaurants	5812	Eating Places
		722211	Limited Service Eating Places		
		722212	Cafeterias		

Sector	Industry	NAICS Code	NAICS Industry (1997 NAICS)	SIC Code	SIC Industry (1987 SIC)
		722213	Snack and Nonalcoholic Beverage Bars		
	Hotels & Lodging Places	721110	Hotels (Except Casino Hotels) and Motels	7011	Hotels and Motels
		721191	Bed and Breakfast Inns		
	Marinas	713930	Marinas	4493	Marinas
	Recreational Vehicles Parks & Campsites	721211	RV Parks and Recreational Camps	7033	Recreational Vehicles Parks & Campsites
	Scenic Water Tours	487210	Scenic and Sightseeing Transportation, Water		
	Sporting Goods	339920	Sporting and Athletic Goods Manufacturing	3949	Sporting and Athletic Goods Manufacturing Not Elsewhere Classified
	Amusement & Recreation Services	487990	Scenic and Sightseeing Transportation, Other	7999	Amusement and Recreation Services Not Elsewhere Classified
		611620	Sports and Recreation Instruction		
		532292	Recreation Goods Rental		
		713990	Amusement and Recreation Services Not Elsewhere Classified		
	Zoos, Aquaria	712130	Zoos and Botanical Gardens	8422	Zoos and Aquaria
		712190	Nature Parks and Other Similar Institutions		
Transportation	Deep Sea Freight	483111	Deep Sea Freight Transportation	4412	Deep Sea Foreign Transportation of Freight
		483113	Coastal and Great Lakes Freight Transportation	4424	Deep Sea Domestic Transportation of Freight
				4449	Water Transportation of Freight Not Elsewhere Classified
	Marine Passenger Transportation	483112	Deep Sea Passenger Transportation	4481	Deep Sea Transportation of Passengers Except by Ferry
		483114	Coastal and Great Lakes Passenger Transportation	4482	Ferries
				4489	Water Transportation of Passengers Not Elsewhere Classified
	Marine Transportation	488310	Port and Harbor Operations	4491	Marine Cargo Handling

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Sector	Industry	NAICS Code	NAICS Industry (1997 NAICS)	SIC Code	SIC Industry (1987 SIC)
	Services	488320	Marine Cargo Handling	4492	Towing and Tugboat Services
		488330	Navigational Services to Shipping	4499	Water Transportation Services Not Elsewhere Classified
		488390	Other Support Activities for Water Transportation		
	Search and Navigation Equipment	334511	Search, Detection, Navigation, Guidance, Aeronautical and Nautical System and Instrument Manufacturing	3812	Search, Detection, Navigation, Guidance, Aeronautical and Nautical System and Instrument Manufacturing
	Warehousing	493110	General Warehousing and Storage	4225	General Warehousing and Storage
		493120	Refrigerated Warehousing and Storage	4222	Refrigerated Warehousing and Storage
		493130	Farm Product Warehousing and Storage	4221	Farm Product Warehousing and Storage

Table 2
Ocean Economy Sectors and Industries by SIC and NAICS Codes

This comparison shows that the NOEP industries include four industries (boat dealers, recreational vehicles parks and campgrounds, marinas, and search and navigation equipment) which were not included in the other studies. The inclusion of these industries in the NOEP definitions is due in part to the consistent availability of four-digit SIC data in the ES-202 dataset, in part to revisions to the SIC codes which broke these industries out from other aggregations, and in part to the growing importance of these sectors in the ocean economy since the earlier studies.

Table 3

NOEP Industry	Pontecorvo et. al 1980	Luger et al 1990
Marine Construction	●	○
Fish Harvesting	●	●
Aquaculture		●
Seafood Processing		●
Limestone, Sand, and Gravel	●	○
Oil and Gas Exploration		1
Oil and Gas Production	●	
Boat Building	●	●
Ship Building	●	●
Amusement and Recreation Services not elsewhere classified	●	●
Zoos and Aquaria	●	●
Boat Dealers		
Eating and Drinking Places	●	○
Hotels and Motels	●	○
Marinas		
Recreational Vehicle Parks and Campgrounds		
Sporting Goods		○
Deep Sea Freight Transportation	●	●
Marine Passenger Transportation	●	●
Marine Transportation Services	●	●
Search and Navigation Equipment		
Warehousing	●	●
1 Services component only ○ = defined as "coastal services" ● = defined as "coast dependent"		

In the Luger et al and Luger studies, a distinction was made between those industries that are "coast dependent", "coast linked" and "coast related". Some of the industries shown in Table 3 were included as coast dependent, and were the closest to the ocean sectors as defined by Pontecorvo and NOEP, except that no attempt was made to estimate a geographic component to these industries. Others were defined as coastal services, which were held to be indirectly related to the coastal economy. In cases such as restaurants and lodging, the addition of a geographic component allows a better ocean relationship to be defined.

In the case of oil and gas, Luger does not include offshore oil and gas production or exploration since they were outside his definition of the coastal zone. Only the services component was included in his analysis. Pontecorvo on the other hand includes both exploration and production.

Both Pontecorvo et al and Luger et al include a number of industries that are related to ocean or coastal activity by virtue of intermediate linkages. A portion of these industries, such as telephone communication, marine insurance, food stores, building materials, etc. are estimated by both previous studies. Pontecorvo et al designate these as being defined by "demand side" criteria, while Luger defines them within "coastal services". These studies rely on estimates of the share of each of these intermediate industries.

The NOEP selection of industries uses a different approach. The chosen industries may be seen as those whose output is most directly tied to the ocean and may be considered the "primary" sectors of the ocean economy. Economic activity associated with secondary and tertiary economic stemming from intermediate connections to the primary industries can best be estimated using the national input/output tables. This study will be a future task of the NOEP. This approach will both more fully capture the linkages to other intermediate industries, but better capture the "multiplier" effects of the primary ocean-related economic activity.

Greater geographic specificity does not eliminate the problem of counting more activity than is directly tied to the ocean. For example, hotels and restaurants, which are clearly an important part of the tourist economy related to the ocean and which provide the bulk of the employment in the reported data, serve customers who do more than go to the beach or engage in other ocean-recreation activities. For restaurants, there is a mixture of local and tourist customers, while hotels have a mixture of leisure and non-leisure travelers (though even business travelers may specifically seek a coastal location for the amenities it provides.)

Ideally, data would be available that would permit the tourism and recreation or minerals sectors to be further disaggregated by ocean related activity. Such data does exist in some locations, but not others. For example, California has good survey data on hotel patrons on the proportion that are leisure related and the proportion traveling on business. But this data is not available for all states, and no one state is likely to be sufficiently representative of all states that its data could be used for national data. Geographic location, on the other hand, is reasonably consistently measured across all jurisdictions.

Where data permit, more refined estimates of ocean-related activity are available, they will be used in studies of those regions. This is currently being done in a project estimating the California ocean and coastal economy. Again, however, alternative methods do not necessarily mean greater accuracy. This can be seen using the example of offshore oil and gas activity. The method employed here uses ES-202 employment and wages for all establishments located in the near shore area as defined by shore-adjacent zip codes (see below) and attributes the offshore oil and gas economic activity to a region based on these observations.

An alternative method apportions employment, wages and output in the oil and gas industry based on production of oil and gas onshore and offshore. Such data is reported by the U.S. Minerals Management Service of the Department of the Interior and by comparable agencies in the states. Such an apportionment makes intuitive sense, but would miss employment and related activity associated with exploratory activities (from which no production is currently being derived) and redevelopment activity in producing areas, when production may fall but employment may rise. Given the different meanings that can be attached to different methods of estimating activity in this sector, we find it most appropriate to develop alternative estimates in specific regional studies and permit readers to select.

The use of SIC codes for the industrial selection also entails some compromises. For example, marine construction is included in SIC 1629 (heavy construction) which also includes other types of heavy construction activity. Again, geographic location of establishments is used as the criterion for assigning activity to the ocean sector. In the revised industrial taxonomy provided by the North American Industrial Classification System, marine construction activity is broken out as two separate 6 digit industries, allowing much greater precision for this sector. NAICS will be used in data releases on employment and wages from the project for 2001 and later. NAICS will be used for estimates of GSP when BEA converts to a NAICS based GSP reporting, expected for the GSP data for 2002 to be released in 2004.

A somewhat similar problem occurs with search and navigation equipment. This industry produces primarily electronic equipment such as radar, sonar, geographic positioning systems, etc. These products all have applications in marine transportation (and increasingly in recreational boating) but also in aviation. No information exists to separate the applications to which the products of this industry may be put. All of the output is counted in marine transportation, which probably overstates the actual marine component of the output.

Another problem arises from the grouping of industries into sectors. Industries could be included in more than one ocean sector. The example of search and navigation equipment just discussed indicates that the products of the industry may be used both in marine transportation of goods and people as well as in recreational boating. We have assigned it to transportation since the largest dollar volume of marine related products is in the commercial side of the business.

Marinas are another example of possible sectoral confusion. Marinas are the home to both recreational boats and some commercial boats, primarily in the fishing industry.

However, the vast majority of boats in marinas are recreational boats and so this sector is assigned to tourism and recreation. Where data for the individual industries is available, users may adjust the sector totals to suit their preferences of sectoral definition.

The use of the SIC classification undoubtedly leaves out a number of industries that are directly related to the ocean. These include:

- Specialized services like boat designers
- Rental of homes as temporary lodging
- Sales in food stores to tourists
- Sales from miscellaneous retail outlets in tourism areas
- Ocean related production that does not take place in coastal states, for example of recreational boats and other recreational equipment.

These omissions can be addressed, at least in part, by using the national input/output tables to estimate total national direct and indirect economic activity based on the data estimated as described here. This is a future task in the project.

7. Conversion to the North American Industrial Classification System

One of the byproducts of the 1993 North American Free Trade Agreement (NAFTA) was the need to standardize the system of industrial classification used by the United States, Canada, and Mexico in order to implement some of the provisions of the agreement. This need arose just as the U.S. economy was undergoing a significant transformation as information technologies and other complex shifts in the services sector were transforming the economy in ways that could no longer be adequately captured by the Standard Industrial Classification (SIC) system, which, though revised many times (most recently in 1987), had been in use since the 1930s. Thus the North American Industrial Classification System (NAICS) was created.

NAICS began to be implemented in federal statistical programs with the 1997 Economic Census. Gradually all government statistics programs that are compiled on an industrial basis are being migrated to NAICS. Employment and wage data began to appear in this format in 2002; GSP data will be on a NAICS basis when that data is released for 2002 as well.

In order to accommodate the shift to NAICS, data compiled by the National Ocean Economics Project will shift to a NAICS basis beginning with the 2001 data.

- For 2001, establishment, employment and wage data will be produced in both an SIC and a NAICS series for each state and for the U.S. GSP data for 2001 will be calculated only on an SIC basis, since the Bureau of Economic Analysis released the 2001 data on an SIC basis only.

- For 2002 and beyond, all data will be released on a NAICS basis only.

The shift to the NAICS system will represent a significant shift in the basis of estimating the ocean economy. Releasing establishment, employment, and wage data on both bases for 2001 will allow users to see where the differences in the taxonomies affect the estimates of ocean-related economic activity.

NAICS: An Overview

There are a number of changes between the SIC and NAICS systems. For a complete discussion see Office of Management and Budget 1998 North American Industrial Classification 1997 Lanham, MD Bernan Press and North American Industrial Classification System 2002. The major changes made include:

- Shifting from a four-digit classification system to a six-digit classification, permitting a larger number of industries to be identified.

- The creation of new sectors, particularly in the services industry sectors, showing a much greater diversity of industries.

- With the additional industry codes created and the evolution of different types of economic activity, many SIC groups are now split into multiple NAICS groups resulting in less mixing of dissimilar activities.

- A shift in the basis upon which establishments are classified. Under the SIC, an establishment was classified in the code appropriate to what the firm produced. Under NAICS, the classification is based on what the establishment produces. For example, if a ship building firm had two establishments, a corporate headquarters and a ship yard located in two different towns, both would be classified as "ship building and repair" (3731) under the SIC code, but only the ship yard itself would be classified as "ship building and repair", while the corporate headquarters would be classified as a service industry establishment.

  This change primarily affects the manufacturing and the oil and gas exploration and production industries in the ocean economy, resulting in a significant reduction in the number of establishments in these sectors.

NAICS and Ocean Industries

Table 4 shows the ocean economy sectors and industries as defined by the National Ocean Economics Project along with the SIC codes and industries and the NAICS codes and industries for each ocean economy industry. Many of the ocean industries are essentially unchanged in classification between SIC and NAICS. The major changes in classification are:

1. SIC 2077 Animal and Marine Fats and Oils. Under NAICS, a separate code is created for animal fats and oils. Marine fats and oils are now incorporated in NAICS 311711, Canned and cured seafood.

2. SIC 5810 Eating and Drinking Places.   This sector is broken into 5 NAICS industries. Alcoholic beverage bars are excluded from the tourism and recreation ocean sector; all others are included.

3. SIC 7999 Amusement and Recreation Services Not Elsewhere Classified. This industry is divided into a number of NAICS industries. Those included in the ocean industry are shown in Table 4. Excluded are firms involved activities such as theater booking agents, dance studios, travel agents, ticket agents, etc.

4. SIC 4449 Water Transportation of Freight Not Elsewhere Classified and SIC 4489 Water Transportation of Passengers Not Elsewhere Classified.   These industries were reclassified as inland transportation of freight and inland transportation of passengers (not including the Great Lakes) and are not included in the ocean economy. SIC 4489 also included activities now included in NAICS 487210, scenic water tours.   This industry is included in the tourism and recreation sector.

5. SIC 4225, General Warehousing. This sector is now divided between commercial warehouses and mini-warehouses and storage facilities.   The former group is included in the ocean economy, the latter is excluded.

6. SIC 7011 Hotels and Lodging Places. Hotels that are parts of casinos are now a separate NAICS code. These are excluded from the ocean sector. Casinos that were owned and operated by Native American tribes were classified under the SIC system in local government, and were not included in SIC 7011.

Table 4 shows a national summary of ocean sectors and industries for 2001. The NAICS based estimates show total employment of 1.86 million SIC estimates of 2.2 million. The largest differences are in oil and gas exploration and production, ship and boat building, and hotels, for the reasons indicated above.

Table 4 Ocean Economy Measured by SIC and NAICS (2001)

Sector	Industry	Establishments		Employment		Wages ($Millions)	
		SIC	NAICS	SIC	NAICS	SIC	NAICS
Construction	Marine Related Construction	1,919	1,702	30,992	24,304	$1,421.9	$1,149.6
	Total	1,919	1,702	30,992	24,304	$1,421.9	$1,149.6
Living Resources	Fish Hatcheries & Aquaculture	601	658	4,756	5,044	$117.4	$123.1
	Fishing	2,304	2,290	6,175	5,779	$240.8	$221.2
	Seafood Processing	1,272	1,061	49,562	42,751	$1,396.2	$1,110.7
	Total	4,177	4,009	60,492	53,573	$1,754.5	$1,455.1
Minerals	Limestone, Sand & Gravel	280	276	4,883	4,744	$218.4	$212.4
	Oil & Gas Exploration and Production	6,124	941	106,957	19,749	$10,231.6	$1,399.9
	Total	6,404	1,217	111,839	24,493	$10,450.0	$1,612.4
Ship & Boat Building	Boat Building & Repair	2,954	1,303	51,886	43,284	$1,592.0	$1,329.5
	Ship Building & Repair	805	639	116,260	111,220	$5,395.8	$5,192.7
	Total	3,759	1,942	168,146	154,504	$6,987.8	$6,522.3
Tourism & Recreation	Amusement and Recreation services	6,578	4,747	114,175	44,399	$2,648.4	$874.8
	Boat Dealers	2,032	2,029	15,395	15,390	$498.9	$498.4
	Eating & Drinking Places	70,825	65,990	1,084,479	1,012,925	$14,824.7	$13,421.9
	Hotels & Lodging Places	10,599	10,520	353,472	299,624	$7,853.6	$6,240.7
	Marinas	1,947	1,944	13,944	13,869	$386.8	$385.4
	Recreational Vehicles Parks & Campsites	643	642	4,762	4,747	$84.7	$83.9
	Sporting Goods	402	417	8,472	8,363	$350.4	$342.0
	Zoos, Aquaria	163	162	7,914	8,194	$183.6	$262.1
	Scenic Tours		1,367		8,124	$0.0	$174.8
	Total	93,189	87,818	1,602,614	1,415,635	$26,831.1	$22,284.0
Transportation	Deep Sea Freight	935	625	33,756	20,313	$2,055.0	$1,348.3
	Marine Passenger Transportation	997	212	25,715	13,155	$886.5	$559.5
	Marine Transportation Services	3,638	3,205	95,005	91,217	$4,470.4	$4,235.8
	Search and Navigation Equipment	174	165	34,564	34,453	$2,869.8	$2,861.0
	Warehousing	3,259	1,410	45,738	34,709	$1,438.6	$1,137.9
	Total	9,003	5,617	234,778	193,847	$11,720.3	$10,142.6
Total Ocean Economy		118,451	102,305	2,208,861	1,866,355	$59,165.5	$43,165.9

NOTE: Excludes Massachusetts.

8. Geography

The geographic dimension of the ocean industry was implemented by using the zip code of the establishment. This required identifying all zip codes adjacent to the oceans and Great Lakes in the coastal zone counties defined by each state, which was accomplished based on analysis using geographic information systems. Arc Map® was used, combining zip code polygons from ESRI with Census boundary files from the Bureau of the Census.

Three addresses appear on the record of the ES-202 data. The zip code of the physical address of the establishment as recorded in the ES-202 data was used to determine location where available on the record. If not available, the zip code of the mailing address or unemployment insurance address was used, with preference to the mailing address. If no zip code was present on the record, the record was excluded. Less than 1% of records were thus excluded.

As with industries, the selection of geography involves some arbitrary choices. The identification of coastal zone counties was described above. The selection of zip codes is relatively straightforward in most of the coast, but the complex geography of the U.S. coast makes some selections difficult. This is particularly true with rivers, estuaries, and bays. The general approach used was to include the borders of all major bays (Long Island Sound, Chesapeake, Tampa, Galveston, San Francisco, and Puget Sound, and the Sacramento River Delta), but to limit the selection of zip codes up rivers, particularly in urban areas.

This results in some arbitrary selections in major urban areas. In New York City, Manhattan is excluded; only zip codes bordering the ocean in Brooklyn and Richmond counties are selected. The District of Columbia is excluded, as are New Orleans and Portland, Oregon. On the other hand, given its peninsular geography, virtually all of San Francisco is included. The estimates of total ocean-related activity are undoubtedly affected by these choices. However, until there is a generally accepted principle about how to define ocean-related geography for economic purposes, these choices represent a conservative approach to selecting the appropriate geography.

9. Special Note: Massachusetts

The one exception to the methodology described above was Massachusetts, whose state legislature prohibits, by statute, access by researchers to their establishment-level ES-202 data. In order to estimate Massachusetts' data, the publicly available ES-202 data from the Bureau of Labor Statistics was used. This permitted estimates to the two and in some cases three digit levels. Where four digit data was required, the Massachusetts estimates were derived by taking national ratios of four-digit to two-digit employment and wages.

Where zip code level data was required for the tourism and recreation industries, data from the Bureau of the Census Zip Code Business Patterns, which shows aggregate employment and wages by zip code, was used to estimate shares of employment and wages.

For major tourist counties, such as Dukes, Nantucket, and Barnstable, all of the tourism and recreation employment reported by BLS as defined above was included.

These estimating methods for Massachusetts probably result in an over-estimate of the ocean sector in that state since, in general, only 2-digit SIC industry data is available and the same level of geographic precision is not possible, though the size of that error is unknown

10. Ocean Economic Values in a National Income Accounting Framework

Previous measures of the ocean economy (for example, (Pontecorvo, Wilkinson et al. 1980; Pontecorvo 1988; Luger 1991)) have sought to measure the ocean economy as a proportion of the national economy. This is an important first step, but measurement of the ocean's contribution to the economy should go beyond simply measuring the share of the national economy to meet three criteria:

- Measures should be consistent across time and space and should sum to national, state, and regional measures of the economy.

- Measures must be able to show detail at the industrial level.

- Measures must be able to reflect the geographic character that defines ocean industries such as tourism and recreation, which is ocean related only when located in certain areas.

This section discusses the derivation of the measures used at the national level and their adaptation to the ocean economy.

The National Income and Product Accounts are the basic measure of the level of economic activity in the United States. These accounts have been developed to the values to ultimate consumers as the principal measure of value. This means distinguishing between final goods and services (those purchased by ultimate consumers) and intermediate goods and services. These latter are the inputs to the production process that creates final goods and services; their value is subsumed within the final market prices of goods sold at final demand. (Seskin and Parker 1998)

The total market value of goods and services can be measured each year as the Gross Domestic Product. This measure provides the sum of the value of goods and services measured at market prices to the final consumers. Three broad classes of final consumers are considered: households and businesses, government, and those in other countries. A fourth category, investment, counts the purchases of long-lived goods by households, businesses and government. GDP is thus defined as:

GDP= C + I + G + X

where:

GDP=Gross Domestic Product
C= Expenditures for personal consumption of goods and services
I= Net private investment
G= Government purchases of goods and services for both consumption and investment
X = Net Exports (Total Exports– Total Imports)

The measurement of GDP is also based on the equivalence between production and consumption. GDP is a measure of production (what the economy produces) but is measured as consumption (what is bought) in order to avoid the problem of double counting. If each sale of goods or services in the economy were simply summed, many values would be counted twice. For example, the sale of cod from the fishing boat to the processor to the restaurant constitutes three separate sales, but only the final sale to the consumer at the restaurant includes all the previous sales. It is this value that is counted in the GDP as the value of the ocean's output of fish for food.

Gross Domestic Product by Industry (Gross Product Originating)

Because the Gross Domestic Product is measured at the values paid by the final customers (whether of consumer or investment goods and services), it is not possible to identify the contribution of any particular industry to the nation's output of goods and services. To address this need, the BEA has developed a companion measure to the GDP, Gross Product Originating (GPO), which measures output by sector of production. This measure is also called "Gross Domestic Product by Industry". It is derived from the Gross Domestic Income data (Lum. and Moyer 1998) and is defined as:

$$ GPO = \sum_{i}^{n} S_i - \left(L_i + \sum_{i}^{n} I \right) $$

Where:
  S_i = sales by industry i
  L_i = labor inputs purchased by industry i
  I_i^n = intermediate inputs (goods and services) purchased from all other industries i to n.

As this definition indicates, GPO is the "value added" of each sector and thus is consistent with the GDP calculations.

Gross State Product

As noted, the GDP measure does not permit disaggregation by contribution, so the GPO figure was developed for this purpose. Similarly, the way GDP is defined and measured, it is not possible to disaggregate it by region since no regional measure of consumption is available. The regional counterpart to the GDP by industry is the gross state product, which is estimated by BEA for all states. GSP is equivalent to GDP, when

certain statistical discrepancies and adjustments are made. For regional data, BEA estimates gross product by industry only at the state level because detailed data required to construct these estimates is not available consistently at levels below the state.

Like the GDP, GSP is a measure of value added designed to avoid double counting of output. The GSP for each industry is defined as the sum of employee compensation (wages and salaries, employee contributions to social insurance, and other labor income), indirect business taxes and non-tax business liabilities, and property type income (including corporate profits, proprietors' income, rental income of persons, capital consumption allowances, net interest, business transfer payments, and the income of government enterprises less subsidies). (Panek and Obidoa 2003) GDP is equivalent to GSP, except:

- Government wages and salaries for personnel outside the United States are excluded from GSP.
- The sum of GSP is equal to GDI (gross domestic income)

- GSP and GDP are estimated and revised on different schedules by BEA. GDP is released and revised quarterly, generally about two quarters after the close of the subject quarter. GSP is released and revised once a year, about 18 months after the close of the year.

Since the goal of the NOEP estimates is to have data that is available at the national, state, and local levels, the GSP is the appropriate measure of output, since regional variations in output for each industry are best captured using this measure rather than the national estimates of gross product by industry. Gross state product allows differences in industries across states to be measured so that both state and national estimates can be made. For example, the transportation equipment industry is dominated by the automobile industry in some states (e.g. Michigan) and the ship building industry in other states (e.g. Maine). If firms in the transportation equipment industry were measured using a single national figure for the industry, automobiles would be overemphasized in Maine and underemphasized in Michigan. These differences are essential to correctly measuring the ocean economy.

Gross State Product for each industry in the ocean economy is estimated using equation 1, which states that an establishment's share of the state's GSP is based on the establishment's share of the appropriate industry GSP for that state. Wages as reported by the Bureau of Economic Analysis are multiplied by the GSP for that two digit industry, and then summed across all establishments in that industry.[1] This method assures that the sum of wages and GSP for the ocean sector is consistent with the total GSP for the state as reported by BEA.

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[1] The Standard Industrial Classification (SIC) system uses a four digit code to denote industries. Thus SIC 2092 is fresh and frozen seafood, with 2 denoting the manufacturing sector, 20 the food and kindred products industry, 209 the seafood industry, and 2092 fresh and frozen seafood.

$$GSP_r^i = \sum_{i=1}^{n} \left(\frac{W_e^i}{W_S^I} \right) GSP_S^I$$

Where:

GSP_r^i = the Gross State Product for industry i in region r

W_e^i = the wages for a given establishment in industry i

W_S^I = the total wages in industry i in state S (from BLS data)

GSP_S^I = the total gross state product for industry I in state S from BEA.

Disaggregation of GSP by wages represents the most practical method of developing specialized regional or industrial estimates of GSP, since the BLS data provides primary observations of wages. Wages and salaries are also a major component of GSP, which is calculated from employee compensation, indirect business taxes, and property income by industry. Employee compensation used by BEA in estimating GSP includes more than wages. It also includes benefits and self employment income. But wages comprise the vast bulk of employee compensation, so the disaggregation using wages is a reasonable, if an imperfect approach to estimating sub-state and detailed industry GSP.

Gross state product is reported by the Bureau of Economic Analysis for 63 industries which are generally consistent with the two-digit SIC level. Many of the industries in the ocean sectors are defined at the four digit level. This introduces some distortions into the results. For example, in the SIC codes, boat dealers are a subgroup of auto dealers, which are part of the retail industry. But the retail industry is not broken down in the BEA GSP figures, meaning that this methodology groups boat sales with all other retail industries, and thus understates the value of boat sales since boats are among the highest value items sold at retail. Possible future disaggregation of the GSP data for retail by the Bureau of Economic Analysis would address this issue.

An exception to the GSP being available at the two digit level is in the transportation equipment industry (SIC 37), where data is reported for the automobile industry and the "rest of transportation equipment". Boat and ship building would be included in the latter category, but so is aviation-related manufacturing. The GSP estimates for ship and boat building are computed as a share of the "rest of transportation equipment", but this may distort upward the GSP figures in regions such as Washington State where there is a much higher degree of aviation-related manufacturing than of boat and ship building in the "rest of transportation equipment" category. These distortions are embedded in the BEA GSP data and cannot be countered without further disaggregation of that data. This is an issue for future research.

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The use of this method for estimating GSP represents a departure from the "establishment level up" methodology that forms the basis of the estimates; the estimates of GSP are based on a disaggregation of higher level data to the establishment level. This disaggregated data is then reaggregated the appropriate industry and geography. An alternative methodology would have been to use the data from the Economic Census to derive GSP estimates for the specific firms and industries selected for this study using a process similar to that which the BEA uses in developing its own GSP estimates. However, the Bureau of the Census refused permission to use their data for this purpose, citing concerns about data disclosure.
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11. Strengths and Weaknesses of the NOEP methodology

The NOEP methodology was developed to overcome the limitations of other approaches to measuring the ocean economy, particularly the reliance on only disclosure-screened data and the lack of geographic specificity. This methodology met the objectives set out at the beginning of the discussion, and may also be considered to have the following strengths:

- Use of primary data. The use of the ES-202 data permits all estimates to be based on primary reporting data from almost all establishments in the U.S. The data is verified by both the state and U.S. Departments of Labor and is the basis for all employer-related government employment statistics in the United States.

- Consistency and comparability. The data is collected using consistent methodologies across all fifty states. It can be aggregated by industry and geography (although small area geographies do have limitations discussed below). The data is also consistent over time, at least until the implementation of the new North American Industrial Classification System in 2001, which created a break in the industrial data series.

- Estimates are derived from the bottom up. Employment and wage estimates are the sum of actual reported data and, except where limited by confidentiality restrictions, are the sum of firm-level reports.

- Using the zip code permits a much finer geographic level of detail than the county level at which employment data is normally released. This is especially important in states like California, where large urban counties such as in Southern California seriously distort the picture of ocean related activities measured at the county level only.

Weaknesses:
- At the same time, this data series does have some weaknesses: Zip code geography is imperfect. Zip codes change over time, and available GIS files on zip codes (from Environmental Systems Research Institute) do not always contain correct historical or recent revisions. The zip code data used here was for 1999. It matches very

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closely with 2000 data, but there may be unknown errors in the 1990 data since zip code information in GIS format was not available for that year.

- There are errors in the original employment reports. Firms make errors in reporting their SIC codes and may make errors in reporting addresses. For example, while required to give the physical location of each establishment, not every record contains this information. In such cases, alternative mailing addresses on the record were used. If no address was given, the record was omitted. These reporting errors introduce biases in the data of unknown directions and sizes which may be amplified in the fine-level geographic detail examined here.

- Industry definitions related to the ocean are imperfect. Some industries, such as those in SIC 44 (Water Transportation) are reasonably well related to the oceans. Others such as restaurants and hotels will always present problems in determining the degree to which they are related to the ocean.

- Still others, such as SIC 1629 (Heavy Construction) and SIC 3999 (Sporting Goods not elsewhere classified) do not separate a marine from a non-marine component. In these cases, the assumption is that the marine component (dredging and pier construction companies or surfboard manufacturers) are most likely located near the shore and so may be captured in a shore-adjacent zip code. But in both cases it is likely that other non-marine related firms may be located in a near shore zip code and thus over-counted in the data.

On balance, the strengths of the methodology outweigh the weaknesses, primarily because they meet the objectives for the data collection that were defined for the project. For the most part, the weaknesses are inherent to either the original data sources used or to the nature of any taxonomic process, or to data availability limitations that cannot easily be overcome.

12. Future Developments

The NOEP data on the ocean and coastal economy remains under development. In 2003-2004, the data on employment, wages, and GSP will be published for the years 2001 and 2002. Beginning with 2001, the data will be made available in the North American Industrial Classification System in addition to the Standard Industrial Classification. From 2002 on, data will only be provided in NAICS to be consistent with other government data series. This shift to NAICS will improve, but not eliminate, many of the issues discussed above with industry definitions since any industrial classification system contains aggregations that are suitable for some purposes and not others.

Improved estimating methods for some sectors will also be sought. The highest priority will be to seek improved estimates for the oil and gas sector, and means of refining the tourist and recreation data.

Comments on the NOEP methodology are welcome. Comments should be directed to the author at csc@usm.maine.edu and the Principal Investigator of the NOEP project at Judith_Kildow@csumb.edu.

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