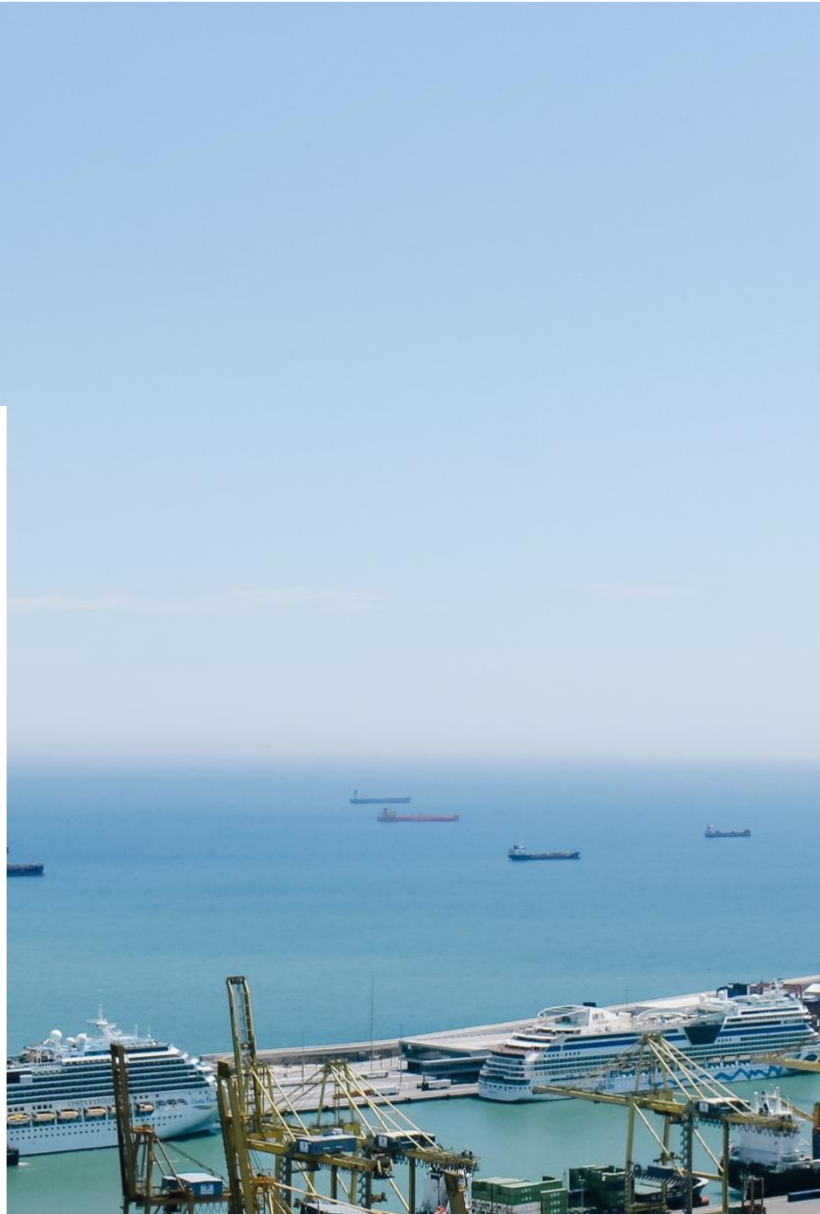
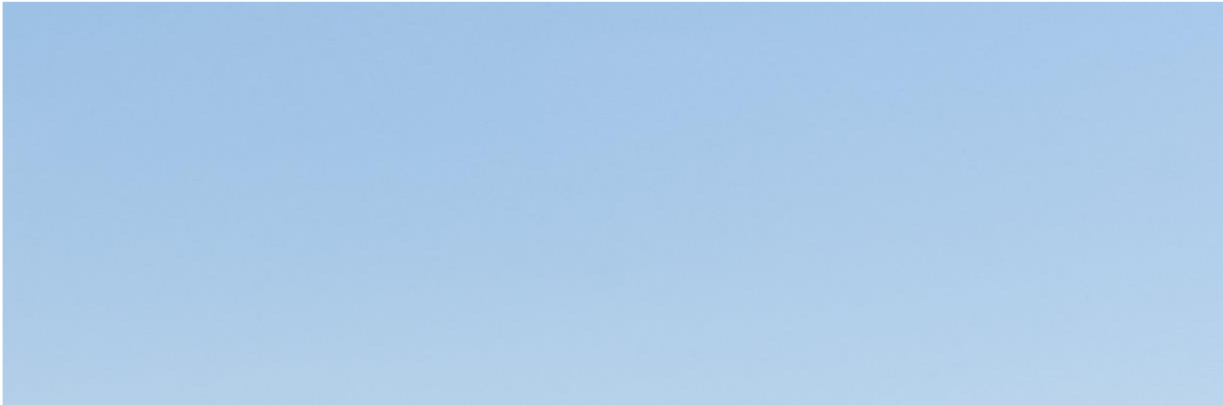




**Global Ocean
Accounts
Partnership**

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**A Guide to Creating Core Ocean GDP
Accounts**



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Introduction

Start with a simple question. What does the ocean contribute to the national economy? This might seem like a trivial question. After all, the contributions of other major natural resources such as agriculture or forest products are regularly counted as the output of farming, food, and fibre industries along with lumber and other forest products. But in most countries, there is no identifiable “ocean economy”. Industries like marine transportation or fishing are accounted for, but nothing that ties all the varied ocean-related economic activity together. Without a deliberate effort to identify and measure all relevant economic activity related to the ocean as part of a comprehensive account it is easy to miss industries like tourism and recreation or marine construction.

Combining data on ocean-related economic activities to provide an ongoing, comprehensive picture of how ocean and coastal resources that can be used for a variety of purposes is the task of creating what can be called core ocean accounts. This process is underway in many countries around the world, and many others are considering creating their own core ocean accounts or are asking whether it is worth doing so. This guidance document has been prepared to assist the latter countries decide whether and how to proceed with creating core ocean accounts. For those countries that have created accounts, it provides a review of methodologies that may improve future versions of their accounts. The guidance is designed for readers with little familiarity with economics but also contains practical information for specialists who may work such accounts.

Why are they called “core” ocean accounts? Ocean accounting is envisioned as a system of measurement that can show the complex interactions of physical, biological, social, and economic systems in ways that are consistent, understandable, and actionable. Full ocean accounts as envisioned by the Global Ocean Accounts Partnership (GOAP) will consider not only the value of labour and capital employed in directly producing goods and services associated with the ocean, but also the values of the ocean natural capital whose returns are not paid for in the transactions that make up what we usually think of as “the economy”. Ocean accounts can also include ways to measure the capacity of organizations to address the complex systems involved. Figure 1 provides a conceptual overview of the full ocean accounting system as envisioned, with the core accounts highlighted in red.

But at the core of all these “accounts” lie those goods and services whose production and sale must be understood first because they affect directly or indirectly all other values and because they are the aspects of ocean economic value. They are “core” to the ocean accounting process because they are necessary, though not sufficient. This does not mean that setting up ocean accounts must start with the national income-based accounts. For many reasons a country may choose to start the ocean accounting process with an environmental account for a particular region or resource, and other guidance for the creation of these accounts will be available from GOAP (www.oceanaccounts.org).

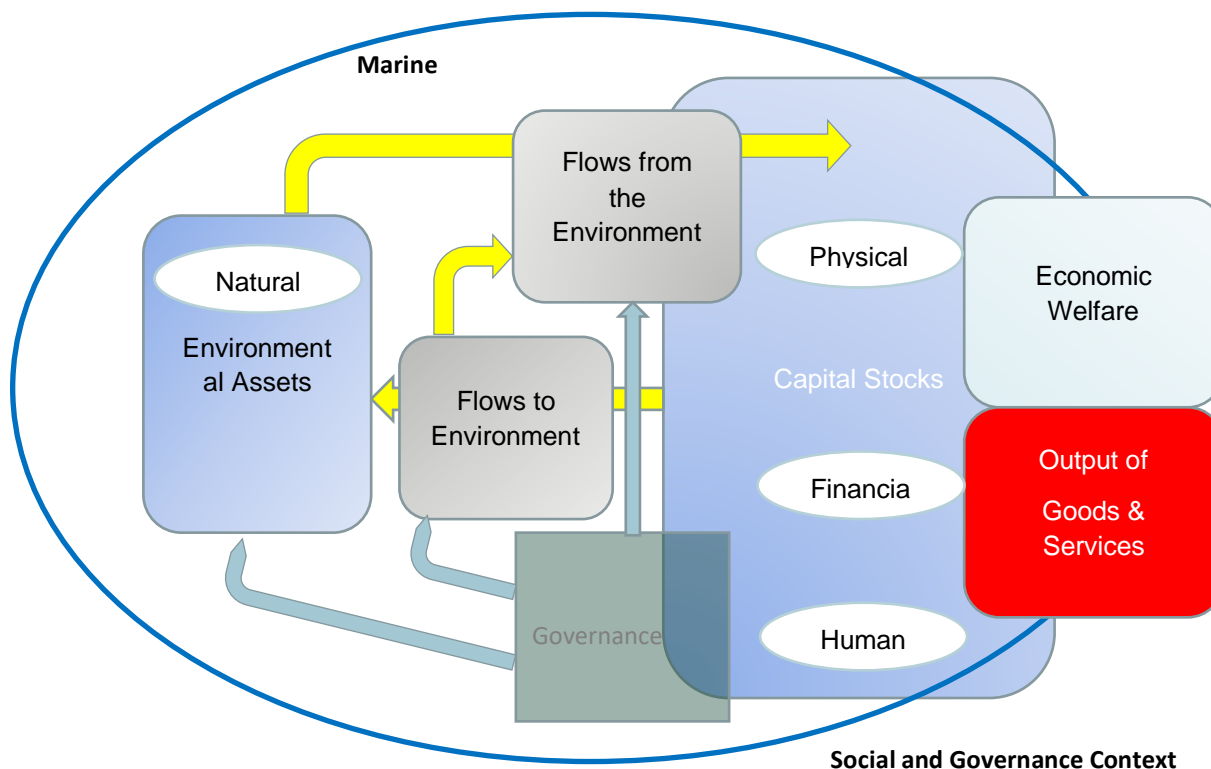


Figure 1. Full Ocean Accounts Conceptual Overview

Why undertake the creation of such accounts?

What important questions can ocean accounts answer that make the effort worthwhile? There are many questions, but four stand out:

Measuring Change

The most important information that ocean accounts provide is about change. The entire field of national income accounting, from which core ocean accounts are derived, was developed to measure changes in economic output so as to understand what is growing and what is not. This includes the direction of change and the pace of change. Knowing what in the economy is changing is essential to making policy in the public sector and to making investments in the private sector. Accounts that provide credible, consistent, and transparent measures of change are fundamental to all decisions affecting how people use the ocean. For this reason, ocean accounts must be considered as an ongoing commitment. Many studies have been done of national or regional ocean industries covering a single year and then left on the shelf, never to be updated. The most vital information from ocean accounts comes only from repeated updating, upgrading, and communicating.

Measuring Structure

The second major piece of information from the core accounts concerns the structure of the ocean economy. Structure means identifying the elements of the economy and their relative sizes as measured from different perspectives. Some industries are larger than others and have more impact on the overall economy. “Larger” might be that they have larger output, or they might have more employment, or they might be larger sources of income. Structure can be seen from the perspective of the national economy as a whole or it may be seen from the perspective of regions within the nation or the international position of the economy. An industry may be relatively small in employment but be an important player in some regions but not others or may be a key source of exports. Structure also



describes how the “ocean industries” are linked to related and supporting industries and organizations and thus have impacts on the economy far beyond their “headline” numbers.

Economic Impact

When questions are asked about the size or performance of specific industries they are often also interested in the total economic role of that industry, that is the industry itself and the related and supporting industries from which inputs are purchased and to which outputs may be sold (including final customers). This total economic role is also called the economic impact of an industry or sometimes the ‘multiplier effect’. Understanding this effect is particularly important when a change in the primary (called the direct) industry is being evaluated. Ocean accounts can help measure economic impacts, though the precision of the measurement varies with the way the accounts are constructed.

Communication

Another advantage in creating core accounts is that the output of these accounts are economic statistics with which people are already familiar for the most part, or which are variations on those statistics. All countries build their core ocean accounts from their national income accounts which are themselves built on the standards set in the U.N. System of National Accounts. (European Commission et al., 2009) Other parts of ocean accounts, such as those involving ecological resources, are built on economic concepts and measures that are unfamiliar to most people and are derived from many different measurement techniques. This use of familiar economic ideas like output and value also makes it much easier to place the ocean economy in the context of the larger national economy as the measurement of both is based on the same concepts and data. This means the output or employment of the fisheries or transportation sector can be directly compared to that of any other industry measured in the national accounts. This comparability will become more difficult as the ocean accounts broaden their coverage but at the core accounts stage comparability is largely a built-in feature.

Fours Steps in a Creating Core Ocean Account

Creating the ocean account has four basic stages:

1. **Planning** in which the basic parameters of the accounts are defined, including the geography that defines “ocean” for accounting purposes, the identification of the industries and groups of industries (sectors), and the choice of which economic measures will be included in the account.
2. **Disaggregating**, the process by which the proportion of economic activity is measured.
3. **Aggregating**, the summing up of the data identified in the first two phases. The choice of Type 1 or Type 2 accounts determines the specific actions in this phase. If a Type 2 account is chosen, the task of disaggregation becomes more complex.
4. A final phase is **documentation** of the process so that it can be continued, and the meaning of the account communicated to others

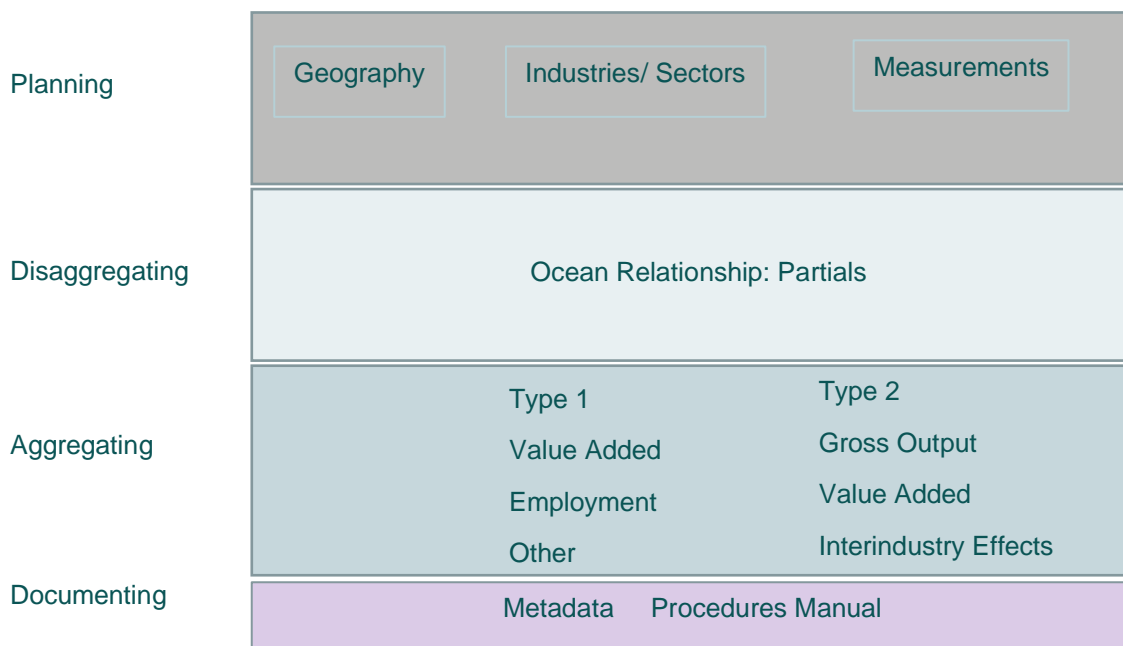


Figure 2. The Process of Creating Core Ocean Accounts

Planning

Ocean accounts start with exercises in definition that define the boundaries and contents of the accounts. This means defining a geography of the ocean that is relevant for economic purposes, deciding which industries and sectors are to be included in the accounts, and how those industries and sectors will be measured.

Geography: What is the Ocean?

The question of what the ocean is for the purpose of defining ocean economy accounts may seem to have so obvious an answer as to not require asking. But it is, in fact, a complicated question. There is a need to have both an inland boundary and a seaward boundary. In most cases the seaward boundary will be the 200-mile boundary of the Exclusive Economic Zone authorized by the U.N. (United Nations Convention on the Law of the Sea, 1982) The inland boundary, however, depends on the geography of the coast, which can be highly variable. The choice of the inland boundary is therefore both unique to each country and the product of a number of somewhat arbitrary choices including:

- How far **upriver** does the ocean economy reach? Many cities with important ocean economic activity in industries such as ports, marine transportation, and related services are located on rivers but at some distance from the “ocean”. Examples include London (once the largest ocean port in the world), Montreal, (Quebec, Canada) Portland (Oregon, US), and Dhaka (Bangladesh). In these countries the ocean economy would look very strange if it omitted the ocean transportation activity in each of these cities.
- **Bays, estuaries, and deltas.** The world’s coasts are highly irregular landforms, comprised of various forms of inlets, bays, estuaries, beaches, mountains, and many other types. The question of whether “ocean” includes major bays, estuaries, and deltas arises in many countries. Bays may be designated for open ocean spaces (the Bay of Bengal) or for areas surrounded by land (San Francisco Bay). The latter type of bay is often seen as distinct from the ocean. A somewhat similar issue arises with estuaries that form large scale deltas at the mouths of major rivers. Such deltas include those in Bangladesh, Viet Nam, Louisiana (US), and Egypt.



- **Distance inland from the shoreline** is a common metric for defining inland boundaries for some industries. But how far the inland boundary should extend so as to be sure of defining an ocean relationship- and excluding those with such a relationship- is rarely clear. Moreover, what is the shoreline boundary? Is the shoreline fixed at mean high tide, mean high tide, or mean low tide? And what will sea level rise do to any shoreline-based definition?
- **Coastal zones.** Many nations have coastal management programs that address issues of natural resource management in coastal areas. The geography of the coastal zones varies hugely. In the United States for example, the definition of coastal zones, which are defined and administered at the state level, can range in size from a zone a few hundred meters wide (California) to the entire state (Florida and Rhode Island). The inclination in defining the ocean economy is to make the area covered coterminous with the coastal zone so that the ocean account becomes part of the information for the coastal zone management program. But doing so can result in widely different estimations of economic activity in different parts of the country.
- **Large inland bodies of water.** There are many major bodies of water that are freshwater, but which are so large that they have many of the same industries as would be included in the ocean economy if located on salt water. Examples include the Great Lakes in the U.S. and Canada, Lake Victoria in Africa, the Caspian Sea and Lake Baikal in Russia. Inclusion of these bodies of water is a matter of judgment.

There are no inherently right or wrong choices in geography. Thus, decisions to include or exclude any areas as part of the ocean economy is a decision that must be made according to the needs and expectations in each country. There will be somewhat arbitrary geographies chosen as a result. For example, the United States includes all of the Great Lakes in its definition of the ocean economy region; Canada does not include the Great Lakes.

Ocean Industries and Sectors

Core ocean accounts are organized by industries, which may be grouped in sectors. Industries and sectors are organized based on taxonomies or organized hierarchies that denote groupings of economic activity of similar types. These taxonomies, or *standard industrial classifications*, are built by grouping organizations producing similar goods and services and are hierarchical in that they contain several levels of grouping, with those at the bottom of the hierarchy producing the most similar products and those at the top producing the least similar products but which can still be distinguished from other similarly defined goods and services. At the broadest level the hierarchies distinguish between primary goods (natural resource harvesting and mining), secondary goods (manufacturing) and tertiary goods (services).

The most widely used industrial taxonomy is the International Standard Industrial Classification (ISIC)¹ which is a companion standard to the U.N. System of National Accounts. The general outline of ISIC is shown in **Error! Reference source not found.**

ISIC is the most widely used industrial taxonomy, but there are others. The U.S., Canada, and Mexico use the North American Industrial Classification System² (NAICS). The European Union has its NACE system³ (*Nomenclature statistique des activités économiques dans la Communauté européenne*).

Australia and New Zealand have adopted their own version of a standard industrial classification.⁴

¹ <https://unstats.un.org/unsd/classifications/Econ/isisic>

² <https://www.census.gov/naics/>

³ [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_\(NACE\)](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_(NACE))

⁴ <https://www.qgso.qld.gov.au/about-statistics/statistical-standards-classifications/australian-new-zealand-standard-industrial-classification>



Several definitions of “ocean industry” have been proposed. One of the more commonly cited is from Park and Kildow (Park & Kildow, 2015) which identifies economic activity that takes place in the ocean, flows to the ocean or uses the ocean as an input. The OECD extends these concepts to define ocean economic activities as those that:

- Take place on or in the ocean
- Produce goods and services primarily for use on or in the ocean
- Extract non-living resources from the marine environment
- Harvest living resources from the marine environment
- Use living resources harvested from the marine environment as intermediate inputs
- Would likely not take place were they not located in proximity to the ocean
- Gain a particular advantage by being located in proximity to the ocean (OECD, 2020)

Table 1 Major groups in international standard industrial classification (ISIC)

Group Designation	Group
A	Agriculture, forestry, and fishing
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam, and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific, and technical activities
N	Administrative and support service activities
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities



R	Arts, entertainment, and recreation
S	Other service activities
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
U	Activities of extraterritorial organisations and bodies

These definitions leave a lot of latitude when overlaid on industrial taxonomies. There are some industries that are obviously appropriate for inclusion such as fisheries and marine transportation. But there are many other industries that are plausible for inclusion. A review of thirty-five different ocean account definitions used by nations and international organizations shows over 50 possible industries for inclusion (**Error! Reference source not found.**).

The major sectors based on the number of mentions in Table 1 are:

- Living Resources
- Minerals, including oil and gas
- Marine Construction
- Tourism & Recreation
- Ship & Boat Building and Repair
- Tourism & Recreation
- Energy (Electric)
- Marine Research & Education
- Government
- Marine Services

Table 2. Survey of ocean economy industries and percent of ocean accounts including industry

Sector	Industry	%	Sector	Industry	%	Sector	Industry	%
Living Resources	Commercial Fishing	96%	Living Resources	Seafood processing	32%	Misc. Inputs	Marine Chemical Industry	8%
Minerals	Offshore Oil and Gas	92%	Seawater	Seawater Utilization Industry	32%	Marine Services	Marine social and international organizations	8%
Tourism & Recreation	Coastal Tourism	92%	Marine Services	Ocean-related Services	32%	Marine Services	Marine/Environmental Consulting	8%
Transportation	Marine Transportation	92%	Misc. Inputs	Marine equipment	32%	Misc. Inputs	Ocean-related materials	8%
Ship & Boat	Shipbuilding Industry	84%	Seawater	Marine Salt Industry	28%	Minerals	Seabed Mining	4%
Marine Services	Marine Engineering	84%	Marine Services	Marine Geologic Exploration	24%	Minerals	Refineries	4%
Research & Education	Marine science research	80%	Other	Marine Agriculture,	20%	Minerals	LPG Processing	4%



Sector	Industry	%	Sector	Industry	%	Sector	Industry	%
				Forestry Industry				
Minerals	Ocean Mining Industry	76%	Construction	Marine Construction	16%	Ship & Boat	Boat Building	4%
Government	Marine Management/ Pub Admin/Defense	76%	Minerals	Extraction of Aggregates	12%	Tourism & Recreation	Recreational Fishing	4%
Living Resources	Aquaculture	72%	Tourism & Recreation	Cruise Tourism	12%	Transportation	Transport Services	4%
Energy	Marine Electric Power Industry	72%	Marine Trade	Marine Wholesale and Retail Industry	12%	Biotech	Biotechnology	4%
Government	Marine environmental protection	60%	Transportation	Ports	12%	Govt	Government	4%
Biotech	Marine Biomedicine Industry	56%	Living Resources	Seafood Supply	8%	Marine Services	Waste Management Services	4%
Government	Marine Environment Monitoring and Prediction	52%	Minerals	Petroleum Oriented Supply Industry	8%	Marine Services	Surveying and Mapping	4%
Research & Education	Marine Education	52%	Marine Equipment	Marine Equipment Retailing	8%	Energy	Renewable Energy	1%
Marine Services	Marine insurance	40%	Transportation	Ports	8%	Misc. Inputs	Cordage	1%
Marine Services	Marine technology services	40%	Transportation	Search and Navigation Equipment	8%			
Marine Services	Marine Information Services	36%						

Source: (Colgan, 2018)

Error! Reference source not found. shows ocean economy definitions based on a sample of definitions and is designed to distinguish between the more common and less common approaches as well as to illustrate the variety of terms used. Appendix A provides a more complete listing of industries and related products, together with their ISIC and CPC codes. This list is proposed by OECD (2020) as a list of candidate industries from which ocean accounts may be constructed. The list is meant to be universally applicable without modification for local circumstances.



Error! Reference source not found. shows how terminology can shape the core ocean account. Many of the terms in **Error! Reference source not found.** may cover the same activity. “Marine Commercial Fishing” and “Seafood Supply” are examples. Others are extremely broad: “Marine wholesale and retail”. Still others are different levels of specificity: “Marine Related Services” and “Marine Environmental Services”. These definitions may be partly a function of the industrial taxonomy used, though as the discussion below will point out, most of the industry definitions in taxonomies do not clearly identify ocean/marine related activity. For many industries there is a choice about what to call them. This will depend on which industries are present in a country, but also on how industries perceive themselves. Marine insurance may be the principal line of business for insurance companies, or it may be one among many lines of business.

The industries most commonly included in ocean economy accounts noted above are generally those with the clearest relationship to the ocean. But there are also many industries in **Error! Reference source not found.** like “marine equipment” and “search and navigation equipment” that are clearly inputs to the production of the more directly ocean related industries identified above. Some inputs may be included in the ocean accounts, but the question is which to explicitly to include and which to leave out of the industries reported as being part of the ocean account. The answer is to be found in the type of ocean account to be constructed.

Measurement

Account type

There are two types of core or national-income based ocean accounts:

- Type 1 accounts are comprised primarily of value-added data for industries selected as discussed above, accompanied by related data such as employment.
- Type 2, or satellite⁵ accounts, are more completely integrated with the national income accounts. These accounts are built from more detailed product data as well as industry data, better account for inter-industry relationships through input-output tables and use of more detailed price adjustments that more accurately track changes in production over time.

As noted, an important distinction between the two types of accounts is how they handle final and intermediate goods. Both final and intermediate goods are included in the various definitions of ocean economies noted above. For example, ships are an intermediate good to the marine transportation industry and boats are an intermediate good to the fishing industry. But boats may also be a final good to the recreational boating market or to the marine passenger transportation industry in the form of ferry boats.

In a Type 1 account, the value added of each selected “ocean industry” is selected from the national income data and each industry is reported separately. Value added (described below) is used because it avoids double counting of the output of industries. In this approach intermediate goods and final goods are shown together in the accounts without necessarily acknowledging the inter-industry relationships between boats and other industries.

Type 2 accounts are built from input-output tables that measure all inter-industry relationships at both the product and industry level and thus provides a much more complete picture of the ocean economy’s effects on the total national economy. In a Type 1 account only those input industries designated for inclusion in the account are shown. In a Type 2 account the input of all industries to the ocean industry are measured through the input-output structure of the economy. This expands the economic impact measured in the account to include the entire economy. It also permits two different

⁵ The term “satellite account” is applied to both types 1 and 2 accounts but it is more accurately used with Type 2 accounts which are more fully integrated with the complete set of national accounts.



perspectives on ocean related economic activities, one those with a direct ocean relationship (which might be termed “economic activities”) and those which affect all industries.

Including both final and intermediate goods in the definition requires a strict use of value added as the principal measure of the ocean economy. Value added is the only measure that avoids double counting because only the marginal addition at each stage of production is included. If gross output (total sales by industries) is to be used, the totals must be adjusted to avoid double by counting by using and input/output table of the economy that tracks all the inputs to goods and services per unit of output.

The two types of ocean accounts are illustrated using the United States in Table 2. The Type 1 Account, known as the Economics National Ocean Watch (ENOW) ocean economy has 6 sectors and 21 industries. The industries were comprised of single and multiple industries as defined by the industrial taxonomy. The Type 2 account, called the Marine Economy Satellite Account, is shown in two formats. The first are “marine economy activities”, which are those industries most closely tied to the ocean. These were calculated using ocean shares applied to the products that are produced by these industries. (See below for a discussion of ocean shares, or partials.). Using the national input/output tables, the total value added of ocean related economic activity is then calculated for all industries for which GDP is measured. The Type 2 account has considerably more detail than the Type 1 account. However, the Type 1 account (ENOW) is also available at the regional level, while the Type 2 account is currently only available at the national level⁶.

Table 3. Value added in Type 1 and 2 Ocean Economy Accounts for the United States 2019 millions of USD

Type 1 Account- ENOW		Type 2 Account-MESA			
Ocean Economy Industry		Marine Economy Activity		Standard Industrial Classification (NAICS)	
Total Ocean Economy	\$351,225	Total Marine Economy	\$385,051	All Industries	\$385,051
Marine Related Construction	\$8,026	Living resources, marine	\$12,028	Private industries	\$273,552
Living Resources	\$11,427	Commercial harvest, seafood markets, and processing	\$10,899	Agriculture, forestry, fishing, and hunting	\$5,144
Fish Hatcheries & Aquaculture	\$1,016	Commercial harvest and seafood markets	\$7,744	Farms	\$392
Fishing	\$1,495	Seafood processing	\$3,294	Forestry, fishing, and related activities	\$4,755
Seafood Markets	\$4,851	Fish-based animal foods	\$90	Mining	\$69,928
Seafood Processing	\$4,064	Pharmaceuticals, marine-based	\$1,036	Oil and gas extraction	\$59,651
Minerals	\$89,503	Construction, coastal and marine	\$3,694	Mining, except oil and gas	\$824

⁶ Details on the industries included in the ENOW data are contained in the User Guide available at https://oceanomics.org/Download/Market_Guide.asp For information on the Marine Economy Satellite.



Type 1 Account- ENOW		Type 2 Account-MESA			
Ocean Economy Industry		Marine Economy Activity		Standard Industrial Classification (NAICS)	
Limestone, Sand & Gravel	\$1,713	Conservation	\$2,343	Support activities for mining	\$13,279
Oil & Gas Exploration and Production	\$87,789	Dredging	\$127	Utilities	\$6,074
Ship & Boat Building	\$22,059	Recreation facilities	\$1,221	Construction	\$3,240
Boat Building & Repair	\$4,218	Research and education, marine	\$6,613	Manufacturing	\$28,993
Ship Building & Repair	\$17,841	Scientific research	\$4,493	Durable goods	\$15,821
Tourism & Recreation	\$150,710	National defense R&D	\$110	Wood products	\$4
Amusement and Recreation Services NEC	\$4,613	Federal nondefense R&D	\$1,230	Nonmetallic mineral products	\$36
Boat Dealers	\$1,646	State and local R&D	\$1,659	Primary metals	\$1
Eating & Drinking Places	\$88,759	Nonacademic R&D	\$1,493	Fabricated metal products	\$56
Hotels & Lodging Places	\$49,960	Educational programs and courses	\$1,959	Machinery	\$2,289
Marinas	\$1,745	Vocational training	\$140	Computer and electronic products	\$276
Recreational Vehicle Parks & Campsites	\$566	Laboratories	\$48	Electrical equipment, appliances, and components	\$145
Scenic Water Tours	\$683	Transportation and warehousing, marine	\$21,268	Motor vehicles, bodies and trailers, and parts	\$90
Sporting Goods Retailers	\$666	Freight transportation	\$12,710	Other transportation equipment	\$12,665
Zoos, Aquaria	\$2,071	Passenger transportation	\$6,610	Furniture and related products	\$7
Transportation	\$69,500	Warehousing and storage	\$2,068	Miscellaneous manufacturing	\$322
Deep Sea Freight Transportation	\$5,548	Professional and technical services, marine	\$2,979	Nondurable goods	\$13,062
Marine Passenger Transportation	\$4,376	Minerals, offshore	\$78,028	Food and beverage and tobacco products	\$1,240



Type 1 Account- ENOW		Type 2 Account-MESA			
Ocean Economy Industry		Marine Economy Activity		Standard Industrial Classification (NAICS)	
Marine Transportation Services	\$11,896	Oil and gas	\$76,296	Textile mills and textile product mills	\$89
Search and Navigation Equipment	\$27,186	Sand and gravel	\$1,439	Apparel and leather and allied products	\$437
Warehousing	\$20,493	Support services	\$236	Paper products	\$0
		Utilities, coastal	\$7,690	Printing and related support activities	\$1
		Traditional power generation	\$7,690	Petroleum and coal products	\$11,456
		Ship and boat building, nonrecreational	\$12,906	Chemical products	\$595
		Ship building ¹	\$11,850	Plastics and rubber products	\$34
		Barges and other nonpropelled ships	\$63	Wholesale trade	\$13,575
		Military ships	\$11,551	Retail trade	\$20,254
		Other ships	\$255	Motor vehicle and parts dealers	\$2,697
		Boat building ²	\$1,125	Food and beverage stores	\$2,190
		Fishing boats	\$69	General merchandise stores	\$3,142
		Tugboats and towboats	\$166	Other retail	\$12,249
		Outboard motorboats	\$89	Transportation and warehousing	\$31,439
		Inboard motorboats	\$327	Air transportation	\$4,163
		Other boats	\$475	Rail transportation	\$418
		Tourism and recreation, coastal and offshore	\$132,984	Water transportation	\$9,733
		Guided tours	\$5,995	Truck transportation	\$2,934
		Water guided tours	\$3,472	Transit and ground passenger transportation	\$639
		Other scenic tours	\$2,522	Pipeline transportation	\$3,283
		Recreational fishing, offshore	\$3,740	Other transportation and support activities	\$9,012



Type 1 Account- ENOW		Type 2 Account-MESA			
Ocean Economy Industry		Marine Economy Activity		Standard Industrial Classification (NAICS)	
		Boating and paddling, offshore	\$21,121	Warehousing and storage	\$1,511
		Sailing	\$994	Information	\$478
		Motorboating	\$13,387	Publishing industries, except internet (includes software)	\$144
		Canoeing	\$88	Motion picture and sound recording industries	\$17
		Kayaking	\$57	Broadcasting and telecommunications	\$114
		Other boating and paddling ³	\$6,602	Data processing, internet publishing, and other information services	\$209
		Other water activities ⁴	\$782	Finance, insurance, real estate, rental, and leasing	\$50,873
		Other coastal recreation	\$15,810	Finance and insurance	\$3,122
		Maritime museums and cultural institutions	\$685	Federal Reserve banks, credit intermediation, and related activities	\$50
		Beachgoing	\$94	Securities, commodity contracts, and investments	\$0
		Amusement parks	\$1,391	Insurance carriers and related activities	\$3,072
		Hiking and camping	\$577	Funds, trusts, and other financial vehicles	\$0
		RVing	\$4,796	Real estate and rental and leasing	\$47,688
		Photography	\$339	Real estate	\$46,042
		Other general expenses	\$7,893	Housing	\$46,040
		Trips and travel, coastal	\$85,619	Other real estate	\$2



Type 1 Account- ENOW		Type 2 Account-MESA			
Ocean Economy Industry		Marine Economy Activity		Standard Industrial Classification (NAICS)	
		Eating and drinking places	\$10,900	Rental and leasing services and lessors of intangible assets	\$1,815
		Hotel and lodging places	\$59,135	Professional and business services	\$4,876
		Travel arrangement services	\$1,657	Professional, scientific, and technical services	\$1,809
		Transportation services	\$14,043	Legal services	\$443
		National defense and public administration	\$104,233	Computer systems design and related services	\$103
		National defense and coast guard	\$97,343	Miscellaneous professional, scientific, and technical services	\$1,266
		Federal public administration	\$6,492	Management of companies and enterprises	\$40
		State and local public administration	\$407	Administrative and waste management services	\$3,025
		Administrative and support services	\$3,019	Accommodation and food services	\$23,983
		Waste management and remediation services	\$11	Accommodation	\$14,435
		Educational services, health care, and social assistance	\$1,998	Food services and drinking places	\$9,550
		Educational services	\$1,854	Other services, except government	\$2,525
		Health care and social assistance	\$145	Government	\$112,023
		Ambulatory health care services	\$68	Federal	\$105,137
		Hospitals	\$67	General government	\$105,080
		Nursing and residential care facilities	\$7	National defense	\$95,168
		Social assistance	\$6	Nondefense	\$9,926
		Arts, entertainment, recreation,	\$31,752	Government enterprises	\$56



Type 1 Account- ENOW		Type 2 Account-MESA			
Ocean Economy Industry		Marine Economy Activity		Standard Industrial Classification (NAICS)	
		accommodation, and food services			
		Arts, entertainment, and recreation	\$7,767	State and local	\$6,867
		Performing arts, spectator sports, museums, and related activities	\$719	General government	\$3,778
		Amusements, gambling, and recreation industries	\$7,049	Government enterprises	\$3,114

Source: See footnote 6.

Measurement Concept

The choice of which measures to include in the ocean accounts depends on several factors. In general, some version of output will be included as this is the most basic component in the System of National Accounts. Employment is usually of concern to policy makers and so it is often included. Other measured may be included in the ocean accounts as a matter of choice.

Gross output is also known as *Gross Domestic Product*. This is the total value of all goods and services within the country⁷. There are two ways to calculate this value.

The first is to measure the value at the point of final sale or “*final demand*”. Final demand falls into four categories: purchases by households for consumption, purchases for investment, purchases by the government, and sales to from other countries minus purchases from other countries. The traditional formulation is Consumption + Investment + Government + net eXports. (C+I+G+X). Put another way, gross output equals what we buy from within the country less what we buy from outside the country. This is the most comprehensive measure of the economy, or at least that part of the economy determined by market-based transactions.

But the final demand approach has a disadvantage particularly for the estimation of ocean accounts, which are primarily interested in the outputs of specific industries. The final demand method does not identify the contributions of industries to the gross domestic product, only the final value. To see the economy from the perspective of producers rather than the consumers requires use of the value-added method. Value added is built on the concept of a supply chain which starts with primary production and then traces a good or service at each stage of its transformation from lower valued products to higher valued products.

Figure 3 explains the concept of value added using the fishing industry. The various stages from inputs to the fishing vessels, landings (the gross output of the harvesting sector) to the final sales to customers are shown. The three stages in boxes show the harvesting sector, the processing sector, and the fish markets/restaurants sector that are normally included within the national income accounts

⁷ “Gross Domestic Product” (GDP) and “Gross National Product” (GNP) are both used, but there is a difference. A simple explanation of the difference is the “Gross Domestic Product” is the output of goods and services produced within the borders of a country and “Gross National Product” is the output of goods and services by citizens (including businesses) of a country. “Gross National Product” thus includes production in other countries usually by companies owned within the country doing the accounting. There are some instances where this would be the appropriate measure, but in most countries, it is production within the country (GDP) that is appropriate to the ocean economy.



as the output of the harvesting, processing, and final demand sectors. Figure 3 also shows that there are other steps in the value chain that are measured in the accounts, but which are only partly related to fisheries. The share of the output of the fuel, fishing gear, bait, ice, transportation, and distribution industries (called a “partial” in some countries) is considered an indirect part of the fishing industry. The partial is best measured in the supply/use tables of the national input/output tables, which measure the portion of the amount supplied by one industry that is used by another industry.

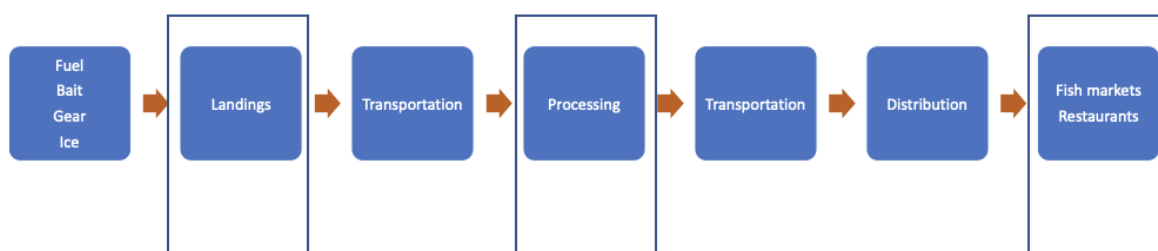


Figure 3. Value added in the seafood sector

GDP measured as final demand for goods and services must equal the GDP as the sum of all value added (adjusting both for imports). That is, what a country consumes equals what a country produces. The sum of value added of those industries designated as ocean-related equals the total ocean product of the country. In addition to being built on the contributions of each industry to the national economy measured as value added, this approach has the additional advantage of being the appropriate measure of *gross regional output* when data is aggregated by a selected region such as a province or state. Value added is associated with specific producers in specific locations and the location-based data can be summed to regional as well as national totals.

Exports and imports are an essential part of the national income accounts as the previous discussion indicates. Net exports are essential to calculate the final results of GDP on a demand basis, but exports are only included in the value-added measure because imports are added value in other countries. Exports are optionally included in ocean accounts built on value added data. Exports of ocean products and services may be an important part of a nation’s means of earning foreign exchange used to purchase imports that are essential to other parts of the economy.

An observer will have noted that the above discussion defining the basic measures of what is produced in an economy referred to the National Income Accounts. “*Income*” in this context is based on the fundamental principle of national income accounting which is that gross domestic income equals gross domestic output. What we earn is what we produce. But “income” has other important meanings, one of which is *income* to businesses and the other income to households.

Income to businesses, or profits, are measured as the difference between gross sales and the costs of all inputs including labour. Income to labour (*wages and salaries*) is a vital measure for assessing the role of ocean economies in meeting employment and distributional goals. Wages and salaries are the most well-known part of labour income but in many countries wages and salaries are supplemented with various employer-paid benefits that are part of total labour compensation, which is the most accurate measure of labour income. However, wages and salaries are most commonly used as these are most often reported by employers.

Employment is the most important measure of economic activity, but one which is measured outside the National Income Accounts framework. Employment is a multi-faceted concept, each of which is valuable perspective for ocean accounts. But because it has many different definitions it is important



to be aware of each so that the employment data in the ocean accounts can be interpreted properly. Key types of employment are:

- *Self-employment* is particularly important in many industries related to the oceans, most notably fish harvesting. It is also one of the most difficult to measure
- *Part time employment* means employment that is regular but less than some specified number of hours per week, generally 35 hours
- *Part year (seasonal) employment*. In many industries, employees are hired for only part of the year. This is common of employment in tourism and recreation industries and can also be a type of employment in fisheries.

Jobs reported by employers are not necessarily the same as *jobs reported by employees*. Jobs reported by employers are the most commonly used in ocean accounts, but the number of jobs may be more than those reported employers when based on measuring by employee since people may hold more than one job. In fact, individuals can combine different types of employment, working for an employer part year or part time and also holding a self-employment job.

Each of the types of employment noted above is estimated from data collected specifically on employment, generally either surveys of employers or employees or the use of administrative data for programs such as unemployment insurance. Employment can also be estimated from income (compensation) data by dividing wages and salary totals through by some estimate of the number of hours per year (for example 1820 hours per year for 35 hours per week).

Establishments are places of employment. This is a measure of the location of economic activity and is useful for ocean accounting elements which may be defined by their location. Establishments are not the same as “businesses”, which are units of ownership. One business may own many establishments.

Adjusting for price changes

The most important reason to prepare ocean accounts is to measure change in the economic activity related to the ocean. But change in activity is in fact a complex mixture of forces. On the one hand are changes in the volumes of physical outputs. Examples include more fish caught, more tourists at the beach, for cargo moved through the ports, or the number of dredging projects undertaken in a year. But for core accounts purposes, it is the monetary value of the physical changes that are of interest and these values may change for two reasons. One is that the per unit value of a good or service may change. More valuable goods are carried in the marine transportation system, or fish that can be sold at higher prices in restaurants increase in value. But it is important to distinguish between increases in monetary values driven by product-related price changes and system-wide changes in prices known as inflation (increasing prices) and deflation (falling prices). Without adjusting for these system-wide price changes, it would be easy to interpret an increase in the value of output as a change in the value of the goods and services. Put another way, without an adjustment for inflation (or, less often, deflation), increases in value added could be nothing more than increases to accommodate the economy-wide price changes. The real change in value for an ocean industry would be hidden.

Adjusting values at two different periods to separate pure price changes from changes in the volume of output requires the use of an index, which is essentially a ratio of prices and quantities in one period to the prices and quantities in another period. The challenge is that there are many different prices in the economy. Prices for the same commodity will be different at the producer, wholesale, and retail levels so three different price indexes are needed for each product. There are different prices for imports and exports. There are price changes that can be averaged across industries, sectors, or the whole economy.



Adjustments for prices will generally be done differently in the two types of ocean accounts. In a Type 1 account, prices can be adjusted, or real (inflation-adjusted) estimates created using a broad measure of inflation such as the broadest measure of prices, usually the producer price index. If the national income accounts produce both nominal (unadjusted) and real (adjusted) estimates of value added, then both estimates can be used for the Type 1 account. In a Type 2 account, more detailed price indexes are needed because these are built from the product level. Price indexes are described in detail in the System of National Accounts. (European Commission et al., 2009)

Disaggregating

The ocean industries listed in Appendix A are accompanied by the industry definitions from the three-digit ISIC. Looking at the terms used in the coding schemes, it is clear that only a few of the products or industries are defined so that a clear relationship to the ocean can be identified. For the vast majority, the industry definition bears no relationship to the ocean, even though some firms are ocean related by one or more of the definitions above. The next step therefore is to measure the proportion of output that is ocean related according to one or more of the criteria noted above. A proportion of 0 would exclude an industry or product from further consideration. A proportion of 1 would include all the output. The proportions will vary from country to country because of the geography selected and because of the structure of the ocean economy in each country.

The proportion of output that is ocean related is known as a “partial”. There are three broad approaches. Conduct a survey of firms and ask respondents what part of their output ocean is related, infer the partial from other data, or estimate the partial based on expert judgment.

1. Measurement by Survey

The most accurate way to measure the ocean relationship is to simply ask those in the identified industries what portion of their output is ocean related. This is done if data is collected through a survey. Surveys may be specifically designed to identify the ocean component of the economy on a regular basis as is done in China. Or regular surveys of firms and organizations that provide the information needed for the national income accounts may be modified to include appropriate questions identifying the ocean relationship. The survey method is likely the most accurate way of identifying the proportion of output that is ocean relationship provided appropriate survey methods are used.

However, the survey method can be expensive to use when issues of sample design survey administration, data analysis, and data management are considered.

2. Inference from Other Data

The second approach is to identify a proxy measure for the ocean relationship or partial. Geography is a form of identifying ocean relationship by inference. Some industries are more likely to be ocean related if establishments are located on the coast or near the ocean. This is the case with many establishments in tourism and recreation and with facilities in the electric power industry that rely on ocean connections for fuel supply and cooling water. It may also be the case with warehousing, often co-located with ports.

Defining ocean relationship by geography requires that economic data have a geographic locator attached to the records. Ideally this is a locator field that is as precisely defined as possible. In some government data, establishments are coded by latitude and longitude permitting precise location. Latitude/longitude locations will require some arbitrary choices about how far from the shoreline qualifies as “coastal” for this purpose. If a value added tax is used, tax receipt data from individual establishments might be used as a geography indicator. Postal codes or addresses have also been used. Street address data can be used in place of latitude and longitude. Modern Geographic Information Systems (GIS) have the capability to locate street addresses and determine locations relative to the shoreline or to some other ocean-related establishment. Most economic data is coded



at least by state/province or some subnational political boundary. The larger the geographic area included the larger will be the economic value but the more tenuous will be the ocean connection.

Where location is not an appropriate or consistent indicator partials may be built from other data sets. Examples from the U.S. include:

- The volume of oil and gas produced from offshore wells as a proportion of total oil and gas produced in the country. (Ocean oil and gas production)
- Permits issued for offshore drilling as a proportion of total permits issues. (Oil and gas exploration)
- The sum of the tonnages of goods imported and exported through water transportation by the U.S. total tonnage of goods transported by all means (Warehousing)
- Sails. The ocean portion of these items is estimated by dividing the boat registration and registrants located in coastal states by the U.S. total for all registrations, weighted by the doubled costs for larger, more expensive, and more sails used in ocean sail boats.
- Sum of ocean-going barges registration in the U.S. total for all the registrations of barges (non-motorized ships).

As the above examples indicate, partials other than geography require rather extensive other data systems that reflect in some way an ocean partial. It also greatly assisted by a level of creating thinking in how to use other data systems.

3. Expert Review

There will almost certainly be situations in which a survey is not available and there is insufficient other data to impute a partial. In this case it will be necessary to use either “best professional judgment” of those who are responsible for the specific industry or the collective judgments of a number of experts. Best professional judgment is an acceptable method if it is intended as a starting point for refinement in future editions of the ocean accounts. But it is better to use the collective judgment of a number of experts. This can best be done through a technique called the Delphi process.

This process was developed in the 1960s as a way at arriving at quantitative answers to questions for which no data is available. The process is simple. A group of “experts” is identified, and each is provided with a range of high and low estimates for the value being sought. Each expert is then asked to provide their own estimate of the high and low possibilities of the value. The responses of each of the experts are then analysed and the results sent back to the experts. This process goes on until an estimate that represents consensus is reached. Consensus does not mean everyone agrees; it only means that the estimate is one to which no one disagrees. (Everyone can live with that estimate.)

The analysis can take several forms. Responses can be averaged, with or without the highest and lowest extremes. The lowest high estimate and the highest low estimate can also be used in subsequent rounds. The point of the analysis is to shrink the acceptable range of possible answers until one number emerges as a consensus. An important part of the process is that it takes place entirely with written communications. It is thus ideally suited for conduct by email. Experts may or may not be identified to one another, but their answers are always reported anonymously.

For this purpose, experts would be asked for the proportion of the output of industry X that was derived from the ocean or an ocean relationship (some description of the type of relationship might be needed. Either a specific year should be identified or some time frame such as “on average over the past N years”). Experts could be drawn from industry, government, or nongovernmental organizations or they could include those with traditional knowledge. The number and type of experts depends on the individual country and specific industry. The process should be designed to take no more than a few weeks and the aim should be to propose a consensus estimate in four rounds or fewer. If no consensus is reached, the process can continue until one is reached.



Special Issues 1: Regions

In addition to national level accounts, it is often desired to also have regional level accounts. The definition of the regions would depend on the political arrangements within the country, such as provinces, counties, cities, etc. Regional accounts consistent with the national accounts may be available already, in which case the process described above may be used at the regional level. The result would be regional accounts that were essentially the same as the national accounts. There are two ways that regional accounts can be built: top down and bottom up.

The top-down approach means disaggregating the ocean-related economic output at the national level to the regional level with an additional partial. Regional shares could be calculated using physical output data for some industries. For example, regional marine transportation could be assigned to coastal provinces based on some measure such as the volume or value of cargo moved through ports. In general value would be more appropriate to disaggregation of monetary measures. A more comprehensive method of disaggregation is available if a country has a value added tax (VAT) and returns from taxpayers are classified by industry and location. Using VAT returns a coefficient of regional output as a share of national output could be calculated and applied to the national income data.

A bottom-up approach is built from data at a geographically specific level and then summed at the regional level. For example, employment security programs that collect data from individual firms and establishments could be identified as ocean-related by industry definition and geographic location and then summed to the desired level to show ocean related employment and then further summed to the national level. If available, wage data could also be used to calculate shares of output at the regional level. This is the approach taken in the Type 1 accounts for the U.S. discussed above.

An important element of regional accounts is correctly adjusting for differences in ocean relationships between regions. For example, hotels and restaurants, a key part of the tourism and recreation sector, are likely to have very different ocean relationships in an highly urbanized area where business travel makes up a substantial share of tourists and in a rural area near a national park where business travel is much less. In these cases, the ocean sector has to be calculated by first a regional relationship and then an ocean-related partial. In the example used here, surveys of tourists may identify trip purpose in studies of visitors to specific regions and could be used as the “recreation” partial.

Special Issues 2. Type 2 Accounts

If a Type 2 (satellite account) is to be developed, then the estimation of partials becomes somewhat more complex. With a Type 1 account, a single partial can apply to the total value added for an ocean industry, but with a Type 2 account partials must be estimated for each of the four components of GDP, that is consumption, investment, government, and net exports because each of these elements of output is represented in the input-output tables. The ocean relationship may be different for each of these elements. But as the above discussion indicates, partials can require a great deal of secondary data, the volume of which is multiplied with the needs of Type 2 accounts.

Aggregating

Upon completion of the ocean accounts, each government will then seek to distribute the results in whatever manner they deem appropriate. But there are two aspects of the reporting phase that should be part of the accounting process. One is to screen the data to protect the confidentiality of individual reporting entities. The second is quality assurance/quality control (QA/QC).

All economic statistics ultimately are built from data sourced either in administrative records or in responses to surveys. To assure compliance with requests for reporting of often-sensitive business data like sales, profits, and labour compensation governments provide assurances that data will be



aggregated and not reported to risk identifying the data of any single reporting entity. This is done by running all data through various confidentiality screening calculations. The most common of these is the n/k rule. This rule requires that the contents of any cell of data (defined by a data item for specific industry in a specific location) should be suppressed if there are fewer than n number of reporting units or any single reporting unit accounts for k percent of the total value. Thus, if the fish processing industry in each province had three or fewer companies or there was one company that accounted for more than 80% of the employment the seafood processing sector in that province would not be reported. Values of three for n and 80% for k are commonly used as they usually provide sufficient protection for larger companies. But additional protection can be provided by increasing the size of n or reducing the size of k. There are also other statistical rules designed to assure the confidentiality of the two largest reporting units such as the p-percent rule.

Whichever approach is taken to the primary screen there is also a need for a secondary or complementary screen. A complementary screen is needed to prevent disclosure of confidential data either by manipulating the data within a release or by comparing the data to any other public release of the data. For example, take the seafood processing sector (a three-digit industry), which in most industrial classifications is divided between canning and freezing (four-digit industries). For a given country, there are 7 canneries, and no cannery has more than 80% of employment; but there are only two companies freezing seafood. Under the n/k rule alone, the canning industry data can be released, but not the freezing industry. In this situation, it is also not possible to publish a total for “seafood processing” because the total for freezing could be calculated by subtracting the canning total from the seafood processing total.

With two industries in a group, either both must be suppressed if a total is released, or if one industry can be released and the other must be suppressed, no total can be released. By extension of this principle if there are three four-digit industries in a three-digit industry and one of the four-digit industries fails the n/k or other primary test, then two of the four-digit industries must be suppressed. Common practice is to suppress the smallest of the industries that could otherwise be disclosed.

This principle of complementary disclosure also extends to other data published. For example, in the ocean economy data series the suppression of a total for a three-digit industry may be done to allow disclosure of a four-digit industry, but there are other public data series where the three-digit total is available. This would still require, then, that the three-digit total be suppressed in the ocean economy data series.

An overall strategy for data suppressions should be part of the ocean economy data should be adopted. In general, the ocean account should publish accurate totals at higher levels of industrial and geographic criteria, which means some additional suppression will be needed to meet complementary disclosure requirements. [For more information on confidentiality screening in an ocean accounts context see (Colgan, 2013)]

A second post-processing step is to make sure that QA/QC (quality assurance, quality control) procedures are put in place. Construction of ocean accounts will involve processing large volume of data, which will involve creation of new computer programs in whatever system is being used. Creating new programs almost always involves the potential for errors entering the results. Data checking routines should be built into the programming process to allow problems to be identified. The two most common such routines are to compare data in the ocean account with comparable data in already released data and to create a long enough time series to detect anomalies. Sudden large increases or decreases should be investigated to determine if it is a programming issue, or the changes are reflective of real performance.

Upon completion of the first complete versions of the ocean accounts they can be released for review and comment. Following whatever procedure is set forth the accounts can be revised and published in final form.



Documenting and Reporting

The final step before releasing ocean account data is to prepare and publish the account's metadata. Metadata is data about the data. It documents sources, methods, assumptions, and definitions so that the user fully understands what the ocean account measures, along with its limitations. Metadata is particularly critical with ocean accounts because, as the previous discussion makes clear, any ocean account has both features unique to each country and likely several features that required arbitrary choices (such as the inland boundaries of the geography defining the ocean economy). Even if international standards are set for ocean accounts, there will still exist sufficient variation across countries that full metadata will be required to allow comparisons across countries.

Though there are no international standards for ocean accounts metadata, there is general guidance of what should be included in metadata. There are three major elements to be addressed in creating a metadata standard:

- Content standards describe the contents of the data. Examples for the ocean accounts could include:
 - Sector
 - Industry
 - Economic concept
 - Time period
 - Geography
 - Industrial Classification
 - Data collection method
 - If surveys: populations, samples, sample frames, standard errors, etc.
- Technical Standards

Technical standards describe how the data is stored, made available, and how data can be combined both vertically (adding records) and horizontally (adding variables). This can be done using standard database formats and data management systems such as SQL or it can be done in data management systems that provide pre-structured metadata such as Data Package <https://specs.frictionlessdata.io/data-package/> or Dublin Core <http://dublincore.org/>. Technical standards may also include geospatial metadata standards for use with geographic information systems.

- Consistency with other metadata standards

There are both national and international metadata standards that are either already shaping national and international data systems or may be of particular relevance to an ocean economy standard. A few of the relevant national standards may be those in the U.S., China, Canada, or the U.K. There are also a number of data standards published by the International Standards Organization (ISO).

The final step is reporting the results of the ocean accounts. This generally takes the form of some type of website from which data can be downloaded. Examples of websites www.oceaneconomics.org and <https://coast.noaa.gov/digitalcoast/data/enow.html>. These access the U.S. accounts. The second part of the reporting process is to prepare a document of some kind usually summarizing the data and providing interpretations of the data. An example for the U.S. can be found at <https://coast.noaa.gov/data/digitalcoast/pdf/econ-report.pdf> and for the E.U. at https://ec.europa.eu/oceans-and-fisheries/system/files/2021-05/the-eu-blue-economy-report-2021_en.pdf. Both reports provide numerous examples of ways to report and display the data. The E.U. also has a summary report of its ocean accounts in graphic form available at https://blueindicators.ec.europa.eu/sites/default/files/2021_06_BlueEconomy_infographics_FINAL.pdf



Special issues in ocean accounting: blue technology

One part of the ocean economy that is of increasing interest in blue economy policy making is blue technology. This is a term without an agreed-upon definition, but which generally connotes innovative products associated with the ocean. Examples include ocean-based renewable electricity production, biotechnological applications of ocean-derived materials, robotic marine vehicles, advanced applications of information and communications technologies in marine applications, and advanced vessel propulsion systems. Many countries look to the development of such technologies to be an integral part of their ocean economy or “new blue economy” strategies. As such there is a logical desire to include these industries in their core ocean accounts.

Three problems may be encountered. The first is that many of the technologies are qualitative improvements of existing technologies, such as improved data storage and transmission rates for data being collected from platforms such as observations buoys. These may be critical to improvements in the use of ocean observation data, but they do not fundamentally alter inter-industry relationships already captured by the economic data.

The second problem is that many new products will not be identifiable in the industry or product accounts simply because they are new, and no product or industrial codes are available. Revisions to product and industrial codes occur only on long time frames (5-10 years) so having the appropriate accounting codes will take some time.

The third problem is that many of the innovative products that comprise the “new blue technology” may show significant growth rates, but they are still very small in the overall sectors of which they are a part, at least in the early years of production. They may even be quite large in their field; robotic vehicles are becoming common in many scientific research programs, but they are still quite small in the overall ship and boat building industries.

For these reasons, if special attention is to be paid to innovative technologies and services are a part of the ocean economy it is best that these innovative products and services be documented in separate studies that can focus on the areas of interest and can develop measures of employment, output, value added, etc. that would be consistent with other parts of the ocean accounts. The European Union (European Union, 2021) and OECD (2020) both identify “emerging sectors” in their ocean accounting, reporting them separately from the core accounts so that each is described at a level appropriate to the available information.

Tips and Tricks in Ocean Accounts

The processes outlined above are ingredients from which the core ocean accounts are built. But as with all such processes, there are easier and harder ways to accomplish the goals. Here are some lessons learned that may help different efforts.

- Remember that much of the data for the core ocean account is already available. It is a matter of finding and organizing existing data rather than creating a great deal of new data.
- There are no “right” answers as to what geographies and industries to include. Arbitrary decisions will be required.
- Once made, choices should be adhered to in order to assure spatial and temporal consistency in the data. If changes are required, these should be fully explained so that data users can decide how best to handle the changes for their own purposes.



- Don't let the best be the enemy of the better. Every step taken provides improved information about the ocean-related economy.
- The hardest data to acquire will be the portion of output attributable to an ocean relationship. The temptation is to select the industries and then estimate the partials. The better approach is identifying the sources of the partials before selecting the industries.
- The best uses of the data may be for purposes that are not envisioned by the producers of the data so the data should be provided to have the maximum flexibility for users.



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Appendix A. Ocean industry/product definition proposed by OECD (2020)

Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
1 Marine fishing	311	Marine fishing		
			4111	Wild ornamental fish
			4191	Other wild live fish, not for human consumption, including seeds and feeds for aquaculture
			4221	Wild salmonidae, live, fresh or chilled
			4231	Wild flatfish, live, fresh or chilled
			4241	Wild fish of Gadiformes, live, fresh or chilled
			4251	Wild tunas, skipjack or stripe-bellied bonito, live, fresh or chilled
			4261	Other wild pelagic fish, live, fresh or chilled
			4291	Other wild fish, live, fresh or chilled
			4311	Wild crabs, live, fresh or chilled
			4321	Wild rock lobster and other sea crawfish, live, fresh or chilled
			4331	Wild lobsters (Homarus spp.), live, fresh or chilled
			4341	Wild Norway lobsters, live, fresh or chilled
			4351	Wild cold-water shrimps and prawns (Pandalus spp., Crangon crangon), live, fresh or chilled
			4361	Other wild shrimps and prawns, live, fresh or chilled



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			4391	Other wild crustaceans, live, fresh or chilled
			4411	Wild abalone, live, fresh or chilled
			4421	Wild oysters, live, fresh or chilled
			4431	Wild mussels, live, fresh or chilled
			4441	Wild scallops, live, fresh or chilled
			4451	Wild clams, cockles and ark shells, live, fresh or chilled
			4471	Wild octopus, live, fresh or chilled
			4491	Other wild molluscs, live, fresh or chilled
			4511	Wild sea cucumbers, live, fresh or chilled
			4521	Wild sea urchins, live, fresh or chilled
			4530	Jellyfish, live, fresh or chilled
			4590	Other aquatic invertebrates, live, fresh or chilled, n.e.c.
			4911	Coral and similar products, shells of molluscs, crustaceans or echinoderms and cuttle-bone
			4912	Wild live aquatic plants and animals for ornamental purpose
			4920	Natural sponges of aquatic animal origin
			4931	Wild seaweeds and other algae, fresh, frozen or dried, whether or not ground, fit for human consumption
			4933	Wild seaweeds and other algae, fresh, frozen or dried, whether or not ground, unfit for human consumption



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			38210	Pearls, natural or cultured and unworked
			86151	Fishing services on resources owned by others
			86153	Support services to fishing
2 Marine aquaculture	321	Marine aquaculture		
			4112	Farmed ornamental fish
				Other farmed live fish, not for human consumption, including seeds and feeds for aquaculture
			4192	
			4222	Farmed salmonidae, live, fresh or chilled
			4232	Farmed flatfish, live, fresh or chilled
			4242	Farmed fish of Gadiformes, live, fresh or chilled
			4252	Farmed tunas, skipjack or stripe-bellied bonito, live, fresh or chilled
			4262	Other farmed pelagic fish, live, fresh or chilled
			4292	Other farmed fish, live, fresh or chilled
			4312	Farmed crabs, live, fresh or chilled
			4322	Farmed rock lobster and other sea crawfish, live, fresh or chilled
			4332	Farmed lobsters (Homarus spp.), live, fresh or chilled
			4342	Farmed Norway lobsters, live, fresh or chilled
			4352	Farmed cold-water shrimps and prawns (Pandalus spp., Crangon crangon), live, fresh or chilled



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			4362	Other farmed shrimps and prawns, live, fresh or chilled
			4392	Other farmed crustaceans, live, fresh or chilled
			4412	Farmed abalone, live, fresh or chilled
			4422	Farmed oysters, live, fresh or chilled
			4432	Farmed mussels, live, fresh or chilled
			4442	Farmed scallops, live, fresh or chilled
			4461	Wild cuttle fish and squid, live, fresh or chilled
			4472	Farmed octopus, live, fresh or chilled
			4492	Other farmed molluscs, live, fresh or chilled
			4512	Farmed sea cucumbers, live, fresh or chilled
			4522	Farmed sea urchins, live, fresh or chilled
			4590	Other aquatic invertebrates, live, fresh or chilled, n.e.c.
			4911	Coral and similar products, shells of molluscs, crustaceans or echinoderms and cuttle-bone
			4913	Farmed live aquatic plants and animals for ornamental purpose
			4932	Farmed seaweeds and other algae, fresh, frozen or dried, whether or not ground, fit for human consumption
			4934	Farmed seaweeds and other algae, fresh, frozen or dried, whether or not ground, unfit for human consumption



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			38210	Pearls, natural or cultured and unworked
			86152	Aquaculture services on inputs owned by others
			86154	Support services to aquaculture
3		Maritime passenger transport		
	5011	Sea and coastal passenger water transport		
			64231	Coastal and transoceanic water transport services of passengers by ferries
			64239	Other coastal and transoceanic water transport services of passengers
4		Maritime freight transport		
	5012	Sea and coastal freight water transport		
			65211	Coastal and transoceanic water transport services of freight by refrigerator vessels
			65212	Coastal and transoceanic water transport services of freight by tankers
			65213	Coastal and transoceanic water transport services of intermodal containers by container ships
			65219	Other coastal and transoceanic water transport services of other freight
			66022	Rental services of freight vessels for coastal and transoceanic water transport with operator
5		Offshore extraction of crude petroleum & natural gas		
	610	Extraction of crude petroleum		
			12010	Petroleum oils and oils obtained from bituminous minerals, crude



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			12030	Bituminous or oil shale and tar sands
			86221	Oil and gas extraction services on resources owned by others
	620	Extraction of natural gas	12020	Natural gas, liquefied or in the gaseous state
6		Marine and seabed mining		
	729	Mining of other non-ferrous metal ores	14210	Copper, ores and concentrates
			14220	Nickel ores and concentrates
			14230	Aluminium ores and concentrates
			14240	Precious metal ores and concentrates
			14290	Other non-ferrous metal ores and concentrates (other than uranium or thorium ores and concentrates)
			86229	Other mining services on resources owned by others
	810	Quarrying of stone, sand and clay	15310	Natural sands
			15320	Pebbles, gravel, broken or crushed stone, macadam; granules, chippings and powder of stone
			15400	Clays
			16330	Chalk and dolomite
	891	Mining of chemical and fertilizer minerals	16110	Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk
			16190	Other chemical minerals



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			34639	Carnallite, sylvite and other potassic fertilizers, n.e.c.
			34654	Excreta of animals useful for manure/fertilizer and fuel preparation
	893	Extraction of salt	16200	Salt and pure sodium chloride; sea water
7		Offshore industry support activities		
	910	Support activities for petroleum and natural gas extraction	86211	Support services to oil and gas extraction
	990	Support activities for other mining and quarrying	86219	Support services to other mining
	4290	Construction of other civil engineering projects	53261	Mining constructions
			54261	General construction services of mines
8		Processing and preserving of marine fish, crustaceans and molluscs		
	1020	Processing and preserving of marine fish, crustaceans and molluscs	21211	Freshwater fish, frozen
			21212	Salmonidae, frozen
			21213	Flatfish, frozen
			21214	Fish of Gadiformes, frozen
			21215	Tunas, skipjack or stripe-bellied bonito, frozen
			21216	Other pelagic fish, frozen
			21219	Other fish, frozen
			21221	Fish fillets and fish meat (whether or not minced), fresh or chilled
			21222	Fish fillets, frozen



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			21223	Fish meat, whether or not minced, frozen
			21224	Fish fillets, dried, salted or in brine, but not smoked
			21225	Fish livers and roes, fresh or chilled
			21226	Fish livers and roes, frozen
			21227	Fish livers and roes dried, smoked, salted or in brine
			21231	Fish, dried, but not smoked; salted, but not dried or smoked; or in brine
			21232	Fish including fillets, smoked
			21233	Edible fish meal
			21234	Edible fish offal ; fish fins, heads, tails, maws and other edible fish offal
			21242	Fish, otherwise prepared or preserved
			21243	Caviar and caviar substitutes
			21251	Crabs, frozen, dried, salted or in brine
			21252	Rock lobster and other sea crawfish, frozen, dried, salted or in brine
			21253	Lobsters, frozen, dried, salted or in brine
			21254	Norway lobsters, frozen, dried, salted or in brine
			21255	Cold-water shrimps and prawns, frozen, dried, salted or in brine
			21256	Other shrimps and prawns, frozen, dried, salted or in brine
			21259	Other crustaceans, frozen, dried, salted or in brine
			21261	Abalone, frozen, smoked, dried, salted or in brine



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			21262	Oysters, frozen, smoked, dried, salted or in brine
			21263	Mussels, frozen, smoked, dried, salted or in brine
			21264	Scallops, frozen, smoked, dried, salted or in brine
			21265	Clams, cockles and ark shells, frozen, smoked, dried, salted or in brine
			21266	Cuttle fish and squid, frozen, smoked, dried, salted or in brine
			21267	Octopus, frozen, smoked, dried, salted or in brine
			21268	Other molluscs, frozen, smoked, dried, salted or in brine
			21269	Other aquatic invertebrates, frozen, smoked, dried, salted or in brine
			21270	Crustaceans, otherwise prepared or preserved
			21280	Molluscs and other aquatic invertebrates, otherwise prepared or preserved
			21291	Flours, meals and pellets, inedible, of fish, crustaceans, molluscs or other aquatic invertebrates
			21299	Products n.e.c. of fish, crustaceans, molluscs or other aquatic invertebrates; dead fish, crustaceans, molluscs or other aquatic invertebrates unfit for human consumption
			88120	Fish processing services
9		Maritime ship, boat and floating structure building		
	3011	Building of ships and floating structures		



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
				Cruise ships, excursion boats and similar vessels, principally designed for the transport of persons; ferry boats of all kinds
			49311	
			49312	Tankers (ships)
			49313	Refrigerator vessels (ships), except tankers
			49314	Other vessels for the transport of goods and other vessels for the transport of both persons and goods
			49315	Fishing vessels; factory ships and other vessels for processing or preserving fishery products
			49316	Tugs and pusher craft
				Other vessels (including light-vessels, fire-floats, dredgers, floating cranes, floating docks, warships and lifeboats other than rowing boats), except floating or submersible drilling or production
			49319	platforms
			49320	Floating or submersible drilling or production platforms
			49390	Other floating structures
			88821	Ship building services
	3012	Building of pleasure and sporting boats		
			49410	Sailboats (except inflatable), with or without auxiliary motor
			49490	Other vessels for pleasure or sports; rowing boats and canoes
			88822	Pleasure and sporting boat manufacturing services
10		Maritime manufacturing, repair & installation		
	2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics		



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			35110	Paints and varnishes and related products
			88425	Paint manufacturing services
	2651	Manufacture of measuring, testing, navigating and control equipment		
			48211	Direction finding compasses; other navigational instruments and appliances
			48212	Rangefinders, theodolites and tachymeters (tacheometers) and levels
			48219	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances
			48220	Radar apparatus, radio navigational aid apparatus and radio remote control apparatus
			48242	Cathode-ray oscilloscopes and cathode-ray oscillographs
			48243	Instruments and apparatus (except cathode-ray oscilloscopes and oscillographs) for measuring or checking voltage, current, resistance or power, without a recording device (except electricity production or supply meters)
			48244	Instruments and apparatus (except cathode-ray oscilloscopes and oscillographs) for telecommunications
			48249	Instruments and apparatus for measuring or checking electrical quantities n.e.c.
			48251	Hydrometers and similar floating instruments, thermometers, pyrometers,



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
				barometers, hygrometers and psychrometers
			48252	Instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases, except navigational, hydrological or meteorological instruments and appliances, gas or liquid supply meters and automatic regulating or controlling instruments and apparatus
			48253	Instruments and apparatus for physical or chemical analysis, for measuring or checking viscosity, porosity, expansion, surface tension or the like, or for measuring or checking quantities of heat, sound or light
			48263	Gas, liquid or electricity supply or production meters
				Revolution counters, production counters, taimeters, mileometers, pedometers and the like; speed indicators and tachometers, except
			48264	hydrographic and meteorological instruments; stroboscopes
			48266	Automatic regulating or controlling instruments and apparatus, hydraulic or pneumatic
			48269	Measuring, checking, regulating or controlling instruments, appliances and machines n.e.c.



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			88745	Measuring, testing, navigating and control equipment manufacturing services
	2731	Manufacture of fibre optic cables	46360	Optical fibre cables made up of individually sheathed fibres
				Optical fibres and optical fibre bundles; optical fibre cables (except those made up of individually sheathed fibres); sheets and plates of polarizing material; lenses, prisms, mirrors and other optical elements (except of glass not optically worked), whether or not mounted, other than for cameras, projectors or photographic enlargers or reducers
			48311	enlargers or reducers
			88753	Fibre optic cable manufacturing services
	3311	Repair of fabricated metal products		Maintenance and repair services of fabricated metal products, except machinery and equipment
			87110	
	3312	Repair of machinery		Maintenance and repair services of office and accounting machinery
			87120	
			87156	Maintenance and repair services of commercial and industrial machinery
	3313	Repair of electronic and optical equipment		Maintenance and repair services of medical, precision and optical instruments
			87154	
			87290	Maintenance and repair services of other goods n.e.c.
	3314	Repair of electrical equipment		



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
				Maintenance and repair services of electrical machinery and apparatus n.e.c.
			87152	
	3315	Repair of transport equipment, except motor vehicles		Maintenance and repair services of other transport equipment
			87149	
	3319	Repair of other equipment		Maintenance and repair services of other equipment
			87159	
	3320	Installation of industrial machinery and equipment		Other electrical installation services
			54619	
				Installation services of fabricated metal products, except machinery and equipment
			87310	
				Installation services of industrial, manufacturing and service industry machinery and equipment
			87320	
				Installation services of mainframe computers
			87331	
				Installation services of radio, television and communications equipment and apparatus
			87340	
				Installation services of electrical machinery and apparatus n.e.c.
			87360	
				Installation services of other goods n.e.c.
			87390	
	3510	Electric power generation, transmission and distribution		Electrical energy
			17100	
				Transmission of electricity (on own account)
			69111	
				Distribution of electricity (on own account)
			69112	



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			86311	Electricity transmission services (on a fee or contract basis)
			86312	Electricity distribution services (on a fee or contract basis)
12		Maritime ports & support activities for maritime transport		
	4290	Construction of other civil engineering projects		
			53232	Harbours, waterways and related facilities
			53233	Dams
			53269	Other constructions for manufacturing
			53270	Outdoor sport and recreation facilities
			53290	Other civil engineering works
			54232	General construction services of harbours and similar waterworks
			54233	General construction services of dams
			54269	General construction services of other industrial plants
			54270	General construction services of outdoor sport and recreation facilities
			54290	General construction services of other civil engineering works
	5210	Warehousing and storage		
			67210	Refrigerated storage services
			67220	Bulk liquid or gas storage services
			67290	Other storage and warehousing services
	5222	Service activities incidental to water transportation		
			67511	Port and waterway operation services (excl. cargo



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
				handling), on coastal and transoceanic waters
			67521	Pilotage and berthing services on coastal and transoceanic waters
			67531	Vessel salvage and refloating services on coastal and transoceanic waters
			67590	Other supporting services for water transport
	5224	Cargo handling		
			67110	Container handling services
			67190	Other cargo and baggage handling services
	5229	Other transportation support activities		
			67910	Freight transport agency services and other freight transport services
			67990	Other supporting transport services n.e.c.
13		Ocean scientific research & development		
	7210	Research and experimental development on natural sciences and engineering		
			81111	Basic research services in physical sciences
			81112	Basic research services in chemistry and biology
			81113	Basic research services in biotechnology
			81114	Basic research services in engineering and technology
			81115	Basic research services in medical sciences and pharmacy
			81116	Basic research services in agricultural sciences
			81119	Basic research services in other natural sciences



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			81121	Applied research services in physical sciences
			81122	Applied research services in chemistry and biology
			81123	Applied research services in biotechnology
			81124	Applied research services in engineering and technology
			81125	Applied research services in medical sciences and pharmacy
			81126	Applied research services in agricultural sciences
			81129	Applied research services in other natural sciences
			81131	Experimental development services in physical sciences
			81132	Experimental development services in chemistry and biology
			81133	Experimental development services in biotechnology
			81134	Experimental development services in engineering and technology
			81135	Experimental development services in medical sciences and pharmacy
			81136	Experimental development services in agricultural sciences
			81139	Experimental development services in other natural sciences
			81301	Interdisciplinary basic research services
			81302	Interdisciplinary applied research services
			81303	Interdisciplinary experimental development services



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			81400	Research and development originals
	7220	Research and experimental development on social sciences and humanities		
			81211	Basic research services in psychology
			81212	Basic research services in economics
			81213	Basic research services in law
			81219	Basic research services in other social sciences and humanities
			81221	Applied research services in psychology
			81222	Applied research services in economics
			81223	Applied research services in law
			81229	Applied research services on other social sciences and humanities
			81231	Experimental development services in psychology
			81232	Experimental development services in economics
			81233	Experimental development services in law
			81239	Experimental development services in other social sciences and humanities
			81301	Interdisciplinary basic research services
			81302	Interdisciplinary applied research services
			81303	Interdisciplinary experimental development services
			81400	Research and development originals



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
14 Marine & coastal tourism				
	5011	Sea and coastal passenger water transport		
			64133	Sightseeing services by water
				Coastal and transoceanic water transport services of passengers on cruise ships
			64232	Rental services of passenger vessels for coastal and transoceanic water transport with operator
			66021	
	5510	Short term accommodation activities		
			63111	Room or unit accommodation services for visitors, with daily housekeeping services
			63112	Room or unit accommodation services for visitors, without daily housekeeping services
			63113	Room or unit accommodation services for visitors, in time-share properties
			63114	Accommodation services for visitors, in rooms for multiple occupancy
	5520	Camping grounds, recreational vehicle parks and trailer parks		
			63120	Camp site services
			63130	Recreational and vacation camp services
	5590	Other accommodation		
			63210	Room or unit accommodation services for students in student residences
			63220	Room or unit accommodation services for workers in workers hostels or camps
			63290	Other room or unit accommodation services n.e.c.
	5610	Restaurants and mobile food service activities		



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			63310	Meal serving services with full restaurant services
			63320	Meal serving services with limited services
			63399	Other food serving services
	5629	Other food service activities		
			63392	Contract food services for transportation operators
			63393	Other contract food services
	5630	Beverage serving activities		
			63400	Beverage serving services
	6810	Real estate activities with own or leased property		
			72111	Rental or leasing services involving own or leased residential property
			72112	Rental or leasing services involving own or leased non-residential property
			72121	Trade services of residential buildings
			72122	Trade services of non-residential buildings
			72123	Trade services of time-share properties
			72130	Trade services of vacant and subdivided land
	6820	Real estate activities on a fee or contract basis		
			72211	Residential property management services on a fee or contract basis except of time-share ownership properties
			72212	Non-residential property management services on a fee or contract basis
			72213	Time-share property management services on a fee or contract basis



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
				Residential building sales on a fee or contract basis, except of time-share ownership properties
			72221	
			72222	Non-residential building sales on a fee or contract basis
			72223	Sale of time-share properties on a fee or contract basis
			72230	Land sales on a fee or contract basis
			72240	Real estate appraisal services on a fee or contract basis
	7710	Renting and leasing of motor vehicles		
			73111	Leasing or rental services concerning cars and light vans without operator
			73112	Leasing or rental services concerning goods transport motor vehicles without operator
			73114	Leasing or rental services concerning other land transport equipment without operator
	7721	Renting and leasing of recreational and sports goods		
			73240	Leasing or rental services concerning pleasure and leisure equipment
	7911	Travel agency activities		
			85511	Reservation services for air transportation
			85521	Reservation services for accommodation
			85523	Reservation services for cruises
			85524	Reservation services for package tours
	7912	Tour operator activities		



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			85540	Tour operator services
	7990	Other reservation service and related activities		
			85512	Reservation services for rail transportation
			85513	Reservation services for bus transportation
			85514	Reservation services for vehicle rental
			85519	Other transportation arrangement and reservation services n.e.c.
			85521	Reservation services for accommodation
			85522	Time-share exchange services
			85531	Reservation services for convention centres, congress centres and exhibition halls
			85539	Reservation services for event tickets, entertainment and recreational services and other reservation services
			85550	Tourist guide services
			85561	Tourism promotion services
			85562	Visitor information services
	9000	Creative, arts and entertainment activities		
			38961	Paintings, drawings and pastels; original engravings, prints and lithographs; original sculptures and statuary, in any material
			73320	Licensing services for the right to use entertainment, literary or artistic originals
			96210	Performing arts event promotion and organization services
			96220	Performing arts event production and presentation services



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			96230	Performing arts facility operation services
			96290	Other performing arts and live entertainment services
			96310	Services of performing artists
			96320	Services of authors, composers, sculptors and other artists, except performing artists
			96330	Original works of authors, composers and other artists except performing artists, painters and sculptors
	9102	Museums activities and operation of historical sites and buildings		
			38963	Collections and collectors' pieces of zoological, botanical, mineralogical, anatomical, historical, ethnographic or numismatic interest, antiques
			96411	Museum services except for historical sites and buildings
			96412	Preservation services of historical sites and buildings
	9103	Botanical and zoological gardens and nature reserves and activities		
			96421	Botanical and zoological garden services
			96422	Nature reserve services including wildlife preservation services
	9200	Gambling and betting activities		
			96921	On-line gambling services
			96929	Other gambling and betting services
	9311	Operation of sports facilities		
			96520	Sports and recreational sports facility operation services
	9319	Other sports activities		



Ocean specific description	ISIC 4	ISIC 4 description	CPC 2.1	CPC 2.1 description
			86132	Support services to hunting
			96511	Sports and recreational sports event promotion services
			96590	Other sports and recreational sports services
			96610	Services of athletes
			96620	Support services related to sports and recreation
	9321	Activities of amusement parks and theme parks		
			96910	Amusement Park and similar attraction services
	9329	Other amusement and recreation activities n.e.c.		
			96930	Coin-operated amusement machine services
			96990	Other recreation and amusement services n.e.c.

Appendix B. The United States Ocean Economy: Three Perspectives

This Appendix presents three different views of the U.S. Ocean economy for 2019. The views are derived from two different methods of defining and estimating the economic values associated with the oceans.

1. Economics National Ocean Watch (ENOW): The Ocean Economy as Aggregation of Establishment Level Data

ENOW estimates of the number of establishments, employment, wages paid, and value added by using unemployment insurance records of over 9 million places of employment. Individual records collected in each state contain the industry (designated by North American Industrial Classification), the monthly employment, total wages paid by quarter, and address. GDP is added to this data by disaggregation of state-wide gross domestic product estimates to the establishment level using the share of state wages paid by industry. See Colgan (2013)

Sector	Industry	Establishments	Employment	Wages (\$ Millions)	GDP (\$Millions)
Construction	Total	3,234	54,735	\$4,499.09	\$8,025.67
	Total	8,754	89,246	\$4,426.31	\$11,426.86



Sector	Industry	Establishments	Employment	Wages (\$ Millions)	GDP (\$Millions)
Living Resources	Fish Hatcheries & Aquaculture	868	6,585	\$291.85	\$1,016.18
	Fishing	2,175	6,288	\$517.32	\$1,495.06
	Seafood Markets	4,895	41,792	\$1,886.75	\$4,851.24
	Seafood Processing	816	34,579	\$1,730.40	\$4,064.39
Minerals	Total	4,517	118,782	\$18,954.80	\$89,502.88
	Limestone, Sand & Gravel	663	6,367	\$472.80	\$1,713.41
	Oil & Gas Exploration and Production	3,854	112,414	\$18,482.00	\$87,789.46
Ship & Boat Building	Total	1,849	167,409	\$11,964.02	\$22,058.94
	Boat Building & Repair	970	30,823	\$1,527.37	\$4,218.39
	Ship Building & Repair	879	136,584	\$10,436.65	\$17,840.55
Tourism & Recreation	Total	135,289	2,494,610	\$69,482.53	\$150,710.00
	Amusement and Recreation Services NEC	7,999	76,918	\$2,064.20	\$4,613.05
	Boat Dealers	1,768	14,544	\$759.63	\$1,645.93
	Eating & Drinking Places	107,930	1,887,693	\$45,643.54	\$88,759.13
	Hotels & Lodging Places	12,242	449,133	\$18,294.53	\$49,960.15
	Marinas	2,214	22,492	\$890.99	\$1,745.27
	Recreational Vehicle Parks & Campsites	797	7,124	\$201.46	\$565.55
	Scenic Water Tours	1,528	12,387	\$440.40	\$683.48
	Sporting Goods Retailers	323	4,319	\$311.61	\$665.72
	Zoos, Aquaria	487	19,996	\$876.15	\$2,071.36
Transportation	Total	10,741	580,663	\$39,466.39	\$69,500.19
	Deep Sea Freight Transportation	1,017	19,789	\$2,137.22	\$5,547.88
	Marine Passenger Transportation	341	19,958	\$1,684.65	\$4,376.24
	Marine Transportation Services	2,778	96,571	\$7,834.72	\$11,896.34
	Search and Navigation Equipment	943	111,922	\$12,991.51	\$27,186.24



Sector	Industry	Establishments	Employment	Wages (\$ Millions)	GDP (\$Millions)
	Warehousing	5,662	332,421	\$14,818.29	\$20,493.48
All Ocean Sectors	Total	164,384	3,505,444	\$148,793.00	\$351,224.00

2. The Marine Economy Satellite Account: Value Added

a. Value Added Ocean Industry

The Marine Economy Satellite Account (MESA) is estimated by the U.S. Bureau of Economic Analysis. It is an estimated based on the national input output table at the product (rather than industry). The ocean shares of a given product at the national were estimated using a variety of secondary data and the ocean-related product data aggregated to the industry level. The result allows a view of the ocean share of the national economy as ocean-specific industries (or “activities”) and as the portion of conventionally defined industries (section 3 below). This method also permits a broader definition of ocean-related industries.

Ocean Economy by Ocean Industry

	2019 (\$ Millions)
Total Marine Economy	396,540
Living resources, marine	13,662
Commercial harvest, seafood markets, and processing	12,387
Commercial harvest and seafood markets	7,951
Seafood processing	4,436
Fish-based animal foods	70
Pharmaceuticals, marine-based	1,205
Construction, coastal and marine	4,276
Conservation	2,686
Dredging	146
Recreation facilities	1,445
Research and education, marine	7,267
Scientific research	4,832
National defense R&D	117
Federal nondefense R&D	1,382
State and local R&D	1,664
Nonacademic R&D	1,669
Educational programs and courses	2,223



	2019 (\$ Millions)
Vocational training	159
Laboratories	53
Transportation and warehousing, marine	26,023
Freight transportation	16,479
Passenger transportation	7,296
Warehousing and storage	2,249
Professional and technical services, marine	3,119
Minerals, offshore	57,398
Oil and gas	55,672
Sand and gravel	1,450
Support services	276
Utilities, coastal	7,984
Traditional power generation	7,984
Ship and boat building, nonrecreational	12,242
Ship building ¹	11,082
Barges and other nonpropelled ships	65
Military ships	10,776
Other ships	241
Boat building ²	1,160
Fishing boats	66
Tugboats and towboats	157
Outboard motorboats	101
Inboard motorboats	362
Other boats	475
Tourism and recreation, coastal and offshore	149,361
Guided tours	7,073
Water guided tours	4,093
Other scenic tours	2,981
Recreational fishing, offshore	3,891
Boating and paddling, offshore	22,445
Sailing	1,105



	2019 (\$ Millions)
Motorboating	14,634
Canoeing	98
Kayaking	63
Other boating and paddling ³	6,546
Other water activities ⁴	832
Other coastal recreation	16,305
Maritime museums and cultural institutions	786
Beachgoing	97
Amusement parks	1,792
Hiking and camping	624
RVing	5,097
Photography	295
Other general expenses	7,615
Trips and travel, coastal	98,816
Eating and drinking places	13,104
Hotel and lodging places	69,788
Travel arrangement services	1,645
Transportation services	14,279
National defence and public administration	115,207
National defence and coast guard	107,589
Federal public administration	7,166
State and local public administration	451

b. Ocean Economy Value Added by Standard Industry Definition

	2019 (\$ Millions)
All Industries	396,540
Private industries	272,258
Agriculture, forestry, fishing, and hunting	4,995
Farms	377
Forestry, fishing, and related activities	4,618
Mining	47,587



	2019 (\$ Millions)
Oil and gas extraction	36,776
Mining, except oil and gas	719
Support activities for mining	10,092
Utilities	5,983
Construction	3,767
Manufacturing	27,471
Durable goods	15,672
Wood products	5
Non-metallic mineral products	42
Primary metals	2
Fabricated metal products	66
Machinery	2,424
Computer and electronic products	281
Electrical equipment, appliances, and components	154
Motor vehicles, bodies and trailers, and parts	115
Other transportation equipment	12,195
Furniture and related products	9
Miscellaneous manufacturing	381
Nondurable goods	11,799
Food and beverage and tobacco products	2,011
Textile mills and textile product mills	87
Apparel and leather and allied products	459
Paper products	0
Printing and related support activities	1
Petroleum and coal products	8,421
Chemical products	779
Plastics and rubber products	40
Wholesale trade	15,188
Retail trade	21,768
Motor vehicle and parts dealers	2,785
Food and beverage stores	2,607
General merchandise stores	3,100



	2019 (\$ Millions)
Other retail	13,276
Transportation and warehousing	37,548
Air transportation	4,688
Rail transportation	453
Water transportation	12,221
Truck transportation	3,487
Transit and ground passenger transportation	676
Pipeline transportation	3,753
Other transportation and support activities	10,628
Warehousing and storage	1,642
Information	510
Publishing industries, except internet (includes software)	144
Motion picture and sound recording industries	19
Broadcasting and telecommunications	139
Data processing, internet publishing, and other information services	208
Finance, insurance, real estate, rental, and leasing	58,748
Finance and insurance	3,208
Federal Reserve banks, credit intermediation, and related activities	59
Securities, commodity contracts, and investments	0
Insurance carriers and related activities	3,148
Funds, trusts, and other financial vehicles	0
Real estate and rental and leasing	55,540
Real estate	54,154
Housing	54,152
Other real estate	3
Rental and leasing services and lessors of intangible assets	1,385
Professional and business services	5,588
Professional, scientific, and technical services	2,088
Legal services	525
Computer systems design and related services	113
Miscellaneous professional, scientific, and technical services	1,450
Management of companies and enterprises	44



	2019 (\$ Millions)
Administrative and waste management services	3,456
Administrative and support services	3,453
Waste management and remediation services	3
Educational services, health care, and social assistance	2,254
Educational services	2,097
Health care and social assistance	157
Ambulatory health care services	67
Hospitals	77
Nursing and residential care facilities	8
Social assistance	6
Arts, entertainment, recreation, accommodation, and food services	37,731
Arts, entertainment, and recreation	9,000
Performing arts, spectator sports, museums, and related activities	826
Amusements, gambling, and recreation industries	8,174
Accommodation and food services	28,731
Accommodation	17,232
Food services and drinking places	11,499
Other services, except government	3,120
Government	124,282
Federal	116,228
General government	116,168
National defence	105,186
Nondefense	10,982
Government enterprises	60
State and local	8,054
General government	4,059
Government enterprises	3,995

3. Gross Output by Ocean Industry

	2019 (\$ Millions)
Total Marine Economy	655,794



	2019 (\$ Millions)
Living resources, marine	24,660
Commercial harvest, seafood markets, and processing	22,666
Commercial harvest and seafood markets	11,457
Seafood processing	11,250
Fish-based animal foods	202
Pharmaceuticals, marine-based	1,774
Construction, coastal and marine	6,192
Conservation	4,115
Dredging	235
Recreation facilities	1,838
Research and education, marine	9,539
Scientific research	6,724
National defence R&D	147
Federal nondefense R&D	1,655
State and local R&D	2,189
Non-academic R&D	2,729
Educational programs and courses	2,511
Vocational training	275
Laboratories	54
Transportation and warehousing, marine	57,751
Freight transportation	30,054
Passenger transportation	24,500
Warehousing and storage	3,161
Professional and technical services, marine	5,845
Minerals, offshore	110,230
Oil and gas	107,123
Sand and gravel	2,587
Support services	416
Utilities, coastal	12,620
Traditional power generation	12,620
Ship and boat building, nonrecreational	30,555
Ship building ¹	27,795



	2019 (\$ Millions)
Barges and other nonpropelled ships	157
Military ships	27,058
Other ships	599
Boat building ²	2,837
Fishing boats	163
Tugboats and towboats	392
Outboard motorboats	244
Inboard motorboats	867
Other boats	1,175
Tourism and recreation, coastal and offshore	224,864
Guided tours	13,985
Water guided tours	8,051
Other scenic tours	5,934
Recreational fishing, offshore	7,543
Boating and paddling, offshore	47,172
Sailing	2,007
Motorboating	28,445
Canoeing	148
Kayaking	99
Other boating and paddling ³	16,377
Other water activities ⁴	1,356
Other coastal recreation	29,555
Maritime museums and cultural institutions	1,270
Beachgoing	175
Amusement parks	2,225
Hiking and camping	1,016
RVing	9,828
Photography	474
Other general expenses	14,467
Trips and travel, coastal	125,047
Eating and drinking places	19,490
Hotel and lodging places	72,056



	2019 (\$ Millions)
Travel arrangement services	3,718
Transportation services	29,830
National defence and public administration	167,055
National defence and coast guard	156,769
Federal public administration	9,150
State and local public administration	1,137

4. Gross Output by Standard Industry Definition

	2019
All Industries	655,794
Private industries	473,592
Agriculture, forestry, fishing, and hunting	6,482
Farms	677
Forestry, fishing, and related activities	5,804
Mining	98,053
Oil and gas extraction	82,361
Mining, except oil and gas	1,517
Support activities for mining	21,030
Utilities	8,915
Construction	5,725
Manufacturing	85,526
Durable goods	37,249
Wood products	4
Non-metallic mineral products	64
Primary metals	3
Fabricated metal products	101
Machinery	4,134
Computer and electronic products	324
Electrical equipment, appliances, and components	281
Motor vehicles, bodies and trailers, and parts	271
Other transportation equipment	31,436



	2019
Furniture and related products	21
Miscellaneous manufacturing	630
Nondurable goods	45,686
Food and beverage and tobacco products	7,675
Textile mills and textile product mills	189
Apparel and leather and allied products	724
Paper products	1
Printing and related support activities	2
Petroleum and coal products	36,226
Chemical products	989
Plastics and rubber products	59
Wholesale trade	20,234
Retail trade	36,745
Motor vehicle and parts dealers	4,083
Food and beverage stores	3,385
General merchandise stores	4,768
Other retail	24,514
Transportation and warehousing	74,301
Air transportation	7,749
Rail transportation	729
Water transportation	36,783
Truck transportation	6,108
Transit and ground passenger transportation	1,078
Pipeline transportation	4,006
Other transportation and support activities	15,301
Warehousing and storage	2,580
Information	674
Publishing industries, except internet (includes software)	214
Motion picture and sound recording industries	25
Broadcasting and telecommunications	126
Data processing, internet publishing, and other information services	315
Finance, insurance, real estate, rental, and leasing	60,273



	2019
Finance and insurance	6,516
Federal Reserve banks, credit intermediation, and related activities	72
Securities, commodity contracts, and investments	0
Insurance carriers and related activities	6,444
Funds, trusts, and other financial vehicles	0
Real estate and rental and leasing	53,700
Real estate	51,340
Housing	51,338
Other real estate	2
Rental and leasing services and lessors of intangible assets	2,446
Professional and business services	10,937
Professional, scientific, and technical services	3,230
Legal services	602
Computer systems design and related services	139
Miscellaneous professional, scientific, and technical services	2,494
Management of companies and enterprises	55
Administrative and waste management services	7,652
Administrative and support services	7,643
Waste management and remediation services	11
Educational services, health care, and social assistance	2,836
Educational services	2,663
Health care and social assistance	174
Ambulatory health care services	86
Hospitals	76
Nursing and residential care facilities	7
Social assistance	6
Arts, entertainment, recreation, accommodation, and food services	54,384
Arts, entertainment, and recreation	13,981
Performing arts, spectator sports, museums, and related activities	1,240
Amusements, gambling, and recreation industries	12,740
Accommodation and food services	40,411
Accommodation	22,834



	2019
Food services and drinking places	17,570
Other services, except government	3,213
Government	182,323
Federal	167,665
General government	167,560
National defence	153,656
Nondefense	13,907
Government enterprises	105
State and local	14,670
General government	5,635
Government enterprises	9,022