

Introducing the Open ENOW Dataset

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Introduction

What is Open Economics: National Ocean Watch (ENOW)?

Open ENOW is a dataset that was developed using publicly available information to track economic activity in six sectors that depend on the oceans and Great Lakes. The dataset is intended to complement the original, more comprehensive [ENOW dataset](#) during a temporary pause in those updates.

NOAA’s Office for Coastal Management has produced Open ENOW estimates for the United States as a whole and for the coastal portions of 30 U.S. states. The Open ENOW dataset currently covers the years from 2001 to 2024.

How is Open ENOW different from the original ENOW dataset?

NOAA created Open ENOW to bridge a temporary gap in the original [ENOW dataset](#). The original ENOW dataset draws on establishment-level microdata collected by the Bureau of Labor Statistics (BLS) while Open ENOW uses publicly available data aggregated at the county and state levels. Table 1 compares the two datasets.

Table 1. Comparison of ENOW and Open ENOW datasets

	ENOW	Open ENOW
Data Years	2005–2021	2001–2024
Underlying Data for Establishments, Employment, and Wages	Establishment-level microdata from the Bureau of Labor Statistics	County- and state-level data from the Bureau of Labor Statistics’ Quarterly Census of Employment and Wages ¹
Underlying Data for GDP	Bureau of Economic Analysis	
Geography Covered	30 U.S. states <i>and</i> ~475 counties	30 U.S. states, no county-level reporting
Economic Sectors Covered	Living Resources, Marine Construction, Ship and Boat Building, Marine Transportation, Offshore Mineral Resources, and Tourism and Recreation ²	

1. Open ENOW draws on less detailed data than the original ENOW dataset because a larger amount of the source data is suppressed for confidentiality reasons and uses imputed values to fill in data gaps. As a result, it is less accurate than the original ENOW dataset.

2. Open ENOW includes four additional NAICS codes to the Tourism and Recreation sector and one additional NAICS code to the Marine Transportation sector.

How frequently will NOAA update the Open ENOW dataset?

We expect to update the Open ENOW dataset annually until the next update of the original ENOW dataset. Once the original, more comprehensive ENOW dataset is up-to-date, Open ENOW will be discontinued.

General Concepts

What is the ocean and Great Lakes economy?

Conceptually, NOAA’s definition of the “ocean economy” corresponds to that of the Organisation for Economic Co-operation and Development (OECD)¹:

The sum of the economic activities of ocean-based industries, together with the assets, goods and services provided by marine ecosystems.

The ocean and Great Lakes provide direct or indirect inputs to a wide range of businesses and economic activities throughout the county. Some businesses are directly and entirely dependent on marine resources (e.g., a salmon cannery). Many more businesses are indirectly involved in or partly dependent on marine industries (e.g., a hotel in a coastal city). A large share of ocean- and Great Lakes–related economic activity falls within those indirectly involved or partly dependent industries, so they are important to consider. However, it is typically impossible to isolate marine-dependent output and employment in those sectors from economic survey data. To quantify the real-world impact of the ocean economy, it is necessary to make some assumptions about what constitutes “ocean-based industries.”

For the purposes of Open ENOW, the Ocean and Great Lakes economy is made up of a set of industries that, if located in a shoreline county or zip code, may reasonably be assumed to directly benefit from marine resources. The North American Industry Classification System (NAICS) codes associated with each ENOW marine sector are listed under “[Sector Definitions](#)” below.

Open ENOW’s definition of the Ocean and Great Lakes economy is imprecise; it is overinclusive in some respects and underinclusive in others. It should not be regarded as a precise measurement of marine sectors. Rather, it is intended to help users understand the *approximate* size of those sectors in relation to each other and to the broader state economies, as well as to show trends over time.

What makes an industry or sector “dependent” on ocean or Great Lakes resources?

The oceans and Great Lakes provide direct or indirect inputs to a wide range of economic activity. Open ENOW estimates are based on industry and location. Economic activity for a business establishment is included in Open ENOW when the establishment is either:

- associated with an industry whose definition explicitly ties the activity to the ocean or
- located in an industry which is partially related to the ocean and in a shoreline- adjacent zip code.

¹ LeBoeuf, Nicole; Rayner, Ralph F.; Gouldman, Carl; Baize, Zack; Grasso, Monica; Croll, Brittany; and Quigley, Kate (2024) "Terminology Related to Ocean and Coastal Economic Activity," *Journal of Ocean and Coastal Economics*, 11:1, Article 1. DOI: <https://doi.org/10.15351/2373-8456.1189>.

Geography

What states are covered in the Open ENOW dataset?

Open ENOW includes all 30 U.S. states with a shoreline on an ocean or the Great Lakes. Within those states, Open ENOW aggregates data for all counties on or near the shoreline. Open ENOW uses state-level instead of county-level data for three states—Delaware, Hawai‘i, and Rhode Island—where all counties are on the shoreline, thereby yielding more robust results, as state-level data avoids some county-level data suppressions.

What is a coastal county?

The Open ENOW dataset draws on public QCEW data for the same [set of coastal counties](#) as the original ENOW dataset. The basic geographic footprint for ENOW’s county-level data is a suite of “[Coastal Shoreline Counties](#)” determined by the Federal Emergency Management Agency’s definition, which states that a coastal county must:

- have a shoreline bordering the open ocean or the Great Lakes or
- contain coastal high hazard areas (V-zones).

ENOW (and, thus, Open ENOW) makes two adjustments to the list of Coastal Shoreline Counties:

- removal of shore-adjacent counties with little relevant economic activity (11 counties and the District of Columbia) and
- the addition of counties that are not shore-adjacent but are near the coast and have significant relevant economic activity (17 counties).

Does Open ENOW include U.S. territories?

No, the Open ENOW dataset does not include the territories. However, up-to-date marine economy estimates for American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, Puerto Rico, and the U.S. Virgin Islands will continue to be published by the U.S. Census Bureau and through the [ENOW Explorer](#) tool.

Economic Metrics

What metrics are reported in the Open ENOW dataset?

Open ENOW provides annual estimates for four economic indicators:

- **Establishments**, representing the number of places of employment in a given marine sector. A firm or organization may have multiple establishments.
- **Employment**, representing the average annual jobs at establishments in a given marine sector. This figure includes most part-time and seasonal workers but does not include self-employed workers.
- **Wages**, representing total annual wages and salary paid to employees. Open ENOW estimates both nominal (current dollar) wages and real (inflation-adjusted) wages.
- **Gross Domestic Product (GDP)**, representing value added in a given marine sector in terms of its contribution to nominal (current dollar) and real (inflation-adjusted) state GDP.

What are “establishments,” “employment,” “wages,” and “real wages” in Open ENOW?

The Open ENOW dataset estimates employment, wages, and the number of establishments in each marine sector using data from the Quarterly Census of Employment and Wages (QCEW). For each sector, estimates are calculated as the sum of reported QCEW values across a defined set of NAICS codes and a defined set of coastal counties or county equivalents.

For example, Open ENOW estimates employment in Louisiana’s marine transportation sector based on reported annual average employment in four NAICS codes (334511, 48311, 4883, and 4931) in 18 Louisiana parishes on or near the shoreline.

Employment estimates are based on annual average employment, wage estimates are based on total annual wages paid, and establishment counts are based on the number of reported establishments.

To address gaps in public, county-level QCEW data, Open ENOW imputes missing values based on data from other years or broader economic sectors (as explained in the [Methodology](#) section). Wage estimates are also reported as inflation-adjusted real wages in 2017 dollars, calculated by adjusting nominal wages using the Consumer Price Index (CPI).

What is “contribution to GDP”?

The Open ENOW dataset estimates a sector's contribution to GDP based on the average ratio of wages paid to GDP reported for the relevant industry and state in the Bureau of Economic Analysis (BEA) “Gross domestic product (GDP) by industry” (SAGDP2) table in current-year dollars. GDP for the Open ENOW dataset is reported in current-year dollars (not adjusted for inflation).

What is “contribution to real GDP”?

Real GDP is reported in 2017 dollars. Open ENOW estimates a sector's contribution to real GDP based on the average ratio of wages paid to GDP reported for the relevant industry and state in the Bureau of Economic Analysis’ “Real GDP by industry” (SAGDP9) table in chained dollars.

Why isn't there a GDP estimate for the most recent data year?

Open ENOW employment, wage, and establishments estimates are based on annual QCEW data, which is available sooner than BEA data used for GDP and real GDP estimates.

Marine Sector Definitions

What marine sectors are covered in the Open ENOW dataset?

The Open ENOW dataset tracks six economic sectors:

- Living Resources
- Marine Construction
- Marine Transportation
- Offshore Mineral Resources
- Ship and Boat Building
- Tourism and Recreation

What is the Living Resources sector?

The living resources sector includes industries engaged in the harvesting, processing, or selling of marine life. This encompasses commercial fishing, aquaculture (such as fish hatcheries and shellfish farming), seafood processing and packaging, and wholesale or retail seafood markets.

Table 2. NAICS codes included in the living resources sector

NAICS Code	Years	Description
11251	All years	Fish Hatcheries and Aquaculture
11411	All years	Fishing
311710	2012–2024	Seafood Product Preparation and Packaging
311711	2001–2011	<i>Seafood Canning (discontinued)</i>
311712	2001–2011	<i>Fresh and Frozen Seafood Processing (discontinued)</i>
424460	All years	Fish and Seafood Merchant Wholesalers
445220	2001–2021	<i>Fish and Seafood Markets (discontinued)</i>
445250	2022–2024	Fish and Seafood Retailers

What is the Marine Construction sector?

The marine construction sector comprises establishments involved in heavy and civil engineering construction related to the marine environment, such as dredging, pier construction, and beach nourishment.

Table 3. NAICS code used for the marine construction sector

NAICS Code	Years	Description
237990	All years	Other Heavy and Civil Engineering Construction

What is the Marine Transportation sector?

The marine transportation sector includes industries that provide transportation for freight and passengers on the deep sea, coastal waters, or Great Lakes. It also covers support activities essential for water transport, such as port and harbor operations, marine cargo handling, and navigational services. The manufacturing of search and navigation equipment and warehousing services are also included in this sector.

Note that the *Warehousing* industry group (NAICS 4931, highlighted in yellow below) contains one industry (493190: Other Warehousing) that is not in the original ENOW dataset. That industry will be included in future updates to the original ENOW dataset.

Table 4. NAICS codes included in the marine transportation sector

NAICS Code	Years	Description
334511	All years	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing
48311	All years	Marine Freight and Passenger Transport
4883	All years	Marine Transportation Services
4931	All years	Warehousing

What is the Offshore Mineral Resources sector?

The offshore mineral resources sector comprises industries involved in the exploration and extraction of minerals from the seafloor. This includes the extraction of crude petroleum and natural gas, the mining of sand and gravel, and support activities such as drilling and geophysical exploration.

Table 5. NAICS codes included in the offshore mineral resources sector

NAICS Code	Years	Description
211111	2001–2016	Crude Petroleum and Natural Gas Extraction (discontinued)
211112	2001– 2016	Natural Gas Liquid Extraction (discontinued)
211120	2017– 2024	Crude Petroleum Extraction
211130	2017– 2024	Natural Gas Extraction
212321	All years	Construction Sand and Gravel Mining
212322	All years	Industrial Sand Mining
213111	All years	Drilling Oil and Gas Wells
213112	All years	Support Activities for Oil and Gas Operations
541360	All years	Geophysical Surveying and Mapping Services

What is the Ship and Boat Building sector?

The ship and boat building sector is composed of establishments that build, repair, and maintain ships and recreational boats.

Table 6. NAICS code used for the ship and boat building sector

NAICS Code	Years	Description
33661	All years	Ship and Boat Building

What is the Tourism and Recreation sector?

The tourism and recreation sector comprises a diverse group of industries that provide goods and services to people enjoying coastal recreation. This includes businesses such as full-service and limited-service restaurants, hotels and motels, marinas, boat dealers, and charter fishing operations. It also encompasses scenic water tours, sporting goods manufacturers, recreational instruction, and

attractions like aquaria and nature parks.

Note that the four codes highlighted in **yellow** below (713110, 721199, 721214, 722410) are not in the original ENOW dataset. These industries will be included in future updates to the original ENOW dataset.

Table 7. NAICS codes included in the tourism and recreation sector

NAICS Code	Years	Description
339920	All years	Sporting and Athletic Goods Manufacturing
441222	All years	Boat Dealers
487210	All years	Scenic and Sightseeing Transportation, Water
487990	All years	Scenic and Sightseeing Transportation, Other
532284	2017–2024	Recreational Goods Rental
532292	2001–2016	<i>Recreational Goods Rental (discontinued)</i>
611620	All years	Sports and Recreation Instruction
712130	All years	Zoos and Botanical Gardens
712190	All years	Nature Parks and Other Similar Institutions
713110	All years	Amusement and Theme Parks
713930	All years	Marinas
713990	All years	All Other Amusement and Recreation Industries
721110	All years	Hotels (except Casino Hotels) and Motels
721191	All years	Bed-and-Breakfast Inns
721199	All years	All Other Traveler Accommodation
721211	All years	RV (Recreational Vehicle) Parks and Campgrounds
721214	All years	Recreational and Vacation Camps (except Campgrounds)
722110	2001–2011	<i>Full-Service Restaurants (discontinued)</i>
722211	2001–2011	<i>Limited-Service Restaurants (discontinued)</i>
722212	2001–2011	<i>Cafeterias, Grill Buffets, and Buffets (discontinued)</i>
722213	2001–2011	<i>Snack and Nonalcoholic Beverage Bars (discontinued)</i>
722410	All years	Drinking Places (Alcoholic Beverages)
722511	2012–2024	Full-Service Restaurants
722513	2012–2024	Limited-Service Restaurants
722514	2012–2024	Cafeterias, Grill Buffets, and Buffets
722515	2012– 2024	Snack and Nonalcoholic Beverage Bars

Marine Industry Definitions

What is the difference between a marine sector and a marine industry?

Marine industries are more specific than marine sectors. With the exception of marine construction, each ENOW sector contains multiple industries.

What marine industries are covered in the Open ENOW dataset?

The Open ENOW dataset reports state, regional, and national estimates for 23 marine industries.

Table 8. Current NAICS codes included in ENOW marine industries

Sector	Industry	Current NAICS Code(s)
Living Resources	Fish Hatcheries and Aquaculture	11251
	Fishing	11411
	Seafood Markets	424460, 445250
	Seafood Processing	311710
Marine Construction	Marine Construction	237990
Marine Transportation	Marine Freight	483111, 483113
	Marine Passenger Transportation	483112, 483114
	Marine Transportation Services	4883
	Search and Navigation Equipment	334511
	Warehousing	4931
Offshore Mineral Resources	Limestone, Sand and Gravel	212321, 212322
	Oil and Gas Exploration and Production	211120, 211130, 213111, 213112, 541360
Ship and Boat Building	Boat Building and Repair	336612
	Ship Building and Repair	336611
Tourism and Recreation	Amusement and Recreation Services	487990, 532284, 611620, 713110, 713990
	Boat Dealers	441222
	Eating and Drinking Places	722410, 722511, 722513, 722514, 722515
	Hotels and Lodging Places	721110, 721191, 721199, 721214
	Marinas	713930
	RV Parks and Campgrounds	721211
	Scenic Water Tours	487210
	Sporting Goods Manufacturing	339920
Zoos and Aquariums	712130, 712190	

Methodology

What are the data sources for the Open ENOW dataset?

Open ENOW uses publicly available data to estimate marine economy metrics. The primary data sources are the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) for establishment, employment, and wage figures and the Bureau of Economic Analysis' gross domestic product by state statistics for GDP estimates. It also draws on the U.S. Census Zip Code Business Patterns dataset to estimate the portion of shoreline counties' tourism and recreation jobs in shoreline zip codes.

Why does Open ENOW include imputed values?

The public QCEW data used for the Open ENOW dataset contains "suppressed" values, which are data points that cannot be published to protect the identity, or identifiable information, of individual employers. Suppressions are very common in public QCEW data, particularly in sectors like shipbuilding that tend to have a small number of large employers. To create comprehensive totals for each marine sector, the Open ENOW dataset must estimate and fill in these missing, or suppressed, data points. These estimates are referred to as imputed values.

How does Open ENOW impute missing values?

The Open ENOW dataset utilizes data from other years or broader economic sectors to impute missing values. If there is missing data for a given combination of six-digit NAICS code, county, and year, values are estimated based on (in order of preference):

- Interpolation from the last known and next known value for the same county-industry combination;
 - *For example, if county employment in a given industry was 40 in 2022 and 50 in 2024, the imputed value for 2023 would be 45.*
- Extrapolation from the last known or next known value for the same county-industry combination, adjusted for change in state-level values for the same industry;
 - *In effect, this assumes that a given county's share of state industry output stays relatively constant from year to year. For example, say that the QCEW reports that a marine industry employed 200 people in a given county and 1,000 statewide in 2023. In 2024, the QCEW does not report industry employment in that county but does report that the industry employed 1,100 people statewide. Based on the ratio of county to state employment in the last known year (1:5 in 2023), imputed industry employment in the county would be 220 for 2024.*
- Extrapolation from the last known or next known value for the same county-industry combination, scaled by change in number of industry establishments in that county;
 - *For example, say that the QCEW reports 3 establishments in a given county-industry combination in 2024, but employment data are suppressed for that year. If the QCEW reported 20 employees in five county establishments in 2022, imputed employment for 2024 would be 12 (20 employees in the last known year x (3 establishments in the missing year / 5 establishments in the last known year)).*
- Average employment per establishment (and wages per employee) at the five-digit NAICS level for the same county-year combination, multiplied by the number of establishments at

- the six-digit NAICS level; or
- Average employment per establishment (and wages per employee) at the four-digit NAICS level for the previous available year in that geography, multiplied by the number of establishments at the six-digit NAICS level.

Why doesn't Open ENOW report county-level estimates?

The Open ENOW dataset relies on publicly available data from the Quarterly Census of Employment and Wages, which often suppresses data at the county level to protect business confidentiality, while the original ENOW dataset used confidential microdata that allowed for county-level reporting. At the state level, Open ENOW estimates for data years 2005–2021 are strongly correlated with the “known” values from the original ENOW dataset. There is much more variability at the level of individual counties.

Why does Open ENOW use different sector definitions than the original ENOW dataset?

Open ENOW sector definitions are very similar to those used in the original ENOW dataset, with the following minor exceptions.

First, the Open ENOW dataset uses four- or five-digit NAICS codes in lieu of some six-digit NAICS codes used in the original ENOW dataset. A shorter NAICS code is used if all industries covered by that code are part of the same marine economy sector. For example, Open ENOW uses a single five-digit NAICS code for the ship and boat building sector (33661) in place of the two six-digit NAICS codes used in the original ENOW dataset (336611 for Ship Building and 336612 for Boat Building). This change allows us to avoid some data suppressions in the county QCEW data.

Second, the Open ENOW dataset includes five additional NAICS codes in the marine transportation and tourism and recreation sectors. These industries are included in all data years covered by the Open ENOW dataset. NOAA had planned to add these codes to ENOW for the 2022 data year, and these codes will be included in future updates to the original ENOW dataset.

Table 9. NAICS codes not previously used in the ENOW dataset

NAICS Code	NAICS Description	Marine Sector
493190 <i>(within NAICS 4931)</i>	Other Warehousing and Storage	Marine Transportation
721199	All Other Traveler Accommodation	Tourism and Recreation
721214	Recreational and Vacation Camps (except Campgrounds)	Tourism and Recreation
722410	Drinking Places (Alcoholic Beverages)	Tourism and Recreation
713110	Amusement and Theme Parks	Tourism and Recreation

How close are Open ENOW estimates to historical ENOW estimates?

The Open ENOW dataset is intended to provide up-to-date estimates of the marine economy during a temporary pause in updates to the original, more comprehensive ENOW dataset. Users should not make direct comparisons to historical ENOW data, as there are differences in source data, industry coverage, and geographical coverage.

In aggregate, however, Open ENOW estimates of marine economy employment, wages, establishments, and GDP are quite similar to the historical ENOW numbers. While calibrating the Open ENOW model, NOAA compared Open ENOW and historical ENOW estimates when limited to the same set of industries and geographies as the original ENOW dataset. In these “apples to apples” comparisons, the mean percent difference between Open ENOW estimates and historical ENOW estimates were:

- Employment: 1.7%
- Wages: 3.4%
- Establishments: 1.7%
- GDP: 4.4%

The mean percent difference in employment estimates for each sector were:

- 0.1% for Living Resources
- 6.7% for Marine Construction
- 4.3% for Marine Transportation
- 1.1% for Offshore Mineral Resources
- 0.1% for Ship and Boat Building
- 3.6% for Tourism and Recreation