Clean Coast Economy

Technical Methodology

OCEANA

Oceana's economic state fact sheets provide an updated economic analysis of current employment and gross domestic product (GDP) figures that rely on healthy ocean resources, namely commercial and recreational fishing, and other ocean-dependent tourism and recreation. Additionally, the analysis provides updated estimates of offshore oil and gas resource potential for the Outer Continental Shelf (OCS). This methodology document details the sources, estimates and approaches used in this updated analysis. For additional information, please contact Oceana's Economist, Kevin He, at **khe@oceana.org**.

Technical methodology summary:

Current Ocean-Related Jobs: Certain jobs directly depend on healthy ocean ecosystems, particularly those related to commercial and recreational fishing as well as tourism and recreation. We estimated these numbers using recent National Oceanic and Atmospheric Administration (NOAA) analyses and incorporated the indirect and induced jobs they support by using the appropriate economic multipliers. We used both employed workers and self-employed workers in NOAA's Living Resources sector and Tourism and Recreation sector.

Current Ocean-Related GDP: The sectors that rely on healthy ocean ecosystems contribute significantly to U.S. GDP in many coastal states. We estimated the portion of GDP associated with healthy oceans using recent NOAA analyses and incorporated the indirect and induced GDP from ancillary markets by using the appropriate economic multipliers. We used GDP from employed workers in NOAA's Living Resources sector and Tourism and Recreation sector.

Potential Offshore Oil and Gas Resources: We used assumptions to estimate the oil and gas resource potential in all OCS basins, and used information from the government's most recent national assessment of undiscovered oil and gas resources. We determined both the technically recoverable resources and economically recoverable resources in each region, however the economically recoverable portion of those resources is the most realistic projection of what will be extracted. Our analysis of resource potential is likely an overestimate of what will be extracted because we elected to use more generous assumptions to estimate resource potential.

1. Current ocean-related jobs

The National Oceanic and Atmospheric Administration (NOAA) produces a website titled "Economics: National Ocean Watch (ENOW)"[1] that uses Quarterly Census of Employment and Wages (QCEW) data compiled by the Bureau of Labor Statistics (BLS) to determine the number of jobs that are dependent on the oceans and major bodies of water. We only used data from the Living Resources,[2] and Tourism and Recreation[3] sectors, which represent the fishing, tourism and recreation industries respectively. These job numbers represent the direct jobs from the two sectors in 2014, which are the most recent data available. It is important to note that the market-based aspects of sectors like tourism and recreation can be greatly affected by ecosystem health, water quality and the associated aesthetics.[4]

1.1 Incorporating Self-Employed Workers

The ENOW data portal provides information on employed workers[5] and self-employed workers[6] in separate datasets. A large proportion of the Living Resources and Tourism and Recreation sectors classified as "self-employed" need to be included in this analysis. Nearly half of the 2014 Living Resources sector's workforce is self-employed.[7] Specifically, many fishermen and recreational activities trainers are classified as self-employed workers.[8] Therefore, information from the ENOW portal classified as self-employed workers was added to the initial set of employment data to arrive at total direct employment in each sector by geography:

> Total direct employment = total employed workers + total self-employed workers

1.2 Incorporating Multipliers

Understanding the broader impacts of tourism, fishing and recreation on the regional economy requires incorporating multiplier effects, or the effects of indirect and induced employment and GDP on the economy. For example, when a new beachfront hotel is developed, the resulting additional hotel jobs and income earned by hotel employees are considered direct effects on the ocean economy. Growth in related industries, like additional jobs and income in the industrial laundry or beverage supply industries, are measured as indirect effects of the new hotel. Finally, the induced effects of the hotel would be the higher regional spending on groceries, transportation and housing resulting from increased household incomes of the hotel, laundry and beverage service employees.

After establishing the total direct employment in the Living Resources and the Tourism and Recreation sectors (Section 1.1), we used the most recent job multiplier data to calculate indirect and induced jobs for each of the coastal states. The National Ocean Economics Program (NOEP) includes data from BLS to determine total employment by factoring in multipliers.[9] We used the following equations to determine total employment:

> Employment multiplier = employment with multipliers / employment
>
> Total employment (direct + indirect + induced) = employment multiplier * total direct employment (Section 1.1)

We used multiplier data from 2010, the most recent year that NOEP has available data on multipliers.[10] We calculated the multipliers for all years that data were available (2005-2010) and found minimal variation over time. Since multipliers do not change significantly from year to year, applying 2010 multiplier data to 2014 jobs data is appropriate and accurate considering both are the most recent year where data are available.

Both marine sectors – Living Resources and Tourism and Recreation – have unique multipliers. Additionally, these multipliers vary by geographic scale. In this analysis, data were analyzed at the national, regional and state level. For example, the Living Resources sector has a national multiplier of 1.53, but a Mid-Atlantic regional multiplier of 1.35 and a North Carolina state-level multiplier of 1.28. Total employment was calculated for each of these geographies with the relevant employment multipliers for each sector. For a full list of the multipliers used, see the Table 1 in the Appendix.

1.3 Split States

The ENOW data portal provides information on jobs related to coasts, which include those bordering both oceans and the Great Lakes. Three states in the analysis were what NOAA calls "split states," since they generate jobs from multiple coastal sources. Both New York and Pennsylvania have a Mid-Atlantic region and a Great Lakes region factoring into their total ENOW data. To exclude jobs dependent on the Great Lakes region, we subtracted these jobs from the total to arrive at the number of jobs for the Mid-Atlantic, therefore only including jobs supported by a strictly ocean economy in our analysis. Florida has a similar split between the Southeast region and the Gulf of Mexico region. Again, we split the Gulf of Mexico region jobs from the Southeast region to look at the two independently. From there, we used the same multiplier data generated at the state level, as split-state multipliers were not available.

2. Current ocean-related GDP

Determining ocean-related GDP follows similar methods to the jobs section. Although self-employment data include gross receipts, these are not directly comparable to wages or GDP in the employer-reported datasets.[11] As such, we did not include self-employment data in our calculations for total GDP under the conservative assumption that total GDP already

accounts for that economic activity. We subtracted the Great Lakes portion of GDP in split states to leave only the GDP created from activities along the ocean, and we looked at Florida's GDP from the Gulf of Mexico and the Atlantic separately.

We generated the GDP multiplier the same way we arrived at a jobs multiplier:

GDP multiplier = GDP with multipliers / GDP

Total GDP per state = GDP multiplier * employed workers GDP

Like the jobs multiplier, the GDP multiplier varies for each of the marine sectors used, Living Resources, and Tourism and Recreation, and we used unique multipliers when we assessed the data at different scales. In this analysis, data were analyzed at increased resolution from the national and regional level down to the state level. As with the jobs multipliers (Section 1.2), each region and state have discrete multipliers, which differ slightly from the national multiplier for each industry sector. Total GDP was calculated for each of these levels with the relevant GDP multipliers. For a full list of the multipliers used, see Table 1 in the Appendix.

3. Potential offshore oil and gas resources

3.1 Economically Recoverable Oil and Gas Estimates

In December 2017, the Bureau of Ocean Energy Management (BOEM) released a minor update to their 2016 National Assessment of Undiscovered Oil and Gas Resources of the U.S. Outer Continental Shelf (OCS).[12] The document designates known oil and gas plays[13] on the OCS and the potential reserves located in the geologic formations of each region. The 2016a Assessment gives estimates of the Undiscovered Technically Recoverable Resources (UTRR) for each OCS Planning Area in the Arctic Ocean, Atlantic Ocean, Pacific Ocean and Gulf of Mexico. BOEM uses "play-based" modeling, which extrapolates information from similar geologic formations with known oil and gas resources to estimate resource potential of unknown oil and gas fields.[14]

Specifically, UTRR are the reserves which can be extracted with current technology regardless of the size, accessibility and economics of the accumulations.[15] However, UTRR estimates give no consideration to the economic viability of extraction, and based on BOEM's analysis of economic factors, a significant portion of these resources will not be extracted and used because they would be prohibitively expensive to develop. We used the mean, or average, UTRR values for oil and gas in each of the planning areas incorporated in our analysis.

BOEM's 2016a National Assessment also provides the expected Undiscovered Economically Recoverable Resources (UERR) for the OCS. UERR is the portion of UTRR which is economically feasible to recover under certain economic and technological conditions, like the price of oil and gas.[16] BOEM estimates UERR scenarios at a range of price points from $30/barrel (Bbl) of oil up to $160/Bbl of oil and from $1.60/thousand cubic feet (Mcf) of gas up to $8.54/Mcf of gas.

Based on current trends in the spot prices of oil and gas reported by the U.S. Energy Information Administration (EIA), we used the $100/Bbl (and $5.34/Mcf) price cases for our primary estimates of UERR. This price case reflects the rising trend in oil prices, which has increased by almost 91% since its lowest point, from $30.32/Bbl in February 2016 to $57.88/Bbl in December 2017.[17] As of February 1, 2018, the price has continued its upward trajectory and sits at $65.71/Bbl for January 29, 2018.[18] While the current spot prices are closer to the $60/Bbl scenario, our estimate conservatively utilizes the $100/Bbl scenario. This estimate provides a significant margin between current spot prices and future prices, and as a result, overestimates current UERR.

However, since the spot prices for crude and natural gas have seen significant fluctuation in the past several decades, we report several other price scenarios. Both the $40/Bbl ($2.14/Mcf) and $60/Bbl ($3.20/Mcf) price scenarios are reflective of recent conditions within the oil and gas industries. The $160/Bbl ($8.54/Mcf) price scenario serves as an upper-bound estimate. In fact, prices reflecting this scenario for both oil and gas have not occurred since the recession in the summer of 2008.[19]

For each OCS Planning Area, we took the expected values of UTRR and UERR and calculated the amount of time each would last the nation at current consumption rates. According to the U.S. EIA, the U.S. consumed approximately 7.19 billion barrels of oil[20] and 27,490,301 million cubic feet of gas[21] in 2016.

We computed how long the estimated oil and gas reserves in each planning area would meet U.S. demand with the following equation:

> Amount of time reserves meet domestic demand = reserves / consumption rate

3.2 Oil and Gas Resource Estimates at the State Level

The 2016a National Assessment breaks down oil and gas resource estimates by all four OCS Regions and the 22 OCS Planning Areas within those four, but does not delineate how much of those reserves are located offshore each state. To determine the portion of resources assumed to be offshore each state, we incorporated information from reports put out by Quest Offshore Resources, Inc. In three separate reports, Quest estimated energy and job potential for offshore oil and gas development in the Atlantic Ocean,[22] Pacific Ocean[23] and Gulf of Mexico.[24] It is important to note that the Quest Reports use substantial assumptions favoring the oil industry and their employment values appear to be exaggerated.[25] Despite this overestimation, the Quest Reports give projections for government revenues (rentals, royalties and bonus bids) accrued by each state over a projected time period from 2017 to 2035.

Projected government revenues serve as a proxy for determining the oil and gas resources in each state since they are proportional to the amount of oil and gas extracted. We summed these projected revenues over the entire project lifetime, and used the proportion of government revenue in each planning area that is accrued by each individual state to determine the assumed oil and gas resources coming from each state's offshore waters. Finally, we multiplied this proportion by the respective Planning Area's UERR estimate. These projections represent an analysis done by Quest, and it should be noted that state-level policies do not contribute to differences in revenue streams between states.

We used the equation below to calculate the estimated oil and gas off each state's coast:

> Projected oil or gas reserves (Billion barrels of oil (Bbbl) or trillion cubic feet of gas (Tcf) respectively) per state = (state total of government revenues / Planning Area total of government revenues) * 2014 UERR (Bbbl or Tcf) for Planning Area

Appendix

Table 1: Multipliers used to calculate current ocean-related jobs and GDP.

GEOGRAPHIC SCALE	EMPLOYMENT MULTIPLIER		GDP MULTIPLIER	
	Living Resources	Tourism & Recreation	Living Resources	Tourism & Recreation
National	**1.530**	**1.573**	**2.044**	**2.450**
Regional				
West	1.482	1.414	1.779	2.045
Gulf of Mexico	1.286	1.297	1.633	1.750
Southeast	1.395	1.493	1.754	1.974
Mid-Atlantic	1.351	1.403	1.784	2.025
Northeast	1.394	1.425	1.792	2.025
State				
California	1.478	1.454	1.786	2.133
Connecticut	1.311	1.335	1.626	1.903
Delaware	1.257	1.290	1.486	1.686
Florida	1.426	1.543	1.800	2.051
Georgia	1.304	1.361	1.633	1.919
Maine	1.357	1.421	1.621	1.840
Maryland	1.363	1.378	1.674	1.926
Massachusetts	1.381	1.411	1.754	1.979
New Hampshire	1.297	1.338	1.579	1.755
New Jersey	1.337	1.382	1.692	1.934
New York	1.287	1.372	1.701	1.962
North Carolina	1.284	1.324	1.572	1.848
Oregon	1.397	1.404	1.659	1.924
Pennsylvania	1.286	1.347	1.586	1.909
Rhode Island	1.341	1.372	1.593	1.837
South Carolina	1.270	1.318	1.456	1.721
Virginia	1.290	1.327	1.693	1.878
Washington	1.642	1.405	1.820	1.996

Endnotes

1 Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA). (2014) *Economics: National Ocean Watch*. Available: **https://www.coast.noaa.gov/digitalcoast/data/enow.html**

2 Includes: commercial fishing, fish hatcheries, aquaculture, seafood processing, and seafood markets; recreational fishing is excluded.

3 Includes: eating and drinking establishments, hotels and lodging, marinas, boat dealers, campsites and RV parks, scenic water tours, manufacture of sporting goods, amusement and recreational services, recreational fishing, charter boats, zoos, and aquariums.

4 Office for Coastal Management, NOAA (2017) NOAA Report on the U.S. Ocean and Great Lakes Economy. Available: **https://coast.noaa.gov/data/digitalcoast/pdf/econ-report.pdf**.

5 Office for Coastal Management, NOAA. (2014) Economics: National Ocean Watch (ENOW) Data. Available: **https://www.coast.noaa.gov/digitalcoast/data/enow.html**.

6 Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA). Economics: National Ocean Watch (ENOW) for Self-Employed Workers. Available: **https://www.coast.noaa.gov/digitalcoast/data/enow-nes**.

7 Office for Coastal Management, NOAA (2017) NOAA Report on the U.S. Ocean and Great Lakes Economy. **Available:https://coast.noaa.gov/data/digitalcoast/pdf/econ-report.pdf**.

8 *Ibid*.

9 National Ocean Economics Program (NOEP). *Market Data, Ocean Economy Data*. Available: **http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp** Accessed October, 2017.

10 National Ocean Economics Program (NOEP) (2010) *Market Data, Ocean Economy Data*. 2010 Dataset. Available: **http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp** Accessed October, 2017.

11 Office for Coastal Management, NOAA (2017) NOAA Report on the U.S. Ocean and Great Lakes Economy. Available: **https://coast.noaa.gov/data/digitalcoast/pdf/econ-report.pdf**.

12 Bureau of Ocean Energy Management (BOEM) (2017) 2016a National Assessment of Undiscovered Oil and Gas Resources of the US Outer Continental Shelf. Available: **https://www.boem.gov/National-Assessment-2016/**. Accessed February 2018.

13 A "play" is defined as a "group of pools that share a common history of hydrocarbon generation, migration, reservoir development, and entrapment", in BOEM's 2016a National Assessment.

14 Bureau of Ocean Energy Management (BOEM) (2017) Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016a. Available: **https://www.boem.gov/2016a-National-Assessment-Fact-Sheet/**. Accessed February 2018.

15 Bureau of Ocean Energy Management (BOEM) (no date) Resource Evaluation Glossary. *Oil & Gas Energy Programs, Resource Evaluation*. Available: **https://www.boem.gov/Resource-Evaluation-Glossary/** Accessed June 2017.

16 *Ibid*.

17 Based on the monthly average price, Feb 2016 through Dec 2017; U.S. Energy Information Administration (2017) Cushing, OK WTI Spot Price FOB, Monthly (Dollars per Barrel). Petroleum & Other Liquids. Available: **https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=rwtc&f=m**. Accessed February 1, 2018.

18 *Ibid*.

19 U.S. Energy Information Administration (2017) Cushing, OK WTI Spot Price FOB, Daily (Dollars per Barrel). *Petroleum & Other Liquids*. Available: **https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=rwtc&f=d**. Accessed February 1, 2018.

20 U.S. Energy Information Administration (no date) How much oil is consumed in the United States? *FAQs*. Available: **https://www.eia.gov/tools/faqs/faq.php?id=33&t=6** Accessed June 2017.

21 U.S. Energy Information Administration (no date) U.S. Natural Gas Total Consumption (Million Cubic Feet). *Natural Gas*. Available: **https://www.eia.gov/dnav/ng/hist/n9140us2A.htm** Accessed June 2017.

22 Quest Offshore Resources, Inc. (2013) The Economic Benefits of Increasing U.S. Access to Offshore Oil and Natural Gas Resources in the Atlantic. Prepared for American Petroleum Institute (API) and National Ocean Industries Association (NOIA). Available: **http://questoffshore.com/wp-content/uploads/Economic-Benefits-Full-Dec.13.pdf**.

23 Quest Offshore Resources, Inc. (2014) The Economic Benefits of Increasing U.S. Access to Offshore Oil and Natural Gas Resources in the Pacific. Prepared for API and NOIA. Available: **http://www.noia.org/wp-content/uploads/2015/12/Embargoed-The-Economic-Benefits-of-Increasing-U-S-Access-to-Offshore-Oil-and-Natural-Gas-Resources-in-the-Pacific.pdf**.

24 Quest Offshore Resources, Inc. (2014) The Economic Benefits of Increasing U.S. Access to Offshore Oil and Natural Gas Resources in the Eastern Gulf of Mexico. Prepared for API and NOIA. Available: **http://www.noia.org/wp-content/uploads/2014/11/The-Economic-Benefits-of-Increasing-US-Access-to-Offshore-Oil-Natural-Gas-Resources-in-the-Eastern-GoM.pdf**.

25 Colgan, C. (2015) Middlebury Institute of International Studies at Monterey, Center for the Blue Economy. Available: **https://www.southernenvironment.org/uploads/audio/Center_for_the_Blue_Economy_Atlantic_Offshore_Drilling.pdf**.