3.12 SOCIOECONOMIC RESOURCES

This section identifies those aspects of the social and economic environment in the action area that may be affected by the Proposed Action. The Proposed Action is essential to the coastal economy because it ensures safe navigation for coastal-dependent industries and provides data for local communities to plan for coastal resiliency in response to climate change. Potential socioeconomic impacts with the greatest magnitude, duration, and extent would occur in U.S. coastal communities and the U.S. Ocean and Great Lakes economies (referred to as the "ocean economy" from here on). U.S. coastal communities and the ocean economy are the focus for the analysis of direct socioeconomic impacts.

There are over 120 million people living in U.S coastal counties (OCM, 2016a). Although some NOS projects would occur in coastal areas, they would not substantially affect social values, aesthetics, or demographic composition of the action area and likely would not have a substantial direct or indirect social impact. The Proposed Action would not require hiring at a scale which would substantially alter any local economies or stimulate migrations of populations. Furthermore, all of NOS's activities except for the installation, maintenance, and removal of tide gauges would occur offshore, so sound and visual intrusions from all other activities would not be experienced by the general public. In addition, due to the expansive geographic scope of the action area and the programmatic nature of this Draft PEIS, any social impact to demographic composition, aesthetics, or social values of communities would be difficult to quantify

A discussion of coastal minority and low-income communities that rely on subsistence hunting and fishing is presented in detail in Section 3.13, Environmental Justice.

The COVID-19 pandemic has caused many changes in the ocean economy. Widespread reductions in consumer behaviors and demand have drastically disrupted the maritime shipping, tourism, and commercial fishing sectors. Given the unprecedented nature of the situation, it is currently unclear how the ocean economy will continue to adapt and change moving into the future. Long-term ocean economic trends will be contingent upon many highly unpredictable variables, including the impacts of the COVID-19 virus on the global population level, international trade policy, consumer attitudes/behavior, and demand for tourism. Considering the uncertainty of the situation, any current projections of future economic activity based on the small quantity of available pandemic economic data would be highly speculative and may not accurately represent future economic conditions. Therefore, the analysis of socioeconomic impacts does not attempt to account for the effects of the COVID-19 pandemic and instead uses the best available pre-pandemic data. Although the magnitude and extent of impacts described by these data may be inflated compared to current economic conditions, the trends suggested by these analyses should remain constant.

The data supporting this analysis were collected and derived from standard sources, including federal agencies such as NOAA, the U.S. Census Bureau (USCB), Bureau of Labor Statistics (BLS), and Bureau of Economic Analysis (BEA). All of the tables in this section present data from the NOAA Economics: National Ocean Watch (ENOW) dataset, which is developed by NOAA's Office for Coastal Management in partnership with the BEA, BLS, and USCB. National and regional economic data presented in this section focus on the ocean economy and its supporting sectors.

3.12.1 Affected Environment

The ocean economy consists of six sectors: marine construction; living resources; offshore mineral extraction; ship and boat building; tourism and recreation; and marine transportation. Marine construction includes dredging navigation channels, beach renourishment, and pier building.

In 2016, the ocean economy's 154,000 business establishments employed about 3.3 million people, paid $129 billion in wages, and produced $304 billion in goods and services (OCM, 2016b). As described in the 2019 NOAA Report on the U.S. Ocean and Great Lakes Economy, this accounted for 2.3 percent of the nation's employment and 1.6 percent of its gross domestic product (GDP) in 2016. Employment in the ocean economy rose 2.7 percent (adding 85,000 jobs) from 2015 to 2016 – faster than the national average employment growth of 1.7 percent. To put this in perspective, the ocean economy generated a larger share of the U.S. economy in 2016 than many better-known economic activities such as crop production, telecommunications, and building construction. In 2016, the ocean economy employed more people than these three sectors combined (OCM, 2019).

National data by industry sector for the ocean economy in 2016 are shown below in **Table 3.12-1**. The tourism and recreation sector was the largest in terms of establishments, employment, wages, and contribution to GDP.

Table 3.12-1. U.S. Ocean and Great Lakes National Economy by Sector (2016)

Industry Sector	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
Tourism and Recreation	125,972	2,367,746	58,727,878	124,232,520
Marine Transportation	10,191	467,453	32,726,192	64,313,381
Offshore Mineral Extraction	4,960	132,007	20,241,667	80,130,037
Living Resources	8,517	87,869	3,941,825	11,292,923
Marine Construction	3,053	45,092	3,267,443	6,397,310
Ship and Boat Building	1,751	157,912	10,521,187	17,498,842
Total	154,492	3,258,081	129,426,193	303,865,013

Source: OCM, 2016b

National data by region for the ocean economy in 2016 are shown in **Table 3.12-2**. The Mid-Atlantic Region had the most establishments (41,407) and employees (787,652) compared to the other regions; but the Gulf of Mexico paid the most in wages (about $33.6 billion) and produced the most in goods and services (about $104 billion).

Table 3.12-2. U.S. Ocean and Great Lakes National Economy by Region (2016)

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
Mid-Atlantic	41,407	787,652	2,937,154	57,192,282
Gulf of Mexico	24,570	598,311	33,607,076	104,355,021
West	32,887	733,118	29,517,336	62,118,004
Southeast	18,888	402,438	11,108,623	24,650,323
Northeast	15,185	260,056	9,775,768	19,253,186
Great Lakes	14,805	310,855	8,835,522	19,027,089
North Pacific	2,412	47,561	2,744,865	8,643,807
Pacific	4,338	118,083	4,465,464	8,625,298
Total	154,492	3,258,074	102,991,808	303,865,010

Source: OCM, 2016b

Note: Totals from Table 3.12-2 may not exactly match the total or the "All Ocean Sectors" row from Table 3.12-1 due to rounding.

Economic data from NOAA's ENOW 2016 dataset are presented below in Sections 3.12.1.1 through 3.12.1.6 for each of the six sectors that compose the ocean economy, highlighting the importance of contributions from ocean and Great Lakes-dependent activities to the nation's economy. As stated above, NOS data acquisition informs charting that provide for safe navigation that is crucial to the ocean economy. NOS data serve a variety of users including commercial and recreational mariners, emergency and coastal managers and responders, researchers, educators, and others. Furthermore, these data provide information that is essential for coastal resiliency planning for coastal communities, particularly on the East Coast.

3.12.1.1 Tourism and Recreation

In 2016, the tourism and recreation sector of the ocean economy had more business establishments and employed more people than all the other five sectors combined. It was also the largest sector measured in terms of GDP, accounting for about 41 percent of the total ocean economy. This sector includes a wide range of businesses that attract or support ocean-based tourism and recreation: eating and drinking places, hotels and lodging, scenic water tours, parks, marinas, recreational vehicle parks and campsites, and associated sporting goods manufacturing (OCM, 2019).

While this sector employs more people and pays more in total wages than any of the other sectors of the ocean economy, the seasonal nature of the activities and the large number of part-time jobs (which are often held by students and others just entering the workforce) accounts for the relatively low average annual wages for employees ($25,000). From 2015 to 2016, tourism and recreation gained 73,000 jobs, accounting for most of the employment growth in the ocean economy. The majority of the jobs are in hotels and restaurants. These two industries together account for 94 percent of employment and 92 percent of GDP in this sector. Although vacationers stay at hotels and eat in restaurants, many of the coastal and oceanic amenities that attract visitors are free, such as beach visitation and swimming. These "nonmarket" activities generate no direct employment, wages, or GDP. However, they are usually key drivers for all of the market-based activity, and can be greatly affected by ecosystem health, water quality, and the associated aesthetics (OCM, 2019).

California and Florida are the two major contributors to the sector, accounting for more than one-third of the sector's total employment and GDP in 2016 (OCM, 2019). A summary of the tourism and recreation sector by region is shown in **Table 3.12-3** below.

Table 3.12-3. Tourism and Recreation Sector by Region (2016)

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
Mid-Atlantic	36,407	600,271	16,520,850	34,367,599
West	27,363	535,852	14,075,099	29,398,853
Gulf of Mexico	16,249	338,837	7,096,812	14,781,708
Southeast	15,502	335,204	7,611,164	16,378,267
Great Lakes	12,355	240,214	4,929,997	11,097,080
Northeast	12,458	189,098	4,520,523	9,732,781
Pacific	4,020	105,573	3,439,781	7,400,476
North Pacific	1,618	22,691	533,652	1,075,758

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
Total	125,972	2,367,746	58,727,878	124,232,520

Source: OCM, 2016b

3.12.1.2 Marine and Coastal Transportation

The marine and coastal transportation sector includes businesses engaged in the traffic of deep-sea and intracoastal freight, marine and intracoastal passenger services, warehousing, and the manufacturing of navigation equipment. This sector accounted for 14.3 percent of the employment and 21.2 percent of the GDP of the U.S. Ocean and Great Lakes economy. About 21.5 percent of employment and 25.1 percent of GDP attributable to the sector are supported by California. The rest is distributed across the nation, concentrated around major ports (OCM, 2019). A summary of the marine and coastal transportation sector by region is shown in **Table 3.12-4** below.

Table 3.12-4. Marine and Coastal Transportation by Region (2016)

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
West	2,384	127,202	10,398,448	20,053,221
Mid-Atlantic	2,217	124,407	8,770,712	15,833,490
Gulf of Mexico	1,980	80,392	5,127,189	11,637,926
Great Lakes	1,231	55,354	3,107,550	5,652,450
Southeast	1,417	45,053	2,488,822	5,638,885
Northeast	430	23,178	2,007,429	3,599,582
North Pacific	229	2,253	158,625	393,735
Pacific	102	3,806	303,100	687,602
Total	10,191	467,453	32,726,192	64,313,381

Source: OCM, 2016b

Warehousing is the largest component of this sector in terms of employment, accounting for 50 percent of total sector employment. These figures include loading, unloading, and warehousing cargo and the movement of cargo in and out of harbors, but they do not include the value of the cargo itself. The $1.5 trillion of cargo imported or exported through U.S. ports in 2016 is suggestive of the large indirect effects of coastal ports; not only are maritime commerce and navigation linked to other ocean uses, they are also linked to land-based transportation needs (OCM, 2019). Over 82,000 vessel calls were made at U.S. ports during 2015 (USDOT, 2017). Vessels carrying cargo are becoming larger and have deeper drafts than ever before. These vessels include bulk ships carrying iron, coal, and grain for export; heavy-load vessels carrying project cargo (large, heavy, high value or critical pieces of equipment for the project they are intended for); container ships carrying general export and import cargo for markets around the U.S. and the world; and tankers carrying petroleum and other liquids used to power U.S. transportation systems and industry (OCM, 2019). Many of these goods are also transported along coastal and inland waterways, which transport approximately 15 percent of U.S. freight at the lowest unit cost of any transportation method (USACE, 2012a). Imported and exported goods account for 40 percent of U.S. foreign trade as measured by value and 69 percent as measured by weight. These effects are realized across the nation, accruing as benefits to the producers of agricultural and manufactured products that are sold in international markets and to the manufacturers and retailers whose businesses rely on imported goods (OCM, 2019).

3.12.1.3 Offshore Mineral Extraction

Offshore mineral extraction includes oil and gas exploration and production, as well as limestone, sand, and gravel mining in the coastal and marine environment. This sector accounted for 4.1 percent of the total employment in the ocean economy in 2016, but contributed 26.4 percent of the GDP. Offshore mineral extraction is capital-intensive, requiring substantial investments in research, engineering, infrastructure, and operational equipment such as oceangoing vessels and drilling platforms. Much of the work in this sector takes place in hazardous conditions, and is one of the reasons the average annual wage per employee in this sector was $153,000 – almost three times the national average (OCM, 2019).

Oil and gas production is the largest component of this sector and is principally located in the Gulf of Mexico, as shown below in **Table 3.12-5**. The Gulf of Mexico, both onshore and offshore, is one of the most important regions for energy resources and infrastructure. Gulf of Mexico federal offshore oil production accounts for 17 percent of total U.S. crude oil production and federal offshore natural gas production in the Gulf accounts for 5 percent of total U.S. dry gas production. Crude oil production in federal waters exceeds 1.5 million barrels/day and dry gas production is 1.2 trillion cubic feet annually. Over 45 percent of total U.S. petroleum refining capacity is located along the Gulf Coast, as well as 51 percent of total U.S. natural gas processing plant capacity (EIA, 2019a; EIA, 2019b). Oil prices fell sharply between 2015 and 2016, leading to declines in the inflation-adjusted GDP of the offshore mineral extraction sector (down 18 percent) and the ocean economy as a whole (down 7 percent).

Table 3.12-5. Offshore Mineral Extraction by Region (2016)

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
Gulf of Mexico	3,336	106,792	17,411,920	70,099,694
West	548	9,710	1,030,956	2,930,128
Mid-Atlantic	318	1,700	119,839	387,286
Great Lakes	277	921	64,564	305,312
North Pacific	170	11,525	1,529,061	5,972,744
Southeast	152	522	24,845	65,239
Northeast	123	659	45,198	314,739
Pacific	11	110	11,828	45,866
Total	4,960	132,007	20,241,667	80,130,037

Source: OCM, 2016b

Limestone, sand, and gravel production is generally performed in support of marine and coastal construction activities and is, therefore, widely distributed among the U.S. coastal states. Generally speaking, states with large economies and long coastlines such as California, Washington, Florida, and Texas have the greatest production of sand, gravel, and limestone (OCM, 2019).

3.12.1.4 Living Resources

The living resources sector includes the commercial fishing, fish hatcheries and aquaculture, seafood processing, and seafood markets industries. The living resources sector accounted for 3 percent of the employment and 4 percent of GDP of the ocean economy in 2016 (OCM, 2019). Seafood processing converts the whole fish or shellfish harvested by fishermen or produced by aquaculture operations into the products that are sold at retail stores or restaurants. It is the largest producer in the living resources sector, accounting for 41 percent of the contribution to GDP. The seafood market industry retails fresh, frozen, and cured fish and seafood items such as tuna, salmon, lobster, and shrimp. Products are sold at various brick-and-mortar locations including independent markets, delicatessens, fishmongers, and butcher shops. Fish and seafood markets and counters operating within a supermarket are excluded from this industry, as are online sales of fish products. The seafood market industry accounts for most of the employed workers at 46 percent of the sector (OCM, 2019). In 2015, the seafood industry supported 1.2 million full-and part-time jobs and generated $144.2 billion in sales, $39.7 billion in income, and $60.6 billion in value-added impacts nationwide. The seafood retail sector generated the largest employment impacts across sectors at 573,000 jobs, the largest income impacts ($13.3 billion), and the largest value-added impacts ($18.2 billion) (NMFS, 2017d).

Commercial fishing can be an important component of a community's identity. Lobster, crab, oysters, and finfish are important to cultural identities from Maine to the Chesapeake Bay on the Mid-Atlantic Coast, Apalachicola Bay in Florida, and Grays Harbor in Washington. Shrimp and crawfish are an integral part of Cajun culture and Creole cuisine in Louisiana. Even seafood processing and marketing can shape cultural identities; consider the examples of Cannery Row in Monterey, California, and the Pike Place Market in Seattle, Washington (OCM, 2019). The impact of fishing and seafood in the Western, Gulf of Mexico, Mid-Atlantic, and Northeast regions' cultural identities is reflected in the number of establishments, employment, wages, and contribution to GDP (see **Table 3.12-6**).

Table 3.12-6. Living Resources Economy by Region (2016)

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
West	1,802	21,654	1,137,858	2,899,629
Gulf of Mexico	1,625	17,117	590,094	1,943,584
Mid-Atlantic	1,667	14,102	572,160	1,947,744
Northeast	1,637	11,791	658,892	1,892,138
Southeast	855	7,143	275,500	841,473
Great Lakes	451	4,101	172,990	486,094
North Pacific	324	10364	469,313	1,116,862
Pacific	153	1,591	65,019	165,399
Total	8,517	87,869	3,941,825	11,292,923

Source: OCM, 2016b

The living resource sector relies on the health of coastal and ocean ecosystems. The sector also depends on coastal wetlands that serve as habitat, juvenile nurseries, and feeding grounds for marine fish; estuaries that are the primary habitat for oysters and other shellfish; and the open ocean ecosystems where much of the finfish harvesting occurs. The health of these ecosystems can be affected by a wide range of other activities which underscores the need for wise use, conservation, monitoring, and management of ocean and coastal resources. For example, **Figure 3.12-1** shows coastal wetlands in Alaska that serve as a nursery and rearing habitat for juvenile Pacific salmon. These "salmon factories" are crucial for maintaining the wild salmon stocks upon which the commercial salmon fishery industry in Alaska depends.

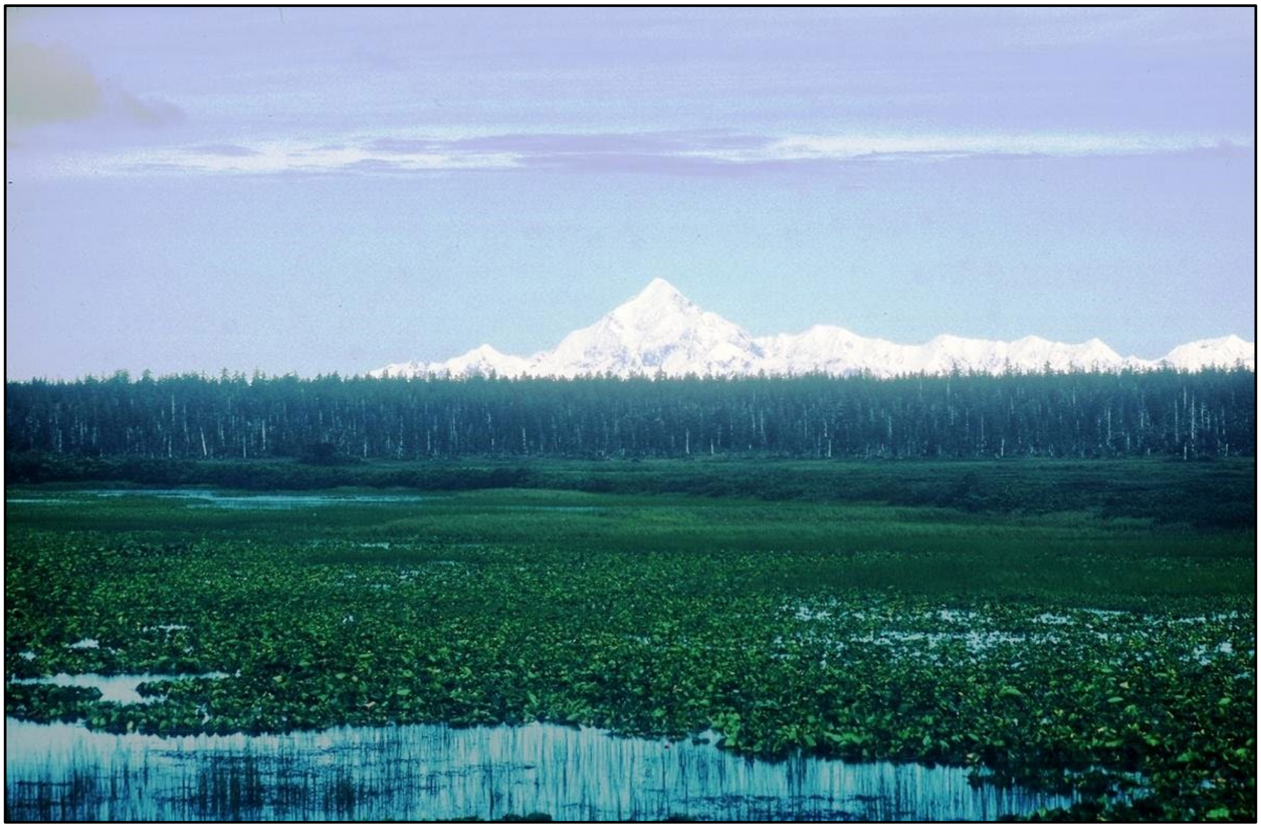

Photo Credit: Leon Kolankiewicz

Figure 3.12-1. Coastal Wetland in Alaska Serves as Nursery and Rearing Habitat for Juvenile Pacific Salmon

3.12.1.5 Marine Construction and Planning

The marine construction sector accounts for heavy construction activities associated with dredging of navigation channels, beach renourishment, and pier building[5]. Marine construction accounted for 1.4 percent of the employment and 2 percent of the GDP in the ocean economy in 2016. While the sector represents a small percentage of the ocean economy, it is an integral component, paying one of the highest annual average wages per employee of $72,000, much higher than the national average of $54,000. Furthermore, construction activities such as dredging navigation channels and renourishing beaches are vital to the marine transportation and tourism and recreation sectors (OCM, 2019).

Coastal resilience planning is an increasingly important component of marine and coastal construction. Rising sea levels and extreme weather events are constantly eroding coastlines throughout the action area. Erosion rates vary considerably from location to location and year to year, but average less than 1m (2-3 ft) annually along the Atlantic coast and over 2m (6 ft) annually in areas bordering the Gulf of Mexico (Heinz Center, 2000). Pacific coastlines tend to erode less than 0.3m (1 ft) each year, but this lower rate is

[5] Data for activities supporting offshore oil and gas production would normally be considered a form of marine construction. However, the underlying data on these activities are almost always suppressed because of the small number of businesses in any one area. In many cases, protecting the confidentiality of these businesses requires the suppression of the entire sector, including information for activities that could otherwise be reported. For this reason, these activities are not included in ENOW's data on the ocean economy. The effect of this omission is most prominent in the Gulf of Mexico and Alaska (OCM, 2019).

primarily a result of averaging episodic cliff erosion events, which can erode over 31 (100 ft) of coastline at one time, over many years (Heinz Center, 2000). Nationwide, annual coastal erosion may be responsible for $500 million in property loss to coastal landowners, including both damage to structures and loss of land. Approximately 87,000 homes are currently located in low-lying land or coastal bluffs that are likely to erode into the ocean by 2060. The federal government currently spends over $150 million annually on coastal resilience enhancement, including beach nourishment and other erosion prevention measures such as structural rip-rap installation (USGCRP, 2018).

Marine construction activities occur in most regions of the U.S., but are highly concentrated in Florida, Texas, California, and Louisiana, which together in 2016 accounted for about 56 percent of the employment and about 54 percent of GDP contribution from this sector. Marine construction economics by region are shown below in **Table 3.12-7**.

Table 3.12-7. Marine Construction Economy by Region (2016)

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
West	486	8,653	784,166	1,569,650
Gulf of Mexico	719	15,904	1,055,460	1,974,990
Mid-Atlantic	617	8,571	681,813	1,360,598
Northeast	159	2,425	110,256	193,613
Southeast	597	5,550	300,605	639,694
Great Lakes	326	2,074	154,677	303,677
North Pacific	47	354	35,066	59,171
Pacific	30	1,126	116,360	238,177
Total	3,053	45,092	3,267,443	6,397,310

Source: OCM, 2016b

3.12.1.6 Ship and Boat Building

This sector includes the construction, maintenance, and repair of ships, recreational boats, commercial fishing vessels, ferries, and other marine vessels. The ship and boat building sector accounted for 4.8 percent of employment and 6 percent of GDP in the ocean economy in 2016. The construction, maintenance, and repair of ships in particular (as opposed to recreational boats, commercial fishing vessels, ferries, and other marine vessels) accounted for about 83 percent of the sector's employment and 84 percent of GDP (OCM, 2019).

Large shipyards are concentrated in a few locations around the country. However, boat building and repair activity is spread throughout the country, with concentrations in areas with high levels of commercial fishing and recreational boating. In 2016, Virginia contributed most to employment in this sector, accounting for 22 percent of the national total. Washington State was the largest contributor to GDP, accounting for 23 percent of the total. Kitsap County, Washington contributed more to the nation's ship and boat building sector than any other county in the U.S.; it alone accounted for about 9 percent of the employment and 18 percent of the GDP in the nation's ship and boat building sector (OCM, 2019). The number of establishments, employment, wages, and contribution to GDP are shown by region in the below **Table 3.12-8**.

Table 3.12-8. Ship and Boat Building by Region (2016)

Region	Establishments	Employment	Wages ($000)	Contribution to GDP ($000)
West	304	30,044	2,090,809	5,266,522
Gulf of Mexico	573	37,561	2,225,882	3,737,732
Mid-Atlantic	173	38,528	2,702,482	3,288,397
Northeast	188	28,371	2,139,833	2,825,495
Southeast	365	8,959	407,687	1,086,764
Great Lakes	81	6,920	351,895	928,987
North Pacific	24	372	19,147	25,538
Pacific	22	5,873	529,376	87,778
Total	1,751	157,912	10,521,187	17,498,842

Source: OCM, 2016b

3.12.2 Environmental Consequences for Socioeconomic Resources

This section discusses potential impacts of Alternatives A, B, and C on socioeconomic resources.

3.12.2.1 Methodology

NOS activities would not substantially directly impact socioeconomic resources. The collection of oceanic data in Alternatives A, B, and C would not result in the hiring of personnel. Instead, NOS projects would support the collection of ocean data in order to provide information for a variety of users including commercial and recreational mariners, commercial and recreational fishing industries, renewable and non-renewable energy developers, emergency and coastal managers and responders, researchers, educators, and others (NERACOOS, No Date). The data collected would allow businesses and coastal economies to increase operational efficiency and reduce risks associated with oceanic activities.

As discussed in Section 3.2.2, significance criteria were developed for each resource analyzed in this Draft PEIS to provide a structured framework for assessing impacts from the alternatives and the significance of the impacts. The significance criteria for socioeconomic resources are shown in **Table 3.12-9**.

Table 3.12-9. Significance Criteria for the Analysis of Impacts to Socioeconomic Resources

Impact Descriptor	Context and Intensity	Significance Conclusion
Negligible	There would be no detectable effect on businesses and employment; the recreational experience and revenue from recreational expenditures; coastal economic systems; or sectors of the larger Ocean and Great Lakes economies in response to NOS projects and the resulting data. Several coastal towns or the coastal economy of a state could be impacted by NOS activities. Impacts would be temporary and would last the duration of and immediately after project activities.	Insignificant
Minor	There would be a detectable effect on businesses and employment; the recreational experience and revenue	

Impact Descriptor	Context and Intensity	Significance Conclusion
	from recreational expenditures; coastal economic systems; or sectors of the larger Ocean and Great Lakes economies in response to NOS projects and the resulting data. Several coastal towns or the coastal economy of a state and/or the coastal economies of several states could be impacted by NOS activities. Impacts would be short-term and would last beyond activities, up to one year.	
Moderate	There would be a sizeable effect on businesses and employment; the recreational experience and revenue from recreational expenditures; coastal economic systems; or sectors of the larger Ocean and Great Lakes economies in response to NOS projects and the resulting data. The coastal economies of several states and/or most of or all of the coastal economies in the Exclusive Economic Zone (EEZ) would be impacted by activities. Impacts would be short-term and/or long-term, lasting longer than one year.	
Major	There would be a substantial effect on businesses and employment; the recreational experience and revenue from recreational expenditures; coastal economic systems; or sectors of the larger Ocean and Great Lakes economies in response to NOS projects and the resulting data. The coastal economies of several states and/or most of or all of the coastal economies in the EEZ would be impacted by activities. Impacts would be short-term and/or long-term, lasting longer than one year.	Significant

3.12.2.2 Alternative A: No Action - Conduct Surveys and Mapping for Coastal and Marine Data Collection with Current Technology and Methods, at Current Funding Levels

Although the survey effort under Alternative A would vary by year (see **Table 3.4-6**), the greatest number of nautical miles surveyed over the six-year period would be in the Southeast Region (over 50 percent). The survey effort in each of the other four regions are of a similar order of magnitude (approximately 10 percent in each region for each of the six years), and is slightly greater in the Alaska Region where the survey effort would be somewhat higher overall (approximately 16 percent). Additionally, survey effort in the Great Lakes would average 3,106 nm (5,752 km) annually, as compared to the remaining annual average survey effort of 550,007 nm (1,018,613 km). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as the type, location and depth of surveys, that add nuance to this trend.

3.12.2.2.1 Economic Benefits of Coastal and Marine Data

NOS conducts recurring surveys throughout the action area to characterize ocean features (e.g., habitat, currents, bathymetry, marine debris). Data collected from these projects are used by NOS and other entities, both public and private, to produce charts, maps, and other hydrographic products that are relied upon by mariners, scientists, shipping and fishing industries, and many other users in the U.S. and beyond. Therefore, although few direct economic impacts (i.e., job creation, large capital investment) are anticipated as a result of Alternative A, the distribution and availability of data collected as a result of NOS activities could indirectly benefit ocean economy stakeholders by increasing the efficiency and risk management of ocean-related operations.

Quantifying the indirect economic benefits of increased ocean surveying and mapping data, quality, and availability is inherently difficult due to the lack of available data necessary to quantify economic impacts over the entire action area. The economic benefits of ocean surveying and mapping data are derived from the value of the information and the effects that information has on the behavior of individuals and organizations. The standard measure of these economic benefits is the value that users of the information place on it, based on their willingness to pay for such information to either enhance their uses of ocean resources or to avoid harms that may come from oceanic or atmospheric phenomena affecting individuals and organizations. The propensity of users to pay for such information is a measure of "social surplus" (i.e., the value of the information in excess of the costs of acquiring it). When such value accrues to businesses, it is referred to as "producer surplus"; when it accrues to individual users, it is "consumer surplus" (Kite-Powell et al., 2004). The economic information needed to compile estimates of both the total users of such information and the value they place on such information is only sporadically available and usually incomplete. As such, attempts to quantify these values would be highly subjective, speculative, and would not accurately represent the intensity or extent of impact across the entire action area.

Nearly all sectors of the ocean economy would benefit from the data tools and products resulting from data collection during NOS projects. Kite-Powell et al.'s 2004 "Estimating the Economic Benefits of Regional Ocean Observing Systems" evaluates the potential economic benefits that can be realized by developing and deploying enhanced data collection systems (e.g., data collection buoys) within the action area. Although NOS uses different methods than those analyzed by Kite-Powell et al. (2004) to collect data, the primary economic impacts of the alternatives would result from data products and tools developed from data collected during NOS projects and would be consistent with the resulting impacts of increased data collection described by Kite-Powell et al. regardless of the differing collection methods. As such, the results of the Kite-Powell et al. (2004) report serve as the primary basis for this economic impact analysis. The report examines five major affected economic activities, including recreational activities (e.g., boating, beach going, fishing); transportation (e.g., freight, cruise ships); health and safety (e.g., search and rescue, oil spill and hazard cleanup, property damage); energy (e.g., oil and gas development, electric generation management); and commercial fishing.

Kite-Powell et al. (2004) conducted reviews of these activities in 10 coastal regions (Pacific Northwest, California, Gulf of Mexico, Florida, Southern Atlantic coast, Mid Atlantic coast, New England/Gulf of Maine, Alaska, Hawaii, and the Great Lakes) to establish baseline economic conditions and the potential impact of improved coastal and marine data quality and availability. Benefits were estimated using a multi-phased modeling process. Baseline estimates were first calculated by conservatively assuming that total social surplus generated from increased coastal and marine data quality and availability within a specific economic sector was one percent of the total economic activity (i.e., revenues or expenditures, depending on the benefit) of the sector reported in publicly available economic data sources. This assumption reflects the likelihood that changes in consumer and producer surplus elicited by coastal and marine data are small relative to the total aggregate level of expenditures and revenues within a sector, and is standard in the estimation of economic benefits from weather and atmospheric data. The second phase of the estimation process used fine-scale economic modeling of representative regional economic activities as case studies to validate the magnitude of estimates from the first phase of modeling; the activities modelled in phase two were selected on the basis of data availability (Kite-Powell et al., 2004).

Table 3.12-10 summarizes the potentially affected economic sectors, their predominant region(s) of influence, and descriptions of the types of indirect benefits from increased coastal and marine data, quality, and availability.

Table 3.12-10. Summary of Benefits to Activities Affected by Coastal and Marine Data

Activity		Region*	Description of Benefit
Health & Safety	Search & Rescue	Pacific Northwest, Gulf of Maine, Mid Atlantic coast, South Atlantic coast, California, Alaska, Hawaii, Florida, Great Lakes, Gulf of Mexico	Costs saved to U.S. Coast Guard plus value of lost lives saved; cost saved to local rescue squads plus value of lost lives saved; value of life; avoidance of costly accidents or collisions
	Oil Spills	Pacific Northwest, California, Gulf of Mexico	Reductions in clean up and compensation costs
	Tropical Storm Prediction	South Atlantic	Reduced loss of life, evacuation cost, and lost tourism revenue
	Residential Property	Florida South Atlantic	Avoided costs from earlier preparation for storms; coastal resilience planning
	Beach Restoration	California	Daily cost saving on beach restoration from optimized planning
Recreational Activities	Recreational Fishing	Pacific Northwest, Mid Atlantic coast, Southern Atlantic coast, Florida, Gulf of Mexico, California, Hawaii, Great Lakes	Willingness to pay for improved charts and maps; increased licensing and chartering expenditures
	Recreational Boating	California, Gulf of Mexico, Gulf of Maine, Mid Atlantic coast, South Atlantic coast, Alaska, Hawaii, Florida, Great Lakes, California	Willingness to pay for improved charts and maps; increased chartering and fuel expenditures
	Beaches	Florida, Great Lakes, California	Beach-related consumer expenditures; increased economic impact; operating cost savings; increased business sales; increased visitor daily values; increased consumer surplus
Transportation	Freight	Pacific Northwest, Gulf of Maine, Mid-Atlantic coast, South Atlantic coast, Alaska, Florida, Great Lakes, California, Gulf of Mexico	Daily cost savings from optimized route-planning

Activity		Region*	Description of Benefit
	Cruise Ships	Pacific Northwest	
Energy	Electric Load Planning	Great Lakes	Avoided use of most expensive peak generators; operating cost savings
	Oil and Gas Development	Gulf of Mexico	Operating cost savings; increased accuracy of oceanographic risks in design
Commercial Fishing		Pacific Northwest Gulf of Maine Mid-Atlantic coast	Increased landed values; total regional economic impact in industries dependent on living resources (e.g., seafood processing, retail seafood market); reduced operating costs

Source: Kite-Powell et al., 2004.

*The regional designation of impacts reported in this table were contingent upon the availability of economic data for the region and therefore may not fully represent the overall regional influence of a given economic activity. Also note that the Gulf of Mexico region in this study excludes the west (Gulf) coast of Florida.

The Kite-Powell et al. report provides information on the general order of magnitude of economic benefits produced as a result of improved coastal and marine data quality and availability; estimates of economic activity resulting from enhanced data quality and availability can range broadly and are not meant to be a descriptive accounting of all possible economic outcomes. As such, the estimates provided in the subsequent paragraphs serve only to provide context for the general economic impacts of Alternative A. Nonetheless, Kite-Powell et al. indicate that annual benefits to recreational fishing, recreational boating, energy development and production, and commercial fishing from improved coastal and marine data quality and availability range in the hundreds of millions of dollars per year for each sector. The following sections provide descriptions of the economic impacts to each of these sectors.

3.12.2.2.2 Health and Safety

Health and safety activities refer to planning and operations that contribute to the health and safety of ocean users and their property (i.e., coastal real estate, boats, or small businesses). These activities contribute to all other sectors of the ocean economy by reducing inherent risks involved with other commerce-producing maritime activities or capital (e.g., recreational boating, commercial fishing) and primarily benefit from increased data quality and availability through increased operational efficiency and risk reduction related to extreme weather events. Search and rescue operations, oil spill modeling and hazard cleanup, and reduction of property damage are anticipated to contribute an additional $275 million to the ocean economy per year with increased ocean data quality and availability (Kite-Powell et al., 2004).

Search and rescue teams rely on bathymetric charting and mapping to establish search areas and plan rescue operations. Improving the spatial and temporal resolution of ocean data would continue to increase the likelihood of successful search and rescue operations while also reducing their cost. Successful search and rescue operations additionally contribute to the ocean economy by minimizing loss of life in the event of catastrophe, which preserves future economic contributions from saved individuals and reduces inherent risk associated with oceanic activities or employment. Improved ocean mapping would also allow ocean resource managers to more effectively predict the spread of volatile chemicals, such as oil, in the event of a spill, allowing for more precise targeting of response efforts and reducing the overall cost of restoration. Similarly, more precise bathymetric charting and mapping of collision hazards would allow for more optimized route planning that could reduce the occurrence of costly marine accidents; collisions and groundings accounted for 16 percent of all marine vessel insurance claims at a total cost of $1.56 billion from 2013 to 2018 or approximately $300 million annually (Allianz, 2018). These savings are demonstrated in the success of the PORTS system, which uses an integrated network of real-time oceanographic data collectors to aid navigation and is estimated to generate $300 million in economic benefits annually from reducing risk and increasing the operational efficiency of vessels (NOAA, 2014).

Data collected during NOS projects would continue to reduce costs associated with recovery from extreme weather events and natural disasters. After hurricanes or other severe weather events have moved through an area, NOS would continue to survey areas of critical marine infrastructure such as ports and shipping channels to identify submerged storm debris or transported sediment that could prevent ships carrying food and medical supplies from reaching affected areas. These efforts would reduce the risk of collisions with storm debris and would increase the operational efficiency of recovery and restoration efforts.

Although no direct economic impacts (i.e., job creation, capital investment) are anticipated within the health and safety sector as a result of Alternative A, the indirect economic benefits of increased operational efficiency of rescue missions and risk reduction related to extreme weather events facilitated by data collected under Alternative A would range in the magnitude of hundreds of millions of dollars and would be distributed among coastal economies throughout the action area. Furthermore, the data collected under Alternative A would be available to the public indefinitely, and indirect economic benefits resulting from its use and distribution would persist beyond the conclusion of activities. Overall, the economic impacts of ocean data procured under Alternative A on health and safety would be **indirect, beneficial,** and **moderate**.

3.12.2.2.3 Recreational Activities

Recreational activities, for the purposes of this analysis, refer to recreational consumption of ocean resources primarily through beach visitation, boating, and sport fishing. Recreational activities are a main component of the ocean economy; recreation and tourism contributed 2.4 million jobs and $124 billion to the GDP in 2016. Increased coastal and marine data availability and quality greatly benefit the recreational activity sector by allowing stakeholders to make informed decisions about ocean resources. Beachgoing, recreational boating, and recreational fishing would be expected to increase their contribution to the ocean economy by approximately $430 million per year with increased ocean data quality and availability (Kite-Powell et al., 2004).

. Improved Recreational boaters rely on accurate ocean charts and maps to transit ocean waters safely; improved ocean data quality would continue to allow recreational boaters to more effectively plan potential routes around prevailing winds, currents, and bathymetry. Finally, improved bathymetric data would continue to improve transit efficiency for recreational fishermen.

Although few direct economic impacts (i.e., job creation, large capital investment) are anticipated within the recreational activity sector as a result of Alternative A, the indirect economic benefits of enhanced decision-making by ocean economy stakeholders facilitated by data collected under Alternative A would range in the magnitude of hundreds of millions of dollars and would be distributed among coastal economies throughout the action area. Furthermore, the data collected under Alternative A would be available to the public indefinitely, and indirect economic benefits resulting from its use and distribution would persist beyond the conclusion of activities. Overall, the economic impacts of ocean data procured under Alternative A on recreational economic activity would be **indirect, beneficial,** and **moderate**.

3.12.2.2.4 Transportation

Transportation activities refer to the transit of goods and passengers throughout the EEZ and are a substantial component of the ocean economy, contributing 467,000 jobs and $64 billion to the GDP. Transportation activities benefit from increased data quality and availability primarily through improving operational efficiency of vessel transit. The transportation of freight and the transportation of passengers via cruise ships are expected to increase their contribution to the ocean economy by approximately $127 million per year with increased ocean data quality and availability (Kite-Powell et al., 2004).

The primary benefit of increased ocean data to the transportation sector is enhanced route-planning capabilities. Improved charts, maps, and bathymetry resulting from data collected during NOS projects would continue to allow ship crews and decision-makers to plan transit routes more efficiently, avoiding costs associated with longer routes and delays. However, it is important to note that much of the navigationally important part of the action area has been previously surveyed, and ocean data collected under Alternative A are not expected to open a substantial number of novel transit routes or shipping lanes. NOS data collection efforts in the Alaska region could potentially yield a small number of novel shipping routes in areas previously restricted by sea ice, but the economic impact of these routes is difficult to estimate given the current lack of mapping coverage and underlying risks of arctic maritime navigation (NOS, No Date-b). As such, the increased ocean data quality and availability resulting from Alternative A would primarily increase the efficiency of existing routes as opposed to discovering new routes. Nonetheless, the current operating performance efficiency of maritime shipping is low when compared to other industries (Panayides et al., 2011) and improved route planning could have a substantial marginal impact on the overall efficiency of the industry.

Although no substantial direct economic impacts (i.e., job creation, large capital investment) are anticipated within the transportation sector as a result of Alternative A, the indirect economic benefits of enhanced route-planning capabilities and daily cost savings stemming from the data collected by NOS would range in the magnitude of hundreds of millions of dollars and would be distributed among coastal economies throughout the action area. Furthermore, the data collected under Alternative A would be available to the public indefinitely and indirect economic benefits resulting from its use and distribution would persist beyond the conclusion of activities. Overall, the economic impacts of ocean data procured under Alternative A on transportation would be **indirect, beneficial,** and **moderate**.

3.12.2.2.5 Energy

Energy-related activities, for the purposes of this analysis, refer to the development and distribution of energy resulting from ocean resources and contributed 132,000 jobs and $80 billion to the GDP in 2016. These activities primarily benefit from increased ocean data quality and availability by increasing the operational efficiency of energy planning and more precise targeting of potential oceanic oil and gas resources. The predominant oceanic energy activities, electric load planning and oil and gas development, would likely contribute an additional $70 – $138 million to the ocean economy per year with increased ocean data quality and availability (Kite-Powell et al., 2004).

Increased precision and resolution of bathymetric data resulting from NOS data collection would reduce the uncertainty and risk associated with oceanic oil and gas development as well as the operating costs of existing energy infrastructure. Risk reduction also allows for greater levels of investment in the development of oceanic oil and gas resources, which spurs economic activity in coastal regions through job creation and revenues from employees. However, it is important to note that NOS projects and activities would not specifically identify or quantify offshore oil and gas resources; doing so is outside of the scope of this analysis and is typically accomplished by private companies using proprietary equipment and methodologies.

Although no direct economic impacts (i.e., job creation, large capital investment) are anticipated within the energy sector as a result of Alternative A, the indirect economic benefits of increasing the operational efficiency of energy planning and more precise targeting of potential oceanic oil and gas resources facilitated by data collected under Alternative A would range in the magnitude of tens or hundreds of millions of dollars and would be distributed among coastal economies throughout the action area. Furthermore, the data collected under Alternative A would be available to the public indefinitely, and indirect economic benefits resulting from its use and distribution would persist far beyond the conclusion of activities. Overall, the economic impacts of ocean data procured under Alternative A on energy-related activities would be **indirect, beneficial,** and **moderate**.

3.12.2.2.6 Commercial Fishing

Commercial fishing refers to the harvest of living ocean resources for market and is a critical component of the ocean economy; in 2016 the living resource sector provided nearly 90,000 jobs and $11 billion to the GDP. With increased ocean data quality and availability, commercial fishing activities are expected to increase their contribution to the ocean economy by over $500 million (Kite-Powell et al., 2004).

Commercial fishermen rely on marine charts, maps, and bathymetry information that are updated using data collected during NOS projects. These data products are used to select potential fishing locations and plan transit routes. Improving the spatial and temporal resolution of these data products would continue to increase the landed values of fish and reduce risks of unsuccessful voyages, particularly in fisheries with short seasons and limited fishing grounds such as the Alaskan salmon fishery. These benefits are especially important to small, independent fishing operations with limited cash reserves and coastal fishing communities with local economies largely dependent on the commercial fishing industry. Improved data collection would also continue to increase the efficiency of route planning, thereby reducing the operational costs of fishing vessels while increasing the safety of crew members.

Although no direct economic impacts (i.e., job creation, large capital investment) are anticipated within the commercial fishing sector as a result of Alternative A, the indirect economic benefits of increased landed values and operating cost reductions facilitated by data collected under Alternative A would range in the magnitude of hundreds of millions of dollars and would be distributed among coastal economies throughout the action area. Furthermore, the data collected under Alternative A would be available to the public indefinitely, and indirect economic benefits resulting from its use and distribution would persist beyond the conclusion of activities. Overall, the economic impacts of ocean data procured under Alternative A on commercial fishing would be **indirect, beneficial,** and **moderate**.

3.12.2.2.7 Overall Economic Impacts of Alternative A

Data collected under Alternative A would continue to improve the quality and quantity of ocean data and related data products, including marine charts, maps, and hydrographic models of ocean conditions. These data and data products would contribute to the ocean economy indirectly, primarily by increasing operational efficiency and reducing risks associated with using ocean resources in a variety of economic sectors (e.g., route-planning, fishing ground selection, targeting of oil and gas resources, closing/opening recreational areas). Indirect economic benefits would likely range in the magnitude of hundreds of millions of dollars for each sector, although it is important to note these estimates are broadscale and contingent on assumptions of data use and availability. Benefits would be most pronounced in the recreational, commercial fishing, and health and safety sectors of the ocean economy; the energy and transportation sectors would also indirectly benefit from data collected under Alternative A, but to a lesser extent. Overall, Alternative A would have an **indirect, beneficial**, and **moderate** impact on the ocean economy.

3.12.2.3 Alternative B: Conduct Surveys and Mapping for Coastal and Marine Data Collection with Equipment Upgrades, Improved Hydroacoustic Devices, and New Tide Stations

Under Alternative B, all of the activities and equipment operations proposed in Alternative A would continue but at a higher level of effort, although the percentage of nautical miles covered by project activities in each region would be the same as under Alternative A. As under Alternative A, the greatest number of nautical miles surveyed over the six-year period would be in the Southeast Region (over 50 percent). The survey effort in each of the other four regions are of a similar order of magnitude (approximately 10 percent in each region for each of the six years), and is slightly greater in the Alaska Region where the survey effort would be somewhat higher overall (approximately 16 percent). Additionally, survey effort in the Great Lakes would average 3,416 nm (6,327 km) annually, as compared to the remaining annual average survey effort of 605,008 nm (1,120,475 km). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as the type, location and depth of surveys, that add nuance to this trend.

Project activities under Alternative B would take place in the same geographic areas and timeframes as under Alternative A; however, Alternative B would include a larger number of activities and projects, and thus nautical miles traveled, than Alternative A. Overall, there would be an additional 331,868 nm (614,619 km) of survey effort under Alternative B as compared to Alternative A. The types and mechanisms of impacts would remain the same in Alternative B as discussed for Alternative A; ocean data collected under Alternative B would be used by other entities to create data products to increase the operational efficiency and reduce inherent risks of the oceanic industry. Since these impacts are largely indirect in nature and data collected would be available to a wide variety of users throughout the action area, the resulting impacts would not necessarily be geographically correlated with the collection of data. Therefore, the difference between the two alternatives is primarily a matter of scale with an increased activity level, although distributed unevenly among the different types of activities, leading to a corresponding, incremental increase in effects under Alternative B as compared to Alternative A.

As such, the economic benefits of impacts of Alternative B would be the same or slightly, but not appreciably, larger than those discussed above under Alternative A. Overall, the economic impacts of Alternative B on the ocean economy would be **indirect, beneficial,** and **moderate**.

3.12.2.4 Alternative C: Upgrades and Improvements with Greater Funding Support

Under Alternative C, all of the activities and equipment operation proposed in Alternatives A and B would continue but at a higher level of effort, although the percentage of nautical miles in each region would be the same as under Alternatives A and B. In addition, there would be an overall funding increase of 20 percent relative to Alternative B, thus the level of survey activity would increase further. As under

Alternatives A and B, the greatest number of nautical miles surveyed over the six-year period would be in the Southeast Region (over 50 percent). The survey effort in each of the other four regions are of a similar order of magnitude (approximately 10 percent in each region for each of the six years), and is slightly greater in the Alaska Region where the survey effort would be somewhat higher overall (approximately 16 percent). Additionally, survey effort in the Great Lakes would average 3,727 nm (6,902 km) annually, as compared to the remaining annual average survey effort of 660,009 nm (1,222,336 km). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as the type, location and depth of surveys, that add nuance to this trend.

Project activities under Alternative C would take place in the same geographic areas and timeframes as under Alternatives A and B; however, Alternative C would include more projects and activities, and thus more nautical miles traveled, than Alternatives A and B. Overall, there would be an additional 331,868 nm (614,619 km) of survey effort under Alternative C as compared to Alternative B, and an additional 663,736 nm (1,229,238 km) as compared to Alternative A. The types and mechanisms of economic impacts would remain the same in Alternative C as discussed for Alternatives A and B; ocean data collected under Alternative C would be used by other entities to create data products to increase the operational efficiency and reduce inherent risk of oceanic industry. Since these impacts are largely indirect in nature and data collected would be available to a wide variety of users throughout the action area, the resulting impacts would not necessarily be geographically correlated with the collection of data. Therefore, the difference between the alternatives is primarily a matter of scale with an increased activity level, although distributed unevenly among the different types of activities, leading to a corresponding, incremental increase in effects under Alternative C as compared to Alternatives A and B.

As such, the economic benefits of impacts of Alternative C would be the same or slightly, but not appreciably, larger than those discussed above under Alternatives A and B. Overall, the economic impacts of Alternative C on the ocean economy would be **indirect, beneficial,** and **moderate**.