International Journal of Current Practice in Management and Leadership (IJCPML)
Volume.15, Number 1; January-2024;
ISSN: 2837-3189 | Impact Factor: 9.83
https://zapjournals.com/Journals/index.php/ijcpml
Published By: Zendo Academic Publishing

SAILING THROUGH THE SEAS: A COMPARATIVE STUDY OF THE AMERICAN AND CHINESE MARINE ECONOMIES

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Article Info

Keywords: Ocean GDP, maritime economy, economic development, China, United States.

DOI
10.5281/zenodo.10572380

Abstract

The relationship between humanity and the ocean has a deep historical significance, particularly in the context of the economic dimension. The concept of ocean Gross Domestic Product (GDP) was introduced in 1974 to quantify the wealth generated from ocean-related activities (Colgan, 2013). Pontecorvo et al. (1980) and Pontecorvo (1988) estimated the ocean sector's contribution to the U.S. economy in the late 20th century. Collaborative efforts by the Bureau of Economic Analysis (BEA) and the National Oceanic and Atmospheric Administration (NOAA) have resulted in prototype statistics for U.S. ocean GDP (Nicolls et al., 2020).

In 2011, China's marine economic GDP surpassed that of the United States, marking a significant shift in global maritime economic dynamics (Zhang et al., 2016). This milestone ignited a sense of national pride and ambition in China as a maritime powerhouse. To gain a comprehensive understanding of the maritime economic development in both China and the United States, it becomes imperative to analyze their respective paths and disparities. The recently proposed Four Eras Theory of Ocean Utilization (Sun, 2021) provides a promising analytical framework to dissect these differences and chart the developmental trajectories of maritime economies. This framework serves as a valuable tool for examining the maritime accomplishments and challenges faced by China and the United States.

1 Introduction

From a historical perspective, the relationship between mankind and the ocean is extremely close, among of these relationships, the economic relationship between humans and the ocean is the most important one. It is well known that GDP is the best indicator to measure the amount of human wealth produced and created. Therefore, 1974 Nathan Associates proposed the concept of ocean GDP (Colgan, 2013). “Pontecorvo et al. (1980) and Pontecorvo (1988) estimated the contribution of the ocean sector to the U.S.A Economy for the years
1977 and 1987.” (Park &Kildow, 2014, p5). Bureau of Economic Analysis (BEA) cooperates with the National Oceanic and Atmospheric Administration (NOAA) to develop prototype statistics of U.S. Ocean GDP (Nicolls, et al, 2020).

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In 2011, China's marine economic GDP surpassed that of the United States of America (Zhang, et al., 2016), then China began to have the feeling and mind of a great maritime country and a powerful maritime country. This feeling and mind are reflected in some speeches and reports.

In such a situation, it is necessary to analyze the development path and differences between China and the United States of America in the maritime economy, in order to have a clearer understanding of the development status of the maritime economy in China and the United States of America, and to find a better development path. However, above analysis needs to be carried out with the help of a framework, the four eras theory of the use of the ocean by mankind was put forward in 2021 (sun, 2021), we think the four eras theory of the use of the ocean by mankind could be used as a good analysis frame to analyze the development path and differences between China and the United States in the maritime economy.

Through a comparative analysis of the composition of the United States and China's marine GDP, as well as an analysis of the development path of the world's marine economy, we believe that there is still a clear gap between China and the United States of America in terms of marine economic development. China still needs to learn from and imitate the United States of America.

2 Literature Review

The concept of ocean GDP was proposed in 1974 (Colgan, 2013). "Pontecorvo et al. (1980) and Pontecorvo (1988) estimated the contribution of the ocean sector to the U.S. Economy for the years 1977 and 1987." (Park &Kildow, 2014, p5). Lou, et al. (2005) analyzed the quantity, composition, and geographical distribution of China's marine resources, as well as analyzed the degree of correlation between various marine subindustries and the total marine output value, then found that the China marine resources are rich; marine aquaculture industry, coastal tourist industry, ship construction industry, are the pillar industries of China economy, and have the greatest contribution to China's economy.

He (2011) described the development achievement in China marine economy statistics over twenty years from 1990 to 2010. Its development characteristics are the upgrade from decentralized statistics to centralized statistics, the upgrade from partial statistics to comprehensive statistics, the upgrade from loose management to institutionalized management.

Song, et al. (2011) did a comparative analysis of the marine economic development of China and the United States from the angles of development scale, economic contribution, trends, industrial structure, and productivity. They found that, the U.S. marine economy is highly developed, the U.S. tertiary marine industry accounts for a high proportion in the U.S. marine economy, the marine economy's contribution share to the U.S. economy is stable, and the labor productivity of U.S. marine industry is high. China's marine economy is showing a trend of rapid development, the proportion of China tertiary marine economy industry in China marine economy is showing an increasing trend, the contribution of the marine economy to the Chinese economy is increasing, the labor productivity of China marine economy is low.

Colgan (2013) combines the industry and geographic location features to measure the ocean economy activity of the USA, at the national, state, and county levels. The national ocean economy of the U.S. is about 2% of U.S. employment and 1.7% of gross domestic product. Colgan (2013) also argues that the ocean economy of the USA will have a larger share in rural areas. Wang (2013) constructed the marine economic competitiveness evaluating indicators, and utilized the DEA analysis method to evaluate the China main marine economic zones' competitiveness.

Zhang, et al. (2016) analyzed the evolution of China's marine industry surpassing the United States in the period of 2005 to 2012, they think China has taken the first step towards becoming a powerful country of maritime economy and will be a leading country headed by marine GDP in the world. Yan (2018) focused on how China coastal cities can make better use of the direct economic contribution of the marine economy in the National Maritime Silk Road strategy of China. Yan (2018) also pointed out that the development of China marine economy must adhere to the concept of ecological harmony and innovative development.

Sun (2021) from the perspective of human use of the ocean, proposes four era theories on the relationship between humans and the ocean, i.e., in the first era, the ocean is a geographic barrier for mankind; in the second era, the ocean is a road for human transportation; in the third era, the ocean is a granary for mankind; in the fourth era,

the ocean is a treasure house of mankind's natural resources, and gets the following conclusion: every era has the most significant feature of this era; Change of the eras is accompanied by the continuous improvement process of human influence and utilization of the oceans; historically, once a country has maritime hegemony, this country would become wealthy, powerful, and the leaders of maritime civilization.

3 Compared with China, the United States of America has taken the lead out of the era of geographical barriers of the Ocean

Ocean was a natural safety barrier for human beings. China has a long history of using the ocean as a barrier. There is a poem in the classic Chinese book titled the Bible of Poetry, which is translated into English as "Xiangtu is brave and talented, so that overseas people also submit to him". There is a sentence in another Chinese classic book titled Noble Book, which is translated into English as "Walk all over the earth, until the sea". The first poem means that a country or region could be conquered even if this country or region has sea as barrier, the second sentence means that sea is a barrier for human beings.

The Ming Dynasty of China implemented sea ban policy, the purpose of which was to protect oneself via the natural barrier of the sea, mainly to resist armed smuggling, looting and harassment in coastal areas of China from the Japanese warriors, merchants, and ronin. The Qing Dynasty also used the ocean as barriers many times and for a long time: the sea ban was implemented at the beginning of the Qing Dynasty, the purpose of which was to deal with the attack from the sea by Zheng Chenggong, the remnant force of the Ming Dynasty; the Qing Dynasty lifted the sea ban after Zheng Chenggong was suppressed; due to increasingly serious pirate activities and the potential threats from Western culture, Western civilization, and Western industrial products in East Asian waters, the policy of fully opening the sea began to shrink after more than 30 years.

People's liberation army navy was established on 23 April 1949, the PLA Navy had been mainly responsible for offshore defense work for decades, and was largely a riverine and littoral force (brown-water navy) until the late 1980s. PLAN has developed rapidly after entering the 21st century, seeking to build a navy with both offshore defense and ocean-going escort capabilities. Now PLAN is the second largest navy in the world in terms of tonnage, and has the largest number of major combatants of any navy. I think that since China's reform and opening up in the 1980s, China has stepped out of the era of using the ocean as a barrier function.

The United States of America has also experienced the era of using the ocean as a barrier function. At the beginning of the founding of the United States, the US naval power was also very weak. October 13, 1775 was the date of the United States Navy official establishment, but the Continental Navy was disbanded with the end of the War of Independence. Due to the threats to American merchant shipping from Barbary pirates, the Naval Act of 1794 and a resolution to reestablish a permanent standing U.S. Navy were passed by Congress in 1794. The war with the British in 1812 made the United States feel weak in its navy. In the American Civil War, the U.S. Navy fought the small Confederate States Navy with both sailing ships and ironclad ships to shut down the Confederacy's civilian coastal shipping. After the Civil War, most of its ships were laid up in reserve, and by 1878, the Navy was just 6,000 men. The publication of Mahan's work titled "The Influence of Sea Power Upon History, 1660–1783" in 1890 marks the transformation of American ocean strategy. The United States began to walk out of the era of using the sea as a barrier and finally gained the hegemony of the sea in 1939, as 1939 was marked as the year of end of Britain's cycle of hegemony by Robert Gilpin (Spiezio, 1990). Therefore, it is obvious that, compared with China, the United States has taken the lead out of the era of geographical barriers of the Ocean.

4 The United States of America is the last owner of maritime hegemony of the era of sea channel of trade and transportation

The human needs for transportation belong to the category of means (Sun &Philips, 2020), transportation is a means for humans to satisfy their needs. Roads are infrastructures that match human transportation. The sea provides vast roads for mankind, which can be extended to all directions. Although sea roads are natural, human use of sea roads requires two abilities, one is the capacity for maritime transport, the other is the ability to protect the safety of maritime transport and the smooth flow of sea routes. The first ability is relative to maritime navigation technique &knowledge, the courage and passion of the navigator, ship building technology and level, etc. The second ability is relative to the military strength of a country's navy. It is clear that there are differences

in the possession of these two capabilities by different countries, and that the countries with the highest combined capabilities have easy access to maritime hegemony. History also proves that maritime hegemony is constantly alternating: from Portugal's maritime supremacy, to Spain's maritime supremacy, to the United Provinces' maritime supremacy, to the United Kingdom's maritime supremacy, to the U.S.'s maritime supremacy. The United States is the last owner of maritime hegemony of the era of sea channel of trade and transportation. If a country has maritime hegemony, it can form a monopoly on the sea road, and if a country has the monopoly on the sea road, it can form a monopoly on the world commodity trade and transportation, as the monopoly on the world commodity trade and transportation can bring huge economic benefits, therefore, the control and monopoly of ocean transportation channels can bring huge economic benefits. So, before 1800, monopoly dominated in the overseas expansion and colonial trade of Europe:

"It is inconceivable that any country would have willingly shared access to such fabulous riches as the spices of the Eastern seas or the gold and silver of Mexico and Peru. Following the example of the Iberian kings, every other European monarch refused to permit any other power to trade with his colonies before the end of the eighteenth century." (Hamilton, 1948, p51).

Interestingly, under British maritime hegemony, the United Kingdom implemented an inclusive and open maritime policy, i.e., freedom of navigation and free trade policies. It is economic ideas rather than the pressure of interests that were central to repeal the Corn Laws (Irwin, 1989). To maintain the international trade order is the ultimate goal of the United Kingdom by holding sea power. During the maritime hegemony process "Britain as the hegemon can be seen to have provided a 'public good' to the international economy in the form of a liberal ideology" (O'Brien, et al., 1992, p.110).

The United States does not seem to show a diligent pursuit of maritime hegemony. 1939 was marked as the year of end of Britain's cycle of hegemony (Spiezio, 1990), that means the world entered the era of the U.S.'s maritime supremacy. All this is due to the occurrence of World War I and World War II, and the accumulation of U.S. economic, political, military and technological strength.

The United States has always pursued the policy of the freedom of the seas, which has been followed after entering the era of American maritime hegemony: "Generation after generation, America has battled for the general policy of the freedom of the seas. And that policy is a very simple one – but a basic, a fundamental one. It means that no Nation has the right to make the broad oceans of the world at great distances from the actual theater of land war unsafe for the commerce of others." (Franklin D. Roosevelt, Fireside Chat on the Greer Incident, September 11, 1941). "Upon our naval and air patrol – now operating in large number over a vast expanse of the Atlantic Ocean – falls the duty of maintaining the American policy of freedom of the seas – now." (Franklin D. Roosevelt, Fireside Chat on the Greer Incident, September 11, 1941). 1979 United States launched Freedom of Navigation Program.

The U.S. maritime strategy is influenced by Mahan's theory. Mahan's work titled "The Influence of Sea Power Upon History, 1660–1783" was published in 1890, in his this book Mahan argued that: (1) national greatness was associated with the sea; (2) the importance of strategic locations, such as choke points, canals, and coaling stations, had been emphasized; (3) states should increase production and shipping capacities and acquire overseas possessions; (4) the primary mission of a navy was to secure the command of the sea by destroying or neutralizing the enemy fleet and not by destruction of commerce.

Mahan's sea power theory provided the basis for the strengthening of the U.S. Navy. America's powerful naval and military forces have given the United States enough power to control the world's strategic maritime passage. The U.S. control over the world's maritime strategic passages is mainly manifested in the following aspects: (1) the U.S. won two major battles during the 1898 Spanish–American War, eventually the US drove the Spanish out of the Pacific Ocean, and occupied all the important islands in the Pacific Ocean, including Guam, Hawaii. (2) strategic locations of the islands of the ocean are the key points for controlling the ocean, by the end of World War II, most of the islands in the Pacific, most of Southeast Asia, were occupied by the United States, then the U.S. for the first time effectively controlled the Pacific, Indian and Atlantic oceans. (3) via the US global military base networks to control the world's maritime strategic passages. According to Pentagon property portfolio, the

United States has a military presence or a base in over 500 locations overseas, which have been spread across 80 to 160 nations.

The U.S. has also paid a substantial economic price for maintaining maritime hegemony and maintaining control over the world's strategic maritime corridors. “As per US defence budget proposals for 2019, the DoD requested for $686.1 Billion. This is more than $74 billion over the 2018 defence budget. However, as per the Rand Survey Report, the annual defence budget hovers around $150 billion, with an annual increase of $20 billion.” In 1902 President Theodore Roosevelt said that: “A good Navy is not a provocation to war.

It is the surest guaranty of peace.” Because the power and benefits of maritime hegemony and control over strategic maritime corridors can only be fully demonstrated in non-peaceful times, in times of peace there is no obvious power and benefits. Therefore, under the current control structure of ocean hegemony and world ocean strategic channels, and state of peace, China's best strategy is to make great use of the ocean passages rather than to change the current control structure of the ocean hegemony and strategic passages. The most important sign of vigorously using the ocean passages for peaceful purposes is to vigorously develop the ship manufacturing industry, marine construction industry, and the marine transportation industry; another important sign of vigorously using the ocean passages for peaceful purposes is the construction of “Maritime Silk Road 21st Century”, which is a strategic measure to build a peaceful and stable surrounding environment, to open up new areas of cooperation and deepen mutually beneficial cooperation with Association of Southeast Asian Nations, and will be helpful for China and the countries along the maritime Silk Road to carry out all-round cooperation in the fields of port shipping, marine energy, economic and trade, scientific and technological innovation, ecological environment and human exchanges.

Table 1 GDP of China's Three Marine Industries and Their Annual Growth Rates unit: ten percent of billions (current price) and %

industry / year	Marine ship manufacturing industry (current price)	Column 2’s growth rate	Marine engineering industry (current price)	Column 4’s growth rate	Marine transportation industry (current price)	Column 6’s growth rate
2019	1182	11.3%	1732	4.5%	6427	5.8%
2018	997	-9.8%	1905	-3.8%	6522	5.5%
2017	1455	-4.4%	1841	0.9%	6312	9.5%
2016	1312	-1.9%	2172	5.8%	6004	7.8%
2015	1441	3.4%	2092	15.4%	5541	5.6%
2014	1387	7.6%	2103	9.5%	5562	6.9%
2013	1183	-7.7%	1680	9.4%	5111	4.6%
2012	1331	-1.1%	1075	12.7%	4802	6.5%
2011	1437	17.8%	1096	14.9%	3957	7.1%
2010	1182	19.5%	808	14.5%	3816	16.7%
2009	828	15.8%	658	31.9%	3748	-2.4%
2008	762	36.4%	411	-9.0%	3858	16.1%
2007	448	17.6%	342	28.0%	3414	21.1%
2006	252	32.4%	135	20.4%	1060	10.4%
2005	176	11.8%	103	17.2%	1145	5.0%
2004	141	54.4%	-	-	852	21.9%
2003	-	32.1%	-	-	-	30.0%

Source: China Marine Economic Statistics Bulletins from Ministry of Natural Resources of the People’s Republic of China.

Based on the data in Table 1, the average annual growth rate of China GDP of marine ship manufacturing industry from 2002 to 2019, i.e., x_1, can be calculated as the following:

$(1+x_1)^{17}$ =1*(1+32.1%) *(1+54.4%) *(1+11.8%) *(1+32.4%) *(1+17.6%) *(1+36.4%) *(1+15.8%) *(1+19.5%) *(1+17.8%) *(1-1.1%) *(1-7.7%) *(1+7.6%) *(1+3.4%) * (1-1.9%) *(1-4.4%) *(1-9.8%)*(1+11.3%) x_1=11.89%

Based on the data in Table 1, the average annual growth rate of China GDP of marine engineering industry from 2004 to 2019, i.e., x_2, can be calculated as the following:

$(1+x_2)^{15}$ =1*(1+17.2%) *(1+20.4%) *(1+28.0%) *(1-9.0%) *(1+31.9%) *(1+14.5%) *(1+14.9%) *(1+12.7%) *(1+9.4%) *(1+9.5%) *(1+15.4%) *(1+5.8%) *(1+0.9%) * (1-3.8%) *(1+4.5%) x_2=10.41%

Based on the data in Table 1, the average annual growth rate of China GDP of marine transportation industry from 2002 to 2019, i.e., x_3, can be calculated as the following:

$(1+x_3)^{17}$ =1*(1+30.0%) *(1+21.9%) *(1+5.0%) *(1+10.4%) *(1+21.1%) *(1+16.1%) *(1-2.4%) *(1+16.7%) *(1+7.1%) *(1+6.5%) *(1+4.6%) *(1+6.9%) *(1+5.6%) * (1+7.8%) *(1+9.5%) *(1+5.5%) *(1+5.8%) x_3=9.72%

Table 2 Real GDP of the U.S.'s Three Marine Industries and Their Annual Growth Rates unit: dollar and %

industry / year	Ship and boat building sector	Column 2's growth rate	Marine construction sector	Column 4's growth rate	Marine transportation sector	Column 6's growth rate
2005	$15,921,601,056	-	$6,377,378,917	-	$39,637,460,768	-
2006	$15,566,473,727	-2.23%	$6,313,996,894	-0.99%	$44,842,301,905	13.13%
2007	$18,194,173,246	16.88%	$6,439,805,277	1.99%	$47,234,742,542	5.34%
2008	$18,166,209,266	-0.15%	$6,168,829,533	-4.21%	$52,545,516,817	11.24%
2009	$16,731,589,752	-7.90%	$5,886,597,414	-4.58%	$54,623,846,709	3.96%
2010	$17,231,196,109	2.99%	$5,717,259,326	-2.88%	$54,539,331,706	-0.15%
2011	$16,862,861,772	-2.14%	$5,277,055,352	-7.70%	$54,454,853,545	-0.155%
2012	$16,975,720,924	0.67%	$5,331,640,732	1.03%	$55,656,428,698	2.21%
2013	$17,460,017,490	2.85%	$5,168,480,302	-3.06%	$59,087,473,892	6.16%
2014	$17,054,922,263	-2.32%	$4,891,169,135	-5.37%	$58,552,009,172	-0.91%
2015	$18,725,492,427	9.80%	$5,110,874,190	4.49%	$60,912,169,540	4.03%
2016	$18,130,991,311	-3.17%	$5,008,435,236	-2.00%	$58,967,090,923	-3.19%
2017	$18,406,473,518	1.52%	$5,248,299,895	4.79%	$59,624,561,866	1.12%

Source: NOAA Office for Coastal Management https://coast.noaa.gov/digitalcoast/data/

Based on the data in Table 2, the average annual growth rate of the U.S. GDP of ship and boat building industry from 2005 to 2017 can be calculated, and this result =1.21%.
Based on the data in Table 2, the average annual growth rate of the U.S. GDP of marine construction industry from 2005 to 2017 can be calculated, and this result = -1.62%.
Based on the data in Table 2, the average annual growth rate of the U.S. GDP of marine transportation industry from 2005 to 2017 can be calculated, and this result =3.4%.
By comparing the average annual growth rates of the United States and China in three sectors of ship and boat building sector, marine construction sector, and marine transportation sector, we can find that China is showing long-term high growth in above these three sectors in the 21th Century, the United States is slow to grow in above these three sectors from 2005 to 2017, and even retrogression in the marine construction sector. Due to China's long-term high growth in above these three sectors, in 2003, China's shipbuilding industry accounted for more than 10% of the world's output for the first time; in the first half of the year 2007, China's new ship orders increased significantly, ranking first in the world for the first time; by the end of 2005, throughput of Shanghai Port had reached 400 million tons, making Shanghai port the world's largest port.
Based on the above analysis, we can draw the following conclusion: the United States enjoys the prestige of controlling the strategic channel of the ocean, and China makes full use of the economic role of the channel.

5 The United States of America has no urgent need for blue granaries

Like land, the sea is an important source of human food. Therefore, the sea is regarded as the blue granary for humans, fishing is one way for humans to get food from the ocean, and the other main way is fishing farming, but the size of the blue granary depends on the human's ability to exploit the sea.
Table 3 world fisheries and aquaculture production, utilization, unit: million tonnes, live weight

	1986–1995 Average per year	1996–2005 Average per year	2006–2015 Average per year	2016	2017	2018
Capture: Inland	6.4	8.3	10.6	11.4	11.9	12.0
Capture: Marine	80.5	83.0	79.3	78.3	81.2	84.4
Total capture	86.9	91.4	89.8	89.6	93.1	96.4
Aquaculture: Inland	8.6	19.8	36.8	48.0	49.6	51.3
Aquaculture: Marine	6.3	14.4	22.8	28.5	30.0	30.8
Total aquaculture	14.9	34.2	59.7	76.5	79.5	82.1
Total world fisheries and aquaculture	101.8	125.6	149.5	166.1	172.7	178.5
Human consumption	71.8	98.5	129.2	148.2	152.9	156.4
Non-food uses	29.9	27.1	20.3	17.9	19.7	22.2
Population (billions)	5.4	6.2	7.0	7.5	7.5	7.6

Per capita apparent consumption (kg)	13.4	15.9	18.4	19.9	20.3	20.5

Source: FAO, The State of World Fisheries and Aquaculture 2020, P. 3.

From the data in Table 3, we can see that 2016, 2017, 2018 per capita apparent consumption (kg) of fisheries and aquaculture production reached around 20 kg, and the amount of total marine capture has basically stabilized at around 90 million tonnes from 1986 to 2018, but the amount of aquaculture increased greatly, the ratio of the amount of total aquaculture to the amount of total capture was 17%, 37%, 66%, 85%, 85%, 85% in 1986-1995, 1996-2005, 2006-2015, 2016, 2017, 2018 respectively. The ratios above show that the contribution of farming and fishing to human food supply is almost evenly divided now, which also shows the huge development potential and space of farming.

Table 4 Real GDP of the U.S.'s Living Resources Sector unit: dollar

industry / year	Fishing	Fish Hatcheries and Aquaculture	Seafood Processing	Seafood Markets	Total
2005	$1,352,756,157	$1,351,441,429	$3,701,772,111	$754,048,420	$7,160,018,117
2006	$1,533,923,977	$1,211,674,218	$4,346,538,693	$745,536,232	$7,837,673,120
2007	$1,325,989,672	$1,087,263,286	$4,450,159,605	$711,446,677	$7,574,859,240
2008	$1,334,689,072	$937,645,095	$3,806,877,134	$672,467,633	$6,751,678,936
2009	$1,275,761,262	$1,194,553,941	$4,067,153,911	$677,594,805	$7,215,063,919
2010	$1,469,976,135	$1,173,572,800	$3,632,777,994	$686,157,109	$6,962,484,038
2011	$1,701,047,742	$873,244,500	$3,692,549,989	$705,099,949	$6,971,942,180
2012	$1,644,230,502	$871,029,822	$3,677,916,284	$732,693,612	$6,925,870,221

2013	$1,361,659,362	$1,114,846,209	$3,858,639,006	$744,927,561	$7,080,072,138
2014	$1,177,983,913	$1,099,161,739	$3,749,206,774	$752,654,117	$6,779,006,543
2015	$1,234,288,798	$1,258,631,346	$3,986,420,563	$778,671,394	$7,258,012,101
2016	$1,228,651,786	$1,312,770,377	$3,577,149,179	$3,983,887,235	$10,102,458,576
2017	$1,298,775,402	$1,359,976,163	$3,698,637,115	$4,150,183,552	$10,507,572,233

Source: NOAA Office for Coastal Management https://coast.noaa.gov/digitalcoast/data/

Based on the data in Table 4, we can calculate and get the data of Table 5:

Table 5 the Annual Growth Rate of Real GDP of the U.S.'s Living Resources Sector

industry / year	The growth rate of fishing sector	The growth rate of fish hatcheries and aquaculture Sector	The growth rate of seafood processing sector	The of gro wth rate seafood markets sector	The growth rate of living resources
2006	13.39%	-10.34%	17.42%	-1.13%	9.46%
2007	-13.56%	-10.27%	2.38%	-4.572	-3.35%
2008	0.66%	-13.76%	-14.46%	-5.48%	-10.87%
2009	-4.42%	27.40%	6.84%	0.76%	6.86%
2010	15.22%	-1.76%	-10.68%	1.26%	-3.50%
2011	15.72%	-25.59%	1.65%	2.76%	0.136%
2012	-3.34%	-0.254%	-0.40%	3.91%	-0.66%
2013	-17.19%	27.99%	4.91%	1.67%	2.23%
2014	-13.49%	-1.41%	-2.84%	1.04%	-4.25%
2015	4.78%	14.51%	6.33%	3.46%	7.07%
2016	-0.46%	4.30%	-10.27%	-	-
2017	5.71%	3.60%	3.40%	-	-

The data in Table 5 show that the U.S. living resources sectors are at the intersection process of growth and retreat. Based on the data in Table 4 or Table 5, the average annual growth rate of the U.S. GDP of fishing sector from 2005 to 2017 can be calculated, and this result = -0.339%; the average annual growth rate of the U.S. GDP of fish hatcheries and aquaculture sector from 2005 to 2017 is 0.052%, it is because that the U.S. did not take part in the blue revolution, “U.S. aquaculture production as a share of global aquaculture production has fallen steadily from a high of 10% in 1950 to the currently all-time low of 0.39% in 2017.” (Shamshak, et al., 2019, p. 724); the average annual growth rate of the U.S. GDP of seafood processing sector from 2005 to 2017 is 0.0071%; the average annual growth rate of the U.S. GDP of seafood markets sector from 2005 to 2015 is 0.32%; the average annual growth rate of the U.S. GDP of total living resources sector from 2005 to 2015 is 0.136%.

When we calculate the average annual growth rate of the U.S. GDP of seafood markets sector, we choose the time period from 2005 to 2015 rather than from 2005 to 2017, this change is due to "the addition of seafood wholesale activities to the seafood market industry, which only included seafood retail activities before 2016."[3] Above data show that the U.S. living resources sector has stagnated from 2005 to 2017.

Table 6 GDP of China's Marine fisheries Industry and its Annual Growth Rates unit: ten percent of billions (current price) and %

industry / year	GDP of marine fisheries industry (current price)	Marine fisheries industry's annual growth rate
2019	4715	4.4%
2018	4801	-0.2%
2017	4676	-3.3%
2016	4641	3.8%
2015	4352	2.8%
2014	4293	6.4%
2013	3872	5.5%
2012	3652	6.4%
2011	3287	3.7%
2010	2813	4.4%
2009	2509	12.4%
2008	2216	3.3%
2007	1904	-
2006	1902	-6.1%
2005	2011	20.0%

Source: China Marine Economic Statistics Bulletins from Ministry of Natural Resources of the People's Republic of China.

Based on the data in Table 6, the average annual growth rate of China GDP of marine fisheries industry from 2007 to 2019, i.e., x_4, can be calculated as the following:

$(1+x_4)^{12}$ =1*(1+3.3%) *(1+12.4%) *(1+4.4%) *(1+3.7%) *(1+6.4%) *(1+5.5%) *(1+6.4%) *(1+2.8%) *(1+3.8%) *(1-3.3%) *(1-0.2%) *(1+4.4%) x_4=3.99%

Compared the marine fisheries between the U.S. and China, we know that the U.S. living resources sector has stagnated from 2005 to 2017, China has maintained a steady long-term growth status, the average annual growth rate is 3.99 per cent. The main reason for this status is that the United States has no food pressure, while China has food pressure.

6 The United States of America is the leader of the era of human natural resources treasure house

Economics has a basic premise: human desires/wants are infinite, but resources are limited. Human beings are always seeking resources and places where they contain them. With the improvement of human science and technology, human beings are more and more aware of the abundance of marine resources, and the ocean is the treasure house of human natural resources. Marine resources include marine mineral resources, sea chemical resources, marine biological (aquatic) resources and marine power resources.

Table 7 Real GDP of the U.S.'s Offshore Mineral Extraction Industries and Their Annual Growth Rates unit: dollar and %

[3] https://coast.noaa.gov/data/digitalcoast/pdf/econ-report-2016.pdf

industry / year	Limestone, sand and gravel sector	Column 2's growth rate	Oil and gas exploration and production sector	Column 4's growth rate	Offshore mineral extraction: total	Column 6's growth rate
2005	$2,951,578,025	-	$86,085,932,877	-	$89,037,510,901	-
2006	$3,102,101,183	5.10%	$99,826,216,046	15.96%	$102,928,000,000	15.60%
2007	$3,059,804,471	-1.36%	$111,112,000,000	11.31%	$114,172,000,000	10.92%
2008	$2,288,374,741	-25.21%	$103,443,000,000	-6.90%	$105,731,000,000	-7.39%
2009	$1,986,929,231	-13.17%	$131,495,000,000	27.12%	$133,482,000,000	26.25%
2010	$1,593,730,419	-19.79%	$101,110,000,000	-23.11%	$102,704,000,000	-23.06%
2011	$1,357,898,669	-14.80%	$104,645,000,000	3.50%	$106,003,000,000	3.21%
2012	$1,361,974,639	0.30%	$127,670,000,000	22.00%	$129,032,000,000	21.72%
2013	$1,477,413,081	8.48%	$131,580,000,000	3.06%	$133,057,000,000	3.12%
2014	$1,468,595,698	-0.60%	$134,308,000,000	2.07%	$135,776,000,000	2.04%
2015	$1,743,923,702	18.75%	$164,671,000,000	22.61%	$166,415,000,000	22.57%
2016	$1,946,810,495	11.63%	$163,953,000,000	-0.44%	$165,900,000,000	-0.31%
2017	$1,831,713,466	-5.91%	$145,275,461,903	-11.39%	$147,107,175,370	-11.33%

Source: NOAA Office for Coastal Management https://coast.noaa.gov/digitalcoast/data/

Based on the data in Table 7, the average annual growth rate of the U.S. GDP of limestone, sand and gravel sector from 2005 to 2017 can be calculated, and this result = -3.98%.

Based on the data in Table 7, the average annual growth rate of the U.S. GDP of oil and gas exploration and production sector from 2005 to 2017 can be calculated, and this result =4.36%.

Based on the data in Table 7, the average annual growth rate of the U.S. GDP of total offshore mineral extraction sector from 2005 to 2017 can be calculated, and this result =4.18%.

Table 8 GDP of China's Three Marine Industries and Their Annual Growth Rates unit: ten percent of billions (current price) and %

industry / year	Marine oil and gas exploration industry (current price)	Column 2's growth rate	Marine mining industry (current price)	Column 4's growth rate	Marine chemical industry (current price)	Column 6's growth rate
2019	1541	4.7%	194	3.1%	1157	7.3%
2018	1477	3.3%	71	0.5%	1119	3.1%
2017	1126	-2.1%	66	-5.7%	1044	-0.8%

2016	869	-7.3%	69	7.7%	1017	8.5%
2015	939	-2.5%	67	15.6%	985	14.8%
2014	1530	-5.9%	53	13.0%	911	11.9%
2013	1648	0.1%	49	13.7%	908	11.4%
2012	1570	-8.7%	61	17.9%	784	17.4%
2011	1730	6.7%	53	2.1%	691	2.5%
2010	1302	53.9%	49	-0.5%	565	12.4%
2009	748	8.5%	21	7.5%	611	26.0%
2008	874	-1.1%	9	21.3%	542	6.8%
2007	769	17.3%	5	-24.2%	209	16.3%
2006	683	29.2%	8	-24.2%	140	13.0%
2005	467	17.9%	8	-6.1%	79	-19.8%

Source: China Marine Economic Statistics Bulletins from Ministry of Natural Resources of the People's Republic of China.

Based on the data in Table 8, the average annual growth rate of China GDP of marine oil and gas exploration industry from 2005 to 2019, i.e., x_5, can be calculated as the following:

$(1+x_5)^{15}$ =1*(1+17.9%) *(1+29.2%) *(1+17.3%) *(1-1.1%) *(1+8.5%) *(1+53.9%) *(1+6.7%) *(1-8.7%) *(1+0.1%) *(1-5.9%) *(1-2.5%) * (1-7.3%) *(1-2.1%) *(1+3.3%) *(1+4.7%) x_5=6.35%

The average annual growth rate of China GDP of marine oil and gas exploration industry from 2012 to 2019, i.e., x_6, can be calculated as the following:

$(1+x_6)^8$ =1*(1-8.7%) *(1+0.1%) *(1-5.9%) *(1-2.5%) * (1-7.3%) *(1-2.1%) *(1+3.3%) *(1+4.7%) x_6=-2.43%

Based on the data in Table 8, the average annual growth rate of China GDP of marine mining industry from 2005 to 2019, i.e., x_7, can be calculated as the following:

$(1+x_7)^{15}$ =1*(1-6.1%) *(1-24.2%) *(1-24.2%) *(1+21.3%) *(1+2.1%) *(1-0.5%) *(1+7.5%) *(1+17.9%) *(1+13.7%) *(1+13.0%) *(1+15.6%) *(1+7.7%) *(1-5.7%) * (1+0.5%) *(1+3.1%) X_7 =1.84%

Based on the data in Table 8, the average annual growth rate of China GDP of marine chemical industry from 2005 to 2019, i.e., x_8, can be calculated as the following:

$(1+x_8)^{15}$ =1*(1-19.8%) *(1+13.0%) *(1+16.3%) *(1+6.8%) *(1+26.0%) *(1+12.4%) *(1+2.5%) *(1+17.4%) *(1+11.4%) *(1+11.9%) *(1+14.8%) *(1+8.5%) *(1-0.8%) *(1+3.1%) *(1+7.3%) x_8=7.90%

Table 9 GDP of China's Marine Power Industry and its Annual Growth Rates unit: ten percent of billions (current price) and %

industry / year	GDP of marine power industry (current price)	Marine power industry's annual growth rate
2019	199	7.2%
2018	172	12.8%
2017	138	8.4%
2016	126	10.7%
2015	116	9.1%
2014	99	8.5%
2013	87	11.9%
2012	70	14.3%
2011	49	25.0%
2010	28	31.3%

2009	12	25.2%
2008	8	51.6%
2007	5	17.0%
2006	-	3.1%
2005	-	6.7%

Source: China Marine Economic Statistics Bulletins from Ministry of Natural Resources of the People's Republic of China.

Based on the data in Table 9, the average annual growth rate of China GDP of marine power industry from 2005 to 2019, i.e., x_9, can be calculated as the following:

$(1+x_9)^{15}$ =1*(1+6.7%) *(1+3.1%) *(1+17.0%) *(1+51.6%) *(1+25.2%) *(1+31.3%) *(1+25.0%) *(1+14.3%) *(1+11.9%) *(1+8.5%) *(1+9.1%) *(1+10.7%) *(1+8.4%) *(1+12.8%) *(1+7.2%) x_9=14.50%

Viewing from above calculated results, China's acquisition of marine resources is mainly reflected in renewable energy and low-value-added products: the average annual growth rate of China GDP of marine power industry from 2005 to 2019, i.e., x_9, is 14.5%; the average annual growth rate of China GDP of marine chemical industry from 2005 to 2019, i.e., x_8, is 7.9%. China is also striving to pursue the acquisition of high-value-added resources, such as oil and natural gas, however, such efforts have not achieved much: the average annual growth rate of China GDP of marine oil and gas exploration industry from 2012 to 2019, i.e., x_6, is -2.43%; the average annual growth rate of China GDP of marine mining industry from 2005 to 2019, i.e., x7, is 1.84%. The U.S. focuses on acquisition of high-value-added products: the average annual growth rate of the U.S. GDP of oil and gas exploration and production sector from 2005 to 2017 is 4.36%; the average annual growth rate of the U.S. GDP of limestone, sand and gravel sector from 2005 to 2017 is -3.98%, which means that the world has truly entered the era of treating the ocean as a treasure house of natural resources, and the United States is the leader in this era.

7 The U.S. marine economy industry has formed a reasonable regional division of labor

Compared with the marine economy of China, the marine economy of the U.S. has formed a relatively clear regional division of labor structure, and China's marine economy has not yet formed a clear regional division of labor structure.

①②

The U.S. marine economic geography has been divided into eight regions: Great Lakes, Gulf of Mexico, ③ Mid-Atlantic, ④ Northeast, ⑤ North Pacific (Alaska), ⑥ Pacific (Hawaii), ⑦ Southeast, ⑧ West Coast.

The Great Lakes is dominated by the freshwater fisheries, including the commercial fishing and recreation fishing; the Gulf of Mexico is dominated by offshore mineral extraction (primarily oil and natural gas); the Mid-Atlantic is dominated by marine tourism and recreation industry; the Northeast is dominated by marine tourism and recreation industry, marine transportation industry and, boat and ship building; the North Pacific (Alaska) is dominated by commercial fishing; Pacific (Hawaii) is dominated by marine tourism and recreation industry; the Southeast and the West Coast are dominated by marine tourism and marine transportation industry.

8 Conclusion

In this paper, we analyze the development path and differences between China and the United States of America in the maritime economy, and have the following findings: (1) the United States of America has taken the lead out of the era of geographical barriers of the Ocean; (2) the United States of America is the last owner of maritime hegemony of the era of sea channel of trade and transportation; (3) China has made great achievements in the blue granary; (4) the United States of America is the leader of the era of human natural resources treasure house; (5) the U.S. marine economy industry has formed a reasonable regional division of labor. The overall conclusion is that there is still a clear gap between China and the United States in terms of marine economic development. China still needs to learn from and imitate the United States in the development way of maritime economy.

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