

Analysis and Evaluation of Scientific Papers of Five Common Marine Colleges and Universities

With the Core Collection of Web of Science as the Tool and Source of Data

Minqiang Dong

Library

Shanghai Ocean University
Shanghai, China 201306

Weijiang Wang*

Archive

Shanghai Ocean University
Shanghai, China 201306

*Corresponding Author

Abstract—The 21st century is a century in which people intend to explore more about the ocean. China is a country with abundant marine resources. There are mainly six marine colleges and universities in China. Among them, the Ocean University of China is a 985 school, and the other five universities are ordinary universities. Therefore, this article only conducted analysis and evaluation of the five ordinary marine universities. Using the Web of Science core collection and ESI of Clarivate Analytics (formerly Thomson Reuters) as the data source and analysis tool, this paper has analyzed and studied the scientific research situation and dominant disciplines of the five colleges and universities from the perspective of bibliometrics from the multiple dimensions of total number of papers, co-authors and fund sponsorships, dominant disciplines and disciplines included in the ESI subject analysis, in order to provide some reference for relative schools in their scientific research development.

Keywords—China; general marine universities; SCI; ESI; Web of Science

I. INTRODUCTION

It has become a routine bibliometric analysis means to use the WOS database as the data source [1], and use its statistical analysis tools to analyze the scientific and technological competitiveness of a certain unit, region or country in a multi-angle manner, or make statistical comparative analysis of scientific competitiveness for units with high degree of relevance in the scientific and technological disciplines. This article used the WOS core corpus as the tool and data source(2000-2016), conducted statistics and analysis of the five domestic general marine colleges and universities including Shanghai Ocean University, Guangdong Ocean University, Zhejiang Ocean University, Dalian Ocean University and JiMei University. We have analyzed the relevant data from various angles such as the total number of papers, average number of papers per teacher, the institution of the author and funding institutions, the research direction of the subject, and whether or not included in the ESI. We have also compared and analyzed the relevant data of the five universities in order to more objectively reflect the scientific and technological competitiveness of domestic marine colleges

CLC number: G258.6 Document code: A.

and universities and their respective academic advantages.

II. THE TOTAL NUMBER OF PAPERS AND THE AVERAGE NUMBER OF PAPERS PER TEACHER

TABLE I. THE RESPECTIVE TOTAL NUMBER OF SCI PAPERS AND AVERAGE NUMBER OF SCI PAPERS PER TEACHER OF THE FIVE UNIVERSITIES

Name of Universities	Total Number of SCI Papers	Number of Full-time Teachers	Average Number of SCI Papers Per Teacher
Shanghai Ocean University	2649	800	3.31
JiMei University	1392	1500	0.93
Guangdong Ocean University	1162	1434	0.81
Zhejiang Ocean University	1086	764	1.42
Dalian Ocean University	893	788	1.13

It can be seen from "Table I" that Shanghai Ocean University ranks first in both the total number of papers and the average number of papers per teacher. The total number of papers of Shanghai Ocean University is nearly double that of JiMei University which ranks the second, and the average number of papers per teacher of Shanghai Ocean University is more than double that of Zhejiang Ocean University which ranks the second. High-level scientific papers represent the level and strength of scientific research of the school. It can be seen from the above data that Shanghai Ocean University has the highest level of scientific research and the strongest scientific research strength among the five general ocean universities. JiMei University has the second largest total number of papers because of its relatively large number of disciplines. Zhejiang Ocean University, despite having been split up, has the second largest average number of papers per teacher, indicating that the scientific research level and strength of teachers of the school ranks in the forefront among the five schools.

III. THE AUTHORS' AND FUND SPONSORS' INSTITUTIONS

In modern scientific research, teamwork is very important. There are few researches done by a single person now, and there have been cases where a paper has been completed by

several institutions together. The scientific research level of the partner unit can also objectively reflect the scientific research level and strength of the unit itself from the side.

TABLE II. THE TOP TEN COAUTHOR'S INSTITUTIONS OF SHANGHAI OCEAN UNIVERSITY

No.	Name of the Coauthor's Institutions	Number of Papers	Percent %
1	CHINESE ACAD FISHERY SCI	421	15.89
2	CHINESE ACAD SCI	176	6.64
3	MINIST AGR	108	4.08
4	CITY UNIV HONG KONG	84	3.17
5	TONGJI UNIV	84	3.17
6	SHANGHAI JIAO TONG UNIV	79	2.98
7	UNIV MAINE	76	2.87
8	OCEAN UNIV CHINA	67	2.53
9	FUDAN UNIV	58	2.19
10	ZHEJIANG UNIV	57	2.15

As it can be seen from "Table II", among Shanghai Ocean University's partner institutions, the most important one is the Chinese Academy of Fishery Sciences, which accounts for nearly 16%, the proportion of which is nearly 10% more than that of the Chinese Academy of Sciences ranking the second. This shows that Shanghai Ocean University has distinct research features and has been focused on the aquatic science. In addition, among the top ten partner institutions, there are eight domestic institutions (one of which is in Hong Kong, China) and two foreign institutions, indicating that the partners are mainly domestic institutions. Analyzing the specific condition of the domestic institutions, except for the Chinese Academy of Sciences, the rest are all 985 colleges and universities, and most of them are the top ranked domestic schools.

TABLE III. TOP TEN PAPER FUNDING SPONSORS OF SHANGHAI OCEAN UNIVERSITY

No.	Name of the Funding Institutions	Number of Papers	Percent %
1	NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA	767	28.95
2	SHANGHAI MUNICIPAL EDUCATION COMMISSION	164	6.19
3	SHANGHAI LEADING ACADEMIC DISCIPLINE PROJECT	109	4.12
4	SHANGHAI UNIVERSITIES FIRST CLASS DISCIPLINES PROJECT OF FISHERIES	96	3.62
5	SHANGHAI OCEAN UNIVERSITY	89	3.36
6	INNOVATION PROGRAM OF SHANGHAI MUNICIPAL EDUCATION COMMISSION	83	3.13
7	SCIENCE AND TECHNOLOGY COMMISSION OF SHANGHAI MUNICIPALITY	71	2.68
8	NATIONAL HIGH TECHNOLOGY RESEARCH AND DEVELOPMENT PROGRAM OF CHINA	65	2.45
9	SPECIAL FUND FOR AGRO SCIENTIFIC RESEARCH IN THE PUBLIC INTEREST	59	2.23
10	RESEARCH GRANTS COUNCIL OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION CHINA	57	2.15

Among the top ten funding institutions showed in "Table III", the No.1 institution is the National Natural Science Foundation of China, accounting for 28.95%, close to one-third of the total. This illustrates that the scientific research level of Shanghai Ocean University is very high. The one ranking eighth is the national high technology research and development program of China, accounting for 2.45%, and the research grants council of the Hong Kong special administrative region China ranks 10th, accounting for 2.15%. The rest are the research institutions in Shanghai and the Shanghai Ocean University itself.

TABLE IV. TOP TEN COAUTHOR INSTITUTIONS OF JIMEI UNIVERSITY

No.	Name of the Cooperative Institutions	Number of Papers	Percent %
1	XIAMEN UNIV	320	22.99
2	CHINESE ACAD SCI	100	7.18
3	FUJIAN PROV KEY LAB FOOD MICROBIOL ENZYME ENGN	38	2.73
4	FUZHOU UNIV	38	2.73
5	ZHEJIANG UNIV	37	2.66
6	NAGASAKI UNIV	33	2.37
7	CHINESE ACAD FISHERY SCI	27	1.94
8	FUJIAN PROV KEY LAB MARINE FISHERY RESOURCES EC	25	1.80
9	CLEMSON UNIV	22	1.58
10	DALIAN UNIV TECHNOL	22	1.58

As it can be seen from "Table IV", the most important partner institution of JiMei University is Xiamen University, which accounts for more than 20%, and the proportion of Xiamen University is nearly a dozen percentage points more than that of the Chinese Academy of Sciences which is in the second place. This shows that the scientific research of JiMei Ocean University is closely related to that of Xiamen University. In addition, among the top ten partner organizations, there are eight domestic organizations (including four local institutions in Fujian) and two foreign organizations. It shows that the partners are mainly domestic institutions, and JiMei University mainly cooperates with local institutions in Fujian in its scientific research.

TABLE V. TOP TEN PAPER FUNDING SPONSORS OF JIMEI UNIVERSITY

No.	Name of the Funding Sponsors	Number of Papers	Percent %
1	NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA	419	30.10
2	FOUNDATION FOR INNOVATIVE RESEARCH TEAM OF JIMEI UNIVERSITY	90	6.47
3	NATURAL SCIENCE FOUNDATION OF FUJIAN PROVINCE	88	6.32
4	NATURAL SCIENCE FOUNDATION OF FUJIAN PROVINCE OF CHINA	75	5.39
5	NSFC	64	4.60
6	FOUNDATION FOR INNOVATIVE RESEARCH TEAM OF JIMEI UNIVERSITY CHINA	56	4.02
7	PROGRAM FOR NEW CENTURY EXCELLENT TALENTS IN FUJIAN PROVINCE UNIVERSITY	52	3.74

No.	Name of the Funding Sponsors	Number of Papers	Percent %
8	NATIONAL NATURAL SCIENTIFIC FOUNDATION OF CHINA	48	3.45
9	NATURAL SCIENCE FOUNDATION OF FUJIAN PROVINCE CHINA	35	2.51
10	INNOVATION TEAM FOUNDATION OF JIMEI UNIVERSITY	32	2.30

It can be seen from the top 10 funding institutions in “Table V” that the first, fifth and eighth institutions are all the National Natural Science Foundation of China, which totally accounts for 38.44%, more than one-third of the total. This shows that the scientific research level of JiMei University is high. And the rest are research funding institutions in Fujian and the JiMei University itself.

TABLE VI. TOP TEN COAUTHOR INSTITUTIONS OF GUANGDONG OCEAN UNIVERSITY

No.	Name of the Coauthor Institutions	Number of Papers	Percent %
1	CHINESE ACAD SCI	132	11.36
2	SUN YAT SEN UNIV	48	4.13
3	GUANGDONG PROV KEY LAB PATHOGEN BIOL EPIDEMIOLOG	47	4.05
4	S CHINA UNIV TECHNOL	39	3.36
5	CHINA AGR UNIV	30	2.58
6	ZHONGKAI UNIV AGR ENGN	26	2.24
7	OCEAN UNIV CHINA	25	2.15
8	S CHINA AGR UNIV	25	2.15
9	SOUTH CHINA AGR UNIV	25	2.15
10	CHINESE ACAD TROP AGR SCI	24	2.07

As it can be seen from “Table VI”, among the partner institutions of Guangdong Ocean University, the most important one is the Chinese Academy of Sciences, accounting for more than 11%, more than double the number of Zhongshan University which ranks the second. And the top ten partner institutions are all domestic institutions. In addition, among the top ten partner organizations, there are seven in Guangdong. It shows that the partners are mainly domestic institutions, and Guangdong Ocean University mainly cooperates with the local institutions in Guangdong.

TABLE VII. TOP TEN PAPER FUNDING SPONSORS OF GUANGDONG OCEAN UNIVERSITY

No.	Name of the Funding Institutions	Number of Papers	Percent %
1	NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA	277	23.84
2	GUANGDONG OCEAN UNIVERSITY	58	4.99
3	GUANGDONG NATURAL SCIENCE FOUNDATION	42	3.61
4	NATIONAL SCIENCE FOUNDATION OF CHINA	23	1.98
5	NATURAL SCIENCE FOUNDATION OF GUANGDONG PROVINCE	23	1.98
6	NATIONAL BASIC RESEARCH PROGRAM OF CHINA	21	1.81

No.	Name of the Funding Institutions	Number of Papers	Percent %
7	SPECIAL FUND FOR AGRO SCIENTIFIC RESEARCH IN THE PUBLIC INTEREST	21	1.81
8	GUANGDONG PROVINCE KEY PROJECT IN THE FIELD OF SOCIAL DEVELOPMENT	17	1.46
9	FUNDAMENTAL RESEARCH FUNDS FOR THE CENTRAL UNIVERSITIES	16	1.38
10	NSF OF GUANGDONG PROVINCE	15	1.29

As it can be seen from the top ten funding institutions in “Table VII”, the first and fourth are both the National Natural Science Foundation of China, which totally account for 25.82%, more than a quarter of the total; The ninth is the Fundamental Research Funds for the Central Universities; These show that the level of scientific research of Guangdong Ocean University is relatively high. And the rest are research funding institutions of Guangdong Province, the Ministry of Agriculture and the Guangdong Ocean University itself.

TABLE VIII. TOP TEN COAUTHOR INSTITUTIONS OF ZHEJIANG OCEAN UNIVERSITY

No.	Name of the cooperative institutions	Number of Papers	Percent %
1	OCEAN UNIV CHINA	119	10.96
2	CHINESE ACAD SCI	60	5.53
3	DALIAN UNIV TECHNOL	43	3.96
4	ZHEJIANG UNIV	39	3.59
5	CHINESE ACAD FISHERY SCI	35	3.22
6	XIAMEN UNIV	23	2.12
7	SHANGHAI JIAO TONG UNIV	21	1.93
8	HEBEI NORMAL UNIV	20	1.84
9	YANBIAN UNIV	19	1.75
10	CHINESE UNIV HONG KONG	18	1.66

As it can be seen from “Table VIII”, among Zhejiang Ocean University's partner institutions, the most important one is the Ocean University of China, accounting for nearly 11 percent, nearly double the number of Chinese Academy of Sciences which ranks the second. The top ten partner institutions are all domestic institutions (of which one is in Hong Kong). In addition, among the top ten partner organizations, only one is in Zhejiang, namely Zhejiang University, indicating that the cooperation of Zhejiang Ocean University with other institutions has broken through local limitations and the partner organizations are widely distributed all over China.

TABLE IX. TOP TEN PAPER FUNDING INSTITUTIONS OF ZHEJIANG OCEAN UNIVERSITY

No.	Name of the Funding Institutions	Number of Papers	Percent %
1	NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA	379	34.90
2	ZHEJIANG PROVINCIAL NATURAL SCIENCE FOUNDATION OF CHINA	130	11.97
3	NATURAL SCIENCE FOUNDATION OF ZHEJIANG PROVINCE	70	6.45

No.	Name of the Funding Institutions	Number of Papers	Percent %
4	ZHEJIANG OCEAN UNIVERSITY	33	3.04
5	ZHEJIANG PROVINCIAL NATURAL SCIENCE FOUNDATION	32	2.95
6	OPEN FOUNDATION FROM OCEAN FISHERY SCIENCE AND TECHNOLOGY IN THE MOST IMPORTANT SUBJECTS OF ZHEJIANG	30	2.76
7	PUBLIC SCIENCE AND TECHNOLOGY RESEARCH FUNDS PROJECTS OF OCEAN	30	2.76
8	NATION NATURE SCIENCE FOUNDATION OF CHINA	29	2.67
9	FUNDAMENTAL RESEARCH FUNDS FOR THE CENTRAL UNIVERSITIES	25	2.30

It can be seen from the top ten funding institutions in “Table IX” that the first and eighth are both the National Natural Science Foundation of China, which together account for 37.57%, more than one-third of the total; The seventh is the public science and technology research funds projects of ocean; The ninth is the fundamental research funds for the central universities; These indicate that the scientific research level of Zhejiang Ocean University is high. And others are the research funding institutions in Zhejiang and the Zhejiang Ocean University itself.

TABLE X. TOP TEN COAUTHOR INSTITUTIONS OF DALIAN OCEAN UNIVERSITY

No.	Name of the Coauthor's Institutions	Number of Papers	Percent %
1	CHINESE ACAD SCI	165	18.48
2	DALIAN UNIV TECHNOL	131	14.67
3	CHINESE ACAD FISHERY SCI	95	10.64
4	OCEAN UNIV CHINA	54	6.05
5	UNIV CHINESE ACAD SCI	44	4.93
6	DALIAN MARITIME UNIV	30	3.36
7	SHANGHAI OCEAN UNIV	29	3.25
8	NATL MARINE ENVIRONM MONITORING CTR	21	2.35
9	DALIAN POLYTECH UNIV	20	2.24
10	RUSSIAN ACAD SCI	15	1.68

As it can be seen from “Table X”, the total proportion of partner institutions of Dalian Ocean University is very high, and the top three are all more than 10%, of which the proportion of Chinese Academy of Sciences is the highest. Among the top ten partner institutions, there are nine domestic institutions and one foreign institution. In addition, among the top ten partner organizations, there is only one in Dalian, indicating that the partner institutions are not localized and distributed all over China.

TABLE XI. TOP TEN PAPER FUNDING SPONSORS OF DALIAN OCEAN UNIVERSITY

No	Name of the Funding Institutions	Number of Papers	Percent %
1	NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA	263	29.45
2	earmarked fund for modern agro industry technology research system	31	3.47
3	CHINESE NATIONAL 863 PROJECT	26	2.91
4	PROGRAM FOR LIAONING EXCELLENT TALENTS IN UNIVERSITY	26	2.91
5	FUNDAMENTAL RESEARCH FUNDS FOR THE CENTRAL UNIVERSITIES	24	2.69
6	NATURAL SCIENCE FOUNDATION OF CHINA	21	2.35
7	NATIONAL SCIENCE FOUNDATION OF CHINA	20	2.24
8	NATIONAL NATURE SCIENCE FOUNDATION OF CHINA	19	2.13
9	NATIONAL HIGH TECHNOLOGY RESEARCH AND DEVELOPMENT PROGRAM OF CHINA 863 PROGRAM	18	2.02
10	TAISHAN SCHOLAR PROGRAM OF SHANDONG CHINA	18	2.02

As it can be seen from the top ten funding institutions in “Table XI”, the first, sixth, seventh and eighth are all the National Natural Science Foundation of China, which together account for 36.17%, more than three-thirds of the total. The third and ninth are both the Chinese National 863 Project; the fifth is the fundamental research funds for the central universities; these conditions indicate that Dalian Ocean University's scientific research level is high. The others are local research funding institutions in Liaoning.

To sum up, the Chinese Academy of Sciences has appeared in the cooperation institutions of all the five universities, and it ranks in the forefront among the cooperative institutions. The Chinese Academy of Sciences is the highest professional scientific research institution in China. It can be seen that the cooperation institutions of the five universities are of a high level. In addition, the Ocean University of China has appeared in the cooperation institutions of the five universities except for the JiMei University. This not only shows the distinctive marine characteristics of the four universities, but also reflects the leading position of the Ocean University of China in the marine scientific research in China. Among the five universities, there are four Fujian local institutes in the cooperative institutions of JiMei University, indicating that JiMei University's scientific research has distinctive local characteristics. Among the cooperation institutions of the five universities, except the Chinese Academy of Sciences, the Chinese Academy of Fishery Sciences, and the National Marine Environmental Monitoring Center, the rest are all colleges and universities, and there are no enterprises. Among the five universities' research funding institutions, the first is the National Natural Science Foundation of China, and the proportions of it in five universities are all close to or more

than one-third of the total fund, indicating that the scientific research levels of the five universities are relatively high.

IV. RESEARCH DIRECTIONS OF THE PAPERS

From the research directions of the published papers of the five universities, we can know the research direction and preponderant and key disciplines of each university in scientific research.

TABLE XII. TOP TEN RESEARCH DIRECTIONS IN PAPERS OF SHANGHAI OCEAN UNIVERSITY

No.	Research Direction	Number of Papers	Percent %
1	MARINE FRESHWATER BIOLOGY	448	16.91
2	FISHERIES	440	16.61
3	GENETICS HEREDITY	325	12.27
4	BIOCHEMISTRY MOLECULAR BIOLOGY	311	11.74
5	CHEMISTRY	252	9.51
6	ENVIRONMENTAL SCIENCES ECOLOGY	218	8.23
7	OCEANOGRAPHY	207	7.81
8	FOOD SCIENCE TECHNOLOGY	173	6.53
9	ENGINEERING	160	6.04
10	BIOTECHNOLOGY APPLIED MICROBIOLOGY	158	5.97

As it can be seen from "Table XII", the top two are marine freshwater biology and fisheries. The proportions of the two are close to each other and relatively large. This shows that Shanghai Ocean University pays attention to both the basic disciplines and the characteristic disciplines of aquatic products in its scientific research, and its characteristics of aquatic fisheries are obvious. Marine freshwater biology is the school's preponderant discipline, and fisheries is the most important characteristic discipline, and the main relationship between the two disciplines is exactly that between the theory and practice. It can be seen from the top ten disciplines in Table XII that the oceanography ranks seventh. Except for the eighth food science technology and ninth engineering, other disciplines all belong to the field of biology or chemistry. And biology is the basic discipline for fishery and marine disciplines, and chemistry is the basic discipline for food science technology.

TABLE XIII. TOP TEN RESEARCH DIRECTIONS IN PAPERS OF JIMEI UNIVERSITY

No.	Research Direction	Number of Papers	Percent %
1	MATHEMATICS	267	19.18
2	CHEMISTRY	231	16.60
3	PHYSICS	165	11.85
4	FISHERIES	147	10.56
5	MARINE FRESHWATER BIOLOGY	137	9.84
6	ENGINEERING	122	8.76
7	BIOCHEMISTRY MOLECULAR BIOLOGY	118	8.48
8	FOOD SCIENCE TECHNOLOGY	114	8.19
9	COMPUTER SCIENCE	81	5.82

It can be seen from "Table XIII" that the top three disciplines are mathematics, chemistry and physics. The total proportion of the three is close to 47%, nearly half, and the proportion of mathematics is over 19%. The fisheries and marine freshwater biology only rank fourth and fifth respectively, and their proportions are only about 10%. Engineering ranks sixth, food science technology ranks eighth, computer science ranks ninth, and oceanography has not entered the top ten. This shows that the basic disciplines of mathematics, physics and chemistry have become the preponderant disciplines of JiMei University, having replaced the traditional preponderant disciplines of fisheries and aquatic products.

TABLE XIV. TOP TEN RESEARCH DIRECTIONS IN PAPERS OF GUANGDONG OCEAN UNIVERSITY

No.	Research Directions	Number of Papers	Percent %
1	CHEMISTRY	176	15.15
2	MARINE FRESHWATER BIOLOGY	126	10.84
3	FISHERIES	124	10.67
4	ENGINEERING	112	9.64
5	MATHEMATICS	102	8.78
6	BIOCHEMISTRY MOLECULAR BIOLOGY	75	6.45
7	PHYSICS	68	5.85
8	FOOD SCIENCE TECHNOLOGY	60	5.16
9	AGRICULTURE	58	4.99
10	OCEANOGRAPHY	56	4.82

It can be seen from "Table XIV" that the first is chemistry, and marine freshwater biology and fisheries rank second and third respectively. Engineering ranks fourth, physics ranks seventh, and oceanography ranks tenth. In addition to the traditional food science technology which ranks eighth, the agriculture also ranks ninth in the top ten disciplines, which is a feature of Guangdong Ocean University.

TABLE XV. TOP TEN RESEARCH DIRECTIONS IN PAPERS OF ZHEJIANG OCEAN UNIVERSITY

No.	Research Directions	Number of Papers	Percent %
1	BIOCHEMISTRY MOLECULAR BIOLOGY	126	11.60
2	MARINE FRESHWATER BIOLOGY	124	11.42
3	FISHERIES	115	10.59
4	ENGINEERING	113	10.41
5	GENETICS HEREDITY	111	10.22
6	CHEMISTRY	107	9.85
7	PHYSICS	103	9.48
8	MATHEMATICS	95	8.75
9	COMPUTER SCIENCE	84	7.74
10	FOOD SCIENCE TECHNOLOGY	79	7.27

It can be seen from "Table XV" that biochemistry molecular biology ranks first, marine freshwater biology and fisheries rank second and third respectively, engineering ranks fourth, physics ranks seventh, computer science ranks ninth, and food science technology ranks tenth. The oceanography

has not entered the top ten. In addition to traditional fisheries and biological sciences, the engineering characteristic disciplines such as engineering, physics and computer science have also become the preponderant disciplines of Zhejiang Ocean University.

TABLE XVI. TOP TEN RESEARCH DIRECTIONS IN PAPERS OF DALIAN OCEAN UNIVERSITY

No.	Research Directions	Number of Papers	Percent %
1	MARINE FRESHWATER BIOLOGY	197	22.06
2	FISHERIES	195	21.84
3	BIOCHEMISTRY MOLECULAR BIOLOGY	128	14.33
4	CHEMISTRY	105	11.76
5	IMMUNOLOGY	96	10.75
6	ENGINEERING	85	9.52
7	ENVIRONMENTAL SCIENCES ECOLOGY	70	7.84
8	VETERINARY SCIENCES	69	7.73
9	BIOTECHNOLOGY APPLIED MICROBIOLOGY	59	6.61
10	GENETICS HEREDITY	58	6.50

It can be seen from "Table XVI" that marine freshwater biology and fisheries rank first and second respectively, and their proportions are both more than 20%. Eight of the top ten research directions are related to fisheries and fishery basic disciplines of biological sciences and chemistry.

TABLE XVII. RANKING OF DISCIPLINES OF CHINESE OCEAN UNIVERSITIES INCLUDED INTO THE ESI IN CORRESPONDING ACADEMIC AREAS

No.	Institution	Total Number of Papers	Total Number of Citations	Average Number of Citations Per Paper	Number of Hot Papers
761	SHANGHAI OCEAN UNIV	723	4304	5.95	0

VI. CONCLUSION

Among the five ordinary marine colleges and universities, Shanghai Ocean University has the largest number of papers, and nearly doubles the papers of JiMei University, indicating that the overall scientific research of Shanghai Ocean University is in an absolute position among the five institutions.

From the quality of the paper, National Natural Science Fund accounted for 38.44% in JiMei University; National Natural Science Fund accounted for 37.57% in Zhejiang Ocean University; National Natural Science Fund accounted for 36.17% in Dalian Ocean University. The National Natural Science Fund of these three universities accounted for more than one third of the total number of papers, indicating that the papers of these three universities are of higher quality.

Viewing from the research direction, Shanghai Ocean University and Dalian Ocean University have retained the basic science and application of fishery and aquatic product. Marine and freshwater biology and fisheries are the top two areas of research. Zhejiang Ocean University and Guangdong Ocean University have also maintained their traditional characteristics, with seawater and freshwater biology and fisheries ranking second and third. The top three research fields of JiMei University are mathematics, chemistry and

Oceanography is not in the top ten disciplines. This phenomenon shows that Dalian Ocean University maintains the most obvious characteristics of fisheries and aquatic products in the past. The university still has advantages in the traditional fishery disciplines. In addition, the oceanography ranks tenth and the marine characteristics of the school are not obvious enough. The basic disciplines of fisheries and fisheries are clearly dominant disciplines of the school.

V. ESI INCLUSION

Essential Science Indicators (ESI) is a basic analytical evaluation tool developed by the US Institute for Scientific Information (ISI) to measure scientific research performance and track scientific development trends. It is a database of econometric analysis established on the basis of the academic journals included in the ISI Science Citation Index Database (SCI) and Social Sciences Citation Index Database (SSCI). From the perspective of citation analysis, ESI conducts statistical analysis and ranking of countries, research institutions, journals, papers and scientists in 22 professional fields [2]. Among the five ordinary marine universities in China, only Shanghai Ocean University has a discipline to be included in the ESI. The discipline is the plant & animal science, ranking 761th among the 1147 global top 1% institutions.

physics, and they are completely turned to basic scientific research.

From the perspective of the co-author organization, the main co-author organization of Shanghai Ocean University is the Chinese Academy of Fisheries, which has obvious aquatic characteristics. The main co-author organization of JiMei University is Xiamen University, which has obvious local characteristics. In addition to JiMei University, Chinese Ocean University has appeared in the cooperative institutions, and it ranks first among the co-author organization of Zhejiang Ocean University, indicating that the ocean characteristics of these four universities are more obvious.

REFERENCES

- [1] Web of Science Core Collection [EB/OL]. [2011-07-06] http://apps.webofknowledge.com/WOS_GeneralSearch_input.do?product=WOS&SID=V1YJ98alxjTIFSHmugF&search_mode=GeneralSearch. (in Chinese)
- [2] Zhang Ziqian, Shi Liwen, Li Maomao, et al. Analysis of the status quo and development trend of agricultural science disciplines in Chinese agricultural universities based on ESI[J]. Journal of Anhui Agricultural Sciences, 2011, 39(23): pp.14 443-14 445. 2017.7.6. (in Chinese)