



## Bibliometrics Analysis of Paleontology Research on the Global Context

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### ABSTRACT

The paper analyses the Bibliometrics Analysis of Paleontology Research in the Global Context during the period of 2005-2019. The research productivity in the field of Paleontology literature, the frequency distribution of publications was analyzed and interpreted. A total number of 12052 records were published between 2005 and 2019 on Paleontology literature and those records retrieved from the Scopus database which is a multidisciplinary abstract and citation database. The maximum number of citations in the year 2011 comprises 24683 citations and the minimum number of citations is 3115 in 2019. The maximum number of citations per paper is 39.28 in 2006.

**Keywords:** Paleontology, Bibliometrics, Scopus, Citations, Frequency Distribution,

### Introduction

The terms "bibliometrics" and "metrics" were coined by combining the words "biblio" and "metrics." The word "biblio" is derived from a mixture of Latin and Greek roots that mean "book" and "paper." The term metrics, on the other hand, refers to the science of measuring (measurement). It is defined by Metron and Garfield as a branch of investigation dedicated to quantitative analysis of science and scientific fields. Pitcher characterized it as "the application of mathematical and statistical methods to books and other forms of communication," as well as "the metrology of the information transfer process," with the goal of "process analysis and control." Bibliometrics was defined by the British Standard Glossary of Documentation of Terms as "the study of the usage of documents and patterns of publication using mathematical and statistical methodologies," which is similar to Pitchard's definition. In 'Science Progress,' F.J. Cole and Nellie B. Eates published the first study on bibliometrics. Statistical analysis of literature is a term that refers to the functions of interest and distribution of literature among countries. In 1923, E.W. Hulme published the Statistical Bibliography, a second report on bibliometrics. He ranked countries based on their output by analysing journal articles from the 'English International Catalogue of Science Literature.' Gross and Gross published the first known examination of citation data in 1927.

### Paleontology

Paleontology studies the fossil record left behind by living species to learn about the evolution of life on Earth. Although paleontology is a branch of biology concerned with the study of previous living species, its historical growth has been tightly linked to geology and the study of the Earth's history. Xenophanes (570-480 BC) wrote about fossil sea shells demonstrating that land was once under water in ancient times. The Persian naturalist discussed fossils during the middle Ages. The scientific study of fossils became a vital aspect of the transformations in natural philosophy that happened throughout the Age of Reason in early modern Europe.

### Review of Literature

Andreo-Martínez, P. et.al., (2020) based on the database Web of Science The following parameters were considered when analysing 608 articles: I publication type, language, and output characteristics, (ii) Lotka's Law, Price's index, and h-index, (iii) collaboration analysis between authors, countries, and institutions. Baas, J. et.al., (2020) Scopus provides comprehensive author and institution profiles, which are derived from advanced profiling algorithms and manual curation, ensuring high precision and recall. As a result, many publications have used Scopus data to investigate topics like researcher mobility, network visualisations, and spatial bibliometrics. Herrera-Franco, G. et.al., (2020) The goal of this study is to look into the scientific material on geotourism in the Scopus database using bibliometric analysis and the VOSviewer programme to assess the structure, conceptual evolution. Nattar, S. (2019) In the journal Indian Journal of Physics, this research investigates the applicability of Lotka's Law to authorship distribution. The data will be gathered from issues of the Indian Journal of Physics between 2008 and 2017. Andreo-Martínez, P., Ortiz-Martínez, V. M., García-Martínez, N., López, P. P., Quesada-Medina, J., Cámara, M. Á., & Oliva, J. (2020). A descriptive bibliometric study on bioavailability of pesticides in vegetables, food or wine research (1976–2018). *Environmental toxicology and pharmacology*, 77, 103374.

Baskaran (2013) discussed that Doubling time (Dt) was found to be increased and decreased trend in this study. Degree of collaboration and its means value is found to be 0.963. The three institutions are more leading productivity, which are Alagappa University with CECRI, National Cheng King University and Anna University. Baskaran and Binu (2019) analysed that Most of the 416 respondents (98.8%) are looking for education and research

information. The research results can determine the various parameters of academic access to electronic resources. The research will help promote the acquisition of electronic information to stimulate users' research and academic thinking. Baskaran (2018) studied the role of computers in providing education. Baskaran (2016) discussed The highest publication published in the Bioinformatics Journal, and Harvard University scientists contributed the most publications in this research. Both RGR and DT showed this fluctuating trend throughout the study period. Baskaran (2015) studied the three Major Paradigm Shifts 21<sup>st</sup> Century Library Setting, Revolutionary Changes, Library Roles, Millennial Generation, Cyber Infrastructure Characteristics, Major Challenges of 21<sup>st</sup> Century Librarian, Tasks, Library Should be the Customers' Expectations and so on. Baskaran (2015) analyzed the USA scientists have contributed totally 15832 (30.815%) items and include 87.947% percent are appeared as journal articles. Scientists at Harvard University have attracted much attention in writing a large number of research papers and occupy a leading position in research cooperation in the field of enzyme research. Baskaran (2012) discussed that the doubling time (Dt) exhibited a fluctuating trend during the study period. The results use the least squares method to exclude highly productive authors and the maximum likelihood method to examine the exponential growth of authors. In the course, it was found that Lotka's law is applicable to graph theory research. Baskaran and Ramesh (2019) analyzed that the study analyzed that the electronic information access pattern between faculty and staff plays an important role in the completion of various tasks of the interviewee in the engineering school. According to the study, the study aimed to analyze that 76% of the respondents were men, of which 26% were women. Baskaran and Ramesh Babu (2019) examined the publishing productivity of forensic medicine output from 1989 to 2016. Growth of publications in research, RGR and Dt of research output, cooperation between authors. Baskaran (2018) analyzed the highest SD was 21. 71405 and 21.71405 the problems were found Do not have smart Phone and Lack of security on personal information. The highest CV was 864.5 found on Lack of security on personal information. Baskaran and Karuilancheran (2015) analyzed the C.V. at 0.05 significant level for 29 degrees of freedom is 42.56 and the calculated value of Chi-Square ( $X^2$ ) obtained in this case is 5309.368. Afterwards, the performance of researchers started diminishing. It was supported by SPI that ranges between 9 and 10 only. Baskaran (2014) discussed the quantitative analysis of the productivity and characteristics of citations of Library and Information Science (LIS) publications during 2003-2012. A total of 1,942 articles and 12,502 citations were published in LIS journals indexed by SSCI. 21.36% of citations were received in 2012. Baskaran, C. (2013) analyzed that 70 (59.1%) of the faculty and staff participating in the study learned through 28 (56%) guidance from teachers/managers. There is evidence that the largest proportion of faculty and staff 21 (42%) use their department to access information, while 28 (40%) of researchers access the e-journals of their department themselves. Baskaran (2019) analyzed the 210 (55.26) respondents are extremely satisfied on OPAC/Web OPAC. 205(53.90) respondents are extremely satisfied on E-Databases, 192(50.52) respondents are extremely satisfied on Automated circulation services. Baskaran (2018) explored the map the number of publications, growth rate and doubling time, scattering of publication over journals, and its impact on publication output, authorship patterns and Global citation score of bioremediation research publication in India using the HistCite, VOSviewer software. Indian Institute of Technology, Baba Atomic Research Center and CSIR are the main producers of research results in the field of bioremediation. Sivakami and Baskaran (2016) analyzed a total of 64,030 data sets of in this study from the MEDLINE database. All types of resources experienced the largest decline in 2010 and 2011, with an average of 2,784 releases per year. A time series analysis was performed on the most productive countries (the United States) and India to compare the results of the next few years. Baskaran (2014) discusses the quality of the collection from the perspective of books, magazines and resources. Yahoo is the most popular web surfing search engine. The book rental service is the staff's favorite. Saravanan and Baskaran (2019) studied the bibliographic coupling, language distribution, keyword distribution, geographic distribution of documents, and the history of local and global citations of established institutions. Baskaran (2019) analyzed . Most of the respondents of 90 (33%), 76 (27.8) and 51 (18.7%) said they "strongly agree", "agree" or "have no comments" and prefer "easy access" Analyze large amounts of data". Baskaran (2018) examined most of the publications of 44.15% of the two authors in the analysis of BM. Guptha has published 18 articles on DJLIT, and he is the number one author. It is closely followed by Chenupathi K. Ramiah, the 11th University of Delhi, ranked second in his publications, which is the highest ranked institution. Binu and Baskaran (2017) analyzed the user's satisfaction assessment of resources and services. It turns out that most people surveyed use resources for different purposes to a large or very large extent. Users are very satisfied with the various electronic resources and services provided by the library.

Ramesh Babu and Baskaran (2017) analyzed an analysis that explored the growth trend of forensic medicine from 1989 to 2015. It is the highest value observed in forensic research in 2013. In 2013, forensic research accounted for 447 (11.05%) publications, followed by 420 (10.38%). Publications published in 2015. The doubling of publications also shows the fluctuating trend throughout the study period. Baskaran (2020) analyzed the lowest relative growth rate (RGR; 0.04) of in 2008. In 2010, 2012 and 2014 RGR increased to 0.75 in 1990, with an average relative growth rate (RGR) of 0.15. The most publications (293; 63.55%) come from information science in library science. This field ranks first among the 25 research fields listed in the study. Baskaran (2020) describes the use of altmetrics in a cross-platform public API to collect data using open scripts and algorithms. Altmetrics did not initially cover the number of citations. It calculates the impact of scientists based on various online studies, such as: B. Social media, online news media, and online reference managers. Baskaran, C. (2020) analyzed 11,941 data sets in social networks and media retrieved from the Web of Science database during the research period. Most of the 2,576 (21.57%) publications published in 2018 were recorded, followed by the 2,281 (19.10%) data set published in 2017. Palanivel and Baskaran (2018) studied 2313 scientific articles published in the Journal of Economic Affairs. The analysis mainly includes the number of articles and the form of documents. The research is to obtain 2313 results from 37 years from the SCOPUS database, and the search results are analyzed using Excel worksheets. Pramanathan and Baskaran (2015) discussed that 199 (49.13%) and 131 (43.52%) of the respondents were female respondents from Bharathidasan University and Periyar University. Most of the 310 (76.54%) and 198 (65.78%) respondents had less than 3 years of research experience at Hindu University and Periyar University. Murugaiah and Baskaran (2013) collaborated with American researchers to analyze a large number of publications in the field of human DNA. The research measures performance based on multiple parameters, the country's annual growth rate, author model, cooperation index, cooperation coefficient, major cooperating countries, and authors who contribute.

Baskaran (2020) discussed the most 290 (12.20%) publications contributed by researchers from the Central Institute of Electrochemistry. SK Pandian, proposed by Google Scholar Metrics (GSM), is a top researcher, despite its annual citations of 4491 and hIndex of 36 from 2008 to 2018. Ramesh and Baskaran (2019) stated that respondents are "satisfied" with the availability of teaching materials. These data show that a large number of respondents 265 (51.0%) prefer gateway portals rather than "wide scale", 139 (26.7%) Respondents who liked the "very large area" found that 105 (20, 2%) of the respondents said they were "not satisfied" and 11 (2.1%) chose "no opinion". Prasad and Baskaran (2019) reviewed the research analysis. Male

respondents were 263 (69.21%), followed by female respondents 117 (30.79%). 285 (75%) is followed by M. Phil. NET qualified respondents 51 (13.42%) and PG and NET qualified respondents 44 (11.57%). Most of the 259 (98.50%) respondents had received training in accessing electronic resources from university libraries, and only 4 (1.50%) male respondents had not received training in university libraries. Prasad and Baskaran (2019) analyzed 380 (100%) respondents who understand the electronic resources available in university libraries. Most of the 259 respondents (98.50%) received training in accessing electronic resources from university libraries, and only 4 (1.50%) male respondents had not received training in university libraries. It also shows that among 117 (30.80%) female respondents. Baskaran (2018) discussed the majority of 63 (27.6%) designations to "know" and use Whatsapp, 53 (23.2%) You Tube, 47 (20.6%) Google+, 46 (20.2%) Facebook, 23 (10.1%) Tumbler / Messenger, 21 (9.2%) Twitter, 18 (7.9%) other and 17 (7.5%) Instagram. Suitable for the function of its parent organization. Pramanathan and Baskaran (2014) analyzed 230 (58.4%) research scientists covered by the study. They believed that the Internet provided the information necessary to complete their research satisfactorily or on a large scale. The majority of respondents access electronic resources via e-mail 252 (63.95%).

Pitchaipandi and Baskaran (2020) analyzed the "research cooperation" of 6.4% of respondents who "strongly agree". 30.9% of Web 2.0 is used for research communication and cooperation, and 19.6% of Web 2.0 tool opportunities and learning support the social interaction of respondents in the learning process. Baskaran (2021) analyzed most of the 134 (1.96%) publications contributed by the University of California system researchers. Zhang Y is the first author and contributed 16 (0.23%) publications in the Web 2.0 field, followed by Kolt GS, Li Q, Vandelante C, and Zhang J. These publications also appeared 13 (0.19%) publications. Baskaran and Pitchaipandi (2021) analyzed that respondents like group sites (Yahoo, Google and Whatsapp) very much. The research analyzed that most respondents prefer social media research tools to share research information from respondents from eight universities in Tamil Nadu. Pitchaipandi and Baskaran (2021) surveyed 51.3% of respondents who visit WhatsApp 1 / h every day. 78.9% of respondents added the respondent's WhatsApp friend group. Used in WhatsApp as an educational aid and management tool for the University of Tiruvallore. Baskaran (2020) analyzed that there are 25 institutions on the list, among which the University of Washington ranks first among 25 institutions, and 48 (0.98%) of them are ranked first for publications. Radhakrishnan and Baskaran, C. (2020) discuss the existence of a moderate correlation between citations and alternative indicators. Only one work received the same citations and alternative indicators. The citation and surrogate index scores of the other paper are roughly the same. 4 out of 10 papers received more citations. Among the 4 frequently cited articles, three articles have very low scores on alternative indicators, and only one article has very high scores on alternative indicators. Baskaran and Binu (2020) discussed that the majority of respondents 109 (25.9%) are graduate students, and 75 (17.8%) have PG and NET qualifications. The average value of "borrowed books" is 3.86, ranking first. Most of the 416 respondents (98.8%) are looking for education and research information. The research results can determine the various parameters of academic access to electronic resources. Baskaran and Ramesh (2020) analyzed that 255 (48.3%) of the respondents rated the e-book information as "excellent", while 205 (39.4%) rated it as "very good". 280 people (53.8%) "agree" that the e-magazine saves users' time, and 219 people (42.1%) "completely agree". Few 21 (4.0%) respondents "disagree". Radhakrishnan and Baskaran (2019) analyzed the square root of authors, accounting for 7.94% of the total posts, and 255.52 in the price square root method. The results of the Pareto 80/20 rule show that 20% of authors contribute only 46.60% of the total posts. Baskaran and Babu, P. R. (2019) discussed the activity index and exponential growth of the analyzed authors from 1989 to 2016. The results of the study showed that the number of published papers increased between 11 (0.26%) in 1989.

## Objectives of the study

1. To examine the growth of literature on Paleontology at global and Indian level during the study period 2005 to 2019.
2. To extrapolate and predict the future trend of Paleontology Literature
3. To study the nature of authorship pattern and productivity in Paleontology literature
4. To find the correlation between Contributor & Contributions, Authorship pattern & Publications.
5. To find the Degree of Collaboration, Collaborative Index, Collaborative Coefficient, Modified Collaborative Coefficient and Co-authorship Index

## Methodology

The source database used in this study is Scopus. Scopus launched in November 2004 by Elsevier, which is the largest abstract and citation database of peer-reviewed literature, that includes scientific journals, books and conference proceedings. It is equipped with high class data and comprehensive contents to track, analyze and imagine the research to give a complete overview of the world's research output in the fields of science, technology, medicine, social sciences, and arts and humanities..

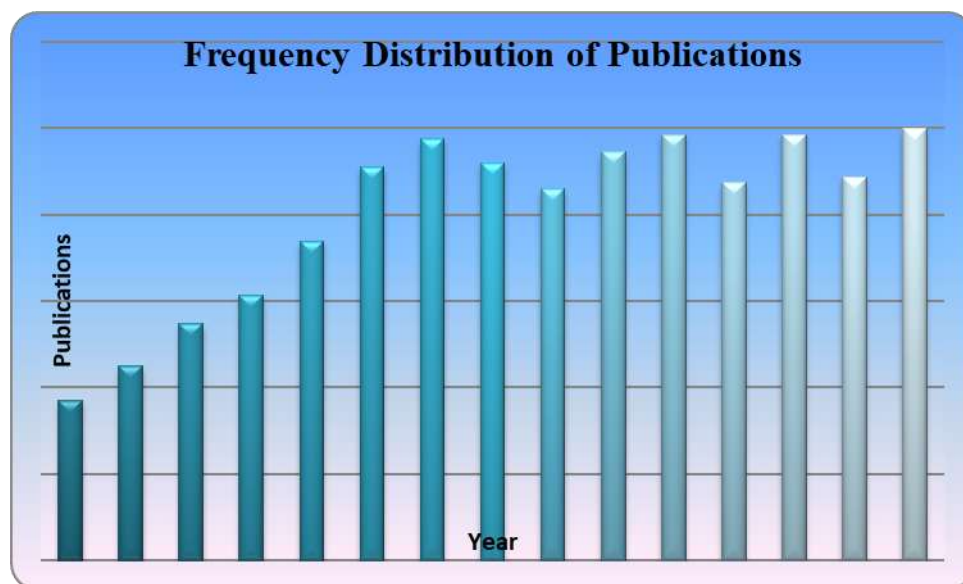
## Results and Discussion

To evaluate the research productivity in the field of Paleontology literature, the frequency distribution of publications was analyzed and interpreted. A total number of 12052 records were published between 2005 and 2019 on Paleontology literature and those records retrieved from the Scopus database which is a multidisciplinary abstract and citation database. As per the analysis of data, it was observed from Table 1 that the topmost productive year was 2019 with 998 records (8.28%). Similarly the least productive year was 2005 with 371 records (3.08%).

**Table 1: Frequency Distribution of Publications in Paleontology literature**

S. No	Year	Publications	% of 12052	Cumulative Growth	Cumulative Percentage
1	2005	371	3.08	371	3.08

2	2006	449	3.73	820	6.80
3	2007	547	4.54	1367	11.34
4	2008	614	5.09	1981	16.44
5	2009	739	6.13	2720	22.57
6	2010	909	7.54	3629	30.11
7	2011	974	8.08	4603	38.19
8	2012	919	7.63	5522	45.82
9	2013	858	7.12	6380	52.94
10	2014	944	7.83	7324	60.77
11	2015	985	8.17	8309	68.94
12	2016	873	7.24	9182	76.19
13	2017	985	8.17	10167	84.36
14	2018	887	7.36	11054	91.72
15	2019	998	8.28	12052	100
<b>Total</b>		<b>12052</b>	<b>100</b>		
<b>Average Number of Publications per year</b>					<b>803.46</b>



**Figure 1: Frequency Distribution of Publications in Paleontology literature**

Frequency Distribution of Citations and Citation per paper (CPP) in the field of Paleontology literature research output is observed from Table 2. The maximum number of citations in the year 2011 comprises 24683 citations and the minimum number of citations is 3115 in 2019. The maximum number of citations per paper is 39.28 in 2006. The minimum number of citations per publication is 3.12 in 2019. A total of 232618 citations were observed during the study period. The overall citation per paper is 19.3. Average Number of Citations per year is 15507.86.

**Table 2 Frequency Distribution of Citations in Paleontology literature**

S. No	Year	Publications	Citations	CPP
1	2005	371	14295	38.53
2	2006	449	17635	39.28
3	2007	547	20895	38.2
4	2008	614	18242	29.71
5	2009	739	21689	29.35

6	2010	909	24219	26.64
7	2011	974	24683	25.34
8	2012	919	19192	20.88
9	2013	858	14667	17.09
10	2014	944	15218	16.12
11	2015	985	16862	17.12
12	2016	873	9177	10.51
13	2017	985	7373	7.49
14	2018	887	5356	6.04
15	2019	998	3115	3.12
<b>Total</b>		<b>12052</b>	<b>232618</b>	<b>19.3</b>
<b>Average Number of Citations per year</b>			<b>15507.86</b>	

Table 3 shows the exponential growth of publications output in Paleontology literature observed during the period 2005-2019. The highest exponential growth rate was found to be 1.23 in the year 2010 with 909 publications. The lowest exponential growth rate was found to be 0.89 in the year 2016 with 873 publications. The analysis shows that overall average exponential growth rate was 1.07. On the whole, it was clearly known that there was a fluctuation in Exponential Growth Rate during the study period.

**Table 3 Exponential Growth Rate in Paleontology literature**

S. No	Year	Publications	Exponential Growth Rate
1	2005	371	
2	2006	449	1.21
3	2007	547	1.22
4	2008	614	1.12
5	2009	739	1.20
6	2010	909	1.23
7	2011	974	1.07
8	2012	919	0.94
9	2013	858	0.93
10	2014	944	1.10
11	2015	985	1.04
12	2016	873	0.89
13	2017	985	1.13
14	2018	887	0.90
15	2019	998	1.13
<b>Total</b>		<b>12052</b>	<b>1.07</b>

Table 4 depicts the annual growth rate output of Paleontology literature. It indicates that the annual growth rate fluctuated throughout the study period 2005-2019. The highest AGR was found in the year 2010 (23) followed by the year 2007 (21.83). It was also found that the years 2012, 2013, 2016, and 2018 had a negative growth rate. However, there is positive growth during the recent years in the field of Paleontology literature research in India.

**Table 4 Annual Growth Rate of Paleontology literature**

S. No	Year	Publications	Annual Growth Rate
1	2005	371	
2	2006	449	21.02
3	2007	547	21.83

4	2008	614	12.25
5	2009	739	20.36
6	2010	909	23.00
7	2011	974	7.15
8	2012	919	-5.65
9	2013	858	-6.64
10	2014	944	10.02
11	2015	985	4.34
12	2016	873	-11.37
13	2017	985	12.83
14	2018	887	-9.95
15	2019	998	12.51
<b>Total</b>		<b>12052</b>	

## Conclusion

The minimum number of citations per publication is 3.12 in 2019. A total of 232618 citations were observed during the study period. The overall citation per paper is 19.3. Average Number of Citations per year is 15507.86. The highest exponential growth rate was found to be 1.23 in the year 2010 with 909 publications. The lowest exponential growth rate was found to be 0.89 in the year 2016 with 873 publications. The analysis shows that overall average exponential growth rate was 1.07. On the whole, it was clearly known that there was a fluctuation in Exponential Growth Rate during the study period. The highest AGR was found in the year 2010 (23) followed by the year 2007 (21.83). It was also found that the years 2012, 2013, 2016, and 2018 had a negative growth rate. However, there is positive growth during the recent years in the field of Paleontology literature research in India.

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