Quantitative Analysis on Paleontology Literature: A Scientometric Study

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Abstract

The study analyzes the Scientometric analysis on the publications metrics on paleontology during 2001-2015. It has been analyses the minimum number of citations per publication is 3.12 in 2015. A total of 232618 citations were observed during the study period. The analysis shows that overall average exponential growth rate was 1.07. Doubling Time increases from 0.87 (2002) to 8.28 (2014). RGR has shown a decreasing trend while the DT shows an increasing and decreasing trend. it is found that the predicted value of literature output has increased from 8620 (2015) to 1311.16 (2025) and the value further increased in the year 2030 (1506.43). There were some anonymous contributions found with 58 publications (0.48%) in the authorship pattern of Paleontology Literature.

Keywords

Scientometrics, Paleontology, Year wise analysis, Relative Growth rate, Doubling time, Exponential Growth, Authorship Pattern and Degree of Collaboration

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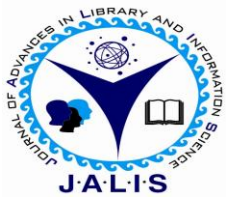
The journal is available at www.jalis.in



Journal of Advances in Library and Information Science
ISSN: 2277-2219 Vol. 7. No.4. 2018. pp.352-357

Introduction

The terms "bibliometrics"(Pritchard,1969) 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 (Price,1969) (measurement). It is defined by Metron and Garfield as a branch of investigation dedicated to quantitative analysis of science and scientific fields. Pitcherd 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 Glossory 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.

The methods are recognized as the best way to monitor research trends and scholarly activities (Moed, De Bruin, & VanLeeuwen, 1995). These writings include authors, institutions, type of documents, citation analysis, and co-occurrence of keywords. Scientometric analyzes clusters to find out the current research topics in any discipline (Ginn, 2003). Scientometric methods have been utilized to interpret the quantitative indicators for academic productivity and quality (Whit-ley, 2007). Scientometric determines the research productivity and citation impact of researchers over a specific periodby quantifying the “assessment of literature on a particular subject (bibliometrics); authorship patterns (co-citation analysis); and its impact on reading groups and societies(social epistemology)” (Erfanmanesh, Didegah, &Omidvar,2010). It particularly perceives how a field has grown duringa specific period (Erfanmanesh, Didegah, &Omidvar, 2010).Scientometrics relates to the measurement and evaluation of knowledge with respect to a particular domain. Practically, Scientometrics is a frequently used bibliometric technique on the basis of impact of publications (Garfield, 1970).

History of paleontology

Paleontology studies the fossil record left behind by living species to learn about the evolution of life on Earth. Although palaeontology 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. During the 17th and 18th centuries, the nature of fossils and their relationship to past life became better understood, and at the end of the 18th century, Georges Cuvier's work put an end to a long-running debate about the reality of extinction, resulting in the emergence of palaeontology, along with comparative anatomy, as a scientific discipline. The growing understanding of the fossil record also influenced the evolution of geology, particularly stratigraphy.

Review of Literature

Knievel & Kellsey (2005) observed and compared citations to articles published in various journals in eight humanities fields. Authors extracted 9,131citations from journals which were published in 2002 and found that citation patterns varied widely among humanities disciplines. Authors found that French and German language are more dominant as compared to others while in some fields' citation to monographs is seen less than the expected numbers. Levitta and Thelwall (2013) examined 1500 articles published in Social Sciences from theSocial Science Citation Index (SSCI) during 2003 and plotted data on alphabetization with the surname of two authors, three authors and four authors contributed research papers. Authors allocated resulted data in disciplines and calculated mean value. Authors emphasized on how alphabetization should be discouraged where the journals do not specify the relative contribution of co –authors or readily available in CVs and used in any research metric. Davis (2009) examined author-choice open-access models through citation analysis of research articles which were published in 11 biological and medical journals from 2003 to 2007. Articles metadata, citations and Cumulative citations extracted from Web of Science to know the difference in citations between open-access and subscription-based articles. Tamilselvan, Sivakumar and Sevukan. (2013) conducted a bibliometric analysis of the literature published in the fields of engineering and technology by the faculties of NIT's in India.

Objectives of the Study

1. To examine the growth of literature on Paleontology at global and Indian level during the study period 2001 to 2015.
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 Degree of Collaboration, Collaborative Index, Collaborative Coefficient, Modified Collaborative Coefficient and Co-authorship Index

Methodology

The present study aims at the distribution of research output on the basis of research publications contributed by Scientists in the field of Paleontology. The required data was collected from SCOPUS database for the period 2001-2015. A total of 8620 records were retrieved from the database using the search strings "Paleontology", analyzed by using MS-Excel software package as per the objectives of the study and data has been presented in tabular as well as in graphical form. This study explores the growth rates of publications and citation patterns, author productivity and collaboration, most productive journals, distribution of publication by geographical and structure.

Results and Discussions

The study has been analyzed year wise distribution of the publications in the field of Paleontology during 2001-2015. It is observed from Table1, the maximum number of publications distributed 931(10.08%) of the publications in the year 2015. The study can be witnessed that the publications trend has been slowly increased over the period of study between 2001 and 2015. Further, the study finds more than five hundred publications contributed by the scientists in the field of Paleontology during 2007 and 2015.

Table 1: Year wise Distribution of Publications in Paleontology literature

S. No	*Year*	*Publications*	*%*	*Cumulative Growth*
1	2001	321	3.72	321
2	2002	359	4.16	680
3	2003	374	4.33	1054
4	2004	396	4.59	1450
5	2005	421	4.88	1871

6	2006	486	5.63	2357
7	2007	531	6.16	2888
8	2008	576	6.68	3464
9	2009	591	6.85	4055
10	2010	631	7.32	4686
11	2011	674	7.81	5360
12	2012	717	8.31	6077
13	2013	796	9.23	6873
14	2014	816	9.46	7689
15	2015	931	1.080	8620
Total		***8620***	***100***	

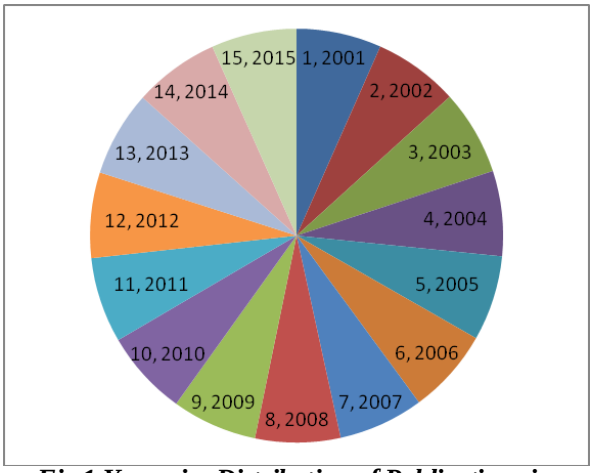


Fig.1 Year wise Distribution of Publications in Paleontology literature

Year wise Distribution of Citations 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 2015. The maximum number of citations per paper is 39.28 in 2006. The minimum number of citations per publication is 3.12 in 2015. 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	2001	321	14295	38.53
2	2002	359	17635	39.28
3	2003	374	20895	38.2
4	2004	396	18242	29.71
5	2005	421	21689	29.35
6	2006	486	24219	26.64
7	2007	531	24683	25.34
8	2008	576	19192	20.88
9	2009	591	14667	17.09
10	2010	631	15218	16.12
11	2011	674	16862	17.12
12	2012	717	9177	10.51
13	2013	796	7373	7.49
14	2014	816	5356	6.04
15	2015	931	3115	3.12
Total		***8620***	***232618***	***19.3***
Average Number of Citations per year			***15507.86***	

Exponential Growth Rate in Paleontology literature

Table 3 shows the exponential growth of publications output in Paleontology literature observed during the period 2001-2015. 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 2013 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	2001	321	
2	2002	359	1.21
3	2003	374	1.22
4	2004	396	1.12
5	2005	421	1.20
6	2006	486	1.23
7	2007	531	1.07
8	2008	576	0.94
9	2009	591	0.93
10	2010	631	1.10
11	2011	674	1.04

12	2012	717	0.89
13	2013	796	1.13
14	2014	816	0.90
15	2015	931	1.13
Total		**8620**	**1.07**

Annual Growth Rate of Paleontology literature

Table 4 depicts the annual growth rate output of Paleontology literature. It indicates that the annual growth rate fluctuated throughout the study period 2001-2015. The highest AGR was found in the year 2010 (23) followed by the year 2007 (21.83). It was also found that the years 2009, 2011, 2012, and 2013 had a negative growth rate. However, there is positive growth during the recent years in the field of Paleontology literature research in India.

Relative Growth Rate (RGR) and Doubling Time (DT) of Paleontology literature

Table 5 shows the Relative Growth Rate and Doubling time of Paleontology literatureresearch output. The maximum RGR value is found to be 0.79 in the year 2006 and the minimum value is found to be 0.08 in the year 2013. In the RGR analysis, a steady decrease is found during the study period. However, Doubling Time increases from 0.87 (2006) to 8.28 (2013). RGR has shown a decreasing trend while the DT shows an increasing and decreasing trend. From the study, **It is noticeable that the Hypothesis-1 "The relative growth rate (RGR) and the doubling time (DT) are inversely proportional" is not proved.**

Table 5: Relative Growth Rate (RGR) and Doubling Time (DT) of Paleontology literature

S. No	*Year*	*Publications*	*Cumulative*	*W1*	*W2*	*RGR*	*DT*
1	2001	321	321		5.92		
2	2002	359	680	5.92	6.71	0.79	0.87
3	2003	374	1054	6.71	7.22	0.51	1.36
4	2004	396	1450	7.22	7.59	0.37	1.87
5	2005	421	1871	7.59	7.91	0.32	2.19
6	2006	486	2357	7.91	8.20	0.29	2.40
7	2007	531	2888	8.20	8.43	0.24	2.91
8	2008	576	3464	8.43	8.62	0.18	3.81
9	2009	591	4055	8.62	8.76	0.14	4.80
10	2010	631	4686	8.76	8.90	0.14	5.02
11	2011	674	5360	8.90	9.03	0.13	5.49
12	2012	717	6077	9.03	9.13	0.10	6.94
13	2013	796	6873	9.13	9.23	0.10	6.80
14	2014	816	7689	9.23	9.31	0.08	8.28
15	2015	931	8620	9.31	9.40	0.09	8.02
Total		***8620***					

Time Series Analysis of Paleontology literature output

Time Series Analysis is used to estimate the productivity of publications in the future. In this study this technique is used to estimate the literature output for the year 2025 and 2030.

Based on the calculation, it is found that the predicted value of literature output has increased from 8620 (2015) to 1311.16 (2025) and the value further increased in the year 2030 (1506.43). Hence from the results, it is clearly observed that productivity of Paleontology literature may increase in the future.

Table 6 shows the estimated future growth. Based on the analysis, the estimated future productivity of Paleontology literature in 2025 and 2030 is declining. Hence the **Hypothesis -2 "There will be an Increasing Trend in Paleontology Literature in Future is proved".**

Straight Line equation $Yc = a + bX$

Since $\sum X = 0$

$a = \sum Y/N = 803.467$

$b = \sum XY/\sum X^2 = 39.0536$

Estimated literature in 2025 = 1311.16

Estimated literature in 2030 = 1506.43

Table 6: Time Series Analysis of Paleontology literature output

S. No	*Year*	*Publications Y*	*X*	*X²*	*XY*
1	2001	321	-7	49	-2597
2	2002	359	-6	36	-2694
3	2003	374	-5	25	-2735
4	2004	396	-4	16	-2456
5	2005	421	-3	9	-2217
6	2006	486	-2	4	-1818
7	2007	531	-1	1	-974
8	2008	576	0	0	0
9	2009	591	1	1	858
10	2010	631	2	4	1888
11	2011	674	3	9	2955
12	2012	717	4	16	3492
13	2013	796	5	25	4925
14	2014	816	6	36	5322
15	2015	931	7	49	6986
Total		**8620**	**0**	**280**	**10935**

Authorship Pattern vs Number of Publications in Paleontology Literature

Table 7 concerned with Authorship Pattern Vs Number of Publications disclosed that the Authorship Pattern in Paleontology Literature varies from single authored publications to maximum of fifty seven authored publications during the study period 2001-2015. As per the analysis of the table, the highest number of research output by Single authored was 21.96% with 2647 contributions followed by double authored contributions was 21.48% (2589) and three authored contributions was 17.48%). It was inferred that the optimum number of research publications in a collaborative research was two authored. At this point, the biggest cluster had been formed by publications with single authored to five authored. It was also inferred that only one publication contributed by 57 authors. It shows that the collaborative research governed than individual research in the field of study. There were some anonymous contributions found with 58 publications (0.48%) in the authorship pattern of Paleontology Literature.

Table 7: Authorship Pattern vs Number of Publications in Paleontology Literature

S. No	*Pattern of Authors*	*Publications*	*%*	*Total Authors*
1	1	2647	21.96	2647
2	2	2589	21.48	5178
3	3	2107	17.48	6321
4	4	1562	12.96	6248
5	5	1020	8.46	5100
6	6	643	5.34	3858
7	7	439	3.64	3073
8	8	317	2.63	2536
9	9	175	1.45	1575
10	10	142	1.18	1420
11	11	81	0.67	891
12	12	64	0.53	768
13	13	32	0.27	416
14	14	32	0.27	448
15	15	28	0.23	420
16	16	19	0.16	304
17	17	15	0.12	255
18	18	13	0.11	234
19	19	11	0.09	209
20	20	9	0.07	180
21	21	10	0.08	210
22	22	6	0.05	132
23	23	5	0.04	115
24	24	3	0.02	72
25	25	4	0.03	100
26	26	2	0.02	52
27	27	2	0.02	54
28	30	1	0.01	30
29	32	1	0.01	32
30	33	2	0.02	66
31	35	3	0.02	105
32	36	1	0.01	36
33	38	2	0.02	76
34	41	4	0.03	164
35	47	1	0.01	47
36	51	1	0.01	51
37	57	1	0.01	57
38	Anonymous	58	0.48	58

Conclusion

The study explores the research performance of the publications trend in Paleontology research. The finding of the study was discussed though above the analysis made on research records were indexed in Scopus database. The publications trend has been slowly increased over the period of study between 2001 and 2015. The maximum number of citations per paper is 39.28 in 2006. The minimum number of citations per publication is 3.12 in 2015. The result finds 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 overall average exponential growth rate was 1.07. The highest AGR was found in the year 2010 (23)

followed by the year 2007 (21.83). It was also found that the years 2009, 2011, 2012, and 2013 had a negative growth rate. The collaborative research governed than individual research in the field of study. There were some anonymous contributions found with 58 publications (0.48%) in the authorship pattern of Paleontology Literature.

References

[1.] Pritchard, A (1969). Statistical bibliography or Bibliometrics. *Journal of Documentation*. 25(4), 348-49.

[2.] Price, D. J. De Solla (1963). Little Science, Big Science. New York: Columbia University Press.

[3.] Moed, H., De Bruin, R., & Van Leeuwen, T. H. (1995). New bibliometric tools for the assessment of national research performance: Database de- scription, overview of indicators, and first applications. *Scientometrics*, 33(3), 381–422. doi:10.1007/BF02017338

[4.] Ginn, L. K. (2003). Citation analysis of authored articles in Library & Information Science Research 2001–2002. *Mississipi Libraries*, 67, 106–109

[5.] Whitley, R. (2007). Changing governance of the public sciences. In R. Whitley, & , J. Gl¨aser (Eds.), The changing governance of the sciences (3–27). The Netherlands: Springer.

[6.] Erfanmanesh, M. A., Didegah, F., &Omidvar, S. (2010). Research pro- ductivity and impact of Library and Information Science in the Web of Science. *Malaysian Journal of Library & Information Science*,15(3),85–95.

[7.] Garfield, E. (1977). *SCI Journal citation reports: A bibliometric analysis of science journals in the ISI data base*. Philadelphia: Institute for Scientific Information.

[8.] Knievel, J. E., &Kellsey, C. (2005). Citation Analysis for Collection Development: A Comparative Study of Eight Humanities Fields. *The Library Quarterly*, 75(2), 142–168. https://doi.org/10.1086/431331

[9.] Levitt, J. M., &Thelwall, M. (2013). Alphabetization and the skewing of first authorship towards last names early in the alphabet. *Journal of Informetrics*, 7(3), 575–582. https://doi.org/10.1016/j.joi.2013.03.002

[10.] Davis, P. M. (2009). Author-choice open-access publishing in the biological and medical literature: A citation analysis. Journal of the American Society for Information Science and Technology, 60(1), 3-8. https://doi.org/10.1002/asi.20965

[11.] Tamilselvan N., Sivakumar N. and Sevukan R. (2013). Lotka's law: a study with reference to the literature by faculties of national institutes of technology, India, *International Journal of Library and Information Studies*, 2(1), 19-34,

1.