



Applications of Bradford's Law of Scattering in Fisheries Microbiology Literature

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Abstract

The present study is based on the selection of 17 PhD theses in Fishery Microbiology during 2005 to 2011. There are 4973 bibliographical references which were identified in PhD thesis. A total of 623 journals were identified and ranked up to 40 journals. The objectives of the study focuses on: the types of documents cited by the researchers, Ranking of most cited journals and verifies the Bradford's law distributions of journals literature in Fisheries Microbiology and the same is found to be fit from the study.

Keywords: Citation Analysis, Fisheries Microbiology, PhD Thesis, Journal Ranking, Bradford's Law.

1. Introduction

Journals are the important sources for every researcher. They cover latest and original research findings information. These are published in a large amount, its cost, is high and due to the limited budget for its subscriptions it is very difficult to subscribe by library and information centres. Citation analysis is one of the best methods to solve the above problem. Through citation study it can help to identify the core journals of any subject. This also helps librarians to select need based collection according to the requirement of the researchers. The present study is based on application of Bradford's law of scattering on the journal citations of thesis in Fishery microbiology.

2. Review of Literature

Chaman et al. (2018), their paper is to analyse the application of Bradford's Law of scattering to the Chemical Science literature published during 2002 to 2016. The paper presents an overview on scholarly contribution presented on Bradford Law applied in different studies from both theoretical as well as practical aspects and the law is being tested.



Ramalingam and Elangovan (2017), studied law research scholars in their Ph.D. Thesis submitted to various universities in India, which are available in Shodhganga digital repository. This study finds out 773 journals, containing 3187 citations collected from 252 doctoral theses. It also list the Ranked list of core journals in law. The researchers Top most cited journals are American Journal of International Law with (5.24%) of citation from (USA), followed by the Journal of Indian Law Institute (India) with (3.79%) of citation, International and Comparative Law Quarterly from publication of UK with (2.66%) of citation. The research applied for testing of Bradford's law of scattering it is fit for the studies.

Tripathi and Sen (2016), they examined Bradford's law. The dataset comprised of 10,100 papers indexed in Indian Science Abstracts and CAB Abstracts during the period 1965-2010. The ranked lists of journals have been prepared and Leimkuhler test was conducted. The lists of core journals are also provided. The data does not follow Bradford law even with Leimkuhler formulation. It combined data for six crops together and cumulating of data in every fifth year deviated the dataset from Bradford law of scattering.

Velmurugan and Radhakrishnan (2015), identified a total of 2802 papers, out which 83.4% were journal articles and 99.7% were in the English language. According to Australian researchers, the output of Environmental Sciences, Ecology (13.80%) account for the largest increase and it is occupied in the first place and Energy Fuels (6.20%) is in the 6th place in the study. The three most highly cited journals are Ecological Applications, Astrophysical Journal, Monthly notes of the Royal Astronomical Society. It is based on the speculative aspects of Bradford's Law of Scattering and is tested and identified. The ratio depicts that it does not fit into the Bradford's law of distribution.

Singh and Bebi (2014), found that the journal Economic & Political Weekly is the most cited journal with 22.8% citations, followed by The Punjab Past and Present with 1.80% citations. Bradford's law of scattering was applied and result was positive.

Wardikar and Gudadhe (2013), presented a review of the contribution in Library & Information Science & theoretical aspects of the law. Study content on the data of journals cited by Ph.D. research scholars of Universities of Maharashtra for their doctoral research. To examine Bradford's Law of Scattering, study for 798 periodicals containing 5467 references collected form 138 theses during the period 1982-2010 was made. Rank list was prepared and Annals of Library Science and Documentation took top place with 207 citations followed by College and Research Libraries with 184 and Herald of library science with 160 citations it is most preferred journals. Application of Bradford's Law in various methods was tested.



Gupta (1991), studied Cartographies for citations collected from Ethiopian Medical Journal Cartographies were analysed and Bradford's Law was applied to them to test its applicability and was found fit for the study. The Rank list also followed of journals based on the journals received 50% of the citations.

3. Objectives

The following are the objectives of the study

- To study bibliographical form wise distribution of citations
- To prepare a rank list of most cited journals
- To verify Bradford’s law of scattering of journals citations

4. Methodology

The data for this study were drawn from a selected from submission of Ph.D. thesis in Department of Fishery Microbiology at Karnataka veterinary, Animal and Fisheries Science University, Bidar. The necessary data was retrieved through online via in ShodhaGanga website. A total of 17 theses were selected which covering a period of 2005 to 2011. In total 4973 citations were selected and the references listed for each thesis were examined and duplicate references in each individual list were removed. Total of 4973 citations were analysed and form wise distribution and geographical distribution was recorded. The data collected for the study were analysed and the rank list of most cited journals was prepared. Applied the Bradford’s law and data presented in the form of tables and graphs.

5. Data Analysis

Table 1
Submission of thesis for award of PhD degree in Fishery Microbiology

Years of submission of Ph.D Thesis	Total No. of Thesis Submitted for Ph.D. Award	Total Citations	Average Citations per thesis
2005 to 2011	17	4973	292.52

The above Table 1 show that Year of submission of PhD Thesis in Fishery Microbiology to Karnataka Veterinary, Animal and Fisheries Science University, Bidar. There are 17 Ph.D. theses submitted for award of Degree from 2005 to 2011. A total 4973 were identified. The average number of citations calculated per thesis in each were 292.52 citations.

Table 2
Types of documents cited by the PhD Students

S. No	Types of Documents cited by researchers	No of Citations cited by researchers	%
1	Journals	4382	88.11
2	Text Books	363	7.29
3	Newspaper &Magazines	75	1.50
4	Technical reports	66	1.34
5	conference proceedings	45	0.90
6	Handbooks	19	0.39
7	Thesis and dissertations	13	0.27
8	Websites	08	0.16
09	Encyclopaedias	02	0.04
Total		4973	100.00

Table 2 describes the use of documents cited by researchers. The highest 4382 (88.11%) of cited from periodicals by research students, followed by 363(7.29%) from text books, Newsletters & Magazine with 75(1.50%), Technical reports with 66(1.34%), Conference proceedings with 45(0.90%) citations respectively.

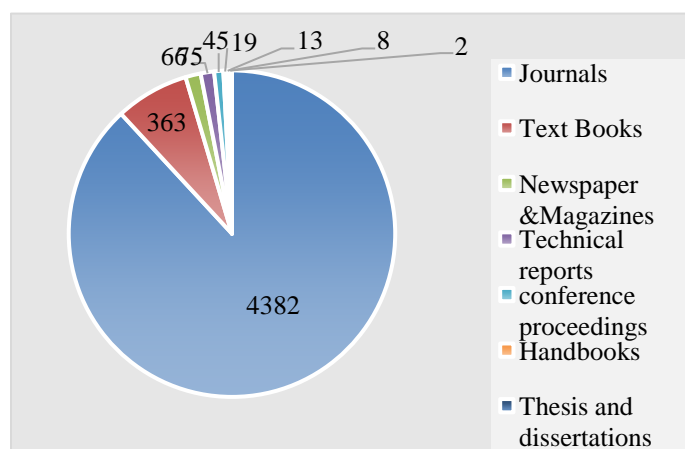


Figure.1 No. of Citations cited by researchers

Table 3
Ranking of cited journals

S. No	Rank	Journal name	No of citations	%	Cumulative citation	%	Country of publishers
1	1	Appl. Environ. Microbiol.	267	6.09	267	6.09	USA
2	2	Disease. Aquatic Organisms	223	5.08	490	11.17	Germany
3	3	Aquaculture	204	4.65	694	15.82	Netherland
4	4	Infection and Immunity	139	3.17	833	18.99	USA
5	5	J. of Clinical Microbiology	132	3.01	965	22	USA
6	6	J. Virology	81	1.84	1046	23.84	USA
7	7	J. Fish Diseases	76	1.73	1122	25.57	UK
8	8	Proce. of Nat.Acaed Sci.(USA)	66	1.50	1188	27.07	USA
9	9	J. Biological Chemistry	62	1.41	1250	28.48	USA
10	10	Fish & Shellfish Immunology	61	1.39	1311	29.87	USA
11	11	Fish Pathology	56	1.27	1367	31.14	Japan
12	12	J. Bacteriology	55	1.25	1422	32.39	USA
13	12	J. Medical Microbiology	55	1.25	1477	33.64	UK
14	13	J. General Virology	54	1.23	1531	34.87	UK
15	14	J. Infectious Diseases	53	1.20	1584	36.07	USA
16	15	J. Applied Microbiology	49	1.11	1633	37.18	UK
17	15	J. Molecular Biology	49	1.11	1682	38.29	USA
18	16	Nature	48	1.09	1730	39.38	UK
19	17	FEMS Microbial. Letters	45	1.02	1775	40.4	UK
20	17	Molecular Ecology	45	1.02	1820	41.42	UK
21	18	J. Food Protection	43	0.98	1863	42.35	USA
22	19	Antimicrobial Agents and Chemotherapy	42	0.93	1905	43.28	USA
23	20	Intl. J. Food Microbiology	40	0.91	1945	44.19	Netherland
24	21	Dev. and Comparative Immune	39	0.89	1984	45.08	UK
25	22	Science	33	0.75	2017	45.83	USA
26	23	J. Invertebrate Pathology	31	0.70	2048	46.53	USA
27	24	J. Virological Methods	28	0.63	2076	47.16	Netherland
28	24	Nucleic Acids Research	28	0.63	2104	47.79	UK
29	25	Letters in Applied Micro bio	27	0.61	2131	48.4	UK
30	25	Marine Biotechnology	27	0.61	2158	49.01	Germany
31	26	Microbiol. Mol. Biol. Rev	25	0.57	2183	49.58	USA
32	26	Mol. Biol. Evol.	25	0.57	2208	50.15	UK
33	27	Europe J. Biochemistry	24	0.54	2232	50.69	UK
34	27	FEMS Immu& Medical Micro	24	0.54	2256	51.23	UK
35	27	Genetics	24	0.54	2280	51.77	USA
36	27	J. AntimicrobialChemotherapy	24	0.54	2304	52.31	UK



37	27	Molecular biology and biotech	24	0.54	2328	52.85	Germany
38	28	Biochemical Journal	23	0.52	2351	53.37	UK
39	29	Epidemiology & Infection	22	0.50	2373	53.87	UK
40	29	Marine Fisheries Review	22	0.50	2395	54.37	USA
41	30	A. J. Human Genetics	21	0.47	2416	54.84	USA
42	30	Virus Research	21	0.47	2437	55.31	USA
43	31	FEBS Letters	20	0.45	2457	55.76	USA
44	31	Int. J. Syst. Evol. Microbiol.	20	0.45	2477	56.21	UK
45	31	J. Microbiological Methods	20	0.45	2497	56.66	Netherland
46	31	Med. Microbiol. Immunol.	20	0.45	2517	57.11	Germany
47	31	Protein Expression and Purify	20	0.45	2537	57.56	USA
48	32	Current Science	18	0.41	2555	57.97	India
49	32	Transgenic Research	18	0.41	2573	58.38	Switzerland
50	32	World. J. Micro and Biotech	18	0.41	2591	58.79	Netherland
51	33	Current Microbiology	17	0.38	2608	59.17	Germany
52	33	New. Eng. J. Medicine	17	0.38	2625	59.55	USA
53	34	Comp. Biochem. Physiol. B.	16	0.36	2641	59.91	Netherland
54	34	Cell. Mol. Life Sci.	16	0.36	2657	60.27	Switzerland
55	35	Annals of Internal Medicine	15	0.34	2672	60.61	USA
56	35	Biochem. Biophys. Res. Commun.	15	0.34	2687	60.95	USA
57	35	Cell Tissue Research	15	0.34	2702	61.29	Germany
58	35	Fishery Technology	15	0.34	2717	61.63	India
59	35	Microbiology and Immunology	15	0.34	2732	61.97	USA
60	35	Trends in Ecology & Evolution	15	0.34	2747	62.31	Netherland
61	35	Water Science & Technology	15	0.34	2762	62.65	UK
62	36	ActaAmazonica	14	0.31	2776	62.96	Brazil
63	36	Gene	14	0.31	2790	63.27	Netherland
64	36	Immunochemistry	14	0.31	2804	63.58	USA
65	36	Microbial Pathogenesis	14	0.31	2818	63.89	Netherland
66	36	Trans Ame. Fisheries Society	14	0.31	2832	64.2	UK
67	37	Ame. J. Clinical Pathology	13	0.29	2845	64.49	USA
68	37	Ame. J. Gastroenterology	13	0.29	2858	64.78	USA
69	37	Archives of Virology	13	0.29	2871	65.07	Germany
70	37	Can J. Microbiology	13	0.29	2884	65.36	Canada
71	37	Genome. Research	13	0.29	2897	65.65	USA
72	37	J. Heredity	13	0.29	2910	65.94	UK
73	37	J. Appl. Bact.	13	0.29	2923	66.23	UK
74	37	J. Food Safety	13	0.29	2936	66.52	USA
75	37	J. Fish Research Board Canada	13	0.29	2949	66.81	Canada
76	37	Lancet	13	0.29	2962	67.10	UK
77	37	Microbiology	13	0.29	2975	67.39	UK
78	37	J. Food Sciences and Nutrition	13	0.29	2988	67.68	UK



79	37	Microbiological Research	13	0.29	3001	67.97	Netherland
80	38	Actavirologica	12	0.27	3013	68.24	<u>Slovakia</u>
81	38	Arch Micro Immunology	12	0.27	3025	68.51	Romania
82	38	Biotechnology Letters	12	0.27	3037	68.78	Netherland
83	38	Florida Scientist	12	0.27	3049	69.05	USA
84	38	Indian J. Virology	12	0.27	3061	69.32	India
85	38	J. Environmental Biology	12	0.27	3073	69.59	India
86	38	Water Research	12	0.27	3085	69.86	Netherland
87	38	Biological Bulletin	12	0.27	3097	70.13	USA
88	39	Am. J. Trop. Med. Hyg.	11	0.25	3108	70.38	USA
89	39	Biochimica et BiophysicaActa	11	0.25	3119	70.63	Netherland
90	39	Chinese J. Micro	11	0.25	3130	70.88	China
91	39	J. Cell Biology	11	0.25	3141	71.13	USA
92	39	J. Immunological Methods	11	0.25	3152	71.38	Netherland
93	39	Microbial Ecology	11	0.25	3163	71.63	Germany
94	39	Veterinary Microbiology	11	0.25	3174	71.88	Netherland
95	40	Asian Fisheries Science	10	0.22	3184	72.94	Malaysia
96	40	Insect Biochemistry	10	0.22	3194	73.16	UK
97	40	J. Aquatic. Animal Health	10	0.22	3204	73.38	UK
98-100	41	3 journals cited with 9 times $3*9=27$	27	0.61	3231	73.99	
101-107	42	7journals cited with 8times $7*8=56$	56	1.27	3287	75.26	
108-117	43	10 journals cited with 7 times $10*7=70$	70	1.59	3357	76.85	
118-138	44	21 journals cited with 6 times $21*6=126$	126	2.87	3483	79.72	
139-154	45	16 journals cited with 5 times $16*5 =80$	80	1.82	3563	81.54	
155-192	46	38 journals cited with 4 times $38*4=152$	152	3.46	3715	85	
193-232	47	40 journals cited with 3 times $40*3=120$	120	2.73	3835	87.73	
233-389	48	157 journals cited with 2 times $157*2= 314$	314	7.16	4149	94.69	
390-623	49	233 journals cited with 1 times $233*1=233$	233	5.31	4382	100	
		Total	4382	100.00	4382	100.00	0

The above Table 3 provides the ranked list of journals preferred by the researchers. The 4382 articles in journals are scattered over 623 journals. The top five journals account for the discipline of Fishery Microbiology. Applied and Environmental Microbiology with 267 (6.09%) cited by the PhD Students.

These are followed by Diseases of Aquatic Organisms with 223(5.08%), Aquaculture with 204(4.65%), Infection and Immunity 139 (3.17%), Journal of Clinical Microbiology with 132(3.01%) cited by the Ph.D. Students.

6. Application of Bradford's Law of Scattering

S C Bradford's law in the year 1948 made a study in two subjects ie. Applied Geophysics and Lubrication, and which is used in his study that the journals literatures distributed in 3 zones. Each group contained about a third of total number of research papers. The first group consisted of a small number of journals contained a large number relevant papers, the second zone consisted of a moderate of productive journals related to its neighbouring subjects and The third group contained many journals contributed pure relevant research papers in other areas .

In this study the numbers of journals were grouped in 3 zone by using data Bradford's law and was applied to the literature of fisheries microbiology.

Table 4
Bradford's law distribution of Citations

Zone	No of Journals	No of Citations	%
1	13	1477	33.64
2	63	1485	32.46
3	547	1420	33.90
Total	623	4382	100.00

The above Table reveals the Bradford's Law of scattering for Journal Citations. The journal Citations distribution was divided in three zones. The first zone containing 13 journals cited with 1477 Citations, there are 63 journals cited 1485 in second zone and the third zone there are 547 journals with 1420 Citations.

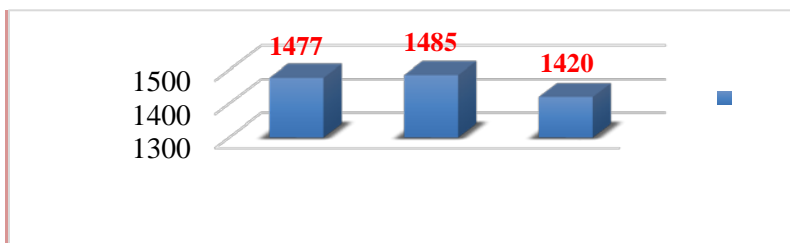


Figure-2 Bradford's Law distribution of citations



7 Findings and Conclusion

It is found that the highest (88.11%), citations were cited from periodicals by the researchers. In among ranking of most cited journals, the first rank goes to “Applied Environmental Microbiology” cited 267 times, followed by “Diseases Aquatic Organisms” occupied in second place with 223 citations and “Aquaculture” is in third place cited with 204 citations and respectively. The Bradford’s law of distribution of citations groups in to 3 zones. A small group i.e 13 journals were cited with 1477(33.64%), followed by the second zone 63 journals cited with 1485(32.46%) and remaining 547 journals cited with 1420(33.90%) citations. To conclude this, Bradford’s Law of scattering of scientific periodicals describes quantitative relationships between journals and research papers published by authors. The law serves as guidelines to the librarians to determined numbers of core journals in a given subject. The journals distribution of articles according to Bradford’s law reveals that the ratio of 13:63:547 hence Bradford’s law is found fit from the study.

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