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Mapping of Cyprinus carpio research: a global perspectives

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Abstract

Considering the importance of fish culture to meet out the needs of livelihood and nutrition, this study has been carried out to identify the highly productivity institutions, author, country, countries international collaboration and citation impact on Cyprinus *carpio* research. This study revealed that USA was the predominant country contributed more number of publications with low relative collaboration. Svobodova, Z from Czech Republic contributed more number of publications, whereas none from USA came under top 20 authors. Though Chinese Academy of Science, China was ranked 1st in total publication, the relative collaboration 14th position only. The Netherlands and Agricultural University of Wageningen had the highest relative citation impact. Aquaculture from Elsevier was ranked 1st among the journals.

Keyword: Scientometric study, *Cyprinus carpio*, common carp, Relative collaboration, Citation impact.

Introduction

The *Cyprinus carpio (Linnaeus, 1758)* is commonly known as common carp or European carp. It was introduced from France and European countries to India. Common Carp is large fish, growing up to 30 inches long, and sixty pounds. It has a "heavy" body with a dark, olive-colored back, yellowish belly, two barbels ("whiskers") on their upper lip and also has a large dorsal (back) fin. Carp live in streams, lakes, ponds, and rivers, wherever there is a lot of aquatic plant. Although it is a freshwater fish, it grows well in brackishwater and even slightly saline water. Common carp has rich in vitamins (Vitamin A, Vitamin E , Vitamine C, Vitamin D, Vitamine K_1, Vitamin B_1, Vitamin B_2, Vitamin B_3, Vitamin B_5 , Vitamin B_6 , Vitamin B_7, Vitamin B_9, Vitamin B_{12}), minerals (Calcium, Copper, Iodine, Magnesium, Manganese, Phosphorus, Potassium, Selenium, Sodium and Zinc), protein (18g/100g) and amino acids (Alanine, Arginine, Aspartic acid, Cystine, Glutamic acid, Glycine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Proline, Serine, Threonine, Tryptophan, Tyrosine and Valine) (Oehlenschlager and Rehbein, 2009)[6]. Farmed common carp production was nearly 14 percent of the total global freshwater

aquaculture production in 2002 (2,813,522 tonnes). Common carp production increased by an average global rate of 9.5 percent/yr between 1985 (681, 319 tonnes) and 2002. During 2013 it was increased to 3,969,806 tonnes. There is no scientometric study has been conducted to examine global research output of Common Carp. The present study made an attempt to examine the research productivity in terms of number of countries, institutions and authors undertaking research on different aspects of Common Carp.

2. Review of Literature

The review of literature is a primary significant component in any research and intended to give a background as well as a broad review of research methods and procedures used by earlier workers in the field of study. Kumaresan et al (2014)[4] studied the global literature productivity on WSSV based on Web of Science database and inferred China as the top literature productive country, followed by India. Chinese Academy of Sciences, Beijing stood first place followed by National Taiwan University, Taipei. C. F. Lo contributed more literature on WSSV. Kumaresan et al (2014)[3] analysed the Indian contribution in the Aquaculture journal during 1972 – 2011. During this period 374 publications were contributed by Indian authors. The percentage of Indian contribution was 2.74 during this study period. A. S. Sahul Hameed scored first rank with 27 publications, Central Institute of Freshwater Aquaculture (ICAR), Bhubaneswar, Odisha scored first rank with 40 publications among Indian Institutions and Tamil Nadu secured first position with 133 contributions. Liao and Huang (2014)[5] studied the global trends in aquatic ecosystem research from 1992 to 2011 and found that North America was leading the subject. Aquatic ecosystem research trends were shifting from water environment to aquatic ecosystem issues. Jaric et al (2012)[2], studied the fisheries science research globally which reveals that *Salmonidae* was most frequently studied group of species and USA was the most productive country among countries. International collaborations was increasing in trends and scores higher number of citation than single country publications.

3. Objective of the study

The main objective of this study is to analyse the global literature productivity on *Cyprinus carpio (Linnaeus, 1758)* research during the period of study (1990 – 2014) and the objectives are to:

i) quantify the global literature productivity,
ii) study the year-wise distribution of literature,
iii) identify the highly productive authors
iv) identify the highly productive institutions
v) study the Institutional collaboration
vi) identify the highly productive country
vii) study the highly productive journals
viii) identify the document type and

ix) study the language-wise distribution and
x) study the highly cited reference

4. Methodology and source of data

The required data were collected from Web of Science databases such as Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), Conference Proceedings Citation Index - Science (CPCI-S), Conference Proceedings Citation Index - Social Sciences & Humanities (CPCI-SSH) and Index Chemicus (IC) for the period of 25 years (1990 – 2014) on 29.05.2015. Advance search was employed TS = "*Cyprinus carpio" OR "Common Carp"*. Nearly 8582 bibliographic records were retrieved on *Cyprinus carpio*. The downloaded 8582 bibliographic records were analysed using HistCite software (developed by Thomson Reuter).

5. Limitation of the study

This study confined to Web of Science Database only and the period considered is also limited to twenty five years (1990 – 2014).

6. Result and discussion

The analysis of data was done to measure the global literature contribution in *Cyprinus carpio* research. The analysis was done year-wise distribution, author's productivity, collaborative patterns, country-wise distribution, institutional productivity, international collaboration, journal-wise distribution, document type, language-wise distribution, and highly cited articles etc.

6.1. Year-wise distribution of Publications

There were 8582 publications published during the study period (1990 – 2014). The maximum number of publications was recorded in 2014 (661, 7.7%) and lowest number in 1990 (112, 1.3%). The graph showed continuous raising trends from 1990 – 2009 and deep declining was found in 2010 and upward trends were shown from 2011 – 2014. However, the annual growth rate was inconsistent and fluctuated during the study period (numbers mentioned in the brackets in fig. 1). It is also observed that the number of publications in 2003 and 2004 was same (331). The Compound Annual Growth Rate (CAGR) was calculated using the website available at www.investopedia.com/calculator/cagr.aspx. The mean annual growth rate was found to be 13.41.

$$CAGR = \left(\frac{\text{Ending value}}{\text{Beginning value}} \right)^{1/n-1} - 1$$

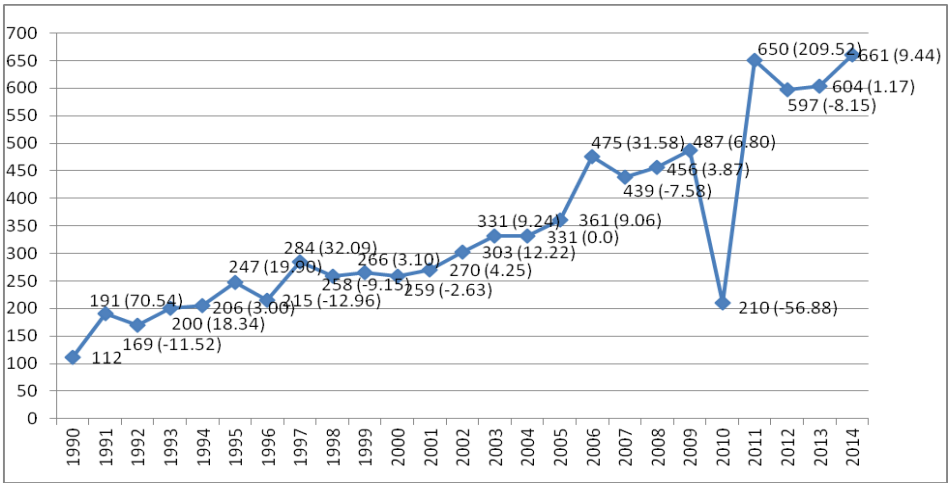

Fig. 1. Growth pattern of global research output on *Cyprinus carpio* research

6.2. Authorship pattern

Out of 8582 publications, 5 publications were anonymous. The rest of 8577 publications were taken for studying the authorship pattern. The 8577 publications were contributed by 18051 authors. Authorship patterns revealed that three authors publications were predominant (1705) followed by four authors' publications (1599) and two authors publications (1486). Only 535 publications were by single author. The degree of collaboration among authors was measured by using Subramanian (1983)[7] formula and the degree of collaboration in *Cyprinus carpio* research was 0.94.

6.3. High Prolific authors

Theses 8577 publications were contributed by 18051 authors. Among these authors, Svobodova, Z had secured first position with 109 (1.3%) in publications and 1529 citations and secured 9th rank in citation count, followed by Liu, Y 81(0.94%) and Blust, R 79 (0.92%) secured second and third position respectively in publication count and scored 1062 and 2091 citations secured 12th and 4th position respectively in citation count. Whereas Flik, G had 75 (0.87%) publications and 3101 citation and scored 4th rank publications and 1st rank in citation (Table 1). Out of top 20 authors, more numbers of authors were from People Republic of China (6), followed by The Netherlands (4), Czech Republic (4), Japan (3), Germany (2) and Belgium (1).

Table 1: Prolific authors

Name of the author	No. of contribution	(%)	Total No. of Citation	Rank in Citation	Country
Svobodova, Z	109	1.3	1529	9	Czech Republic
Liu, Y	81	0.94	1062	12	People Republic of China
Blust, R	79	0.92	2091	4	Belgium

Flik, G	75	0.87	3101	1	The Netherlands
Wiegertjes, G. F.	62	0.72	2038	5	The Netherlands
Linhart, O	59	0.69	1440	11	Czech Republic
Velisek, J	56	0.65	995	13	Czech Republic
Nakao, M	54	0.63	1945	7	Japan
Becker, K	53	0.62	1930	8	Germany
Rombout, J. H. W. M	51	0.59	2554	2	The Netherlands
Sakai, M	51	0.59	2175	3	Japan
Zhou, X. Q	51	0.59	826	15	People Republic of China
Feng, L	48	0.56	757	16	People Republic of China
Jiang, J	48	0.56	719	17	People Republic of China
Steinhagen, D	47	0.55	596	19	Germany
Bonga, S. E. W	46	0.54	1451	10	The Netherlands
Xu, P	46	0.54	627	18	People Republic of China
Yano, T	44	0.51	2020	6	Japan
Rodina, M	43	0.50	974	14	Czech Republic
Li, S. H	41	0.48	414	20	People Republic of China

6.4. International Collaboration among countries

Out of 8582 publications, 41 publications do not have country information in the author affiliation. So, the remaining 8541 publications were considered for International collaboration of countries. Theses 8541 publications were contributed by 112 countries. Out of 8541 publications, 6875 (80.49%) publications were single country (SP) publications and 1666 (19.51%) publications were collaborated countries (CP) with two or more countries. Table 2 shows the top 20 international collaborated countries. Among the top 20, USA had absolute dominance with 1084 (12.63%) total publications. It secured first position in international collaborated publications (342, 20.53%) and second position in single country (742, 10.79%) publications and the Relative Collaboration was 31.55% and secured 11th rank. This shows the lack of interest in international collaboration in *Cyprinus carpio* research. Peoples Republic of China (869, 10.13%), Japan (796, 9.28%) and India (534, 6.22%) secured second, third and four places, respectively in publications count. In single country publications Peoples Republic of China (805, 11.71%), Japan (647, 9.41%) and India (463, 6.73%) secured first, third and four places, respectively. Whereas, in international collaborations Peoples Republic of China (64, 3.84%), Japan (149, 8.94%) and India (71, 4.26%) secured 16th, 6th and 14th places, respectively and in relative collaboration Peoples Republic of China (7.36%), Japan

(18.72%) and India (13.30%) secured 19th, 17th and 18th position respectively. UK had the highest relative collaboration (47.84%) and secured first position.

Table 2: International collaboration among countries

Country	TNP	R	%	SP	R	%	CP	R	%	RC %
USA	1084	1	12.63	742	2	10.79	342	1	20.53	11 (31.55)
Peoples Republic of China	869	2	10.13	805	1	11.71	64	16	3.84	19 (7.36)
Japan	796	3	9.28	647	3	9.41	149	6	8.94	17 (18.72)
India	534	4	6.22	463	4	6.73	71	14	4.26	18 (13.30)
UK	487	5	5.67	254	9	3.69	233	2	13.99	1 (47.84)
The Netherlands	452	6	5.27	287	7	4.17	165	5	9.90	7 (36.50)
Canada	427	7	4.98	329	6	4.79	98	10	5.88	16 (22.95)
Germany	382	8	4.45	204	11	2.97	178	3	10.68	4 (46.60)
Czech Republic	374	9	4.36	255	8	3.71	119	9	7.14	10 (31.82)
Spain	371	10	4.32	248	10	3.61	123	8	7.38	8 (33.15)
Turkey	363	11	4.23	341	5	4.96	22	20	1.32	20 (6.06)
France	360	12	4.19	192	13	2.79	168	4	10.08	3 (46.66)
Poland	326	13	3.80	202	12	2.94	124	7	7.44	6 (38.04)
Australia	220	14	2.56	154	14	2.24	66	15	3.96	12 (30.00)
Italy	214	15	2.49	138	16	2.00	76	13	4.56	14 (25.51)
Belgium	201	16	2.34	114	17	1.66	87	11	5.22	5 (43.28)
Brazil	199	17	2.32	152	15	2.21	47	18	2.82	15 (23.62)
Norway	183	18	2.13	96	20	1.42	87	11	5.22	2 (47.54)
Hungary	163	19	1.90	109	18	1.59	54	17	3.24	9 (33.13)
Israel	150	20	1.75	105	19	1.53	45	19	2.70	12 (30.00)

TNP- Total number of publications; R – Rank; SP- Single country publication; CP- Internationally collaborative publications; RC- Internationally collaborative publication in total publications of each country; %- Share in publications.

6.5. International Collaboration among institutes

There were 41 publications without author affiliation. The rest of 8541 publications were considered for international collaboration among institutes. These 8541 publications were contributed by 4106 institutions. Table 3 shows the top 20 internationally collaborated institutes. Out of 8541 publications, Chinese Academy of Science, China contributed 218 (2.54%) and secured

1st position in publication count, whereas international collaboration concerned it secured 5th position with 39 (2.34%) publications, followed by Univ. S Bohemia Ceske Budejovice (187, 2.19%) and Wageningen University and Research Centre, Netherland (163, 1.90%) secured 2nd and 3rd position in publication count and 2nd (65, 3.90%) and 1st (89, 5.34%) position in internationally collaborated publications respectively. Relative collaboration of institutes concerned, Chinese Academy of Science, China (17.89%) secured 14th position, whereas University of Stirling, Scotland (64.06%) secured 1st position, Wageningen University and Research Centre, The Netherlands (54.60%) and IFREMER, France (49.12%) 2nd and 3rd position respectively .

Table 3 – international Collaboration among Institutes

Institute	TNP	R	%	SP	R	%	CP	R	%	RC %
Chinese Academy of Science, China	218	1	2.54	179	1	2.51	39	5	2.34	14 (17.89)
Univ. S Bohemia Ceske Budejovice,	187	2	2.19	122	3	1.76	65	2	3.90	7 (34.76)
Wageningen University and Research Centre, Netherland	163	3	1.90	74	6	1.07	89	1	5.34	2 (54.60)
Univ. Vet & Pharmaceut. Sci., Brno	137	4	1.60	128	2	1.85	9	16	0.54	18 (06.57)
INRA, France	109	5	1.27	59	10	0.85	50	3	3.00	4 (45.87)
University of Tokyo, Japan	106	6	1.24	87	4	1.26	19	12	1.14	13 (17.92)
Chinese Academy of Fisheries Science, China	102	7	1.19	72	7	1.04	30	7	1.80	9 (29.41)
Univ. Antwerp	98	8	1.14	77	5	1.11	21	10	1.26	10 (21.43)
Polish Academy of Science, Poland	82	9	0.96	47	15	0.68	35	6	2.10	6 (42.68)
Kyushu University, Japan	75	10	0.87	63	9	0.91	12	14	0.72	15 (16.00)
Agri. Univ. Wageningen	73	11	0.85	66	8	0.95	7	18	0.42	17 (09.59)
CSIC, Spain	69	12	0.80	48	14	0.69	21	10	1.26	8 (30.43)
University of Stirling, Scotland	64	13	0.75	23	20	0.33	41	4	2.40	1 (64.06)
Miyazaki Univ.	63	14	0.73	50	13	0.72	13	13	0.78	11 (20.63)
Tokyo Univ. Fisheries, Japan	60	15	0.70	57	11	0.82	3	19	0.18	19 (05.00)
IFREMER, France	57	16	0.66	29	18	0.42	28	8	1.68	3 (49.12)
Sichuan Agr Univ., China	56	17	0.65	56	12	0.81	0	20	0.00	20 (0.0)
Huazhong Agr. Univ., China	54	18	0.63	45	16	0.65	9	16	0.54	15 (16.67)
Univ. Hohenheim, Germany	53	19	0.62	29	18	0.42	24	9	1.44	5 (45.08)
Univ. Murcia, Spain	53	19	0.62	43	17	0.62	10	15	0.60	12 (18.87)

TNP- Total number of publications; R – Rank; SP- Single country publication; CP- Internationally collaborative publications; RC- Internationally collaborative publication in total publications of each country; %- World share in publications.

6.7. High profile countries with their citation impact

There are many bibliographic indicators available to measure the impact of research output of countries, institutions and authors. We used Citations Per Publication (CPP), Relative Citation Impact (RCI), and Percentage of Publication not cited (PNC).

$$CPP = \frac{\text{Total Number of Citation}}{\text{Total Number of Publications/Papers}}$$

$$RCI = \frac{\text{A country's share of world citations (C\%)}}{\text{A country's share of world publications (P\%)}}$$

RCI measures both the influence and visibility of a nation's research in the world. It was developed by the Institute of Scientific information (now Thomson Reuters, USA) and has been applied by Dwivedi et al (2017)[1] to analysis the research output of global male breast cancer research. Table 4 shows the top 20 high profile countries and their citations. If the RCI = 1, the country's citation rate is equal to world's citation rate; RCI > 1, the country's citation rate is greater than world's citation rate and RCI<1, the country's citation rate is less than world's citation rate. USA, Japan, UK, The Netherlands, Canada, Germany, Spain, France, Australia, Belgium, Norway and Israel had more than world's citation rate. Out of 20 countries, 12 countries had value more than world average citations.

Table 4: High prolific countries and their citation impact

country	TNP	%	TNC	%	CPP	RCI	PNC (% of TNP)
USA	1084	12.63	34536	17.94	32	1.4	74 (6.83)
Peoples Republic of China	869	10.13	11794	06.13	14	0.6	154 (17.72)
Japan	796	9.28	19274	10.01	24	1.1	63 (7.91)
India	534	6.22	6599	03.43	12	0.5	111 (20.79)
UK	487	5.67	19796	10.29	41	1.8	27 (5.54)
Netherlands	452	5.27	16312	08.48	36	1.6	17 (3.76)
Canada	427	4.98	17197	08.94	40	1.8	18 (4.21)
Germany	382	4.45	9072	04.71	24	1.1	35 (9.16)
Czech Republic	374	4.36	5710	02.97	15	0.7	48 (12.83)
Spain	371	4.32	10880	05.65	29	1.3	25 (6.74)
Turkey	363	4.23	4141	02.15	11	0.5	89 (24.52)
France	360	4.19	10467	05.44	29	1.3	20 (5.55)
Poland	326	3.80	3989	02.07	12	0.5	50 (15.34)
Australia	220	2.56	5339	02.77	24	1.1	18 (8.18)
Italy	214	2.49	4449	02.31	21	0.9	17 (7.94)

Belgium	201	2.34	5947	03.09	29	1.3	13 (6.47)
Brazil	199	2.32	2712	01.41	14	0.6	34 (17.08)
Norway	183	2.13	6514	03.38	35	1.6	11 (6.01)
Hungary	163	1.90	3431	01.78	21	0.9	20 (12.27)
Israel	150	1.75	5297	02.75	35	1.5	3 (2.00)

TNP- Total number of publications; TNC- Total number of citations; CPP- Citation per publication; RCI- Relative citation impact; PNC- Percentage of publications not cited; % - world share

6.8. High profile institution and their citation impact

Table 5 shows the top 20 high prolific institutions and their citation impact. Out of these 20 institutions, INRA, France, University of Tokyo, Japan, Univ. Antwerp, Kyushu University, Japan, Agri. Univ. Wageningen, CSIC, Spain, University of Stirling, Scotland, IFREMER, France, Univ. Hohenheim, Germany and Univ. Murcia, Spain had more than world citation average. Chinese Academy of Science, China, Univ. S Bohemia Ceske Budejovice, and Wageningen University and Research Centre, The Netherland were 1st, 2nd and 3rd position respectively in publication count, but they had value less than world's citation rate.

Table 5: High prolific institutions and their citation impact

Institute	TNP	%	TNC	%	CPP	RCI
Chinese Academy of Science, China	218	2.54	3809	1.98	17	0.8
Univ. S Bohemia Ceske Budejovice,	187	2.19	3416	1.77	18	0.8
Wageningen University and Research Centre, Netherland	163	1.90	3476	1.80	21	0.9
Univ. Vet & Pharmaceut. Sci., Brno	137	1.60	1914	0.99	14	0.6
INRA, France	109	1.27	2859	1.49	26	1.1
University of Tokyo, Japan	106	1.24	2785	1.45	26	1.2
Chinese Academy of Fisheries Science, China	102	1.19	1290	0.67	13	0.6
Univ. Antwerp	98	1.14	3206	1.67	33	1.5
Polish Academy of Science, Poland	82	0.96	1091	0.57	13	0.6
Kyushu University, Japan	75	0.87	2577	1.34	34	1.5
Agri. Univ. Wageningen	73	0.85	3546	1.84	49	2.2
CSIC, Spain	69	0.80	2496	1.30	36	1.6
University of Stirling, Scotland	64	0.75	2197	1.14	34	1.5
Miyazaki Univ.	63	0.73	2332	1.21	37	1.7
Tokyo Univ. Fisheries, Japan	60	0.70	1479	0.77	25	1.1
IFREMER, France	57	0.66	2204	1.14	39	1.7
Sichuan Agr. Univ., China	56	0.65	826	0.43	15	0.6
Huazhong Agr. Univ., China	54	0.63	583	0.30	11	0.5
Univ. Hohenheim, Germany	53	0.62	1855	0.96	35	1.5
Univ. Murcia, Spain	53	0.62	1808	0.94	34	1.5

TNP- Total number of publications; TNC- Total number of citations; CPP- Citation per publication; RCI- Relative citation impact; % - World share

6.9. Journal-wise distribution

Table 6 shows the top 20 highly productivity journal in *Cyprinus carpio* research. 8582 publication were published in 1168 journals. The journal Aquaculture ranked first (500, 5.8%) in publication and 9th rank in Impact Factor (IF). The top 20 journals were contributed 3193 (37.21%) publications. Most of the journals were from Elsevier, The Netherland (9 journals). Chemosphere from Elsevier, The Netherland had the highest IF (4.208) among top 20 journals.

Table 6: Top productivity journals in *Cyprinus carpio* research

Journal	TNP	%	TC	Country	IF (2016)	IF Ranking
Aquaculture	500	5.8	18311	Elsevier, The Netherland	2.570	9
Fish & Shellfish Immunology	396	4.6	11704	Elsevier, The Netherland	3.148	6
Fish Physiology and Biochemistry	199	2.3	2984	Springer, Germany	1.647	15
Aquatic Toxicology	191	2.2	7674	Elsevier, The Netherland	4.129	2
Journal of Fish Biology	190	2.2	4472	Wiley, USA	1.246	18
Aquaculture Research	163	1.9	2652	Wiley, USA	1.461	16
Developmental and Comparative Immunology	146	1.7	6342	Elsevier, The Netherland	3.218	5
Ecotoxicology and Environmental Safety	141	1.6	3415	Elsevier, The Netherland	3.743	3
General and Comparative Endocrinology	133	1.5	3413	Elsevier, The Netherland	2.585	8
Journal of Experimental Biology	128	1.5	4632	The Company of Biologist Limited, UK	3.32	4
Journal of Fish Diseases	128	1.5	3636	Wiley, USA	2.138	11
Diseases of Aquatic Organisms	119	1.4	2565	Inter-Research Science Center, Germany	1.752	13
Comparative Biochemistry and Physiology: B-Biochemistry & Molecular Biology	111	1.3	2570	Elsevier, The Netherland	1.757	12
Fisheries Science	110	1.3	1246	Springer, Germany	0.839	19
Chemosphere	108	1.3	3213	Elsevier, The Netherland	4.208	1
Environmental Toxicology	96	1.1	3369	Wiley, USA	2.951	7

and Chemistry						
Aquaculture Nutrition	86	1.0	1251	Wiley, USA	1.665	14
Comparative Biochemistry and Physiology: C-Toxicology & Pharmacology	84	1.0	2672	Elsevier, The Netherland	2.416	10
Bulletin of Environmental Contamination and Toxicology	83	1.0	905	Springer, Germany	1.412	17
Israeli Journal of Aquaculture-Bamidgeh	81	0.9	743	Israel	NA	20

6.10. Highly cited references

Out of 8582 publications, 212 publications had no references. The rest of 8370 publications had 192935 cited references. The average reference per publication was 23.05. The review article Devlin RH, Nagahama Y. Sex determination and sex differentiation in fish: an overview of genetic, physiological, and environmental influences, *Aquaculture*, 2002 JUN 21; 208 (3-4): 191-364 had the highest cited references (1463). Whereas, in research article, Harmon SM, Wiley FE., Effects of Pollution on Freshwater Organisms, *Water Environment Research*, 2010 OCT; 82 (10): 1945-2000 had 371 references. Table 7 shows the top 10 highly cited references which were cited 120 or more times.

Table 7: Top 10 highly cited references

Author/Year/Title/Journal	No. of citation	%
Bradford, Marion M. (1976). A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Analytical Biochemistry*, 72(1–2):248-254. doi:10.1016/0003-2697(76)90527-3	395	4.6
LOWRY, O. H., ROSEBROUGH, N. J., FARR, A. L., and RANDALL, R. J. (1951). Protein measurement with the Folin phenol reagent. *J Biol Chem*., 193 (1):265-275.	352	4.1
Laemmli, U. K. (1970). Cleavage of Structural Proteins during the Assembly of the Head of Bacteriophage T4. *Nature*, 227 (5259): 680-685	214	2.5
Ron van der Oost, Jonny Beyer, Nico P.E Vermeulen. (2003) Fish bioaccumulation and biomarkers in environmental risk assessment: a review. *Environmental Toxicology and Pharmacology*, 13(2): 57–149	161	1.9
Bonga, S. E. Wendelaar. (1997). The stress response in fish. *Physiological Reviews*, 77(3): 591-625	139	1.6
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ELLMAN GL, 1961, *Biochem. Pharmacol.*, V7, P88, DOI 10.1016/0006-2952(61)90145-9	130	1.5
Sakai, Masahiro (1999). Current research status of fish immunostimulants. Aquaculture, 72(1-2): 63-92. https://doi.org/10.1016/S0044-8486(98)00436-0	124	1.4
THOMPSON JD, 1994, *Nucleic Acids Res.*, V22, P4673, DOI 10.1093/nar/22.22.4673	120	1.4

6.11. Documents types and language distribution

There were 9 types of documents found in *Cyprinus carpio* research during this period. They were Article, Proceedings paper, Review, Meeting abstract, Note, Editorial materials, Correction, Book Review and Letter. Among 9 types, articles (7461, 87.0%) were predominant, followed by conference proceeding papers, reviews and meeting abstracts. The *Cyprinus carpio* research was published in 18 languages, English, French, Japanese, Portuguese, Turkish, German, Polish, Russian, Spanish, Chinese, Czech, Hungarian, Italian, Dutch, Rumanian, Serbo-Croatian, Slovak and Ukrainian. Among 18 languages, English (8370, 97.5%) was the preferential language for the world scientist.

Conclusion

There were 8582 publications contributed by the researchers in *Cyprinus carpio* research globally. The maximum number of publications was brought out during 2014 and the minimum of publications in 1990. The mean annual growth rate was found to be 13.41. Multiple authored publications were predominant in *Cyprinus carpio* research and the degree of collaboration was 0.94. Out of 8582 publications, 5 publications were anonymous. The rest of 8577 publications were contributed by 18051 authors, of which Svobodova, Z from Czech Republic contributed 109 and secured 1st rank among authors. International collaboration and citation impact were also studied for country and institutes. USA had absolute dominance both in terms of publications and international collaboration, but in relative collaboration USA secured 11th rank only. Chinese Academy of Science, China scored 1st rank in terms of publications and 5th rank in international collaboration and in relative collaboration it secured 14th rank. Citation impact concerned USA had more than the world mean value, i.e RCI>1. China and India had less than the world mean value i.e RCI<1. Citation impact on institutes were also studied and it revealed that the top 4 institutes were scored less than that of world mean value e.i RCI<1. The 8582 publications were contributed by 1168 journals. Among these, Aquaculture scored 1st rank with 500 publications. 192935 references appended in 8370 publications. The average reference per publication was 23.05. Article was the

predominant type of publications and English was the preferential language for scientific communication.

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