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Neotropical Ichthyology: trajectory and bibliometric index (2003 - 2010)

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The *Neotropical Ichthyology* journal was created in 2003 and soon became one of the main publications in its field as it is reflected in the number of articles submitted every year and the fact that it has been indexed by both SciELO and ISI. In order to understand the reasons for its trajectory, the journal history was recovered and bibliometric indices on author, citation and impact factor were mapped for the period between 2003 and 2010. A descriptive study on journal information source and a bibliometric study of the 388 articles published by the journal and the 642 articles that cite it have been carried out. Bibliometric analyses showed that 75.8% of the articles had been written by Brazilian authors and 91.3% had been published in collaboration. The journal was cited by 171 different publications from 28 countries, including renowned journals in the field. Self-citation accounted for 26.8% of journal citation. Analyses have been able to show that strict evaluation control and editing of the articles have contributed towards its success and internationalization.

O periódico *Neotropical Ichthyology* foi criado em 2003 e rapidamente despontou como uma das principais publicações em sua área, fato refletido no número de submissões de artigos anuais e na sua inclusão na SciELO e no ISI. Com o objetivo de entender os motivos desta trajetória, resgata-se a história da revista e mapeiam-se indicadores bibliométricos de autoria, citação e fator de impacto no período de 2003 a 2010. Para isso, procede-se a um estudo descritivo de fontes de informação sobre o periódico e a um estudo bibliométrico dos 388 artigos publicados e dos 642 artigos citantes. Os resultados das análises bibliométricas revelam que 75,8% dos artigos foram escritos por autores brasileiros e 91,3% foram publicados em colaboração. O periódico foi citado até agora por 171 diferentes publicações provenientes de 28 países, incluindo periódicos de renome na área. A auto-citação perfez 26,8% das citações ao periódico. As análises realizadas permitiram identificar que rígidos controles de avaliação de artigos e de edição contribuíram para o sucesso e a internacionalização da revista.

Key words: Bibliometrics, Citation analysis, Co-authorship, Impact factor, Scientific journal.

Introduction

Scientific journals are fundamental in formal scientific communication and they register, legitimate and disseminate scientific output. They were created to include contributions resulting from scientific research in a specific field of knowledge and in time have become ever more subdivided or specialized. The study of such publications has always kept scientific communication researchers busy, casting their gaze on the community that generates them and on how knowledge is produced and disseminated in a specific field of knowledge in order to understand it.

The study of journals can have several aims, such as investigating aspects of their output, dissemination or use, by means of bibliometric indices of production and use. Such indices are used in the mapping of scientific activity and to subsidize national policies on Science. The Universidade Federal do Rio Grande do Sul (UFRGS) Scientific Communication Research Team focuses mainly on scientific journal investigation, and among these journals, specifically the ones produced in Brazil and inside the institution. When analyzing the Brazilian journals represented in the international database of the Institute for Scientific Information (ISI), one recently created journal, dedicated to a specialized subject, which had already been published and indexed by the *Scientific Electronic Library Online* (SciELO) with an impact factor close to 1.0, was found. All scientific journal researchers are aware of the difficulties faced by Brazilian journals to reach such a standard, thus the need to investigate the *Neotropical Ichthyology* journal became evident.

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This paper tries to recover the trajectory of the journal, map the bibliometric indices of authorship and citation and to identify the factors that turned it into a successful and international journal. The different methods and approaches used in the study are described in the following section.

Material and Methods

In order to contextualize the *Neotropical Ichthyology* history and indices, we have tried to understand the reasons for the creation of the journal and the factors that have contributed towards its evolution. With that purpose, editorial content analysis within the publication itself and in the Sociedade Brasileira de Ictiologia bulletins published between 2002 and 2010, as well as an interview with the scientific editor in chief on August 26, 2010 were carried out. Data on number of articles submitted per year were provided by the editor himself.

Bibliometric techniques were applied in the analysis of published articles and citations received by *Neotropical Ichthyology*, comprising authorship, co-authorship, citation and impact factor. Bibliometric analyses were done with Bibexcel (software for bibliometric data organization and treatment available at http://www8.umu.se/inforsk/Bibexcel/) and Microsoft Excel 2007. Due to *Web of Science* (WoS) data availability, two different procedures for data collection were adopted, both to be described as follows.

For the authorship analysis, all of the 388 articles and scientific notes published from the creation of the journal in September 2003 to its first issue of 2010, comprising 8 volumes and 27 numbers were recovered. Data collection, carried out in June 2010, was divided into two stages: in the first stage, we imported articles that were published from 2006 onward that had been indexed by WoS; and in the second stage, articles that had been written prior to that date and therefore were not available at WoS were manually collected from SciELO, copied onto a text files and reorganized in the Bibexcel format. For the collaboration network analysis, Pajek (software for social network analysis available at http://vlado.fmf.uni-lj.si/pub/networks/pajek/) was used.

Data imported from the *Cited Reference Search* option available at WoS was used in the citation analysis. As previously stated, the journal was first indexed in 2006 and, therefore, only the period from 2006 to the first issue of 2010 is included in the analysis. A total of 642 articles that cite the 308 articles published in the journal during this period have been analyzed.

The names of the authors of the articles and the citing authors, as well as the institutions and countries they are affiliated with have been standardized in order to keep a standardized pattern of entry in the database. This was a manual procedure using text files and the List of Institution Authority (tool developed by the authors). Lattes Curriculum (Brazilian Curriculum data base available at http:// lattes.cnpq.br/) was also used to check names.

In both authorship and citation analyses one article was accounted for each occurrence, meaning that in case of an article published in co-authorship each co-author had one article assigned to his/her total number.

The findings have been structured into three different parts: history of the journal and IF evolution, article authorship and citation.

Results

The *Neotropical Ichthyology* journal was created in 2003, 20 years after the foundation of the Sociedade Brasileira de Ictiologia, with the purpose of becoming an international forum for scientific dissemination and original research discussion on the diversity of neotropical marine, estuarine, and freshwater fish (Malabarba, 2002, 2006). The journal has an editorial board of about 20 specialists from Brazil and abroad and it is edited in English, with a strict and blind system of peer review. It has been indexed by SciELO, WoS, Scopus, and Life and Science indexes such as *Biological Abstracts*. It is important to add that the journal has been indexed by WoS since it first applied in 2006, which shows the relevance of the journal.

Since then, the journal has had its impact factor evaluated by the *Journal Citation Report* (JCR*)*. Impact factor is a bibliometric measure used to indicate relevancy of a scientific publication. It measures the ratio between the number of citations that a journal received in a specific year and the number of articles published by the journal in the two preceding years (Garfield, 2006).

With an impact factor of 0.985, the *Neotropical Ichthyology* journal ranks number 11 among the 65 Brazilian publications indexed by JCR and number 70 among the 127 international publications on Zoology, according to data from JCR collected in November 2010. This impact factor brings *Neotropical Ichthyology* close to other older journals in the Ichthyology field, such as the German *Ichthyological Exploration of Freshwaters* (IF = 0.940), created in 1990, and the Japanese *Ichthyological Research* (IF = 0.635), created in 1997. The table below shows annual data on the impact factor of *Neotropical Ichthyology* and summarizes data referring to the submission of articles.

As shown in Table 1, the number of submissions increased five fold in the period of five years, from 34 articles submitted

Table 1. Summary of submission/publication of articles and impact factor. Sources: *Neotropical Ichthyology* and JCR. Note: * period that *NI* has not been indexed by ISI.

Year	Number /Year	Submission	Publication	% of submission acceptance	Impact Factor
2003	2	34	18	52.9	*
2004	4	65	28	43.1	*
2005	4	102	55	53.9	*
2006	4	120	57	47.5	0.512
2007	4	152	63	41.4	1.133
2008	4	173	73	42.2	0.856
2009	4		82		0.985

in 2003 to 173 in 2008. As a consequence, the number of articles published has also increased, but the article acceptance rate fell from 52.9% in 2003 to 42.2% in 2008, which suggests improvement in quality of manuscripts submitted to journal evaluation. In order to ensure greater strictness in the review process, the editorial board analyzes manuscripts in three stages. First they are examined by the scientific editor who assesses format and content. When approved, the manuscripts go through new format and content evaluation by editors in the area. Only after this filtering process are the manuscripts sent to outside evaluations.

Table 2 shows journal position according to Qualis 2008 classification. Classification B1 is predominant, which is excellent for a Brazilian journal.

Authorship analysis of articles published by the journal shows predominant collaboration between authors (91.3%) and groups of 2 and 3 authors account for a major percentage of those (60%), as can be seen in Fig. 1. Every field of science has experienced an increase in collaboration and studies show that in the year 2000, only 10.7% of articles indexed by ISI had been signed by an individual author (Glänzel & Schubert, 2004). In Brazil, this trend seems to be intensified and ISI data between 2004 and 2006 show that only 3.9% of the articles had been written by on author alone (Vanz, 2009). One of the basic reasons for team work is the increased number, specialization and professionalization of research (Meadows, 1999; Beaver & Rosen, 1978, 1979). There are several reasons for collaboration: economic aspects, due to the high cost of Science and the possibility to share costs and resources; cognitive aspects, related to acquisition of new knowledge and specialties through cooperation with other professionals; and social aspects, related to the researcher's professional and personal network, theme, emotional or ideological affinity (Luukkonen *et al.*, 1992). Some studies indicate a correlation between collaboration and impact, measured by the number of citations received (Glänzel, 2001). Articles written in collaboration are cited more often due to several different reasons, such as the wide dissemination the paper gets because of the greater number of authors/institutions involved and amplified opportunity for citation, multiplied by the number of authors (Persson *et al.*, 2004). Further qualitative studies would be necessary to make it clear, but it is believed that collaboration found in Neotropical Ichthyology has several motivation factors.

Table 2. Qualis strata for the *Neotropical Ichthyology* journal. Source: Capes, WebQualis 2008

Field of Evaluation	Strata
Interdisciplinary	A2
Zoo technology/Fishing Resources	A2
Anthropology/Archeology	B1
Agricultural Science I	B1
Biological Sciences I	B1
Engineering I	B1
Engineering III	B1
Geosciences	B1
Psychology	B1
Food Science	B2

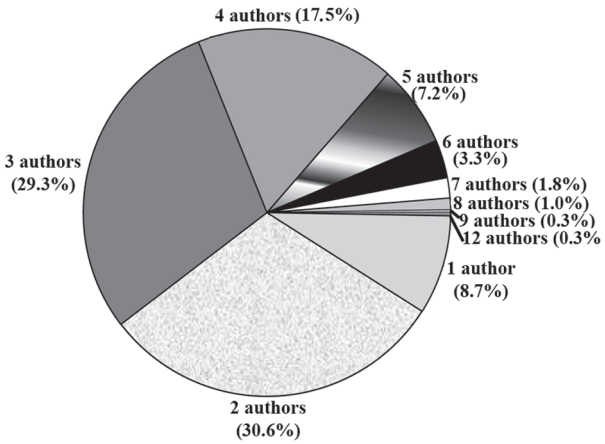

Fig. 1. Number of authors per article.

Author distribution is symmetric, as can be noted from similar mean (3.1) and median (3) values in Table 3 below. The number of authors varies from 1 to 12. These results are in line with others reported in literature. For instance a mean of 4.7 authors per article referent to articles in the Biology field indexed by ISI in the period between 2004 and 2006 was found (Vanz, 2009). Packer & Meneghini (2006) justify that scientific collaboration in Astronomy, Physics, Medical and Surgical fields is higher, since the type of research being developed in such areas requires joint effort from various authors and countries, as opposed to Biology, Chemistry and Biomedicine fields. Among articles in the Biology field cited more than 100 times in ISI between 1994 and 2003, researchers found a mean of 8.9 authors, supporting the idea that articles published by a group of authors cause greater impact.

Analysis on author productivity in the journal revealed a total of 675 authors, from which 460 published only one article in the period, thus showing the diversity of researchers and how open the journal is to the community interested in neotropical ichthyofauna in general. All of the 10 most productive authors (who published from 9 to 15 articles in the period), work in the wider area of Biological Sciences. Most of them work specifically in Zoology, though some also do research on Ecology and in smaller number in the area of Genetics, according to data collected from Lattes Platform in August 2010.

Table 3 presents a summary of co-authorship central tendency measurement among authors, affiliated institutions, and countries.

Table 3. Descriptive measures of co-authorship.

Measures	Co-authorship among individuals	Co-authorship among countries	Co-authorship among institutions
Mean	3.1	1.2	1.9
Median	3	1	2
Mode	2	1	1
Minimum	1	1	1
Maximum	12	3	6

In terms of foreign author participation, the results show the presence of researchers from 20 different countries. The mean of co-author countries in a single article is 1.2 in the period between 2003 and 2010, which is close to 1.4, the number found for Brazilian scientific output in the Biology field (Vanz, 2009). Among these international articles, 46 (11.8%) were written by foreign authors only and co-authorship between countries, without Brazilian participation was found in 14 of those. Another 48 articles (12.4%) were written in co-authorship with Brazilian researchers. Among countries that established partnership, the United States and Argentina have already been recognized as main Brazilian collaborators (Glänzel, 2001). Venezuela, Uruguay, France, Mexico, Colombia, Peru, Italy, and Bolivia, among others show high occurrence too. The participation of foreign authors is a factor that can interfere in the foreign citation of the journal, giving the article added quality (Katz & Martin, 1997). Exclusive participation of Brazilian authors was found in 294 articles (75.8%).

In Fig. 2, the fifteen institutions that stand out in terms of article production were identified according to the affiliation given by authors.

It can be noted that the institution with the greatest number of articles published in the period is the Universidade de São Paulo (USP). There is a relative geographic author distribution, given the presence of institutions from several different Brazilian states. The fifteen most productive institutions represent seven different states: four located in São Paulo State, three in Paraná State, two in Rio Grande do Sul State, two in Amazonas State and one each respectively in Rio de Janeiro, Mato Grosso and Tocantins States. It was also a noticeable fact that the 10 most productive authors belonged to the most productive institutions, three from Universidade Estadual de Maringá (UEM), two from Pontificia Universidade Católica do Rio Grande Sul (PUCRS), and the remaining (five authors) from Universidade Federal do Rio Grande do Sul (UFRGS), Universidade Estadual Paulista (UNESP), Universidade Estadual de Campinas (UNICAMP), Instituto Nacional de Pesquisas da Amazônia (INPA), and USP.

In terms of institutional collaboration, analyzed through institutional affiliation assigned by authors in the articles, a mean of 1.9 institutions per article was found and the maximum number of collaborating institutions in a single article was six. It is important to note, however, that the collaboration was analyzed inter-institution wise and not intra-institutionally, when post graduate departments/programs within the same institution work in collaboration.

Starting with the 30 most productive institutions, a collaboration network was created, with the purpose of studying the links in the scientific community in the area in depth.

Fig. 3 shows that collaboration takes place mostly among public universities. The institutions Universidade Federal de São Carlos (UFSCAR) and UEM were found to have the greatest number of partners, followed by USP, PUCRS, UNICAMP, Universidade Federal do Rio de Janeiro (UFRJ), and UFRGS. The network is well distributed, which demonstrates that partnerships among different institutions occur, without specific clusters.

Neotropical Ichthyology citation analysis pointed to Bertaco, V. A. (52 citations), Costa, W. J. E. (32 citations), and Ribeiro, A. C. (30 citations) as the most often cited authors. The articles that had been most often cited in the period between 2006 and 2010 were found to be "Tectonic history and the biogeography of the freshwater fishes from the coastal drainages of eastern Brazil: an example of faunal evolution associated with a divergent continental margin", by Alexandre Cunha Ribeiro, cited 26 times; "Putative relationships among inseminating and externally fertilizing characids, with a description of a new genus and species of Brazilian inseminating fish bearing an anal-fin gland in males (Characiformes: Characidae)" by Stanley H. Weitzman, Naércio A. Menezes, Hans-Georg Evers and John R. Burns, cited 23 times; followed by "Two new species of *Astyanax* (Ostariophysi: Characiformes: Characidae) from eastern Brazil, with a synopsis of the *Astyanax scabripinnis* species complex" written by Vinicius A. Bertaco and Carlos A. S. de Lucena, cited 18 times.

Neotropical Ichthyology was cited by 171 different journals published in the five continents. Of the total, 107 journals were responsible for just one citation , which indicates that *Neotropical Ichthyology* has a wide range of readers. However, self-citation amounted to 26.8%, 172 of the total 642 citations. The *Zootaxa*

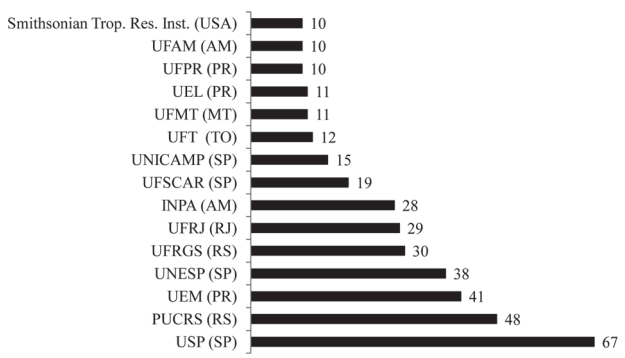

Fig. 2. Institutions authors are affiliated to.

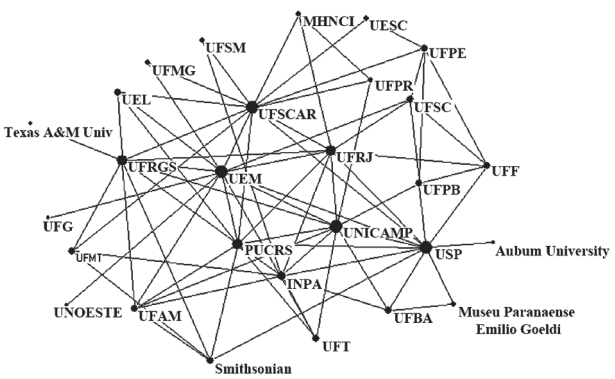

Fig. 3. Co-authorship network among institutions.

Table 4. Citing journals. Source: author data. Note: * numeric data does not apply.

Journal	Number of citations	%	Field	Country
Neotropical Ichthyology	172	26.8	Zoology	Brazil
Zootaxa	53	8.3	Zoology	New Zealand
Ichthyological Exploration of Freshwaters	22	3.4	Marine and freshwater Biology; Zoology	Germany
Copeia	22	3.4	Zoology	United States
Journal of Fish Biology	17	2.7	Fishing; Marine and Freshwater Biology	United States
Hydrobiologia	17	2.7	Marine and Freshwater Biology	Holland
Environmental Biology of Fishes	15	2.3	Ecology; Marine and Freshwater Biology	United States
Revista Brasileira de Zoologia	15	2.3	Zoology	Brazil
Genetics and Molecular Biology	13	2.0	Biochemistry and Molecular Biology; Genetics and heredity	Brazil
Molecular Phylogenetics and Evolution	12	1.9	Biochemistry and Molecular Bio. Evolutionary Bio.; Genetics and Heredity	United States
Brazilian Journal of Biology	11	1.7	Biology	Brazil
Other publications	273	42.5	*	*
Total	642	100.0	*	*

jounal, responsible for 53 citations (8.3%), specializes in the Zoology field. Journals with more than ten citations are shown in Table 4, along with the number of citations, the field of knowledge and the country where the journal is edited.

Analysis on the language in which the citing articles are written shows that English is predominant, reaching 93.8% of citing documents. As far as country of origin, citing journals were edited in 28 different countries, most of which located in South America (40.0%), followed by Europe and North America, both with similar percentages (25.4% and 24.8% respectively). However, if self-citations are excluded, Europe ranks first with 34.7% of the citations, followed by North America with 33.8%. The most representative countries in terms of *Neotropical Ichthyology* citations are Holland and the United States.

In terms of key-words, the most frequently connected to the *Neotropical Ichthyology* citing articles were Taxonomy, which occurred 71 times, closely followed by Neotropical (34 times), Systematic (33 times), South America (31 times), Fish (30 times), Reproduction and Biogeography (24 times each), Brazil (16 times), Freshwater Fish and Neotropical Fish (15 times each).

The ten authors that most cite the journal have an average of 7 articles published by the same journal. In comparing this list with the list of most productive authors in the journal, 5 names were found in both lists: Agostinho, A. A.; Malabarba, L. R.; Gomes, L. C.; Oliveira, C. and Sazima, I.

Discussion

The case of *Neotropical Ichthyology* reflects a tendency towards Brazilian scientific journal improvement, which can be observed by the increase in number of Brazilian titles indexed by ISI, among other indicators. Some of the factors that support the improvement of journals, making them more visible are the multiplication of post graduate courses, availability of research grants, creation of new journals, stricter research assessment rules, and dispute over governmental funding.

Bibliometric data show the predominance of collaboration between authors (91.3%) and mostly groups of 2 and 3 authors (60.0%). Co-authorship between Brazil and other countries accounts for 12.4% of the articles. In terms of participation of other countries, 11.8% of the articles were written by foreign authors only, indicating how much visibility the journal has in the international scientific community. Citation study shows that the purpose of the journal to become a discussion forum for researchers in the area is being fulfilled, since authors of the journal are also its readers, as can be concluded from the citation study. Therefore, research outcomes that are published feed new research, creating a continuous flow that propels growth in the field and Science in general.

Content analysis of the publication itself and Brazilian Ichthyology Society bulletins and the interview with the editor reveal that the *Neotropical Ichthyology* journal was created based upon the need for a specialized Ichthyology journal, need which the Brazilian scientific community itself had expressed. However, the success achieved by the journal is due to the hard work of the board of editors in an effort to achieve quality, through accurate assessment and correction of submitted texts and the primacy of the journal.

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