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COMMENTARY

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World-level ecologists in Chile: Oldtimers, newcomers, and the bypassed

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Abstract

Background: A team of 3 scientometrists led by John Ioannidis published in 2020 an extensive and updated database (ca. 6.9 million researchers in 22 disciplines and 176 sub-disciplines), ordering them according to a composite bibliometric index that measures their whole trajectory (career-long) impact and their annual impact at year 2019. They reported the top 100,000 scientists (1.45% across all disciplinary fields) or the top 2% of each subfield discipline, thus publishing the ranking of ca. 150,000 researchers worldwide.

Methods and findings: We filtered that information for the disciplinary and sub-disciplinary areas corresponding to Ecology and identified a total of 14 ecologists with residence in Chile that appear in either of those two worldwide rankings. We report their measured productivity as both whole trajectory (career-long) and as annual impact at year 2019. We attribute their high registered productivity to their training at the doctoral level in prestigious foreign universities, their academic positions in internationally recognized Chilean universities, and their participation in state-funded research centers of scientific excellence. Exceptions to the rule are presented.

Conclusions: The 14 ecologists identified with the scientometric algorithm proposed by Ioannidis and coworkers include, but are not restricted, to the most cited ecologists in Chile. We put forth possible reasons for some puzzling omissions from these rankings.

Keywords: Annual impact, Bibliometric index, *H* index, Scientometrics, Scopus

Background

Before scientometric measures became popular, Jaksic and Santelices [1] asked if anyone read Chilean ecologists, and provided a quantitative perspective, but based on $n=2$ researchers. This paper in part elicited serious introspections about the relative contribution of different ecologists in Chile [2–6]. Today, 30 years later, we can answer the pointed question posed above [1] by stating that they are not only read but also cited and recognized worldwide [7].

This contention is based on the results of a recent review paper [8] reporting a database that ranks the top 100,000 scientists (1.45% across all disciplinary fields) – or the top 2% of each subfield discipline-- from a worldwide universe of 6,880,389 who published at least five articles indexed in the Scopus database (stored at the Mendeley web site). Toward this, they considered 22 disciplinary areas and 176 sub-disciplines, and elaborated a ranking of scientists by both whole trajectory (career-long) impact and their current impact at year 2019.

It thus proves tempting to assess the national contribution to world science of any discipline, but by reason of academic interest we choose to concentrate on the contribution and accomplishments of ecologists based in Chile toward this endeavor. Rau and Jaksic [7] recently documented their impact with reference to the Latin American context, placing those ecologists in Chile and

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Argentina as the most productive --occupying the first and second per capita place-- followed by those in Brazil and Mexico. It seems adequate, then, to scrutinize more closely the trends observed in Chile.

Methods

To obtain their metrics, Ioannidis et al. [8] used a composite index that is the sum of the decimal logarithms of 6 bibliometric indicators that include the number of allocites (NC, cites excluding self-citation; see [1, 9, 6, 10] for rationale), the *h* index (H, see [11, 12]), a corrected version of it (Hm, see [13]; it is H based on a fractionalized counting of papers according to the number of coauthors), and the allocites by quality of authorship in three conditions: as single author (NCS), as single + first author (NCSF), or as single + first + last author (NCSFL). This formula is used to calculate the composite indicator for both career-long and single-year (2019) impact. To find out the identity and productivity of ecologists in Chile, the Excel spreadsheets of Tables S-6 and S-7 by [8] were filtered. Only the term "Ecology" was used as a disciplinary and sub-disciplinary area (columns AL and AN in [8], respectively). For a detailed explanation of these calculations and their limitations see [7].

Results

Table 1 presents the names of the nine ecologists with institutional address in Chile that appear in the whole trajectory (career-long) impact ranking. They represent 4.7% of the 190 members of the Ecological Society of Chile (http://www.socecol.cl). Four of these ecologists (Castilla, Navarrete, Santelices, and Thiel) work mainly in marine ecosystems, and the remaining five in terrestrial ones. Bozinovic (in 2020), Castilla (2010), Jaksic (2018), and Santelices (2012) have obtained in Chile the National Prize for Natural Sciences or for Applied Sciences and are also full or corresponding members of the Chilean Academy of Sciences.

Neither Jaksic, Navarrete, nor Santelices appear in the 2019 annual impact ranking, while Ebensperger, Fajardo, Gelcich, Lara, and Rezende are recognized for the first time. Notice that the ranking goes up from career-long to single-year in the case of Bozinovic, Gianoli, Marquet, and Thiel, which attests to them capturing relatively more citations during 2019 than in previous years. The contrary applies to Castilla, Jaksic, Navarrete, Niemeyer, and Santelices. All 14 ecologists mentioned up to here are full, corresponding, or honorary members of the Ecological Society of Chile.

Using data from Table 1, the position in the whole-career rank ranged between 22,950 and 100,707 (CV = 48%) and from 13,539 to 148,194 (CV = 58%) for single-year (2019) rank. The number of allocites ranged 1982 to 9521 (CV = 46%) for whole-career and 194 to 2052 (CV = 72%), respectively. Productivity variations thus seem higher at a given year than over time. The number of articles published varied the least, between 96 and 271 (CV = 34%; $n = 9$). As expected [14], all the correlations between number of published articles, number of allocites, and position in the rankings were negative, but not significant due to the low sample size.

As evidenced in Table 2, all but one of the 14 ecologists listed have obtained their doctorates from internationally recognized foreign universities All of schools are

Table 1 Authors' worldwide productivity position based on Rank for whole trajectory (career-long) and for single year (2019), as reported in Tables S-6 and S-7 by [8]. No. of papers in the Scopus database and No. of allocites, as reported in spreadsheet columns D and H by [8], respectively. Added by us is the Scopus-based *h*-index accessed 16 October 2021)

Author name	Scopus *h*	Rank career	Rank 2019	N° papers	N° cites career	N° cites 2019
Juan C. Castilla	58	22,950	29,417	192	8104	862
Martin Thiel	50	30,033	13,539	232	7192	2052
Francisco Bozinovic	49	37,534	35,041	271	5738	788
Hermann Niemeyer	41	45,942	119,922	243	4080	266
Fabian Jaksic	43	50,576	–	137	4281	–
Pablo Marquet	48	60,565	54,350	162	9521	1343
Bernabé Santelices	31	71,212	–	96	1982	–
Ernesto Gianoli	34	95,480	49,810	146	3077	591
Sergio Navarrete	45	100,707	–	124	4115	–
Alex Fajardo	28	–	83,281	61	–	532
Stefan Gelcich	36	–	86,820	111	–	636
Enrico Rezende	36	–	125,064	72	–	373
Luis Ebensperger	31	–	126,235	91	–	194
Antonio Lara	37	–	148,194	94	–	553

Table 2 Academic profiles of the 14 ecologists that appear in Table 1, in the same sequence

Name	Birth year	Institutions (Ph.D., current, CCTE)	Research lines declared
Juan Carlos Castilla	1940	U. of Wales, U. Católica de Chile, CASEB	Human impacts in marine ecosystems
Martin Thiel	1962	U. of Maine, U. Católica del Norte, CEAZA	Ecology and biodiversity of marine ecosystems
Francisco Bozinovic	1959	U. de Chile, U. Católica de Chile, CASEB, CAPES	Zoology, integrative biology, and biodiversity
Hermann Niemeyer	1941	U. of California-Berkeley, U. de Chile, IEB	Chemical ecology and communication
Fabian Jaksic	1952	U. of California-Berkeley, U. Católica de Chile, CASEB, CAPES	Ecological impacts of invaders, biodiversity, and sustainability
Pablo Marquet	1963	U. of New México, U. Católica de Chile, CASEB, IEB	Macroecology and metabolic ecology
Bernabé Santelices	1945	U. of Hawaii, U. Católica de Chile, CASEB	Ecology of marine algae
Ernesto Gianoli	1970	Swedish U. of Agricultural Sciences, U. de La Serena, CEAZA	Functional ecology of plants and herbivores
Sergio Navarrete	1964	Oregon State U., U. Católica de Chile, CASEB, CAPES	Dynamics, diversity, and conservation of marine ecosystems
Alex Fajardo	1971	U. of Montana, U. de Talca, CIEP	Forest ecology and climate change
Stefan Gelcich	1973	U. of Wales, U. Católica de Chile, CASEB, CAPES, SECOS	Interactions between ecological and social systems in coastal areas
Enrico Rezende	1977	U. of California-Riverside, U. Católica de Chile, CAPES	Interface between physiology, ecology, and evolution
Luis Ebensperger	1964	Boston U., U. Católica de Chile, CASEB	Behavioral ecology, group living, and sociality
Antonio Lara	1956	U. of Colorado, U. Austral de Chile, FORECOS, CR2	Global change, ecosystem services, and ecological restoration

listed in the recognized and demanding world ranking of universities prepared by Jiao Tong University (http://www.shanghairanking.com). With only one exception, obtaining doctorates abroad is observed among the ten ecologists born from 1940 to 1964 (inclusive). For those generations, the only current availability of doctorates in ecology was abroad, but not so for the recent additions to the list (the newcomers Fajardo, Gelcich, Gianoli, and Rezende, born in the 1970s), whom all are Ph.D.'s from abroad. Possibly, newer graduates from Chilean universities will constitute the replacement generation in the future, but only time will allow testing this hypothesis.

Nine or 64% (Bozinovic, Castilla, Ebensperger, Gelcich, Jaksic, Marquet, Navarrete, Rezende, Santelices) of the 14 ecologists have been or are attached to the current Ecology Department of the Pontificia Universidad Católica de Chile (Table 2). A detailed description of the historical development of that Department is available in [15, 16]. The remainder five are evenly spread over Universidad Austral de Chile, Católica del Norte, de Chile, de La Serena, and de Talca.

All 14 ecologists have integrated or are integrating seven Centers of Scientific and Technological Excellence (CCTE's) of the National Research and Development Agency (ANID): Center for Advanced Studies in Ecology and Biodiversity (CASEB, see [17]), Center for Climate and Resilience Research (CR2), Center of Applied Ecology and Sustainability (CAPES), Centro de Estudios Avanzados en Zonas Áridas (CEAZA), Centro de Investigación en Ecosistemas de la Patagonia (CIEP), Institute of Ecology and Biodiversity (IEB), Instituto Milenio de Ecosistemas Forestales (FORECOS), and/or Instituto Milenio de Socio-ecología Costera (SECOS).

Their research lines (synthesized from web pages Academia, ANID, Google Scholar, Publons, Research Gate, Scopus, and/or Wikipedia) are at the frontier of ecological science worldwide, including global change, individual adaptability, biodiversity function, and ecosystem sustainability, of algae, animals, and plants, in marine and terrestrial environments. Microorganisms, fungi, and freshwater systems are conspicuously missing.

Discussion

A recent study indicates that the most scientifically productive countries in Latin America are, from highest to lowest, Brazil, Mexico, Argentina, and Chile [18]. With regard to only Ecology, said productivity is ordered in the same decreasing sequence, but it is somewhat reversed when the data are expressed by number of ecologists per million inhabitants [7]. In such analysis, ecologists in Chile occupy the first place followed by those in Argentina, Brazil, and Mexico (Table 7 in [7]). Interestingly, Chile currently ranks only after Brazil in Latin America when it comes to total scientific publications across all fields in high-impact journals (https://www.natureindex.com/annual-tables/2019/country/all). Judging from this, it seems that ecologists in Chile are better positioned than national practitioners of other scientific disciplines, at least within the Latin American context.

A total of 14 world-level ecologists based in Chile are reported in our Table 1 and they are as well highly ranked in their Scopus based *h*-index, ranging 28-58 (https://www.scopus.com/freelookup/form/author.uri? Accessed 16 October 2021). Why reputedly productive ecologists with Scopus $h > 28$, such as Luis Corcuera ($h = 34$), Mauricio Lima ($h = 34$), Julio Gutiérrez ($h = 38$), Aníbal Pauchard ($h = 40$), Juan Armesto ($h = 42$), and Lohengrin Cavieres ($h = 43$) are not listed among the *ca*. 150,000 researchers ranked by [8] is open for discussion. For instance, a productive scientist resident in Chile that one might think keys out as an ecologist, e.g. Alejandro Buschmann (76,709 career-long rank, 39,894 single-year rank), is classified by Ioannidis et al. [8] in Marine Biology & Hydrobiology and in Fisheries, and thus does not qualify for our analysis.

Of course, the first consideration is that of the database used. For starters, the Scopus database, created by Elsevier in 2004, covers slightly over 23,000 journals, but goes back only to 1990. In comparison, the Web of Science database (formerly, Web of Knowledge), created by the Institute for Scientific Information in 1997 (but later managed by Thomson Reuters and now by Clarivate Analytics) covers only about 12,000 journals, but goes all the way back to 1900. Just for this fact, ecologists whose most cited publications date before the 1990s see their productivity downgraded by the Scopus database.

Secondly, the use of different databases, to which we may now add Dimensions, created in 2018 ([19]), affects the calculations of the *h* index [20–22]. For any given author, *h* calculated with WoS, Scopus, or GS typically yields from lower to higher values, in the same sequence (e.g. Table 1 in [6]; Scopus-*h* not reported). As just noted, Scopus *h*-index values tend to upgrade more recent, usually younger researchers (born in the 1960s or 1970s), with the opposite occurring with the WoS *h*-index.

And finally, there is the structure of the Ioannidis et al.'s formula [8], which may generate biases in the presumed world recognition of ecologists. As pointed out by Rau and Jaksic [7] this happens because: (a) Total production of papers is not considered --only its first or second derivative is, namely, number of citations-- and non-citable publications do not add to the compound index. (b) Given the different weights attributed to the three qualifications in authorship (single, first, or last), ecologists that collaborate with many authors and are in the middle of the authorship line may not show well in this type of ranking.

Our findings call to caution when interpreting the productivity of resident ecologists in their field, both in Chile and worldwide. Conspicuously missing in such measurements is the formation of human capital and the influence exerted in academic circles, civil society, and public policy.

Abbreviations

NC: Number of allocites; H: *h* index; Hm: Corrected *h* index; NCS: Single author; NCSF: Single + first author; NCSFL: Single + first + last author; CV: Coefficient of variation; CCTE's: Centers of Scientific and Technological Excellence; ANID: National Research and Development Agency; CASEB: Center for Advanced Studies in Ecology and Biodiversity; CR2: Center for Climate and Resilience Research; CAPES: Center of Applied Ecology and Sustainability; CEAZA: Centro de Estudios Avanzados en Zonas Áridas; CIEP: Centro de Investigación en Ecosistemas de la Patagonia; IEB: Institute of Ecology and Biodiversity; FORECOS: Instituto Milenio de Ecosistemas Forestales; SECOS: Instituto Milenio de Socio-ecología Costera; WoS: Web of Science; GS: Google Scholar.

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Authors' contributions

Data analysis: JRR, FMJ. Manuscript preparation: JRR, FMJ. All authors read and approved the final version of the manuscript.

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