

NOTE

Underrepresentation of regional ecological research output by bibliometric indices

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ABSTRACT: We analyzed the articles cited in 4 reviews on various aspects of Mediterranean marine and freshwater fishes. In total, these reviews used 498 published sources, from which less than 40% were in journals covered by Thomson ISI. The remaining sources were published either in local journals (23.5%) or in other media formats (e.g. theses, conference proceedings, technical reports). Thus, searching only the ISI's database produces a strongly biased picture of the scientific output of professionals studying Mediterranean ecosystems. This results in a devaluation of the scientific effort devoted to the Mediterranean Sea. Such a bias has ethical and science policy implications, arising from applying double standards. Thus, although the non-ISI publications and their citations are not used for the evaluation of countries, or institutions, the information included in these non-ISI articles is frequently used to develop and test scientific theories. In the new electronic era, it is untenable to use only traditional citation-search methods for any professional evaluation; new online options should be fully exploited for such purposes.

KEY WORDS: Marine ecology · Mediterranean · Professional evaluation · Research devaluation · Science administrators

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Contrary to many other scientific disciplines, ecology and conservation are greatly benefited by a variety of area-specific and time-specific information on the different organisms embedded in ecosystems. For instance, information on the length- and age-structure, maturity, and abundance of fish species within a certain locality at different time periods is essential for defining 'shifting baselines' (Pauly 1995) and thus for identifying the anthropogenic effects on ecosystems. Indeed, many recent discoveries in marine ecology (e.g. fishing down the marine food webs: Pauly et al. 1998; drastic decline in the biomass of high-trophic-level fishes: Christensen et al. 2003, Pauly & MacLean 2003; patterns and propensities in the life history of marine species: Roff 1992, Stearns 1992, Charnov 1993, Cury & Pauly 2000, Froese 2006) would not have been realized if a plethora of such area/time specific, seemingly unimportant, information were not available for a large number of marine species. One of the best examples illustrating this is FishBase (Froese & Pauly 2000; www.fishbase.org), the largest electronic

encyclopedia on fishes, which contains information on 29400 species from more than 35000 published sources, and has opened up new approaches for the study of the life history of fishes (see Froese 2006).

Nowadays, articles including descriptive information such as this are rarely accepted for publication in the main scholarly literature covered by Thomson ISI, either because the submitted manuscripts are of 'low quality' or because the editorial policy of such journals does not encourage such submissions. The latter is justified because these articles are usually characterized as regional and thus of no interest to a wider audience. The 'no-interest' factor translates into 'no citations' and thus to 'low impact factors', in an era during which editors and publishers are eager to increase the impact of their journals (e.g. Begley 2006). As a result, the information included in manuscripts of regional interest is either left 'unpublished' in the form of institutional technical reports, or is directed to local journals, symposium or conference proceedings, and/or other media. Further, ISI also favors articles written in English (Seglen 1997).

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The Mediterranean Sea is surrounded by a large number of countries (Spain, France, Monaco, Italy, Slovenia, Croatia, Bosnia-Herzegovina, Serbia-Montenegro, Albania, Greece, Turkey, Cyprus, Syria, Lebanon, Israel, Gaza Strip, Egypt, Libya, Tunisia, Malta, Algeria, Morocco) with distinct languages, cultures, and histories—both scientifically and otherwise—where scientists are usually characterized by low performance in English. The vast majority of these countries host their own local, ecology-related journals (e.g. Spain: *Thalassas*; Italy: *Biologia Marina Mediterranea*; Croatia: *Acta Adriatica*; Greece: *Mediterranean Marine Science*; Turkey: *Egee University Journal of Fisheries and Aquatic Sciences*; Egypt: *Bulletin of the National Institute of Oceanography and Fisheries ARE*). Some of these journals used to publish articles in the local language until very recently; others still do so. In addition, some articles published in these journals are now considered as key articles, even if they are undercited. An example is the work of Zupanovitch (1968) on the factors affecting *Sardina pilchardus* catches (see Cushing & Dickson 1976, CIESM 2003).

Elsewhere, we have collected and analyzed the available literature on various aspects of Mediterranean marine and freshwater fishes (feeding habits, Stergiou & Karpouzi 2002; reproduction, Tsikliras et al. 2005; length-weight relationships, Stergiou & Moutopoulos 2001; growth, Bobori et al. 2005). Herein, we analyzed the articles cited in these 4 reviews (Table 1). In total, these reviews used 498 published sources (peer-reviewed international and local journals, conference proceedings, technical reports, books, and theses), from which less than 40% were in journals covered by ISI (Table 1). The remaining sources were published either in local journals (23.5%) or in other media formats (e.g. theses, conference proceedings, technical reports). The

percentage of ISI-covered journals differed depending on the subject area with which they were concerned. Thus, the review on the feeding ecology of the Mediterranean fishes used more ISI-covered articles than that on length–weight relationships. The likely explanation: feeding encompasses ecological relationships that may be of interest to ISI-covered journals, while studies on length–weight relationships are of a narrower scope.

Pauly (1994) collected the citations (excluding self citations) of his own 50 papers in ISI journals and in non ISI journals published in the tropics. Citations from ISI journals were less than 10% of total citations received for the period 1973 to 1983. This clearly shows that publications from tropical countries are less represented in ISI's database than those from non-tropical countries.

Our analysis showed that searching only ISI's database produces an underrepresentation of the scientific output of professionals studying marine ecosystems. This will result in a devaluation of the scientific effort devoted to the study of Mediterranean ecosystems. The same will also be true of other geographic areas (e.g. tropics, see Pauly 1994) and/or disciplines (e.g. Spain—Geology; Martin-Sempere et al. 2000 and Medicine—Eastern Mediterranean countries, Pakistan; Jawaid & Jawaid 2005, Habibzadeh 2005).

Such an underrepresentation has ethical and science policy implications, arising from applying double standards. Firstly, when countries (or institutions) are evaluated on the basis of their publication or citation output, both of which are based on ISI-covered journals (e.g. Lawrence 2003, King 2004), the Mediterranean countries, especially those in the southern rim, are always underrepresented. Secondly, although the information included in non ISI articles is frequently used to develop and test scientific theories,

Table 1. Number of articles used per journal category in 4 reviews on various ecological aspects of Mediterranean marine and freshwater fishes. S & M 2001: Stergiou & Moutopoulos (2001); S & K 2002: Stergiou & Karpouzi (2002); T 2005: Tsikliras et al. (2005); B 2005: Bobori et al. (2005). n = number of articles used; % = percent of total

	S & M 2001		S & K 2002		T 2005		B 2005		Total	
	n	%	n	%	n	%	n	%	Articles used	%
ISI journals	19	29.7	75	51.0	68	33.7	36	42.4	198	39.8
Other international journals ^a	8	12.5	32	21.8	50	24.8	27	31.8	117	23.5
CIESM proceedings	2	3.1	15	10.2	43	21.3			60	12.0
Other proceedings ^a	6	9.4	9	6.1	11	5.4	13	15.3	39	7.8
FAO reports	14	21.9	5	3.4	6	3.0			25	5.0
Other reports ^a	5	7.8	6	4.1	3	1.5			14	2.8
Theses ^a	9	14.1	3	2.0	21	10.4	9	10.6	42	8.4
Other (books, etc) ^a	1	1.6	2	1.4					3	0.6
Total	64		147		202		85		498	

^aThese values must be higher because although we probably did not miss many ISI articles, we certainly missed many other non ISI cited publications

the journals in which these articles are published are often not assigned an impact factor by ISI. Furthermore, professional evaluation and promotion of Mediterranean scientists based on ISI-related citations (and impact factors) are highly biased.

In the new electronic era, it is untenable to use only traditional citation-search methods for any professional evaluation (see e.g. www.ecs.soton.ac.uk/~harnad/Temp/bookcite.htm, or <http://openaccess.eprints.org/index.php?/archives/75-guid.html>). This was formerly a standard practice because there was no tool to identify non ISI citations. This reason is no longer valid. Google Scholar (<http://scholar.google.com/>) (see Butler 2005) performs as well as ISI for literature published in recent years (Pauly & Stergiou 2005). It can also 'track down' and 'reveal' non ISI publications and its tracking ability is expected to greatly improve in the near future. However, in order for this to be realized, items published in any local sources must become available online. This is the responsibility not only of the local journals but also of the authors themselves, who can post the full text of all their publications on the web (see Harnad 2003). Should all published items become available on the web, they will be located, used and cited. This will allow publishers and editors to estimate the impact factor of their media, journals or otherwise, using non-traditional tools. In this case, assessed institutes and scientists will have an important weapon in their battle against administrators, who put pressure on scientists to publish in high impact journals 'requiring simplistic measures of esteem ... and citation rates' (Maslin 2006). Finally, administrators should also be well informed and updated on the rapidly changing arena of science assessment and must not restrict themselves to ISI-based metrics only.

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