Openness of Spanish scholarly journals as measured by access and rights

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Abstract
Metrics on open access (OA) availability of content published in scholarly journals (i.e. content licences, copyright ownership, and publisher-stipulated self-archiving permissions) are still scarce. This study implements the four core variables of the recently published Open Access Spectrum (OAS) (reader rights, reuse rights, copyright, and author posting rights) to measure the level of openness in all 1,728 Spanish scholarly journals listed in the Spanish national DULCINEA database at the end of 2015. Data exported from the database and used as variables for the analysis were: journal research area, type of publisher, type of access, self-archiving and reuse policy, and type of Creative Commons (CC) licence used. Out of the total number of journals (1,728), 1,285 (74.5%) published their articles OA immediately after initial publication and thus received the maximum OAS score for reader rights; 37.5% of all journals used CC licences, and 79.5% allowed self-archiving in some form. In 72% of journals, authors retained or publishers granted broad rights, which included author reuse and authorization rights (for others to reuse), whilst 13.5% did not specify any terms for copyright transfer. Similar studies could be carried out on other countries as this would enable comparisons of the general adoption and form of openness in different parts of the world.

GROWTH AND INCREASING DEGREE OF OPENNESS IN SCHOLARLY PUBLISHING

As a result of the digital shift, the global scholarly journal landscape has undergone four key, interconnected changes on a global scale. The first change is related to growth in scholarly journal publishing overall. The volume of articles published in academic journals has been increasing steadily at a pace of 3% annually for at least two centuries, and today, there are over 28,000 active journals publishing over 2.5 million articles a year (Ware & Mabe, 2015). The second change relates to the distribution of journal ownership internationally: a few large publishers own most of the journals, fuelled by scholarly societies handing over publishing activities for management by commercial publishers (Larivière, Haustein, & Mongeon, 2015). This gradual infusion of profit-maximizing interests into scientific communication has been criticized by many and has created practical challenges for libraries that want to maintain comprehensive subscription access to published research. The third change is the ongoing growth in the share of scholarly journals that publish research articles openly on the web. According to the most recent study, at least 9,512 full open access (OA) journals published a total of 482,361 articles in 2014 (Crawford, 2015). The fourth and final change is in the role of journal publishers. In the past, publication of a specific article meant the beginning and end of the dissemination of research results. While journals are still used as the primary publication outlet for research, authors of articles published in
subscription access journals now often have the option of independently disseminating their own copy of the article on other websites, as authors usually retain at least some self-archiving rights (Laakso, 2014). Archambault et al. (2014) found that around half of all recently published articles in scholarly journals could be retrieved for free through the internet in some form thanks to a combination of OA journal publishing, author self-archiving, and other mechanisms uncategorized in the study.

Although these changes have actively shaped the practical field of scholarly communication, there has been a persistent lack of standardized tools and measurement methods to study the degree of openness in scholarly journal publishing at regional and global scales. Although individual measurements and estimations have been made, such as those referenced in the previous paragraph, many studies have failed to consider the extent to which the emerging openness in science is actually supported by sustainable policies rather than enabled by breaches of copyright. An initiative to remedy the lack of proper measurement tools was supported by the Scholarly Publishing and Academic Resources Coalition (SPARC), the Public Library of Science (PLOS), and the Open Access Scholarly Publishers Association (OASPA), and resulted in the Open Access Spectrum (OAS) (SPARC, 2015). A recent article by Chen and Olijhoek (2016) documented the history of the OAS and described the method and experiences. When it was first designed, an initial batch of over 1,000 journals was scored, and the openness information was manually entered into a database that can be accessed through a public website: the Open Access Spectrum Evaluation Tool (OASET) (oaspectrum.org, 2016).

The objective of this article is to build upon existing research on access and rights issues in scholarly journals by taking a close look at Spanish journals as the population and empirical material. Of interest are active scholarly journals owned by public or private Spanish organizations that publish peer reviewed papers in Spanish or other languages.

In addition to a brief description of the journals, the study introduces a new analysis based on the structure of the OAS. This provides insight into the implementation of editorial policies that define reader access, publishing licences, self-archiving policies, and reuse rights.

The OAS and the numerical scoring system (OASET) were used as the main instruments to gauge the level of openness in Spanish journals. Use of the OASET will make it easy to replicate the study in future comparisons using the same population of journals or journals from other countries. To guide the study, two main research questions were defined.

RQ1. What is the current composition of Spanish scholarly journals? We gathered data on:
- Types of publishers.
- Distribution across research areas.
- Publishing and access models.

RQ2. What is the current degree of openness in Spanish scholarly journals according to the criteria of the OASET? We established values for the following variables and assessed them according to the OAS/OASET:
- Reader rights.
- Author posting rights.
- Copyright ownership.
- Reuse rights.
- Automatic posting (not measured as not significantly applicable).
- Machine readability (not measured as not significantly applicable).

PREVIOUS RESEARCH
Reader rights
In this context, ‘reader rights’ is synonymous with readers being granted access to articles on a journal’s webpage and covers the kind of (potential) limitations that are related to such access. Of the four OAS variables included in this study, this is certainly the one that has garnered the most attention in practice and research to date. As mentioned in the introduction, there has been strong growth in the number of full OA journals (Crawford, 2015). In evaluations using established citation indicators, it was found that the quality of full OA journals has been increasing, and such journals are already among the highest ranking in Life Sciences and Medicine (Gumpenberger, Ovalle-Perandones, & Gorraiz, 2013). However, reader rights/access to read is not something that is either on or off but can be in between, as also indicated by the OAS variable in question. For example, many subscription access journals make their articles free to read after a set embargo period, for example, 6 or 12 months. This is known as delayed OA (Laakso & Björk, 2013). In other journals, only some of the

Key points
- The Open Access Spectrum Evaluation Tool can be used to measure and compare the openness of large journal collections.
- The 1,728 Spanish journals included in the study make use of the full scales of the four core Open Access Spectrum criteria.
- In all, 70% of Spanish journals publish freely online – far higher than world averages.
- The most common Creative Commons (CC) licence used by Spanish journals is CC-BY-NC-ND, whereas the most common licence used by open access journals worldwide is CC-BY.
- Spanish journals have become increasingly open over the past 2 years.
articles are free to read. Most of the main publishers’ subscription access journals allow authors to publish their individual article OA in exchange for a one-time fee. These are known as hybrid OA journals (Laakso & Björk, 2016). In a recent development in hybrid OA, organizations that subscribe to journals from a publisher also obtain a quota or full compensation for hybrid OA fees. These ‘offset agreements’ (e.g. JISC, 2016) can be assumed to have increased uptake in recent years and will continue to do so.

**Author posting rights**

Author posting rights (i.e. self-archiving rights) have been studied from several perspectives. The main difference between studies is whether the emphasis is on publisher- or journal- level of analysis or expanded to consider the volume of articles published in the journals.

Similar to this study, a country-specific scholarly journal overview incorporating an analysis of retained author rights has been carried out in France (Dillaerts & Chartron, 2013). The authors analysed the self-archiving policies of journals included in the French national Héloïse index (Heloise.csdd.cnrs.fr, 2016), an initiative that was inspired by the Spanish DULCINEA index (Accesoabierto.net, 2016) that will be the focus of this study. The Héloïse index covers 32 publishers and a total of 299 journals. Of all these journals, 88% allowed self-archiving of some version of a published article (as per March 2013) (Dillaerts & Chartron, 2013). From a global perspective, Laakso (2014) conducted an analysis of the copyright agreements of the 100 largest scholarly journal publishers in Scopus (by annual article volume) based on information on their websites. The results revealed that over 80% of all published articles globally could be made available on institutional repositories as accepted manuscripts 12 months after the original publication (Laakso, 2014).

To highlight the complex nature of author rights in OA journals specifically, Singson, Sevukan, and Murugaiyan (2015) studied the self-archiving and licensing clauses of 132 Directory of Open Access Journal (DOAJ)-registered OA journals on library and information science through the SHERPA/RoMEO database and by visiting the journals’ websites. Authors found that only 23% of journals allowed post-print self-archiving and noted that a drawback of SHERPA/RoMEO is that it is not updated as frequently as could be desired, which can lead to the need to consult other sources for comprehensive self-archiving and licensing information. In a longitudinal analysis covering 2004–2015, the policies of the 107 publishers that were first entered into SHERPA/RoMEO in 2004 were studied by Gadd and Troll Covey (2016). The initial 107 publishers included many of the large global publishers. The authors found that while a higher proportion of publishers are now explicitly coded ‘green’ (i.e. they allow some form of self-archiving), the conditions for doing so (how, where, when) have been defined and restricted to a very high degree. The authors also found that self-archiving policies have become more restrictive in tandem with publishers introducing paid OA options (hybrid OA journals).

**Copyright ownership**

The issue of copyright ownership is very relevant, even in an age with many immediate OA journals. It may even require a stronger focus, as issues such as reuse and redistribution need to be clearly defined for authors, publishers, and the general public. Hoorn and van der Graaf (2006) reviewed the various approaches to copyright ownership adopted by OA journals and surveyed authors of articles in full OA journals within biomedicine to determine their opinions on copyright transfer. The survey results mainly show that rights management is a complex issue with divisive answers to many of the questions relating to commercial exploitation and reuse of published contents. Ludwig (2014) studied the copyright and OA landscape among scholarly journals in Mediterranean Europe (France, Greece, Italy, Portugal, Spain, and Turkey) through a survey answered by 187 publishers in 2012. A total of 110 out of 174 (63.2%) publishers did not require their authors to sign a copyright agreement, and 19 (10.9%) publishers only required authors to transfer non-exclusive rights to publish the article. Schlosser (2016) recently reviewed the copyright information of 385 journals from 83 library publishing programmes in the USA. Of the 385 journals, 285 (74%) included a copyright ownership statement at journal or content (article) levels. Of those 285 journals, 261 journals presented consistent and intelligible copyright ownership information. Of those 261,166 journals (64%) stated that authors retain copyright, and the publisher is only assigned some non-exclusive rights required for publication. The general conclusion was that there is still a lot of room for improvement in the presentation and consistency of how copyright information is presented in journals and individual articles.

**Reuse rights**

The most beneficial licence for scientific progress, while also acknowledging the interests of individual authors and publishers, is still actively debated (see e.g. Graf & Thatcher, 2012; Morrison & Desautels, 2016), and many different practices exist among publishers. Relatively little has been researched on this aspect, probably because the practice of permissive licences is still emerging, and aggregated information is not readily available.

For insight into which licences OA journals use, the most comprehensive and up-to-date information is available from the DOAJ. Based on figures from 31 May 2016, over half of the journals registered to the DOAJ (Doaj.org, 2016) reported having a Creative Commons (CC) licence, most with a CC-BY, CC-BY-NC, or CC-BY-NC-ND classification. We will return to and compare these figures in the Results section when we present the findings from the Spanish journal population.

**Previous studies on the Spanish scholarly journal publishing landscape**

A previous study of Spanish scholarly journals (Melero, Rodríguez-Gairín, Abad-García, & Abadal, 2014) analysed research...
areas, types of publishers, publishing models, and self-archiving permission data extracted from the DULCINEA database in October 2013. DULCINEA is an index containing active scholarly Spanish journals. It provides their identification data, type of access, self-archiving, and licensing policies. DULCINEA classifies journals in accordance with the SHERPA/RoMEO colours taxonomy (Sherpa.ac.uk, 2016). The DULCINEA database (http://www.accesoabiertoneto/dulcinea/) is updated and supported by the Acceso Abierto a la Ciencia (accesoabiertoneto) working group and is hosted by the University of Barcelona. Journals that are included must be active, owned by a public or private Spanish Institution, and contain peer-reviewed research papers in Spanish or another language. Inclusion is based on these criteria and does not take into account quality control of contents. DULCINEA was created in 2008, with initial data collected by an online survey sent to editors and publishers. The data was then incorporated manually or provided automatically by third parties (as others can suggest journals for inclusion), in which case, it is validated by the web administrator. In December 2015, the database contained records of 1,728 journals.

In July 2011, the Spanish government introduced a mandate to make publications stemming from publicly funded research available through OA within 12 months of publication. Borrego (2016) evaluated the effectiveness of the mandate in the first quarter of 2014, 2.5 years after its implementation, by taking a random sample of articles from the Web of Science (WoS) that mentioned the Spanish Ministry of Science and Innovation in the grant information. A total of 478 (58.4%) of 818 articles were found OA in some form, which is fairly close to the figure of around 50% global OA presented by Archambault et al. (2014). This suggests that OA mandate compliance was still lacking as most countries did not have a national-level OA mandate in place. Having an OA mandate in place creates long-term demand for compatible publication outlets and transparent rights information. Directories such as SHERPA/RoMEO or DULCINEA can help authors, librarians, and repository managers to check journals’ reuse rights and self-archiving allowance policies.

Torres-Salinas, Robinson-García, and Aguillo (2016) conducted a longitudinal study of the output of researchers affiliated with Spanish institutions, using WoS data for 2005–2014. The authors discovered a persistent trend: Spanish authors publish more in full OA journals than the global average. The global average for 2014 was 10% of articles published in full OA journals, while Spanish authors published 13% of their articles in such journals. The 2–3% increase was persistent during the study period. An analysis of average, subject-normalized impact placed Spanish research output in available OA (articles that could be found in a variety of journal types, i.e. immediate OA, embargo, and hybrid OA) below the global average for all observed years. According to the authors, the fact that most of these articles are published in national, Spanish-language, low-impact journals explains this result.

**METHODS**

**Journal data**

Journals were extracted directly from a MySQL database containing DULCINEA’s master records on December 2015, at which time it contained 1,728 journal records. The export was stored in a CSV file, which was used to create graphs and tables in Microsoft Excel (Microsoft Office Professional Plus 2016). Table 1 contains a summary of variables from the dataset that were included in our analysis and their potential values.

**Descriptive analysis**

In addition to updating the previous dataset analysed in Melero et al. (2014) by including the new journals introduced to the database and the two new years of development for the entire

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**TABLE 1** Variables and options used to describe journals.

| Variable                  | Possible values                                                                 |
|---------------------------|-------------------------------------------------------------------------------|
| Subject                   | Life sciences, engineering + physics + maths, humanities, health sciences, social sciences |
| Type of publisher         | Society/association/learned association, commercial publisher, governmental organization, universities/research institutions |
| Type of access            | Gratis, gratis after embargo, restricted to subscribers with or without OA choice |
| Rights specification      | Yes, no                                                                        |
| Self-archiving permission | Not allowed, allowed after embargo, allowed, unknown                           |
| RoMEO colour              | White, blue, green, unknown                                                   |
| Type of CC licence        | Creative Commons Attribution, Creative Commons BY-ShareAlike, Creative Commons BY-NoDerivativeWorks, Creative Commons Attribution-Noncommercial, Creative Commons BY-Noncommercial-ShareAlike, Creative Commons BY-Noncommercial-NoDerivativeWorks |
| Copyright holder          | Authors, governmental organization, commercial publisher, society/association/learned association, and universities/ research institutions |

CC, Creative Commons; OA, open access.
dataset, this study adds three important dimensions: rights ownership, type of CC licence, and detailed self-archiving information (which version of a manuscript can be uploaded and when rather than a simple yes/no variable). Descriptive statistics are provided by journal subject, type of publisher, copyright holder, and type of CC licence.

**Measuring degree of openness**

To evaluate the degree of openness of journals, we used four categories from the HowOpenIsIt Guide (SPARC, 2015) and the quantitative scales published as part of the OASSET (oaspectrum.org, 2016). We excluded the evaluation of ‘automatic posting’ and ‘machine readability’ from the analysis because it is difficult to find journals in our population that specify these issues in their websites, and very few journals in our study would meet either of these criteria. Taking into account the omitted categories, the maximum score a single journal could obtain was 72 points.

**Statistical analysis tool and methods**

SPSS statistical package v.23 by IBM was used for all analyses. Crosstabs tables were grouped by subject, type of publisher, copyright holder, and CC licence, and the chi-squared test was applied to evaluate potential associations or dependence among groups. Spearman’s correlation factors were calculated to measure the strength and direction of associations between variables.

**RESULTS AND DISCUSSION**

First, the obtained results were compared with a previous study of Spanish journals (Melero et al., 2014). Then, we analysed the new data and variables introduced as part of this study. Finally, we applied the OAS framework to the population in order to evaluate the openness of Spanish journals.

To provide a high-level descriptive overview of the data and show how the Spanish journal landscape evolved in the 2-year period between the studies, Table 2 compares the new results with those of the previous study on the DULCINEA database (Melero et al., 2014). The most notable changes over the last 2 years relate to the type of access, as the percentage of restricted access journals has decreased; the specification of rights, which has increased; and the percentage of journals that allow immediate self-archiving, which has also increased (from 65 to 72.6%) in direct relation to the increased specification of author’s rights on the journals’ websites (from 73 to 86.5%). The percentage of journals coded ‘white’ according to SHERPA/RoMEO’s criteria has remained almost the same, while the proportion of journals coded ‘blue’ and ‘green’ has increased because publishers have improved the specification of their self-archiving policies. Regarding which version authors are allowed to self-archive, 69% of journals allowed the deposit of the version of record (VOR) immediately after publication, 18% allowed the author’s postprint at acceptance, 22% the preprint at submission, and almost 7% the author’s post-print or VOR after an embargo.

**Journal subject areas and types of publishers**

Strong relationships were found between life sciences journals and the association/learned society publisher type, between humanities and social sciences journals and university/research institution publishers, and between health sciences journals and commercial publishers (p < 0.001). Most social sciences (60%) and humanities journals (68%) were published by academic and research institutions, and most health sciences journals by private commercial publishers (48%) or by academic/professional learned societies (41%) (Fig. 1). Over 50% of journals within the health sciences were published by Elsevier.

**Journal subject areas and reader access**

Most Spanish scholarly journals were accessible online free of charge (Fig. 2). There was a strong relationship between health sciences journals and restricted access, and social sciences and free/gratis access (p < 0.001).

Slightly over 40% of journals published by commercial publishers were freely accessible online. This is possible because agreements existed between publishers and scholarly associations or learned societies to distribute the electronic version of the journals for free. Some journals could be freely accessed after an embargo. Examples include journals published by Elsevier that are associated with medical societies (Allergologia et Immunopathologia, Medicina Intensiva, and the Revista Española de Medicina Nuclear e Imagen Molecular, among others). There were also a few hybrid OA journals, mostly published by Springer (12), Taylor & Francis (6), Cambridge University Press, and EPI SCP (1).

**Self-archiving conditions and comparison between subject areas**

Most journals allowed self-archiving of the VOR immediately, in parallel with publication of the journal article. In all, 80% of all journals allow archiving (72.6% immediately and 6.8% after an embargo). However, when split into subject categories, it is noticeable that only 42% of health journals allow immediate archiving and 24% publication after an embargo. Figure 3 provides an overview of the key document versions and when they can be self-archived.

There was a statistically significant relationship between subject area and self-archiving allowance (p < 0.001), and a strong relationship between health science journals and prohibited self-archiving or self-archiving after an embargo, and social sciences and humanities journals with a self-archiving allowance (Fig. 4). This is in accordance with previous comments regarding subject and type of publisher.

Regarding the RoMEO classification of journal colours (Fig. 5), the DULCINEA database did not include any journal that fulfilled the criteria for classification as yellow (i.e. only the
Most of the journals were blue (60%, the post-print or VOR can be archived) or green (24%, the preprint, post-print, or VOR can be archived). The correlation between research area and RoMEO colour was significant.

**TABLE 2** Relative shares of Spanish journals compared to data from 2013 (Melero et al., 2014).

| Subject                  | % in 2013 | % in 2015 |
|--------------------------|-----------|-----------|
| Life sciences            | 6.5       | 6.4       |
| Engineering + physics + maths | 4.5       | 4.3       |
| Humanities               | 24        | 25.8      |
| Health sciences          | 20        | 18.0      |
| Social sciences          | 44.5      | 45.5      |

| Type of publisher        |        |          |
|--------------------------|--------|----------|
| Society/association/learned association | 29    | 27.4     |
| Commercial               | 17     | 16.3     |
| Governmental             | 6      | 5.7      |
| Universities/research institutions | 48    | 50.6     |

| Type of access            |        |          |
|--------------------------|--------|----------|
| Gratis                    | 71     | 74.4     |
| Gratis after embargo      | 11     | 11.3     |
| Restricted to subscribers ± OA choice (hybrid OA) | 18 | 14.4 |

| Rights specification     |        |          |
|--------------------------|--------|----------|
| No                       | 27     | 13.5     |
| Yes                      | 73     | 86.5     |

| Self-archiving allowance |        |          |
|--------------------------|--------|----------|
| Not allowed               | 15     | 15.5     |
| Allowed after embargo     | No data | 6.8      |
| Allowed (yes)             | 65     | 72.6     |
| Unknown                   | 21     | 5.2      |

| RoMEO colour              |        |          |
|--------------------------|--------|----------|
| White                     | 15     | 15.5     |
| Blue                      | 52     | 56.6     |
| Green                     | 12     | 22.7     |
| Unknown                   | 21     | 5.2      |

| Copyright holder          |        |          |
|--------------------------|--------|----------|
| Authors                   | No data | 14.0    |
| Governmental organization | No data | 5.1     |
| Commercial publisher      | No data | 10.9    |
| Society/association/learned association | No data | 29.1 |
| Universities/research institutions | No data | 40.8 |

| Use of CC licenses        |        |          |
|--------------------------|--------|----------|
|                          | 21     | 37.5     |

**TABLE 2** Continued

| Type of CC licence         | % in 2013 | % in 2015 |
|---------------------------|-----------|-----------|
| Creative Commons Attribution | No data | 21.2     |
| Creative Commons Attribution-NoDerivativeWorks | No data | 0.6     |
| Creative Commons Attribution-Noncommercial | No data | 16.2     |
| Creative Commons Attribution-Noncommercial-NoDerivativeWorks | No data | 54.7     |
| Creative Commons Attribution-Noncommercial-ShareAlike | No data | 6.7     |
| Creative Commons Attribution-ShareAlike | No data | 0.6     |

CC, Creative Commons; OA, open access.

FIGURE 1 Journal subject areas across types of publishers.

FIGURE 2 Type of online access by journal subject area.

preprint version can be deposited). Most of the journals were blue (60%, the post-print or VOR can be archived) or green (24%, the preprint, post-print, or VOR can be archived). The correlation between research area and RoMEO colour was significant.
Copyright holder by journal subject area and publisher type

Authors were only allowed to retain copyright in 14% of the journals; of those journals, the percentages by discipline were as follows: life sciences, 6%; engineering + physics + mathematics, 5%; humanities, 35%; health sciences, 6%; and social sciences, 48%.

Although we assigned a unique category for authors who were listed as the copyright holders, we found different ways of expressing this:

- Authors retain copyright and grant the journal the right of first publication.
- Authors retain copyright and grant the journal right of first publication, with the work simultaneously licensed under a CC Attribution.
- The authors hold copyright.
- The authors transfer to the journal the right – not exclusive – to reproduce and distribute the article.
- The authors hold copyright and assign the publisher the exclusive right to distribute the paper for 1 year after publication.

The association between subject area and copyright holder was found to be statistically significant according to Pearson’s chi-squared test at a level of $p < 0.001$. The strongest positive associations were between health sciences and commercial publishers, when publishers are the copyright holders, and between humanities and non-profit academic publishers, when the latter are the copyright owners. Some societies and professional associations have their journals published by commercial publishers but do not utilize standard commercial copyright transfer policies because the society is the owner of the journal and determines its own policy. This is the case of the Anuario de Psicología Jurídica published by Elsevier. This journal is a gold OA journal, and the authors transfer copyright to the Colegio Oficial de Psicólogos de Madrid. Another example of an OA journal published by a commercial publisher (Springer) is SERIEs – Journal of the Spanish Economic Association. In this example, the Association covers the APCs, and papers are distributed under a CC-BY-ND licence. Authors can retain copyright and only assign to Springer the exclusive right to any commercial use of the article. In around 80% of journals published by universities, authors transfer copyright to the institution. In this regard, the behaviour of commercial and academic publishers does not differ: both request copyright transfer.

Copyright holder, reader access, and self-archiving

There was a close relationship between who owns the copyright and the free online availability of the journals (Fig. 6). The strongest positive associations were found between authors (owners) and
gratis-OA (adjusted residual = 6.4), between commercial publishers and restricted access (adjusted residual = 18.1), and between academic publishers (university/research institutions) and gratis-OA (adjusted residual = 5.3). This finding is in agreement with the fact that most journals published by commercial publishers are restricted to subscribers, and authors in such journals traditionally transfer their copyright. Contrary to the general international tendency for journal publishers to restrict open distribution of the publishers’ VOR and only allow self-archiving of accepted manuscripts (Laakso, 2014), most journals published by Spanish universities allow self-archiving of the VOR after a set embargo period.

With respect to the colours of journals according to RoMEO’s taxonomy, most Spanish journals were blue (60%). The relationship between colour and copyright holder was significant (p < 0.001, Fig. 7), and the strongest associations were between authors as copyright owners × green journals, academic publishers × blue journals, and commercial publishers × white journals.

CC licences across publisher types and reader access

A total of 643 of the journal population use a CC licence. BY-NC-ND is the most popular classification (55% of those 643 journals distribute their content with a CC licence, followed by CC-BY and CC-BY-NC). The relationship between licence and journal subject area (Fig. 8) was not found to be significant (p > 0.05). Out of the total population of journals using a CC licence, the order by use of any CC licence was: social sciences (53%), humanities (30%), health sciences (8%), life sciences (6%), and engineering + physics + mathematics (4%). The limitation of no commercial redistribution was found in 78% of licences, likely due to publishers guarding against third parties reusing published papers for profit.

A strong relationship was found between type of licence used and type of publisher (p < 0.001). The use of CC licences by type of publisher was as follows: university/research institution (67.2%), association/learned society (22.1%), commercial (6.8%), and governmental (3.9%). A total of 93% of the journals that use CC licences are gold OA journals; 6.5% are OA after an embargo; and 0.3% are restricted to subscribers, but authors have the option of hybrid OA (as do some journals published by Springer; for instance, the Revista Matemática Complutense, Qualitative Theory of Dynamical Systems, Securitas Vialis, Revista Europea de Tráfico, Transportes y Seguridad Vial).

Regarding the type of licence and who is the copyright holder, the statistical analysis showed a relationship between the type of licence and the owner of the rights (p < 0.001). In 319 (49.6%) of the 643 journals that used CC licences, the copyright holder was the university/research institution; in 23%, it was the authors; in 19.6%, the association/learned society; in 4.8%, the commercial publisher; and in 3.0%, governmental organizations. When journals used CC-BY, the authors were mainly the owners of the rights (51%) followed by private publishers. Spearman’s correlation analysis revealed significant correlations among these ordinal variables (access, CC licence, and RoMEO colour). CC licences were ordered from CC-BY (1) to CC-BY-NC-ND (6), access from free access (1) to restricted access (3), and RoMEO colours from white (1) to green (4). Taking this into consideration, there was a positive correlation between access and CC licence (both variables increased and decreased in parallel) and a negative correlation between CC licence and RoMEO colour.
| Reader rights                                                                 | No. of journals, % | Reuse rights                                                                 | No. of journals, % | Copyrights                                                                 | No. of journals, % | Author posting rights | No. of journals, % |
|-------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------|--------------------|----------------------|--------------------|
| Free readership rights to all articles immediately upon publication (20 points) | 1,285, 74.4%      | Generous reuse and remixing rights (e.g. CC-BY license) (20 points)            | 136, 7.9%          | Author holds copyright with no restrictions (16 points)                       | 74, 4.3%           | Author may post any version to any repository or website with no delay (16 points) | 305, 17.7%         |
| Free readership rights to all articles after an embargo of no more than 6 months (16 points) | 49, 2.8%          | Reuse, remixing, and further building upon the work subject to certain restrictions and conditions (e.g. CC-BY-NC & CC-BY-SA licenses) (14 points) | 108, 6.3%         | Author retains/publisher grants broad rights, including author reuse (e.g. of figures in presentations/teaching, creation of derivatives) and authorization rights (for others to use) (10 points) | 1,247, 72.2%       | Author may post some version (determined by publisher) to any repository or website with no delay (10 points) | 949, 54.9%         |
| Free readership rights to all articles after an embargo greater than 6 months (12 points) | 145, 8.4%         | Reuse (no remixing or further building upon the work) subject to certain restrictions and conditions (e.g. CC-BY-ND license) (seven points) | 476, 27.5%        | Author retains/publisher grants limited rights for author reuse (e.g. of figures in presentations/teaching, creation of derivatives) (four points) | 25, 1.4%           | Author may post some version (determined by publisher) to any repository or website with some delay (determined by the publisher) (six points) | 110, 6.4%         |
| Free and immediate readership rights to some, but not all, articles (including 'hybrid models') (five points) | 25, 1.4%         | Some reuse rights beyond fair use for some, but not all, articles (including 'hybrid models') (four points) | 25, 1.4%           | Author may post some version (determined by publisher) to certain repositories or websites, with or without delays (four points) | 7, 0.4%            |                                  |                     |
| Subscription, membership, pay-per-view, or other fees required to read all articles (0 points) | 224, 13%         | No reuse rights beyond fair use/dealing or other limitations or exceptions to copyright (all rights reserved) (0 points) | 983, 56.9%        | Publisher holds copyright, with no author reuse beyond fair use (0 points)   | 382, 22.1%         | Author may not deposit any versions to any repositories or websites at any time (0 points) | 357, 20.7%        |
FIGURE 9  Open Access Spectrum Evaluation Tool score distribution for Spanish journals (as percentages of the maximum of 72 points total per journal).

OAS analysis

In this analysis, the OAS, with quantitative scores defined by the OASET, was applied to all Spanish journals listed in the DULCINEA database.

Table 3 summarizes the number of journals that comply with the OAS criteria for the first four categories. Out of the total journals (1,728), 1,285 (74.5%) received a maximum score of 20 for reader rights. Of these, 1,285, 187 did not permit any reuse, and 2.1% were comprised mainly of journals published by Elsevier that allowed some reuse of the reviewed post-print after an embargo and under the licence CC-BY-NC-ND. Elsevier policies for Spanish journals have changed several times over the last few years. Recently, some journals have been converted from a restricted to a hybrid model, including the Revista Internacional de Acupuntura, Gastroenterología y Hepatología, Clínica e Investigación en Ginecología y Obstetricia, Enfermería Clínica, Revista Médica de Homeopatía, Medicina Clínica, Medicina Intensiva, Psiquiatría Biológica, Revista Clínica Española, Revista de Logopedia, Foniatría y Audiología, and Vacunas: Investigación y Práctica. In fact, most hybrid journals, besides the aforementioned, are published by commercial publishers: Springer (12) and Taylor and Francis (7). The rest are published by small independent private publishers.

Figure 9 shows a histogram of the total scores for all journals (as percentages of the maximum of 72 points per journal). The median is 55.6 and the mean 52.1. In our study, 68% of journals received a total score equal to or higher than 50%. Most journals (86%) ranked within the fourth quartile (Q4) are published by universities or research institutions. Journals with a total score of zero (11.5%) are restricted to subscribers, and there is no information about reuse and/or depositing rights on their websites.

The distribution of the OAS score is not the same across subjects ($p < 0.05$) because subject, type of publisher, and access type are related, as revealed in the previous analysis. A total of 662 (38%) out of 1,285 journals received a perfect score of 20 for reader rights but do not allow any reuse beyond fair use or other limitations or exceptions (all rights reserved); 22.5% allow reuse (no remixing or further building upon the work) and use CC-BY-NC-ND; 5.9% allow reuse, remixing, and further building upon the work, subject to certain restrictions and conditions, and use CC licences BY-NC or CC-BY-SA; and 133 journals (7.7%) had a maximum score for readers rights and reuse rights and use a CC-BY licence (Table 4).

Out of all 1,285 gratis-OA journals (i.e. those that achieve a perfect score of 20 for reader rights), 61 (3.5%) received a perfect score of 16 for copyright (authors hold the copyright); 1,039 (60.1%) are freely available on the internet and the publisher grants broad rights; and in 185 (10.7%), the publisher holds the copyright, with no reuse beyond fair use (Table 5). These results are based on the first condition of an OA journal: free access to its contents immediately after publication. Other combinations can be seen in Table 5.

Author posting rights are directly related to the SHERPA/RoMEO colour of journals (see Fig. 5 for meaning of colours) since the colour indicates which version of the papers can be deposited in an institutional or subject repository. Journals rated 0 in posting rights include RoMEO white journals and journals that have not been graded because of a lack of information about archiving policies.

To sum up the posting 6, posting 10, and posting 16 categories (Table 6), 64% of journals had a perfect score of 20 for readers’ rights and allow posting of at least one version of the paper (pre-print, post-print, or VOR) with or without conditions. A total of 266 (15.4%) journals had the best score for posting and readers’ rights. If we take into account the OA definition of the Berlin declaration on open access to knowledge in the sciences and humanities (https://openaccess.mpg.de/Berlin-Declaration), an OA contribution must satisfy two conditions: first, it must grant users ‘a free, irrevocable, worldwide, right of access to, and a licence to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship’, and second, ‘a complete version of the work and all supplemental materials, including a copy of the permission as stated above, in an appropriate standard electronic format is deposited (and thus...

| Reuse rights OASET score | Reuse 0 | Reuse 4 | Reuse 7 | Reuse 14 | Reuse 20 | Total |
|--------------------------|---------|---------|---------|----------|----------|-------|
| Reuse 0                  | 187 (10.8%) | 0 (0.0%) | 37 (2.1%) | 0 (0.0%) | 0 (0.0%) | 224 (13.0%) |
| Reuse 5                  | 0 (0.0%) | 25 (1.4%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 25 (1.4%) |
| Reuse 10                 | 103 (6.0%) | 0 (0.0%) | 37 (2.1%) | 2 (0.1%) | 3 (0.2%) | 145 (8.4%) |
| Reuse 14                 | 31 (1.8%) | 0 (0.0%) | 14 (0.8%) | 4 (0.2%) | 0 (0.0%) | 49 (2.8%) |
| Reuse 20                 | 662 (38.3%) | 0 (0.0%) | 388 (22.5%) | 102 (5.9%) | 133 (7.7%) | 1,285 (74.4%) |

OASET, Open Access Spectrum Evaluation Tool.
A comparison of the results of this study with those obtained in 2013 (Melero et al., 2014) reveals that awareness of reuse and posting rights has improved among Spanish journals. Copyright terms are more accurately expressed and are easier to locate, and the use of CC licences has been increasingly adopted. A comparison of the CC licence distribution of Spanish journals with that of all OA journals listed in the DOAJ (Table 7) shows that Spanish journals are more restrictive. Most Spanish journals have a CC-BY-NC-ND rather than a CC-BY classification, which is the most popular licence among journals in the DOAJ as measured by number of journals and number of published articles. Nevertheless, most Spanish scholarly journals are open, with more than

TABLE 5  Cross tabulation of reader rights by copyright.

| Reader rights OASET score | Reader 0 | Copyright 0 | Copyright 4 | Copyright 10 | Copyright 16 | Total |
|--------------------------|---------|-------------|-------------|--------------|--------------|-------|
| Count (% of total)       | 137 (7.9%) | 0 (0.0%) | 81 (4.7%) | 6 (0.3%) | 224 (13.0%) |
| Reader 5                 | 0 (0.0%)  | 25 (1.4%) | 0 (0.0%)  | 0 (0.0%) | 25 (1.4%)   |
| Count (% of total)       | 51 (3.0%)  | 0 (0.0%)  | 89 (5.2%)  | 5 (0.3%)  | 145 (8.4%)  |
| Reader 16                | 9 (0.5%)  | 0 (0.0%)  | 38 (2.2%)  | 2 (1%)    | 49 (2.8%)   |
| Count (% of total)       | 185 (10.7%) | 0 (0.0%) | 1,039 (60.1%) | 61 (3.5%) | 1,285 (74.4%) |

OASET, Open Access Spectrum Evaluation Tool.

TABLE 6  Cross tabulation of reader rights by posting rights.

| Posting 0 | Posting 4 | Posting 6 | Posting 10 | Posting 16 | Total |
|-----------|-----------|-----------|------------|------------|-------|
| Reader 0  | 136 (7.9%) | 0 (0.0%)  | 36 (2.1%)  | 44 (2.5%)  | 224 (13.0%) |
| Reader 5  | 1 (0.1%)   | 0 (0.0%)  | 27 (1.6%)  | 12 (0.7%)  | 25 (1.4%)   |
| Reader 12 | 39 (2.3%)  | 7 (0.4%)  | 0 (0.0%)   | 69 (4.0%)  | 145 (8.4%)  |
| Reader 16 | 7 (0.4%)   | 0 (0.0%)  | 9 (0.5%)   | 24 (1.4%)  | 49 (2.8%)   |
| Reader 20 | 174 (10.1%) | 0 (0.0%) | 35 (2.0%)  | 810 (46.9%) | 266 (15.4%) | 1,285 (74.4%) |

OASET, Open Access Spectrum Evaluation Tool.

TABLE 7  Breakdown of journal licences for OA journals included in the DOAJ as per 31 May 2016, compared with the CC licenses used by Spanish OA journals.

| Journal licence | Global | Percentage | Spanish journals | Percentage |
|-----------------|--------|------------|------------------|------------|
| Journal count   | Percentage | Journal count | Percentage |
| CC BY           | 2,977 | 33.5% | 133 | 22.2% |
| CC-BY-NC-ND     | 1,280 | 14.4% | 321 | 53.6% |
| CC-BY-NC        | 1,062 | 12% | 98 | 16.4% |
| CC-BY-NC-SA     | 374 | 4.2% | 40 | 6.7% |
| CC-BY-SA        | 170 | 1.9% | 4 | 0.7% |
| Publishers own license | 87 | 1% | |
| CC-BY-ND        | 52 | 0.6% | 3 | 0.5% |
| Not CC-like     | 42 | 0.5% | |
| No licence      | 8 | 0.1% | |
| Publisher's own license agreement | 2 | 0% | |
| No licence information available | 2,825 | 31.8% | |
| Total           | 8,879 | 100 | |

CC, Creative Commons; DOAJ, Directory of Open Access Journals; OA, open access.

published) in at least one online repository using suitable technical standards. A total of 1,076 journals (62.3%) would satisfy those conditions (Table 6).

CONCLUSIONS

A comparison of the results of this study with those obtained in 2013 (Melero et al., 2014) reveals that awareness of reuse and posting rights has improved among Spanish journals.
70% of journals freely available on the internet. This is an exceptionally high number compared with the global average, which does not even reach a third of this number, depending on the reference index that is used. If we contrast reader rights with self-archiving rights, 64% of journals are gratis OA and also allow the deposit of some versions of articles. This percentage represents periodicals that meet the widely recognized Budapest Open Access Initiative (BOAI) definition of OA (Budapestopenaccessinitiative.org, 2016). However, a lower percentage (36%) is found when we compare readers’ rights with reuse rights. This is due to the division of reuse and self-archiving rights in the OAS. In reality, there is an intersection between both rights when the authors become users but also have the right to post their works.

Regarding the type of publisher and research areas, most journals are focused on the social sciences and humanities, followed by the health sciences. Social sciences and humanities journals are mainly published by higher education and research institutions, and health sciences journals are generally published by commercial publishers, learned societies, or professional associations, which in some instances have agreements with private publishers to distribute their publications.

There are challenges involved in collecting and curating data on journal policies at a global scale, whether we are talking about SHERPA/RoMEO or the OASET. Even with the DULCINEA database as a starting point, we encountered similar challenges to those stated by Chen and Olijhoek (2016): editorial policies are not easy to find, and sometimes, they are not even stated on the website; they change, and editors do not tell aggregators about the changes. This makes it difficult to maintain updated records. There are also inconsistencies in rights permissions and the use of open licences. When discovered, DULCINEA administrators alert journal publishers or editors to amend these kinds of contradictions, but changes are not always made immediately, and in some cases, publishers do not respond.

On a global scale, the reporting of access and rights by journals is still problematic. The OAS and the OASET are valuable initiatives to help increase the availability and accuracy of such information in a standardized way. This study is the largest practical implementation of the OAS that examines not only an individual outlet but a large cohort of journals. It is the only study that incorporates a complete national population of journals. National indexes of journals’ editorial policies are still rare, and without the data in DULCINEA, it would have been impossible to conduct this study. The long-standing problem with SHERPA/RoMEO is that ever-changing journal policies are not updated frequently, and there is a lack of clear responsibility for submitting information and updates. By decentralizing journals to national level but still retaining RoMEO-compliant coding and data structures, the population becomes much easier to curate. We encourage actors overseeing numerous journals, publishers, and national science policy-makers to make use of the OAS as a tool for monitoring the development of openness among journals.

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