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Justin Stoler & Chad Staddon

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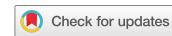


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VIEWPOINT



Open access and the evolving academic publishing landscape of the water sector

Justin Stoler  ^{a,b} and Chad Staddon  ^c

^aDepartment of Geography and Sustainable Development, University of Miami, Coral Gables, FL, USA;

^bDepartment of Public Health Sciences, University of Miami Miller School of Medicine, Miami, FL, USA;

^cDepartment of Geography and Environmental Management, University of the West of England, Bristol, UK

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Introduction

The launch of many new water journals in recent years is a testament to the growth and importance of water research as a *problematique*, that is, as both a problem in and of itself and as an important correlate of other global challenges. As entire regions start to run dry or suffer repeated flooding due to climate change, it is more important than ever to understand water availability, quality, use and governance. And as the burgeoning industry of ‘nexus’ studies shows, researchers and policy-makers have discovered that, indeed, most elements of society are linked to water. This is a great time to be a water scholar with exciting new opportunities to collaborate with researchers from across the natural and social sciences, engineering, and humanities. Water scholars also have initiated many new journals, book series, etc., that clamour for our insights and academic production. But there are tensions too, linked to the perhaps too-rapid proliferation of journals, their transition to open access (OA) business models, and the unhealthy ways in which these are linked to career prospects for water scholars.

In this viewpoint, we explore some of the challenges associated with the recent launch of several new water journals and the concomitant shift to OA publication models. The OA movement offers tremendous upsides in terms of expanding readership, access to scientific knowledge, transboundary collaboration and funding to improve regional equity. But there are downsides too, such as ever-increasing demand for free peer-review services, the continued ‘metrification’ of scholarship, dilution of journals managed by professional associations and the monetization by private publishing companies of publicly funded scholarship. There are also other unintended consequences that may reshape the publishing landscape in yet-unknown ways. While these issues affect most scientific disciplines, they are particularly salient for the water sector due to greatly accelerated change in the water-related academic journal landscape over the past five years.

A brief history of water journals

The oldest water journals are about a century old, dating back to the advent of chlorination, sand filtration and other technologies in urban water systems, and several leading outlets have been around since the 1960s. For example, the *Journal of the American Water Works Association* (JAWWA) was founded in 1914 with the clear sense of purpose: 'With this issue, the American Water Works Association enters upon a new era of advancement [...] requiring] a more prompt medium for the early production of our proceedings and papers' (Alvord, 1914, p. 1). Like JAWWA, most water journals at that time were founded by professional associations and tended to focus on the design and operation of the world's rapidly growing fleet of new water and sewerage treatment plants.

Fast forward to the post-war period: the *Journal of Hydrology* (1963) and *Water Resources Research* (1965) were founded, responding to growing scientific interest in the hydrosphere and international cooperative efforts such as the International Hydrological Decade (from 1965), which also gave us the UNESCO International Hydrological Programme. In the same decade the American Water Resources Association launched the *Journal of the American Water Resources Association* (JAWRA) in 1965, and the International Water Association inaugurated its stable of journals with the *Water Quality Research Journal* in 1968. From the 1960s onwards water journals slowly evolved to include policy studies and social science, such as *Water International*, launched by the International Water Resources Association in 1975, and *Water Resources Management* by the European Water Resources Association in 1987. Interdisciplinary content accelerated after 2000, likely due to increased appreciation for the interconnectedness of water research during the Millennium Development Goals era. All these journals were either available to members of the associated professional societies or operated on a subscription basis. Only a handful of subscription model journals have been launched since 2000, including two interdisciplinary review journals, *Wiley Interdisciplinary Reviews: Water* and Elsevier's *Water Security* (Table 1).

The number of water journals has continued to grow since 2010. These additions reflect broad trends across academic publishing – particularly widespread adoption of the OA format – as the percentage of new scientific literature published OA surpassed 50% in 2017 for the first time (Brainard, 2021). The goal of universal OA science is widely shared throughout the scientific community. But the ongoing transition to universal OA has not been smooth or without problems, involving transitions in corporate publishers' business models prompted by new OA publishers (e.g., PLOS, MDPI and Frontiers) who have disrupted the traditional subscription model. The needs and labour of science's biggest stakeholders – scientists themselves – have often taken a backseat to the needs of corporate publishers' revenue streams.

Fortunately, many traditional publishers are now pivoting towards OA, increasingly with the expressed goal of being fully OA as part of the cOAlition S's Transformative Journal initiative requirements, also known as 'Plan S', imposed by public funders (McNutt, 2019):

With effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms,

Table 1. Characteristics of select leading academic water journals from Scimago's Water Science and Technology rankings grouped by publication model (traditional/hybrid versus open access – OA) and sorted by launch year.

Title	Publisher and organizational affiliation	Launch year	Articles published in 2021	Article processing charge (standard article)
<i>Select leading traditional and hybrid journals</i>				
<i>Journal of the American Water Works Association</i>	Wiley (American Water Works Association)	1914	110	0; no OA option
<i>Water Environment Research</i>	Wiley (Water Environment Federation)	1928	247	0; US\$2850 for OA
<i>Journal of Hydrology</i>	Elsevier	1963	1408	0; US\$3300 for OA
<i>Journal of the American Water Resources Association</i>	Wiley (American Water Resources Association)	1965	86	US\$1900 fee (25% discount for AWRA members); US\$3000 for OA
<i>Water Resources Research</i>	Wiley (American Geophysical Union)	1965	706	0; US\$2700 for OA
<i>Water Research</i>	Elsevier (IWA)	1967	1159	0; US\$4220 for OA
<i>Water International</i>	Taylor & Francis (International Water Resources Association)	1975	82	0; US\$3085 for OA
<i>Journal of Soil and Water Conservation</i>	Soil and Water Conservation Society	1981	61	US\$190 per page (US\$150 for SWCS members); US\$750 additional fee for OA
<i>International Journal of Water Resources Development</i>	Taylor & Francis	1983	105	0; US\$3605 for OA
<i>Water and Environment Journal</i>	Wiley (Chartered Institution of Water and Environmental Management)	1987	134	0; US\$3700 for OA
<i>Water Resources Management</i>	Springer (European Water Resources Association)	1987	291	0; US\$3390 OA
<i>Journal of Water Resources Planning and Management</i>	American Society of Civil Engineers	1993	173	0; US\$2000 OA
<i>Urban Water Journal</i>	Taylor & Francis	2004	90	0; US\$3085 for OA
<i>Wiley Interdisciplinary Reviews: Water</i>	Wiley	2014	67	0; US\$3700 for OA
<i>Environmental Science: Water Research & Technology</i>	Royal Society of Chemistry	2015	223	0; £1800 for OA (15% discount for RSC members)
<i>Sustainable Water Resources Management</i>	Springer	2015	106	0; US\$2780 for OA
<i>Water Security</i>	Elsevier	2017	25	0; US\$3030 for OA
<i>Nature Water</i>	Springer Nature	2023	–	0; €9500 for OA
<i>Select leading open-access journals</i>				
<i>Water Quality Research Journal</i>	IWA	1966 ^a	18	0
<i>Hydrology Research</i>	IWA	1970	100	US\$1950
<i>Water Science & Technology</i>	IWA	1982 ^a	536	0
<i>AQUA</i>	IWA	1998 ^a	10	0
<i>Hydrology and Earth System Sciences</i>	Copernicus Publications (European Geosciences Union)	1997	323	€93 (per journal page)
<i>Journal of Water and Land Development</i>	Polish Academy of Sciences	1998	121	€300
<i>Journal of Hydroinformatics</i>	IWA	1999 ^a	87	0
<i>Water Supply</i>	IWA	2001 ^a	345	0
<i>Journal of Water & Health</i>	IWA	2003 ^a	80	0
<i>Water Policy</i>	IWA (World Water Council)	2003 ^a	106	0
<i>Water Practice & Technology</i>	IWA	2006 ^a	111	0

(Continued)

Table 1. (Continued).

Title	Publisher and organizational affiliation	Launch year	Articles published in 2021	Article processing charge (standard article)
<i>Water Alternatives</i>	Water Alternatives Association (non-profit)	2008	43	0
<i>Drinking Water Engineering and Science</i> (closed as of October 2022)	Copernicus Publications	2008	6	€75 (per journal page)
<i>Desalination and Water Treatment</i>	Desalination Publications 2017–present (Taylor & Francis 2009–16)	2009	1256	€1050
<i>Water Journal of Water & Climate Change</i>	MDPI IWA	2009 2010 ^a	3645 240	CHF2200 0
<i>Water Reuse</i>	IWA	2011	52	US\$1950 (waived for UK partners of Jisc) 0
<i>Journal of Water, Sanitation & Hygiene for Development</i>	IWA	2011 ^a	98	
<i>International Soil and Water Conservation Research</i>	Elsevier (World Association of Soil and Water Conservation)	2013	65	US\$1200
<i>Water Resources and Industry</i>	Elsevier (IWA)	2013	25	US\$2350
<i>Journal of Hydrology: Regional Studies</i>	Elsevier	2014	201	US\$2460
<i>Hydrology</i>	MDPI	2014	184	CHF1600
<i>Water Conservation and Management</i>	Zibeline	2017	25	0
<i>npj Clean Water</i>	Springer Nature	2018	47	US\$3190
<i>Journal of Hydrology X</i>	Elsevier	2018	20	US\$1600
<i>Water Research X</i>	Elsevier (IWA)	2018	42	US\$2120
<i>Frontiers in Water</i>	Frontiers	2019	197	US\$1150
<i>PLOS Water</i>	PLOS	2022	–	US\$2100

Note: ^aThese IWA journals were converted to open access in early 2021.

Source: Scimago Journal Reports, Journal and Country Rank for Water Science and Technology, 2021 (<https://www.scimagojr.com/journalrank.php?category=2312>).

or made immediately available through Open Access Repositories without embargo. HT HT (cOAlition, 2018)

Similarly, the UK government now requires that research must be published OA as a condition of public research funding and to facilitate inclusion in the Research Excellence Framework. The Joe Biden administration announced a similar rule for the US in August 2022 (Brainard & Kaiser, 2022). But these transitions are happening with various (and often unclear) timelines. The UK's decisive move towards OA came with the 2012 Finch Report on Open Access which championed the 'Gold Route' version of OA, where authors pay to have their research published with access to the material thereby rendered free for users. The hope and intent are that this would expand overall use and access, especially of publicly funded research. By 2020, 9712 (79%) of 12,289 journals surveyed had adopted gold or hybrid publishing models (Zhang et al., 2022).

OA water journals

OA water journals, as with most disciplines, are a 21st-century phenomena. Motivated by the laudable desire to make scientific research more accessible, the OA movement has been adopted unevenly around the world. In countries that have opted for so-called 'gold' standard OA arrangements whereby authors are required to pay high article-processing charges upon publication, private publishing empires have successfully coined publicly funded science into private profit (these fees are usually paid by the grants that funded the original research). As nations such as the UK, and leading institutions everywhere, opt for the gold OA route, it becomes increasingly difficult for other nations to do anything other than follow suit – to the great benefit of private publishers. There are other money-making opportunities too, for example, the fees that private publishers impose for the right to publish OA under Creative Commons attribution (CC BY). The laudable principle of OA, operationalized by making publicly funded research outputs free at the point of use/consumption (i.e., when an article is published) as gold OA, has created a financial bonanza for publishers, who have responded by racing to launch ever more academic journals. The recent explosion in OA water research titles exemplifies this trend.

Water Alternatives, founded in 2008 by the non-profit Water Alternatives Foundation in France, may be the first water journal to publish OA (older journals that are now OA converted more recently). The journal's fee-free business model differs from most contemporary OA publishers, but they only publish several dozen papers annually. MDPI became the first OA mega-publisher to launch a water journal with *Water* in 2009, which grew quickly to publish 3645 articles in 2021, though with generally high article processing charges (currently up to CHF2200, depending on article type). In 2014, Elsevier launched the *Journal of Hydrology: Regional Studies*, an OA companion to the *Journal of Hydrology* established in 1963. Just a few years later, the number of new and OA water outlets began to accelerate.

In 2018 Springer Nature launched *npj Clean Water*, and Elsevier launched *Water Research X*, the OA companion to *Water Research*. In 2019 the mega-publisher Frontiers launched *Frontiers in Water*. In early 2021, the International Water Association (IWA) converted 10 of its 19 academic journals to OA through a 'Subscribe to Open' model in which institutional subscriptions sustain OA with no article processing charges. *PLOS Water* launched in early 2022, with PLOS becoming the third OA mega-publisher to initiate a water journal. Although not strictly OA, *Nature Water* opened for submissions in July 2022 and is slated to launch in January 2023 using the same hybrid publication model that most traditional journals have adopted in response to the OA movement. Hybrid journals allow authors to choose between gold OA and fee-free publication that is only accessible to the journal's subscribers, usually for a fixed embargo period (known as green OA publishing). Incidentally, the fees for gold OA in hybrid journals tend to be higher than those of full OA journals (Björk & Solomon, 2015), resulting in lower uptake.

These titles now present a broad spectrum of publication options in terms of content, article type and publisher reputation (Bohannon, 2013). The recent trend is a welcome sign of the explosion of interest and production in water research, though while journals have proliferated, there has been significant corporate consolidation with Holzbrink, Wylie, Taylor & Francis and Elsevier buying up other publishers. Competition between

for-profit publishers will continue to reshape the reputation and rankings of water journals in the inevitable arms race of metrics, such as impact factors. Perhaps it was inevitable that as the journal marketplace became more crowded, publishers would seek to imbue their particular offerings with prestige and distinction through rankings and other sorts of metrics. Among the most popular are the Clarivate Journal Impact Factor (JIF) and the Scopus CiteScore, respectively developed by Thomson Reuters and Elsevier. These metrics originated to guide libraries in choosing their journal subscriptions (Hickman et al., 2019). Others include the SciImago Journal Rank (SJR) and the more diffuse grouping of metrics collectively known as ‘altmetrics’, which include social media references to published research. Many national governments have also developed their own metrics of academic productivity, often with as much interest in political control over scholarship (especially in contentious areas such as climate research) as academic quality assurance (Pontille & Torny, 2010). But the most commonly used journal metrics have themselves become commercial products of the very publishing houses whose journals they rate and rank. Of course, establishing market dominance is not the only reason for the burgeoning ‘metrification’ of academic publishing, but it is certainly a powerful contributor. More importantly, such a self-referential system – in which authors are incentivized to cite the journals that publish their work, thus boosting those impact metrics – favours publishers who can use their market power to acquire sub-disciplinary families of journals, encourage coercive citation and quickly drive up their own metrics (Oravec, 2017). Some have even questioned the legality of such manipulation strategies, given how they can affect the allocation of public funds by government and research institutions (Hickman et al., 2019).

Avoiding unintended consequences

Submission bias

The changes to the academic publishing landscape for water journals are part of two systemic trends: (1) the broader ‘discovery’ by the rest of academia of water research’s intersectional importance; and (2) the OA business model that has especially benefited mega-publishers such as Holzbrink, Springer and Elsevier. These two relatively sudden shifts could have unintended consequences. The most obvious implication is submission bias, or inadvertent siloing of research, by career stage, institution type and country into particular sorts of journals. In a 2015 study of predatory OA journals, over 75% of corresponding authors from a sample of 262 articles were from Asia or Africa (Shen & Björk, 2015). A Nigerian study suggested that this bias may be partially driven by the difficulty faced by non-Western scholars publishing in more established and prestigious Western outlets, institutional pressure for ‘international’ publications and cost sensitivity, given that many predatory OA journals specifically market themselves as fast turn-around publishers with relatively ‘light’ peer review requirements (Omobowale et al., 2014). We would expect these same pressures to continue to steer submissions to OA water journals with lower fees and lighter review processes regardless of region of origin.

High publication fees have always disproportionately benefited high-resource institutions in high-income nations because they create a two-tier system where investigators and institutions with the most resources are best positioned to receive the grants that

cover OA fees or work in institutions with deeper pockets (Burchardt, 2014; Estakhr et al., 2021). These inequalities are exacerbated by the move towards institutional 'chest' or blanket subscriptions that unlock fee-free publication by corresponding authors at the subscribing institution. Ability to pay for OA may also vary within an institution by career stage; early career faculty at top research institutions, for example, often receive generous start-up packages that can finance article processing charges, whereas unfunded faculty can be priced out of OA journals. Most OA publishers offer some form of fee waiver for authors from low-income countries, resource-constrained institutions (e.g., teaching universities or junior colleges) or those with otherwise lower financial means, which promotes global inclusivity. But publisher data on the frequency and value of fee waivers (or other forms of support to under-resourced authors, such as scholarships or conference travel support) is generally proprietary, making it difficult to assess impact, and minimizing accountability for equitable, inclusive practices. It is unclear whether such fee waivers inadvertently detract from the internationalization of authorship in traditional subscription-based journals; these steering effects remain understudied.

Worse still, such fee waivers may silo contributions from low-income countries in lower quality journals. There is some evidence of submission bias that leads to highly resourced institutions and investigators gaining *even more* exposure in top-ranked journals through OA business models. An analysis of 11 OA mega-journals found that, despite variation in geographical authorship (such as some journals being dominated by Chinese authors), citation distributions may be similar to those of subscription journals (Wakeling et al., 2016). But other studies suggest that although OA publishing can strengthen academic collaboration and output, the citation impact is not always equal across geographical regions (Breugelmans et al., 2018; Torres-Salinas et al., 2016).

Early career implications

Economic inequalities aside, the proliferation of water journals is problematic for other, more practical, reasons. The evolving landscape complicates submission decisions for new scholars who are less able to distinguish between journals of meaningful repute. Established academic researchers are regularly approached by less-experienced colleagues bewildered by the deluge of solicitations they (and we) receive for our work. This can be challenging for scholars who have had years to think through their approaches to publication, let alone those new to the trade. Emailed 'offers' attempting to rope unsuspecting academics into publishing their work with dubious predatory OA publishers – whose antics are frequently discussed in the pages of yet another journal, *Retraction Watch* – are easier to ignore. Even more pernicious is the 'invitation' to guest edit a special issue/collection for an OA mega-publisher. These invitations typically flatter the academic, often tailoring suggested special issue/collection themes drawn directly from the scholar's own work, and carry the expectation that the guest editor can secure several full-fee contributions. This is capitalism at its best and worst: a junior or mid-career scholar willing to perform the labour of soliciting and managing the peer review of 10–12 papers might raise half of their annual salary in revenue for a multi-billion-dollar corporate publisher who performs some light formatting of accepted papers and manages the journal's website. In return, the scholar may receive a fee waiver for themselves (a form of kickback, assuming a desire to publish with that journal), and the ability to list

‘guest editor’ on their CV – a role that is increasingly devalued due to the mass-production of special issues/collections. This leads to additional grey areas for tenure and promotion committees; the true scholarly contribution of guest editorship depends, more than ever, on the outlet. But with so many new journals, and their metrics and reputations seemingly in flux from year to year, it becomes ever harder to assess related forms of academic service.

Reviewer fatigue

Another downside of the influx of new water journals and explosion in water research is increasing fatigue of the reviewer pool. Editors are having a harder time than ever securing reviews, thereby lengthening review times, a phenomenon anticipated years ago in other fields (Diamandis, 2017). This is happening just as many researchers are desperately trying to regain some sense of normalcy and work-life balance as we emerge from the coronavirus pandemic, rather than take on more peer review. We, like many of our colleagues, are approached several times per week to provide reviews, often by journals of little standing, and sometimes for papers so far outside our technical competence that we wonder if any due diligence was undertaken by the editors. Much of this is likely due to the increasing use of publisher algorithms to automate reviewer identification and invitation, a practice more likely to be used by mega-publishers, given their higher submission volumes, than smaller society-run journals that are more hands-on. While most academics expect to perform a certain amount of reviewing labour as professional service, the rate of demand is wearing out the review pool. Many of our colleagues are capping their reviews at a level equal to the number of their own submissions, a reciprocity-based model aiming to steady the total reviewing workload. But this ‘reviewer homeostasis’ is rarely achieved and can backfire: some colleagues have also ceased reviewing papers for journals from which they are excluded due to inability to pay article processing charges. And it appears that many academics prefer to undertake little or no peer-reviewing at all: in some disciplines, as few as 20% of researchers perform up to 95% of the reviewing, which suggests that reviewers will continue to find themselves under increasing pressure (Kovanis et al., 2016).

To pay or not to pay?

Recognizing these problems, some outlets, such as the journals of the American Economic Association, have attempted to establish a different dynamic by offering to pay reviewers. Others, particularly the larger mega-publishers – who also issue the most reviewer requests – sometimes offer an article processing charge discount on a future submission to reviewers to thank them for their service and cultivate affinity towards the publisher. The case for compensated peer review continues to grow on the basis of improving review efficiency and quality, expanding the reviewer pool, reducing editor workloads and decolonizing academic publishing (Cheah & Piasecki, 2022). Paid peer review still faces resistance from publishers – for whom free peer review constitutes, by one estimate, an annual US\$1.5 billion subsidy (Aczel et al., 2021) – and from academics who fear increasing article processing charges, the potential unsustainability of paying for reviews recommending rejection and the rise of commercial peer review agencies

(Moustafa, 2022). These objections to paid reviews can largely be mitigated by improved screening, standard-setting for reviews and registration of reputable paid reviewers by journal editors, who are themselves often compensated. Experiments also suggest that hybrid models of reviewer compensation can be sustainable if they allow authors the choice of paying for speedy reviews (García Soria et al., 2022).

Transparent review

The rapid influx of OA journals and collective response to the surge in water scholarship seems to further cloud the transparency of journals' decision-making, review timelines, and status of reviews and reviewers in different editorial processes. The evolution of editorial roles among OA journals may contribute to this. For example, the role of an 'Academic Editor' at PLOS is essentially an honorific bestowed for facilitating and assessing peer review for as little as one paper, and is clearly different from the role of 'Associate' or 'Section' editor at a subscription journal. As of 1 August 2022, *PLOS One* had over 9000 Academic Editors, and newly launched *PLOS Water* had 73. This role is needed to process high submission volumes, but also buffers the senior editorial team from accountability over reviewer selection, timelines and decisions. Although secrecy in reviewing can provide the necessary space for honest and rigorous peer review, it can also provide ready cover for lazy, dishonest or even antisocial practice (Clase et al., 2022). Careers are powerfully affected by publication decisions, and so it is vitally important that these decisions are above reproach and timely.

Publisher responses have varied: some journals employ *open peer review* in which all reviewer and editorial feedback is published with the article, or *transparent peer review*, which publishes all feedback but offers voluntary identification of reviewer names. Others emphasize constructive criticism by asking reviewers to undertake *supportive review*. Predatory publishers have always been keenly aware of the appeal of rapid review, and their marketing pitches frequently highlight 'days to publication' and the ease of their reviewing processes when trawling for trade in the sea of bewildered academics. In practice, the growth in submission rates has led to similar review timelines at reputable journals regardless of format. All journals can increase goodwill among their readership through greater transparency of review times on their respective websites, and holding reviewers to those expectations.

What is lost?

Finally, we should reflect upon the growth in academic journals – particularly OA business models – by asking a counterintuitive question: *Are other sorts of academic journals disappearing?* Since 2011, at least 140 Australian journals have closed, most of them either linked to an educational institution or non-profit organizations (Jamali et al., 2022). All cited lack of funding as a reason for closing, and many had no plans for preserving their existing academic content. *Drinking Water Engineering and Science*, an OA journal by Copernicus Publications (Göttingen, Germany) that charged €75 per journal page to sustain operations, closed its submission system in December 2021 and will cease publication in October 2022. Could the explosion in numbers of water journals ultimately come at the cost of relevant scholarly venues that were always predicated on

more communitarian principles? Can journals administered by professional associations – who launched many of the original water journals, and whose global professional networks and training opportunities contributed to the growth in water research – continue to compete with OA mega-publishers and still attract the same quality of scholarship if their relative operational scale ultimately leads to lower impact metrics and citation rates? Simple journal impact metrics suggest yes, but we have yet to see the full effects of so many new water journals and market forces that are likely to shape academic publishing in the name of market share.

It is clear that the proliferation of OA water journals, driven by both surging interest in water issues and changing business models in academic publishing, has been a mixed blessing. Although it is gratifying to see the increased demand for water research drive up the supply of scholarly outlets, this dynamic may not be sustainable. There has been little attention to distributional inequities created, the massive transfer of public funds to private publishers in the form of article processing charges, effects on the peer review process, and the squeezing out of journals built on alternative business models.

Where do we go from here?

The launch of so many new water-related academic journals in such a short period of time provides an interesting case study of the transition to OA publishing – a transition which does not necessarily have a clear ending. Given the wide range of corporate, professional association and independent publishers, academic publishing is unlikely to go fully OA, and we should expect an ongoing mix of publication models. What matters more are the potential unintended consequences of OA market forces, such as steering authors to certain journals based on institution, funding status, career stage or geographical region, as well as devaluing certain forms of academic service, exhausting the reviewer pool and obscuring the review process. If nothing else, we must be wary of the implications of excessive transfers of public research funds to private-sector publishers as OA becomes the new standard. Elsevier, for example, runs a profit margin of about 37%, comparable with Microsoft or Google (Buranyi, 2017; Page, 2019), and with market share of about 16% (Hagve, 2020) may inadvertently reshape scientific practice in lieu of effective checks and balances.

Perhaps another way of approaching this bundle of interrelated challenges is to ask a different and potentially liberating question: *What sort of publishing ecology do we want to be a part of?* We suggest the following principles as a useful starting point:

- In principle, we should all support OA as an important philosophical and political principle for making publicly funded research outputs free at the point of use.
- In practice, OA models must balance equity in who can *contribute* to the published literature with who can *access* it.
- Scholars and funders should be wary of a potentially massive privatization of public funds via OA publishing and contemplate ways to scale non-profit OA models.
- OA publishers must prioritize scientific integrity alongside profits because low-integrity, predatory OA publishing undermines the value of free access.
- Although metrics can be useful in assessing journal quality, scholars must recognize, and be transparent about, metrics' limitations – particularly when assessing career

progression – until we have consensus journal metrics that are harder to manipulate.

In lieu of evidence from other disciplines of changing publication patterns, water researchers and editors should be mindful of these challenges. Despite potential game-changing policies by the US and UK that tacitly endorse OA, change within the publishing industry will continue incrementally, and private publishers will adapt to what is profitable and exploit academic labour as long as there is a willing supply. What can be done? One possibility is to ‘vote with your wallet’ and prioritize society journals – even those managed by a corporate publisher – for manuscripts, publication fees, institutional subscriptions and review labour. These organizations often provide leadership, networking and professional development services that are not part of the mega-publisher business plan, yet should be a competitive advantage. When negotiating with mega-publishers, institutions might also increase pressure for financial transparency to help us understand how fee waivers are being allocated around the world, the potential viability of paid peer review or special collection editing, and other reinvestment opportunities in our research ecology.

We do not have all the answers to these complex issues and hypotheticals. But editorial staff, researchers and funders should monitor these developments in academic publishing in order to improve scientific integrity, promote equity and mitigate unintended consequences for authors. As we all know, our research is critical for helping humanity sustainably manage our precious water resources and improve global living standards.

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ORCID

Justin Stoler  <http://orcid.org/0000-0001-8435-7012>
Chad Staddon  <http://orcid.org/0000-0002-2063-8525>

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