Aalborg Universitet

Good enough for governance? Audit and marine biodiversity offsetting in Australia

Niner, Holly J.; Randalls, Samuel

Published in:
Geoforum

DOI (link to publication from Publisher):
10.1016/j.geoforum.2021.01.009

Creative Commons License
CC BY-NC-ND 4.0

Publication date:
2021

Document Version
Accepted author manuscript, peer reviewed version

Link to publication from Aalborg University

Citation for published version (APA):
Niner, H. J., & Randalls, S. (2021). Good enough for governance? Audit and marine biodiversity offsetting in Australia. *Geoforum*, *120*, 38-45. https://doi.org/10.1016/j.geoforum.2021.01.009

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy
If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from vbn.aau.dk on: December 05, 2025

Good enough for governance? Audit and marine biodiversity offsetting in Australia

Holly Niner and Samuel Randalls

Geoforum

Abstract

Biodiversity offsetting is often presented as a way to manage competing demands of environmental protection and economic development. It is premised on the transparent demonstration of how aims of no net loss of biodiversity (NNL) or similar are met in practice. This is complicated in marine systems where ecological predictions are commonly highly uncertain, knowledge of ecological restoration is low and administrative governance is complex. Drawing on a case study of marine biodiversity offsetting in Australia, this paper shows how these uncertainties pose practical challenges for both producers and consumers of marine biodiversity offsets, needing to progress with decision-making while meeting increasing societal pressure for demonstrable NNL. These competing needs are met through the centrality of an auditable decision-making process that contributes to establishing an organisation's social licence to operate. The need for auditability drives the use of an imprecise measure of NNL through financial equivalency and the use of strategic offsetting projects. The coarse-grained interpretation of biodiversity offsetting best practice reduces the risks posed by explicit acknowledgement of biodiversity loss, offset failure or prohibitively large offset liabilities. Strategic relationship management across government, industry, academia and non-governmental organisations has raised the profile of biodiversity and its importance, but whether the auditing process has delivered on environmental protection is an open question. What is 'good enough' to meet governance standards may have become the over-riding goal. We conclude by acknowledging that the seemingly unattainable yet expected aim of NNL for marine systems prioritises auditability above discussions of 'acceptable' risk.

Keywords

Audit culture; biodiversity offsetting; no net loss; environmental governance; social licence to operate

Introduction

Offsets and net zero targets have proved to be a lively topic of enquiry for geographers. Since their emergence as part of what have been called neoliberal environmental regulatory regimes from the 1980s (Robertson, 2000), they have become a central focus in environmental policy from climate change to biodiversity and ecosystem services. As more corporations, governments and individuals pledge to reduce their environmental impacts, biodiversity offsets are increasingly becoming both a central tool to manage 'unavoidable' impacts of economic development and as a way to promote a 'net gain' or 'net positive' outcome for the environment. Doubts have, however, been raised about the technical feasibility and reliability of biodiversity offsets, as well as criticism of their complicity within a neoliberal system where profit comes before environmental goals (Apostolopoulou et al., 2018). While acknowledging the importance of these claims, this paper focuses instead on the more pragmatic ways in which biodiversity offsets are engaged within practice in the context of marine offsetting in Australia. Rather than simply re-enforcing arguments for an unfolding system of neoliberal environmental governance or an abject failure to measure what matters, we argue that as offsets are integrated into decision-making, they are increasingly governed through and with a concern for auditability. This paper, therefore, offers an exploration of the way that offsets function as part of an environmental 'audit society' (following Power, 1997) where trust in the auditing process creates a more pragmatic sense of what is 'good enough' for meeting regulatory rules through offsets.

The paper unfolds by first reviewing existing literatures on biodiversity offsetting before going on to set out the importance of understanding the primacy of audit as a means of accounting for offsetting processes. The paper then moves on to briefly contextualise the marine biodiversity offsetting environment in the case study of Australia as well as setting out the methodology. In discussing the empirical findings, the paper first establishes the centrality of audit in offsetting, before critically exploring the implications this has for the definition of targets, the establishing of trust and acceptability in the process, and the consequences of a focus on what can be measured and audited for biodiversity outcomes. In conclusion, we argue that the trust in the system of accounting is what will enable biodiversity offsets to work, but that this comes with significant risks.

A critical review of biodiversity offsetting

Biodiversity offsetting, net gain and no net loss (NNL) are policy tools and concepts that emerged with the decentralisation of environmental governance from the 1980s (Hardin, 1978; Lemos and Agrawal, 2006). Through competition, increased participation, and accountability they intend to instil efficiency in natural resource use (Lemos and Agrawal, 2006) and to improve social, economic and environmental conditions - the triple bottom lines of sustainability. In theory, biodiversity offsetting presents a 'win-win' situation where the environmental damages commonly associated with economic development are controlled through actions to avoid, minimise, compensate or offset (Bull et al., 2013). Using the mitigation hierarchy, biodiversity replacement is the last resort only pursued after avoidance and minimisation of damage. The hierarchy signals where biodiversity offsetting is required, and assists in the quantified measurement of ecological equivalence which determines the 'amount' and 'type' of biodiversity to be created. Central to their use is the clear and quantifiable demonstration of ecological equivalence between the biodiversity (and associated benefits) lost and gained (Bull et al., 2016). Accordingly, biodiversity offsets need to meet the criterion of additionality, where benefits need to exceed those that may occur in the absence of any offsetting project. Conceptually, the step-wise implementation of the mitigation hierarchy should bring transparency and logic to development consent processes implicating biodiversity damage, and enable auditing of outcomes. Biodiversity offsets are described as a way for business and governments to demonstrate their commitment to sustainable development and environmental protection (ten Kate et al., 2004).

Despite the increasing uptake of biodiversity offsetting and associated aims of NNL and net gain, there are concerns that the approach may be ill-equipped to halt or even reduce biodiversity losses attributed to development and land use change. It is technically challenging to quantify and then create fully functioning biodiversity that matches the complexity and 'value' of that lost. Reviews of compensatory habitat creation and restoration have consistently identified that offsetting projects do not deliver the full suite of ecological functions and benefits attributed to natural systems (Ambrose, 2000; Burgin, 2009; Kentula, 2000; Moreno-Mateos et al., 2012; Quigley and Harper, 2006). This poor performance is attributed to limited understanding of ecological restoration and inability to both measure and recreate the complex and specific biological, chemical and physical relationships that support the existence of biodiversity (Calvet et al., 2015; Dauguet, 2015; Hobbs and Norton, 1996). Given this, it is difficult to demonstrate equivalency and define offsetting requirements (Walker et al., 2009). While metrics have been developed to support standardised, transparent calculations of equivalency and to establish the units by which biodiversity should be exchanged (Maron et al., 2012; Robertson, 2006, 2000) they have been criticised for over-simplifying complex ecological systems (Bekessy et al., 2010; Burgin, 2009, 2008; Van Dover et al., 2017). Ferreira (2017), for example, identifies the lack of ecosystem accounting standards as a particular weakness in the UK's biodiversity offset trials between 2012 and 2014. Sullivan and Hannis (2017) likewise point to the ways that biodiversity units become exchangeable such that in aggregate, biodiversity is unchanged, but the composition of the units could be significantly different. Numbers, for them, enable the function of "*the truth regime of the market*" (ibid:

1471), a point echoed by other critical scholars of biodiversity offsetting (e.g. Apostolopoulou and Adams, 2015; Robertson, 2000).

Conceptually, offsets or NNL offer a quick and easily understood 'fix' for the unacceptable damages associated with economic development. This is achieved through obscuring the definition of success by masking the complexity of biodiversity, the true costs of economic development, and eroding the societal boundary associated with the approval of environmental damages by reframing and legitimising them as a transaction (Apostolopoulou and Adams, 2015; Büscher, 2012). Critics fear that the overestimated and overstated confidence in abilities to create biodiversity through restoration activity is central to this legitimisation of offsets and may reduce the impetus to explore options to avoid losses (Gordon et al., 2015; Ives and Bekessy, 2015; Maron et al., 2015; Spash, 2015)

The politics of audit

Given the concerns about whether ecological equivalence is being met, the demonstration of positive outcomes through technical measurement and review processes has been pivotal to decision-making about offsetting (e.g. Department of Environment Water and Natural Resources, 2019). The high degrees of uncertainty in how to scientifically meet or assess aims of NNL, and the highly contested arena of natural resource management have led to a favouring of audit as a mechanism of control (Power, 2003). To demonstrate the effectiveness and legitimacy of offsets, there is a focus on measurement and subsequently management systems (audits) that monitor performance in relation to those measurements (Power, 2003, 1994). This translates to a simplified and abstracted audit process, through the development of guidelines and certification schemes that enable a "*cost effective and economically possible*" (Power, 2003) way to monitor or control the complexities of biodiversity offsetting.

The history of audit has been well established in Power's classic account of the audit society, which drew attention to the increasingly visible work of auditing as a means to provide transparent and efficient governance, in public services as well as private corporations (Power, 1997). The idea of a financial audit arose through a proliferation of paperwork that focused on risks and their mitigation that would ensure all aspects of an organization would become auditable. Often castigated as 'box-ticking', audit trails provide a vital mechanism through which organizations encourage compliance with rules (Power, 2009). Auditing almost invariably simplifies issues, but this simplicity enables internal interventions and controls. While quantification may be important, it is the power of the systemic processes of audit that enables these simplified assessments to become symbols of regulatory good governance (Power, 2007). Proof of this is that while numbers can be gamed, this does not seem to undermine trust in the overall process of auditing (Bevan and Hood, 2006). It is thus not so much the numbers as the system of auditing that enables its authority.

This point is crucial when it comes to a subject like biodiversity offsets. There has been a significant literature within geography and cognate disciplines exploring the failure of offsets to accurately or reliably measure ecological equivalence. Scholars have criticised weak simplifications in terms of wetland or stream credit design (Lave et al., 2010a; Robertson, 2012, 2004) and the way carbon offset forestry writes out other important communities and ecologies (Lohmann, 2009). Despite the weakness of numbers, the desire for auditability of 'environment performance' remains strong. These nascent markets have been widely critiqued and in dissecting the calculation of biodiversity offset quantification in their trial in the UK Carver and Sullivan (2017) argue that they emerged through an iterative process in which developers and local planning authorities negotiated the final numbers of units of biodiversity that would be mitigated. The process was shown to potentially sacrifice conservation values for marketable values i.e. those that could be translated into an ideal of exchangeable, fungible units.

In doing so, Carver and Sullivan (2017) make a critical intervention as they demonstrate that biodiversity calculations are not a neutral expert process, but rather a negotiated process through which there is no possible precisely accurate answer. As Wilshusen (2019) notes, the reassembling of networks of biodiversity governance through economistic techniques "*encourages the development of new social technologies and devices in ways that enable economistic governance techniques to guide business practices*" as well as the work of other actors such as non-governmental organizations (NGOs). In other words, while accounting for the accuracy of biodiversity offsets has been of central interest to ecologists and geographers, it is equally important to recognise that quantification may not be as powerful as the system of auditing that effects particular forms of governance. That biodiversity should be audited through techniques and processes derived from economic auditing is critical here. What is interesting, however, is that this auditing needs to be trusted to be *good enough* to validate a particular goal or outcome. Biodiversity losses must not become excessive. As Power (2007) reminds us, auditing is risk-based rather than a striving for completeness of quantification or full accuracy. A criticism of the exact numbers is maintained parallel to an enduring belief in the qualitative value of the auditing processes as is the case with university managements that project the value of university rankings for their public relations while decrying the incomplete equations behind such rankings (Shore and Wright, 2015). There can be an acceptance of biodiversity offsets and their audit trails, even as the actual numbers or units are considered to be insufficient. This is the argument we develop in this paper.

Marine biodiversity offsetting – accuracy vs. audit

Before turning to the case study and analysis, it is important to contextualise the distinctive situation with marine offsets. In marine contexts, biodiversity offsetting commonly follows a direct and unadjusted translation of policy and guidance developed for terrestrial environments (Bas et al., 2016; Jacob et al., 2017; Author, 2017a, 2017b). The application of terrestrially developed offsetting principles in marine contexts is complicated due to the high uncertainty in current levels of ecological knowledge, relating to both impact assessment and restoration (Bas et al., 2016; Jacob et al., 2017; Vaissière et al., 2014; Van Dover et al., 2014). The ability to audit the process of offset implementation becomes vital as it is simply harder to verify offsets to ensure their compliance and success. Whilst demonstrating compliance is particularly challenged in marine contexts, it has also been identified as an issue in the use of biodiversity offsetting in terrestrial settings where low levels of compliance assessment is attributed to a lack of resources (Brown et al., 2013), political disincentives where increased scrutiny could be financially or reputationally damaging (Keene and Pullin, 2011) and poorly designed planning conditions (Lindenmayer et al., 2017). In a review of offset effectiveness in Western Australia May et al. (2017) illustrate that offset effectiveness (or success) is often not a requisite for compliance success. Auditing and accuracy are not the same thing.

Within a marine context, it is much harder to establish ecological equivalence due to the inability to accurately measure losses and gains of marine bioidversity or link predicted and observed ecological changes to specific activities. The diffuse nature of impact pathways coupled with complex administrative arrangements such as overlapping temporal and spatial claims to an area or target resource pose difficulties for management of marine biodiversity. This situation is very different to terrestrial contexts where clearly defined ownership supports the use of physical (e.g. fences) and enforceable legal measures to isolate an area for restoration (Kearney et al., 2013). In addition to the practical limitations to creating 'new' marine biodiversity, these factors have complicated the use of metrics commonly used in the terrestrial application of biodiversity offsetting. Metrics to establish the type and quantity of biodiversity to be offset commonly rely on a calculation relating to the spatial area affected and the vulnerability or significance of the type of biodiversity to be damaged (Bas et al., 2016). The diffuse nature of impact pathways in marine environments and the lack of knowledge of the environmental dependencies inherent to a healthy marine environment challenge the ecological relevance of such simplified algorithms. The specificities of what aspects of biodiversity are lost are not captured by current approaches and so broad-brush assessments are used to provide an estimate of what an equivalent 'amount' of new biodiversity might be. Assessments are also challenged in establishing the specific impacts arising from a specific action against a backdrop of a host of other diffuse pressures that are known to cumulatively be affecting marine biodiversity (Halpern et al., 2015). Available knowledge and science is not readily or sufficiently available to easily (or affordably) inform a metric refined enough to calculate the specific type and quantity of biodiversity lost through a specific activity.

In summary, the "*knowledge basis*" (Power, 2003) for the application of biodiversity offsetting in marine environments can be described as weaker than that observed in terrestrial systems. Accordingly, the use of audit systems to control the risks of controlling environmental harm, present different modes of feedback to those apparent in terrestrial environments where understanding, ownership and consequently oversight of biodiversity are perceived to be greater. High degrees of uncertainty and societal disconnection leaves the marine application of biodiversity offsetting vulnerable to misuse (Maron et al., 2015). Auditing therefore plays an even more critical role in the marine context, an argument that we explore using the case of Australia.

Case study & methods

Biodiversity offsetting is a requirement of environmental impact policy at a Federal level (Australian Government, 2012) and five of Australia's seven states and territories have state level policy that apply to marine areas (Miller et al., 2015; Niner et al., 2017b). This policy and associated guidance is implemented in practice with limited consideration of how marine applications may vary from terrestrial experiences (Bell et al., 2014; Bos et al., 2014; Brodie, 2014; Niner et al., 2017a). At a Federal level, the marine environment is identified as a 'challenge' to the strict adherence to ecological definitions of equivalence; in response the policy relaxes requirements for 'like for like' biodiversity gains (Australian Government, 2012). This Federal framing for marine offsetting follows through into State legislation in New South Wales (Fairfull, 2013) and Queensland (Fisheries Queensland, 2012; State of Queensland, 2020, 2015, 2014) including specific policy for the Great Barrier Reef (GBR) (Australian Government, 2017; Commonwealth of Australia, 2018). At this level marine biodiversity offsetting policy and guidance sets out the benefits of a strategic approach to marine restoration as compared to ad hoc offsetting projects. Accordingly, these policies prefer that marine offsetting requirements are addressed through financial payments to be centrally applied to large scale efforts to create biodiversity benefit (Niner et al., 2017a). Rather than curating and developing a bank of biodiversity credits, the aim is to accumulate sufficient funds to address large-scale issues of concern such as water quality (Bos et al., 2014). Given the limited detailed consideration of marine biodiversity offsetting globally (Niner et al., 2017b), Australia where marine application has been addressed within policy, provides a useful case study to explore how the approach is addressing uncertainty within decision-making and also how this same uncertainty is influencing its application.

To inform this analysis, 31 interviews were conducted between October 2016 and May 2017 to explore the perspectives of a range of different actors that had professional experience in the development and application of biodiversity offsetting policy in marine environments in Australia. This included regulators, industry members, consultants, NGO representatives and academics. In depth thematic analysis of interview data was combined with extensive reading of related academic and grey literature including policy and development-consenting documents.

Table 1. The distribution of participants across profession type.

Participant type		**Code**	**Total participants**
Practitioner*	Industry	IND#	6
	Consultancy	CON#	7
Regulator		REG#	7
Non-Governmental Organisation		NGO#	6
Academia		ACA#	5
Total			**31**

*Industry and consultancy representatives are collectively referred to as practitioners.

The importance of audit and defining targets for measurement

Making biodiversity offsets auditable might suggest an ability to quantify the ecological benefits of an offset. NNL is often considered to be a 'specific and quantified' goal wherein the measurement of biodiversity gains and losses informs the approach to mitigation (Bull et al 2013; Rainey et al, 2014). This appeal to quantification, however, is challenged in marine offsetting, because the metrics are currently unavailable or under development in most jurisdictions in Australia (Dutson et al., 2015; Maron et al., 2016). There is therefore no agreement to how marine biodiversity should be quantitatively represented in decision-making.

Research participants echoed this conclusion suggesting that a key barrier to the development of marine offsetting was the lack of a comprehensive understanding of the multiplicity of relationships across time and space that give rise to marine biodiversity. This challenges the development of metrics to quantify biodiversity losses and gains, and consequently it becomes administratively difficult to implement marine offset projects where accuracy is the primary goal (Freestone et al., 2014; Van Dover et al., 2017). Participants described their frustration suggesting that the practice is unfeasible and has *"…always been one of those things that people have stayed away from"* (ACA1), leading, for example, "*to a position that we don't provide for physical offsetting of seagrass. It's just too difficult … it just has failed…"* (REG5). There was common agreement across participants that the measurable gains and losses stipulated as a requirement to meet NNL in terrestrial systems are not appropriate for marine systems. Given such challenges of creating trustworthy numbers, it might be assumed that marine biodiversity offsetting would simply fail.

Yet this apparent failure of quantification has not diminished an ideal of auditability through numbers. The majority of actors acknowledged the failures of quantification, but perceived offsets as an accepted *"cornerstone … [or a] … key regulatory tool … [for] … compensation*" (REG3) and development consent more widely. Indeed actors involved in developing and applying this policy approach argued that offsetting is necessary as an audit trail for environmental regulation and decision-making. This likely stems from the ubiquity of the approach in terrestrial settings and an increased demand for the transparency and auditability of decision-making. A system for marine offsets that could be *good enough* to be operationalised is vital to support the activity and interest of governments and industry and their respective social licence to operate.

Whilst this framing does not meet the rigour that the scientific (academic) community might expect for biodiversity offsetting, it indicates that it is performing as a quantifiable (and auditable) risk-based tool to demonstrate how the risks of an activity are considered. The social licence to operate is particularly important here whereby broad acceptance of an activity is fostered through trust-based relationships between actors (e.g. industry or government) and society (Bice et al., 2017; Moffat et al., 2016). The majority of participants described marine biodiversity offsetting positively as an *"an opportunity to demonstrate industry's social licence to operate"* (IND4). This is further suggested by participants who argued that biodiversity offsetting influenced an organisations' perceived image and thereby a preference for offsetting activities that are *"highly visible"* (NGO1) that *"target the right things"* (IND3) and *"get the right messaging out there"* (IND5). This suggests that quantifying the metrics for marine offsetting performs a stronger role in managing the social licence to operate (i.e. secondary business risk) than the ecological risks posed by the loss of biodiversity. It becomes an issue of institutional risk management (Power, 2007; Rothstein et al., 2006). Auditability performs a vital role for an organization's ability to establish that they undertook biodiversity offsetting through due processes, even if formal quantification is incomplete and considered ecologically insufficient.

Auditing for financial equivalence

For this reason, offsetting is about managing institutional risks as much as achieving a goal of ecological equivalency (e.g. NNL). Rather than strictly focussing on ecological equivalence, therefore, the ambition for an auditable system leads to a focus on financial equivalency. Ecological equivalence seeks rigorous quantification of losses to set specific ecological offsetting targets, such as an area of habitat or species population, to ensure that this target does not diminish against counterfactual scenarios in the absence of the impact or offsetting activity (Maron et al., 2012). Financial equivalence is often described as an 'out of kind' offsetting measure whereby losses are attributed a monetary value which is paid to another party in exchange for a defined quantum of biodiversity benefit. Ecologists describe this as an incorrect use of the term offset, as activity falling under this term frequently falls short of demonstrating how the biodiversity gains to be achieved with this finance will be measurable and commensurate with the losses triggering the offsetting requirement (Bull et al., 2016; Niner et al., 2017a). Conservation funds seek to achieve more certain benefits of a 'higher value' than ad hoc but ecologically equivalent offsets (an approach deemed appropriate in some circumstances (Habib et al., 2013)), but the use of such funds further challenges the demonstration of ecological equivalence as the units of exchange are often very different (Bull et al., 2016) and often lead to a focus on units of finance.

Financial equivalency allows offsetting requirements to be successfully and demonstrably met at the point of funds transfer, with *"better bang for buck"* (IND5). The consequent liability for biodiversity creation or offset success is diluted or passed on to the party delivering the biodiversity benefit, which in Australia is most frequently the Government. Financial equivalency and the payment of offsetting liabilities into strategic funds is advised by some as a way to address the demands of marine biodiversity creation (Bos et al., 2014). Large projects can address the sources of impact at a cumulative level i.e. tackling the sources of trends of decline, as opposed to seeking to restore and protect an individual specific quantum of marine biodiversity loss (e.g. an area of seagrass) under these trends. For example, a commonly proposed option for marine biodiversity offsetting is the improvement of water quality, which would require a large-scale project to manage the use of coastal and catchment land use (Bos et al., 2014; Dutson et al., 2015). The challenges of applying ecological equivalence and the promise of greater gains and efficiency, have led to the dominance of financial equivalence with sums defined arbitrarily as "*a proxy*" (IND3), often based on "*precedent"* (REG7) and limited transparency over how funds will be used.

Recognising the benefits of tackling marine conservation projects at scale in Australia, there has been a push to instil academic interpretations of biodiversity offsetting with a stipulation for ecological equivalence. This has led to the calculation of ecologically equivalent financial offsets that were found by practitioners to be so large as to be "*absolutely frightening for industry"* (CON8). A reason for these large numbers when basing assessments of financial equivalence on ecological science could be explained by the use of offsetting ratios to address uncertainties in marine biodiversity. Conceptually, offset ratios are applied to account for uncertainty in creating 'new' biodiversity and can be applied to reduce the risk of offset failure by increasing the effort, scale or significance of an offsetting activity (Moilanen et al., 2009; Quétier and Lavorel, 2011). These ratios can also be applied to to calculate offset liabilities seen to be large enough to meet expectations that big urban developers, "*the baddies*" (CON1), are suitably punished and to ensure sufficient support for the activity required to meet strategic conservation aims. The process of auditing offsets generates responses that go beyond ecological equivalence to ensure the development of trust and legitimacy in the system. However, the strategic pooling of offset finance to overcome the challenges of marine biodiversity offsetting may still fall short of the large sums required to meet conservation targets identified (Brodie, 2014). Financial equivalence is calculated based on the impacts identified through legislative frameworks and limited in scope to certain ecological aspects such as 'fish habitat' (Fairfull, 2013) or 'native vegetation' (Government of South Australia, 2015). Accordingly, it is not clear that assessment against these limited ecological receptors will support the totals necessary to enact these strategic efforts. Offsetting losses might simply not be sufficient in marine environments. Regardless, the high costs of an ecologically relevant financial equivalence represent a distinct change in budget allocations for environmental aspects of development consent where historically biodiversity depletion has not been internalised.

Combined, these challenges lead to actors resisting a scientifically robust interpretation of offsetting given the prohibitive financial costs and the risk of failure involved. Financial equivalence comes to shape the audit process instead. The ad hoc and ambiguous determination of financial equivalence accepted by actors was widely recognised as falling short of encompassing the full value of biodiversity loss. Rather than this becoming a stumbling block to offset development, it is this lack of definition that enables actors to reach agreement, to make decisions and to progress with development. Current opaque processes to offset biodiversity through financial equivalence appear sufficient enough demonstration that due process has been followed and crucially that agreement on offsetting liabilities has been met.

The numbers then are mobilised in support of an audit trail. It is unlikely that the numbers could be too far removed from instinctive reactions about biodiversity (i.e. losses are acknowledged), as this would present an unacceptable threat to an organisations social licence. But neither do the numbers need to be excessively precise or accurate to make offsetting legible in auditing terms. To re-iterate our argument, while the design and quantification of offsets matters, as mechanisms for efficient governance it is their ability to enable an auditing of organizational performance in relation to biodiversity risks that matters more. Counting marine offsets in one form or another enables a proximate, good enough account and response, at least for achieving financial equivalence if not ecological equivalence. A key question is whether this would be sufficient to allay scientific concerns that what is measured is not really what matters in terms of biodiversity loss.

Auditing to convince stakeholders

For an audit trail to convince and for the governance framework to become legitimate and established, the varying stakeholders involved in the process need to agree that this system is the best possible or good enough to achieve the stated aims of biodiversity offsetting such as NNL. This system relies on governmental support, third party organisations such as large environmental NGOs and, public and academic goodwill. Accordingly, Biodiversity offsetting has become a threat for users, where threats are perceived to arise through the expectations of society for environmental responsibility and protection. The approach poses a threat to an organisations' social licence by increasing societal expectations for NNL. Participants describe how expectations exist that *"industry will fix the problem"* (IND1) that they acknowledge is "*both naturally occurring and influenced by human interaction"* (IND1) and very unlikely to be addressed through offsets for a specific planned impact. Falling short of this expectation is described as a risk to an organisation's social licence to operate and highlights the challenges of communicating significance and cumulative impacts, which are complex and often poorly defined scientific concepts as opposed to an easily understood measure of biodiversity loss.

As a management tool for these perceived threats, the control of messaging around the use of biodiversity offsetting and environmental impact is important for users. The loss of control associated with the use of coarse grain measures of financial equivalence and strategic offset funds was described as a point of concern for industry. Control is lost through the reliance on third parties or governments to decide on the final form and project design of the offset project and its delivery, and how targets are defined, monitored and then reported against. Similarly, the risk of offset failure was described as entirely unpalatable to government representatives, yet the conceptually simple message of NNL was described as creating an overarching institutional expectation that refusal of a potentially damaging activity was unwarranted and unacceptable.

Whereby *“everyone thinks they’re an environmental expert”* (REG1) and this perceived understanding of biodiversity offsetting process assumed by ecologically unqualified government officials (e.g. ministers of planning or infrastructure) seeking to further their own interests, undermines abilities to refuse development on the grounds of unacceptable environmental impact through the misinformed identification of *“a fantastic offset”* (REG1).

The threats to the legitimacy of the offsetting system were further outlined in relation to the likelihood of failure:

> ***“****…the biggest barrier and it's, there's two there’s a legal, a legal fear and a... human fear of failure, we're too scared of failure, we aren't prepared to fail. So we spend all our time trying to make sure that it's fool proof and holds water and then we don't go and measure it because we don't actually want to know that it's failed. So, we're too scared of the nasty answer, Minister doesn't want to stand up in parliament and go well my department has issued four hundred approvals requiring this many offsets and none of them have worked, it doesn't work, he's not going to do it...”* **(CON8)**

Auditing a process of offsetting that has been agreed among many stakeholders provides collective reassurance that institutional and societal risks have been managed, however overt ecological failure remains unacceptable and an acknowledged source of risk. There is a security through the process as long as the audit does not too carefully examine the details.

To navigate the perceived impossibility of meeting a quantifiable NNL in marine systems, organisations coalesce around biodiversity offsetting as a system of auditing which allows for decisions to be made and economic activity to proceed. This is not to say that there is an explicit intention to damage biodiversity but rather that NNL in marine contexts presents too many risks for users to be practicable and a more rigorous application of NNL is not sought. Indeed tacit approval of this mode of practice is garnered from the increased attention on the technicalities of biodiversity offsetting by independent academics and large environmental NGOs. This attention takes the form of ‘best practice guidance’ for marine biodiversity offsetting (e.g. Fauna & Flora International, 2017), and despite acknowledging the limitations of the approach, perpetuate the narrative that NNL is an achievable and politically supported target. Conversely, much formal academic attention describes the scientific challenges of meeting a meaningful NNL but promotes the accepted norm that NNL is a desirable and achievable outcome. Academic representatives among others were critical of the misuse offsets *“they're [financial offsets] not offsetting anything they're just a payment to go and do* *something that's not actually an equal and opposite effect. It's not a benefit that's equivalent to a loss. So that to me is not an offset it's a form of compensation"* (ACA3). However, voices that explicitly challenge whether or not NNL is appropriate in marine contexts at all remain absent and the technical focus on 'improving practice' remains dominant. Improvements that were commonly sought include the definition of the offset 'problem' "So the question, no net loss of what, compared to what, get clear on that (ACA3) and improving the information basis for decisions "you don't have the baseline data … and thus like what the counterfactual looks like into the future" (ACA4). Counterintuitively this critique does not support transparency in the use of NNL but leads to a dependence on audit to navigate the risks posed by expectations of biodiversity offsetting. The engagement of perceived independent academic 'experts' and societal actors (e.g. large environmental NGOs) – either as a form of resistance through critique of effectiveness or acceptance – serves to amplify the use of the approach within the management of risk (Power, 2007). These relationships serve to manage the 'threatening agents' (Power, 2007) of alternative narratives that could damage an organisation's social licence to operate. It is why bringing stakeholders together to unite around an ideal of offsetting is an effective institutional and societal risk management strategy.

In turn, a reliance on these relationships as opposed to formalised process is a point of conflict where users of offsets (practitioners) perceived that regulators do not have the capacity to pragmatically assess scientific advice. Indeed regulators admitted a lack of expertise:

> **"***…we don't have anyone with any marine expertise whatsoever …I just don't know, I don't know the marine environment and we don't have anyone here that does…"* **(REG1)**

The struggle for regulators to assert any kind of scientific authority was not, however, embraced as an opportunity to take advantage of the process. Practitioners were concerned about the ability of regulators to use information and scientific advice appropriately to *"put a good filter on what comes to them"* (CON1) rather than take advice at face value in the absence of a perceived lack of *"real world perspective"* or *"experience"* (CON1) of both academics and regulators involved. The lack of expertise, therefore, was equally concerning in both the risk of overly cautious regulators under pressure from conservationists and in risks to trust in their ability to establish the authority of the audit process in enabling 'good enough' offsetting to proceed. Governing through audit needs to convince the relevant stakeholders, not least to ward off possible criticisms about gaming or insufficiency.

Consequences of a focus on audit

Conceptually attractive and operationally challenging targets such as NNL have the potential, as described here, to focus attention on measurement of what is possible as opposed to 'what matters' with respect to biodiversity (Bevan and Hood, 2006; Radnor, 2008). A common critique of offsets is that they erode moral boundaries to environmental damage (Apostolopoulou and Adams, 2015; Ives and Bekessy, 2015) and we present some evidence here that supports these concerns. Conservationists also fear that overarching trust in the system whilst closed to ecological challenge, is open to gaming, where targets are defined for purposes of auditability more than environmental protection.

Gaming, however, implies systems where a focus on audit distorts behaviour such that offsetting targets are defined to meet the benefit of users over that of biodiversity creation. One avenue of system gaming was described as the use of biodiversity offsetting to facilitate development consent decision-making as a *'sweetener'* (NGO4) where, despite a lack of evidence of equivalent impact, commitments to offsets were made with a view to denial of these commitments at a later date. Evidence of this was provided by several participants where an extensive suite of offsets were agreed to that were not tied to a specific impact but rather as an acknowledgement of working in an ecologically important area with the likelihood of some unquantified impact occurring. An NGO representative described how these commitments were then "*progressively weakened"* (NGO4) and systematically reneged after approval had been achieved and development initiated. A key reason for this was perceived as the absence of ministerial support for implementation of biodiversity offsetting policy.

This example whilst illustrating the potential for gaming of current weak offsetting systems, did not appear to be representative of the wider experience of marine biodiversity offsetting in Australia. The majority of participants described frustration at the limitations of current practice where a lack of trust in others to respect or understand the needs of their organisation when interpreting biodiversity offsetting forces a focus on audit. However, the absence of trust between players in the system provide opportunities for those that are able to play the *"honest broker"* (NGO3) such as NGOs who seek to use offset finance to restore areas of degraded habitat. By the same token, trusted actors that are able to bridge institutional siloes and work across disciplines and sectors may be able to leverage biodiversity benefit outside of that currently measured in relation to biodiversity offsetting. This was observed here where engagement of industry with NGOs and academic representatives at a strategic level or at stages of project planning whilst primarily sought for the purposes of legitimacy, may increase the scientific rigour of policy development and implementation.

Yet the benefits afforded by these opportunities to act as a trusted and honest broker do not appear to be open to all. Requirements to audit performance could be leading to a decrease in funding for wider activity associated with a social licence to operate such as contributions to community capacity building, health and, education programs. Participants felt that the more formalised approach, where targets can be clearly achieved, favoured those organisations and activities that provide the most effective and valuable outcome to support their social licensing activity. In practice, this could mean that smaller locally focussed NGOs that may not have the capacity to engage with biodiversity offsetting at a strategic level are marginalised from decision making. Further, the need for auditability of environmental performance could also detract from funding that was previously available to these locally focussed NGOs to develop the capacity to assist in their engagement.

Another consequence of a focus on audit as opposed to biodiversity gain is eroding the organisational value or "business case" (CON7) of the initial target of NNL and environmental protection. For example, where commitments for ecological interpretations of NNL set by a company as an "environmental differentiator" (CON7) can set that company at a disadvantage because the system is not set up to present a *'level playing field'* (CON7) and value biodiversity protection. There appears to be sufficient trust in this system that is delivering against stated aims regardless of the way in which it is enacted. Consequently, these good intentions are penalised both through exposure to increased risk of failure of meeting their commitments and through investment of capital that competitors are not required to do. The system is set up to support those that adhere to the 'mediocre' requirement of audit (Bevan and Hood, 2006).

Requirements to meet an audit trail frustrate actors that wish to engage in better conservation practices and tend toward a focus on doing what is required rather than best practice. Even if there is limited evidence of actual gaming, the system of auditability is liable to be gamed and at best incentivises a pragmatic, 'good enough' approach to offsetting. This pragmatic interpretation, necessary to manage the high uncertainty and impracticalities of marine biodiversity offsetting, helps ensure trust in the system for the actors involved, but is likely to create distrust from concerned conservationists.

Conclusion

The case of marine biodiversity offsetting in Australia illustrates the increasing interest in and relevance of offsetting mechanisms as the way to achieve conservation objectives of NNL. Yet marine ecosystems are particularly tricky to measure and monitor in terms of ecosystem losses and gains, because of the high degrees of uncertainty involved arising from the highly interconnected and diffuse relationships that give rise to marine biodiversity. Indeed, there is a general recognition that the goals of marine biodiversity offsetting are not currently being achieved. Despite this, offsetting retains an enduring power. We have argued that this is because offsets provide a form of accountability through a process that enables auditability. In light of Power's (1997) arguments about an audit society, we suggest that marine biodiversity offsets function as techniques through which good environmental governance can be rendered legible and acceptable. The limits to quantification and accuracy are less consequential for offsetting than the positive endorsement of an audit trail that makes deliberations more visible.

Offsetting in principle thus becomes a way to share the risks of ad hoc compensatory activity across actors and projects in providing a process in which trust can be established. The process of offsetting is not about a full quantification of outcomes, but rather an agreement that this is the way through which organizations can benchmark their performance against other organizations, and therefore in setting expectations for standard forms of behaviour. Trust becomes a critical component – trust in the system in terms of delivering a satisfactory outcome for auditing processes for biodiversity governance and trust in other organizations believing in the system to unlock avenues for offset finance. It is not a 'trust in numbers' therefore so much as a trust in the auditing of the process of biodiversity governance. Collective, shared agreements, after all, may help secure an outcome that could otherwise be scientifically challenged. They might also, of course, achieve some environmental benefits that would be better than having no system.

We concur with a number of critiques of biodiversity offsets from geographers and others (Gordon et al., 2015; Lave et al., 2010b; Lindenmayer et al., 2017; Maron et al., 2015; Robertson, 2012) about the weak quantification, monitoring and evaluation schemes for biodiversity offsets. But as we have shown, the distrust in numbers does not necessarily over-rule a trust in the system. The case of marine biodiversity offsetting provides a potentially more dramatic example of this compared to terrestrial biodiversity offsetting because the uncertainties are so significant and, to a great extent, irreconcilable. If marine offsets are to be made to work, it will most likely not be because of accurate quantification of biodiversity loss and gains. It will be because organizations trust in a system of apparently transparent governance that is good enough to enable companies to audit their biodiversity management plans to meet set goals. Whether objectives such as NNL can maintain their public acceptability in delivering on expectations for good environmental governance remains an open risk.

References

Ambrose, R.F., 2000. Wetland mitigation in the United States: assessing the success of mitigation policies.

Wetl. 19, 1–27.

Apostolopoulou, E., Adams, W.M., 2015. Biodiversity offsetting and conservation: reframing nature to save it. Oryx 51, 23–31. https://doi.org/10.1017/S0030605315000782

Apostolopoulou, E., Greco, E., Adams, W.M., 2018. Biodiversity offsetting and the production of "equivalent natures": A Marxist critique. Acme 17, 861–892.

Australian Government, 2017. Reef Trust Offsets: How the Reef Trust Manages Offsets Funds October 2017.

Australian Government, 2012. Environment Protection and Biodiversity Conservation Act 1999: Environmental Offsets Policy. Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Bas, A., Jacob, C., Hay, J., Pioch, S., Thorin, S., 2016. Improving marine biodiversity offsetting: A proposed methodology for better assessing losses and gains. J. Environ. Manage. 175, 46–59. https://doi.org/10.1016/j.jenvman.2016.03.027

Bekessy, S.A., Wintle, B.A., Lindenmayer, D.B., Mccarthy, M.A., Colyvan, M., Burgman, M.A., Possingham, H.P., 2010. The biodiversity bank cannot be a lending bank. Conserv. Lett. 3, 151–158. https://doi.org/10.1111/j.1755-263X.2010.00110.x

Bell, J., Saunders, M., Lovelock, C., Possingham, H., 2014. Legal frameworks for unique ecosystems – how can the EPBC Act offsets policy address the impact of development on seagrass? Environ. Plan. Law J. 31, 34–46.

Bevan, G., Hood, C., 2006. What's measured is what matters: Targets and gaming in the English public health care system. Public Adm. 84, 517–538. https://doi.org/10.1111/j.1467-9299.2006.00600.x

Bice, S., Brueckner, M., Pforr, C., 2017. Putting social license to operate on the map : A social , actuarial and political risk and licensing model (SAP Model). Resour. Policy 53, 46–55. https://doi.org/10.1016/j.resourpol.2017.05.011

Bos, M., Pressey, R.L., Stoeckl, N., 2014. Effective marine offsets for the Great Barrier Reef World Heritage Area. Environ. Sci. Policy 42, 1–15. https://doi.org/10.1016/j.envsci.2014.05.002

Brodie, J., 2014. Dredging the Great Barrier Reef: Use and misuse of science. Estuar. Coast. Shelf Sci. 142, 1–3.

Brown, M.A., Clarkson, B.D., Barton, B.J., Joshi, C., 2013. Ecological compensation: An evaluation of regulatory compliance in New Zealand. Impact Assess. Proj. Apprais. 31, 34–44. https://doi.org/10.1080/14615517.2012.762168

Bull, J.W., Gordon, A., Watson, J., Maron, M., 2016. Seeking convergence on key concepts in No Net Loss policy. J. Appl. Ecol. 53, 1686–1693. https://doi.org/10.1111/1365-2664.12726

Bull, J.W., Suttle, K.B., Gordon, A., Singh, N.J., Milner-Gulland, E.J., 2013. Biodiversity offsets in theory and practice. Oryx 47, 369–380.

Burgin, S., 2009. 'Mitigation banks' for wetland conservation: a major success or an unmitigated disaster? Wetl. Ecol. Manag. 18, 49–55. https://doi.org/10.1007/s11273-009-9147-5

Burgin, S., 2008. BioBanking: an environmental scientist's view of the role of biodiversity banking offsets in conservation. Biodivers. Conserv. 17, 807–816. https://doi.org/10.1007/s10531-008-9319-2

Büscher, B., 2012. Payments for ecosystem services as neoliberal conservation: (Reinterpreting) evidence from the Maloti-Drakensberg, South Africa. Conserv. Soc. 10, 29. https://doi.org/10.4103/0972-4923.92190

Calvet, C., Guillaume, O., Claude, N., 2015. Tracking the origins and development of biodiversity offsetting in academic research and its implications for conservation: A review. Biol. Conserv. https://doi.org/10.1016/j.biocon.2015.08.036

Carver, L., Sullivan, S., 2017. How economic contexts shape calculations of yield in biodiversity offsetting. Conserv. Biol. 31, 1053–1065. https://doi.org/10.1111/cobi.12917

Commonwealth of Australia, 2018. Reef 2050 Plan: Net Benefit Policy. https://doi.org/10.1017/CBO9781107415324.004

Dauguet, B., 2015. Biodiversity offsetting as a commodification process: A French case study as a concrete example. Biol. Conserv. 192, 533–540. https://doi.org/10.1016/j.biocon.2015.08.015

Department of Environment Water and Natural Resources, 2019. Policy for significant environmental benefit. https://doi.org/10.1002/ejoc.201200111

Dutson, G., Bennun, L., Maron, M., Brodie, J., Bos, M., Waterhouse, J., 2015. Determination of suitable financial contributions as offsets within the Reef Trust. Cambridge.

Fairfull, S., 2013. Fisheries NSW Policy and guidelines for fish habitat conservation and management. Wollongbar. https://doi.org/ISBN 978 1 74256 283 4

Fauna & Flora International, 2017. Biodiversity and ecosystem services: good practice guidance for oil and gas operations in marine environments 183.

Ferreira, C., 2017. The contested instruments of a new governance regime: accounting for nature and building markets for biodiversity offsets. Accounting, Audit. Account. J. 00–00. https://doi.org/10.1108/AAAJ-12-2015-2336

Fisheries Queensland, 2012. Marine fish habitat offset policy.

Freestone, D., Johnson, D., Ardron, J., Morrison, K.K., Unger, S., 2014. Can existing institutions protect biodiversity in areas beyond national jurisdiction? Experiences from two on-going processes. Mar. Policy 49, 167–175. https://doi.org/10.1016/j.marpol.2013.12.007

Gordon, A., Bull, J.W., Wilcox, C., Maron, M., 2015. Perverse incentives risk undermining biodiversity offset policies. J. Appl. Ecol. 52, 532–537. https://doi.org/10.1111/1365-2664.12398

Government of South Australia, 2015. Policy for Significant Environmental Benefit. Adelaide, South Australia. https://doi.org/10.1002/ejoc.201200111

Habib, T., Habib, D., Farr, R., Schneider, S., 2013. Economic and ecological outcomes of flexible biodiversity offset systems. Conserv. Biol. 27, 1313–1323.

Halpern, B.S., Frazier, M., Potapenko, J., Casey, K.S., Koenig, K., Longo, C., Lowndes, J.S., Rockwood, R.C., Selig, E.R., Selkoe, K.A., Walbridge, S., 2015. Spatial and temporal changes in cumulative human impacts on the world's ocean. Nat. Commun. 6, 7615. https://doi.org/10.1038/ncomms8615

Hardin, G., 1978. Political requirements for preserving our common heritage, in: Brokaw, H.P. (Ed.), Wildlife and America. Council of Environmental Quality, Washington DC, pp. 310–317.

Hobbs, R.J., Norton, D. a, 1996. Towards a conceptual framework for restoration ecology. Restor. Ecol. 4, 93–110. https://doi.org/10.1111/j.1526-100X.1996.tb00112.x

Ives, C.D., Bekessy, S.A., 2015. The ethics of offsetting nature. Front. Ecol. Environ. 13, 568–573. https://doi.org/10.1890/150021

Jacob, C., Bu, A., Pioch, S., Thorin, S., 2017. Marine ecosystem restoration and biodiversity offset. Ecol. Eng. 1–10. https://doi.org/10.1016/J.ECOLENG.2017.09.007

Kearney, R., Farebrother, G., Buxton, C.D., Goodsell, P., 2013. How terrestrial management concepts have led to unrealistic expectations of marine protected areas. Mar. Policy 38, 304–311.

https://doi.org/10.1016/j.marpol.2012.06.006

Keene, M., Pullin, A.S., 2011. Realizing an effectiveness revolution in environmental management. J. Environ. Manage. 92, 2130–2135. https://doi.org/10.1016/j.jenvman.2011.03.035

Kentula, M.E., 2000. Perspectives on setting success criteria for wetland restoration. Ecol. Eng. 15, 199–209. https://doi.org/10.1016/S0925-8574(00)00076-8

Lave, R., Doyle, M., Robertson, M., 2010a. Privatizing stream restoration in the US. Soc. Stud. Sci. 40, 677–703. https://doi.org/10.1177/0306312710379671

Lave, R., Doyle, M., Robertson, M., 2010b. Privatizing stream restoration in the US. Soc. Stud. Sci. 40, 677–703. https://doi.org/10.1177/0306312710379671

Lemos, M.C., Agrawal, A., 2006. Environmental governance. Annu. Rev. Environ. Resour. 31, 297–325. https://doi.org/10.1093/oxfordhb/9780199584451.003.0007

Lindenmayer, D.B., Crane, M., Bekessy, S., Blanchard, W., Evans, M.C., Maron, M., Gibbons, P., 2017. The anatomy of a failed offset 210, 286–292. https://doi.org/10.1016/j.biocon.2017.04.022

Lohmann, L., 2009. Toward a different debate in environmental accounting: The cases of carbon and cost-benefit. Accounting, Organ. Soc. 34, 499–534. https://doi.org/10.1016/j.aos.2008.03.002

Maron, M., Gordon, A., Mackey, B.G., Possingham, H.P., Watson, J.E.M., 2015. Conservation: Stop misuse of biodiversity offsets. Nature 523, 401–403. https://doi.org/10.1038/523401a

Maron, M., Hobbs, R.J., Moilanen, A., Matthews, J.W., Christie, K., Gardner, T.A., Keith, D.A., Lindenmayer, D.B., McAlpine, C.A., 2012. Faustian bargains? Restoration realities in the context of biodiversity offset policies. Biol. Conserv. 155.

Maron, M., Walsh, M., Shumway, N., Brodie, J., 2016. Reef Trust offsets calculator. Brisbane, Queensland, Australia.

May, J., Hobbs, R.J., Valentine, L.E., 2017. Are offsets effective? An evaluation of recent environmental offsets in Western Australia. Biol. Conserv. 206, 249–257. https://doi.org/10.1016/j.biocon.2016.11.038

Miller, K.L., Trezise, J.A., Kraus, S., Dripps, K., Evans, M.C., Gibbons, P., Possingham, H.P., Maron, M., 2015. The development of the Australian environmental offsets policy: from theory to practice. Environ. Conserv. 42, 306–314.

Moffat, K., Lacey, J., Zhang, A., Leipold, S., 2016. The social licence to operate: A critical review. Forestry 89, 477–488. https://doi.org/10.1093/forestry/cpv044

Moilanen, A., van Teeffelen, A.J.A., Ben-Haim, Y., Ferrier, S., 2009. How much compensation is enough? A framework for incorporating uncertainty and time discounting when calculating offset ratios for impacted habitat. Restor. Ecol. 17, 470–478. https://doi.org/10.1111/j.1526-100X.2008.00382.x

Moreno-Mateos, D., Power, M.E., Comín, F. a, Yockteng, R., 2012. Structural and functional loss in restored wetland ecosystems. PLoS Biol. 10, e1001247. https://doi.org/10.1371/journal.pbio.1001247

Niner, H.J., Milligan, B., Jones, P.J.S., Styan, C.A., 2017a. Realising a vision of no net loss through marine biodiversity offsetting in Australia. Ocean Coast. Manag. 148, 22–30. https://doi.org/10.1016/j.ocecoaman.2017.07.006

Niner, H.J., Milligan, B., Jones, P.J.S., Styan, C.A., 2017b. A global snapshot of marine biodiversity offsetting policy. Mar. Policy 81, 368–374. https://doi.org/10.1016/j.marpol.2017.04.005

Power, M., 2009. The risk management of nothing. Accounting, Organ. Soc. 34, 849–855. https://doi.org/10.1016/j.aos.2009.06.001

Power, M., 2007. Organized uncertainty: Designing a world of risk management. Oxford University Press, Oxford, UK.

Power, M., 2003. Evaluating the audit explosion. Law Policy 25, 185–202. https://doi.org/10.1111/j.1467-9930.2003.00147.x

Power, M., 1997. The Audit Society: Rituals of verification. Oxford University Press, Oxford, UK.

Power, M., 1994. The audit explosion, Demos. Demos, London.

Quétier, F., Lavorel, S., 2011. Assessing ecological equivalence in biodiversity offset schemes: key issues and solutions. Biol. Conserv. 144, 2991–2999.

Quigley, J.T., Harper, D.J., 2006. Effectiveness of fish habitat compensation in Canada in achieving no net loss. Environ. Manage. 37, 351–366. https://doi.org/10.1007/s00267-004-0263-y

Radnor, Z., 2008. Muddled, massaging, manœuvring or manipulated?: A typology of organisational gaming. Int. J. Product. Perform. Manag. 57, 316–328. https://doi.org/10.1108/17410400810867526

Robertson, M., 2012. Measurement and alienation: Making a world of ecosystem services. Trans. Inst. Br. Geogr. 37, 386–401. https://doi.org/10.1111/j.1475-5661.2011.00476.x

Robertson, M.M., 2006. The nature that capital can see: science, state, and market in the commodification of ecosystem services. Environ. Plan. D Soc. Sp. 24, 367–387. https://doi.org/10.1068/d3304

Robertson, M.M., 2004. The neoliberalization of ecosystem services: Wetland mitigation banking and problems in environmental governance. Geoforum 35, 361–373. https://doi.org/10.1016/j.geoforum.2003.06.002

Robertson, M.M., 2000. No net loss: Wetland restoration and the incomplete capitalization of nature. Antipode 32, 463–493. https://doi.org/10.1111/1467-8330.00146

Rothstein, H., Huber, M., Gaskell, G., 2006. A theory of risk colonization: The spiralling regulatory logics of societal and institutional risk. Econ. Soc. 35, 91–112. https://doi.org/10.1080/03085140500465865

Shore, C., Wright, S., 2015. Governing by numbers: Audit culture, rankings and the new world order. Soc. Anthropol. 23, 22–28. https://doi.org/10.1111/1469-8676.12098

Spash, C.L., 2015. Bulldozing biodiversity: The economics of offsets and trading-in nature. Biol. Conserv. 192. https://doi.org/10.1016/j.biocon.2015.07.037

State of Queensland, 2020. Queensland Environmental Offsets Policy (Version 1.6).

State of Queensland, 2015. Environmental Offsets Act 2014.

State of Queensland, 2014. Environmental Offsets Regulation.

Sullivan, S., Hannis, M., 2017. “Mathematics maybe, but not money”: On balance sheets, numbers and nature in ecological accounting. Accounting, Audit. Account. J. 30, 1459–1480. https://doi.org/10.1108/AAAJ-06-2017-2963

ten Kate, K., Bishop, J., Bayon, R., 2004. Biodiversity offsets: Views, experience, and the business case. IUCN--The World Conservation Union, Gland, Switzerland and Cambridge, UK.

Vaissière, A.-C., Levrel, H., Pioch, S., Carlier, A., 2014. Biodiversity offsets for offshore wind farm projects: The current situation in Europe. Mar. Policy 48, 172–183. https://doi.org/10.1016/j.marpol.2014.03.023

Van Dover, C.L., Ardron, J.A., Escobar, E., Gianni, M., Gjerde, K.M., Jaeckel, A., Jones, D.O.B., Levin, L.A., Niner, H.J., Pendleton, L., Smith, C.R., Thiele, T., Turner, P.J., Watling, L., Weaver, P.P.E., 2017. Biodiversity loss from deep-sea mining. Nat. Geosci. 10, 464–465. https://doi.org/10.1038/ngeo2983

Van Dover, C.L., Aronson, J., Pendleton, L., Smith, S., Arnaud-Haond, S., Moreno-Mateos, D., Barbier, E., Billett, D., Bowers, K., Danovaro, R., Edwards, A., Kellert, S., Morato, T., Pollard, E., Rogers, A., Warner, R., 2014. Ecological restoration in the deep sea: Desiderata. Mar. Policy 44, 98–106. https://doi.org/10.1016/j.marpol.2013.07.006

Walker, S., Brower, A.L., Stephens, R.T.T., Lee, W.G., 2009. Why bartering biodiversity fails. Conserv. Lett. 2, 149–157. https://doi.org/10.1111/j.1755-263X.2009.00061.x

Wilshusen, P.R., 2019. Environmental governance in motion: Practices of assemblage and the political performativity of economistic conservation. World Dev. 124, 104626. https://doi.org/10.1016/j.worlddev.2019.104626