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Who Speaks for the River? Exploring Biodiversity Accounting using an Arena Approach

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1. Introduction

In confronting the unsustainability of human activity and attempting to define a 'safe operating space' for humanity, Rockstrom et al. (2009) estimate that biodiversity loss is one of nine planetary boundaries that have already been transgressed. The United Nations' *Millennium Ecosystem Assessment* has extensively documented the extent to which ecosystems have been rapidly altered and global biodiversity has been subject to negative change (UNEP, 2005). Concerns over ecosystem degradation have led to the emergence of international agreements, including the *Convention on Biological Diversity* (1992). These agreements seek to establish policy frameworks for biodiversity and encourage recognition of ecosystem services and biodiversity within decision-making (for example TEEB, 2009). A range of ecological indicators and economic analyses are being developed as metrics to account for biodiversity and to engage with policy-makers and businesses (TEEB 2011; 2012), and forms of environmental reporting have been recognised as a potentially important means to recognise and measure the value of the natural environment (Thompson & Mackey 2010; Mackey & Galbraith 2011).

Within this context, social and environmental accounting and reporting (SEAR hereafter) may have an important role to play in helping to bring about substantive social and ecological change (Gray & Milne, 2002, Unerman et al., 2007). A major focus within the SEAR policy and research field has been the development of organisation-centred forms of accounting and reporting. At the same time, however, some academic SEAR studies have concluded that organisation-centred disclosures may perpetuate, rather than reform, unsustainable organisational and societal behaviour. One of the most significant issues raised by critics is the identification of the organisation itself as the 'accounting entity'. The application of sustainability to the organisational entity may be argued to be fundamentally incompatible, since "sustainability is a *systems* concept, and not an organisational concept... [that] suggests broader eco-system based approaches that require an understanding of cumulative environmental change, and, most likely, new and alternative decision-making arrangements and institutions" (Milne & Gray, 2007, p. 195). Whilst existing organisational sustainability disclosures may claim to respond to such system-level concerns, critics also point to the consequences of such disclosures in legitimating unsustainable 'business-as-usual' practices. Such critics conclude that effective sustainability reporting may not be possible "until we see a shift in emphasis towards accounting for ecosystems and to accounting for communities" (Gray & Milne, 2002, p. 69).

Within the wider academic SEAR literature, the subject of biodiversity has also begun to receive increasing attention (see also Jones & Solomon, 2013, for a more detailed review). Early studies in biodiversity accounting focused on the development of a natural inventory model (see for example Jones, 1996; 2003), while more recent studies have also contributed to the understanding of biodiversity impacts of organisations, especially corporations (Houdet et al., 2012; Rimmel & Jonäll, 2013). However, other recent studies locate accounting for biodiversity in the context of compliance with the broader governance systems within which organisations and corporations operate. For example, Schneider & Samkin (2012) identify legislative programmes in which public sector agencies must adhere to when reporting on biodiversity within legal jurisdictions in New Zealand, while Thomson (2014, in this edited collection) examines the use of biodiversity indicators to report against implementation of biodiversity policies in the United Kingdom.

These studies demonstrate the need to widen the lens through which we examine accounting for biodiversity, and to situate organisation-centred SEAR alongside other potential sources of biodiversity accounting and reporting which are not limited to organisational disclosures and traditional accounting techniques. Alongside governance systems and frameworks, we suggest it is equally important to consider the potential role of other non-corporate actors in framing and legitimising (or de-legitimising) the ecological and biodiversity impacts of organisations. Often associated with these framing activities are a range of alternative accounting techniques and reporting mechanisms, which we refer to as *external accounts*.

External accounts are produced and/or used by stakeholders such as non-governmental organisations, academics or the public sector (Dey et al., 2010). External accounting and reporting is often produced when some degree of public controversy has followed the impact of organised human activity on the environment (see, for example, Georgakopolous & Thomson, 2008; Tregidga, 2013). Such controversies illustrate the importance of the engagement dynamics in the wider discursive 'arena' inhabited by corporations and external actors such as regulators, pressure groups and the media. External reports may be argued to better address sustainability issues, including biodiversity loss, by enabling a more 'system-level' reconceptualisation of the reporting entity and its impacts (Georgakopolous & Thomson, 2008). In this chapter, we will examine the significance of the wider engagements, and external biodiversity accounts produced, within a contested arena inhabited by corporations, government regulators and other active stakeholders. In doing so, we evaluate the use of the arena approach to in examining accounting for biodiversity, and consider the extent to which external accounts and accounting can facilitate substantive social and ecological change.

The remainder of the chapter is structured as follows. Firstly, we provide a brief overview of the arena approach that frames our study of wider engagement dynamics and external accounting practices. Secondly, we outline the history and key characteristics of the setting for our study, a hydroelectric power scheme located in the Tummel catchment in Scotland. We explain the significance and controversy surrounding the status of River Garry, a water body which is directly affected by the Tummel scheme, and which is the empirical focus of our analysis. We then outline the key elements of water regulation in Scotland, and explore how its implementation has impacted on the River Garry, and how key arena participants have sought to engage and influence the governance of the river using their

own accounts and reports of biodiversity. Finally, we consider the wider significance of our analysis for current and future biodiversity accounting research.

2. Applying an arena approach to explore biodiversity accounting

Reducing the rapid decline of biodiversity is just one of the major sustainability challenges facing governments, organisations and communities. As we have briefly outlined in our introduction, the particular issue-based and dynamic nature of sustainability challenges benefits from a different lens through which to frame engagement dynamics and reporting practices. In this chapter, we draw on Renn's (1992) arena approach, as used in the SEAR literature by Georgakopoulos & Thomson (2008) in relation to salmon farming in Scotland.

Broadly speaking, the arena approach may be thought of as "a metaphor that describes the symbolic location of actions that influence collective decisions [and which] attempts to explain the process of policy formulation and enforcement in a specific context" (Georgakopoulos & Thomson, 2008, pp. 1120). As a 'skeletal' heuristic, the arena approach is flexible in a wide variety of contexts. It is especially appropriate to the study of sustainability and biodiversity accounting because it can:

"differentiate stakeholders and consider a wide range of interactions and engagement dynamics [...] The arena metaphor subtly alters the entity concept away from a single organisation towards an issue or specific problem around which different organisations engage [...] and provides a structure to differentiate engagement activities that inform social and environmental discourses and describe the context of any accounting disclosures." (2008, p. 1118)

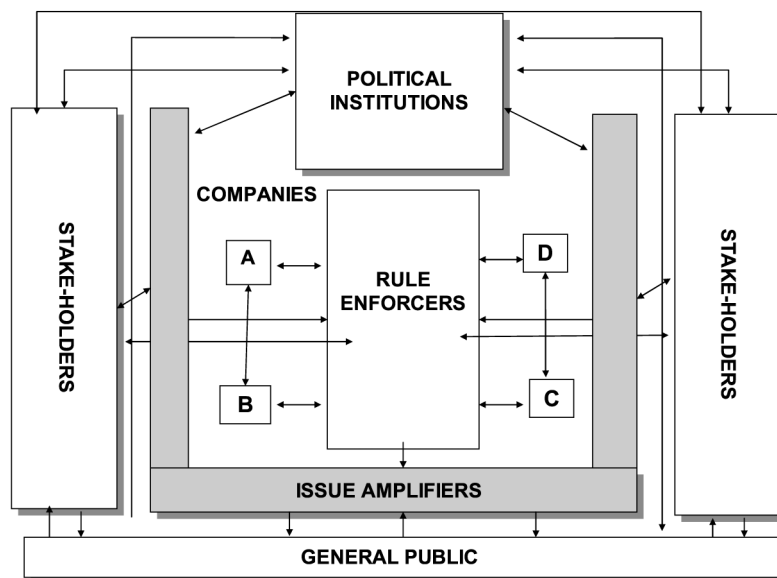


Figure 11.1: Renn's (1992) arena concept (source: Georgakopoulos & Thomson, 2008, p.1120)

As Figure 11.1 shows, the centre of any arena is inhabited by companies and those charged with enforcing the 'rules' by which such companies must comply. These 'rule enforcers' typically gain their authority legislatively from relevant political institutions. Surrounding this central arena is an audience of wider stakeholders, who may adopt explicit 'pro' or 'anti' positions within the arena, and the general public. Finally, mediating the relationship between the central arena participants and this wider audience are so-called 'issue amplifiers', who "play a role analogous to "theatre critics" observing actions on stage, communicating with the participants, interpreting their findings and reporting to others. Issue amplifiers can influence arena dynamics by mobilising public support for particular factions within the arena." (Georgakopoulos & Thomson, 2008, p.1121). Within many contested arenas, the print and broadcast news media will often act as issue amplifiers, but others may also play a key role in drawing in audiences, including bloggers and other social media users, academics, think-tanks, and campaigning NGOs.

Arena participants do not remain passive, but engage actively within it in an attempt to influence outcomes and decisions. The arrows in Figure 11.1 indicate the potential range of different engagements that may occur. A primary characteristic of such engagements is "demands for the giving and receiving of accounts" (ibid, p. 1121). Rule enforcers may use the mechanism of *compliance* reports and accounts. However, the giving and receiving of accounts may encompass not only *compliance* reporting, but a range of other, voluntary reporting activities undertaken by arena participants. These reports may be broadly characterised as either *legitimising* (supportive of) or *problematizing* (reforming) companies' activities. Legitimising accounts often originate from companies themselves, while problematising accounts are external in nature and are produced by non-corporate stakeholders active within the arena.

In this chapter we use the arena approach to examine biodiversity accounting and reporting in the context of freshwater governance and hydroelectric energy generation in Scotland. This approach allows us to identify a range of different accounts produced within the engagements that take place between arena participants, including the corporate owner/operator of the hydro scheme, the Scottish Government and its regulatory agencies, as well as other non-corporate actors. The accounts produced by these participants include compliance accounts, as well as legitimising (corporate) and problematising (external) accounts. We find that there is a shift away from organisation-centred biodiversity accounting towards a more system-level conceptualisation of the accounting entity. When viewed from a more explicit system-level ecological perspective, the primary entity in our case study of the Tummel scheme is understood as the river and surrounding catchments, with the secondary entities being the organisation that owns and operates the scheme, as well as the associated regulatory and stakeholder actors. Thus, the arena approach, combined with an system-level ecological perspective enables us to explore the status of this primary ecological 'accounting entity' – the river - by examining a range of different biodiversity accounts concerning the River Garry and the operation and regulation of the Tummel scheme.

3. Biodiversity, fresh waters & the case of the Tummel hydroelectric scheme

Scotland's iconic landscapes, coastal areas and seas are recognised as fundamental to the quality of life and livelihoods in Scotland (Warren, 2002). Scotland's fresh waters represent 90% of Great Britain's surface waters (Spray, 2011), while its river systems play host to important populations of species including the Atlantic salmon. The natural environment is also a key asset that underpins Scotland's future economic growth prospects, generating an estimated £17 billion annually (Blaney & Rowse, 2011). Tensions may therefore exist between the need to conserve and restore Scotland's ecosystem alongside demands for economic development.

One key example of such tensions concern conflicts between the restoration of river systems' ecological biodiversity and the generation of hydro-electricity. This tension may be summarised as "ensur[ing] that benefits of switching towards greater use of renewable resources such as hydroelectricity are not undermined by the different forms of harm that they may cause" (Reid et al., 2005, pp. 361-362). Here, we examine these tensions in the context of the Tummel hydroelectric scheme. The scheme is located near the town of Pitlochry in Scotland, within the river catchment which gives its name. It is one of the biggest schemes in the country, with an installed capacity equivalent to around 2.5% of Scotland's total electricity consumption (Black et al., 2002). Like many in operation in Scotland, the Tummel scheme relies upon the diversion (or so-called 'abstraction') of water from a number of river catchments via tunnels or viaducts and into reservoirs, in order to maximise the cascade effect needed to drive turbines and generate electricity. This form of renewable power generation delivers environmental advantages compared to thermal or nuclear sources which are increasingly significant in the context of the Scottish Government's legally-binding commitment to reduce carbon emissions by 80 per cent by 2050, under the Climate Change (Scotland) Act 2009 and the 'Hydro Nation' policy initiatives to develop the value of the country's freshwater resources (Scottish Government, 2012).

The potential economic and environmental benefits and impacts of hydro-electricity, alongside other renewable energy sources, are currently the focus of significant political and media interest and debate in Scotland. These debates centre upon the recognition that hydroelectric schemes require the abstraction of water and the creation of artificial reservoirs, which may also have negative consequences for the ecological and biodiversity status of the rivers involved and their surrounding ecosystems. In very broad terms, such impacts could include "loss of land and habitat, alteration of hydrological regime and aquatic ecology, [and] disruption of riverine fisheries" (Reid et al., 2005, p. 363). These immediate impacts (perhaps especially the disruption to fisheries or loss of land) may themselves create further negative social and economic consequences for people who live nearby, or whose livelihoods or recreational experiences are affected.

In the 1930s, the first large-scale hydro-electric power stations were built in the central Highlands of Scotland, where the Tummel Scheme is located. These assets were nationalised in the 1940s, further developed during the 1950s and 60s, before being returned to private ownership in the early 1990s. Currently, there are nine power stations within the Tummel scheme, which is owned and operated by Scottish & Southern Energy plc (SSE). Figure 11.2 below shows a map of the scheme and its major elements:

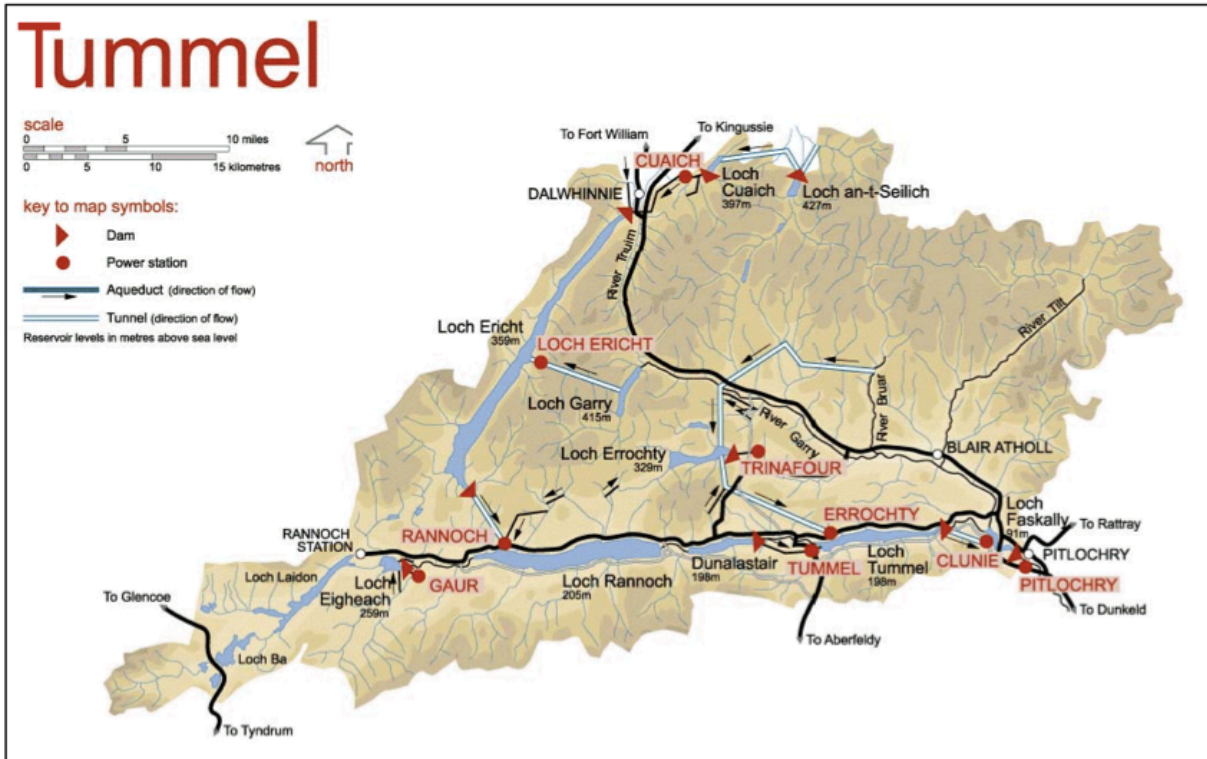


Figure 2: Schematic of the Tummel hydroelectric power scheme (source: SSE, 2010, p.5)
[USED BY PERMISSION]

The Tummel scheme has imposed a number of artificial structures on the landscape, including dams, aqueducts and power stations. The creation of these structures has in turn had significant hydrological impacts on the water bodies affected. One of the most visible is evident in the upper River Garry, a tributary of the River Tummel (shown on Figure 11.2 just north of Trinafour power station). This section of the river drains a catchment of 125km², but is completely diverted into a number of tunnels. Firstly, water is diverted west (the opposite direction from the normal downstream direction of drainage) from Loch Garry down to Loch Ericht. Then, approximately 9km east of Loch Garry, a second abstraction point collects water from side streams that feed into this stretch of the river, this time diverting the water south via another tunnel to Loch Errochty. The complete abstraction of water from the upper Garry leaves the downstream riverbed dry, except for any spillage (Black et al., 2002). The consequences of this affect the river for a distance of approximately 20km, from the dam at the end of Loch Garry to the Garry's confluence with the Errochty Water. The resultant ecological impact on this stretch of the River Garry (much of it highly visible as it runs directly beside the main road between Perth and Inverness) has been highly controversial, especially in terms of its productivity as a salmon river. The situation has been described as "probably the worst example of over-abstraction in Scotland, and among the worst in the UK" (TDSFB, 2006, p. 25). It is to this particular controversy concerning the River Garry that we will return in our exploration of the contested arena surrounding the impact on biodiversity of the Tummel scheme.

As the scheme's controlling entity, SSE's behaviour, and its disclosures, are clearly relevant to an exploration and assessment of the biodiversity impact of the hydro scheme. SSE has been publishing annual voluntary environmental reports since 1999, the year after the company was formed following a merger between Scottish Hydro-Electric plc and Southern Electric plc. A detailed examination of these annual reports is beyond the scope of our study. Nevertheless, a brief overview of SSE's disclosures illustrates the extent of the coverage of biodiversity issues and of the ecological impact of hydroelectric schemes, particularly regarding the River Garry and salmon fishing.

In its early annual environmental reports, SSE recognised the environmental aspects of hydropower as the "disruption of fish migration if [hydro schemes are] maloperated; the modification of timing and rate of river flows; visual impact; and loss of habitat" (1999, p.4). Between 1999 and 2001, the company's reports make only general reference to the importance of conservation in relation to land, birds, mammals and fish. Any ecological policy is limited to a statement of broad principle, to "avoid works on sensitive areas if practical, [and to] research fisheries and work with relevant organisations" (2001, p. 19). However the company also qualifies these principles by stating that, "our licence obliges us to develop the least cost option for new electricity connections [and that it is necessary to] recognise trade-offs between wild fish conservation and fish taken for sport" (p.19). The company states that its "hydro schemes are designed and operated to minimise the impact upon fish" (p. 23) and that "Environmental Impact Statements are produced for relevant projects, which include an assessment of ecological impacts and proposed mitigation measures where necessary" (p.22). However, these additional compliance statements are not included within its annual disclosures.

No explicit mention is made of biodiversity anywhere in SSE's reports until 2002, where the company states that "the biodiversity of the planet is an important resource for both the present and the future", while repeating the earlier general statement about regulatory compliance. More information is also given on the fish-related impact of hydro schemes. The 2002 report offers the general statement that "river flows are maintained in very many locations below power stations or diversion weirs and it is the Group's responsibility to produce these compensation flows all year round to protect not only fish populations, but aquatic biodiversity in general". In its 2003 report, the company acknowledges that, "it is difficult, if not impossible, to provide quantitative information on performance in terms of biodiversity and ecology". SSE does attempt to provide illustrative examples and vignettes in some of its reports, though never from the River Garry. It also offers the general statement; "SSE is working closely with the Scottish Executive and the Scottish Environment Protection Agency (SEPA) to ensure that the River Basin Management Plans which are developed over the next few years enhance the general environment by identifying improvements to local ecology while maximising the output of renewable energy".

From 2003 until 2010, the company's disclosures in relation to biodiversity generally amount to broad policy statements, such as this one from 2009:

"SSE understands the importance of the UK's built and natural heritage, including its biodiversity [...] In this context, SSE's first priority is to meet international and national statutory obligations to protect designated areas, species and habitats of natural heritage. Amongst other things, this involves maintaining a high degree of interaction and co-ordination with environmental and conservation agencies and organisations seeking authoritative views on environmental matters

and, where possible, going beyond the minimum requirements of statutory obligations. The importance of safeguarding biological diversity is particularly acute where SSE is undertaking major projects in electricity generation, transmission and distribution.” (SSE, 2009, p, 30)

Likewise, its disclosures in relation to the ecological impacts of hydro generally consist of the following statement, which appears in several reports:

“The operation of SSE’s hydro-electric schemes – in particular the abstraction and impoundment of water – is already closely licensed, as are the steps taken to mitigate the impact of the schemes, such as the release of ‘compensation’ water and the provision of fish passage facilities. There are also additional mitigation measures where a specific environmental benefit has been identified such as close control over reservoir ranges or fluctuations.” (SSE, 2009, p, 26)

Other than these relatively brief and general statements, SSE does not appear to provide a full account of the biodiversity impacts of its operations, particularly at the disaggregated level of specific sites or schemes where energy is generated. As far as we are aware, SSE has never made a direct reference to the environmental issues surrounding the River Garry in any of its annual disclosures, although the company has very occasionally published other publicity material on the subject (SSE, 2007; 2010).

Whilst SSE’s voluntary SEAR offers relatively little in the way of comprehensive biodiversity disclosure, it is important to note that the company may produce such information in the form of reports and impact assessments produced in order to comply with the terms of the statutory licenses governing the operation of new and existing hydro schemes. Thus it is important to also examine websites and documentation of regulators for relevant accounts and reports. The regulation of water abstraction in Scotland, both during and since its development, is therefore a pivotal part of the contested arena surrounding the biodiversity impact of the Tummel scheme. The next section outlines the main elements of the Europe-wide framework for the regulation of water resources that has emerged since 2000.

4. Rule-enforcement over water resources: the Water Framework Directive

The majority of the Tummel scheme was developed between the 1940s and 1960s, at a time when the generation of electricity when statutory frameworks for water resources management were often highly fragmented and at times even non-existent (Fox & Walker, 2002; Reid et al., 2005). Consequently, the large-scale abstraction of water involved in schemes such as Tummel was approved with minimal controls, leading to the adverse circumstances in the upper River Garry. Since the development of scheme, the regulatory context has gradually evolved, with the arrival of a Europe-wide legal framework in 2000 finally delivering proper regulatory scrutiny over water resources in Scotland (Fox and Walker, 2002).

The European Water Framework Directive (WFD) (EC, 2000) is concerned with a wide range of impacts on the freshwater environment, including water abstraction. The WFD establishes the natural ecological

and hydrological entity of water bodies alongside other competing artificial or economic entities. The primary objectives of the WFD are to prevent deterioration of environmental quality and to protect, enhance and restore water bodies with the aim of achieving so-called 'good ecological status' by 2015. Broadly speaking, the ecological status of a water body measures the extent to which human intervention has adversely affected the structure and condition of the aquatic ecosystem it supports. 'Good' ecological status effectively indicates that human activity has had very little impact on the ecological characteristics of the river ecosystem. However, ecological status may also be adversely affected by a range of different pressures and impacts that arise from a variety of industrial activities, including electricity generation (SEPA, 2007). In such circumstances, any water bodies affected would require further management and mitigation in order to achieve good status by 2015.

The management and improvement of the ecological status of rivers is achieved in the WFD via so-called River Basin Management Plans (RBMPs). Plans are undertaken within a six-year timeframe, with the current (first) planning cycle spanning 2009 to 2015. In general terms, these plans involve: an initial ecological characterisation of all individual water bodies within the river basin district; an identification of any pressures and impacts; the setting of environmental objectives; and programs of measures to allow those objectives to be met and restore or maintain the ecological status of the water body. The characterisation of the ecological status of water bodies lies at the heart of the process. The characterisation is essentially a scientific issue that may be measured via a range of quality elements and resulting in a report of ecological status. The main elements are: *biological*, including composition and abundance of species such as invertebrates and fish; *chemical*, including oxygen and nutrient levels; and *hydromorphological*, including water flows and levels, the condition of beds, banks and shores, and the continuity of rivers for fish migration (Scottish Government, 2010). Once measured, these elements can be compared against relevant typological standards and the status of the water body classified on a five-point scale, ranging from high, to good, moderate, poor and bad.

The operation of the WFD suggests that human pressures or impacts arising from economic activity, particularly large-scale industrial activity such as hydro-electricity, are likely to clash with the framework's objective of restoring good ecological status by 2015. Crucially, while good ecological status may be the 'default' target for water resource management, the WFD explicitly accommodates the existence of other economic or social considerations, and recognises that these considerations may necessitate some level of prioritisation or proportionality over purely ecological concerns. The primary mechanism by which such considerations are accommodated is through the identification of so-called Heavily Modified Water Bodies (HMWBs). If a water body is designated as heavily modified, the target of good ecological *status* is replaced by good ecological *potential*. The latter differs significantly from the measurement of ecological status, and may be defined as "the best that could be achieved... without putting in place mitigation... that would have a significant adverse effect on the relevant use or on the wider environment" (Scottish Government, 2010). The HMWB designation effectively means that, rather than managing and improving water resources purely on the basis of ecological status, "to a considerable degree, the WFD requires environmental regulators to compare the [economic] *costs and benefits* of achieving improvements [to water bodies]" (Hanley & Black, 2006, p. 157, emphasis added). More specifically, only mitigation measures that do not significantly damage the existing use of the

water body may be considered, and even then, the costs of doing so will still need to be estimated and judged in terms of some notion of proportionality.

To summarise, the core objectives of the WFD are based upon the scientific evaluation of the ecological status of individual water bodies and their ecosystems, with a strong emphasis on restoration and maintenance of these ecosystems. This regime centres on the production of biodiversity accounts which explicitly privilege rivers and other water bodies as the primary entity, and which use expert scientific techniques to provide a comprehensive assessment of the ecological status. This is one example of a biodiversity account that differs from more familiar forms of voluntary, organisation-centred sustainability reporting. However, in circumstances where water bodies are heavily modified for industrial uses such as hydropower, and where some degree of proportionality is deemed necessary by the regulator, the objectives of the framework are diluted, and the measurement system augmented, with one that is based on the economics of cost-benefit analysis.

In the next section, we outline the statutory arrangements and agencies responsible for the implementation of the WFD in Scotland, and begin to explore the implications of the designation of HMWB status to the management of the upper River Garry – the most heavily abstracted (and controversial) water body within the Tummel hydro scheme.

5. Regulating Abstraction of the River Garry

In Scotland, the statutory implementation of the WFD was achieved via the Water Environment and Water Services (Scotland) Act 2003. The Scottish Environmental Protection Agency (SEPA) acts as the competent authority to prepare RBMPs and secure compliance with the WFD. Activities such as water abstraction are subject to statutory control through the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (later revised in 2011; 'CAR' hereafter). This requires water abstractors such as hydro-scheme operators to be licensed by SEPA. In the case of hydroelectric schemes, these licences could, for example, set new limits on the amount of water that could be abstracted from rivers.

As the implementation of the WFD in Scotland took shape, the elements of the new RBMP began to emerge, in preparation for the initial planning cycle in 2009. The thousands of individual water bodies within the Scottish RBD underwent ecological analysis and characterisation, and a significant minority were assessed as 'at risk' ecologically. Of those water bodies at risk, some were further designated HMWBs, including many downstream of hydroelectric scheme infrastructure. Figure 11.3 below shows the initial ecological characterisation undertaken by SEPA of the historically controversial stretch of the River Garry downstream of the intake responsible for the complete abstraction of water from that section of the river (SEPA, 2009).

RBMP Water body information sheet for
water body 6911 in Tay

General details

Water body name: River Garry from Garry Intake to Errochty Water confluence
 Water body Identifier code: 6911
 Length: 13.20 km
 Water body category: River
 Baseline: Y
 River basin district: Scotland
 Area advisory group: Tay
 Catchment: River Tay

Complete classification for this water body in 2008

Parameter	Status	Confidence of Class
OVERALL STATUS	BAD ECOLOGICAL POTENTIAL	MEDIUM

Parameter	Status	Confidence of Class
Pre-HMWB status	Bad	Medium
Overall chemistry	Pass	Low
Priority substances	Pass	Low
Overall ecology	Bad	Medium
Physico-Chem	High	High
Temperature	High	High
Soluble reactive phosphorus	High	High
pH	High	High
Dissolved Oxygen	High	High
Biological elements	Poor	Low
Phytobenthos	High	High
Macrophytes	High	Low
Benthic invertebrates	High	High
Macro-invertebrates (acid)	High	Low
Macro-invertebrates (RiCT)	High	High
Macro-invertebrates (ASPT)	High	High
Macro-invertebrates (NTAXA)	High	High
Alien species	High	Low
Fish	Poor	Low
Fish ecology	High	Low
Fish barrier	Poor	Low
Specific pollutants	Pass	High
Ammonium	Pass	High
Hydromorphology	Bad	Medium
Morphology	Good	Medium
Hydrology	Bad	Medium
Hydrology (impoundment)	Bad	Medium
Hydrology (abstraction)	Bad	Medium
Regulatory ammonium	High	High
Water quality	High	
Morphological pressures	Poor	

Figure 11.3: Extract of RBMP Water Body information sheet for a section of the River Garry (Source: SEPA, 2009)

As part of an early Europe-wide process for trial identification and designation of HMWBs, the Tummel and Garry rivers were selected as one of three case study areas in Scotland (Black et al. 2002). Technical accounts of the draft ecological characterisations, HMWB designations, and economic cost/benefit analyses required as part of the process set out in the WFD are laid out in great detail in these case studies (see Hanley & Black, 2006; MacLeod et al., 2006; Moran & Dann, 2008).

The expert stakeholders involved in the project quickly concluded that removal of the hydro scheme infrastructure was not feasible on technical or cost grounds, and that the best available proportionate response was the consideration of alternative scenarios involving the continued operation of the power scheme, while adopting mitigation measures in order to improve the ecological potential of the water bodies involved. The principal mechanisms identified by the technical case study were (1) the use of compensation flows released into the rivers immediately downstream of hydro scheme infrastructure, and (2) upgrading of fish passes to enhance their effectiveness. Three possible sets of mitigating options relating to the use of these measures on the upper River Garry were selected, and proceeding on this basis, the expert team then attempted to quantify the costs and benefits of the various modifications that might improve the ecology of the water bodies involved, and these are summarised in Table 11.1 below.

Option	Length of river where salmon fishing restored	Capital & running costs (a) (£000)	Lost water cost (b) (£000)	Total cost (a + b) (£000)	Benefits of restoration (£000)
1	17 km	1,097	513	1,610	54
2	11 km	49	329	378	30
3	11 km	49	342	391	30

Table 11.1: Costs of restoring good ecological status to the upper River Garry: annualised costs/benefits (adapted from Black et al., 2002)

A significant element of cost associated with each modification (the 'lost water cost' column in Table 11.1) was based on lost electricity generation in annual MWh, valued using a standard figure of £26/MWh to represent typical values for the Tummel catchment. Economic benefits (the 'benefits of restoration' column in Table 1) were defined as benefits to organisations and individuals, which would arise as a result of changes in the ecology. However, in the technical case study, the expert group decided that, for practical reasons, the only assessments of economic benefit that could be made were for direct improvements in increased fishing revenues. This was estimated by predicting the change in salmon fishing in the affected areas, and valuing these using actual data for current rents per km for privately-owned beats, or by estimating impacts on valuations using estimates of the increased numbers of fish which might be caught (based on a figure of £250 per salmon caught). No attempt was made to quantify benefits to the ecology (again for technical reasons) although similar exercises have taken place elsewhere in Scotland at the River Clyde (Hanley & Black, 2006).

Table 11.1 indicates that, in each of the possible proposed options, the cost/benefit analysis appeared to decisively rule out making even modest hydrological modifications to compensation flows and fish passages. However, the case study authors also recognised the subjective and limited nature of this assessment, and eventually went on to conclude that, despite the failure of abstraction controls to pass the cost/benefit test, mitigation could still be justified, so long as the relative size of the catchment area was significant (in excess of 20km²) and no compensation flows currently existed.

When SEPA eventually published its final assessment of the upper River Garry (SEPA, 2009), the document did include a general outline of provision for revised levels of abstraction, flow regulation and changes to improve fish passage on the stretch of the River Garry downstream of the hydro intake system. The document also imposed a deadline of December 2014 (i.e. just before the end of the current RBMP six-yearly planning cycle). However, it did not specify in detail exactly what measures were to be taken. Instead, the variation of the relevant CAR 'controlled activities' licence for the Tummel scheme was the mechanism by which the precise substance of such measures was yet to be determined.

SSE, as the owner/operator of the scheme (rather than SEPA as the regulator) is responsible for compliance with the general requirements for mitigation laid out in the RBMP, and able to propose variations to the activities that are licensed by CAR. In 2010, SSE formally applied to SEPA to make a number of specific changes to the abstraction system in place within the Tummel scheme. Many of these changes aimed at improving the ecological status of the upper River Garry (SSE, 2010). The proposals included the provision of a minimum (or so-called 'hands-off') flow at the Garry intake, and the removal of the weir at the downstream end of this stretch of the Garry which prevents fish attempting to enter the upper stretch of the river. However, SSE's proposals explicitly ruled out any modifications to fish passage at the intake itself. This was rejected on the grounds that, while modifications to make upstream migration of adult fish were possible, the downstream passage of salmon smolts past the intake could not be achieved because of the extent of the specific engineering and structural difficulties involved. SSE also confirmed that the introduction of the new flow regime would be made without materially reducing the generating capacity of the existing hydroelectric scheme. This was achieved by effectively balancing up the water 'lost' into the Garry with reduced compensation flows on other rivers within the hydro scheme. In 2013, SSE's application to the regulator to vary its CAR licence agreement along these lines was still under evaluation by SEPA, and the outcome of the process was still pending¹. When the outcome of SEPA's determination of the application does finally emerge, any dissatisfied stakeholders have a further right to appeal to Scottish Ministers, who would then have the final say.

Our account of the main elements of the statutory regulation of the one of the most heavily abstracted parts of the Tummel hydroelectric scheme has so far explained how the role of rule-enforcement was pivotal to the comprehensive and systematic use of scientific measurement and reporting of the ecological and biodiversity status of the water bodies affected. The fundamental reconceptualisation of the accounting 'entity' achieved by the implementation of the RBMP process seems to be well aligned to the systemic issues identified at the beginning of this chapter. However, the subsequent implementation of the compliance elements of the statutory framework is considerably more complex, and arguably more 'watered down' than it first appears. This is evident in both the process underpinning

the designation of HMWB status, and in the subsequent application of economic cost/benefit analysis to the mitigation of the environmental damage occurring in HMWBs. This process was dependent on a degree of proportionality and the subjectivity. It was also dependent on a scientific assessment of the relationships between river ecology and any hydrological or morphological changes (i.e. water flows and levels, the condition of river beds, banks and shores, and the continuity of rivers for fish migration) that form the practical basis of river management (Soulsby et al., 2001; Gilvear et al., 2002). This compliance-based regime of biodiversity accounting therefore involves a wide variety of techniques of measurement, drawing on quite different epistemologies and rationalities and involving a number of different actors, not just owner/operators and regulatory bodies.

The regulation of Scotland's water bodies under the WFD is designed to be very open to the influence of various arena participants. One of these participants is of course SSE itself, who are actually given responsibility in the statutory provisions to propose their own mitigation measures. As explained earlier, while rule enforcers (in this case, SEPA and the Scottish Government) are always likely to be active within an arena, other participants will also seek to influence both the outcome of rule-enforcement, and the operation of the rules themselves. Next, we explore how stakeholders involved in or affected by the scheme, sought to influence the implementation of the WFD in Scotland using accounts of biodiversity.

6. Wider stakeholder involvement in external accounts of the Garry

A significant degree of wider stakeholder involvement is incorporated in the legislation passed to enact the WFD in Scotland, echoing the broader ambitions of the WFD itself (Kaika, 2003; Ioris, 2010). The Scottish statutory framework explicitly recognises and mandates the involvement of so-called 'responsible authorities', including local authorities, Scottish Water, Scottish Natural Heritage, the Forestry Commission, National Parks Authorities and District Salmon Fishing Boards. These authorities must work in conjunction with SEPA and Scottish Ministers to deliver appropriate solutions to more complex water quality issues (Scottish Executive, 2006). The implementation of the WFD in Scotland therefore offered a significant new route through which stakeholders' concerns about the over-abstraction of rivers, including the Garry, might be heard.

The contested nature of the state of the Garry generated a significant amount of wider interest from the public, media and civil society. Rather than comprehensively map the engagement activities of all of these arena participants, we restrict our interest here to briefly exploring the wider engagement activities of one of the most active of these participants, the Tay District Salmon Fisheries Board (TDSFB). The TDSFB is a statutory public body responsible for the management of salmon and trout within the River Tay catchment (TDSFB, 2006-2012). By preventing the passage of fish, particularly migrating species, water abstraction from the River Garry effectively placed the salmon fishing interests represented by the TDSFB in direct opposition to the Tummel hydroelectric scheme.

In addition to directly engaging SEPA and the Scottish Government, a major part of TDSFB's tactics – and external accounting practices – centred around attempts to mobilise other stakeholders and the wider

public. This was initiated through a campaign of issue amplification in the local media, including a new website², press and TV coverage, a petition, meetings with local politicians, and attendance at SSE's AGM (TDSFB, 2007). Following this publicity campaign, TDSFB formed a coalition with other local organisations, including landowning estates, tourist associations, and fishing associations. The coalition also launched a second website, 'Save the Garry'³, that further highlighted the environmental damage done to the River Garry and criticised the actions of SSE in failing to address the problem.

SSE's proposed remediation measures offered to restore a small flow to the River Garry, whilst making a commensurate cut in the flow of another river elsewhere in the hydro scheme. This was rejected by the TDSFB, who used scientific data to argue that this was "insufficient to optimize the potential juvenile salmon habitat and provide sufficient flow for adult salmon to spawn, apart perhaps from the very lowest reaches of the Garry" (2010, p. 37-38). However, in addition to reporting on the adverse biodiversity impacts on salmon, the TDSFB also devoted significant attention to addressing economic issues, and how these should be balanced against environmental interests. SSE's proposals to re-water the Garry at the expense of a loss of flow elsewhere were argued to be essential in order to protect the overall amount of installed generating capacity available. However, the TDSFB produced its own analysis of the impact of flow adjustments and water abstraction to argue that any loss in generating capacity caused by comprehensively restoring of the River Garry would be minimal, since:

"the amount of energy under consideration is actually irrelevant in the context of national energy production. If the proposed flows were to be restored... without reducing [other] flow[s], then the loss in generation would be equivalent to a continuous production of about 1.5 MW. This is about the same production as two modern land based wind turbines." (TDSFB, 2007, p. 25).

The TDSFB is a statutory agency and is formally represented within the water governance process. However this short vignette of TDSFB's engagement with others in relation to the River Garry illustrates how a significant part of TDSFB's engagement activity within the arena took place outside this formal channel, either through attempts to engage directly with Scottish Ministers, SEPA and SSE, or by a campaign of issue amplification. The alliance of stakeholders led by TDSFB which produced the 'Save the Garry' website represented a largely local and economic set of interests. While these stakeholders purported to 'speak for the river', it may be argued that their perspective was, to some extent at least, motivated by the direct and indirect economic rights and benefits associated with salmon fishing (whereby the salmon and fishermen were primary actors in the arena) on the Tay and its tributaries rather than solely associated with the restoration of ecological biodiversity of the river

7. Discussion and conclusions

The abstraction of water from the River Garry has been a controversial arena that has attracted the involvement and scrutiny of a number of participants, including the Scottish Government, its regulatory authorities, SSE as the commercial owner/operator of the hydro-electric scheme involved, various campaigning stakeholders representing local economic and environmental interests, and the print and

broadcast media. From an organisation-centred SEAR perspective, a case study of the River Garry controversy could have been conceptualised as a struggle for legitimacy, centred around the voluntary disclosures of the corporate owner/operator. However, disclosures specifically relating to the issues at stake in this arena were in fact largely absent from SSE's annual environmental reports. Instead, by using the arena approach, our study has identified a number of other significant accounting and reporting practices that provide a much more comprehensive view of biodiversity within the specific context of the River Garry.

Key amongst these alternative biodiversity accounts and reports were those produced to comply with the governance regime of the Water Framework Directive. The statutory implementation of the WFD has created a regime of freshwater governance with the potential to support the restoration of water bodies to 'good ecological status'. As a basis for new forms of biodiversity accounting, this regime is therefore potentially very significant. The statutory enactment of the WFD in Scotland created a new compliance regime that explicitly involved the regulator and several other participants within the enforcement process. In both the rule enforcement process and the surrounding arena, we observed several examples of the 'demanding and giving of accounts'. These engagement activities included reports of biodiversity in rule-enforcing compliance accounts, (corporate) legitimating disclosures and problematising (external) reports.

The regulatory framework incorporated multiple measurement systems, including cost-benefit analysis and those originating from the scientific disciplines of ecology and hydrology. The primary entity at the heart of the RBMP framework was the river. This was also disaggregated to water bodies affected at a micro (water body) level, then at an area level, and finally a national level (river basin district). Associated with this framework was a primarily scientific measurement process, undertaken independently by SEPA, which centred on the detailed assessment and characterisation of ecological status in a very comprehensive manner across thousands of water bodies within Scotland. Steps taken to improve the ecology and biodiversity of water bodies also depended on the scientific modelling of the relationship between ecology and hydrology.

However, while the core objective of the WFD is to achieve good ecological status of the river, improvements to the ecology of any of those water bodies significantly affected by human activity were subject to a degree of compromise and consideration of proportionality, as a result of the HMWB classification system. This classification explicitly lowered the degree of ecological improvement expected, and introduced measures of economic costs and benefits into the water body management process. For any HMWB, the regulator was required to consider the relative merits of existing human intervention on the water body, and to restrict required improvements to those that would not materially undermine the economic benefits accruing from such activity. Furthermore, the statutory mechanism to actually enforce any required improvements to 'controlled activities', in this case the abstraction of the Garry, operated using a licensing system where the primary entity at stake was no longer the water body itself, but the hydro-electric scheme.

Our study has also shown that biodiversity accounting is intertwined with broader concerns of freshwater governance. This was especially visible in the way that some actors sought to manage a

number of different responsibilities. In particular, SEPA acted not only as the official rule-enforcer, but also as independent scientific and economic monitor. In this way, much of the giving and demanding of accounts was focused around SEPA and its statutory powers. Though this role may appear powerful, SEPA's authority was also arguably undermined or diluted in a number of respects. SEPA was obliged to work collectively with other agencies and stakeholders in applying the rules of the framework. Through the CAR licensing mechanism, SEPA also delegated responsibility to SSE, as commercial operators of the Tummel scheme, to identify measures to improve the ecology of the water bodies involved. Finally, Scottish Ministers could also overrule SEPA's final decision on the license application.

During the period covered in our study, SSE made very little in the way of voluntary corporate disclosures specifically relating to the impact of the Tummel scheme on the River Garry and its biodiversity. Those disclosures that did emerge⁴ may perhaps be better understood as an attempt to maintain or repair the company's wider legitimacy in the face of a sustained campaign by a coalition of stakeholders led by the TDSFB. By contrast, the majority of the detailed biodiversity accounts provided by the company were provided in relation to the statutory CAR compliance regime. Such biodiversity accounts are not available via the company's website, but are publicly available through the SEPA website. Using the arena approach, we showed how the TDSFB's campaign utilised problematising external accounts of the river, which formed the basis for a strategy of media amplification. However, this campaign sought to reform, rather than radically alter, the operation of the scheme and the associated impact on the river. The campaigners did not demand the removal of the hydro scheme. Instead, they wanted more water to flow in order to allow salmon to survive (and perhaps ultimately be caught on the end of a fishing line). Their preferred framing of the key issue at stake boiled down to technical questions of how much compensation flow would be needed, and what the real opportunity cost of this flow would be in terms of power generation (and its equivalent in other renewable terms). TDSFB sought to equate the benefit of hydro generation to other forms of renewable power generation (the generating capacity lost being no more than equivalent to two wind turbines), in order to show that the economic and environmental benefits accruing from the continued maximisation of generating capacity through the complete abstraction of water from catchments such as the Garry were of marginal benefit.

Despite the apparently pivotal role of elements of biodiversity and ecology within the rule-enforcement process, we may conclude that attempts at ecological and/or biodiversity accounting remain problematic. Some accounts did attempt to capture the environmental issues at stake from the perspective of entities such as the water bodies and river catchments involved. However, engagements within the arena were also strongly influenced by prevailing economic concerns surrounding hydro-electricity generation and salmon fishing. Consequently, the possibilities of the WFD to support restoration of ecological biodiversity were limited. Ultimately, none of the arena participants we observed could really claim to 'speak for the river'. Instead, the dominant discourse continued to be driven by the importance of the economic and social benefits of the use of the river to SSE, the Scottish Government, the TDSFB and other key stakeholders.

In relying on documentary evidence that is available in the public domain from actors operating in this contested arena, we recognise that our perspective may exclude other insights from others living and

working within the settings explored here. Further empirical research would perhaps glean a better understanding of the complex dynamics of the arena and the visions for the catchment and the scheme that may continue to be (mis)aligned with aspirations to generate renewable energy, and restoration of the ecological biodiversity of rivers. For accounting research to contribute to sustainability challenges, future biodiversity accounting research needs to engage theoretically and empirically with the complexity and messiness of efforts currently underway to address social and environmental challenges whereby organisational accounts and reports are part of larger programmes of governance for sustainability.

Endnotes

¹ See http://www.sepa.org.uk/water/water_regulation/advertised_applications/1011485.aspx (accessed 30 January 2013).

² See <http://www.tdsfb.org/RiverGarryReport.htm> (accessed 30 January 2013).

³ See <http://www.savethegarry.com> (accessed 30 January 2013).

⁴ In June 2007, SSE's Chief Executive, Ian Marchant wrote to John Swinney MSP, to respond to criticisms of water abstraction in the River Garry. The letter was published on SSE's website as a press release (SSE, 2007). In 2010, SSE's CAR licence application was also accompanied by an additional ad-hoc public disclosure (SSE, 2010). The information leaflet, which was publicly available but not part of the company's annual environmental report, sought to explain the company's approach taken to resolving the re-watering of the Garry.

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