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Models of equilibrium, natural agency and environmental change: lay ecologies in UK recreational angling.

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Abstract

This paper studies how anglers in northern England invoke models of equilibrium and 'the balance of nature' in making sense of the water environments where they regularly fish, and how they use these models as norms or ideals when designing environmental management, alongside an emphasis upon natural agency and unpredictability. Like other publics, anglers are shown to be a heterogeneous group in how they think about nature and their 'lay ecologies' reflect the problematic way in which equilibrium is normalised in science and policy more generally, showing similarities with professional environmental managers. But anglers are unusual publics, because their lay ecologies are put to work in collectively managing water environments, through stocking, culling and habitat management. Thus anglers' environmental knowledge-practices coproduce the environments in which they develop their lay ecologies, making their models of nature and equilibrium important both conceptually and materially.

Introduction

Humans conceptualise environmental change in different ways, whether we are tending a garden or conducting scientific investigations. One model of nature that is often implicit in environmental management and conservation is a model of nature being normally in equilibrium, sometimes referred to as 'the balance of nature.' This model is particularly important where it influences the expectations that people have of environmental change and also (and as a consequence) the decisions that they make about how to manage it.

In this paper, we examine how this model of nature¹ implicitly shapes environmental management, by examining how recreational anglers invoke equilibrium and balance in making sense of and physically managing the water environments where they regularly fish. Anglers are in some ways an unusual public to study for their environmental perceptions and models of nature. Contrary to arguments about modern society being increasingly indoor, sedentary and disconnected from nature (e.g. Natural England 2008; *The Guardian* 2010), many anglers' idea of fun is precisely to be outdoors and walking along a riverbank in the countryside, often in poor weather. Moreover, they are also likely to read about environmental change for pleasure in angling magazines or on websites, albeit often accidentally alongside accounts of the latest big catch.

But more importantly, they matter because, like professional environmental managers in state agencies and similar organisations, how they think about nature also influences how they manage rivers and lakes, in that their knowledge-practices perform environmental realities (Law 2008; Waterton 2003), albeit on a scale somewhat less grand than that of management by state agencies. This makes anglers an important but neglected case study that enables us to challenge the too-easy assumptions often made about the 'lay' public

being ignorant (Wynne 1996) and therefore excluded from expert-led debates about environmental science and management.

Anglers are also a particular example of the pervasive influence of models of nature in environmental management and professional conservation more generally (e.g. Adams 1997; Zimmerer 2000). We thus contribute to the literature about knowledge-practices in science and technology and how these create reality through the work that they do (e.g. Law 2002, 2008; Waterton 2003) but we do so with particular reference to environmental science and management and by emphasising the heterogeneity of ways of thinking about nature, as illustrated through the disagreements between anglers about how best to manage their waters. We take a hybrid approach that understands fishing as a socio-natural practice (Latour 1993), rather than simply a way of 'consuming' the natural environment, as the literature on outdoor recreation sometimes assumes (e.g. Teisl and O'Brien 2003; Tarrant and Green 1999).

We begin by briefly outlining how equilibrium has been conceptualised in science and the associated problems for environmental management in practice. We then show how anglers invoke models of the ideal 'balance of nature' in their angling talk and how these are used to support or challenge different ways of managing the environment through geomorphological, vegetational and biological practices. Throughout, we emphasise that this 'lay' group of anglers is very diverse: some championed new forms of adaptive environmental management but others persisted in traditional practices of targeted intervention – a divide which we also compare with that in professional river management more generally (Adams *et al.* 2004).

Models of nature in science and management

The notion of 'the balance of nature' persists as a powerful but often unacknowledged influence in ecology, despite there being little consensus, clarity or consistency about what it means and how far it can be proved (Cooper 2001; Cuddington 2001; Trudgill 2008). For example, in fish and fisheries science, some papers have continually attempted to model equilibrium relationships (e.g. Dambacher *et al.* 2009; Einum *et al.* 2008; Persson *et al.* 2007; Walters *et al.* 2007) while others have produced evidence of long term instability and non-equilibrium relationships instead (e.g. Hastings and Powell 1991; Mumby and Hastings 2008; Kennedy 2009). Recently it has been argued that a 'paradigm shift' (as yet incomplete) is occurring away from such expectations of equilibrium towards 'the new ecology' that emphasises contingency, chance and chaos instead (e.g. Adams 1997; Zimmerer 2000; Cooper 2001; Walter 2008).

Similarly, in geomorphology, the notion of equilibrium persists as "a metaphor for what we would like to find in the environment, rather than what is necessarily there" (Bracken and Wainwright 2006, 175), serving as a conceptual model of nature that invokes not merely a simplified representation of natural processes, but also an ideal against which 'real' environmental processes (such as river flows) can be judged and, if necessary, redesigned. Yet here too there is now a diversity of views about equilibrium amongst environmental scientists and managers, from seeing disequilibrium as "temporary or aberrant" to seeing equilibrium as "rare, transient and unlikely" (Philips 2009, 22), because for some systems "the natural state is instability" (Brown 2002, 820). Hence, equilibrium is a powerful but problematic model on which to base environmental management today.

Despite this, textbooks and university courses still tend to socialise students into implicitly and uncritically accepting equilibrium as the normal (natural) state of landscape systems and ecologies (Cuddington 2001; Bracken and Wainwright 2006). Although university students may not explicitly be taught about 'the balance of nature', their education in ecology does not change the longstanding ideas of this kind that they gained when growing up in

contemporary culture (Zimmerman and Cuddington 2007). This means that if students become environmental scientists, conservation professionals or in other ways influence how we manage environments, their implicit models of nature become powerful as normative or idealised principles – ‘models’ of nature in the sense of ideals or templates that they apply through their professional environmental management practices. And scientific research may directly influence conservation in other ways, through selecting sites for nature reserves and codifying management practices for maintaining those sites, without questioning the underlying notions of ecological equilibrium (Adams 1997).

Hence, ‘the balance of nature’ is not merely a metaphor to aid understanding, but it also naturalises an unproven assumption into a normative expectation that can be invoked when designing or arguing for environmental management. In other words, our conceptual models of nature are significant not merely for how they describe nature, but for how they can be politically (in the widest sense) applied to change it, to coproduce it, to enact it.

Moreover, when applied implicitly, equilibrium is frequently naturalised as a ‘pre-disturbance’ state – that is, a state of balance that existed prior to disturbance specifically by *human* activities (see Helford 1999; Trudgill 2008). This naturalisation is particularly problematic where it legitimates management strategies that exclude pastoralist communities from nature reserves (Adams 1997; Zimmerer 2000) or eradicate so-called ‘invasive’ species introduced by humans (Shrader-Frechette 2001; Warren 2007). Such naturalisation is predicated upon a nature-culture dualism, a dualism now widely seen (through different theoretical lenses) as a modernist conceit or a social construction, as part of a wider turn to hybridity (e.g. Cronon 1996; Latour 1993; Macnaghten and Urry 1998; Whatmore 2002). In this paper, we do not propose to add to the extensive literature about the general concept of nature; instead, we wish to examine more narrowly how far implicit models of nature (especially models of equilibrium) underlie anglers’ thinking and practices.

There is surprisingly little empirical research on how lay publics, such as anglers, use specific models of nature, such as equilibrium, although Zimmerman and Cuddington’s (2007) study of students is an exception. More frequently, work in geography and the public understanding of science has looked at public perceptions of specific environmental issues, from biotechnology (e.g. Jasanoff 2004; Horlick-Jones *et al.* 2007) to climate change (Bickerstaff *et al.* 2008; Ungar 2000), foregrounding science and technology choices, environmental knowledge (and lack of knowledge), household practices, individual behaviour and public participation, but has rarely looked in detail at ideas of environmental change.

Some work on recreational users of the environment has considered environmental perceptions, but usually only as a sensory experience gained through shallower, sporadic engagements and exemplified in tourism (e.g. Cloke and Perkins 1998; Macnaghten and Urry 1998; Urry 1995; Waitt and Cook 2007), rather than the more long term, involved engagements and underlying models of nature that we focus on in this paper. There is also a burgeoning literature on how amateur naturalists are involved in collecting scientific data (e.g. Bell *et al.* 2008; Ellis and Waterton 2005; Greenwood 2003) as a form of recreational activity amongst lay people, but again little of this has analysed how participants think about nature and sometimes it has treated lay people as little more than recording instruments (e.g. Danielsen *et al.* 2005). By contrast, Lane *et al.* (2010) is a recent example that has sought to bring lay publics into the production of scientific knowledge.

There are a few studies that have looked more explicitly at public ideas of ‘the balance of nature.’ Harrison and Burgess (1994) used Schwartz and Thompson’s ‘myths of nature’ to analyse a controversial proposal to develop marshland. They found that local conservationists tended to see nature as resilient and able to establish equilibrium but only below a certain threshold of disruption, supporting a rationalist, scientifically based view of environmental management. However, local residents not involved in conservation groups

tended to see nature as unpredictable and capricious – not prone to equilibrium. More importantly, Harrison and Burgess (1994) argued that these ideas of nature were not coherently or consistently held, but vary across time and space, contextualised by people's own experiences.

In a different study of wetlands, Burgess *et al.* (2000, 127) found that local farmers “perceived nature in action, as a dynamic force” and one that could achieve equilibrium, if left alone, whereas conservationists in government agencies sought to control and manipulate nature, especially through the use of science. Robbins (2006, 191) made comparable points about the views held by game management professionals, hunters, local residents and businesspeople about elk management in Northern Yellowstone, USA. These groups were similar in identifying a dysfunctional ‘social ecology’ of poor human management that had upset the balance of animal populations (evident in rising elk numbers), although they varied as to whether they blamed this on privatisation or lack of privatisation of the natural resource.

So, although models of equilibrium and ‘the balance of nature’ are problematic in environmental science and conservation, they have been little studied explicitly through public views. This paper therefore addresses a gap in the literature regarding the socialisation and naturalisation of these models of nature, especially and unusually by considering how these models shape arguments about and enactments of management practices implemented directly by active publics. Anglers in this sense are an important but neglected lay group, because they shape local ecosystems through their work to manage rivers and lakes where they fish: the knowledge-practices of their lay ecologies thus coproduce their environmental realities, but in heterogeneous ways, as we shall show.

Methodology

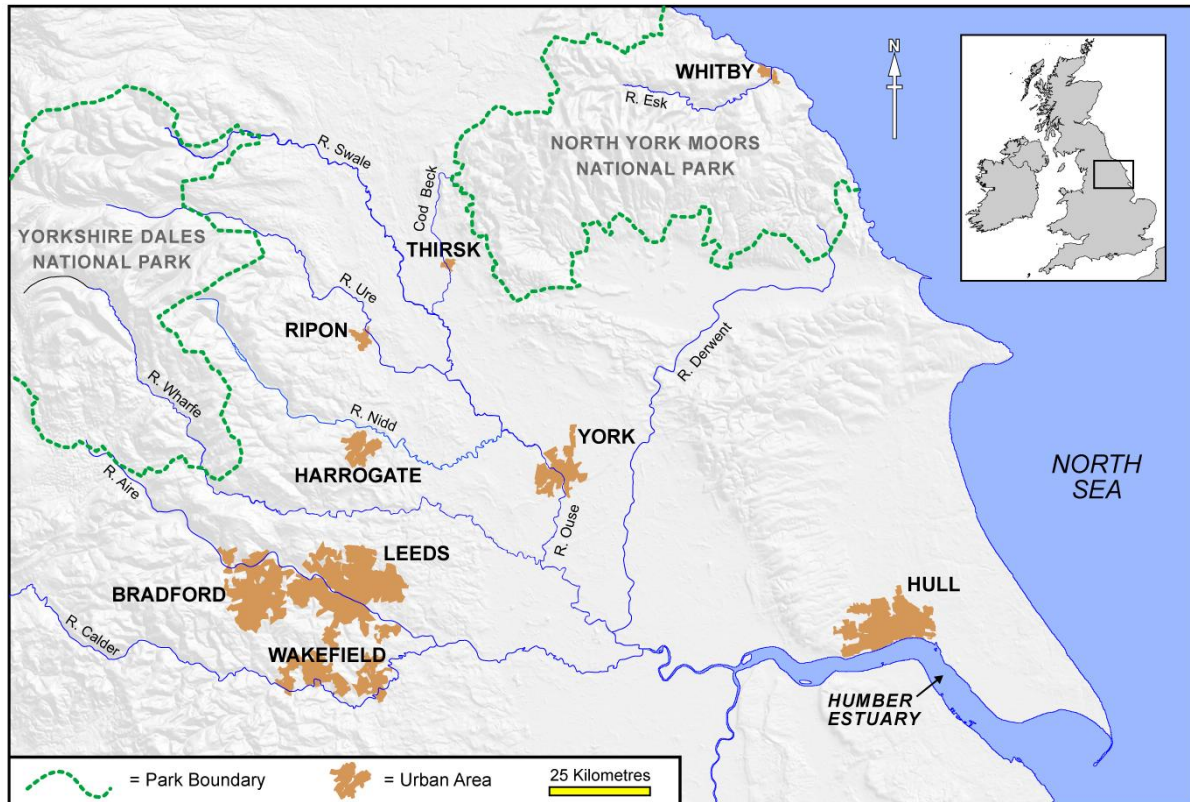
We draw on empirical work with anglers who regularly fished three rivers in northeast England: the Esk, a small river in the North York Moors National Park, the Swale and the Ure, both part of the large Ouse catchment that runs into the Humber estuary (Figure 1). All three run primarily through rural environments. However, most anglers we spoke to lived in urban areas (Leeds, Bradford and smaller market towns) and fished many different rivers and lakes over the course of a season (including overseas on holidays). Hence, although this focus on three rivers spatially defined our sampling process, it did not restrict the experiences that anglers related and in this paper we refer to comments made also about other rivers in the area, including the Wharfe, the Calder, the Trent, the Tees and the Ouse.

To form our sample, we initially approached clubs which owned or leased fishing rights on the three rivers. We ran two focus groups: one of anglers who regularly fished on the lower Swale and its nearby stillwaters for coarse fish like chub, barbel, roach, dace and pike, and one of anglers who regularly fished the middle Esk for game fish like salmon and trout. This difference between coarse and game angling is primarily based on a difference in target species or river location, but is often extended to differences in technology and practices (game species mainly targetted by fly fishing and coarse species by using baits) and class (fly fishing is often portrayed as more expensive, exclusive and elitist). In practice, we found that many anglers participated in both types depending on the season, although most usually preferred one or the other.

We subsequently interviewed some of the anglers from the focus groups in more detail and recruited others by attending matches and other club events, snowballing recommendations, talking to owners/managers of tackle shops and posting on an online fishing forum. In total, we conducted semi-structured interviews² with 60 anglers in 2006-8, some in their own homes, some in pubs or bars but many on the riverbank, especially during day-long matches on the Swale and Ure during the coarse fishing season. Sport England (2006) estimate that fishing (inland and sea) is the 18th most popular sport in the UK, in terms of regular

participation, with 0.7% (c.281,083) of adults fishing at least once a month. More people fish more occasionally - about 6% of households fish freshwaters once a year (EA 2006), with 1,296,865 rod licences sold in England and Wales in 2005-6 (EA 2008).³ Our sample was comprised specifically of regular anglers, although their regularity varied – some fished three or four times a week, but others only fortnightly or monthly at a club match.

Figure 1. Location map of the main rivers and places mentioned in the text.



The aim of our sampling method was therefore not to be representative of national or regional angling populations, but to include diverse types of active anglers, ages, genders and levels of obsession across a small but very heterogeneous recreational community of practice. Profiles of the angling population in the UK vary. An EA survey (2005) suggested that over a fifth of anglers are women, but we found much lower proportions, with several clubs with 70-170 members in the region reporting either no women members or only a handful. Indeed, as our study progressed, we became concerned about speaking to so few women and attempted to target more for interview. In this, we were unsuccessful – indeed, the refusal rate for women anglers was approximately 4 out of 6 approached (depending what one counts as a ‘refusal’), compared to that for men, which was about 4 out of 64 approached – although the resulting male bias in our study does reflect that in the sport generally. Other than a male bias, Mintel (2006) suggest angling shows little skew by age or socioeconomic status. However, most of our participants were of working class origins and our sample was skewed towards the older anglers, although the full age range was 17-83.

Lay publics are often imagined in policy and science as largely unspecialised, excluded, powerless and often unknowledgeable about the issues in question (Owens 2000; Young and Matthews 2007). Here, we deal with a different sort of public - a highly specialised and engaged group of anglers. Many readers will know that interviewing ‘ordinary people’ about science, knowledge and the environment can be made difficult by people’s low confidence in

their own abilities to talk about these things, meaning that they often defer to the interviewer as supposedly knowledgeable. With anglers, this rarely happened: instead, they often became ‘the experts’ in our discussions about rivers, fish and environmental conditions – indeed, as interviewers, we sometimes had to profess ignorance about such issues. This somewhat reverses the usual expectation of power in interviewing, but it also emphasises that research must differentiate ‘the public’ more carefully. As well as interrogating the importance of models of nature, this paper therefore also challenges the usual construction of ‘the public’ in environmental debates, by showing how those engaging with (often little visited) environments do so in highly specialised ways.

Moreover, we need to explain that angling clubs in northern England do not merely fish and socialise – they also manage the waters on which they own or rent the fishing rights. Management practices vary greatly, depending on environmental conditions, club finances and members’ attitudes but may include: stocking tens of thousands of juvenile fish of target species every year; dredging river channels and removing in-stream vegetation and woody debris; stabilising river banks against erosion; removing or planting riparian vegetation; monitoring and reporting water quality levels; and getting involved in the Regional Advisory Committees run by the Environment Agency (EA) for England and Wales to shape wider policy. So as well as the water environment being shaped by official (state) bodies with statutory duties in flood defence, water resources management and pollution control, such as the EA, it is also shaped directly by angling clubs – and this again contrasts with the more general view of ‘the public’ as *not* participating in environmental management.

We also interviewed ten professional scientists and environmental managers (several were also anglers) who had conducted fieldwork on the same three rivers, some from universities in northern England and some from the EA in the same region. We were expecting to be able to contrast their views with those of the anglers and their greater training in environmental science with anglers’ perhaps more local and less systematic environmental experience. However, the scientists often seemed reluctant to express a view about conditions on these rivers and what constituted good management, making direct contrasts difficult (although we do mention some of their views briefly in this paper). This may reflect a common reticence amongst scientists to speak out in the face of uncertainty, but it strongly contrasted with the often vehemently expressed views of anglers on the same subjects.

Except where prevented by poor weather conditions, interviews were digitally recorded, fully transcribed and analysed through thematic coding to saturation using NVIVO qualitative analysis software. All participants have been given pseudonyms and we have also mentioned their age (unless they declined to tell us) and type (based on self-description or main activity) to distinguish:

- pleasure anglers (for both coarse and game fish), who fished for fun;
- match anglers (usually for coarse fish), who regularly fished in club matches on rivers or ponds for prize money; and
- specialist anglers or specimen hunters (mainly for coarse fish in our study), who held records, ran national societies and wrote for magazines, as well as being the most frequent and often solitary in their fishing and avoiding club matches.

Anglers and ‘the balance of nature’

We now turn to our empirical results by considering the general concept of nature briefly, before turning to specific models of nature based on equilibrium. We explicitly asked anglers in the course of conversation if they felt that the rivers they fished were ‘natural’ and many felt that they were, despite these rivers having been heavily recontoured for flood defence in places, with deepened, straightened channels and clearly visible levées on the lower Swale and Ure. Many anglers, therefore, did not separate ‘nature’ from ‘humans’ in this respect. We mention this not to argue that they naturalised this evidence of human management to the

point of invisibility, interpreting 'natural' to mean 'not touched by humans' or pristine. Rather, it gradually became clear that we had fallen into the modernist trap of framing this dualistically ourselves, when we worried about how anglers could see heavily engineered river banks as 'natural'.

As the project progressed, we realised our error and in this paper we refer to natural agency and 'the balance of nature' without assuming that anglers deployed purification (Latour 1993) in discussing their environmental knowledge-practices. We therefore understand angling as a socio-natural practice: anglers often accepted rivers as hybrids and did not conceptualise divisions between the human and natural realms in the dualistic ways that are assumed to characterise modernity (e.g. Cronon 1996). Many anglers in this sense are not 'modern' but fish in a hybrid world; nature was not a separate realm for them, although the word 'natural' did serve as a handy descriptor of relative value, worth or delight, rather than half of an oppositional dualism.

Environmental change and time

We now turn to how these anglers invoked models of nature. Although we did not specifically ask about equilibrium or 'the balance of nature' in interviews, these ideas arose frequently without prompting, often in connection with discussions about how the quality of fishing was changing (or not). This paper was therefore triggered not by our pre-existing research agenda, but by the underlying importance of these ideas, as they arose during the research project. We also did not specifically ask anglers about their views on climate change or global warming either (although in retrospect, this would have been a very good idea). Even so, fifteen anglers raised this subject with us unprompted, often saying that winters were getting warmer and offering quantitative evidence of this from their own records of air and/or water temperatures, echoing Harrison and Burgess's (1994) emphasis on lay people's lived experience of the environment across time and space.

Environmental change was generally accepted by our anglers as normal, but there was strong disagreement by several that this was caused by human activity – five strong sceptics explicitly rejected anthropogenic 'global warming' but claimed climate change as part of a "natural cycle" (Craig 56, match angler; Geoff, 39, specialist angler). Moreover, they emphasised that changes could only be truly appreciated over the long term, citing timescales from "a couple of generations" (Norman, early 60s, pleasure angler – fly fishing) through "1,500 years" (Damian, 53, specialist angler) to "1.8 billion years" (Donny, 60s, pleasure angler). 'The balance of nature' was seen as the core explanation for observed changes in climate on rivers, but that balance was only detectable over periods longer than normal human experience. The different temporalities at play in these lay ecologies reflect Adam's (1990) emphasis upon a time-sensitive ecological perspective in social science, which includes human beings within living nature's rhythmicity and cyclicity. They also reflect Ingold's (1993) emphasis upon relationality of multiple rhythms; anglers are both participants in the rivers of now, as well as part of the rivers to be, rivers that they are co-making through their current activities and management choices (as we illustrate below).

As well as being temporal, their models were also spatial, but in different ways. At the catchment scale, 'the balance of nature' was implicitly invoked by anglers when discussing change and dynamism in the geomorphology and hydrology of river systems. They particularly talked about the power of the rivers themselves, characterised as 'spate rivers', prone to flash flooding and other rapid changes:

"unless you've experienced it, you can't imagine the power of the water when it's in flood" (Ian, 60s, pleasure angler – fly fishing)

Anglers also talked about the power of rivers to establish a balance of processes - a power seen as greater than the human power of environmental management. Partly echoing the farmers in Burgess *et al.*'s (2000) study, anglers thus imply a strong model of natural agency,

wherein rivers can correct or even overturn human interventions, because “they look after themselves” (Arnold, 58, match angler), “a lot of it fixes itself” (Ray, 30s, specialist angler) and “nature’s way usually sorts itself out, doesn’t it?” (Geoff, 39, specialist angler).

Such characterisations may have been affected by the 2007 flooding in northern England (and its heavy media coverage) and the very wet summers of 2007 and 2008, when interviews took place. However, these were often discussed against a backdrop of longer term change, given that all the anglers we spoke to had fished for many years before then (albeit not continuously). Implicitly, this presented a contrast between timescales of perception. The dynamism of these rivers was seen as very great in the short-term, fluctuating dramatically in water level from season to season, year to year and even within the same day over the duration of a fishing match. This reflects Adam’s (1990, 73) insistence on appreciating (human *and* nonhuman) rhythmicity across different timescales as “nature’s silent pulse.” But over the long term, more of a steady state was invoked and equilibrium was a powerful organising idea:

“we’re only here for two minutes [as humans, metaphorically speaking]. Natural states on rivers would be identified for perhaps 500 years.” (Damian, 53, specialist angler)

Ecological interactions and disequilibrium

As well river flows, anglers also discussed ‘the balance of nature’ in terms of animal populations and prey-predator interactions. Predatory birds, like cormorants and goosanders, and predatory animals, like otters, mink and seals, were said to kill and (frequently, but not always) eat fish and thus deplete fish stocks. Yet anglers often argued that a natural balance would be re-established in time through birds and animals controlling their own numbers:

“[cormorants] just find their own level... in a healthy river system, you know, you’ll have predation on fish by various forms of wildlife. If you kill everything that feeds on fish, you’re no worse than the shooters who are killing hen harriers, you know. I mean, cormorants, they will sort themselves out eventually.” (Barry, 50s, pleasure angler and fishing pond owner)

“the mink preys on the local wildlife... but eventually they’ll find a balance, won’t they?” (Charles, 56, match angler)

Here again we see both cyclicity and temporality supporting notions of equilibrium or balance. This echoes Zimmerman and Cuddington’s (2007) study of university students, who commonly defined ‘the balance of nature’ in terms of numerical stability in populations, by coupling form (a stable state) with process (a control mechanism). This is also typical of modelling in fish science, where ‘steady state’ is defined by stable population density over time (e.g. Baskett *et al.* 2006; Einum *et al.* 2008) and illustrates again how science, conservation and public views can share environmental ideas (also Lane *et al.* 2010). Our anglers used similar arguments, citing fish-eating fish like pike and perch as capable of self-regulation or what ecological science calls ‘internal regulation’ in the long term (e.g. Persson *et al.* 2007): corrective mechanisms would come in to play where predators depleted their own food sources, because predator numbers would then reduce and prey numbers would recover:

“[pike] generally control their own numbers because at the end of the day, it is inbuilt into them.” (Ray, 30s, specialist angler)

“people don’t seem to realise over the long term that these fish do actually run in cycles and do tend to come back naturally and do tend to have their own breeding cycles where they all sort of balance out.” (Steve, 43, specialist angler and bailiff)

Moreover, ‘the balance of nature’ was thus seen as generally beneficial, with predation improving the quality of future generations of fish in an evolutionary trajectory:

“I don’t mind pike in a lake, because pike keep that lake clear of ailing fish. It’ll only take fish to eat. And they’re really taking the ones that aren’t quick enough to get away. So what they’re really doing is keeping the rest of the lake healthy, if you like. So things like that, when it’s natural predation, I’ve not a problem with.” (Ernie, 60s,

pleasure and match angler)

“pike are now treated with respect and put back in, because they’re there to serve a purpose and if you persecute them, the general standard of the prey fish, if the weak and diseased aren’t taken out, then they’re still taking their share of the food and the general standard of the prey fish will go down.” (Jim, 70, pleasure angler)

Hence, the anglers expected a natural settling out to equilibrium even where water systems were disrupted, often through the natural agency of the different species in direct interaction with one another. This emphasises internal factors of population growth and decline, rather than external factors of changing environmental conditions, invoking a model of nature as powerful, dynamic and yet self-regulating in the longer term.

But the importance of the concept of equilibrium is also demonstrated in how anglers view *disequilibrium*. The most frequent illustration of this that we encountered was that sea birds like cormorants and goosanders had moved inland from the coast in recent years and were preying on fish in lakes and rivers, thus disrupting the pre-existing but “very precarious” natural balance. Anglers felt that cormorants were ‘out of place’ on inland freshwaters, not “natural” nor “indigenous” there. Similarly, they said that goosanders “don’t belong in this country”, they are “foreigners”, “Scottish” or “normally” coastal birds. So, although cormorants and goosanders are found in Britain, they are naturalised by many anglers as normally existing solely on the coast when in an equilibrium state. They become ‘aliens’ and ‘invaders’ when they come inland, that is, when they disrupt the equilibrium of inland waters by crossing into other habitats, not merely by crossing the nation-state border:

“a mile inland from the coast, if they step over that boundary of a mile, they’re not a sea bird anymore. They’re an alien invader.” (Max, 53, match angler)

Like equilibrium, the distinction between ‘native’ and ‘alien’ species is a key principle of ecology but also highly problematic as a classificatory or normative concept (Warren 2007), showing again how lay people, scientists and environmental managers draw on similar environmental ideas. Here, the two concepts of equilibrium and nativeness are entangled in a view of disequilibrium as a human product of disturbance (also Helford 1999; Trudgill 2008), as a dysfunctional ‘social ecology’ (Robbins 2006): anglers argue that cormorants have both been pushed from the coast by humans overfishing their food source of sea fish, and also pulled inland by humans developing fish farms as (unintentionally) new and easy sources of food for cormorants. Such views emphasise dynamism, the adaptation of animals to changing environmental conditions and the relationality of humans, birds and fish:

“now the cormorants are coming inland to feed. It’s nature’s way, isn’t it? They’re feeding through nature’s way. They’ve got to eat.” (Geoff, 39, specialist angler)

“the seas haven’t got the fish in they used to have, have they?... They’ve moved to where they can find some easier pickings, haven’t they, to survive?” (Dick, 69, pleasure and match angler)

Also cited by anglers as species out of place and thus disruptive of the natural balance are plants like Himalayan balsam. Mink are also seen as “foreigners” (Gordon, 60, pleasure angler – game fishing), not “indigenous to this area” (Ian, 60s, pleasure angler – fly fishing) but released by from mink farms by (well-intentioned) humans. Otters in the Swale were described as “not natural otters”, because they were reintroduced by people and are therefore “tame... they’re more like urban otters” (Jack, 54, match angler). Thus dysfunctional animals are socialised and spoken of in human terms, echoing the problems in distinguishing native/alien species without resorting to xenophobic or even racist metaphors (Warren 2007). This classification clearly politicises the disequilibrium as in need of correction: an effect of purificationist talk.

Consequences for environmental management

We have outlined anglers’ models of nature fairly briefly so far, because we also want to

consider their consequences for the enactment of environmental realities. It is because such ideas *do work* in environmental practices, rather than existing solely as models, that makes them so significant; they are not merely free-floating abstractions but shape people's lived experiences and actions (also Harrison and Burgess 1994; Macnaghten 2003). As we explained earlier, angling clubs deliberately manage their waters, so how anglers perceive the environment affects what they do to manage it, which affects how birds move and rivers flow, which affects how anglers act and so on.

Our interest here is not in defining what nature is or whether equilibrium exists, but how these models of the 'balance of nature' are put into practice as norms or templates for environmental management. This is especially important when environments are seen as out of balance: 'what ought to be' thus shapes the performance and reality of 'what will be.' The 'corrective' practices sought or applied by anglers can be summarised as: (1) do nothing and rely on 'the balance of nature'; (2) intervene directly to restore equilibrium, e.g. through restocking or culling predators; and (3) intervene more indirectly by managing the habitat, to encourage equilibrium or adaptation under natural agency. We now illustrate these in turn.

First, doing nothing, or nonintervention, is invoked by some anglers in terms that suggest an environmental ethic of intrinsic value, in that everything has a right to live, even annoying predators like mink or cormorants:

"everything has to live. Nature provides for everything. If there wasn't an abundance of fish there wouldn't be all [these predatory birds]." (Walter, 80s, pleasure angler - fly fishing)

"at the end of the day it'll all come to a balance, won't it? If the otters eat all the fish, the otters will die or move away - it's as simple as that." (Bert, 40s, specialist angler)

These arguments invoke a 'balance of nature' and natural agency as a model to suggest that, in the long term, the river and its ecology will reassert equilibrium against interference, even if this is not obvious to some humans in the short term:

"Everything balances itself out. If you have more cormorants taking smallish fish then the fish tend to breed more and produce more small fish. It all balances itself out. It doesn't happen overnight but over a period of several years they normally sort themselves out." (Steve, 43, specialist angler and bailiff)

Second, some anglers prefer intervention, through both biological and geomorphological practices. Directly culling of excess or out-of-place predators is advocated by some (e.g. Cliff, 60s, pleasure angler – fly fishing; Ernie, 60s, pleasure and match angler) as a human corrective reluctantly applied to an imbalance at least partly caused by human behaviour – the model of equilibrium here is felt to need a little (human) help:

"there's a place for everything in numbers. But when it gets to a few too many [cormorants], you've got to quietly lessen them a bit [by shooting them]." (Dave, 69, pleasure and match angler)

A corollary of culling is stocking, by directly restoring or increasing fish populations that have been predated or otherwise depleted (e.g. because of pollution), using juvenile fish bought in from nurseries. In our study, anglers fishing the Esk for game species (such as salmon) were most likely to be in favour of stocking and to feel that stocking policies had increased or stabilised fish populations:

"People say, 'Oh, you should leave them to their natural resources,' but it's been proved that it's built the stocks up." (Walter, 80s, pleasure angler – fly fishing)

Game species on the upper Swale were also seen to have benefited by some: "the weight of fish is there because of the stockings" (Bert, 40s, specialist angler), but only Dick (69, pleasure and match angler) mentioned the benefits of stocking for coarse fish on the lower Swale.

There are also physical equivalents of such biological interventions, such as dredging or adding gravel to rivers to correct perceived geomorphological disequilibrium, whether this is banks eroding (bad for anglers' access to the water and their comfort) or water flow being too uniform (bad for fish and, in consequence, bad for anglers trying to catch those fish). The scale of physical management varies, from using bulldozers to resculpt the bed, slopes and course of a river to rebuilding banks using hard engineering (concrete, railway sleepers and wire) or 'soft' engineering (willow stakes). Weirs and groynes may be built, using wood, stone or concrete, to change and diversify the water flow to encourage good fishing conditions, especially on the Esk, which is a smaller river and thus easier to manipulate.

"[groynes are] put in at about 45° angle upstream and they catch the sand and gravel and smaller stone sediments in a flood and leaves and that and block them up and then they fill up and it makes the water probably deeper and better flowing, faster flowing. Because when you're fishing with a fly and that you need just a nice steady stream. And if it's a deep, still pool, it gets just a little bit dull and that improves it." (Bill, 71, pleasure angler – fly fishing)

"we've put water features in in some places. Just get three wooden stakes and hammer them in... then just get some pig wire and wrap it round twice and within 24 hours you can't see any of them. It's all festooned with grass and twigs and allsorts. And there'll be fish around it." (representative of the River Swale Preservation Society)

The point here is that geomorphological and biological management options are chosen in order to reinstate a perceived equilibrium in place of a perceived disequilibrium. But anglers' views differed greatly. Even within small clubs dealing with short stretches of small rivers, there are strong disputes about whether physical intervention is possible. Some anglers thought direct intervention was pointless, because the river would use its own power to destroy any constructions or obstructions and reassert itself against human intervention:

"as soon as you get a flood what they have done is washed away anyway so they have got to do it again." (Ray, 30s, specialist angler)

"if the river wants to go that way, it will go that way... just putting bits of stones in and one thing or another, unless they're put in a correct sort of way, nature puts it back how it wants to be." (Damian, 53, specialist angler)

Because of this, several anglers specifically rejected culling and stocking in favour of the third option: intervention through more general habitat management, to correct the disruption in 'the balance of nature' by more indirectly improving the environmental conditions in which populations might thrive:

"I don't think there should be stocking programmes on the river, because if you're having to stock a river there's a problem... you sort out the problem first and then if you've sorted it out then you restock." (Tim, 59, specialist angler)

Such an approach to management actively includes natural agency, providing space within which species can adapt and change. Implicit in these arguments were assumptions about the inability of human management to control such dynamic and adaptive environments, as a modernist illusion (e.g. Latour 1993). In this way, the autonomy of fish, of rivers and even of gravel to move and change are acknowledged and used positively to question human practices and choices in relation to them (Cronon 1996, 24).

This is shown well in the divide between those for and those against stocking. In one focus group, two bailiffs in the same angling club were asked what they would like the club to do to improve their waters and their views were directly opposed: Mike (30s, pleasure angler) said "Put more fish in!", but Steve (43, specialist angler) said "Sort the breeding areas out, kill the goosanders and cormorants, let it do itself. Don't restock it, just let the river restock itself."

Although we did not directly ask anglers about their stance on stocking, of the thirty of our interviewees who did express a view in passing, twenty were generally in favour and ten generally against.⁴ It is notable that the ten included six specialists/specimen hunters and nearly all targetted coarse fish, especially barbel, with only one fly fisherman amongst them. For example, Geoff (39, specialist angler) called stocking “the biggest load of tosh going,” because he felt the rivers to be full of fish, at least for any angler who is sufficiently skilled and committed. The twenty in favour of stocking, by contrast, excluded specialists/specimen hunters and mainly targetted game fish, especially on the Esk, a river referred to as the only salmon river in Yorkshire, but probably only because salmon were introduced into it in the 19th century and have been repeatedly stocked there since.

Moreover, many of the ten anglers who explicitly opposed stocking felt that it should not be necessary, because natural processes would be better at repopulating and restoring populations hit by predation, pollution or other calamities. Human intervention was seen to be less efficient and less welcome than natural agency through self-regulation and coevolution. Natural equilibrium therefore was seen not only as possible, but also as ideal: rivers are “more or less self-stocking” (Jim, 70, pleasure angler) through “self-propagation” if the habitat is good (Andy, 56, specialist angler).

“The fish would naturally stock itself. It’s a short-term thing is stocking... unless there’s been a big fish kill, due to pollution or whatever, [in which case] you could help them out with a short stocking period or whatever. But it’s no long-term solution just to keep throwing more fish in the river. Because if the problem’s there then it’ll stay there. You need to sort the problems out first and if you sort the problems out then they’ll look after themselves.” (Steve, 43, specialist angler)

“It’s far better, far more use to spend all the money improving the rivers to make them self sustainable. If all that money and effort and research was put into looking after the rivers rather than just dumping more fish in to replace ones which aren’t spawning successfully, I think it would be far more use.” (Malcolm, 46, specialist angler)

And more importantly, stocking was seen (especially by specialist anglers) as a poor strategic choice, as working against nature rather than with it. Consequently, they showed more support for alternative, more holistic forms of river management:

“I would rather see habitat improvement, because if you have got to stock a river for no other reason than recruitment’s [i.e. fish reproduction] poor, then it is an issue with the river, not stock levels.” (Ray, 30s, specialist angler)

This divide of opinion echoes that found in professional environmental management more generally, in which traditionalists favour modernist, direct intervention through hard engineering, culling and stocking, whereas other managers champion the newer style of ‘working with nature’, adaptive management, restoration, rehabilitation, soft engineering and re-naturalisation (e.g. Adams *et al.* 2004; de Groot and Lenders 2006). Culling in particular is a traditional but controversial practice that divides opinion, for example when used on otters (Goedeke and Rikoon 2008) and bison (Lulka 2004), and Robbins (2006) identifies a strong divide for and against ‘natural regulation’ of elk numbers in northern Yellowstone, USA, through wolf predation. Again, this emphasises our earlier point about the contested (and still partial) shift away from notions of equilibrium in environmental science in that, despite the rise of nonequilibrium approaches, equilibrium remains “a strong article of faith” (Trudgill 2008, 103; also Bracken and Wainwright 2006; Philips 2009) in many environmental fields, especially in conservation.

It also shows how environmental managers and lay people may share underlying models of nature. Similar to professional managers, the anglers in our study were divided in their opinions. Some anglers championed habitat improvement and saw those adhering to stocking and culling as traditionalists, stuck in the past and in old habits, thus allying with conservationists who champion adaptive management and with the Environment Agency

(EA), which also seeks to convert traditionalist anglers to the new cause through ‘angler education’:

“I think we’re winning, we’re educating anglers a bit to realise that if you get the habitat right, the fish will breed and do well themselves and the trout clubs are realising that.” (Grant, 40s, EA scientist and pleasure angler)

Some might argue that these views are generational, associated with younger age cohorts of managers and anglers because of their training. Pauly (1995) suggested that ‘shifting baseline syndrome’ occurs because each generation of fisheries scientists uses the state of fish stocks at the beginning of their careers as the baseline against which they compare all future changes. To put it another way, they naturalise the environmental conditions into which they are socialised or trained. Pauly argued that, as marine fish stocks dwindle, each successive generation of fisheries scientists is socialised into assuming ever lower baseline conditions stocks are ‘normal’, meaning that fisheries science lacks historical perspective and underestimates the ongoing depletion of fish stocks and the need for management. However, the for/against stocking division amongst our anglers did not map onto an age division in the way that Pauly suggested. Rather, different models of nature were raised and applied by different anglers; their environmental practices were shaped not by consensus or certainty, but by often unarticulated assumptions about what ‘should’ be – implicit models of equilibrium – and therefore the kinds of environmental practices they chose.

However, even those generally in favour of stocking in principle could see problems with it in practice and felt that their efforts might fail, because predator numbers may grow alongside (or even because of) the growing stocks or restocked fish may fail to thrive (Damian, 53, specialist angler). It was also seen as impossible for angling clubs to control stocking as a management process, because “it’s not an exact science, you know, you can put fish in and you might never see them again” (Grant, EA scientist and pleasure angler), because across miles of river “we can’t control where the fish go” (Harry, 48, match angler).

Again, even where anglers seek to improve river environments through direct management, they invoke natural agency in the rivers and animals, agency that often works against the anglers’ own efforts over time. Like the farmers in Burgess *et al.*’s (2000) study, they thus appreciate a natural dynamism in river systems that is at odds with claims often made that the public expect modern regulation and control over the environment, for example, in the case of flooding.

Conclusions

We have shown that anglers’ lay ecologies and ideas of ‘the balance of nature’ in many ways reflect the problematic character of models of nature more widely in science and policy, in that anglers we spoke to frequently but implicitly invoked equilibrium as the normal state, but only when viewed dynamically and over long time periods. In particular, and perhaps against expectations, they were therefore sceptical about (solely) anthropogenic causes for global warming, because they saw natural causes for climate change as more important. Moreover, they assumed that the natural agency of rivers, climate, fish and other animals is important in both (re)establishing and disrupting that ‘normal’ state.

We also drew attention to the similarities in how anglers, professional environmental managers and scientists use models of the ‘balance of nature.’ Lane *et al.* (2010, 14) argue that the everyday way in which people learn about environmental change locally “is in many ways no different to the way that a scientist assimilates knowledge through working in different places on different problems.” And we have shown that models of equilibrium also remain implicitly powerful in both professional and lay ecologies, despite their attendant problems.

We also emphasised the heterogeneity of views held by anglers and argued that assuming that particular interest groups, whether 'hunters' or 'anglers', are homogeneous or prone to cleavages based on class or other sociodemographics is inadequate and misleading (Robbins 2006), because their environmental knowledge-practices are far more complex than that.

These points are important because anglers put their lay ecologies to work in collectively managing rivers and ponds, significantly shaping the water environment, and can thus be regarded as lay environmental managers, rather than merely lay publics. They make sense of what they encounter when fishing through implicit models of 'the balance of nature', but these also suggest (or are used to argue for) diverse environmental practices, from stocking and culling to more adaptive habitat management. In this way, environmental "knowledge is not something an individual has 'more' or 'less' of, but rather reflects the specific forms of practice undertaken in daily life... knowledge is embedded in daily political and environmental activity" (Robbins 2006, 191). Knowing and doing are not separate – they are reciprocal developments that shift over time, in this case from support for heavy engineering and stocking of rivers to adaptive management.

Anglers also felt that the idea of management itself was a modernist illusion of control and talked about the limitations of their own power in comparison with that of rivers in flood or fish movements, reflexively suggesting the impossibility of managing the environment and emphasising 'the balance of nature' and natural agency, rather than human control. Moreover, anglers' environmental knowledge-practices are coproduced with the environments in which they develop their lay ecologies; anglers are thus themselves *part of* these relational ecologies and 'the balance of nature' through which they frame their own understanding, rather than separate from or somehow above those ecologies. Ingold (1993) argued that the landscape is congealed from activity – and in this case this is not merely human activity, but also the varied activities of rivers, weather, target fish, predators and vegetation which together produce environmental change. Angling and its management practices are thus hybrid as well as heterogeneous and contested.

To summarise the implications of this paper, we would firstly emphasise that lay ecologies about 'the balance of nature' are highly heterogeneous, even amongst lay groups that one might expect to have similar models of nature because of their similar (and frequently shared) experiences of the environment – in this case, as encountered through angling. It might even be argued that the more people engage with specific areas of the environment and specific knowledge-practices (whether angling, swimming, hiking or gardening), the more diverse and deeply held their views become. And this heterogeneity of views about dis/equilibrium (and the practices that should follow from it) also makes predicting and managing public views of and involvement in environmental management even more difficult for state agencies and other professionals.

Secondly, we emphasise that anglers' models of nature are not merely detached perceptions or ways to improve their catch – they are also performed as environmental management and thus continually co-create environmental realities in ongoing, reciprocal and diverse human-nonhuman relationships. Angling, like many other environmental engagements, is thus a socio-natural practice that both makes and is made through multiple encounters across time and space and through practices that have power to shape environments, a power that is embodied not in humans such as anglers but developed through association (Latour 2005) with rivers, rocks, fish and other nonhumans.

Thirdly and perhaps most surprisingly despite all this discussion of knowledge and management, as well as culturally received stereotypes of angling as a sport of domination (stereotypes that we have avoided here), anglers often reject the notion of human control over the environment, surrendering humanistic hubris in favour of a strong sense of natural

agency, unpredictability and restorative power in these human-nonhuman relationships over the long term. This contrasts with how some scientists (e.g. Philips 2009, 17) expect lay people to see environmental change. In future, comparing how the views of such specialised publics differ from those of other lay publics involved in making decisions about environmental management (for example, in contentious debates about engineering for flood defence) would also be very useful in tracing further the relationships between humans and the environment and the continuing implicit but powerful effect of models of nature on how environmental management is enacted.

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Notes

¹ Hence, we use the word 'nature' in this paper not to indicate a separate realm of being or experience that is divided from that of 'culture' or humans, but to mark how participants in our empirical study think about particular assemblages (of human and nonhuman entities) that they encounter or imagine and also seek to shape.

² A topic guide of questions asked is available from the lead author.

³ A rod licence is legally required to fish freshwaters in England. Anglers usually also have to pay for either club membership or day (or week) tickets to fish at rivers or lakes.

⁴ Surveying anglers in Germany, Arlinghaus and Mehner (2005, 10) found habitat management to be preferred more frequently than stocking. In our study, support for habitat management was less widespread, maybe because it was expressed not through responding to specific prompts in a questionnaire, but through talking about expectations and ideals.