Ecosystem services and the common law: evaluating the full scale of damages

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This article explains the science of ecosystem services and uses it as a tool to uncover potential claims for damages to the environment at common law. Ecosystem services analysis has been used successfully in the operation and development of the regulatory regime in South Africa. An ecosystem services analysis recognises and attempts to put a value on the function of the ecosystem and its benefits to society. This is achieved by having a recognisable classification system for ecosystem services, and breaking down ecosystem functionality into four categories: provisioning services, regulatory services, cultural services and supporting services. This science has the potential to relate any damage to the ecosystem to potential plaintiffs and assist the framing of a legal action to resist that damage or claim compensation. Scallop dredging in Lyme Bay off the south coast of the United Kingdom has faced significant criticism because of the unsustainable nature of the operation and its potential to cause long-term harm to the seabed. An ecosystem services analysis reveals a number of potential aggrieved parties suffering from the excessive damage caused by a few operators to the detriment of the larger community and future generations. A number of actions are available at common law, in particular private and public nuisance. This article explores the potential for nuisance actions at sea, echoing the trend established by the famous Pride of Derby and Derbyshire Angling Association Ltd v British Celanese Ltd.[1] *Weaknesses are apparent in this approach because of the requirement for private nuisance actions to defend existing property rights. In territorial waters proprietorial rights are concentrated in state entities such as the Crown Estate Commissioners, or are in common ownership such as the public rights to fish and navigate. Public nuisance, however, has no such limitations. There is damage to identifiable classes of people who suffer from damage to their provisioning services (loss to sustainable commercial fishery) and cultural services (loss of potential recreational fishery and diving sites). It would be possible to frame a case in public nuisance using the approach adopted in* Attorney General v Birmingham Corporation[2] *to protect those aggrieved parties' interests by seeking an injunction against the damaging activity. The use of a common law remedy to restrict the public right to fish for scallops in this manner, it is argued, is appropriate since the right to fish itself claims its origin in the common law.*

Introduction

This article identifies and explores the relationship between the emerging science of ecosystem services and its potential application in common law as it relates to environmental damage. A significant element of the progressive evolution of common law has improved understanding of causal relationships between harm to ecosystems and damages suffered as a consequence by various constituencies of society. Ecosystem services, about which there is now considerable global consensus and consistency, offer a significant and robust basis for the extension of common law to address wider ramifications arising from harm to ecosystems.

Everard and Capper[3] review the potential for expansion of the scale of damages sought under common law resulting from the emergence of systems thinking. A systems perspective takes into account the integrity and functioning of entire river catchment (and other) systems, rather than focusing on their disaggregated elements. For understandable historical reasons, as well as the attribution of local damage to local causes, reductive elements of catchments (such as fish kills in local river reaches) have been the traditional focus for recovery of damage to property under the common law of nuisance, public nuisance, and/or interference with riparian rights. The courts can award, and in the past frequently have awarded, injunctions requiring removal of the nuisance, and thus restoration of the watercourse, including identified ecological services as they pertain to the range of interests of those bringing the action. However, this overlooks more widespread harm to the broader catchment system, to

1 [1953] Ch 149.

2 (1858) 4 K&J 528.

3 M Everard, K Capper 'Common law and river conservation: the case for whole systems thinking' (2004) 16 ELM 3 135–44.

multiple beneficiaries, and potentially fails to take into account more long-lasting, insidious impacts, such as damage to future fish spawning success, food sources for future generations of fish, or loss of public amenity or enjoyment.

The expansion of common law to explore systemic damage is made possible by emerging scientific knowledge of how catchments act as integrated ecological, social and economic systems, further supported by advances in environmental economic techniques, which potentially enable both evolving understanding and more far-sighted and sustainable catchment management.[4] The interdependence of people and economic activities with river catchment functioning is now seen as integral both to observed sustainability problems and their solutions, with catchments considered social as much as ecological constructions.[5] We are beginning to see some of this whole-systems thinking reflected in new legislation, such as the EU Water Framework Directive[6] or South Africa's National Water Act,[7] and to appreciate the importance of inclusive societal dialogue in sustainable decision-making with respect to water throughout the world.[8]

In a developing world context, the direct link between social equity and biodiversity considerations is becoming better appreciated. For example, in South Africa, due to its political history, environmentalism operated as a conservation strategy that neglected or subverted social needs under the former apartheid regime.[9] The principle of 'environmental justice' is concerned primarily with the distribution of environmental resources and damages, including not only racially, economically and geographically distinct communities, but also current and future generations, and between genders. It therefore represents an important shift away from traditional authoritarian concepts of environmentalism, branded by some as 'eco-racism' and concerned mainly with the conservation of threatened plants, animals and wilderness areas, broadening its scope to include urban, health, labour and development issues.[10]

The principle of environmental justice is equally applicable elsewhere in the world. For example, a series of case studies analysing the relationship of social deprivation to various environmental parameters (air quality, tidal flooding, and proximity to regulated industrial sites) raises questions about environmental inequities in the United Kingdom.[11] Issues of environmental equity (or environmental justice) are also recognised widely across the USA,[12] with inequities in global markets representing a major obstacle to sustainable development.[13]

Truly cohesive and sustainable development largely rests upon the extent to which all of society identifies with its dependence upon shared supporting ecosystems.[14] Social justice and biological conservation must proceed hand-in-hand if the political reality of sustainability is to flourish in the long term, as all human health, economic opportunity and 'quality of life' are ultimately supported by shared ecosystems. The converse also applies: where ecosystems decline in extent, quality, function or integrity, their capacity to support the fulfilment of human potential is equally degraded. The UK's Sustainable Development Commission[15] and the sequence of UNDP *Human Development Reports*,[16] published annually since 1990, further underline the many linkages between environmental quality and human health, wealth creation and security.

This reality is being addressed by the science of 'ecosystem services', developed from the late 1980s but coming to greater prominence in terms of governance through the UN's Millennium Ecosystem Assessment[17] during its reports throughout 2004 and 2005 and particularly the general synthesis report.[18] The concept of ecosystem services, addressed in greater detail below, provides a broad-ranging and generic method to understand and account for the many means by which ecosystems provide 'services' of benefit to human wellbeing and activities. All human activities depend upon the 'services' of ecosystems, and in turn influence those ecosystems together with their supportive capacities. It follows that activities by one sector of society which cause disproportionate damage to ecosystems will automatically be likely to affect associated ecosystem services upon

4 M Everard and A Powell 'Rivers as Living Systems' (2002) 12 Aquatic Conservation pp 329–37.

5 R Ison, N Röling and D Watson 'Challenges to Science and Society in the Sustainable Management and Use of Water: Investigating the Role of Social Learning' (2007) 10 Environmental Science and Policy 499–511.

6 Council Directive 2000/60/EC of the European Parliament and of the Council Establishing a Framework for the Community Action in the Field of Water Policy [2000] OJ L327/1–72.

7 Republic of South Africa National Water Act No 36 of 1998 (Pretoria South Africa 1998).

8 M Everard, J D Colvin et al (submitted) 'Integrated Catchment Value Systems'; J D Colvin, F Ballim and others 'Building Capacity for Cooperative Governance as a Basis for Integrated Water Resources Managing in the Inkomati and Mvoti Catchments, South Africa' (Proceedings of the IWRM Conference Cape Town 7–8 March 2008 in press).

9 W Beinart, P Coates *Environment and History: The Taming of Nature in the USA and South Africa* (Routledge London 1995); J Mittelman 'Gobalisation and Environmental Resistance Politics' (1998) 19 Third World Quarterly 5 847–2.

10 J Cock 'Going Green at the Grassroots' in J Cock, E Koch (eds) *Going Green: People, Politics and the Environment* (Oxford University Press Cape Town 1991) pp 1–17.

11 G Walker, J Fairburn et al *Environmental Quality and Social Deprivation* (R&D Technical Report Environment Agency Bristol 2003).

12 Environmental Protection Agency *Environmental Equity Reducing Risk for All Communities. Volume I: Workgroup Report to the Administrator* (Report EPA230-R-92-008 US EPA Washington DC June 1992). *Environmental Equity* (Office of Administration and Resources Management. Environmental Protection Agency Washington DC); K E Haynes, S V Lall and M P Trice 'Spatial Issues in Environmental Equity' (2003) 1 International Journal of Environmental Technology and Management 17–31.

13 K O Shrader-Frechette *Environmental Justice: Creating Equity, Reclaiming Democracy (Environmental Ethics & Science Policy)* (Oxford University Press Inc USA 2000).

14 M Castells *The Power of Identity* (Blackwell London 1997).

15 Sustainable Development Commission *The Natural Environment, Health and Wellbeing. Healthy Futures* 6 (Sustainable Development Commission London 2007).

16 www.hdr.undp.org.

17 www.millenniumassessment.org.

18 Millennium Ecosystem Assessment *Ecosystem and Human Well-being: General Synthesis* (Island Press Vancouver 2005).

which other people depend. Considering ecosystem services from the perspective of common law, there is potential for redress for these damages. The distinction between traditional application of common law and the potential for its extension using the principles of ecosystem services are issues of scale; we are not just accounting for local damage to local claimants (ie dead fish resulting from local pollution) but may potentially be able to address systemic damage to rivers and other ecosystems from which a wide variety of 'services' are compromised and an accordingly broader constituency of people suffers damage.

This article seeks to connect evolving thinking about ecosystem services with the practical application of common law, recognising this more broad-ranging scale of damages to wider constituencies. It does not address the existing body of case law in any depth, but instead explores the practical application of 'ecosystem services' principles to issues of catchment sustainability. The focus is predominantly upon the United Kingdom although, given the influence of the British legal system on the principles and practice of common law across the world, general conclusions are more broadly applicable.

Developments in thinking about ecosystem services

The fundamental principle of the 'ecosystems approach' – which is founded on recognition of ecosystem services – is recognition of the ecological basis of the primary resources that make life possible, profitable, and fulfilling for human society. Ultimately, everyone depends upon natural systems.

One of the properties of ecosystems, whether at global, local or microscopic scales, is that they consist of diverse living and non-living elements which interact to exchange and modify energy, water, and other chemicals. These 'ecosystem functions' – including physico-chemical, hydrological and ecological processes – are properties of the system as a whole, and cannot necessarily be predicted from close examination of elements of the ecosystem (rocks, organisms, water, chemical compounds, etc) explored in isolation. These functions therefore comprise 'emergent' properties of intact ecosystems, and may accordingly be lost when interdependencies within the system as a whole are weakened.

From these ecosystem functions arise a range of 'services' beneficial to humans. Early work on the functions and benefits of wetland ecosystems[19] used terminology borrowed from economists to categorise tangible elements (fish, birds, trees, fibre, etc) as 'goods', retaining the term 'services' to describe less tangible benefits enjoyed by society such as floodwater storage in wetlands and uplands, water purification through physico-chemical processing, soil formation and renewal of fertility, pollination, absorption of wastes, and so forth. Awareness of the societal and economic value of forest, oceanic, catchment, rangeland, cropland and many other ecosystem types did not take long to follow.[20] Today, all global ecosystems are recognised as providers of essential and irreplaceable services to humanity.[21] Although as yet often overlooked in commercial, political, and economic governance systems, this ecosystems-centred approach is becoming increasingly established due to UN, regional and national[22] initiatives, as well as championing by the international Convention on Biological Diversity,[23] and will become progressively mainstream as resource constraints intensify.

Some 'goods' and 'services' of direct utility are readily amenable to direct economic valuation. Others are less easy to quantify, for example the ways in which the natural environment gives us a sense of 'place', resources for education or heritage value. Many more such 'services' are of great significance, yet are far harder to appreciate in day-to-day decision-making, including climate-regulating processes, biodiversity and its genetic resources, pollination, photosynthesis, and options for the future inherently supported by ecosystems that we do not fully exploit or understand today. Many of these important ecosystem processes operate at interconnected scales. For example, a small wetland plays a role in catchment systems and in turn continental water cycles, conferring benefits (including climate change services) widely beyond those most closely associated with the ecosystems in which they are produced.

Modern thinking about the beneficial outcomes provided by natural processes, significantly shaped by the Millennium Ecosystem Assessment, now groups the formerly discrete concepts of 'goods' and 'services' within the overall term 'ecosystem services'. Ecosystem services are a helpful concept that bridges the conceptual gap between 'nature' and the tangible human and economic benefits that, although often overlooked, ultimately flow from it. The idea of 'ecosystem services' provides us with a means for appreciating and a basis for beginning to value the fundamental natural resources and productive ecosystems for human health, wealth and quality of life, both now and into the future. These resources and ecosystems naturally then translate into economic terms through the values that people associate with the utility provided by, or potentially provided by, ecosystem services. They can therefore form a basis for social dialogue about the management and equitable sharing

19 For example, P J Dugan 'Wetland conservation: A Review of Current Issues and Required Action' IUCN 1990, Gland, Switzerland.

20 G C Daily *Nature's Services – Societal Dependence on Natural Ecosystems* (Island Press Washington DC 1997); I R Calder *The Blue Revolution: Land Use and Integrated Water Resources Management* (Earthscan Publications London 1999); C M Holmlund, M Hammer 'Effects of fish stocking on ecosystem services: an overview and case study using the Stockholm Archipelago' Environmental Management 33 (2008) 799–820; D J Krieger 'The Economic Value of Forest Ecosystem Services: A Review' The Wilderness Society Washington DC 2001.

21 Millenium Ecosystem Assessment 2004 (n 17), 2005 (n 18).

22 For example, Defra *An Introductory Guide to Valuing Ecosystem Services: Draft for Comment only – September 2007.*

23 www.cbd.int.

of catchments and other primary ecosystem resources.[24] Valuation of natural capital is essential to underpin a truly sustainable society and economy.[25]

In a pre-industrial era of low population and low per capita resource consumption, over-exploitation of natural resources was an infrequent although not unknown problem. Today the world is heavily populated and our lifestyle increasingly resource-hungry. At the beginning of the industrial revolution (between the 1760s–1780s in the United Kingdom) there were probably only half a billion people on the planet. By the 1930s, the population had risen to 2 billion, topping 6 billion by 2000 and is likely to be heading towards 9 or 10 billion by 2050. The over-exploitation of increasingly limited natural resources and the ecosystems that produce them creates a challenge for all of humanity if those ecosystems are to continue to help us meet our evolving needs and aspirations. It follows that, in an interdependent system, environmental change must also have social and economic consequences. The means by which ecosystems at every scale and the relationships between their living and non-living component parts 'produce' beneficial ecosystem functions are poorly understood, and the importance of the services they provide often becomes evident only as they are lost.[26] However, it is clear that natural capital has finite 'carrying capacity',[27] which is dependent upon the resilience of ecosystems.[28]

While people depend upon ecosystem functions performed by river catchments and other systems, all catchment systems across the globe are modified by local factors as well as broad-scale influences (such as climate change), some significantly so. There are many examples of critical functions lost through, for example, upland drainage or conversion to commercial forestry or croplands, urban and industrial encroachment on floodplains, drainage and paving of former wetlands, pollution in its various forms, and so forth. Counter to this negative trend, in Europe for example, some lessons have been learned about the harmful effects of historic development and 'flood defence' practices resulting in increased risk of and damage from flooding, and the consequences of unwise river management upon fish recruitment, biodiversity more generally, property values depressed by poor environmental quality, and a host of other human benefits. We are beginning to see changes in the way that flood risks are managed through the restoration of wet habitat that naturally stores water, engineered urban drainage schemes that emulate natural processes of infiltration to groundwater, and the restoration of river habitat for amenity, conservation, floodwater control and water quality improvement. Some upland habitat is being restored by water companies, acknowledging that it will restore the natural services of water purification, storage and flow regulation, not to mention biodiversity and landscape benefits, as a cheaper alternative to outmoded 'engineered' solutions to water supply and treatment.[29]

Although research questions remain, the cost-effective delivery of water savings within South African catchments has been proven by the Working for Water programme initiated in 1996 and based upon the clearance of water-hungry invasive vegetation.[30] Preliminary assessments of the costs, benefits and progress of Working for Water demonstrate a considerable set of benefits associated with improved water yields resulting from the clearance of invasive vegetation.[31] The demonstrable success of Working for Water is believed to have influenced the decision by former US President Bill Clinton to initiate the Comprehensive Everglades Restoration Program,[32] one of the largest natural capital restoration projects in the world. Related initiatives such as the Australian Landcare scheme[33] and local projects set up by the UK network of voluntary river trusts[34] demonstrate their effectiveness by putting the functioning of catchment ecosystems at the centre of planning to improve hydrology, water quality and beneficial services enjoyed by catchment communities. The UK's Sustainable Catchment Management Programme (SCaMP) also places the functioning of upland ecosystems centrally in the supply of fresh water for consumers across the wider north west of England.[35] These examples highlight the importance of an ecosystem-centred basis for planning and, conversely, the likely range and scale of damages to societal interests that may result from harm to aquatic ecosystems.

The Millennium Ecosystem Assessment (MEA) classified ecosystem services into four broad categories – provisioning, regulatory, cultural and supporting services – breaking these down into generic sets of

24 M Everard 'Integrated Catchment Value Systems' (n 8); M Everard *The Business of Biodiversity* (WIT Press Ashurst 2009).

25 J Porritt *Capitalism as if the World Matters* (Earthscan 2005); Everard (n 24).

26 G C Daily, T Söderqvist and others 'The Value of Nature and the Nature of Value' (2000) 289 Science 395–96.

27 S Naeem, F S Chapin and others 'Biodiversity and Ecosystem Functioning: Maintaining Natural Life Support Processes' (Fall 1999) 4 *Issues in Ecology* (http://www.esa.org/science_resources/issues/FileEnglish/issue4.pdf).

28 C Folke, M Hammer and others 'Investing in Natural Capital – Why, What, and How?' in A M Jansson, M Hammer and others (eds) *Investing in Natural Capital: An Ecological Economics Approach to Sustainability* (Island Press Washington 1994) 1–20.

29 M McGrath, D Crawshaw 'United Utilities Sustainable Catchment Management Programme SCaMP' (October 2008) Environmental Scientist 21–23.

30 DWAF *Working for Water Programme: Annual Report 1996/97* (Department for Water Affairs and Forestry Pretoria 1997); P Woodworth 'Working for Water in South Africa: Saving the World on a Single Budget?' (Summer 2006) World Policy Journal 31–43; G Preston, M Everard 'Working for Water' (October 2008) Environmental Scientist (27–30).

31 D C Le Maitre, D B Versfeld, and R A Chapman (2000) 'The Impact of Invading Alien Plants on Surface Water Resources in South Africa: A Preliminary Assessment' (2000) 26 Water SA (3) 397–408; C Marais, B W van Wilgen and D Stevens 'The Clearing of Invasive Alien Plants in South Africa: A Preliminary Assessment of Costs and Progress' (2004) 100 *South African Journal of Science* 97–103.

32 www.evergladesplan.org.

33 www.landcareaustralia.com.au.

34 M Everard 'Investing in Sustainable Catchments' (2004) 324/1–3 The Science of the Total Environment pp 1–24.

35 United Utilities (2008) 'Sustainable Catchment Management Programme' (SCaMP). http://www.unitedutilities.com/SCaMPFAQ.htm (accessed January 2009).

services (see table below). This categorisation facilitates uptake of the ecosystem approach as a basis for recognition of the importance of biodiversity in supporting human wellbeing, halting the continuing decline of global ecosystems, and safeguarding the basis for continuing human development. To smooth the implementation of the ecosystems approach in policy-making processes in the United Kingdom, Defra[36] proposes determining the relative magnitude of impacts of options for development on the broad range of ecosystem services outlined by the Millennium Ecosystem Assessment, assessing the marginal implications of different development options on the *status quo* using an indicative system as follows:

Score	Assessment of effect
++	Potential significant positive effect
+	Potential positive effect
O	Negligible effect
–	Potential negative effect
--	Potential significant negative effect
?	Gaps in evidence/contention

By assessing the *status quo* (current conditions) and then looking at the relative impacts of different development options on ecosystems, such as freshwater wetlands or whole drainage basins, it is possible to get some idea of the significance of impacts across a range of beneficial

Table 1: Defra[37] conceptualisation of applying MA ecosystem service types

Consideration of ecosystem services	Baseline	Comparative Options
Provisioning services		
Fresh water		
Food (eg crops, fruit, fish, etc)		
Fibre and fuel (eg timber, wool, etc)		
Genetic resources (used for crop/stock breeding and biotechnology)		
Biochemicals, natural medicines, pharmaceuticals		
Ornamental resources (eg shells, flowers, etc)		
Regulatory services		
Air quality regulation		
Climate regulation (local temperature/precipitation, GHG sequestration, etc)		
Water regulation (timing and scale of run-off, flooding, etc)		
Natural hazard regulation (ie storm protection)		
Pest regulation		
Disease regulation		
Erosion regulation		
Water purification and waste treatment		
Pollination		
Cultural services		
Cultural heritage		
Recreation and tourism		
Aesthetic value		
Spiritual and religious value		
Inspiration of art, folklore, architecture, etc		
Social relations (eg fishing, grazing or cropping communities)		
Supporting services		
Soil formation		
Primary production		
Nutrient cycling		
Water recycling		
Photosynthesis (production of atmospheric oxygen)		
Provision of habitat		
Score Assessment of effect		

36 Defra 'Securing a Healthy Natural Environment: An Action Plan for Embedding an Ecosystems Approach' (December 2007). http://www.defra.gov.uk/wildlife-countryside/natural-environ/eco-action-exec.pdf.

37 Defra *An Introductory Guide to Valuing Ecosystem Services* (n 22).

ecosystem functions. This provides a context against which to plan for maximally beneficial (or minimally damaging) options, to innovate further to maximise benefits (or minimise harm) across all ecosystem services, to account for the 'winners and losers' in development decisions, and to form a basis for dialogue and negotiation between these different constituencies. Where impacts are likely to be significant (positively or negatively), further quantitative study may be deemed necessary. This approach, including the list of MA ecosystem services grouped by category, is summarised in Table 1.

It is therefore possible to make a direct economic assessment of both the quantifiable and likely impacts of human interventions in terms of their ramifications for ecosystem services. For example, by multiplying the market value of water supplied to an average household by the number of households served, or the per capita value of a subsistence or recreational fishery multiplied by the number of fishers, a consolidated estimate of value is derived. Other values are less readily calculated. For example, in tropical countries, any calculation of the impacts of water-borne diseases such as cholera or bilharzia must take into account the direct costs of the disease in addition to the loss of productivity of sufferers, multiplied by the population affected.[38]

Measures such as 'sense of place' or 'heritage value' are less easy to calculate, although some have been tested under case law, and other considerations such as the integrity of the system, to provide resilience to environmental 'shocks' and to support options for future development, defy most rational economic assessment methods. This is not, however, to say that they are not of immense value.

Most useful in legal cases are the 'marginal' values resulting from changes in ecosystem services brought about by discrete catchment (and other ecosystem) interventions. It is generally accepted by environmental economists that 'absolute' economic values have no objective meaning as they are sensitive to the methods and implicit assumptions applied, although marginal differences between values compared pre- and post-intervention are highly informative.

Linking ecosystem services with the practice of common law

Relevant aspects of the evolution of the current twin (statute and common) law as it relates to damage to the water environment in the United Kingdom have been reviewed by Everard and Capper.[39] The key point of interest here is that statute law comprises the body of written law established by successive legislative bodies dating back to the Middle Ages, and has a great emphasis on water pollution, particularly as it relates to human health risks. The formulation of statutes is a slow process, often pertaining to serious issues only after their consequences have become manifest and, according to some commentators,[40] often out of date and/or too much influenced by vested interests at the time the law is enacted. At the global scale, Taylor[41] argues that the proliferation of environmental treaties and other international instruments has failed adequately to address the problem of environmental degradation. Taylor concludes that this apparent failing is due to '... a lack of protection of nature for its own sake and a recognition that humans are part of an interconnected web of life', leading Taylor to call for a new approach to international law with an ecological basis.

Nevertheless, the body of statute law creates a 'level playing field' for all constituencies affected be they national, supranational (ie covered by EU directives) or at other scales. In contrast, common law is the body of law developed, initially in England, primarily from judicial decisions based on custom and precedent. As such, it continually develops and changes over time and can adapt very quickly to changing issues and circumstances. Beyond its more formal definition, its underpinning principles are not far akin from tribal decision-making across less-developed areas of the world, the governing principle being whether the activities of an individual or sector of society have the capacity to affect adversely others sharing a common region or resource.

Both the call by Taylor[42] for a new approach to international law with an ecological basis and the common law emphasis on equitable shares of resources without a disproportionate impact on the interests of other constituencies fit well with the emergence of ecosystem services as a scientific theme and management solution. Systems thinking at a scientific level, and ecosystem services as a socio-economic instrument that links ecosystem vitality and functioning to a range of well-characterised human benefits, provide a robust and tested basis for the common law to address broader issues of harm to human interests. This in turn may lead to more far-reaching reparations for damage, injunctions to remove nuisance, and powers to restore the wellbeing of watercourses upon which human livelihoods and enjoyment depend.

Ecosystem services can be addressed at a number of scales. At the broad conceptual scale, they provide a basis for maximising public benefits and minimising the net costs to society from development decisions. At a more local scale, they constitute a common language for negotiation about the distribution of relative benefits and impacts enjoyed by different communities through the use and potential modification of river catchments.

38 M Mander *Thukela Water Project: Reserve Determination Module. Part 1. IFR Scenarios in the Thukela River Catchment: Economic Impacts on Ecosystem Services* (Institute of Natural Resources Scottsville 2003).

39 M Everard, K Capper (n 3).

40 For example, D Schoenbrod 'Protecting the Environment in the Spirit of the Common Law' in R E Meiners, A P Morriss (eds) *The Common Law and the Environment: Rethinking the Statutory Basis for Modern Environmental Law* (Rowman and Littlefield Publishers 2000).

41 P Taylor *An Ecological Approach to International Law: Responding to Challenges of Climate Change* (Routledge London 1998).

42 ibid.

Dialogue and equitable reallocation of water and other catchment resources are integral to the implementation of water law reforms in South Africa, as it moves from apartheid segregation towards an inclusive and democratic society. South Africa's National Water Act[43] enshrines driving principles of equity, sustainability and efficiency, dissolving pre-existing rights to water. The only legal rights to water are classified as the Reserve, which comprises the two elements of 'basic human needs' and 'Ecological Reserve'. The Ecological Reserve reflects the quantity, quality and periodicity of water that must be left in river systems for the sustainability of catchments and the wide range of beneficial ecosystem services they provide for society.[44] The reserve is set nationally, along with water required for inter-basin schemes, cross-border international agreements and additional critical needs, with allocation of residual water delegated to catchment-based bodies tasked with delivering the greatest public benefit. The creation of a space for dialogue and consensus between local, interdependent communities about the allocation of water for the public good is in essence the statutory creation of a negotiating space for consensus about optimal shares in ecosystem services provided by catchment systems, and one that can promote a pathway of empowerment and continued wellbeing and prosperity without eroding the capacity of river catchments to all society both now and into the future. There are principles of common law here, safeguarded by the statutory framework within which they sit, which are also congruent with traditional tribal dialogue about shares of resources.

It is therefore clear that the principles of ecosystem services can add to the evolving body of common law. By extension, they can potentially enable legal action to be brought to bear on a far broader set of heads of claims than previously, as they illuminate greater scales of damages from harmful activities, a broader constituency of potential plaintiffs across wider geographical areas and, potentially, longer-term problems accruing to those dependent upon ecosystem services.

Specific difficulties in the extension of common law beyond traditional local 'cause and effect' damage include establishing liability (the magnitude of damage caused by clearly-identified responsible parties), remedy (difficulty in proving harm to plaintiffs), and enforcement (who should act on behalf of a potentially wide constituency of people and other interests harmed by environmental damage).[45] In the context of water, this is particularly problematic since the water environment itself does not automatically constitute property under UK law and in many other jurisdictions. Running waters are considered *publici juris* (of public right), while fish and other living elements of river and marine ecosystems (although not necessarily still fresh waters) are considered *ferae natura* (wild animals) and therefore ownerless until caught. This is at least part of the reason why common law has historically been heavily weighted towards two property rights affecting rivers, navigation and fisheries,[46] with the bulk of case law relating to the quality and quantity of water used for abstraction or the costs of restocking based on 'counting the dead fish'.[47]

However, the concept of 'property', forming much of the basis for calculation of damages under common law, is dynamic and may change over time with shifts in cultural values. Ecosystem services provide us with a mechanism to address not merely tangible 'goods' produced by ecosystems (fish, fresh water, fibre, gravel deposits, etc) which may constitute property, but to engage deeper with the workings of the ecosystems themselves since the loss of services such as natural beauty, habitat provision, air and water purification, storm protection, erosion control and so forth can be demonstrated to be harmful to beneficiaries of the water environment. We can therefore address common law remedies at the level of injunctions on harmful activities and restoration of lost ecosystem functioning, before significant harm arising to property triggers a claim for damages, or indeed to head off likely public nuisance through an injunction.

Evolving understanding of the complexity and interdependence of aquatic ecosystems, and the many ways in which they 'produce' and provide the numerous and irreplaceable 'ecosystem services' beneficial to people and societal activities, may be a driving force for a change in the concept of 'property' and of both private and public interest. To extend the reach of common law, it will be necessary to make a defensible science-based case, and to test this in case law. This conceptual leap in the application of case law to the aquatic environment, from its reductive roots to an ecosystem-centred appraisal of wide-scale impact, is likely to occur incrementally through a sequence of judgments.

Case study – damage by scallop dredging in Lyme Bay

There is increasing interest in damage to the marine environment caused by the fishing industry.[48] Scallop dredging (or dragging) is a commercial fishing activity which significantly interferes with the seabed. It involves towing a frame with spring loaded teeth which rake the seabed and cause the scallops to rise into a steel bag

43 Republic of South Africa National Water Act No 36 of 1998 (Pretoria South Africa 1998).

44 E van Wyk, C M Breen and others 'The Ecological Reserve: Towards a Common Understanding for River Management in South Africa' (2006) 32 *Water SA* 3 403–10.

45 R E Meiners, A P Morriss (eds) *The Common Law and the Environment: Rethinking the Statutory Basis for Modern Environmental Law* (Rowman and Littlefield Publishers 2000).

46 W Howarth 'Editorial: Implementing Flood Protection Policy through Planning' (2002) 13 WL 247–48.

47 P Carty, S Payne *Angling and the Law* (Merlin Unwin Books Ludlow 1998).

48 Royal Commission on Environmental Pollution *Turning the Tide; Addressing the Impact of Fishing on the Marine Environment* (25th Report HMSO 2004); C Roberts *The Unnatural History of the Sea* (Island Press 2007).

attached to the frame. Multiple dredges are usually towed behind a boat.[49]

Scallop dredging cannot normally take place in a rocky environment because there is a risk the dredges will foul on the seabed. In Lyme Bay, the rocky reefs are structured in an east-west bedding plane, which means that, with improvements in navigation and echo-location technology, dredging can take place at less of a risk to the operator. As a result, fishing effort has increased, much to the concern of local conservationists.[50]

The Lyme Bay reefs are home to numerous species of plant and animal life, which provide significant ecosystem services. For instance, hydroids are noted for their abundance in Lyme Bay.[51] These are an important species. A study by Bradshaw[52] of the Irish sea concluded that: 'Hydroid colonies ... influence benthic community composition and increase both the diversity and abundance of benthic fauna'.

To some extent, long-lasting bed damage as a result of scallop dredging is evident from video footage. However, it has also been shown by scientific analysis.[53] In order to identify the scale of the problem and its implications so that policy responses can be better informed, one of the key tasks for policy-makers, regulators and the courts is how to assess the damage, and whether that damage is significant enough to warrant control measures ranging from limitation to an outright ban.

A study commissioned by the Wildlife Trusts[54] undertook a programme of research and analysis to estimate the likely economic value of different uses of a proposed conservation zone of some 60 square nautical miles in Lyme Bay, centred on Lyme Regis. The report addressed the range of management options being considered, including a proposal by English Nature (the then statutory biodiversity regulator for England) to prohibit the use of scallop dredges in an attempt to conserve the sensitive and nationally important biodiversity found on the Lyme Bay reefs. Homarus Ltd[55] explored the likely economic benefits of scalloping versus a range of uses deemed to be non-damaging to this sensitive biodiversity, including static gear fishing (potting, netting), recreational fishing, and scuba diving, on the basis of a mixture of data and opinion from neutral public sources (including the Marine and Fisheries Agency, Sea Fisheries Committees, local harbour masters, and relevant literature). Notwithstanding acknowledged difficulties and uncertainties associated with assessing values derived from a relatively small sea area, a range of valuation methods suggests that the economic value of these other selected low-impact uses may exceed the value of harmful scallop dredging by a ratio of 2.7–3.1. This clearly ignores wider and less readily quantified impacts including bed stability and aesthetics, fish recruitment, habitat degradations, etc. Table 2 records our assessment of intensive scallop-dredging versus its abandonment, based on the Defra[56] method of weighted qualification of impacts of activity (scalloping) versus the baseline (no scalloping). In the main, these impacts are not quantifiable with available evidence so the findings should be considered indicative only.

Only two indicative positive benefits are recorded in Table 2. A positive (+) is noted for the 'food' category (provisioning services) for scallop fishing, although this is offset by a significantly negative assessment (--) for impacts on other fisheries. The second indicative benefit is a positive score (+) for 'social relations' (cultural services) based on the social network of a small body of scallop fishermen, although this is balanced by a significantly negative (--) assessment for broader fishery communities. All other impacts of scalloping across the various MA categories of ecosystem service are assessed as negative (-) or significantly negative (--) relative to the baseline, although a good number are subject to evidence gaps or contention (?) or are not applicable (n/a).

Two mitigating factors should be remembered. First, these scores have no absolute value; they are purely indicative. Secondly, it is neither immoral for humans to undertake development activities supported by natural resources, nor surprising that many have negative consequences, for example: beam trawling of the wider seas, impoundment of rivers behind large dams, forest clearance for short-term grazing, etc. However, the key issue revealed here is that scallop dredging using current intensive methods has negative or significantly negative implications for many ecosystem services and potential beneficiaries, critically including all relevant supporting services that maintain the integrity and efficient functioning of ecosystems. Some of these broader ecosystem services (other forms of fishing as a surrogate for the service of 'food production' and both angling and scuba diving as aspects of 'recreation and tourism') have been semi-monetised in the Homarus Ltd[57] study while others, although not yet monetised nor necessarily easily evaluated by benefit transfer methods, would appear to be significant.

As a matter of principle, accrual of economic advantage to a few at net cost to diverse broader constituencies, through practices injurious to ecosystems

49 Video of the activity can be found on http://www.youtube.com/watch?v=gKqM3hXwcRs.

50 Royal Society of Wildlife Trusts (2007) *Lyme Bay Reefs: Last Chance?* http://pinkseafan.wildlifetrusts.org/downloads/Lyme%20Bay%20Leaflet.pdf (accessed March 2008).

51 C Wood *Seasearch Surveys in Lyme Bay, June 2007, A Report to Natural England* (Marine Conservation Society 2007).

52 C Bradshaw, P Collins, A R Brand 'To What Extent Does Upright Sessile Epifauna Affect Benthic Biodiversity and Community Composition?' (2003) 143 Marine Biology 783–91.

53 C Bradshaw, L O Veale, and others 'The Effect of Scallop Dredging on Irish Sea Benthos: Experiments Using a Closed Area' (2001) 465 Hydrobiologia 129–38.

54 Homarus Ltd (2005) *Estimate of Economic Activities in Proposed Conservation Zone in Lyme Bay* http://pinkseafan.wildlifetrusts.org/downloads/LymeBayHomarusLtdJoanEdwards1.pdf (accessed June 2008).

55 ibid.

56 Defra 2007 (n 22).

57 Homarus Ltd (n 54).

Table 2: Indicative impacts of scalloping on a range of ecosystem services

Consideration of ecosystem services	Baseline (no scalloping)	Relative impact of scalloping
Provisioning services		
Fresh water	n/a	n/a
Food (eg crops, fruit, fish, etc)	Significant fishery value	+ for scallops taken, -- for productivity of other fisheries
Fibre and fuel (eg timber, wool, etc)	n/a	n/a
Genetic resources (used for crop/stock breeding and biotechnology)	Significant resources in situ	-- habitat and ecosystem destruction may be significant
Biochemicals, natural medicines, pharmaceuticals	?	?
Ornamental resources (eg shells, flowers, etc)	Part of local tourism industry	-- loss of biodiversity and biomass of species of interest
Regulatory services		
Air quality regulation	?	?
Climate regulation (local temperature/precipitation, GHG sequestration, etc)	?	?
Water regulation (timing and scale of run-off, flooding, etc)	n/a	n/a
Natural hazard regulation (ie storm protection)	?	– (?) negative impact of habitat destruction likely to reduce buffering effect. Hard to quantify
Pest regulation	?	?
Disease regulation	n/a	n/a
Erosion regulation	?	– (?) negative impact of habitat destruction likely to increase sediment mobility, but hard to quantify
Water purification and waste treatment	?	?
Pollination	n/a	n/a
Cultural services		
Cultural heritage	Significant for local residents and tourism industry	-- but hard to quantify
Recreation and tourism	Significant for local tourism industry	-- but hard to quantify (other than Homarus Ltd 2007) data for scuba diving
Aesthetic value	Significant for local 'sense of place'	-- but hard to quantify
Spiritual and religious value	Significant for local identity	-- but hard to quantify
Inspiration of art, folklore, architecture, etc.	Significant for local identity	-- but hard to quantify
Social relations (eg fishing, grazing or cropping communities)	Significant for local fishing communities	+ for local scallop fishers, but -- for other fishery interests
Supporting services		
Soil formation	n/a	n/a
Primary production	?	– (likely, but hard to quantify)
Nutrient cycling	?	– (likely, but hard to quantify)
Water recycling	n/a	n/a
Photosynthesis (production of atmospheric oxygen)	?	– (likely, but hard to quantify)
Provision of habitat	Rich natural ecosystems thrive in Lyme Bay	-- scallop dredging is a destructive practice

Score Assessment of effect
n/a Not applicable

++	Potential significant positive effect
+	Potential positive effect
O	Negligible effect
–	Potential negative effect
--	Potential significant negative effect
?	Gaps in evidence/contention

and their associated suite of ecosystem services, is an inequity. This includes potential intergenerational inequity through threats to the integrity, viability and resilience of the ecosystems required to support future needs.

At a glance, resolving these inequities through the common law is less straightforward but, given that there are identifiable issues affecting the property and public rights of marine stakeholders, it is possible to discuss damage to ecosystem services in a language relevant to the common law, and it is even possible to explore potential remedies.

Discussion

Common law has formed an effective twin with statute law for the protection of water-based ecosystems. It can halt harmful activities through injunctions, recover costs after harm has occurred, and use the threat of either of these remedies as a deterrent. Evolving scientific understanding is revealing the magnitude of the dependence of human activities upon ecosystems, and the broader scales of damage to wider constituencies ensuing from harm to the environment. The application of ecosystem services is congruent with broader environmental thinking stemming from the UN and also relating to environmental justice.

This is an evolutionary step, as the vast bulk of common law claims pertaining to harm to the water environment were previously undertaken on a reductive basis, wherein the causal pathway from offender to plaintiff is more straightforward to calculate on the basis of a single environmental impact. Fisheries have often been a focal point for the application of common law as, to put it crudely, dead fish are easy to count and can be ascribed an economic value based on the relative unambiguity of the property value of river fisheries. Following the famous *Pride of Derby and Derbyshire Angling Association Ltd v British Celanese Ltd*[58] there has been a plethora of cases concerning fish kills in rivers. These have largely been unreported, but in many cases actions have successfully been taken by the Anglers' Conservation Association.[59] Local water quality impacts have also often been a focus for litigation since *Attorney-General v Birmingham Corporation*[60] and more recently *Marcic v Thames Water*,[61] *Dobson et al v Thames Water*.[62] This has a positive consequence for river protection as, while the activity of angling may not include all of society's interests in rivers, thriving fish populations are a tangible indicator of wider ecosystem health. However, only limited numbers of beneficiaries enjoy the property of an angling resource, constraining the damages that have been sought historically on a reductive fishery-by-fishery basis, and so far no significant legal challenges have succeeded in marine fisheries.

Ecosystem services provide common law with the potential to take account of far greater spatial and temporal scales, and multiple disciplines, and this has major implications for recognition of the damages of inappropriate remedies. This includes liberating much common law from its historic shackles to property, and to extend its application to the diverse direct use, indirect use and non-use values now widely applied throughout public policy decision-making using accepted environmental economic tools. The example of scallop dredge damage in Lyme Bay is particularly effective for this assessment. In rivers, most fishing rights are owned by individuals (both organisations and 'natural persons'), and these are often riparian owners with sufficient interest to take legal action to defend their property rights. In the sea, both the right to fish[63] and the seabed are in forms of public ownership. There is no tradition of individual claimants attempting to defend their rights. As a result, a system of common law protection has yet to be extended to damage to the sea and the seabed. Regrettably, the common good of the sea remains victim to cumulative attrition from cumulative exploitative activities according to the well-known metaphor of 'The Tragedy of the Commons'. There has been a tendency for the courts to shy away from reaching decisions which develop the common law in this area. Indeed, the courts have tended to view the public right to fish in the sea as unlimited by its impact on the environment, as summarised below:

- ... the unlimited right given at the common law... ... to all the public fish would be likely to destroy the oysters. It affords an excellent reason why the mayor and aldermen, if they had the power, should put an end to the practice, or put it under such restrictions, as will prevent the oysters from being extirpated; just as it affords a reason why the legislature should put restrictions on the common law right (*Goodman v the Mayor of Saltash*).[64]
- ... the public [or common law] right to fish in the sea waters and on the foreshore was a common law development of some antiquity and emerged in an age that failed to recognise the environmental and ecological impact that flows from an untrammelled right to reap the harvests of the nature. The public right to fish paid no regard to the threat of depletion of fish stocks or to the impact such a depletion would have on the natural chain (*Adair v National Trust for Places of Historic Interest or Natural Beauty and Another*).[65]

It is an obvious contradiction that, in the handful of cases which have gone to court, the courts have admitted that

58 [1953] Ch 149.
59 Anglers' Conservation Association (2008) www.a-c-a.org/caseupdates.php (15 December 2008).
60 [1858] 4 K&J 528. B Pontin (2007) 'The Secret Achievements of Nineteenth Century Nuisance Law' (2007) 19 ELM 271–94.
61 [2004] AC 42;
62 [2007] EWHC 2021.
63 T Bonyhady *The Laws of the Countryside: The Rights of the Public* (Professional Books Abingdon 1987).
64 (1882) 7 App Cas 633 per Lord Blackman at 654.
65 [1998] NI 33 at 44 per Girvan J at 44.

the public right to fish in the sea stems from the common law but have not permitted the common law to regulate it, and sought instead to have it regulated by statute. This contrasts extremely unfavourably with the Victorian court's readiness to impose a rolling injunction in the *City of Birmingham* case and increasing interest in academic legal discussion of the availability of common law remedies because of perceived regulatory failure.[66] At the time of writing, a draft UK marine bill is in its consultation phase and may, perhaps, ease the strain on the common law. However, there is no guarantee that the bill will become an act, or, if it does, that the Act will regulate what has evidently been an unsatisfactory arrangement for the last 100 years at least.[67] It is something of an abrogation of authority in these matters for courts to rely on Parliament to regulate the monster that they have created.

A brief review of the three principal difficulties in application of the common law for environmental protection factors cited by Schoenbrod[68] – liability, damages and representation – may be informative. Traditionally, the last element, representation, has proved the most problematic.

Since the seminal *Pride of Derby* case, successive owners of fisheries and riparian owners have been able to claim damage to their property by pollution in private nuisance. The essential requirement for a successful claim in private nuisance is for there to be an unreasonable interference with the claimant's interest.[69] Pollution claims have succeeded on land and for rivers where the interests of the respective parties are very well understood and the legal framework provides an established method of seeking redress. The same cannot be said for marine cases as the nature of potential claimants' interests is rather complex. While it is clear that the right to fish in the sea usually vests in the public, in which body it vests is not clear.[70] It would be for the owner of the fishery to take an action in private nuisance if a similar case arose in a marine fishery, as established in rivers in *Pride of Derby*. Without clarity of ownership in the marine environment, there is no obvious body to take an action. It is possible that the courts may extend the category of nuisance to those claiming adverse effects to their public right since arguably, as members of the public, they do have an interest in the fishery. This line of argument has not yet been tested, but would involve significant extension of the law in this direction.

The *Pride of Derby* case was not taken only by the Angling Association, but also by the riparian owner.[71] A riparian owner is one who owns the adjoining banks and usually the riverbed itself. It is interesting to note that, in the case of damage to Lyme Bay, the seabed has an identifiable owner to the seabed – the Crown Estate. Its property extends to the seabed and all plant and animal life attached to it. In the past the Crown Estate has tended to concentrate on the commercial management of its marine estate rather than environmental stewardship, relying on the authority contained in s(1)(3) of the Crown Estate Act 1961 to maintain and enhance its value but to act according to the principles of good estate management. Appleby[72] identified that the Crown Estate has additional responsibilities since the passing of the Natural Environment and Rural Communities Act 2006 (NERC Act), s 40 of which requires all public bodies, including the Crown Estate,[73] to 'have regard' to biodiversity. While there was no significant financial impact on its property in the past, it is understandable that the Crown Estate would not want to involve itself in 'valueless' environmental litigation. However, given its additional responsibilities under the NERC Act, there is a serious question as to whether the Crown Estate should be taking action to seek relief for the unquestionable damage to its property by scallop dredging.

On this basis, the *Pride of Derby* style arguments of private nuisance will not succeed in protecting Lyme Bay unless the Crown Estate can be persuaded to take action or at least lease it to those who will, or unless the courts can be persuaded that the public right to fish does give individuals sufficient interest in the fishery to mount a challenge.

Assuming that scallop dredging does cause significant damage to ecosystem services (demonstrated by evidence presented already), and that there is a raft of potential claimants, tort law should provide a remedy. It may be that the traditional route of litigation through private nuisance is not the correct tool to use in this case because of the problems of identifying appropriate claimants.

A full investigation of all the possible causes of action would be impossible here. However, one particular cause of action does look potentially fruitful. Unlike the tightly defined and limited nature of private nuisance, public nuisance claims have far broader scope:

- Every person is guilty of an offence at common law, known as public nuisance, who does an act not warranted by law, or omits to discharge a legal duty, if the effect of that act or omission is to endanger life, health, property, morals or comfort of the public, or to obstruct the public in the exercise or employment of rights common to all Her Majesty's subjects.[74]

Public nuisance has been used in a number of pertinent situations:

66 See for example Pontin (n 60); F McManus '*Marcic* Rules OK? Liability in the Law of Nuisance in Scotland for Escapes from Overloaded Sewers' (2008) 19 WL 2 61–69.

67 See eg W Howarth 'The Effectiveness of Environmental Legislation' Editorial (2007) 18 Water Law 3 75–76.

68 Schoenbrod 'Protecting the Environment' (n 39).

69 S Deakin, A Johnston, and B Markesinis *Markesinis and Deakin's Tort Law* (5th edn OUP Oxford 2003) pp 455–87.

70 Bonyhady *The Laws of the Countryside* (n 63).

71 F Newark 'The *Pride of Derby* Case' (1953) 2 MLR 241–44.

72 T Appleby 'Damage by Fishing in the UK's Lyme Bay – A Problem of Regulation or Ownership?' (2007) 18 WL 39–46.

73 Defra *Guidance for Public Authorities on Implementing the Biodiversity Duty* http://www.defra.gov.uk/wildlife-countryside/pdf/biodiversity/pa-guid-english.pdf p 23 (accessed January 2009).

74 *Archbold's Criminal Pleadings and Practice* (5th edn) quoted in Deakin and others (n 69).

- The public right to navigate in tidal water has been defended by successful legal action where the right has been restricted by the acts of individuals. In *Jan de Nul v NV Royale Belge*[75] the courts protected navigation rights, where they had been interfered with, although, in this case, those benefiting under the public right to navigate were few in number.
- Where an individual's rights have been interfered with it is possible to seek action against an offender by having the Attorney-General prosecute the action on the claimant's behalf in a relator action. This would be particularly useful where the damage is not limited to the claimant's property. In the *City of Birmingham* case, the claimant, Charles Adderley, deliberately took action in public nuisance, although he possibly had a private nuisance remedy, because of the broader public implications of the conversion of the river Tame into an open sewer.[76]

The representation problems of Schoenbrod's criteria may therefore be resolved in this instance. Often with ecosystem damage, it is public property which has been damaged rather than an individual's, and it is the common nature of ownership which has limited those who can be represented. In that context, taking a public nuisance action would seem particularly apposite as it allows not just individuals who have faced obvious damage to their property rights to seek redress, but also those who have faced no direct financial loss but are still adversely affected.

Turning to the second of Schoenbrod's criteria, liability, it is fairly easy to prove that navigation rights have been interfered with because there is clear physical evidence, but it is much harder to show that the public right to fish and the public's enjoyment of the environment have been actionably obstructed. However, using ecosystem services analysis, ideally supported by a greater degree of valuation and consensus than in the example above, it seems obvious that the property rights inherent in the public right to fish are endangered by causing excessive damage to the seabed, where the seabed acts as a nursery area for the fishery. It should be in the public interest for a successful action to stop an activity that benefits a few people at substantially greater costs to other sectors of society.

It is worth looking back at the specific cause of action for public nuisance noted above. It will be an interesting point of speculation to determine whether action to stop the obstruction of the right should be on the basis of *Jan de Nul* or damage to the property right itself, in the same way that pollution damaged fishing rights in the *Pride of Derby* case. In either case, there would appear to be room for development of the law of public nuisance in this area.

Damage, the third of Schoenbrod's criteria is the most relevant to the title of this article. Part of the problem with the traditional private nuisance approach to damages is that, like many torts, claims are limited to damage to property or personal injury resulting from the cause of action. It is impossible to claim for 'pure economic loss' such as those losses of trade associated with the damage. So, in the *Pride of Derby* case, it was possible to claim for damage to the fish, but it would not have been possible to claim for loss of profit if the fishing rights were rented out. From an ecosystems approach (ie founded on ecosystem services), the inability to claim for anything but the most immediate damage stops polluters paying for the full costs of their actions and particularly the long-lasting impacts of ecosystem damage. The law of public nuisance has a very different historical development to most tort law. Its origins are in the common law where it was the mainstay of the court's leet, which regulated a very broad church of public welfare offences, particularly interesting for these purposes as it included prosecutions for catching immature fish.[77]

Public nuisance was originally (and still is) a crime. Applications to the civil courts were allowed under public nuisance originally for injunctions to prevent crimes, to take advantage of the speed with which civil courts worked and subsequently to allow the claimant to seek 'special damages' as well. As a result, damages for public nuisance have developed using a different set of rules to most torts. There is a 'health warning' to this approach; Spencer[78] precedes his description of the damages for public nuisance with: 'Few points in civil law are more obscure than the meaning of "special damages" in the context of public nuisance.'

In line with the piecemeal development of the rest of public nuisance, exactly what constitutes 'special damages' is a little *ad hoc*. To rank as 'special', the general rule is that it must be something worse than the general public has suffered. This raises a grave question which will need to be resolved in the marine context. The problem is that the right to fish belongs to the general public but where an action, such as scallop dredging, damages the public's right to fish the loss is not suffered by individuals but by the public as a whole. It may therefore be difficult for those who have lost livelihood or amenity because of scallop dredging to claim damages for their loss. The courts take opposing views on this. In the case of *Benjamin v Stour*,[79] the court found that obstructing the highway outside a claimant's coffee shop allowed the claimant to succeed not just with an injunction but for 'pure economic loss' resulting from the fall in trade. In the Canadian case of *Hickey v Electric Reduction Company of Canada Ltd*,[80] claimant sea fishers failed in their claim for loss of livelihood from a marine pollution incident. Whether the UK courts chose to follow *Benjamin* or *Hickey* is of paramount importance in this case.

75 [2000] 2 Lloyd's Rep 700.
76 L Rosenthal (2004) 'Economic Efficiency; Nuisance and Sewerage: New Lessons from *the Attorney General v Council of the Borough of Birmingham*' http://www.keele.ac.uk/depts/ec/wpapers/kerp0408.pdf (accessed 15 December 2008).
77 J R Spencer 'Public Nuisance – A Critical Examination' (1989) 48 The Cambridge Law Journal (1) 55–84.
78 ibid.
79 (1874) LR 9 CP 400.
80 (1970) 21 DLR (3d) 368.

Table 3: Impact to ecosystem services measured as common law damages

Damage to ecosystem services	Impacted by scalloping	Common law damages
Provisioning services		
Fresh water	n/a	n/a
Food (eg crops, fruit, fish, etc)	Significant	PEL other commercial fishers and charters LA recreational anglers, divers and conservation groups
Fibre and fuel (eg timber, wool, etc)	n/a	n/a
Genetic resources (used for crop/stock breeding and biotechnology)	Significant resources in situ	PEL other commercial fishers and charters LA recreational anglers, divers and conservation groups
Biochemicals, natural medicines, pharmaceuticals	?	?
Ornamental resources (eg shells, flowers, etc)	Part of local tourism industry	PEL charters LA recreational anglers, divers and conservation groups
Regulatory services		
Air quality regulation	?	?
Climate regulation (local temperature/precipitation, GHG sequestration, etc)	?	?
Water regulation (timing and scale of run-off, flooding, etc)	n/a	n/a
Natural hazard regulation (ie storm protection)	- (?) Negative impact of habitat destruction likely to reduce buffering effect, but hard to quantify	?
Pest regulation	? Creation of monoculture on the seabed likely to increase the danger of pests	PEL other commercial fishers and charters LA recreational anglers, divers and conservation groups
Disease regulation	? Creation of monoculture on the seabed likely to increase the danger of disease	PEL other commercial fishers and charters LA recreational anglers, divers and conservation groups
Erosion regulation	(?) Negative impact of habitat destruction likely to increase sediment mobility but hard to quantify	PD the Crown Estate
Water purification and waste treatment	?	?
Pollination	n/a	n/a
Cultural services		
Cultural heritage	?	?
Recreation and tourism	Significant for local tourism industry	PEL charters LA recreational anglers, divers and conservation groups
Aesthetic value	Significant for local 'sense of place'	PEL charters LA recreational angles, divers and conservation groups
Spiritual and religious value	Significant for local identity	LA recreational anglers, divers and conservation groups
Inspiration of art, folklore, architecture, etc	Significant for local identity	LA recreational anglers, divers and conservation groups
Social relations (e.g. fishing, grazing or cropping communities)	Significant for local fishing communities	LA recreational anglers, divers and conservation groups

Damage to ecosystem services	Impacted by scalloping	Common law damages
Supporting services		
Soil formation	n/a	n/a
Primary production	Likely but hard to quantify	PEL other commercial fishers and charters LA recreational anglers, divers and conservation groups
Nutrient cycling	?	PEL for other commercial fishers and charter boats Loss of amenity to recreational fishers and divers and conservation groups
Water recycling	n/a	n/a
Photosynthesis (production of atmospheric oxygen)	?	?
Provision of habitat	Rich natural ecosystems thrive in Lyme Bay	PD the Crown Estate PEL other commercial fishers and charters LA recreational anglers, divers and conservation groups

Glossary

PEL	Pure Economic Loss
LA	Loss of Amenity
PD	Property Damage
Charters	includes dive and recreational angling charters
?	Gaps in evidence/contention

If it is possible to develop the pure economic loss damages awarded in *Benjamin*, this allows broader scope for recovery to the damage to ecosystem services. Going back to the Lyme Bay example, this would allow scallop divers, potters, angling charter boats, etc, to lodge a claim for the damage caused to their livelihoods by dredgers. One obvious complexity here is that members of a small fishing community may be reluctant to confront others within that community. Equally, some of those engaging in scalloping may also undertake these 'lower impact' forms of fishing.

There is also a question as to whether 'loss of amenity' constitutes special damages. Recreational anglers, divers, and conservationists do not necessarily put an economic value on the reefs of Lyme Bay, but the loss of amenity for the ecosystem services provided by the reefs could amount to an interest which can be compensated. There are differing views on this. In *Winterbottom v Lord Derby*,[81] a claimant was denied his expenses for removing an obstruction in the highway, while in similar circumstances in the case of *Smith v Wilson*[82] expenses were allowed.

Damages and ecosystem services

Ecosystem services analysis is a useful tool to understand the broader scope of impacts of a given agent on the environment, breaking free from a former approach based upon only single (or few) obvious local impacts. It therefore informs a more robust backdrop to a common law legal action. However, the common law will only develop in its own way and along its own lines, and those are generally through a sequence of incremental shifts in understanding of existing terminology and cases.

It will be hard to develop the law of nuisance beyond the narrow confines of damages and the circumstances in which it has operated successfully in the past. Public nuisance offers the hope of a broader ambit in terms of the range of both claimants and categories of damages. Damage to ecosystem services has to be reinterpreted in the light of the specific heads of damages potentially available under public nuisance: personal injury (PI), damage to property (PD), pure economic loss (PEL) and loss of amenity (LA). Table 3 notes where each of these three heads of damages could potentially be applied on the basis of assessment of marginal damage indicated in Table 2.

As the table indicates, the ecosystem itself has no locus standi for a claim; it cannot launch an action, but members of affected groups could. While it would be impossible to reclaim the full damage to ecosystem services by this method, it would at least be a step in the right direction and would not necessitate passing new legislation and altering the existing basis of UK tort laws. Even if it is impossible to make a claim for financial compensation in damages, public nuisance also provides a mechanism to stop the activity continuing through an injunction, as a fallback, and thus secures the future for the ecosystem, the services it provides and the many

81 (1867) LR 2 Exch 316.
82 [1903] 2 IR.

beneficiaries that they serve. In Lyme Bay, while it may be possible to identify members of groups who may be able to lodge a claim, it would be very difficult to identify the parties who were actually causing the damage and thus should pay compensation; the availability of an injunction would at least provide a legal mechanism to stop the damage occurring in the future.

Conclusion

Although much has been done to develop private nuisance as an effective means of stopping pollution in rivers, it has severe limitations when seeking appropriate levels of damages to the broader range of ecosystem services. Analysis of the scope of public nuisance shows areas which could be developed to take fuller account of damage to the ecosystem by antisocial activity. The example of Lyme Bay, where damage has been sustained to common property rather than property in private ownership, shows the limitations of private nuisance but the potential for public nuisance to protect property in common ownership. Public nuisance is not a universal panacea, and taking the impacts of the Lyme Bay scallop fishery through the courts would be a difficult case. Even if the culprits could be identified, damages could only be claimed by the group taking the action and damages available under public nuisance do not reflect the truer reflection of the costs to humanity and the environment as identified by an ecosystem services analysis. Regulatory intervention remains an option, but nuisance claims offer a potential alternative pathway for aggrieved parties to seek compensation and at least obtain an injunction against damaging activities.

Endnote

On 7 September 2007, Defra undertook a public consultation exercise about scallop dredging in Lyme Bay.[83] As part of his submission to the Defra consultation, one of the authors used the argument that ongoing damage was a nuisance in that it interfered with the Crown Estate's proprietorial rights. On 19 June 2008, Defra announced its decision to ban dredging in 60 square miles of Lyme Bay, the maximum area under the consultation.[84] This does not invalidate the principles addressed in this paper; if anything, it affirms them. By choosing to bring in regulation, the Minister for Environment, Food and Rural Affairs must have been reasonably sure of the scientific grounds for the closure to risk making a decision, which would almost certainly be challenged by the fishers' lawyers.[85] The burden of proof before the minister would be at a similar level to that required for a common law remedy. The paper demonstrates an alternative avenue for resolving this sort of problem. The Wildlife Trusts began their campaign to close Lyme Bay to scallop dredging 18 years ago, and the total cost of that campaign must have been significant over the years, certainly many hundreds of thousands of pounds.[86] It is possible that the courts could represent a quicker and more economic solution than the slow and painful application of the regulatory process.

83 Defra http://www.defra.gov.uk/marine/fisheries/conservation/ei.htm (acccessed January 2009).
84 Defra (2008) http://www.defra.gov.uk/news/latest/2008/marine-0619.htm (accessed June 2008).
85 http://www.intrafish.no/fn/article172543.ece (accessed July 2008).
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