R E P O R T

THE SOCIAL AND ENVIRONMENTAL HISTORY OF THE RIVER WYE, WALES, AS VIEWED THROUGH THE CHANGING STATUS OF ITS EURASIAN OTTER (*Lutra lutra*) POPULATION

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Abstract: The River Wye has long had a social meaning to the people of Wales and further afield beginning with the search for the "picturesque" in the late eighteenth and early nineteenth centuries, through to the recognition of its environmental value with its designation as a Special Area of Conservation (SAC). The Eurasian otter (*Lutra lutra*), a key element in that designation of the Wye and at five other such sites in Wales, is the top predator on the river and as such reflects the cumulative changes over time within the riverine food chain and environment. Historically it lived in a river of such salmonid abundance that many poor families relied on salmon as their main protein resource with plenty left for a thriving otter population. Land use change leading to siltation of spawning grounds and agrochemical effects on otter reproduction resulted on the Wye, as elsewhere, in the species decline. Measures to stimulate recovery of the otter population have been well documented including regular surveys complemented by post-mortem analyses. The recovery has been accompanied by a greater awareness of the wider needs of the species as reflected in the provision of artificial holts and in underpasses etc. in new road developments. However, the positive elements of its changing status are not universally welcomed.

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INTRODUCTION

The River Wye in Wales, the UK's fifth longest river, has long been famed for being an early subject of the picturesque landscape movement (Gilpin, 1782; Price, 1796; Turner, 1826) which changed eighteenth and nineteenth century perceptions of landscape, and, with pastoral poet William Wordsworth's famous description of the "sylvan Wye" in a poem of 1798, effectively stimulated a tourist industry in the Wye Valley, a lucrative business which continues to the present day. The river initially received a Site of Special Scientific Interest (SSSI) designation from about 1972 eventually extending along its whole length, between Hereford and Chepstow it was declared an Area of Outstanding Natural Beauty (AONB) in 1971 and now has the

highest European conservation designation (SAC). In 1854, George Borrow, author of *Wild Wales*, standing on Plynlimon (Pumlumon Fawr) mountain at the source of the River Wye thought it "*the most lovely river, probably, which the world can boast of*". All these personalities and events have embedded the river deeply in the social fabric of Wales.

Temporal changes in social and environmental history will inevitably be reflected, not only in the lives of the people at that time, but in the creatures affected by such changes, particularly if they are at the top of their food chain such as *Lutra lutra*, the Eurasian otter, and in the environments in which they live. The River Wye is, at 250 km (Natural Resources Wales data), the longest river in Wales, with a rural catchment of some 4136 km^2, one of the least polluted in England and Wales from non-agricultural sources, and is designated as a Special Area of Conservation (SAC) a designation in which the Eurasian otter (from here on referred to as "the otter") is a major factor. An important player in the social and environmental history of the otter is the Atlantic salmon (*Salmo salar*), which has always, when available, made up an important part of otter diet, and also been abundant as a food source for humans living near the Wye throughout written history. One of the earliest references to Wye salmon was by Gerald of Wales who, in 1191, noted that the Wye "*abounded with salmon, most numerously in winter*" (Thorpe, 1978) and some two centuries later they made up a significant part of the 3000 dried salmon Edward II in 1308 requisitioned from Wales for his Scottish campaign (Slater, 1988). Legislation protecting salmon fisheries, some dating back almost 800 years, had proved ineffective and even the Salmon Fisheries Act of 1861, which aimed to curb such practices as taking finger-sized parr as samlets, poisoning, spearing and gaffing of adults, did little reduce freshwater netting which was increasing in intensity and dramatically reducing salmon stocks. For example, the Miller Bros. who netted the river Wye upstream to Symond's Yat, in 1890 they caught 40,642 kg of salmon and by 1892 caught 61,843 kg. By 1900 the catch had fallen to 11,340 kg. In addition, salmon were heavily netted in other parts of the river, in the Severn Estuary and Bristol Channel. Control to save the salmon population required an almost complete ban on netting between 1901 and 1904 (Hutton, 1949).

Until well in to the nineteenth century, if a poor peasant in Wales could build a house overnight on common land, they could claim ownership of that piece of land. Often, such "night houses" (Tŷ Unnos) were on common land near rivers, to give the occupants free access to catch salmon to smoke and use as staple winter food – without which many of these people would starve. The Salmon Fisheries Act of 1861, and subsequent amendments, were passed to control exploitation of salmon stocks, but, because of the value of this resource to the poor, it ultimately lead to an orgy of poaching in protest at these controls, known on the upper Wye as the Second Rebecca Riots (the First were in the 1840s against road tolls) when, in one night at Rhayader in 1904, over 200 adult salmon were taken (Slater, 1988).

As, if not more, important than salmon as otter food, was the European eel (*Anguilla anguilla*). Eels were, for centuries, always the cheapest of fish and utilized by the entire spectrum of society. At the time of the Doomsday Book in 1086 hundreds of water mills in England and Wales paid their rent in eels. They were so common that they were used as a form of currency to pay tithes and rent, often counted in batches or "sticks" of 25 (Cain, 2018). A map of 1584 of Llangorse Lake, known as an important fishery at this time, shows an eel trap on its outflow to the River Llynfi, a tributary of the mid-Wye (Cain, 2018). An eel trap on the Lake still remains but is not operative as eel in the Wye have all but gone in the last three

decades, but the village of Llyswen on the mid-Wye still bears a name possibly derived from the Welsh for eels, Llysywen. On the nearby River Severn, its source, like the Wye, is also on Plynlimon, it was said that the river was so stocked with eels, an important food of both otters and people, that over 1,000 kg were caught in one night in about 1900 at Melverley weir (Waters, 1949). But this time of plenty was about to change.

SOCIAL CHANGE AND ENVIRONMENTAL DECLINE

The presence of otters in Britain has been recorded in the archaeological record from Neolithic and Roman sites (Harris and Yalden, 2008) but not until the twelfth century from written hunting records (Cummins, 1988). It is recorded that otter skins were still were still articles of commerce at Builth Wells, on the middle reaches of the Wye, until the end of the seventeenth century where they were hunted for fur, sport and as "vermin" (Slater, 1988).

Enclosure Acts of 1700s and 1800s and Salmon Fisheries Acts often effectively gave ownership of commons and rivers to wealthy landowners leading to considerable social change and political unrest including the end of the Tŷ unnos concept (Slater, 1988). Although otter hunting dates to at least the early medieval period, otter hunting for sport peaked in late 1800s and early 1900s when UK hunts annually killed thousands of otters as "vermin" in the UK. Over 1200 were killed in England and Wales in the period 1950-55 and the eleven hunts in England and Wales from 1958-1963 killed 1065 otters (Jefferies, 1989). Stevens (1957) reported that otter numbers improved after the First World War and by 1939 were "comparatively common". Numbers dropped during the Second World War but increased in the post-war period with the Wye River Board reporting "there are plenty of otters on the rivers. They are said to be numerous on the Lugg" (a Wye tributary.) "Plenty" and "numerous" were not terms Walker (1970) would have used when, between 1955 and 1970, he estimated a drop of 75% in the otter population on the River Wye. He noted a marked decline following the severe winter of 1962-63 when the Wye tributaries were frozen and snowed over, and slow deep waters on the main river were icebound. Consequently, he suggests, otters could normally turn to alternative prey such as rabbits, but in 1963 myxomatosis made rabbits very scarce and many otters probably died of starvation – but no recovery followed. Full time otter hunts before this decline would regularly kill three to six otters a day on the Wye tributaries which fell to virtually nil on many days post-decline. Walker's observations on the causes of the decline need to be supplemented by the effects of dieldrin, an organochlorine sheep dip and cereal dressing introduced in 1955-56 and banned in 1966.

The local Otter Hunt (Hawkstone) had found mean weights of male otters had decreased significantly from 11.75 kg 1926-36 to 10.23 kg 1936-46 to 9.90 kg 1946-56 as hunting pressure prevented them reaching maturity (Jefferies, 1997). Concurrently, the average weight of rod caught Wye salmon fell from 7.08 kg in 1906-1910 to 5.22 kg 1979-1983 (Strachan, 2015). The mean the weight of roadkill otters has also declined over time, probably because of increasing numbers of younger animals in the recovering population (Chadwick, 2007).

After over hunting, over fishing and organochlorine sheep-dips had taken their toll, otters, at the top of the riverine food chain, began to be affected by other environmental factors such as, acidification due to air pollution, exacerbated by coniferisation of the uplands; siltation of spawning grounds, again due to drainage for forestry and agricultural land improvement. Another important otter food resource in the Wye, the native crayfish *Austropotamobius pallipes* was itself reduced to near

extinction by the 1980s due to crayfish plague, sheep dip and siltation. On the mid-Wye crayfish constituted much of otter diet before the crustacean's decline (although there is evidence that this "native" species was introduced!) (Slater, 1988).

Since the 1980s, Henderson et al. (2012), report an average 15% per year decline in yellow eels in Bridgewater Bay, Somerset, with abundance in 2009 being only 1% of that in 1980. About a century earlier, in 1904, Sir Herbert Maxwell wrote in his book *British Freshwater Fishes* "*the resources of our waters in the matter of eels is well-nigh inexhaustible*". How things have changed! This rapid decline in eels as a food resource has had undoubted consequences for otters (Strachan et al., 2006).

RECOVERY AND RESEARCH

The Eurasian otter and its habitat have full legal protection as a European Protected Species (EPS), and it is also protected under sections 9 and 11 of the UK Wildlife and Countryside Act 1981. Salmon, an important otter food item, has protection under the Salmon & Freshwater Fisheries Act, 1975 and because of its decline in recent decades, the exploitation of eels is controlled under the Eels (England and Wales) Regulations, 2009.

A better understanding of the needs of the animal on the Wye, and more generally, has been achieved through the Cardiff University Otter Project which began in 1992 from Cardiff University's Field Centre at Newbridge-on-Wye in mid-Wales, an interest which emerged from a number of early studies of the species and peripheral involvement in the Otter Surveys of Wales from the 1970s. In the early 2000s, with the closure of the Field Centre, the Project moved its base to the School of Biosciences at Cardiff University and has continued to received otter carcasses for post-mortem and subsequent studies, of which only example publications are given here:

- genetics (Hobbs et al., 2006; Stanton et al., 2009; O'Neill et al., 2013; Thomas et al., 2019; Mead et al., 2020)
- chemical communication (Bradshaw et al, 2001; Kean et al., 2015, 2017)
- toxicology (Chadwick et al., 2011; Walker et al., 2011; Kean et al, 2013; Pountney et al., 2015)
- diet (Slater and Rayner, 1993; Slater, 2002; Williams Schwartz et al., 2018; Drake et al., 2019; Moorhouse- Gann et al., 2020)
- parasitology (Sherrard-Smith et al., 2009, 2012, 2015)
- population structure (Smallbone et al., 2017)
- dispersal (Stanton et al., 2014; Thomas et al., 2019)
- age (Chadwick and Sherrard-Smith, 2010)
- reproductive status (Sherrard-Smith and Chadwick, 2010)
- morphometrics (Sherrard-Smith and Chadwick, 2010)
- behaviour (Cowell et al., 2001)

A TIME TO BE HAPPY (ALMOST)

Fortunately, since the population lows of three decades ago, the otter population of the United Kingdom continues to recover and can be illustrated in Wales by the percentage of sites occupied on Welsh rivers recorded in repeated surveys in 1977-78 (Crawford et al., 1979), 1984-85 (Andrews and Crawford, 1986), 1991(Andrews et al., 1993), 2002 (Jones and Jones, 2004), 2009-10 (Strachan, 2015) where, on the River Wye, the overall positive sites increased from 24% in 1977 to 97% in 2010 which Strachan (2015) believed was approaching carrying capacity although they measured otter presence not actual population size (Strachan and Jefferies, 1996). However, food resources do not seem as yet to be limiting, as introduced species of

crayfish replace natives, still water fisheries and garden ponds increasingly attract otter attention, more coastal/estuarine records are made and from the author's own observations on the mid-Wye, amphibians dominate diet in spring.

Although better sewage treatment; controls on sheep dip disposal; treatment of mine waste waters; removal of barriers to fish movement such as impassable weirs; and reduced acidification all potentially aid the recovery of some salmon populations (Wye Usk Foundation), environmental problems still remain. The effects of climate change on the population viability of mainly migratory fish is unclear. Road death numbers in otters continue to rise but only, it seems, roughly in proportion to their increasing numbers(Strachan, 2015); many pollutants recorded from otters at post-mortem exceed risk levels quoted for other species (Kean and Chadwick, 2012); sedimentation from intensified agricultural and forestry activities cause problems for otter prey species due to a build-up of sediment-adsorbed heavy metals; loss of interstitial space within gravels for fish eggs and invertebrate habitat including for crayfish; eutrophication from phosphates and nitrates and increased BOD. To counteract part of this problem Nitrate Vulnerable Zones have been declared in many parts of the country including parts of the Wye (Strachan, 2015). In the uplands, although acid pulses from peatland, drained mainly for forestry, and particulate flushing from conifer foliage, have reduced due to the introduction of siltation traps and modified drainage patterns and improving air quality it is of concern that levels of sulphur and nitrogen in precipitation remain relatively high (15-25 kg S/ha/yr and 20-25 kg N/ha/yr , Strachan, 2015). Acidity below pH 5.5 excludes bullhead (*Cottus gobio*) and kills salmon alevins which reduces fish stocks and, in turn, potentially the carrying capacity of otters (Strachan, 2015).

The near complete loss of the native, White-clawed Crayfish (*Austropotamobius pallipes*) from the mid-Wye catchment, due largely to crayfish plague, sheep dip pollution and siltation, has deprived the otter in this region of a former principal food resource. However, the American Signal Crayfish (*Pacifastacus* leniusculus), carrier of the plague which has largely destroyed *A. pallipes*, was introduced in the 1970s to fish farms in the Wye and adjacent catchments, and has now escaped these farms and spread to dominate the invertebrate biomass of several former *A. pallipes* strongholds. It these situations, *P. leniusculus* has seemingly replaced the *A. pallipes* element in otter diet but not without creating further environmental change due to its more aggressive feeding habits (Slater, 1988). To aid its control, it is now illegal to trap or catch *P. leniusculus* without a licence and no commercial exploitation of crayfish is allowed in designated controlled (no-go) areas. *P. leniusculus* is currently one of about eight alien crayfish species present in the British Isles so problems associated with the species may only be indicative of potential future problems.

Although the number of otters killed on Welsh and English roads continues to increase, it is probably a proportional harvest of an increasing population (Strachan, 2015). In Wales, the Welsh Government leads a partnership of organisations interested in the implementation of mitigation measures to reduce otter deaths called the Roads and Otters Steering Group. Otter mortality black spots are identified, and remedial actions suggested, in line with Grogan et al (2001) and incorporated in the technical advice given in the Standards for Highways Design Manual for Roads and Bridges (15 volumes 2020). Mitigation measures in various otter scenarios include, artificial holts, underpasses, ledges, the need for otter guards on legally used fyke nets and otter proof fencing. Since the 1970s artificial otter holts (National Rivers Authority, 1993) and bankside fencing have been constructed on many water courses in Wales, including the Wye, for the benefit of these animals, although the general

need for artificial holts has declined as the population of otters expands and there seem to be sufficient natural holts (Grogan, 2001).

Otters have become increasingly popular in the eyes of the public. In 2020 it was voted Scotland's favourite native species and Britain's favourite mammal in 2008. Organisations such as the Wye/Usk Foundation in Wales have spent years improving the riverine habitat to the benefit of otters, following on from practical work on otter conservation and distribution by the Vincent Wildlife Trust beginning in the 1970s. Public participation through local recording of otter signs has been encouraged by, for example, the South Wales Otter Trust. In literature the otter has been depicted in a favourable light in books as diverse as *Wind in the Willows* by Kenneth Grahame and Henry Williamson's *Tarka the Otter*, the latter coming second in 2019 in a poll of Britain's Favourite Piece of Nature Writing. The otter has appeared in J.K. Rowling's Harry Potter series and gained popularity in the book and film of Ring of Bright Water by Gavin Maxwell. All in all, a positive social perception of the otter has continued to increase as its population has recovered. As Pete Cooper (2016) put it:

"The otter transcends the world we know and the one we don't, and therein lies our deep fascination. A top predator of our rivers and wetlands, mysterious yet familiar and a true comeback-kid that shows that through working together, we can make a difference to the fortunes of the natural world; the otter is a great candidate to champion UK mammals"

Sadly, the rapid recovery of otter populations has created genuine problems, especially for still water fisheries both in Britain and Europe (Kranz, 2000; Spur et al., 2018) and to a lesser extent the owners of ornamental fishponds (Green, 1998). On a commercial level this problem is recognized by the appropriate authorities and the only real answer seems to be otter proof fencing, meaning, that the wheel of social history has come full circle and in certain situations there are calls once again to control otters as "vermin".

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RÉSUMÉ: L'HISTOIRE SOCIALE ET ENVIRONNEMENTALE DE LA RIVIÈRE WYE, AU PAYS DE GALLES, VUE À TRAVERS LE CHANGEMENT DU STATUT DE SA POPULATION DE LOUTRE EURASIENNE (*Lutra lutra*)

La rivière Wye a longtemps eu une signification sociale pour les habitants du Pays de Galles et bien au-delà, à commencer par la recherche du «picturesque» à la fin du XVIIIe et au début du XIXe siècle, jusqu'à la reconnaissance de sa valeur environnementale avec sa désignation comme Zone Spéciale de Conservation (ZSC). La loutre eurasienne *(Lutra lutra*), un élément clé dans cette désignation de la rivière Wye et dans cinq autres sites de ce type au Pays de Galles, est le principal prédateur de la rivière et en tant que telle reflète les changements cumulatifs au fil du temps au sein de la chaîne trophique fluviale et de l'environnement. Historiquement, elle vivait dans une rivière d'une telle abondance de salmonidés que de nombreuses familles pauvres dépendaient du saumon comme principale source de protéines, avec des réserves pléthoriques pour une population de loutres florissante. Le changement d'affectation des sols a eu pour conséquence l'envasement des frayères et des effets agrochimiques sur la reproduction de la loutre, ce qui a entraîné sur la rivière Wye, comme ailleurs, le déclin de l'espèce. Les mesures visant à stimuler le rétablissement de la population de loutres ont été bien documentées, notamment par des suivis réguliers complétés par des analyses post-mortem. Le rétablissement s'est accompagné d'une plus grande prise de conscience des besoins plus larges de l'espèce, comme en témoigne l'installation de catiches artificielles et de passages souterrains etc. dans le cadre des nouveaux projets routiers. Cependant, les éléments positifs de son changement de statut ne sont pas universellement bien accueillis.

RESUMEN: HISTORIA SOCIAL Y AMBIENTAL DEL RÍO WYE, GALES, VISTA A TRAVÉS DEL ESTATUS CAMBIANTE DE SU POBLACIÓN DE NUTRIA EURASIÁTICA (*Lutra Lutra*)

El río Wye ha tenido desde hace mucho tiempo un significado social para la gente de Gales (y no sólo de Gales), empezando por la búsqueda de lo "pintoresco" a fines del siglo 18 y comienzos del 19, hasta el reconocimiento de su valor ambiental con su designación como Area Especial de Conservación (SAC). La nutria eurasiática (*Lutra lutra*), un elemento clave en la designación del Wye y de otros cinco tales áreas en Gales, es el predador tope en el río, y como tal refleja los cambios en la cadena alimentaria y el ambiente riparios, acumulativos a lo largo del tiempo. Históricamente, vivió en un río con tal abundancia de salmónidos que muchas familias pobres obtenían su principal fuente de proteína del salmón, quedando aún así muchos para una próspera población de nutrias. El cambio del uso de la tierra conducente a sedimentación en los ambientes de desove y a efectos de agroquímicos en la reproducción de nutrias, resultó en que en el Wye, como en tantos otros lugares, la especie declinara. Las medidas para estimular la recuperación de la población de nutrias han sido bien documentadas, incluyendo prospecciones regulares complementadas por análisis post-mortem. La recuperación ha sido acompañada por una mayor conciencia acerca de las necesidades integrales de la especie, lo que se reflejó en la provisión de refugios artificiales, y pasos de fauna, etc en los nuevos desarrollos viales. Sin embargo, los elementos positivos de su estatus cambiante no son universalmente bienvenidos.