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# The battle for British Beavers



Beaver feeding at the Scottish Beaver Trial site at Knapdale. Philip Price

**Simon Jones, Derek Gow, Adrian Lloyd Jones and Róisín Campbell-Palmer**

Following its near extinction in the late 19th century, the Eurasian Beaver *Castor fiber* has now recolonised much of its former distribution and now seems poised to reconquer the very western edge of its native range – Great Britain. This is the scene of a fascinating social battle, with this remarkable rodent as the central character.

Beaver reintroduction is not a new concept within a wider European context and has featured in previous issues of *British Wildlife* (e.g. Gaywood *et al.* 2008). To date there have been over 200 formal reintroduction projects involving this species, and numerous unofficial releases, in over 26 European countries (Halley

& Rosell 2002). Some of the unofficial releases into Belgium and Spain have been substantial in terms of the numbers of Beavers released (G Schwab pers. comm.). From an estimated population of 1,200 individuals by the late 19th century (Nolet & Rosell 1998), this species has recovered through a combination of active conservation measures and natural spread to a global population of approximately 1.04 million individuals (Halley *et al.* 2012).

In this article, we shall give an overview of the current situation regarding the status of Beavers in Britain and explore some of the key arguments which may decide their future. There is currently no evidence to suggest that Beavers were native to



Figure 1 Estimated distribution of Eurasian Beaver c.10,000 years ago. (D Halley pers. comm.)

Ireland, and this article therefore is restricted to Britain. The term 'Beaver' refers here to the Eurasian Beaver unless reference is specifically drawn to the North American or Canadian Beaver *Castor canadensis*.

### Historical context

The world range of the Eurasian Beavers once incorporated most of Eurasia, where they may have extended as far east as the Kamchatka Peninsula (Fig. 1). Radio-carbon dating of fossilised remains indicates that Beavers were living in Britain as far back as the Pleistocene epoch (c. 2 million years ago) (Kitchener 2001). Like many species, they would have been forced to retreat in response to the cold of the glacial periods, before recolonising suitable habitats when the climate warmed. Evidence from archaeological sites, historic records, place names and folklore indicate that Beavers were once widespread and common throughout Britain (Coles 2006).

Overhunting by humans for Beaver meat, fur and anal-gland secretions, compounded with the loss of its wetland environment, resulted in its extinction in Britain by the 16th century. This process of over-exploitation was replicated throughout their global range, and the relict populations that did survive into the 20th century, particularly in Europe, did so largely by chance.

### The Beaver returns

By the late 18th and early 19th century the European exploitation of Beavers had dramatically

decreased, mainly as there were very few left to hunt. Humans no longer relied on their flesh for food, the use of castoreum for medicinal purposes had declined, and the demand for their fur was met instead by organisations such as the Hudson Bay Company, which exported many millions of Canadian Beaver pelts worldwide (Hood 2011). Over time, the tiny relict European populations which had survived in Norway, France, Germany and present-day Belarus were afforded effective protection, and began slowly to expand.

Early Beaver reintroductions were undertaken for a variety of reasons. Although some focused on the restoration of lost natural heritage, others were prompted by a desire to restore Beavers as an economic fur resource. The contemporary understanding of the importance of Beavers as creators of biodiverse wetland environments was not a widespread motivation until relatively modern times. Early reintroductions were often unsuccessful, as sufficient numbers of Beavers could not easily be procured. Beaver farms were established in the 1920s at Voroshnev, in Russia, and in the 1960s at Popielno, in Poland, to produce reliable numbers for restocking. These facilities, along with access to the largest surviving wild populations, were, however, located behind the 'Iron Curtain', which made co-operation with western projects problematic. In the first half of the 20th century, before it was established that Eurasian Beavers were genetically distinct from the more readily procurable Canadian species, the latter was introduced into a number of European loca-

tions (Halley & Rosell 2002). Some of these populations were established from tiny numbers of founders; the Finnish population of approximately 10,000 individuals is descended from seven individuals released during 1935-1937 (Nummi 1996). As expertise developed and Beaver numbers rose, reintroductions became more effective. By the latter half of the 20th century, Beaver populations across mainland Europe had grown rapidly as they adapted with ease to utilise wetland landscapes which had been significantly altered and engineered by humans in the post-war period. This process, combined with natural expansion, has proven so successful in mainland Western Europe that the need for further reintroductions is considered to be slight (D Halley pers. comm. 2013).

In Britain, however, the return of the Beaver has been a more complex and convoluted story. In 1998, Scottish Natural Heritage (SNH) launched a public consultation to ascertain wider attitudes to Beaver reintroduction in Scotland (SNH 1998). Whilst the majority of those who responded favoured reintroduction, concerns and opposition were expressed by others who feared that Beaver activities would detrimentally affect the farming, fishing and forestry sectors. It is clear that this opposition commonly applies to species that are wide-ranging and which harbour the greatest potential ability to impact upon important rural economic land uses, including game-rearing, fisheries, forestry and agriculture.

In response to the results of its Beaver reintroduction consultation, SNH took the decision to propose a time-limited, trial reintroduction in the Knapdale Forest area of Argyll. Although the initial SNH application for a trial was turned down by the Scottish Government in 2005, a joint licence application submitted in 2007 by Scottish Wildlife Trust (SWT) and the Royal Zoological Society of Scotland (RZSS) was successful. This led to the first legal and unfenced reintroduction of Eurasian Beavers in Britain taking place in May

### **Beavers and the law**

Releasing Beavers into the wild without a Government licence is currently an offence under section 16(4) of the Wildlife and Countryside Act (1981), as the species is not considered to be 'ordinarily resident' in Britain. Definition of what constitutes 'ordinarily resident' is contested by some, as the Tayside Beaver population appears to have been producing wild-born offspring for a number of generations. In the Natural England feasibility and acceptability study on Beaver reintroduction in England, it is suggested that, where a release into the wild has resulted in the establishment of a resident, wild population of a species, then this could be considered to be 'ordinarily resident' and '*subsequent releases would not require a licence*', and that a release into England, Scotland or Wales that established an 'ordinarily resident' population would remove the need for licensing in the other two countries (Gurnell *et al.* 2009). The Eurasian Beaver is currently listed as a protected species on Annex IV of the EC Habitats Directive, and is also protected under the Bern Convention as an Annex III species. In Scotland, the statutory bodies deem Beavers not to be ordinarily resident and therefore they are not currently considered protected until such a decision is made formally to reintroduce this species. This view has not to date been tested in a Scottish court. Likewise, no legal challenges have been made regarding Beavers which have been killed on the Tay, nor have there been any prosecutions over suspected, unlicensed Beaver releases. While the Scottish Government has licensed the Scottish Beaver Trial and agreed to tolerate the Tayside Beaver population until a decision on the future of the species in Scotland is made, it has also made it clear that Beavers outside these populations can be culled and that landowners currently have a legal right to control Beavers on their land.

2009, when 11 Beavers imported from Norway were released at three sites within a working forest owned and managed by Forestry Commission Scotland. This tiny population of Beavers, together with the impact which the animals have on their surrounding environment and its associated economy, is the subject of an independent scientific monitoring programme co-ordinated by SNH and running until May 2014. The Scottish Government is expected to make a final decision on the future of Beavers in Scotland by late 2015.

### **Enclosed releases, demonstration sites and zoos**

The Scottish Beaver Trial was not, however, the first project to release Beavers into the British countryside. In July 2002, six Eurasian Beavers from Norway were released in two family groups into the enclosed Ham Fen Nature Reserve, near Sandwich, by the Kent Wildlife Trust. This project, which was licensed by English Nature (now Natural England), aimed to use the activity of Beavers to help to regenerate wetland complexity in an area of relict fen. It continues to the present day and was the first of a series of what have been termed 'enclosed releases'. Although some releases have often been on land owned or leased by conserva-



One of the Beavers at Ham Fen Nature Reserve, Kent. Terry Whittaker/FLPA

tion organisations (e.g. Devon Wildlife Trust), with several private landowners have also created large naturalistic enclosures on their properties. Enclosed releases appear to be part of a growing trend, with several sites in Wales currently being considered. Although expensive initially to create because of their high fencing costs, these releases are relatively straightforward, especially when they involve captive-bred animals, as these can be maintained without a licence and require no process of formal public consultation. Some of these sites operate as income-generating operations which provide reliable views and educational or photographic opportunities for paying visitors. At least ten such sites are known currently to exist, while others are planned or are currently under construction. Captive Beavers (Eurasian and a small number of Canadian) are also kept in several zoological collections throughout Britain.

### Unofficial releases in Britain

One of the most fascinating and controversial issues regarding Beavers is the presence of unauthorised populations living in the wild in Britain. In parts of central east Scotland (over 40 sites), Mid Wales (at least one site) and southern England (at least five sites), there is evidence (including field signs, photographs and recovered cadavers) of free-living Beavers in rivers, lochs and drainage ditches. Remarkably little is known about the true distribution, origin and actual numbers of the Beavers involved.

The largest population is now known to be

extensively dispersed throughout the River Tay catchment in east Scotland (Campbell *et al.* 2012), where local reports suggest that it has been present for the last decade. After a brief trial trapping programme co-ordinated by SNH in 2011/12, a vocal public campaign opposed to the capture and removal of these animals was successfully mounted, leading to the Scottish Government taking the decision in 2012 to tolerate and monitor the population, in line with the Scottish Beaver Trial in Knapdale, until 2015. In 2012, SNH commissioned a distribution-and-population estimation survey, which indicated that there could be more than 30 Beaver territories spread through an area covering over 600km<sup>2</sup> (Campbell *et al.* 2012). Arguments and speculation surrounding the origin, legal status and future management of this population have led to some public disagreements being played out in the regional and national media amongst supporters and opponents of these Beavers. Amongst those who support the full reintroduction of Beavers, there are contrasting views on whether or not unauthorised wild Beavers should be welcomed alongside the licensed trial population in Knapdale. Questions concerning the provenance, health status and genetic variability of these Beavers still continue today and are currently being researched. However, their established presence has now moved the whole issue of Beaver restoration forward at a pace not easily emulated by conventional processes. The Tayside Beaver Study Group was formed by the Scottish Government in 2012 and contributes data to the formal decision-making process regarding the species' future after 2015.

The distribution map (Fig. 2) shows all the sites occupied by captive and free-living Beavers in Britain of which the authors are currently aware. Although there appears to be a close correlation between some captive-Beaver sites and evidence of free-living Beavers nearby, there are also credible records of Beaver field signs or sightings well away from any known captive populations. In recent years, wild-living Beavers have been shot, photographed and captured in several parts of

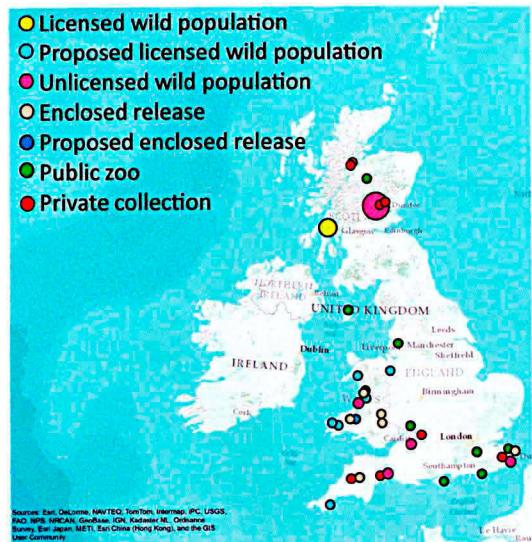
England (D Gow pers. comm.). While the owners of some Beaver collections have admitted that some animals have escaped (it should be noted that Beavers are notorious escape artists), and solitary individuals have been reported to disperse up to 80km from their natal territories, it is also likely that deliberate, unlicensed releases of Beavers have occurred.

Whilst there appears to be general popular support for the concept of wildlife reintroductions, it is important to recognise that the way in which these reintroductions take place has been varied in terms of practice and legality. The recently updated International Union for Conservation of Nature guidelines (IUCN 2012) were developed to facilitate and improve the success and long-term acceptance of reintroductions, and are widely accepted to be effective codes for 'best practice'. Licensing species' reintroductions in the UK, especially for those that evoke even mild controversy, could be perceived to be a slow, expensive and bureaucratic process. Anecdotal evidence suggests that the vulnerability, easy derailment or slow pace of the licensing process has historically resulted in frustration and then unofficial and illegal animal releases. Other former natives, such as Wild Boar *Sus scrofa*, Polecat *Mustela putorius*, Goshawk *Accipiter gentilis* and Eagle Owl *Bubo bubo*, have all been reported as illegally released at various points across Britain.

### **Beaver reintroduction – good or bad?**

In our experience, the debates regarding Beaver reintroduction in Britain tend to be polarised, people generally falling into one of three camps: pro, sceptical/anti or no strong opinion (the last probably being the largest group). From the first Scottish public consultation on the reintroduction proposals over 14 years ago, the reasons which people give for being either for or against reintroduction have remained largely unchanged.

Those in favour of reintroduction argue for the Beaver's ability to restore native wetlands and wildlife, through habitat modification. They highlight the wider environmental benefits associated with Beaver dam systems for water quality, retention and flood dissipation. These ecosystem services are ranked highly by Beaver supporters, as they also tend to attract the attention of political decision-makers, for whom flood control and sustainable solutions for land and water manage-



**Figure 2 Distribution of the current known captive and free-living Beavers in Britain.**

ment are real concerns. The growth in wildlife tourism also means that Beaver supporters can point to the economic benefits that the presence of iconic species affords. Some supporters believe strongly that as humans we have a moral imperative to restore 'lost' species, i.e. as the Beaver was driven to extinction by our ancestors, it is our duty to return it to its rightful presence as part of our native fauna.

Those who are either opposed to Beaver reintroduction or have major concerns about it cite a variety of reasons to support their views. Beavers can flood land and this can lead to widespread and potentially expensive damage to agriculture, forestry and wider landscape infrastructures. Beavers can also damage commercial broad-leaved plantations, fruit trees and some agricultural crops through gnawing, felling and feeding. Beaver dams can temporarily block fish movement in narrow watercourses during low-flow conditions and their silt-trapping effects can potentially lead to the silting-up of some spawning grounds.

By the early 20th century, it was believed that Beavers were a species only of 'open woods alongside rivers, old river beds and lakes' (van den Brink 1967) and that a lack of these habitats would naturally limit their distribution. In the early years following Beaver reintroduction in Bavaria, this belief seemed to be accurate, as developing Beaver populations selected only the best of the available riparian habitats. Once this phase of colonisation



Birch trees felled by Beavers at a demonstration project in Inverness. Laurie Campbell/Nature Photographers

was complete, however, the expanding population rapidly began to adapt to a wide range of sub-optimal, man-made habitats, ranging from highly engineered watercourses to land-drainage ditches, ornamental ponds, sewage plants and public parks. With this modern experience of Beaver adaptability has come a requirement to manage the impact of Beavers upon environments where their presence was never envisaged. This process has in part moved away from an entirely lethal response to measured mitigation techniques, perhaps driven by reasons of changing social acceptability regarding the culling of wildlife in a more urbanised human population, although culling is still a widespread practice. Effective mitigation solutions for Beaver-related conflicts in modern cultural environments have now been effectively trialed, developed and assessed (Parker & Rosell 2003), and new management manuals are currently in development in

Bavaria and Britain.

Many of these arguments have been widely aired publicly and within the scientific literature. More recent developments in a British context are providing interesting material for debate and the progress of scientific research.

### Beavers and health issues

From a health and biosecurity perspective, Beavers are currently considered to present no greater risk to humans, livestock or other wildlife than does any other native mammal (Goodman *et al.* 2012). However, one should not ignore the fact that the health status of unofficially released or escaped Beavers is currently unknown and, if such individuals represent unscreened wild animals directly imported from certain parts of central Europe, then this becomes a greater concern. Retrospective health screening, which is being undertaken on a sample of free-living Beavers from Tayside in order to establish the presence of any non-native diseases, will give further concern regarding wider Beaver reintroduction.

The identification of the potentially lethal tape worm *Echinococcus multilocularis* (EM, which can lead to the condition Echinococcosis) in a captive Beaver which had been imported from Bavaria (Barlow *et al.* 2011) illustrates the risk of unscreened releases. EM is not believed currently to occur in Britain, although it is widespread throughout continental Europe and can result in important human and animal health risks (Kosmider *et al.* 2013). Although this is a parasite of carnivores, namely Foxes *Vulpes vulpes*, but potentially also domestic dogs, Beavers can, like other rodents, act as intermediate hosts, passing on the parasite if consumed by a carnivore. The number of unscreened, directly imported Beavers from central Europe which may now be free-living in Britain is likely to be small, and the actual risk that they may possess this parasite is therefore low, but is also a currently unknown one. Given the consequence of this parasite entering Britain, it is a risk that should be carefully considered, although in 2012 Defra considered the risk of EM arriving in Britain via imported Beavers to be low (Defra 2012). Previously published risk assessments for dog movements returning from Europe highlighted this as a likely greater potential risk for EM introduction into the UK. The risk assessment found 98% likelihood of at least

1 in 10,000 dogs returning to the UK from a short trip to Germany being infected with the parasite, if untreated, and over 99% risk if dogs had been longer-term residents (Torgerson & Craig 2009). Although intended for conservation purposes, unofficial Beaver releases could result in serious health risks and have significant consequences not only for other wildlife but also for public support of future reintroduction processes.

The presence of Beaver-specific parasites has also been demonstrated in both Beaver populations in Scotland. The Beaver Beetle *Platypslus castoris* has been recorded in Scottish-born animals in the Scottish Beaver Trial (Duff *et al.* 2013), whilst the Beaver Fluke *Stichorchis subtriquetrus* has recently been recorded in wild-born Tayside Beavers (Campbell-Palmer *et al.* 2013). Although both of these are the first recordings for Scotland, they could also be considered to be reintroductions as there is little doubt that they would have been present in Britain before Beavers became extinct. The return of both species has been associated with Beaver reintroductions across Europe. These findings provoke a debate on whether host-specific parasites that pose no threat to humans or wildlife can realistically be controlled or should in fact be reintroduced as part of the natural cycle and evolution of a species.

### **Beaver genetics**

Amongst those involved in Beaver reintroduction projects, there has been some debate regarding the origin of donor stock for British restoration schemes (Halley 2011; Rosell *et al.* 2011). The Eurasian Beaver exists in a number of genetically distinct populations (Babik *et al.* 2005; Durka *et al.* 2005). A study of mitochondrial DNA (mtDNA) variation in the Beaver has previously suggested that *Castor fiber* in Eurasia forms two Evolutionary Significant Units (ESUs), one originating from western Europe and another from eastern Europe and Asia, and that therefore the mixing of these should be avoided during reintroductions (Durka *et al.* 2005). A number of populations in Europe, including those from Bavaria in Germany, are thought to consist of mixed ESU stock. On the other hand, a number of Beaver populations that are thought still to be unmixed (e.g. in France and Norway) are known to have passed through considerable population bottlenecks during the 19th century, when they were almost hunted to

extinction (Halley & Rosell 2002), and exhibit low genetic diversity (Babik *et al.* 2005; Durka *et al.* 2005). Although these populations are large in size, they are less likely to be able to adapt to future conditions (e.g. to disease, climate change) than those with high genetic diversity, and this has been presented as an argument by some for using mixed ESU stock in Britain.

In the Scottish Beaver Trial, Norway was selected as a suitable donor country partly on the basis of work comparing skull sizes of extant British and other European Beaver populations (Kitchener & Lynch 2000). Work has been conducted at the Royal Zoological Society of Scotland to carry out partial sequencing of the Beaver genome (Senn *et al.* 2013), and research is now underway to conduct a thorough genetic characterisation of Beaver populations across Eurasia. This will provide background genetic data to aid any future selection of Beavers for reintroduction in Britain. This work will also create the genetic tools to conduct parentage analysis and individual identification, which will be useful for captive-breeding and ex-situ monitoring.

### **Beavers and biodiversity – winners and losers**

Although an extensive body of scientific research indicates that landscapes generated by Beavers contain considerably higher levels of biodiversity and biomass than environments from which they are absent (e.g. amphibians – Karraker & Gibbs 2009; bats – Ciechanowski *et al.* 2012), the return of the Beaver has not always proven popular with specific-interest conservation groups whose focus is on less mobile or rarer, isolated species. While experience in both Europe and North America demonstrates that there are both ‘winners’ and ‘losers’ when Beavers colonise new habitats (Rosell *et al.* 2005), their net impact increases biodiversity and biomass on a landscape scale (Hood 2012).

Whether such habitat-creation activities may also assist the colonisation and expansion of alien invasive species, by increasing the ecological carrying capacity, requires further investigation. Initial investigations in Lithuania suggest that the abundance of three invasive alien mammals (*Muskrat Ondatra zibethicus*, *Raccoon-dog Nyctereutes procyonoides* and American Mink *Neovison vison*) shows positive correlations with Beaver densities. However, whether this is a causa-



**The Aspen Hoverfly.** Steven Falk

tive effect has yet to be established (Ulevičius *et al.* 2012).

Likewise, other invasive, exotic plant species can be common in Beaver habitats, and experience from Europe indicates that species such as Giant Hogweed *Heracleum mantegazzianum* and Himalayan Balsam *Impatiens glandulifera* can flourish, but it is not known whether their presence has a direct correlation with Beaver engineering (D Gow pers. comm.). Evidence of Beavers using other invasive plant species has been seen in Knapdale, where they have been observed felling Rhododendron *Rhododendron ponticum* close to the water's edge (although no evidence of browsing was recorded). On Tayside, detailed video footage exists of a Beaver eating Japanese Knotweed *Fallopia japonica*. Further investigations concerning Beavers and their relationships with the growing numbers of invasive animal and plant species in Britain would be important areas for further research.

An interesting example from Scotland is the discussion regarding the Beavers' relationship with Aspen *Populus tremula* and the closely dependent Aspen Hoverfly *Hammerschmidia ferruginea*, as well as the lichen species *Arthonia patellulata* and *Lecanora populincola*. There has been concerted conservation action for Aspen in

Britain as a result of its limited distribution and poor regenerative capacity largely in response to intensive grazing pressure (Watson Featherstone 2006). It is highly favoured as a source of food by Beavers, and concerns have been raised regarding the potential impact that a reintroduced Beaver population could have on isolated and fragmented Aspen stands, and their associated hoverflies and specialist lichens. Others have pointed out that Beaver reintroduction could also act as a flagship for Aspen conservation by raising awareness of the species (Batty 2002). The coppicing of Aspen by Beavers rapidly results in the felled tree sending out suckers in response. Beavers are untidy feeders and do not use all the material they fell or all the available trees in any stand. Aspen Hoverflies require Aspen stands with appropriate age structures, including saplings, mature trees and dead timber (standing and felled), as a feeding and breeding resource. Experience from other parts of Europe where large populations of Beaver coexist with widespread Aspen woodlands would seem to indicate that proactive Beaver management techniques, such as protective fencing measures, could be deployed in areas where Aspen biodiversity is deemed to be particularly vulnerable. In the long term, a wider effort to increase the quality and quantity of riparian woodland would benefit Aspen and its associated species. Further research into this fascinating ecological relationship would assist in the planning for wider Beaver restoration in areas with important Aspen stands.

Initial findings from elements of the independent monitoring programme carried out at the Scottish Beaver Trial also indicate the complexity of the ecological relationships that result from Beavers returning to native habitats. Work at The James Hutton Institute, in Knapdale, supports other European studies in that the majority of Beaver effects on woodlands occur within 10m of fresh water, with birch *Betula* and willow *Salix* species being heavily used (Moore *et al.* 2013). Interestingly, an estimated 35% of trees felled by Beavers show resprouting. However, the authors highlight subsequent browsing by deer and Beavers as a problem. As with deer browsing, another useful area of further research would be an investigation into the impact of livestock upon tree regeneration stimulated by Beavers. Also, at the Scottish Beaver Trial, the University of Stirling has been monitoring the effect of Beavers on the

aquatic macrophyte assemblages within a series of freshwater, SAC-designated lochs. Here, the Beavers have altered macrophyte communities by both dam-building and browsing, dams leading to an increase in the area and level of some standing waters. Also, selective feeding has resulted in a decrease in the abundance of some species such as Common Club-rush *Schoenoplectus lacustris* and Great Fen-sedge *Cladium mariscus*. To date, there appears to have been no significant Beaver effect on either the distribution or the abundance of the invasive alien Canadian Pondweed *Elodea canadensis*, which is present in some of the Knapdale lochs (Willby *et al.* 2011).

The interactions of Beavers with fish communities continue to attract attention and debate. Fish are known to be affected by Beaver activity largely as a result of changes in hydrology, geomorphology, water chemistry and temperature in some freshwater ecosystems (Collen & Gibson 2001). The lack of British research into and experience of the potential impacts of Beaver activity, such as damming, on economically important fish species, such as migratory salmonids, led in Scotland to the formation of the Government-appointed Beaver Salmonid Working Group, which acts as a sub-group within the wider National Species Reintroduction Forum, established in 2009. Concern regarding this issue led to SNH publishing a review of the effects of Beavers upon fish and fish stocks (Kemp *et al.* 2010). The review, which looked at experiences and research from North America and Europe, found that the majority of fisheries scientists and managers tended to suggest that the overall impact of Beavers on fish populations was positive, with increased habitat heterogeneity, greater areas for rearing and overwintering, higher invertebrate production, and the provision of refuges from both high and low flows. However, that the impact of Beaver dams on the movement of migrating salmonids in tributary streams and on the availability of suitable salmonid spawning habitat was generally considered negative.

### **Beavers and ecosystem services**

There is mounting interest in how the activities of Beavers may contribute to the provision of ecosystem services (e.g. Buckley *et al.* 2011; Vickerman 2013). An interesting aspect of this discussion could be the potential impact that Beaver reintroduc-

tions could have on water management, especially in lowland improved landscapes. The Pitt Review (2008), commissioned by the UK government in response to the summer floods of 2007, stated 'that flood risk cannot be managed by simply building ever bigger hard defences. Softer approaches, such as flood storage...provision of storage, such as on-farm reservoirs or enhanced wetlands; and slowing flows...restoring smaller watercourses to a more natural alignment.' Could Beavers play a role here? Beaver dam- and pond-building activity has been demonstrated to help alleviate flood events through the slowing of peak discharges and water retention (Nyssen *et al.* 2011). Additionally, dams have been observed to trap sediments, toxins and excess nutrients (Lamsdorff & Ulevicius 2012) and in boreal Canada they have been shown to provide additional water storage capacity within river catchments at times of drought (Hood & Bayley 2008). Using these examples, proponents of Beaver reintroduction argue that restored Beaver populations could, if allowed, produce natural flood defences and water reservoirs that may prove to be effective in the fight against the dual problem of major flooding events and drought periods. However, the benefits of this ecosystem engineering activity may be fully realised only should there be a sufficiently sized resident Beaver population to ensure that damming activity was occurring on numerous upstream tributaries of major river catchment systems.

In the Pitt Review, there are several examples of where ponds on wildlife reserves (Potteric Carr, Yorkshire) and restored watercourses (e.g. the Sinderland Brook, Cheshire) were seen to have assisted with flood alleviation in 2007, and recommendations are made for working with more natural processes. On a wider scale, could the Beaver even play a role in the delivery of the Water Framework Directive in the UK by contributing to a healthy, sustainable water environment?

### **Lessons for living with Beavers**

The majority of scientific evidence and overseas experience outlined above indicates that the benefits – ecological, hydrological and economical – which accrue from Beaver activity largely outweigh the negatives. However, their existence will ultimately be dependent on human tolerance. We must be clear about the nature of the chal-



A Beaver dam and pond at the Knapdale trial site. Steve Gardner/SWT

lenges which will ultimately arise from the potential presence of sizeable Beaver populations and, prior to any wider reintroduction programmes in Britain, begin to prepare pragmatic plans for the management of this keystone species.

While the response of individuals who are unlikely to be directly affected by Beaver behaviours is generally positive, this position can rapidly reverse if they are personally affected. This social dichotomy has been demonstrated on a larger scale in Bavaria, where initially the concept of the Beaver as an important 'restorer of nature' meant that there was little general sympathy for the complaints of the few landowners who had issues with the species' presence. As Beaver populations grew and they began to colonise public parks and gardens, their tree-felling and burrowing impacts altered perceptions (G Schwab pers. comm.). A recent American study found that, as Beaver densities rose, so did Beaver-human conflicts, which in turn saw a fall in Beaver acceptance, while the severity of Beaver damage had a direct impact on the acceptance of lethal management by those affected (Siemer *et al.* 2013). Such examples show why it is important to remember that public perceptions can carry as much weight as facts with people (and politicians), if not more so.

While the scientific work of the Scottish Beaver Trial, the monitoring of the Tayside population and other Beaver projects in Britain are investigat-

ing the impacts of Beavers on a range of natural-heritage and land-use interests, it is impossible to assume that these studies will answer all our questions. There is already a widespread, deep and established understanding of Beaver ecology and management across many parts of Europe and North America which offers many answers. In Europe, the state of Bavaria has a long-standing Beaver-management operation which has been driven, by necessity, as a result of a large and rapidly expanded Beaver population following the first releases in 1966. Many interested individuals and groups from the UK have visited Gerhard Schwab and his colleagues at Bibermanager Südbayern in recent years to learn about mitigation measures such as electric fencing, canalbank protection and live-trapping techniques. In North America, Beaver-conflict management specialists Skip Lisle (Beaver Deceivers) and Mike Callahan (Beaver Solutions) have pioneered techniques for managing Beaver pond levels through the installation of 'pond-levelling' pipes and fences designed to protect public and private property. Many of these Beaver-management techniques have already been trialled in Scotland, albeit on a small scale, particularly on Tayside, where intensive arable farming and a growing Beaver population are combining to provide opportunities for experimenting and adapting overseas methods for use in British landscapes.

## The future of Beavers in Britain?

It is clear from the activity of the past ten years that the total number of sites with Beavers in Britain is growing. It is probable that we are entering a critical period concerning the longer-term future of this species on our island as several interacting events and processes converge. Over a relatively short period of time, we have seen the first use of Beavers in Britain as a habitat-management tool, the first formal trial reintroduction of an extinct mammal species, and the almost imperceptible appearance of unlicensed wild Beavers in several areas from the north of Scotland to the west of Wales and the south of England. These combined events have further fuelled public and institutional debate regarding the pros and cons of Beaver restoration.

While European and North American evidence indicates that forms of effective management and mitigation have been developed for Beaver-human conflicts, their existence in some modern, cultural landscapes can be challenging and sometimes inappropriate. This is a species which is capable of producing significant environmental impacts. In 2015, the Scottish Government will be the first devolved government to make a decision on wider Beaver reintroductions. Should we restore the Beaver or not? If the answer is 'yes', then we face some challenging questions. How and where will a larger population be established, and what are the best donor populations to use? How will we manage the species and the impacts that result from its presence and who will pay for Beaver damage? If the answer to wider Beaver restoration is 'no', then a backlash against a widespread and difficult cull or capture-neuter programme will be inevitable from those who oppose it and may encourage further, unlicensed releases into the wild. In 2012, SNH commissioned a report looking into how various European countries managed a selection of protected, reintroduced species through the EU derogations process (Pillai *et al.* 2012). The report illustrated differing interpretations of the same EU laws across a variety of Member States and recommended the need not only for derogations of protected, reintroduced species, such as the Eurasian Beaver, Brown Bear, Eurasian Lynx and Grey Wolf, but also for a range of species management strategies.

In Wales, the Beaver question is gaining momen-

tum following the publication of an ecological feasibility study in 2008 which confirmed the suitability of many Welsh waterbodies, and a further report published in 2012 addressed the desirability of Beaver reintroduction in relation to issues such as environmental and economic effects, Beaver-impact management and likely costs. The identification and investigation of a number of potential reintroduction sites (including the Dee, Glaslyn, Rheidol, Teifi and Cleddau river catchments) are now well underway, the results of which will be considered by Natural Resources Wales and the Welsh Government by 2014. The Welsh Beaver Project is currently aiming to undertake a managed pilot release of Beavers in spring/early summer 2014, but strong opposition remains within some sectors and might present a barrier to any wider-scale reintroduction in the near future.

In England, a feasibility and desirability study on Beaver reintroduction was undertaken (Gurnell *et al.* 2009) and, as in Wales, the resulting report showed that there is an abundance of suitable habitat to support Beaver populations. However, political support for this process is currently absent in England and, although there appears to be grassroots support for Beaver restoration amongst many in the NGO sector and some in the agency sector, there is very little in terms of proactive action at present.

For the time being, the big question regarding widespread Beaver restoration in Britain is not going to go away. There is increasing impetus and significant grounds for potential co-operation amongst stakeholders, but significant barriers in terms of evidence, practicalities and perception still remain. Like the Beaver itself, with its stoical, quiet manner, this issue appears to be just biding its time. What will the final outcome be? Watch this space...

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