(Title page)

Wildlife Trusts Wales

Welsh Beaver Project

Living with Beavers (working title)

(first page/inside cover)

Beavers

Beavers are large, semi-aquatic mammals (average adult weight is 20kg/25kg) that are mostly active at dawn and dusk, and they do not hibernate. They are very well adapted to an aquatic lifestyle with waterproof fur, webbed hind feet and a flattened, hairless tail.

They are exclusively herbivorous. Leaves, branches and bark of trees such as willow and birch form part of their diet – and they are especially partial to aspen and poplar. They also feed on aquatic plants, herbs and shrubs.

Beavers are known as a keystone species and ecosystem engineers, because of they can provide a range of environmental and socio-economic benefits. Ponds created from damming can promote growth of aquatic vegetation and create a favoured habitat for invertebrates, which in turn encourages greater amphibian and mammal life – including otter, water vole, frog, newt and dragonfly. These dams can help slow the flow of water and improve water quality within some river systems.

Water vole

The coppicing of trees and other vegetation reduces canopy cover and creates further habitat diversity as well as providing a supply of dead wood. Increased light levels encourage growth of under-storey plants and aquatic flora as well as a growing abundance of invertebrates – with further benefits to a wide range of species including birds such as duck, heron, woodpecker and kingfisher.

Beavers have been reintroduced to many European countries and we can learn a lot from their experiences.

Reintroductions in Europe

The decline of beavers in Wales was echoed across the rest of Britain and the majority of Europe. At the end of the 19th century the distribution of beavers in Eurasia was reduced to eight isolated populations consisting of less than 1,200 individuals (Halley & Rosell, 2002). However, their near extinction was reversed through a series of conservation measures from greater legal protection to active reintroductions and translocations (Halley & Rosell, 2002). To date there have been over 205 successful beaver reintroductions to over 25 European countries (Halley *et al.* 2012).

The first reintroductions and translocations began in the 1920s in Sweden, Norway, Latvia, Russia and the Ukraine and continued throughout the 1980s and 1990s in the Netherlands, Croatia, Bosnia and Herzegovina, Czech Republic, Denmark, Hungary, Romania and Slovakia.

In 2009, the Scottish Beaver Trial (a partnership between Scottish Wildlife Trust and Royal Zoological Society of Scotland) was the first official beaver reintroduction trial in Britain and further projects have been undertaken since then, such as the River Otter Beaver Trial in Devon, led by Devon Wildlife Trust.

Above: Scottish Beaver Trial logo.

Left: An adult beaver on the River Otter in Devon.

Impacts and Management

Beavers are often referred to as 'ecosystem engineers' because they can modify the habitats and landscapes they live in through coppicing, feeding and in some cases damming (beavers living on lakes or main rivers have little need of constructing dams). However, in many cases when they are living at low density, their impacts can be remarkably subtle and go unnoticed for many years.

Beavers forage close to water with activity usually concentrated within 20 metres of the water's edge (Campbell *et al.* 2016). Beavers fell broad-leaved trees and bushes to reach upper branches to eat the bark during the winter and for construction of lodges and dams. Most native tree species regenerate, which diversifies the surrounding habitat structure and create areas of mixed-height, mixed-age vegetation. Coppicing has been practiced by foresters throughout history as a method to manage bankside trees. The actions of beavers are very similar, meaning woodlands and trees are more naturally managed.

Willow coppiced by a beaver.

Evidence from Europe shows that beaver impacts are, in the vast majority of cases, small-scale and localised. However, where localised problems do occur there are a number of well-established mitigation methods that can be adopted (Campbell-Palmer *et al.* 2016). These include the removal or modifications of dams, the introduction of overflow piping, or the installation of fencing (as one does for deer and rabbits). In some cases, the removal and translocation of beavers could be considered. Some countries with sustainable beaver populations permit seasonal hunting and/or lethal control as legitimate management strategies.

As part of our plan to reintroduce beavers to Wales we have established a Beaver Management Network based on the beaver management strategies that have been developed in Scotland and Devon (Scottish Natural Heritage, 2019; Devon Wildlife Trust, 2020).

Inserting a flow regulator into a dam to control the pond water level.

Beaver dams can come in different sizes and shapes, depending on the landscape.

Agriculture

Beaver impact on livestock farming, the form of agricultural land use occupying the greatest proportion of any prospective beaver territory in Wales, is not seen as a major issue. Beavers do not pose any physical threat, and their role as a vector for disease is considered of negligible significance.

Problems can be caused to riparian crops, including maize and roots, especially sugar beet. Such impacts are usually localised since beavers tend to forage mainly within 20 metres of a riverbank and rarely range further than 100 metres.

A number of management options can address this situation. Large mesh fencing and standard low-voltage electric fencing can be highly effective. Beavers have good memories and electric wiring placed for one week will prevent them from attempting entry for up to 3 months (Halley & Bevanger, 2005).

Electric fencing can provide an effective deterrent.

Overall, experience from beaver reintroductions in continental Europe suggest that the cost of any impact is likely to be substantially outweighed by the revenue potential obtainable, both directly through nature tourism and indirectly via future recognition of ecosystem services, which could generate further agri-environmental support.

Beavers are now present throughout almost all of Europe, having been reintroduced to over 25 countries (Halley *et al.* 2012), including areas of highly intensive agriculture. With adequate management strategies in place, these reintroductions have not posed a significant problem.

Economic Impacts

Studies have shown the reintroduction of beavers can provide an economic benefit through eco-tourism and as a deliverer of ecological services (Campbell *et al.* 2007; Jones *et al*. 2012; Puttock *et al.* 2017). A study on the economic impacts of the beaver by the University of Oxford's Wildlife Conservation Research Unit concluded that "*with forethought, prior consultation and planning, a beaver reintroduction should bring significant monetary benefits within the local economy and communities that could greatly outweigh any potential negative impacts*."

There is the potential for negative impacts to occur where the activity of beavers conflict with human activities. However, the intention with planned reintroductions is that these negative impacts are avoided or minimised through proper planning and with management solutions in place. The costs of beaver management are easier to identify and quantify when compared with the ecosystem and ecological benefits of beavers Campbell-Palmer *et al.* 2015) and whilst the potential negative impacts from beaver activity should not be downplayed, the management costs should be reviewed in context with the potential benefits from a beaver reintroduction.

Research into the impact of beavers on the local economy around Knapdale Forest was carried out as part of the Scottish Beaver Trial. Local businesses reported an upturn in business due to interest

Scottish Beaver Trial

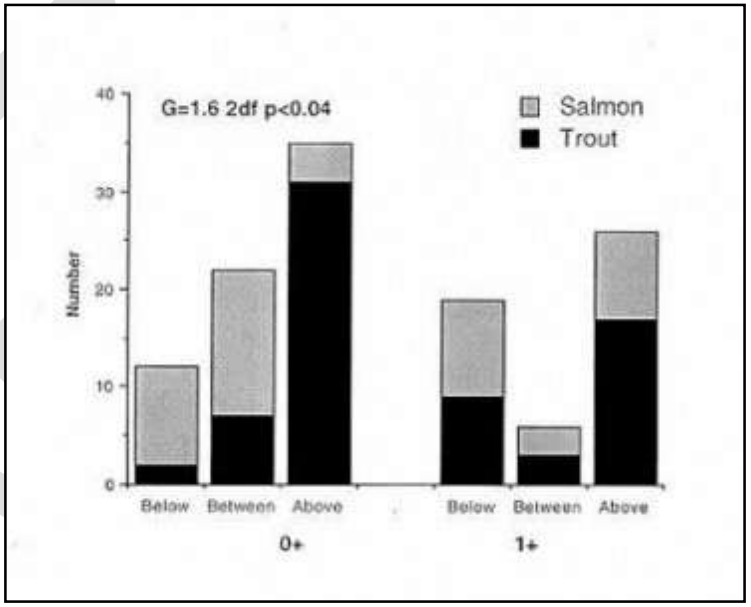
Beaver watching at an enclosed site in Wales.

in the Trial increasing visitor numbers to the area. The value of wildlife experiences at Knapdale itself, such as guided walks were calculated between £355,000 and £520,00 over the five-year trial period (Gaywood *et al.* 2015). In addition, huge numbers of adults and children engaged with the project throughout the 5 year trial through formal and informal activities. Over 31,000 people took part in walks, talks, events and education sessions at Knapdale or during outreach sessions to schools and colleges (Jones and Campbell-Palmer, 2014). Data collected during the River Otter Beaver Trial found that there was an increase in beaver tourists to the River Otter, especially in areas where the beaver families were active and easy to see along the river (Brazier *et al.* 2020).

Fisheries

Beaver are exclusively herbivorous, so do not eat fish. Habitat modification by beavers, however, can have significant impacts on fish populations in some circumstances, and fisheries groups are often concerned about the potential impact of beaver dams on the movement of migratory fish. The interaction between beaver activity and freshwater fisheries has been the subject of several reviews (Kemp *et al.* 2012; Pollock *et al.* 2013; Virbickas *et al.* 2015). Studies in Litlelva River, Norway of the effects of dam creation found no impediment to salmon and trout (Halley and Lamberg, 2001).

A study of the entire Numesdalen watershed, an important salmon and sea trout river in southern Norway with a beaver population, found no evidence of any negative effect; indeed, salmon and sea trout catches increased over the period of beaver recolonisation.



Distribution of juvenile salmon (marked in grey) and trout (black) above and below four dams. These are from hatchings in 1998 (0+ year old) and 1999 (1+ year old). The pattern is very similar to that of a stream without dams. (Duncan Halley: from his presentation in Powys and on the Scottish Beaver network site).

Siltation of beaver ponds may on occasion cover spawning sites, but this occurs on a very small scale and can be readily managed – indeed dams are often responsible for reducing water turbidity. Such ponds themselves are regarded as good fishing sites.

There are, by contrast, beneficial effects for fish from the presence of beaver.

Beaver activity, by coppicing bank-side trees and creating pools, increases food supply by allowing more abundant growth of aquatic plants and invertebrate food supply – measurements of the latter suggesting 2-5 fold increases.

Oxygenation of water flowing over dams and retention of polluted silt also improves water quality, which again leads generates increase in invertebrate life forms.

Creation of deeper pools in a water course can stabilize water temperatures during extremes of weather. There are several recorded instances of beaver dams enabling fish stocks to survive during periods of sustained drought.

"Salmon, trout and beavers have lived in harmony together for millions of years. Those with experience of 'living with beavers' confirm that there is very little conflict with angling". Welsh Salmon and Trout Angling Association website (www.wstaa.org). August 2006.

In recent years there have been studies undertaken in Scotland and England, which give us a better understanding of the impacts that may occur in Wales. The initial results from research investigating brown trout *Salmo trutta* populations in Scotland have shown trout passing upstream and downstream of beaver dams, as well as larger and more abundant trout being found in beaver modified habitats compared with non-beaver modified habitats (Elliot *et al.* 2017). However, the analysis from this research is still ongoing. It is clear that further research is required from within Britain and to date there have been no studies of this kind conducted in Wales. Therefore, this provides us with an opportunity to investigate this subject further to provide a better understanding of the effects that beaver activity can have on fish, especially from a Welsh perspective.

In areas where beaver dams may have an impact on migratory fish then these dam can either be removed, modified or fish passages installed.

Forestry

Commercial plantations do not generally provide suitable habitat for beavers. They can therefore exist in close proximity to beavers.

Studies show that 98% of beaver activity occurs within 20 metres of the riverbank and 95% of is within 5m (Elmeros *et al.* 2003). The effect beavers may have on forestry is thus restricted to trees on woodland edges near watercourses and very unlikely to have a significant impact on the economic viability of timber operations.

Trees used by beaver are usually broadleaved: willow, birch, rowan and especially aspen being the favourites. Deciduous plantations and individual

Wire mesh tree guard

trees may thus require protection, depending on their proximity to water courses.

Should it prove necessary, beavers can be prevented from damaging trees by fencing, or application of sand paint or wire mesh around individual trunks.

Hydrology

Beaver dams and associated wetland habitat can significantly reduce flow velocity and even out the throughput of water following heavy rainfall. Beavers can thus play a role in mitigating downstream flooding and erosion. By contrast water retention resulting from beaver activity can also help sustain flow from local water tables during drier periods (Puttock *et al.* 2017).

Both the above hydrological impacts are likely to assume increased local significance as climate change creates increasingly erratic rainfall patterns, with wetter winters and drier summers.

Damming activity also traps sediment load and oxygenates water throughput, thus reducing the impact of pollution from agricultural or road run-off and moderating acidity levels.

Beavers rarely build dams in main rivers where there is a sufficient depth of water, but in smaller streams or tributaries. Beavers may also make their way into low lying floodplains where agricultural activities depend on land drains and deep ditches, and it is in these areas where beaver dams can have more significant impacts. They can obstruct culverts and "restore wetlands" in places that are not compatible with the existing land-uses and therefore create real, and perceived conflicts. In these situations, dams will eithe2r have to be removed or modified with flow devices to the manage water levels. Although, in some cases these mitigation measures may not be successful, and beavers may need to be moved on.

Above: Beaver dams are permeable structures as they are made from mud and sticks. Water can also over top and flow around the edges of beaver dams.

Right: Flow device installed within a beaver dam.

Health and Welfare

Beavers like all animals have the potential to carry pathogens, but the reintroduction of beavers does not pose any greater risk for the transmission of diseases (Girling *et al.* 2019). Many of the parasites that beavers can carry are already present in Britain and to minimises any risk, all beavers that are sourced for a reintroduction will health screened prior to release (Girling *et al.* 2019). This will ensure that only healthy individuals are reintroduced.

FAQs

- **Are beavers from Europe the same species as was present in Wales and Britain?**
  Yes. There is only one species of beaver native to Europe, this is the Eurasian beaver (*Castor fiber*). The other species is the North American beaver (*Castor canadensis)*, but they are only native to North America.

- **What records exist of beaver in Wales?**
  Ancient beaver remains (skulls, teeth, and other bone fragments) and ancient beaver gnawed wood have been found at a number of sites across Wales (Coles, 2019).

  Written records provide further evidence; writing in the 12th Century, the Welsh cleric Sylvester Gerald de Barri ('Giraldus Cambrensis') says there were beavers on the river Teify, at Cilgerran in Cardiganshire.

  Prior to that Hywel Dda, King of Wales (most of it!) in the 10th century, specifies in the Law that beaver skins, together with ermine and pine marten, are royal privileges. In evaluating compensation in the Law, a beaver's skin is worth 120 pence. Some people estimate that this is worth approximately £10,000 today's money.

- **Why did beavers go extinct in Wales?**
  Beavers were once widespread across Wales, but due to over hunting by man for their fur, meat and scent glands they became extinct by around the 15th Century.

- **Are there any plans to reintroduce beavers to Ireland?**
  No. To date there is no evidence of beavers ever being present in Ireland.

- **Once reintroduced, could beavers become an uncontrollable pest?**
  No, beavers cannot become an uncontrollable pest, like for example, grey squirrel or rabbit.

  Experience from Europe indicates that control and impact mitigation is quite straightforward. Beavers are restricted to suitable rivers, streams and lakes usually staying within 20 metres of the riverbank and rarely ranging further than 100 metres (Campbell *et al.* 2016). They do not like crossing land between water courses so do not readily spread between catchment areas.

  Beavers have been reintroduced to over 25 countries in Europe. If this process had posed a significant overall problem, and not brought substantial benefits, such reintroductions would long ago have been halted and reversed.

- **Would a beaver population need to be controlled by culling?**
  Lethal control would very rarely be needed because of the relative cost-effectiveness of alternative management methods. Beaver population growth is very slow for 20-30 years following reintroduction (Hartman, 1995), and thereafter removal to another site could be a practical option. In lots of European countries, it is already possible to undertake localised culling with a licence, where nuisance can be proven and there is no feasible alternative.

- **Landholdings where beaver may have impacts will not necessarily be those who benefit from reintroduction through tourism revenue, etc. How could this be dealt with?**
  Overall benefits of reintroduction would outweigh the likely cost of any impact, however there may be local instances where impacts are not matched by benefits.

A Beaver Management Network is currently being assessed. This could provide a network of advice on beaver and mitigation solutions.

- **How would the cost of beaver impact compare with that of other wildlife?**
  Deer damage to agriculture alone in England has been estimated at £4.3 million, or £33 (€47) per km^2 per annum (Wilson, 2003). Rabbit damage has been cited as £44 (€63) / km^2 per annum for Britain (Rees, 1985) depending on the incidence of myxomatosis. In contrast to this, the Swedish government has concluded that their 100,000 beaver population has no negative economic impact on a national scale.

- **Can we reasonably assess the short, medium and long term impacts of beavers on other species, ecosystems and landscape?**
  Yes. There has been plenty of research on mature beaver populations of both species (*Castor fiber* and *Castor canadensis*) that give us information on the impacts of beavers on other wildlife and the riparian landscape.

  Much of this has been reviewed in the scientific paper: Rosell *et al.* (2005). *Ecological impact of beavers Castor fiber and Castor canadensis and their ability to modify ecosystems.* Mammal Review 35:248-276.

- **Will the presence of beaver on a river affect Flood Risk Management?**
  Beaver would not be reintroduced to any river catchment if it is thought likely that there would be any significant adverse impact on the delivery of River Basin Management Plans or Flood Risk Management.

  There is no substantive evidence that beaver cause significant flood damage. Indeed, in many instances, the effects of beaver on a river catchment can lessen the impact of flooding by slowing water down and reducing sediment load. Where local flooding occurs (e.g. through blocked culverts) this can be readily prevented or managed.

  Beaver structures can alleviate pollution, by increasing oxygenation and retention of colloidal materials (Rosell *et al.* 2005; Puttock *et al.* 2017).

- **Could beavers affect current agri-environment management agreements that farmers and landowners may have entered into?**
  Agri-environment grant and subsidy schemes would not suffer as a result of beaver reintroduction and current indications suggest that the presence of beavers on landholdings could attract agri-environment payments in future.

- **Is there sufficient habitat for a beaver reintroduction to Wales?**
  An ecological feasibility study commissioned as part of the Welsh Beaver Assessment Initiative has shown that there is an abundance of habitat suitable for beavers in Wales (Jones *et al.* 2012).

- **How would an initial reintroduction be managed?**
  A location with suitable habitat would be chosen.

  Reintroduced animals would be microchipped, tagged and their territorial activities monitored by trained individuals.

  Any undesirable impacts of beavers would be managed by a dedicated team as part of the Beaver Management Network.

- **Who will have responsibility for beavers in the long-term?**
  Reintroduced beavers would be a wild animal, but day to day management would be undertaken by trained individuals under the stewardship of suitable Non-Governmental Organisations such as the Wildlife Trusts, in partnership with Natural Resources Wales.

- **Is the reintroduction of beaver the thin edge of the wedge, i.e. will there be moves to reintroduce wolves, bears and lynx?**
  The Welsh Beaver Project is only concerned with reintroducing beavers to Wales. There is no link to any other species not currently present in the British Isles and the Wildlife Trusts in Wales have no plans to reintroduce large mammalian carnivores into the Welsh landscape, not least as suitable conditions for such species do not exist in Wales.

  Unlike many other species, beaver were driven to extinction by over-hunting for their meat, fur and medicinal by-products rather than through habitat loss or because they were considered a problem species.

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