

A GROSS ASSESSMENT OF THE SUITABILITY OF SELECTED SCOTTISH RIPARIAN HABITATS FOR BEAVER *CASTOR FIBER*

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SUMMARY

In November 1998 we were shown a selection of riparian habitats in Scotland and asked to assess their suitability for beaver based on our experience in working with beaver elsewhere. Though many examples of good beaver habitat were seen, we ranked the following four as among the best: Loch Coillie-Bharr, Knapdale, West Argyll; Loch Beinn a' Mheadhoin (Benevean), Glen Affric, Strathglass; Insh Marsh, Kingussie, Inverness-shire and Culriach on the lower Spey. Many riparian habitats observed had a suitable hydrology and bank structure for beaver but unsuitable broadleaf forest composition or regeneration due mainly to pure stands of conifers planted to the waters edge or heavy grazing from livestock and/or deer. In the presence of heavy grazing pressure, tree felling by beaver could ultimately decrease broadleaf species composition and bole density. Aspen *Populus tremula*, which is highly preferred by beaver, would be particularly vulnerable. Ultimately, we would expect reintroductions to result in viable though somewhat fragmented populations in Scotland.

INTRODUCTION

The Eurasian beaver *Castor fiber* became extinct in Scotland in the 16th century. For the past 20 years there has been considerable debate over the desirability and feasibility of

reintroducing beavers here and to other parts of Britain (e.g. Lever 1980, 1994; Halley 1995, Macdonald et al. 1995). In this connection, the literature has been reviewed (Macdonald et al. 1995, Conroy & Kitchener 1996), the potential impacts assessed (e.g. Macdonald et al. 1995, Collen 1997, Gurnell 1997, Reynolds 1998), potential release sites identified and assessed (Macdonald et al. 1997, Webb et al. 1997) and a public consultation conducted and reviewed (Forestry Commission 1998 a,b; Scottish Natural Heritage 1998, Scott Porter Research & Marketing Ltd. 1998).

Scottish landscapes, including the riparian habitats previously occupied by beaver, have been substantially altered in the intervening centuries between extinction and the present. A central question here is therefore whether present riparian habitats in Scotland are of sufficient quality and quantity to again support viable populations of beaver. At least two studies have addressed this question (Macdonald et al. 1997, Webb et al. 1997) by identifying areas in Scotland potentially suitable as beaver habitat and subsequently predicting, with the use of models, the expected growth and dispersion of beaver populations following an eventual reintroduction.

Another potential method for evaluating the quality of riparian habitats for beaver is to ask individuals with long field experience to grossly evaluate the suitability of different habitats for beaver "based on their experience". Though this method can only be supplementary to more detailed and objective analysis techniques, it can potentially provide new and pertinent information missed by more objective methods, as habitat quality is a complicated phenomena.

On 15 June 1998 Les Bryson and Malcolm Wield of Forest Enterprise, the Scottish Forestry Commission (FC), visited the authors at Telemark College in southeast Norway and were shown a variety of beaver habitats and examples of damage associated with beaver activity. Subsequently we were invited to come to Scotland to grossly evaluate the quality of a set of pre-selected sites as potential beaver habitat and as future release sites.

METHODS

Three days (23-25 November, 1998) were spent driving through Scotland and inspecting various potential beaver habitats. Day 1 was spent in the West Argyll Forest District (Lochgilphead area), day 2 in the Fort Augustus and Inverness Forest Districts (Great

Glen and Inverness areas) and day 3 in the Moray Forest District and Tay Forest District (Aviemore and Perthshire areas). Throughout the trip we met with local Forestry Commission staff and representatives from outside agencies/bodies (e.g. Scottish Natural Heritage (SNH), The Royal Society for the Protection of Birds (RSPB), local salmon fishery managers) with an interest, both positive and negative, in beaver reintroductions to hear their views and comments. At each prearranged site we conducted brief ground inspections of the vegetation and hydrological conditions present. We were briefed by accompanying experts on pertinent topics such as grazing pressure from livestock and deer, local broadleaf coverage and annual fluctuations in stream flow. In addition to visiting prearranged sites, we also made short spontaneous stops throughout the trip to inspect potential beaver habitat seen while driving.

On 26 November we summarized our impressions at a seminar held at the Edinburgh Zoo attended by members of the FC, SNH, and chaired by Sir Michael Strang Steel.

RESULTS AND DISCUSSION

Examples of suitable riparian habitats seen

Though many areas of what could be termed good potential beaver habitat were seen during the three days, we feel that the following four were possibly the best: the Knapdale lochs (KL), principally Loch Coillie-Bharr, Knapdale, West Argyll; Loch Beinn a' Mheadhoin (Benevean) (LB), Glen Affric, Strathglass; Insh Marsh (IM), Kingussie, Inverness-shire and Culriach Wood (CW), Lower Spey.

Both KL and LB contained a number of small to medium sized lochs with numerous burn tributaries, deep shoreline areas, suitable densities and age classes of appropriate broadleaves such as birch *Betula sp.*, rowan *Sorbus sp.* and willow *Salix sp.* and with annual water fluctuations seemingly within acceptable levels. IM was an extensive marsh area comprising a small loch, many kettle holes and a meandering, low velocity river with an apparent abundance of willow. CW was a flood plain area adjacent to the River Spey containing a low velocity burn in what appeared to be an old river channel. Here there was considerable broadleaf forest cover including willow.

All four areas had what appeared to be acceptable densities and quality of broadleaf forest of young to middle age classes, as well as suitable though differing hydrologys and

water flow schemes. Based on the verbal information we were provided with, it appears as though expected annual fluctuations in water levels at all four sites would normally fall within limits that beaver could cope with (e.g. Erome 1984). KL, LB and IM were parts of nature reserves where the preservation of biodiversity is presumably a major objective. This might make them particularly attractive as initial release sites in a future trial reintroduction. The danger of flooding of extensive areas of valuable forest and farmland, as well as other forms of damage, appeared to be minimal at all four sites. Due to the limited nature of our excursion it was difficult to assess the *quantity* of suitable beaver habitat at each of these areas.

Why were some of the riparian habitats seen probably less suitable for beaver?

Many riparian habitats seen during the three days, both at prearranged sites and elsewhere, were obviously less suitable as potential beaver habitat for a number of reasons.

Quality and quantity of broadleaf forest. Many areas observed had a suitable hydrology and bank structure for beaver but unsuitable broadleaf forest composition. There seemed to be two main reasons for this. First, it was common to see pure stands of mainly non-native conifers planted right to the edge of burns and smaller lochs. With natural stands of mixed broadleaf forest, such habitats would likely have been attractive for beaver.

Second, many stretches of riparian habitat with broadleaf forest of suitable coverage and species composition (e.g. much birch and/or willow) showed almost no sign of broadleaf regeneration. This was apparently due to heavy grazing pressure from livestock and/or deer, primarily red deer *Cervus elaphus* (Reynolds 1998). We would expect beaver to find many of these areas initially suitable for colonization. However, the combined effect of selective felling of preferred species by beaver (e.g. Nolet et al. 1994) and little or no regeneration due to heavy grazing could eventually lead to reduced broadleaf forest species composition (Forestry Commission 1998b, Reynolds 1998, Scottish Natural Heritage 1998). In this manner, reintroducing beaver could eventually lead to a further impoverishment of riparian broadleaf forests in Scotland. The extent of this problem could presumably be studied experimentally at different grazing densities by first simulating beaver felling in this type of habitat and then studying regeneration, both in sheep and deer-proof enclosures as well as unenclosed study plots.

In Norway, our experience is that moose *Alces alces* during winter can remove most regrowth of aspen *Populus tremula* and rowan within some patches of riparian habitat,

thereby reducing the quality of these habitats for beaver locally. However, grazing pressure from moose is rarely sufficient to significantly affect birch regeneration as well (see also Tyurnin 1984).

In Invernán Forest we witnessed sites which had experienced rotational spruce felling 5-10 years ago and which had been restocked in accordance with a design plan which took full account of the forest and water guidelines. Though some supplementary planting of broadleaves had taken place, most had regenerated naturally, especially birch and willow, seemingly due to appropriate management of deer densities. Sites of this quality would presumably be attractive to beaver.

Another type of riparian habitat forest cover which seemed to be quite common along many streams was that seemingly dominated by old-age alder *Alnus spp.* and oak *Quercus spp.* and seemingly a result of intensive grazing and selective cutting. Gray alder *Alnus incana* is rarely felled by beaver, though the leaves of common alder *Alnus glutinosa* are sometimes eaten (Simonsen 1973, Histøl 1988, Nolet et al. 1994). Oak can be common in the diet, though trees of smaller diameter are preferred (Simonsen 1973, Histøl 1988). We are therefore uncertain to what extent beaver would colonize riparian habitats dominated by mature oak and common alder.

Due to the time of year and short duration of the investigation it was difficult to get an impression of the quality and quantity of other types of vegetation present that beaver commonly eat such as forbs, heaths and emergent vegetation.

Unsuitable hydrology. Obviously, many of the streams in Scotland are to high-gradient, rocky and rapid-flowing for beaver to build lodges or dams on (e.g. Gurnell 1997). However, our experience from Norway is that short, lower gradient stretches and quiet backwaters of such streams, particularly where small tributaries enter the main stream, can provide sufficient conditions for lodge building and are often colonized if food is sufficient (see also Gurnell 1997).

Likewise, most stretches of shoreline along the larger lochs in Scotland will most likely be unsuitable for lodge building due primarily to heavy wave action, though sheltered backwaters, tributary inlets and adjoining lagoons may be sufficiently protected and therefore suitable. Under such conditions, beaver may use stretches of shoreline along the main loch for foraging. Thus, seemingly unsuitable habitat for beaver may be colonized, albeit at low colony densities, given sufficient food supplies.

Examples of sites seen which we would deem less suitable for beaver were Lochs Awe, Avich and Ness and the Rivers Enrich, Glass and Affric.

General comments

Here we wish to comment on a number of miscellaneous topics that surfaced while viewing the landscape and while conversing with people we met during our journey, and which we feel may be of interest to those involved in the process of a possible beaver reintroduction.

Damage potential. Understandably, a main concern of those involved in this process is the potential for different types of damage which beaver could cause in Scotland. As this topic has been thoroughly handled in a number of recent reviews (e.g. Macdonald et al. 1995, Collen 1997, Gurnell 1997, Reynolds 1998) we will only comment on several aspects of the damage question which seem to be particularly relevant for Scotland, and which we have had considerable personal experience with.

Damage to aspen: We soon became aware of the fact that aspen is relatively rare in Scotland, presumably in part due to heavy grazing by livestock and deer, while being of particular importance due to its associated invertebrate fauna (Scottish Natural Heritage 1998). As this species is highly preferred by Eurasian beaver (Simonsen 1973, Histøl 1988, Nolet et al. 1994.), and as beaver commonly fell large aspen between 0.3-0.5 metre dbh (own observations), aspen growing in riparian habitats will be very susceptible to felling where beaver become re-established. Reynolds (1998) stated that aspen growing within 30 metres of water is vulnerable. Our experience is that beaver regularly travel up to 300 metres, and on occasion up to 500 metres from water to fell aspen, particularly where aspen is rare. Felling this far from the protection of water may be more common where predators such as wolves and lynx are absent. The problem, however, can easily be resolved by sheathing the lower 1.5 meters of each trunk with heavy gauge wire mesh. In Scotland this would likely be expensive due to the often inaccessible nature of aspen stands.

Damage to the salmon *Salmo salar* fishery: The fear among anglers in Scotland that beaver will cause excessive damage to the salmon fishery (Scott Porter Research & Marketing LTD) in our experience is unfounded. The senior author has fished for salmon in Norway for the past 25 years, and for the past 7 years on a river (the Numedalslågen in southeast Norway) where beaver are common, both on the main stream and on some tributaries. With one exception, we have never heard fisherman, on this or any other salmon stream, speak of conflicts between salmon and beaver. The one exception occurs when beaver occasionally

are unintentionally hooked by salmon fishermen. This almost always occurs in the late evening in dim light when beaver begin foraging. After a short battle the hook, which normally gets caught only in the thick fur, usually pulls out and the presumably perplexed beaver swims off. In this connection, it should also be mentioned that many of the same landowners with income from the sale of salmon rights on the Numedalslågen also obtain income from the sale of beaver hunting along the same stretches of river. Thus beaver, as well as salmon along this river, are an economic asset to landowners.

Presumably, beaver sometimes build dams on tributaries where salmon and sea trout *S. trutta* spawn in Norway. To our knowledge, however, no one in Norway, as yet, has described this as being a problem, which is consistent with the paucity of international literature on this subject (Collen 1997). Were a serious problem to develop, an affected landowner in Norway could apply to the municipal wildlife manager for permission to remove both the dam and the beavers.

In summary, we understand the fears that salmon fisherman and managers have expressed concerning potential beaver-salmon conflicts in Scotland, particularly in light of the extensive and increasing problems that both salmon populations and habitats are facing at present. However, in our experience, these concerns are unfounded.

Control of damage individuals and population control through culling: In the event of a successful reintroduction of beaver, damage individuals could initially be live-trapped and relocated to areas where establishment is desired. Eventually however, once areas earmarked for establishment have become saturated with beaver, damage individuals will most likely have to be controlled by hunting or dead-trapping. Culling through hunting will presumably also be necessary if the management objective is to contain populations within certain regions or maintain them below natural carrying capacities (Macdonald et al. 1995, Reynolds 1998, Scottish Natural Heritage 1998). In countries with no tradition for hunting beaver, the general public will predictably react negatively to the idea of hunting to control populations. In the long run, however, population management of beaver without some form of culling would, in our opinion, be highly unrealistic. Therefore the general public must be clearly informed, from the very outset, of the probable future necessity for culling to control populations. To some extent, this has already been done (Scottish Natural Heritage 1998). Regardless of the method of control, rapid action following notification and agreement on damage is important and will help to limit or avoid negative public relations.

We strongly advise that a list of what constitutes beaver damage, and its acceptable solutions, be included in an initial beaver management plan and discussed thoroughly with landowners prior to population establishment. Ecologists and resource managers often feel that landowners exaggerate economic loss due to beaver activity. This is particularly true during the initial stages of population establishment. Once landowners become more accustomed to beaver, their tolerance for damage usually increases. Damage to objects with considerable personal rather than real economic value (e.g. ornamental trees on house lots), is often the most difficult for managers to deal with. In our experience the "damage dilemma" is the root to most opposition to beaver and must be taken seriously, even though the problem is often more of an emotional than economic nature. Ultimately, we must learn to live with beaver again and accept them as an essential and fascinating part of the ecosystem rather than simply an irritating problem.

CONCLUSIONS

We were shown a number of riparian habitats in Scotland which, in our experience, should be of sufficient quality to support Eurasian beaver. We would expect these sites to be suitable for a trial reintroduction, assuming their scope is sufficient to support minimum population sizes. Much of the riparian habitat we observed in Scotland would potentially be suitable for beaver at lower levels of grazing competition from livestock and/or deer. We would predict that a successful reintroduction would eventually lead to viable, though somewhat fragmented populations of beaver in Scotland.

ACKNOWLEDGMENTS

We wish to thank the many members of the Forestry Commission and other bodies involved in the logistics of our journey for their great hospitality and for sharing with us their intimate knowledge of Scottish flora and fauna.

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