SCOTTISH BEAVER TRIAL

Trial reintroduction of the European beaver to Knapdale, Mid-Argyll

Local consulation report:

1 October - 30 November 2007

Scottish Beaver Trial
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THE ROYAL ZOOLOGICAL SOCIETY OF SCOTLAND

SCOTTISH WILDLIFE TRUST

speciesaction FRAMEWORK

Mammals Trust UK

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1. Executive summary

In January 2007, the Scottish Government in partnership with its conservation advisors, Scottish Natural Heritage (SNH), launched the Species Action Framework (SAF).[1] This framework provides a strategic approach to species management in Scotland and identifies certain species requiring targeted management and action. Two reintroductions are included: white-tailed eagle (*Haliaeetus albicilla*) and European beaver (*Castor fiber*).

Through SAF, organisations outwith SNH are encouraged to lead on individual species action. In July 2007, the Scottish Wildlife Trust (SWT) and the Royal Zoological Society of Scotland (RZSS) agreed to work in partnership to secure the future reintroduction of the European beaver to Scotland.

In October 2007, under the project title of the Scottish Beaver Trial, the partnership with support from the Mammals Trust UK launched a two-month local consultation in the vicinity of the preferred trial site of Knapdale Forest, Mid-Argyll.

The consultation built on national and local consultations undertaken in 1998[2] and 2000[3] prior to the previous licence application and as part of the SAF. The consultation process is a key element of IUCN Reintroduction Guidelines.

Over 175 people attended events held in the area during the consultation period. A further 466 people submitted a formal response to the consultation by post or online.

As part of the consultation process, two key questions were posed to those consulted:

1. Would you like to see beavers in Scotland?
2. Would you support a trial reintroduction of beavers to Knapdale?

In addition, respondents were given the opportunity to write comments/questions on their consultation response.

From the responses received from Mid-Argyll, 72% were in favour of beavers returning to Scotland and 73% were in favour of beavers returning to Knapdale Forest. Out of the 466 responses, over 80% were defined as resident in Mid-Argyll (with postcodes PA29, PA30 and PA31).

The Knapdale segment (those living in Tayvallich, Achnamara, Crinan, Bellanoch and Cairnbaan) contained the strongest opposition (31 negative responses) proportionally. This included 20% of landowners recorded as being adjacent to the proposed trial site.

Seven (9%) national/local organisations out of 80 contacted raised “key concerns” and objections.

The majority of comments from those in favour of the trial related to benefits to biodiversity and wildlife tourism and a desire to see the reinstatement of the beaver in Scotland. Comments from those against the trial covered a wide range of concerns and perceptions including environmental and socio-economic impact, public health, containment, length of trial, historical evidence of previous range, consultation process, insurance and compensation, the presence of non-native introductions of species such as mink and the best use of resources.

The overall results reaffirmed the conclusions of previous consultations that there is widespread local public support for a trial reintroduction of the European beaver in Knapdale. The project partners were particularly encouraged by the number of consultation responses, which exceeded those received in the earlier local consultation (63).

The majority of issues relating to the conduct of the trial will be addressed in the licence application and/or will form part of the research and monitoring aims of the trial itself. The project partners consider that the level of support is sufficient to justify proceeding with the trial.

The consultation reinforces the continued requirement to involve the local community and other stakeholders in the development and implementation of the project; mechanisms for this will be included in the licence application. Project staff will endeavour to achieve constructive relationships with all national stakeholder bodies with a view to ensuring that the proposed trial benefits from their experience and input.

2. Introduction

Directive 92/43/EEC Conservation of Natural Habitats and of Wild Flora and Fauna (the Habitats Directive) Article 22 makes provision for member states to consider reintroduction of species in Annex IV, including the European beaver. Article 22 states that it should take place "only after proper consultation of the public concerned".

SNH carried out a national consultation in 1998 on the desirability of reintroducing beavers to Scotland and the results showed that 63% of respondents were in favour of a reintroduction. In response to the detailed feedback, the SNH Main Board decided to propose a trial reintroduction in a specific area over a time-limited period rather than undertake a widespread release. After a detailed review in 2000, Knapdale Forest in Mid-Argyll was selected as the most appropriate site for the trial.

In October and November 2000 a consultation in the local Knapdale area was carried out by SNH. Sixty-four percent of respondents from the Mid-Argyll area were in favour of the proposal.

Subsequent to the rejection of SNH's application to the Scottish Government for a licence to run a trial beaver reintroduction, the Scottish Government joined with SNH, its conservation advisors, to launch the SAF. This framework provides a strategic approach to species management in Scotland and identifies certain species requiring targeted management and action. Two reintroductions were included: white-tailed eagle and European beaver.

Through SAF, organisations outwith SNH were encouraged to lead on individual species action. In July 2007, SWT and RZSS agreed to work in partnership to secure a trial reintroduction of the European beaver to Scotland.

In October 2007, under the project title of the Scottish Beaver Trial, SWT and RZSS, with support from the Mammals Trust UK, launched a two-month local consultation in the vicinity of the preferred trial site of Knapdale Forest, Mid-Argyll. The consultation built on national and local consultations undertaken as part of the previous licence application and the additional 2006 national consultation on the SAF. The consultation process is a key element of IUCN Reintroduction Guidelines and, as part of the SAF, any reintroduction must go through this process. To the best of SWT's knowledge this is the most comprehensively consulted and researched species reintroduction proposal undertaken in Europe to date.

3. Consultation process

The consultation was undertaken over an eight week period (1 October – 30 November 2007). Given the extent and breadth of previously conduced national consultations it was concluded that a local consultation (Mid-Argyll) was most appropriate, specifically to:

- re-validate the previous consultation(s);
- engage the community with the proposal and provide a process to respond to questions and concerns;
- engage local and national organisations with a direct interest in the proposal;
- seek feedback on the proposal to inform the licence application and;
- raise general awareness of the project.

3.1 Target groups

- Local residents within postcodes PA29, PA30 and PA31
- Individual landowners/managers adjacent to the trial site and in the Knapdale area

- Community Councils
- Representatives of local, area and national bodies/organisations whose interests might be affected

Table 1: Stakeholder coverage

Who?	How?
Local residents	Leaflet mail drop, public drop-in day, leaflet and poster distribution to community hotspots
Landowners/managers adjacent to the site	Leaflet mail drop, invite to stakeholders' presentation or individual meeting
Community Councils	Stakeholders' information event, public drop-in day, opportunity for presentation/meeting
Representatives from organisations with local interests	Stakeholders' information event, informal and formal meetings
National organisations with an interest in the trial or the region	Letters, informal and formal meetings

Postal responses were sent to the Forestry Commission Scotland offices at Lochgilphead and forwarded to SWT for data collation. Online responses were received through SWT and RZSS websites.

As part of the consultation process, two key questions were posed to those consulted:

1. Would you like to see beavers in Scotland?
2. Would you support a trial reintroduction of beavers to Knapdale?

In addition, respondents were given the opportunity to write comments/questions on their consultation response.

3.2 Methods of consultation

3.2.1 Face-to-face meetings

A series of informal and formal meetings with different stakeholders and members of the project team (see Appendix A) was organised. These meetings included those opposed to the project as well as those near the trial site. Landowners/land managers adjacent to the proposed trial site and organisations which sought further clarification on the proposals were offered face-to-face meetings.

3.2.2 Events and presentations

SWT's Members Centre for Lorn and Mid-Argyll hosted a public event about the project at Dunstaffnage Marine Laboratory in Oban on 18 October.

A stakeholders' information event was held on 19 October at the Cairnbaan Hotel, Lochgilphead for some local landowners and organisations with an interest in the trial.

An informal public open day event was held on 20 October (10am – 5pm) at the Cairnbaan Hotel, Lochgilphead. The open day was widely publicised and people were encouraged to come and find out about the project, to discuss the proposals with the project staff, and to complete a consultation response.

3.2.3 Letters and mailings

Letters were sent to a range of national bodies with regional or organisational interests (see Appendix B) informing them about the trial and the method of responding to the consultation (see Appendix C). Information was made available to regional offices and local staff invited to attend the stakeholders' information event on 19 October.

Letters with consultation leaflets and posters (see Appendix E) were sent to "community hotspots" (see Appendix D) including schools, post offices and leisure centres to help raise awareness and encourage attendance at the drop-in day.

The consultation leaflet, which also contained details of the public events being held, was posted to 2,897 households in the PA29, PA30 and PA31 areas (7% were returned as bad addresses).

3.2.4 Exhibitions

A manned display was positioned at the Co-op supermarket in Lochgilphead for four days (21 – 24 October 2007). The public was encouraged to ask questions and submit their consultation responses.

3.2.5 Mini displays

Posters and leaflets were sent to community "hotspots" highlighting the project and forthcoming public events.

3.2.6 Media relations and advertising

To coincide with the launch of the consultation, local and national press releases were issued giving details of the proposal as well as dates and times of the events (Appendix F).

An advert was placed in the Oban Times on 11 October and the events were publicised in mailings to SWT and RZSS members.

3.2.7 Websites

Information on the trial, including a question and answer brief, was made available on both SWT and RZSS websites and included the ability to submit the consultation response form online. The Q & A brief was developed in response to queries and issues raised during the consultation.

3.2.8 Response to further information

Responses were made to those who requested further information (by email or letter) during the course of the consultation. The number of written responses totalled approximately 400.

3.3 Consultation criteria

3.3.1 Ineligible

SWT and RZSS staff and their families.

Members of the Beaver Steering Group.

3.3.2 Definition of Mid-Argyll

Those within PA29, PA30 and PA31 postcodes.

3.3.3 Definition of Knapdale

Defined by addresses in Tayvallich, Achnamara, Crinan, Bellanoch and Cairnbaan.

3.3.4 Definition of Knapdale neighbouring landowners

With one or more land boundaries onto Knapdale Forest.

3.3.5 Void

Letters without a completed consultation form or without a direct response to the two key questions.

No address or name supplied, or no specific answer to one or more of the questions.

3.3.6 Multiples at one address

When two or more names on the form were from the same address, responses were counted separately i.e. one response per named person per address.

Every consultation response received was acknowledged either by email or letter (see Appendix G).

4. Summary of feedback

4.1 Overview

The project partners (SWT and RZSS) received an encouraging response to the consultation and the associated events. Out of 466 responses submitted by post or online, 374 were received from the Mid-Argyll area and 92 outwith Mid-Argyll. An additional eight responses were declared void due to duplication or incomplete information. Fifty-six confirmed they were either a member of SWT or RZSS. The number of responses was seven times higher than the previous local consultation.

4.1.1 Public

4.1.1.1 Event attendance

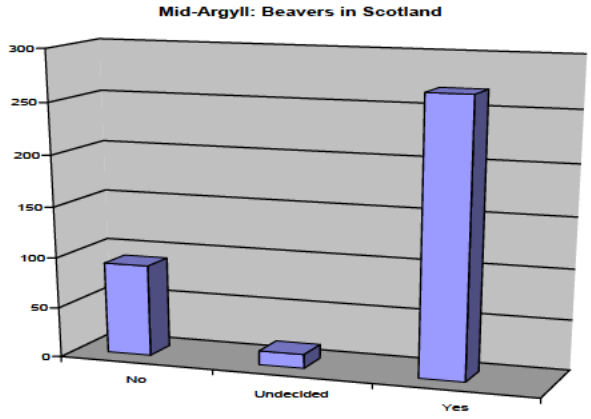
Public events on 18 and 20 October

	Date	**Location**	**Attendance**
Members Centre event (7.30 – 9pm)	18 October	Oban	100
Public drop in day (10am – 5pm)	20 October	Cairnbaan	75 (estimated)

At the events, the project team was available to answer questions and discuss the project. People were encouraged to complete the consultation forms which were available. At both events support for the project outweighed objections; a trend that was reflected in the overall responses received formally (see details on the next page).

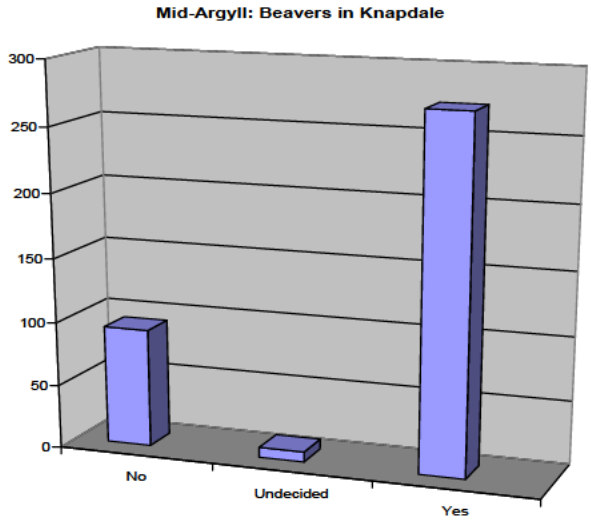
4.1.1.2 Mid-Argyll responses

Table 2: Would you like to see beavers in Scotland?



	Number of response	% of local responses
For	269	72.1%
Against	91	24.4%
Undecided	14	3.8%
Total	374	

Table 3: Would you support a trial reintroduction of beavers to Knapdale?



	Number of response	% of local responses
For	273	73.2%
Against	93	24.9%
Undecided	8	2.1%
Total	374	

4.1.1.3 Knapdale residents

Fifty-six residents living in Tayvallich, Achnamara, Crinan, Bellanoch and Cairnbaan responded to the consultation. This represents 8% of the population in the area (Census 2001).

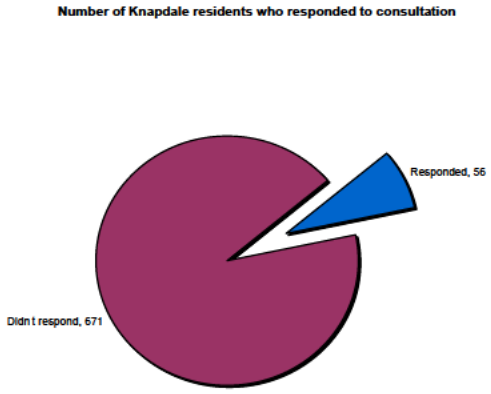
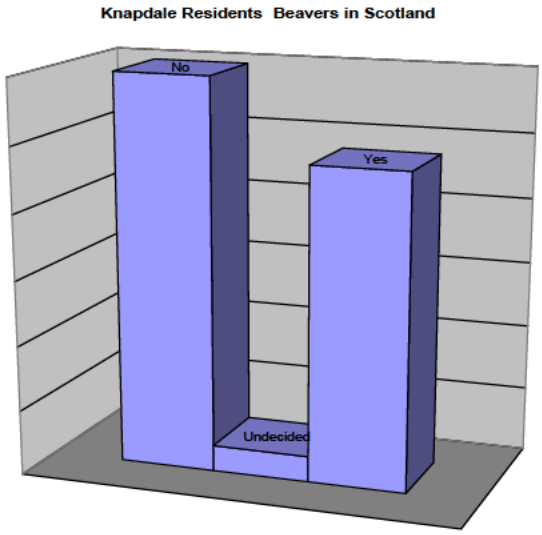
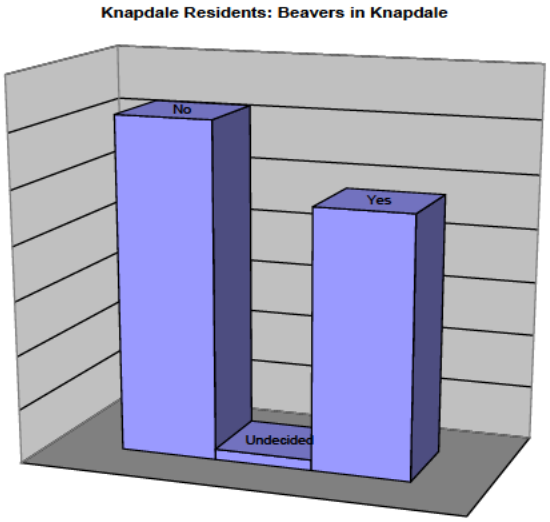


Table 4: Would you like to see beavers in Scotland?



	Number of response	% of Knapdale resident's responses
For	24	44.4%
Against	30	53.6%
Undecided	2	3.6%
Total	56	

Table 5: Would you support a trial reintroduction of beavers to Knapdale?



	Number of response	% of Knapdale resident's responses
For	24	44.4%
Against	31	57.4%
Undecided	1	1.9%
Total	56	

4.1.1.4 Neighbouring landowners or residents to the proposed trial site

Of the 39 neighbouring landowners contacted only 14 (36%) responded to the consultation. All neighbours received a letter inviting them to speak directly to the Project Manager about the trial (see Appendix F).

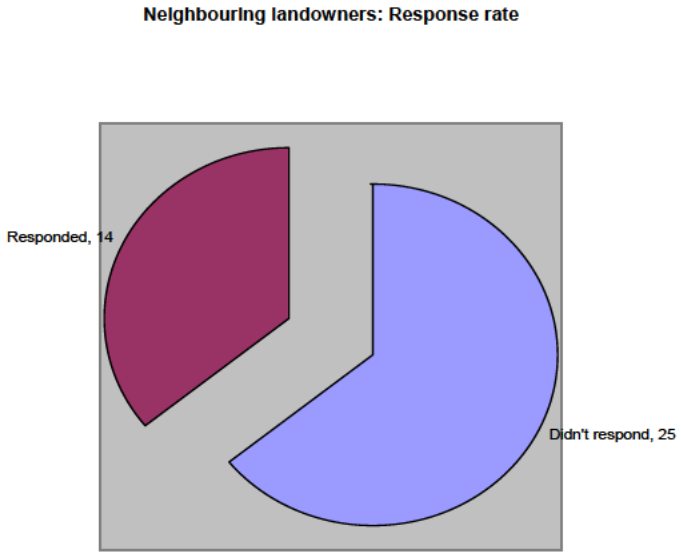
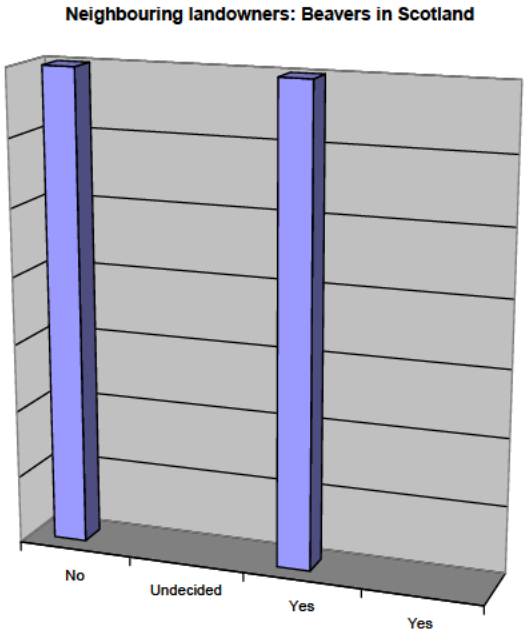
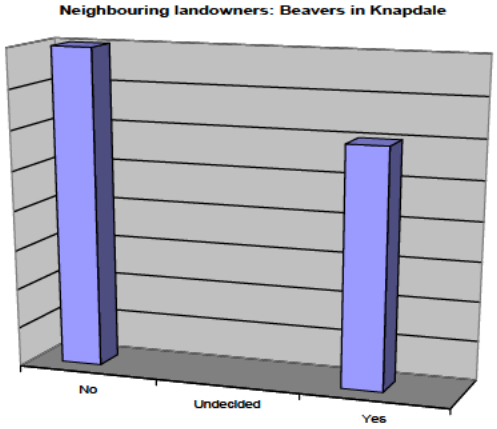


Table 6: Would you like to see beavers in Scotland?



	Number of response	% of neighbour responses
For	7	50%
Against	7	50%
Undecided	0	0%
Total	14	

Table 7: Would you support a trial reintroduction of beavers to Knapdale?

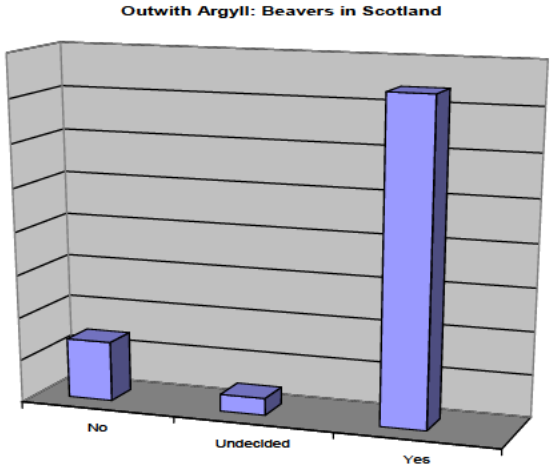


	Number of response	% of neighbour responses
For	6	42.9%
Against	8	57.1%
Undecided	0	0%
Total	14	

4.1.1.5 Responses outwith Mid-Argyll

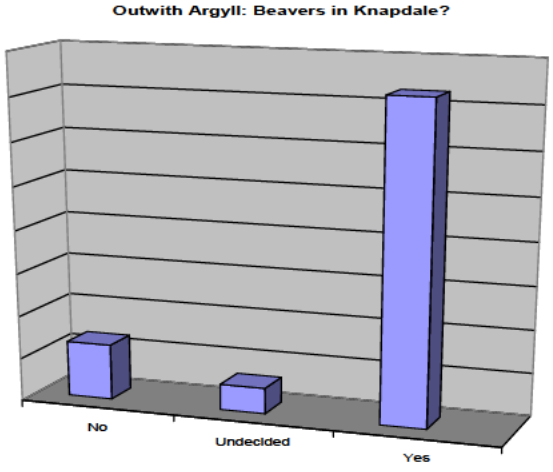
Inevitably a wide range of people outwith Mid-Argyll wished to express a view.

Table 8: Would you like to see beavers in Scotland?



	Number of response	% of specified responses
For	74	80.4%
Against	14	15.2%
Undecided	4	4.3%
Total	92	

Table 9: Would you support a trial reintroduction of beavers to Knapdale?



	Number of response	% of local responses
For	73	79.3%
Against	13	14.1%
Undecided	6	6.5%
Total	92	

4.1.1.6 Analysis of public consultation responses

A significant majority of Mid-Argyll respondents (over 73%) were in favour of beavers being reintroduced to Knapdale and just over 2% were against the trial. Closer to the trial site views were more mixed.

Those in favour of the trial tended not to provide detailed comments supporting their preference; however, the comments received are summarised below.

Table 10: Analysis of positive Mid-Argyll public responses

Reason	Number	Details
Good for biodiversity	25	Enhance species diversity and wetland creation
Moral obligation	15	Extinct due to man, other countries have already reintroduced successfully
Good for wildlife tourism	16	Good for jobs, economy and tourism

Table 11: Analysis of the top 10 negative Mid-Argyll public responses

Most people who objected provided one or more specific reasons, summarised below.

Reason	Number	Details
Beaver reintroduction	40	Outright objection – no supporting evidence given
Resources	18	Money and effort better spent elsewhere
Existing wildlife/habitats	10	Potential negative impact on existing species and habitats, keystone species and interference with the current natural processes not required
Other introductions	9	Would cause similar problems to those resulting from invasive non-native species such as mink, *Rhododendron ponticum* and grey squirrel
Not native	9	No data to prove beavers lived in Argyll and differences in the countryside since beavers were resident
Health risks	7	Concerns with of disease transmission including Giardia
Access restrictions and suitability of site	4	Concerns about possible access restrictions to and on the site. Knapdale not suitable or doesn't have infrastructure to support the trial.
Flooding/water supplies	4	Effect on water levels, drinking water and potential flooding
Consultation	4	Process, need for more research or confidence in project
Salmon/fishing	1	Potential risk of damage to salmon, impact on migration/spawning

4.1.2 Organisations

At the stakeholders' information event on 19 October, 52 individuals including some local landowners, local groups and national bodies with regional interests, were invited to attend.

Neighbouring landowners who were not invited to the event were sent letters inviting them to speak in person to project staff.

Twenty-one attended. The meeting was dominated by those who were not in favour of the proposal and a range of issues to be considered in the licence proposal were highlighted (see Appendix G). Those who raised specific issues received, in writing, more information or clarification about certain aspects of the trial (see Appendix H).

Table 12: Summary of responses from organisations

Organisation	**View**
Argyll & Bute Council	Supportive
Argyll Bird Club	Supportive
Argyll District Salmon Fishery Board	Has concerns and would require safeguards to be put in place, supports AFT position
Argyll Fisheries Trust (AFT)	Has concerns and would require safeguards to be put in place
Association of Salmon Fishery Boards	Against and require clarification on issues raised
Association of Scottish Visitor Attractions	Supportive
British Waterways	Against and require clarification on issues raised
Confederation of Forest Industries	Against
National Union of Farmers Scotland (NFUS)	Has major concerns, wants clear exit strategy and safeguards in place
Ramblers Scotland	Supportive
RSPB	Supportive
Scottish Environmental Protection Agency	Has concerns and would require safeguards to be put in place
Scottish Rural Properties and Businesses Association	Against
Scottish Water	Has concerns (particularly post-trial) and would require safeguards to be put in place
Wild Scotland	Supportive
Woodland Trust Scotland	Supportive

4.1.3 Argyll & Bute Council

The Council recognises the potential benefit to the local economy and community and the potential to extend the biodiversity of Argyll. The Council has undertaken extensive sampling of water courses and water supplies within the release area which will help to serve to inform outcomes of the trial. The Council's Depute Leader, Councillor Robert MacIntyre, and Members of the local Area Committee all agreed that this would represent a positive benefit to the community.

4.1.4 Argyll Bird Club

At the AGM of the Argyll Bird Club (a community organisation constituted in 1985) held on 10 November 2007, discussion was held regarding the trial re-introduction of the European

beaver to Knapdale. The motion was strongly supported by the membership with request being made to write a collective response on behalf of the club.

4.1.5 Argyll District Salmon Fisheries Board

The Argyll DSFB works closely with the Argyll Fisheries Trust (AFT) which acts as its scientific advisor. The AFT has predicted the likely effects of beaver activity to be significant changes in riverine habitat characteristics and profound and significant impacts on fish and fisheries. Constant monitoring will be needed throughout this trial to assess the implications for fish and their environment, including riparian habitat. It is the Board's view that the AFT should be the lead body in making this assessment however it will require significant resources which should be factored in to the project costs.

4.1.6 Argyll Fisheries Trust

Concern expressed about impact on freshwater fish populations both within trial site area (limited impact for proper assessment) and should further reintroductions take place in other areas. Primary concerns relate to changes to riverine habitat characteristics and distribution of salmonid and other native fish that could in the long term change the distribution and productivity of a number of native fish species.

4.1.7 Association of Salmon Fishery Boards (ASFB)

ASFB raised concerns in relation to fish passage issues, habitat modification, environmental impact assessment, biosecurity and exit strategy. They felt unable to support the proposal without further clarification about certain aspects of the trial.

4.1.8 Association of Scottish Visitor Attractions (ASVA)

Recognises the potential benefit to rural economies as well as biodiversity. Beavers can only enhance Scotland's wildlife tourism product.

4.1.9 British Waterways (BW)

Despite being content with the previous SNH proposal in 2000, BW felt unable to support the proposal. BW's main concerns are with assessments of the risks to all potentially affected parties, proposed mitigation measures and residual risks following their implementation. They also stated concerns about the impact on canal structural integrity.

4.1.10 Confederation of Forest Industries (ConFor)

Objected to original application by SNH and continues to uphold this view. Consultation purely conducted on a local level whereas ConFor feels this is a national issue. Trial site is not a closed catchment. Application turned down previously on a number of grounds and not aware that any of these reasons have changed. Impact of other "introductions" and precautionary principle should be applied.

4.1.11 National Farmer's Union Scotland (NFUS)

NFUS was concerned about the economic interests of land managers who may be affected by the proposal and compensation must be made available to support these claims should the proposal go ahead. They felt that the beaver would be reintroduced to a "changed" environment after a 400-year absence. The proposal may have an adverse impact on other species, habitat and water environment. Should the proposal go ahead, a fully agreed and practical exit strategy/contingency arrangement must be put in place before approval.

4.1.12 Ramblers' Association Scotland

In principle, Ramblers' Scotland supports the concept of reintroduction of species to the Scottish countryside provided that this does not have a significant adverse impact on the natural heritage or public enjoyment of the outdoors. It must be carried out in accordance with IUCN guidelines, with the aim of establishing a viable self-sustaining population of beavers.

4.1.13 RSPB Scotland

RSPB Scotland has been involved with successful and popular reintroduction projects for red kites and sea eagles and believes reintroductions can be a valuable conservation tool. They believe the beaver is a clear candidate species for a Scottish reintroduction project and are fully supportive of a well-mounted and controlled trial.

4.1.14 Scottish Rural Properties and Businesses Association (SRPBA)

Introductions into the modern environment will necessarily impact negatively on a range of current land uses and practices. There will be potential negative effects on Knapdale Woods, which is a Special Area of Conservation. The protection afforded to *Castor fiber* under the EU law would render the SNH ”Exit Strategy” either illegal or unenforceable. The period of the trial is inadequate to validate.

4.1.15 Scottish Water

Any controlled re-introduction of beavers needs to consider the potential impacts on public health and in particular the quality of drinking water sources. Scottish Water considers that monitoring of drinking water sources against a baseline level should be considered as part of the study to determine whether there are detrimental effects on water quality. In addition Scottish Water has concerns over the activity of beavers in affecting natural water flows in upland waters which may have a detrimental effect on water availability. These issues would be of particular concern if the trial was deemed a success and resulted in the proliferation of beavers across suitable habitats in Scotland.

4.1.16 Scottish Environmental Protection Agency

SEPA recognises the potential benefits of introducing the European beaver to Scotland’s rivers and wetlands as an agent of biological diversification through, for example, storage of sediments, removal of nutrients and the introduction of woody debris.

There are, however, a number of uncertainties over the potential effects of beaver re-introduction which SEPA believes it would be wise to address before any decision is made about whether to re-introduce the species to an area of Scotland. SEPA does not, however, oppose the principle of reintroducing the European beaver to Scotland provided that the effects are closely monitored and that appropriate control measures would be implemented where evidence becomes apparent of significant undesirable impacts on, for example, hydrology or hydromorphology, natural heritage interests or riparian woodlands.

4.1.17 Wild Scotland

Watching wildlife is an important component of the visitor experience to Scotland and Wild Scotland actively encourages positive developments that provide wildlife viewing opportunities to visitors. Such developments should also provide opportunities for businesses, minimise disturbance to wildlife, and demonstrate and promote responsible wildlife watching.

The introduction of any species into the Scottish environment is a significant issue. It is therefore essential that any managed trial prior to re-introduction is carefully monitored and robust data gathered before any final decisions are taken.

4.1.18 Woodland Trust for Scotland

Supports this proposal as long as IUCN reintroduction guidelines are followed and that populations will be self-sustained with the need for prescriptive management of habitats for beavers. Should be seen as part of riparian restoration because beavers are architects of the wetlands and drivers of wetland natural processes.

5. Conclusions and wider considerations

The overall results of the (fourth) consultation reaffirm that there is widespread local public support for a trial reintroduction of the European beaver in Knapdale (346 positive responses - 79% of these were from respondents in Mid-Argyll), and the project partners are encouraged

by the number of consultation responses (466), which exceeded those received in the earlier local consultation.

The majority of issues raised by respondents relating to the conduct of the trial will be addressed in the licence application and will form part of the research and monitoring of the trial itself. The project partners consider that the level of support is sufficient to justify proceeding with the trial and are grateful to all those who took the trouble and time to respond and for highlighting a wide range of issues.

The development and implementation of the project will continue to involve the local community and stakeholders, and mechanisms for this will be included in the licence application. Project staff will endeavour to achieve constructive relationships with all national stakeholder bodies with a view to ensuring that the proposed trial benefits from their experience and input.

6. References

[1] Scottish Natural Heritage (2007). *Species Action Framework. A Five-Year Species Action Framework: Making a difference for Scotland's Species.* Edinburgh: Scottish Natural Heritage.

[2] Scottish Natural Heritage (1998). *Research Survey & Monitoring Series No 121: Re-introduction of the European Beaver to Scotland: results of a public consultation.* Edinburgh: Scott Porter Research & Marketing.

[3] Scottish Natural Heritage (2001). *Appendix 2; Proposed trial reintroductions of beaver to Knapdale: Report on local consultation*. Edinburgh: Scottish Natural Heritage.

Michael Russell MSP
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EH99 1SP

SCOTTISH BEAVER TRIAL

Dear Minister

APPLICATION FOR A LICENCE FOR A TRIAL REINTRODUCTION OF THE EUROPEAN BEAVER (*Castor fiber*)

We have enclosed with this letter an application to the Scottish Government for a licence to carry out a trial reintroduction of the European beaver into Knapdale Forest, Argyll. The project meets the aims and objectives of the Species Action Framework relating to this species.

Included with the application is a report of the local consultation that was carried out by Scottish Wildlife Trust and the Royal Zoological Society of Scotland which indicates considerable support from the Mid-Argyll community for the trial and has given our two organisations the confidence to submit this application.

During the consultation a number of issues were raised by stakeholders and local people which, if the licence is granted, we will, where possible and relevant, incorporate into the overall project plan. We are also establishing a stakeholders' forum to ensure continued consultation during the development and implementation of the project. By its very nature this is a trial and many of the questions that have been raised will be answered as a result of it during the next six years.

We are also aware that the results of this trial in the Knapdale Forest will not necessarily answer all the questions arising from a general reintroduction of beavers throughout Scotland. Further trials may be necessary in other locations to address issues relating to different habitats and conditions found elsewhere in the country.

We believe this is an important and exciting project for improving the biodiversity and status of wildlife in Scotland and will provide some excellent environmental education opportunities.

We look forward to working with you and your officials in discussing any aspects of this application with a view to securing approval of the licence.

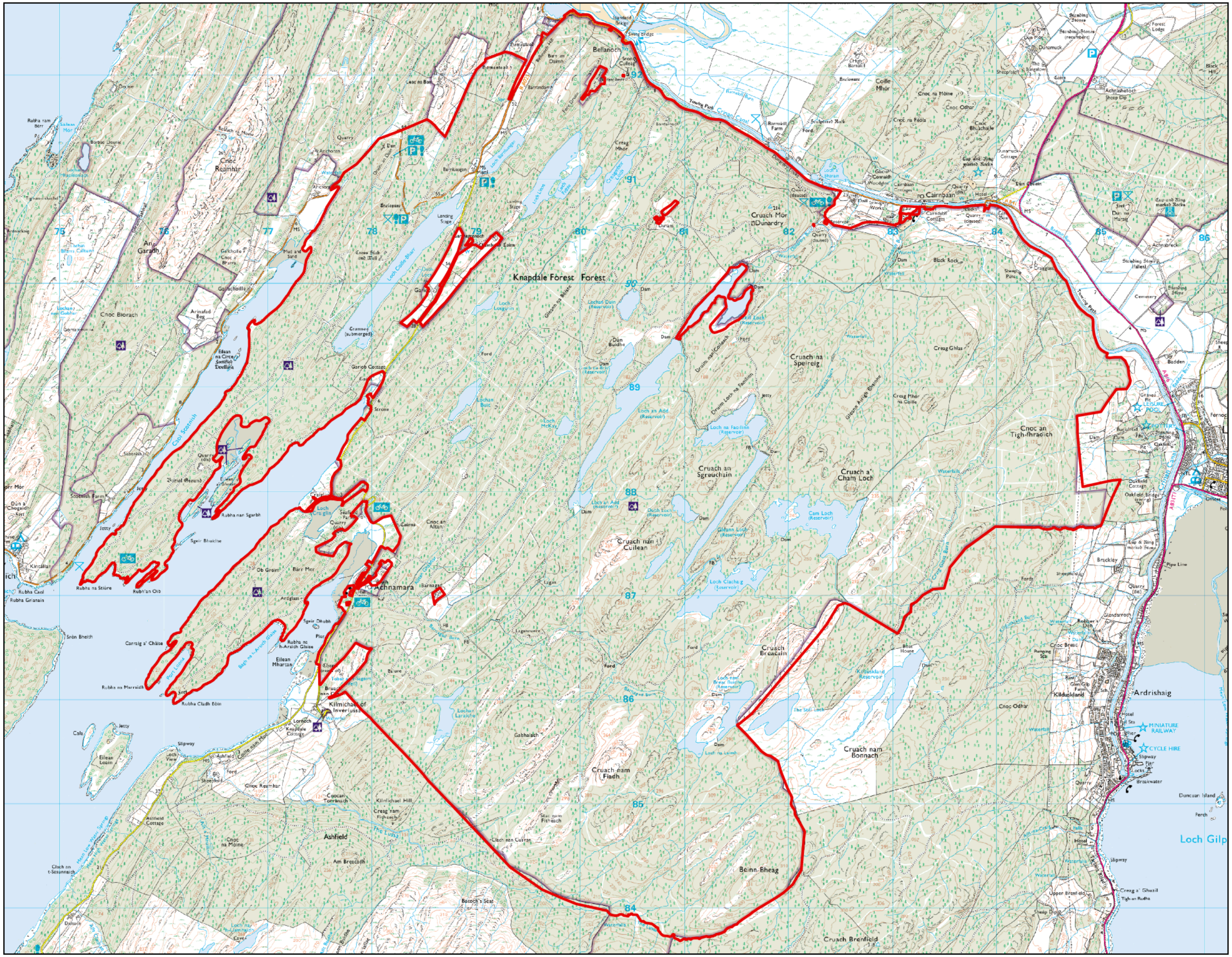
Yours sincerely

[redacted]

.....
David Windmill
Chief Executive RZSS

[redacted]

.....
Simon Milne
Chief Executive SWT



Forest District - WEST ARGYLL

Title: Proposed Beaver Site (FC ownership)

Date: Dec 2007

Scale: 1:35,000

Proposed Beaver Trial Area

Boundary Line

0 500 1,000 2,000 3,000 4,000 Meters

SWT & RZSS

BEAVER REINTRODUCTION TRIAL - DRAFT

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Legal agreements	10,000	0	0	0	0	0
Site fencing	10,000	0	0	0	0	0
Preparatory Works	**20,000**	**0**	**0**	**0**	**0**	**0**
Animal Capture	65,000	0	0	0	0	0
Animal Transport to UK	4,000	0	4,000	0	0	0
Quarantine costs	6,000	0	6,000	0	0	0
Animal Transport to site	0	1,000	0	1,000	0	0
Lodge construction	2,000	0	0	0	0	0
Other release costs	0	1,000	1,000	1,000	1,000	1,000
Animal costs	**77,000**	**2,000**	**11,000**	**2,000**	**1,000**	**1,000**
Employment costs	7,500	45,000	30,000	30,000	30,000	45,000
Recruitment	2,000	0	0	0	0	0
Vehcile & Equipment	20,000	0	0	0	0	0
Vehicle running costs	750	3,000	3,000	3,000	3,000	3,000
Premises / office costs	1,250	5,000	5,000	5,000	5,000	5,000
Staff, Office & Equipment	**31,500**	**53,000**	**38,000**	**38,000**	**38,000**	**53,000**
Monitoring & animal research	0	47,000	47,000	47,000	47,000	47,000
Predictive modelling	3,000	0	0	0	0	3,000
Water Monitoring	7,000	7,000	7,000	7,000	7,000	7,000
NVC Survey (inc macrophytes)	10,000	0	0	0	0	10,000
Land use mapping	2,000					
Freshwater invertebrates	4,000	2,000	2,000	2,000	2,000	3,000
Hydrological monitoring	5,000	1,000	1,000	1,000	1,000	2,000
Environmental impact	65,000	36,000	26,000	25,000	25,000	67,000
Salmonids research		15,000	15,000			
Monitoring & Research	**96,000**	**108,000**	**98,000**	**82,000**	**82,000**	**139,000**
Management costs SWT	10,000	10,000	10,000	10,000	10,000	10,000
Management costs RZSS	10,000	10,000	10,000	10,000	10,000	10,000
Management Costs	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**
Site Interpretation	75,000					
Webcams	10,000					
Education packs	15,000					
Sundry costs	5,000	5,000	5,000	5,000	5,000	5,000
Consultation event						10,000
Interpretation and Communication	**105,000**	**5,000**	**5,000**	**5,000**	**5,000**	**15,000**
Contingencies	**17,475**	**9,400**	**8,600**	**7,350**	**7,300**	**11,400**
TOTAL COSTS	**366,975**	**197,400**	**180,600**	**154,350**	**153,300**	**239,400**

COSTING DEC 07

TOTALS	Lead	Funding	Comments
10,000	SWT		
10,000	SWT		
20,000			
65,000	RZSS		
8,000	RZSS		
12,000	RZSS		
2,000	RZSS		
2,000	RZSS		
5,000	RZSS		
94,000			
187,500			1.5 staff in first & last years. 1.0 between
2,000			
20,000			
15,750			
26,250			
251,500			
235,000		University	phd student / equipment / lab costs
6,000	RZSS		St Andrews Uni or RZSS in house
42,000			Local Council to provide costing
20,000			
2,000			
15,000			
11,000			
244,000			SNH - overstimate? Provided in kind
30,000			
605,000			
60,000			Ballpark figures
60,000			Ballpark figures
120,000			
75,000			Contribution to Forestry Commission centre
10,000			
15,000		LTS	
30,000			
10,000			
140,000			
61,525			5% of project budget. (inc compensation)
1,292,025			

SCOTTISH NATURAL HERITAGE

Application to Scottish Executive by Scottish Natural Heritage for a licence under section 16(4) of the Wildlife and Countryside Act 1981, as amended, to release European beaver, *Castor fiber*, for a trial re-introduction in Knapdale, Argyll:

RESPONSE TO THE MINISTER'S LETTER OF 20 DECEMBER 2002

Scottish Natural Heritage
January 2005

Contents

12. EXTERNAL FUNDING
12.1 Background
12.2 Likelihood of support

1. STRUCTURE OF THE DOCUMENT

This document provides further background to the SNH proposal for a trial reintroduction to Knapdale. Section 2 provides general background information and emphasises that the licence application is for a trial reintroduction rather than a full reintroduction. Section 3 provides some information on experiences of different types of reintroduction in a selection of other European countries (more information on the European experience is provided throughout the remaining document). The rest of the document addresses the more specific points raised in the letter of 20/12/02 to John Markland, in particular the requirements of Article 22(a) of the Habitats Directive, the potential effect of beavers on biodiversity, the potential effects on agriculture, forestry and salmon interests, public health issues, financing and management of the trial, interpretation and education.

2. THE TRIAL

2.1 The Need For A Trial

It should be re-iterated that our proposal is for a ***trial*** reintroduction and not for a full-scale reintroduction of the European beaver to Scotland. The clear difference between the proposed trial and any form of full reintroduction is that animals will be quickly removed if the need arises. An exit strategy is a fundamental part of the project plan. This exit strategy can be operated either during the trial, or at the end of the trial, if a decision is made not to proceed with any further work (see the licence application for details of the exit strategy). This trial approach will allow us to investigate how beavers interact with the Scottish environment, and was developed in response to the outcome of the national consultation process undertaken by SNH in 1998 (public consultation is recommended under Article 22(a) of the EC 'Habitats Directive'. A further local consultation was also undertaken and a report published in 2001, see Appendix 2).

Although there was a substantial majority of consultees in favour of reintroducing the European beaver to Scotland, and studies indicated that the effects land uses were not significant, it was clear that a small number of individuals and interest groups held strong reservations. Accordingly, it was felt the best way to take forward the idea of reintroducing beavers and take account of the concerns which had been raised was to undertake a scientific trial. Apart from the case of Denmark (see below), this is a significantly more measured approach than that taken in other European countries where the pattern has been simply to release animals fully back into the wild (i.e. a 'full' reintroduction) with either limited or no further study.

The trial at Knapdale would involve an investigation of:

- The effect of beavers on;
    - Riparian habitats (particularly woodland)
    - Aquatic macrophytes and macrophyte communities
    - Freshwater fish in standing waters and burns
    - Freshwater invertebrates
    - Species of conservation interest (e.g. otter, water vole, dragonfly species)
    - Natura qualifying interests
    - Biodiversity

    - Water chemistry
    - Channel geomorphology
    - Hydrology
    - Forestry woodland and associated management operations
    - Water quality in terms of public health
- Beaver ecology and behaviour in a Scottish environment, for example;
    - Population dynamics
    - Territory size
    - Movement and dispersal
    - Food selection
    - The testing of predictive population models to estimate population change over time

The information will help to determine any effect of beavers on the Scottish environment and, taken together with information and experience from elsewhere in Europe, will significantly help to inform any future decision as to whether a reintroduction of beavers should take place in Scotland.

It should be noted that the 1992 Convention on Biological Diversity states in Article 9 that *'Each Contracting Party shall, as far as possible and as appropriate, and predominantly for the purpose of complementing in-situ measures:..(c) Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions'.* Furthermore, Article 8 states *'Each Contracting Party shall, as far as possible and as appropriate:..(d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings; (f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies.'* We believe the proposed trial will contribute towards addressing these requirements.

2.2 The Choice of Trial Site

The choice of the trial site at Knapdale followed a wider analysis of site suitability and an offer by the Forestry Commission (FC) to host the trial on one of their land holdings if a suitable site could be identified. Both SNH and FC considered that a vital element of a successful trial was the selection of a site which would allow relatively good natural 'containment' of the beaver population during the trial period.

Knapdale was therefore selected as it provides relatively good natural containment for a trial population of beavers. It also has a number of other advantages (such as a mix of publically accessible and quieter areas within the trial area) as described in our original licence application, and provides the opportunity to monitor a range of environmental factors. The effects of beaver activity on Forest Enterprise (FE) operations on site will also be monitored. It is anticipated by FE that beaver will provide a habitat management role and contribute towards FE's aims of reducing scrub encroachment and pond succession. However, no site is perfect, and we are aware that the trial will provide limited direct information on the effect of beavers on intensive agriculture and on wild salmon in Scotland. What the trial will be able to provide though, is a range of information that will be applicable to these issues (e.g. the effects of beavers on riparian habitats and the forestry infrastructure are also

relevant to these interests). We are also continuing to examine research in other countries in relation to beavers and salmon.

3. EUROPEAN EXPERIENCE OF BEAVER REINTRODUCTION

3.1 Introduction

In responding to the specific points of your letter, we have included further relevant experience and information from other European countries here and in Section 4 onwards. This supplements the information we have collated on European work in our SNH Research, Survey and Monitoring Reports and SNH Review Reports (a reference list is provided in the licence application), the 1998 *Re-introduction of the European Beaver to Scotland: A Public Consultation* document, and the January 2002 licence application. We want to emphasise that, from the outset, SNH has carefully considered those beaver reintroduction projects, which have been, or are currently being, carried out across Europe. We have therefore benefited from the considerable experience which has already been built up (e.g. ecological methods for studying beaver and its habitat, beaver management techniques, conservation issues, education and interpretation methods, information on the effects of beaver on land use and the environment etc.). However, it should be noted that the vast majority of other European countries have undertaken "full" reintroductions without detailed scientific monitoring, and so their work cannot always be directly compared with the scientific ***trial*** reintroduction approach as proposed by SNH. The main comparable work which has been carried out is from Denmark. We are taking a more precautionary approach than the other European countries (even Denmark) which have reintroduced the beaver.

There are now 24 European countries which have undertaken reintroductions, and there have been at least 157 recorded reintroductions outside the former Soviet Union (beaver were also extensively translocated within the former Soviet Union but details are not available). Although we have provided a range of European examples throughout this document, the next four sub-sections give details of four very different types of reintroduction; the Danish 'trial' reintroduction, the Dutch 'full' reintroduction, the Brittany reintroduction using animals from elsewhere in France, and the Belgium "unofficial" reintroductions. We have concentrated on these four countries here as they are towards the western edge of the natural range of beaver (like Britain) and are some of our closest neighbouring EU countries which have undertaken reintroductions. The Danish, Dutch and Belgian cases are also among the most recent reintroductions, whereas the Brittany reintroduction was undertaken about 40 years ago.

3.2 The Danish Experience – A Trial Reintroduction

It is believed beavers became extinct in Denmark between one and two thousand years ago. The Danes decided on a reintroduction in order to restore beavers to their native fauna, and for the ability of beavers to "manage" their habitat, which can benefit other species. The Danes looked at experience elsewhere, particularly in relation to any effects on land uses (including information collated in the research and review reports produced by SNH during the 1990s). They concluded that there would be only minor localised effects, such as some limited flooding. However they believed that any effects could be mitigated through a variety of mechanisms.

A national beaver plan was drawn up which was subject to consultation and release sites were proposed. This was organised by the Danish Forest and Nature Agency. One of the sites was Klosterheden in west Jutland where a limited, local consultation was undertaken. During this process, a national fishery organisation raised concerns over a reintroduction. Therefore a scientifically monitored, time limited trial reintroduction was proposed and a release at Klosterheden took place in October 1999 with the trial ending in late 2003. The results of the trial were reported to the relevant Minister and in 2004 he granted permission for beavers to be retained in Denmark subject to certain conditions (e.g. that the Danish Forest and Nature Agency produce an appropriate management plan).

The release site has some similarities with Knapdale, such as the fact that it is a working conifer plantation and is managed by the state forest service (within the Danish Forest and Nature Agency). However, the release site does not have good natural containment and lies at the upstream end of a river system. The landscape is more gently rolling than Knapdale. During 1999, 18 beavers were released at six localities within the forest. There was no attempt to confine them to a defined area, nor was any radio tracking used. By autumn 2003 there was a minimum of 51 animals, in 13 territories. Five of the territories were in the forest, the remaining eight were on adjacent private farmland. In 2003 one beaver was seen in a new river catchment some 25-30 km downstream from the reintroduction area.

Monitoring was undertaken by NERI (Natural Environment Research Institute) at Klosterheden for;

- Beaver numbers, territories, diet
- Vegetation
- Otters
- Fish
- Freshwater invertebrates
- Amphibians
- Bats
- Birds
- Dead wood invertebrates
- Water chemistry
- Information on the effect of beaver activity on forestry, private owner and angler interests

Results from the study (both published and reported to us in person by NERI staff) indicate;

- An overall positive effect of beaver on habitats and populations of aquatic invertebrates, dead wood insects, amphibians, breeding birds (especially water birds). Increase in suitable hunting grounds for Daubenton's bats
- No observable conflict with otters (number of locations with evidence of otter presence has increased throughout the catchment)
- Localised reduction in willow scrub and, therefore, shading
- Temporal effects on sea trout movements and an assumption made that populations may become isolated upstream of dams (salmon were not present at the site, but the researchers believe the species would not be affected in this way). The barrier effects of dams will constantly change as the

formation of bypasses and lack of maintenance of the dams by the beavers is a dynamic process

- Minimal effects on populations of eel and brook lamprey expected based on results to date. Populations of certain fish species, such as roach and sticleback, may benefit from beaver ponds in longer term
- Relatively minor management problems on private land. Private landowners generally react positively to the presence of beavers.
- A large increase in numbers of visitors to the forest

(see www2.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR489.pdf for full report)

The state forest service has frequent contact with owners of private land where beavers have set up territories. Private land owners appear, on the whole, to be tolerant of minor localised flooding on agricultural land as the land in areas selected by the beavers tend to be undisturbed semi-natural bogs and fens and therefore wet already, difficult for tractors, and often only suitable for grazing. The raising of the water table affects relatively small areas immediately adjacent to the burns. If there is no woody riparian vegetation, and therefore no suitable habitat, then beavers just pass through the areas. Any dams are in the vicinity of areas where woody materials are available. Beavers do not use intensively farmed land.

At three sites where there has been a problem with dams flooding land, pipes have been placed in the dams to lower the water level (the use of pipe systems or 'beaver deceivers' is a standard method of controlling beaver pond water levels), and at another two sites the dams have been repeatedly removed. A few clogged culverts under roads, and the inlet gate to a fish farm, have had to be cleared. Fencing material has been provided by the forest service to private owners to protect vulnerable trees.

There have been guided tours within the forest for local and other people with increasing numbers of people attending the tours (e.g. there were >70 trips with a total of >2300 people on beaver tours in 2002 alone). Even if beavers are not seen during tours, there are opportunities to see beaver signs such as pathways and footprints, scent points, grazed trees, dams, ponds, lodges and canals. Trips are organised by both the forest service and privately. Viewing platforms are used in some locations to reduce disturbance.

Beavers have contributed to the local economy through tourism. Although the forest service has not promoted them widely, the local tourist association has publicised them. The forest service did not plan for visitors before the release, although release sites were selected where people may have a better chance of seeing animals. There is a small 'hut' containing informal beaver interpretation material in one of the main car parks by a beaver release site. Another positive benefit identified by the forest service has been "public health" with the presence of beavers encouraging people to visit the forest and therefore to exercise.

The river habitats and otter population at Klosterheden have been put forward as qualifying interests for a cSAC . The cSAC proposal was made after the beavers had

been released. The view of Danish Forest and Nature Agency is that the cSAC can be maintained in the presence of beavers.

3.3 The Dutch Experience – A Full Reintroduction

The reintroduction project is led by the Dutch Forestry Commission. There was a long period of consideration, c5 years, before the Dutch decided to reintroduce beavers. Dutch forestry staff examined the situation on the Elbe in Germany. They initially took journalists to see beaver sites and their effects to ensure that there was information in the Dutch media to help inform people. Forestry staff visited all the towns and villages in the proposed release areas to provide information to the local community. Initially there were objections from agricultural interests in the Biesbosch area but fears were allayed when compensation was promised for any damage.

The reasons for reintroducing beavers to the Netherlands after c200 years were:

- Beavers were needed as natural habitat managers in nature areas (foresters also use cattle, ponies, deer, etc. as habitat managers so they argued beaver should be used too)
- There is a wish to restore extinct species as part of the natural ecosystem

There are two intentional re-introduction sites, Biesbosch and Gelderse Poort, on state forestry land (a third unplanned 'escape' re-introduction site, Flevoland, is on private land and not managed by the Dutch Forestry Commission). Fifty two animals were released at Biesbosch during 1988-92 and about the same number at Gelderse Poort during 1994-2000.

Since the reintroductions took place, the populations at both the reintroduction sites have increased much slower than expected and the animals are still in the same general release areas. Both reproduction and mortality is low. The populations are now c60-70 at Gelderse Poort and c100 at Biesbosch. For some reason the juveniles are not emigrating from their home territories to look for mates and set up new territories. There appear to be no topographical or other barriers to their dispersal.

Scientific work was carried out at the time of release but little systematic work has been done since. There is no overall plan for the reintroduction and no contingency plans for the slow population growth and dispersal. There has been no long-term management plan considered for beavers in the Netherlands. At the present time, limited research work and little monitoring is being carried out.

No work has been done to ascertain impacts, either positive or negative, on biodiversity. However, during drought conditions in 2003, local staff considered that pools excavated by beavers in the drying ponds helped fish to survive.

Prior to release, possible damage to dykes and riverbanks was not considered a problem. Before reintroduction the government agreed to pay for all damage to agriculture and dykes but they predicted it would be very little, as has since proved to be the case. Since release there had been very limited damage to agriculture and only 250 Euro (c£180) had been paid in compensation up to summer 2003.

In terms of effects on crops, only small areas of maize adjacent to water have been affected. This damage has been minimal due to large field sizes and farmers have not complained. There have also been minor problems with fruit trees and sugar beet. Farmers were able to obtain fencing, including electric fencing, for fruit trees in the early years but it is not considered necessary now. This cost 10,000 Euros (c£7,200) in total.

As well as the official reintroductions there was an unplanned “escape” reintroduction in Flevoland from a wildlife park. The park has had European beavers since 1988 in a large fenced enclosure. The beavers bred successfully and numbers increased. Eventually animals escaped from the park around 1990. Local farmers objected to the escapes and so the Agricultural Ministry instructed the park to recapture them. Some were caught but others set up territories outside and adjacent to the park. When the official reintroduction programme in the Netherlands reached its main release phases around 1994, these escapes came to be regarded, de facto, as a third reintroduction site, albeit an unofficial one. The concern expressed by agricultural interests then died down. The park is immediately adjacent to intensive agriculture but no significant damage has occurred. There was some limited grazing of maize in a large field, up to 10m from the water edge, with no overall impact on crop yield.

3.4 The Brittany Experience – A Local Reintroduction

A relict population of 30 individuals survived in the lower Rhone and has formed the source population for all reintroductions within France. Beavers were reintroduced into the River Ellez catchment of Amorique Regional Park, Brittany, from the Rhone in the late 1960s. They were released onto private land without official permission and without any subsequent monitoring. The population has increased slowly over the last 30+ years and now numbers c60 animals.The beavers have to a large extent been contained in the release area by the topography and large artificial dams on the main river, and their rate of spread has been slow. However around five years ago beavers began to colonise another catchment area. The Ministry of Agriculture does not regard them as a major problem and there have only been two cases of damage, to conifers and poplars, in the last 13 years. The Ministry encourages preventative action in the form of barriers or fencing. The only other reported problem is flooding of a minor road. A local farmer receives agri-environmental funding for the management of his land, including areas that have been affected by beaver activity. Access for the public is difficult but an NGO takes visitors across private land to see beavers and their signs.

3.5 The Belgium Experience – Unofficial Reintroductions

Some natural colonisation of Wallonia (southern Belgium) has taken place from Germany since 1997. In addition, however, there have been a number of unofficial reintroductions since 1998. These releases have often taken place in unsuitable habitats and in some cases have resulted in animals moving large distances (up to 80 km) and being killed by traffic. There are 60 known release sites, nine of which have had minor problems (four related to bank holes, three related to dams, two related to landowners who were unhappy with the presence of beaver). It is now the responsibility of the local government, operating via an NGO, to deal with the resultant situation. Beavers are now in the Flanders part of Belgium following further unofficial releases and colonisation by animals from Wallonia.

3.6 Summary

- Only one country, Denmark, has undertaken a 'trial' reintroduction
- The extent of pre and post-release monitoring varies. Where monitoring has taken place, it suggests that beavers have generally positive effects on biodiversity
- Rates of population increase and animal dispersal can vary. Reasons are not always obvious, although landscape topography can have an effect in "containing" populations for certain periods of time.
- There have been some local detrimental effects on agriculture, forestry etc. but these are relatively few and there are established mitigation methods that can be applied. Beavers have proved to be a popular wildlife attraction at well managed sites
- "Unofficial" releases can result in an increased number of problems, and be detrimental to the beavers themselves.

4. ARTICLE 22a

4.1 Introduction

We will now address the specific questions raised in the letter of 20 December 2002, starting with the issues relating to Article 22(a) of the Habitats Directive. The article states:

'In implementing the provisions of this Directive, Member States shall:

(a) study the desirability of re-introducing species in Annex IV that are native to their territory where this might contribute to their conservation, provided that an investigation, also taking into account experience in other Member States, or elsewhere, has established that such re-introduction contributes effectively to re-establishing these species at a favourable conservation status and that it takes place only after proper consultation of the public concerned:'

Annex IV of the Directive lists "Animal and plant species of Community interest in need of strict protection". "Species of Community interest" are defined in Article 1(g) as species which, within the European territory of the Member States, are "endangered", "vulnerable", "rare" or "endemic". European beaver is identified in Annex IV (and Annex II) as such a "species of Community interest".

SNH believes that the licence application fully meets the requirements under Article 22(a) of the Habitats Directive. We have undertaken considerable study into the desirability and practicality of reintroducing beavers to Scotland. This has taken into careful account experience in other member states and elsewhere where successful projects have gone ahead. In addition we have undertaken consultations with the general public, key interests, and with local people in the vicinity of the proposed trial. Please note that we have consulted our solicitors, Archibald Campbell and Harley, for advice over this issue. They have advised us that we have addressed Article 22(a) fully.

The requirements of the Directive have been considered as follows (full reference details for the SNH reports identified are provided on page 33 of the January 2002 licence application):

"…*study the desirability of re-introducing*…" A report was commissioned which provided evidence of the previous occurrence and eventual extinction of European beaver in Scotland (Conroy and Kitchener 1996). An assessment was made which demonstrated that the Scottish countryside could support a viable population of European beaver if it was ever reintroduced (Webb *et al.* 1997). Other information is provided in various commissioned SNH reports on topics such as investigating beavers and their effects on fish and fisheries, hydrology and woodland habitats (Collen 1997, Gurnell 1997, Reynolds 2000). This and other information has been collated in the 1998 *Re-introduction of the European Beaver to Scotland: A Public Consultation* document, the January 2002 licence application and in this document.

"…*taking into account experience in other Member States*..." Extensive correspondence and meetings with European colleagues, and inclusion of information on European work in SNH reports listed on page 33 of the January 2002 licence application (some of this is collated in the1998 *Re-introduction of the European Beaver to Scotland: A Public Consultation* document). Also see Sections 3 and 5-9 of this document plus general references in the licence application.

"*…such re-introduction contributes effectively to re-establishing these species at a favourable conservation status…"* Once again please note that the current proposal is to undertake a time-limited trial which, on its own, will not address favourable conservation status significantly. However a trial is required before further action can be considered.

"…it takes place only after proper consultation of the public concerned" Please see Section 4.4 of this document which we believe demonstrates that this project has now been involved in extensive and thorough public consultation.

The following sections 4.2-4.4 provide extra supporting information.

4.2 The SNH Approach to Addressing Article 22a - A Trial Reintroduction

SNH has taken a precautionary approach to the issue of the reintroduction of European beaver to Scotland, notably by proposing to undertake a scientific trial rather than a full reintroduction. We have undertaken the most thorough and detailed investigation into the feasibility and desirability of reintroducing the beaver of any European country.

The European beaver was formerly one of the most widespread Palaearctic mammals and was found across Europe and Asia from its western extreme in Britain to eastern Siberia. The natural range of the European beaver in the EU at the present time is much reduced, particularly in the west. Sweden, France and Germany have relatively well-established populations in the west, the Baltic States and Poland in the east. Austria and Finland, have low populations (1000-2000 animals), whilst the others (Spain, Belgium, Denmark, Luxembourg, Netherlands, Czech Republic, Hungary, Slovenia, Slovakia) are still at the early stages of reintroduction and/or recolonisation. A major gap in their natural range in the EU is at

the western edge, Britain. Ample evidence exists to show that the species was formerly widely distributed in Britain, including across Scotland. However it is not possible for European beaver to recolonise Britain naturally (although they will swim in the sea for limited distances they would not cross the channel or the North Sea in normal circumstances). Therefore the only way for Britain to contribute to the re-establishment of beavers to their former range is by active reintroduction.

The trial project proposal includes extensive pre- and post-release monitoring and the results of the trial will help inform any future decision about the reintroduction of European beaver to Scotland. Thus SNH, having followed the consultation process recommended in Article 22(a) and, in the light of European experience, both within and outwith the territory of the member states, and noting the contribution of a Scottish reintroduction to favourable conservation status of the species, has not followed the Continental approach but has taken a more precautionary line to reflect Scottish concerns.

4.3 Favourable Conservation Status

4.3.1 European Context

The European beaver was reduced to c1200 animals in eight isolated populations across Eurasia by the beginning of the 20th century. Within the area covered by the current EU member states there were only two relict populations; on the river Rhone in France and the river Elbe in Germany. Since then beavers have increased in numbers in the countries where they persisted, and have spread by natural colonisation, translocation and, primarily, re-introduction. The species now occurs in more than 20 European countries (Table 1), although it does not yet occupy its historic range across Europe.

Table 1. Reintroduction History of European Beaver

Country	**Occurrence of beavers in the early 20th century**	**Translocation/ re-introduction**	**Additional natural recolonisation**
*Austria	N	1970-90	
Belarus	Y		
*Belgium	N	1998-2001	Y
Bulgaria	N	Planned	
Croatia	N	1996-98	
*Czech Republic	N	1991-92, 1996	Y
*Denmark	N	1999	
*Estonia	N	1957	Y
*Finland	N	1935-37, 1995	
*France	Y	27 translocations 1959-95	
*Germany	Y	1936-40, 1966-89, 1999-2000	
*Hungary	N	1991-93, 1996-2003	Y
Kazakhstan	N	-	Y

*Latvia	N	1927-1952, 1975-84	Y
*Lithuania	N	1947-59	Y
*Luxembourg	N	-	Y
Mongolia and China	Y	1959-85	
*Netherlands	N	1988-92, 1994-2000	
Norway	Y	1925-65	Y
*Poland	N	1943-1949, 1975-86	Y
Romania	N	1998-1999	
Russia	Y	1927-64	
Serbia	N	2004	
*Slovakia	N	1995	Y
*Slovenia	N	1999	Y
*Spain	N	2003	
*Sweden	N	1922-1939	
Switzerland	N	1956-77	
Ukraine	N	Y (no dates)	Y

Y = Yes, N = No

* = EU Member States. Favourable conservation status applies at the EU level and so EU Member States are identified.

Reintroductions and translocations have taken place since 1922, both in EU member states and other European countries. Britain is one of a very small number of European countries where beavers were formerly present and where reintroduction has not taken place. Since the Habitats Directive took effect in 1992, Denmark and Spain have begun reintroduction programmes and Germany and the Netherlands have continued their schemes. Some of the recent "Accession States" are also continuing programmes which they had started before joining the EU on 1 May 2004. The majority of reintroductions pre-date the Habitats Directive and therefore there is limited European experience of how other member states have complied with Article 22(a).

Throughout Europe reintroductions of the European beaver to parts of its former range have taken place with the primary conservation aim of species restoration. They have all taken place as "full" reintroductions (apart from Denmark, see earlier section), with no form of trial nor exit strategy should problems arise. There has been relatively limited consideration of the medium and long-term effects of the presence of beavers. However we have found no evidence of reintroductions or translocations being halted or reversed because of adverse effects. In Bavaria, where some problems have been reported (see later section), some beavers have been removed and used for re-introduction projects elsewhere. However, there are no plans to remove beavers completely.

The longer-term effects of beaver presence on land and water uses are dealt with in later sections. However, in summary, although some adverse effects on land use interests have been reported at a local scale, we have not come across reports of

adverse significant impacts at a national scale. The beneficial effects of beavers have also been reported to us and these, too, are dealt with in later sections.

It appears also that little pre-release study or monitoring has taken place in continental re-introduction projects. The exception is Denmark where limited pre-release studies were undertaken at Klosterheden. Post-release monitoring work has most commonly concentrated on beaver ecology (e.g. population change and dispersal).

Unlike Scotland, with some exceptions there seems to have been either no or minimal public consultation, either national or local, on the Continent. In many countries reintroduction has taken place into a protected site, for example a national park, with limited involvement of the surrounding communities. Subsequently beavers have dispersed and colonised areas outwith the management control of the protected area.

In summary, the reintroduction of beaver to nearly all parts of its natural range in Europe has involved the following;

- a "full" reintroduction without the need for any trial
- limited public consultation
- very limited pre-release, and varying degrees of post-release monitoring
- localised detrimental effects, but also neutral/positive effects
- a general view that, overall, the ongoing restoration of the species is continuing to improve the conservation status of the species

The result has been that reintroductions to nearly all the countries where beaver was formerly present, appear to have been successful. Also they have generally been considered neutral/successful from the wider socio-economic viewpoint.

4.3.2 Contribution to Favourable Conservation Status

It is important that the trial in Scotland is treated on its merits and no further action should take place until after completion. However it seems clear that reintroduction of European beaver to Scotland would make a contribution to the favourable conservation status of the species in the EU as a whole by extending the range of the species considerably. The term, favourable conservation status, is defined in the Habitats Directive as follows;

Article 1
'For the purpose of this Directive:
(i) conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2;
The conservation status will be taken as 'favourable' when:

- *population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
- *the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis:'*

In terms of the Directive the population, range and extent of habitats of a species outside the EU is irrelevant.

The best estimates of the current national populations of European beavers are given in Table 2 and the total populations in Table 3.

Table 2. National Populations of European Beaver in Europe and Asia

Country	**Population**
*Austria	>1300
Belarus	24,000
*Belgium	200-250
Croatia	180
*Czech Republic	500
*Denmark	51-70
*Estonia	11,000
*Finland	2,000
*France	7,000-10,000
*Germany	8,000-10,000
*Hungary	>400
Kazakhstan	1000
*Latvia	>100,000
*Lithuania	50,000-70,000
*Luxembourg	1
Mongolia & China	800
*Netherlands	177-227
Norway	70,000
*Poland	18,000-23,000
Romania	>170
Russia	232,000-300,000
Serbia	30
*Slovakia	>500
*Slovenia	<6
*Spain	18
*Sweden	>100,000
Switzerland	>350
Ukraine	6,000

* EU Member States

Table 3. Total Populations of European Beaver

Area	**cMinimum Population**	**cMaximum Population**
World	634,000	732,000
EU	299,000	329,000

The total world population is 634,000-732,000 but this is heavily weighted towards Eastern Europe, especially Russia with 232,000-300,000 and the Baltic States with

>161,000-181,000, and the Scandinavian countries of Sweden and Norway with >170,000.

Of the 25 EU Member States 18 currently have European beaver; Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Slovakia, Slovenia, Spain and Sweden. The EU total population is 299,000-329,000 of which the vast majority is within seven countries (>100,000 are in Sweden, >161,000-181,000 in the three Baltic States, 18,000-23,000 in Poland, and 15,000-20,000 in France and Germany). This partly reflects the earlier reintroductions to these countries, the fact that France and Germany had surviving remnant populations into the 20th century, and the availability of suitable habitat. The remaining c5,200-5,300 animals are spread between eleven countries (mainly Austria and Finland) but represent just 1.7% of the EU population. Belgium, Denmark, the Netherlands, Hungary, Slovenia, Luxembourg and Spain are all in the early stages of reintroduction (or recolonisation in the case of Slovenia and Luxembourg) and their populations cannot be described as established. Therefore the current EU population is heavily skewed in terms of beaver distribution.

The addition of the Accession States following EU enlargement has resulted in an increase in the range of the beaver within the eastern component of the EU territory but it has not affected its range in the west of the EU. There is therefore still a need to ensure the success of recent reintroduction projects, particularly in the western EU countries, and to consider re-establishing beaver in the north-western part of its range (i.e. Scotland/Britain). Virtually all EU countries within the historical range now have beavers (although populations are still low in some cases) and the major gap lies in the north west.

The present EU population and distribution data indicates that further work is required in many countries to ensure that beavers are maintaining themselves "*on a long-term basis as a viable component of its natural habitat"*. Certain parts of the EU (e.g. Estonia, Latvia, Lithuania and Poland) have relatively large populations which can be assumed to be maintaining themselves on a long-term basis. However this contrasts to the situation in the west (e.g. Denmark, Netherlands, Belgium and Spain) and other eastern countries (e.g. Czech Republic, Hungary, Slovenia and Slovakia) where populations are at a low level and in the early stages of reintroduction and/or recolonisation and where viable populations have not been yet established. A successful reintroduction to Scotland would help towards maintaining the population in the north-western part of its range in the long-term.

In terms of *"long-term distribution and abundance of its populations within the territory"*, the present distribution and abundance of European beaver has been largely achieved by active reintroduction and translocation by member states together with some limited natural recolonisation. However this distribution and abundance could not have been achieved by natural colonisation alone during such a short time scale. Therefore the long-term distribution and abundance can only be achieved through further reintroduction programmes into those parts of the EU where natural distribution would not be achieved or where population levels are still low. As far as Britain is concerned, there are several means by which wild populations of European beaver could be established:

(i) Escapes from captive collections
(ii) “Unofficial” releases
(iii) Natural colonisation
(iv) Reintroduction

Options (i) and (ii) are obviously not acceptable for a range of reasons (they would not be legal, animals could become established in unsuitable habitats and may not be viable on a long term basis, no pre-release public consultation would be involved, animals would not be monitored or managed in a coordinated way etc.). Natural colonisation is unlikely for millenia because of the current marine barrier to beaver movement. Therefore the only way to ensure restoration to Britain is through reintroduction.

There is some evidence from work undertaken in Sweden that reintroduced beaver populations may exhibit an irruptive pattern of development. Recent beaver reintroductions tend to exhibit some degree of population growth and expansion but data from some longer established populations have shown negative changes in beaver population density. So although some European populations appear to be increasing well at the moment, there is a concern that this could reverse in the longer term.

Preparatory research work by SNH prior to the 1998 consultation demonstrated that there was sufficient habitat to support a population of beavers in Scotland (based primarily on 1988 survey data). Since then the habitat, in terms of extent and quality, has probably increased as a result of various habitat management initiatives. This is likely to increase still further by the time a trial has been approved and run, and riparian habitat restoration boosted by linking it with beaver habitat creation programmes (also see section 5). Therefore SNH consider that there would be “*a sufficiently large habitat to maintain its population on a long-term basis”* within the Scottish component of the EU territory should the results of the trial indicate that a reintroduction to Scotland could take place.

In conclusion, a trial reintroduction is judged to be a suitable, precautionary approach at this stage. Any subsequent managed full reintroduction to Scotland (and therefore Britain) would make a contribution to *“re-establishing…”* the *“…species at a favourable conservation status”.*

4.4 Proper Consultation of the Public

4.4.1 The National Consultation

The full details of the 1998 national consultation and its results have already been provided (Scott Porter Research and Marketing Ltd., 1998). It was the results of this consultation that indicated the strong public backing of beaver reintroduction. The Main Board of SNH subsequently approved a time limited trial over a specific area. This, in turn, led to Knapdale being chosen as the most suitable site owned by the Forestry Commission. The Main Board decided that the trial project should be progressed, subject to local public consultation. Therefore a local consultation took place, the details of which are summarised in the 2001 local consultation report (the local consultation report was released to the public and interested bodies). However further clarification was requested in the letter from the Minister about this consultation and this is provided below.

4.4.2 The Local Consultation

The local consultation was based on the Mid Argyll Area and on the North Knapdale Community Council (NKCC) area in particular, to ascertain both the views of the public and also the views of individuals, bodies and organisations who might be affected.

Quantitative information was gathered by means of a survey questionnaire, which was widely available in the locale. Assessments of proportions of the consultees in favour or opposed to the project were derived from these questionnaires. However, we also gathered and reported on views and opinions expressed by other means. A summary of the local consultation process is provided in the January 2002 licence application.

The Mid Argyll Branch of the NFU Scotland was initially content with the trial proceeding and this was included in the March 2001 consultation report. However NFU Scotland nationally opposed the trial, and the local branch later, in November 2001, objected to the trial. This information was communicated to SNH Main Board before they made their decision on the submission of a licence application to Scottish ministers.

For the local respondents who were in favour of the proposed trial re-introduction there were not any general themes that occurred in the responses, and generally respondents did not provide any lengthy detail over the reasons for their support. The key reasons, when any were provided, were:

- restoring part of the lost wildlife of Scotland;
- increasing biodiversity,
- benefits for tourism; and
- the benefits of a well managed trial.

Full details of the process are given in the local consultation report of March 2001 (this includes a November 2001 update regarding the NFUS position). The report was distributed to all those who had requested a copy at the time of the consultation. The results were also released to the press. The report was sent to SE shortly after the SNH licence application was submitted. However, a further copy is enclosed (Appendix 2).

4.4.3 Survey by the Argyll and Bute Community Planning Partnership Citizen's Panel

Since SNH submitted the original licence application in January 2002, a question on the beaver proposal was also put to the independently coordinated Citizens' Panel in Argyll by the Argyll and Bute Community Planning Partnership as part of a wider questionnaire in June 2002. The Citizens' Panel is comprised of 1000 residents recruited to provide a representative cross section of the population in Argyll and Bute. Profiling variables include geographic area, age and gender. The question was *'Do you agree or disagree with the following statement? – Scottish Natural Heritage should undertake a trial re-introduction of the European beaver in Knapdale'.* There was a 68% return (681 questionnaires returned), and the results are given in Table 5.

Table 5 Results of Argyll Citizens Panel Survey

View of Respondents	Percentage	
	Argyll & Bute	Mid Argyll & Kintyre*
Strongly agree	14	10
Agree	32	35
Neither agree nor disagree	33	28
Disagree	11	9
Strongly disagree	10	19

(*Figures not available for Mid Argyll separately. Note the figures do not add up to 100% but are taken from the published report)

Therefore 46% agreed and 21% disagreed for the whole of Argyll and Bute (33% unconcerned either way), while for Mid Argyll and Kintyre 45% agreed and 28% disagreed (28% unconcerned either way). These are similar to the figures obtained by SNH in the local consultation.

4.4.4 Scotecon Study

In October 2003 the Scottish Economic Policy Network (Scotecon) publicised a report on public attitudes towards the control of wild animal species in Scotland. The report was based on an innovative method of valuing some of our rarest wildlife. Willingness to pay for wildlife control measures was assessed using the *CV Market Stall* technique, incorporating a traditional quantitative approaches with an innovative qualitative approach which allows a detailed understanding of attitudes towards wild animal control to be recorded.

The study involved 71 participants. The reintroduction of the beaver was supported by 72% of participants (14% did not support it and 13% were not sure either way). There was also an average willingness to pay of £24 per household per year for 10 years to fund a pilot beaver reintroduction project.

The study concluded that *'Scottish Parliamentarians should be reassured that public expenditure on wildlife management conservation, despite the largely negative press coverage such issues normally receive, represents good value for money. The future economic benefits associated with wildlife management, particularly given the*

close relationships between wildlife and the natural heritage of Scotland and tourism, should not be overlooked by government'.

Full details are available in the published report, (Philip, L.J. and Macmillan, D. (2003) Public Perceptions of Attitudes Towards the Control of Wild Animal Species in Scotland. Report to Scotecon.net, Department of Land Economy, University of Aberdeen)

4.4.5. Summary

Therefore, in summary, there has now been a national consultation, a local consultation, a Citizen Panel survey and a Scotecon study over SNH European beaver proposals. We are unaware of any other species reintroduction project throughout Europe where such a high level of consultation has been carried out. In all consultations, objectors to the trial and/or reintroduction have been a minority and public support has been significant. This is a project which has captured the public imagination and gained widespread support.

5. BIODIVERSITY AND OTHER ENVIRONMENTAL BENEFITS

The experience from Europe of the effect of reintroduced beaver populations is that their presence can have a number of positive benefits on biodiversity and other environmental factors. Beavers are managers of their wetland ecosystems and as such are often termed a 'keystone species'. Beavers introduce a dynamic aspect to the ecosystem leading to wetland creation and succession and woodland coppicing and succession. This modification of their habitat has a generally beneficial effect on other flora and fauna.

The trial, being geographically constrained and time limited, is expected to have a local beneficial effect. An aim of the monitoring programme is to identify some of the effects, of the trial on the local biodiversity at Knapdale.

Information gathered from specialists across Europe suggests that the presence of beavers in particular cases can have the following effects due to their water and woodland management activities;

- increase in abundance of wetland birds, and number of species e.g. ducks, water rail, etc.
- benefit to certain bat species e.g. creation of suitable hunting grounds for Daubenton's bat
- benefit to otter
- benefit to water vole
- benefit to amphibians
- greater diversity of macro freshwater invertebrates
- habitats suitable for certain fish species
- increase in diversity of habitats along small river systems
- maintenance and increase of wetlands and associated vegetation communities
- increase in coppiced riparian woodland habitat
- increase in quantity of standing and fallen dead wood

In the Danish trial reintroduction, NERI staff informed us that the riparian willow scrub breeding habitat of some passerine bird species has declined in places due to localised flooding so they are now breeding in areas closer to the forest edge. There has been an increase in habitat for wetland bird species, such as kingfisher and moorhen. (Also see Section 7 regarding the effect of beavers of aquatic macrophytes). Examples of negative effects of beaver on local biodiversity are not common, although the results of a recent Russian study, as reported at the European Beaver Symposium (October 2003), in tributaries upstream of a very large reservoir suggested that the presence of beaver dams resulted in a localised decline in fish diversity and abundance.

There would also be more indirect positive effects on biodiversity. The beaver would become a very public symbol of biodiversity in Scotland and, more directly, on riparian habitats with the species being used to highlight the need for positive management of this habitat. Management of riparian habitat would not just benefit biodiversity but also fish and fishing interests. It could benefit land managers by being a priority aspect of the woodland grant scheme and Rural Stewardship Scheme. Beavers would also highlight the need, in particular, for positive management of aspen woodland that could be included in management schemes for land managers.

Beavers are already being used as “habitat managers” at three large, fenced sites in Britain. All three have started within the last two years, two in Perthshire on private land holdings, and one at Ham Fen in Kent. The Ham Fen site is a nature reserve and SSSI owned by the Kent Wildlife Trust where beavers are being used to control scrub invasion and restore the fen habitat.

There can be other environmental benefits arising from beaver activity not directly related to biodiversity, for example;

- beaver dams increase purification capacity of burns polluted from agricultural and urban sources thus protecting larger rivers and the marine environment downstream
- increased trapping of sediment and deposition upstream of dams (eventually resulting in ‘beaver meadows’ in areas of deposited soil), which also improves downstream water quality
- beaver dams store water which is then be released during dry periods, thereby moderating the detrimental effects of irregular flows
- beaver ponds provide deeper areas of water, raise the water table locally and slow the overall speed of the water flowing through the system

Many of these effects will obviously be proportional to the numbers of ponds and dams present in any system. Some workers have suggested the possibility of “harnessing” beavers to reduce erosion processes from areas of ploughed agricultural soils. A recent study in the Tatarstan Republic, Russia, examined the effect of 21 reintroduced beavers above a lake suffering from degradation resulting from agricultural soil deposition. The beavers created three dams which, during a flooding period, stopped an estimated 4,000 tons of sediment. The mass of sediments per litre of water downstream of the dams decreased by 53%. The role of beavers in improving water quality near urban areas has also been reported from Estonia.

It is extremely difficult to put a financial value to such potential benefits but they are likely to be significant in many areas (one Latvian specialist has estimated that the positive influences of beaver on the Latvian landscape was worth many millions of pounds).

6. AGRICULTURE

6.1 General Assessment

It is accepted that the trial site will yield predominately local information on the interactions between beavers and land use. However, information gained at Knapdale from the monitoring of, for example, any hydrological change, grazing activity in riparian zones, effects on the forest infrastructure (e.g. forest tracks, culverts etc.) and forestry activities will also be of relevance to more general agricultural situations.

There are a number of potential effects that beavers could have on agriculture if a full reintroduction took place, both positive and negative (although SNH are only proposing a trial reintroduction). Some of these are noted in the licence application. This section concentrates on reported negative effects, although the beneficial effects reported in other sections of this document must also be borne in mind. However beavers are hefted to the riparian zone and generally feed within c50m of the water's edge, usually much closer (the Danish study recorded most activity within 5m). Therefore it is only certain crops within that zone that may be grazed. Similarly, if localised flooding does occur as a result of dam building, it is likely that the immediate riparian zone will be most affected.

There is little published information available in Europe in relation to beavers and agriculture. However anecdotal information (see Section 6.2 for details) suggests that there can be localised problems in some individual cases but on a larger scale the level of damage is not significant. With other "full" reintroductions in Europe the impact on agriculture appears either not to have been considered or is regarded as slight. The lessons from elsewhere in Europe are that reintroductions have proceeded and the effect on the agriculture has not been seen as a significant problem. Local opponents of the proposed SNH trial have reported issues but no specific details have been provided to SNH to allow further investigation.

Beavers have an extremely catholic diet eating a wide range of herbaceous and woody species. Feeding is usually close to the water's edge and so herbaceous plants taken tend to be wetland or the riparian edge species. Thus it is unlikely that beavers would graze on agricultural grasses to any serious extent, unlike rabbits or deer. Intensively farmed fields simply do not provide good beaver habitat. There are no reports of beavers being a problem for grass crops but they have been reported feeding on orchard trees, maize, corn, oil seed rape, potatoes and sugar beet near riparian zones and causing some cases of localised flooding. In terms of good practice for riparian management "The Code of Good Practice for Prevention of Environmental Pollution from Agricultural Activity" (Scottish Office, 1997) and "The Four Point Plan" (SEPA) both encourage the use of buffer strips along water courses and the fencing off of water courses to livestock. Therefore it is assumed that in Scotland the ploughing and planting of crops close to the water's edge would not be

normal good practice. Bank damage, resulting from burrowing activities of beavers, can sometimes be a localised problem.

In the proposed trial area it is highly unlikely that beavers will graze on grass crops to any great extent, even if they were to leave the trial area. There is only the occasional arable crop now grown in the Mid Argyll area and the nearest is likely to be some 5-6 km from the trial boundary.

6.2 European Experience: Agriculture and Beavers

The information available to SNH on problems surrounding beavers and agriculture (plus additional information on the effects on forestry) is as follows. It is mainly derived from direct communication with specialist workers across Europe (both within and outwith the EU).;

Austria; some local damage from flooding, feeding on crops and grazing trees. In some areas of intensive agriculture (flat land, high water table and lots of drains) problems can occur when beavers build dams and flood riparian areas. In general management is carried out to keep them away from problem sites and compensation is only paid for damage in connection with habitat improvement or set-aside As a last resort they use live trapping and removal or killing. Illegal killing has been recorded. The population is too small at present for sustainable hunting to be used as a management method. There are some complaints surrounding damage to commercially used broadleaved trees, such as ash, oak and alder, and some foresters claim to find it more difficult to cut and extract trees from riparian areas where beavers have worked.

Czech Republic; beavers have been present for 10-15 years and are now spreading, both from reintroduced stock and natural colonisation (population c400). As they have spread they have moved to more populated areas and there are some localised problems. There has been some flooding of agricultural land bordering waterways, and they have been reported eating maize and sugar beet on occasions. Compensation is paid as there is scope under national legislation in connection with endangered species. However all the problems are viewed as minor in the national scale.

The Czech Republic is still at an early stage in terms of establishing a viable beaver population but further on than Denmark, Netherlands and Spain. However they are producing a national beaver management plan, before there is a large increase in numbers, to try to take account of all contingencies. This plan will include five to six Special Areas of Conservation (SACs) with beaver as a qualifying species, areas for beaver colonisation and areas from which beavers will be excluded because of potential conflicts (e.g. areas with medieval fish ponds with sandy banks). The plan will also consider control mechanisms, compensation, who does the work, who administers the plan, etc.

Denmark; still at the early stages of reintroduction but beavers are present in intensively farmed areas adjacent to the release site. Some flooding of small streams in valley bottoms has extended areas of wetland but has not impacted significantly on cultivated land. The release site is a state forest and the presence of beavers there is viewed as beneficial by the forest service (e.g. advantageous to local

biodiversity, encouragement of game bird species, beaver grazing of willow scrub has reduced scrub removal costs to the forest service, educational and interpretive opportunities etc.). (Also see Section 3.2).

Estonia; beavers have colonised drainage ditches in flat areas dug during the communist period to increase crop production which are still being maintained to some degree. There is a licensing system to kill beavers if necessary. They are not a significant problem for forestry.

Finland: limited and localised problematic effects of beaver on land uses. These are mainly limited to grazing on individual trees in private land ownership and occasional flooding of agricultural roads but there are no real agricultural problems. No problems have been reported with salmon.

France; the beaver population is 7-10,000 animals. There are c40 claims per year for damage, 90% of these relate to damage to trees (mainly fruit trees) and the other 10% is damage to annual crops e.g. maize and sunflowers. In 80% of the cases damage to fruit trees occurs less than 10m from the water, and less frequently if there is a strip of natural vegetation between the watercourse and the trees at risk. Beavers are not seen as a major agricultural problem. Advice is provided on management measures to try and prevent damage, as no compensation is paid for damage by protected species (except wolf, lynx and bear) though some regions fund protection measures. The impact on natural vegetation, especially willow, is considered beneficial because the cutting of woody vegetation results in bushy growth which stops the development of large trees which could otherwise destabilise riverbanks and contribute to erosion.

For information from Brittany see section 3.4.

Germany; in the Elbe area beavers have caused no major problems. Only a few localised problems have been reported, for example feeding on maize, corn and sugar beet in the summer and oil seed rape in the winter. Occasional reports of animals blocking streams and partially flooding maize fields. Compensation is not paid by the state government.

In Bavaria, the number of reports of problems appear to be higher than elsewhere in Europe. The region has a population of over 6,000 animals. There is an efficient system in place for dealing with beaver management issues. Burrowing into flood dykes, etc. is not an issue with beaver although such problems have been caused by muskrat and coypu. Even though muskrat and coypu may do a lot of damage, the remedial work is carried out by specialist beaver managers to ensure fast action. Consequently the view of the specialist beaver managers we have spoken to is that beavers are sometimes given the blame for damage created by the other species to ensure speedy remedial work is undertaken.

Beaver have caused occasional damage by breaching fish pond dams. There have also been localised problems with hydroelectric schemes in two ways; firstly by dams and breaches along open aqueducts and secondly by woody debris entering intakes and eventually into turbines. The former is not considered a major problem and the latter can be mitigated with better mesh guards over the intakes.

Agricultural damage is small scale (40 m^2 of grazed maize is typical at a problem site) but seen as a greater problem on smaller farms than on larger ones. During 2003 there was low rainfall and crops in areas behind beaver dams did well due to the availability of permanent water sources (although some farmers have complained of grazing on maize in these areas).

Management in Bavaria includes the removal of dams, electric fencing, the use of habitat management and removal of individual problem beavers (283 in 4 years) for reintroductions elsewhere.

Lithuania; reports of some flooding of agricultural fields but considered small-scale. Beavers sometimes block the drainage ditches of land which was once intensively farmed and which would naturally be wetland. Ten thousand beavers are killed each year and their pelts exported. Hunting will continue after accession as Lithuania will have a relevant derogation from the EC Habitats Directive.

Netherlands; still at the early stages of establishing reintroduced populations. Compensation is paid if necessary and so there have not been any problems with farmers. Damage has only occurred on a few occasions and there have been no problems with dams. There are no concerns regarding agriculture as the population and range increase. There are no concerns over impacts to dykes and other water level issues. (Also see Section 3.3).

Poland; in the densely inhabited Krakow area negative effects on agriculture and forestry are minor. In the Warsaw area dams have caused the flooding of low-lying meadows which would naturally be wet. Some compensation is paid to local farmers. We have one report of beavers eating potatoes in Poland.

Poland has a population of 18,000-23,000 beavers. A recent national survey of all 440 Polish forest districts and 100 selected communes and hunting association field units indicated that;

- 3,200 ha of forestry and agriculture was flooded by beaver activities (out of 27,472,000 ha of agricultural and forestry land in Poland)
- large areas had increased wildlife benefits (15,000 ha of wetland created and a further 21,000 ha of improved wildlife habitat by 2001) and increased “attractiveness” of woodlands to visitors as a result of beaver activity
- 200,000 Euro had been paid annually in compensation but the monetary value of environmental benefits which beavers brought are judged to outweigh the costs (each single ha of wetland created by beavers was considered to be worth 10,000 Euro). The view of the author of this survey is that the compensation scheme is poorly organised, inconsistently applied and that 80-90% of compensation payments should not be made.

Russia; studies have demonstrated the value of beaver dams in reducing sediment entering and degrading lake systems and in improving water quality by removing polluted material.

Sweden; there are some problems from flooding of forestry and culverts and also with tractors on undermined banks. However, overall there is no major problem reported from beavers.

Summary; The general experience from Europe seems to be that, nationally, beaver damage to agricultural areas is not a major problem. Where localised problems do occur they can sometimes be relatively serious to the individual affected. However there are a number of straight forward, tried and tested management techniques which have been developed over many years in both Europe and North America that can reduce the problem where necessary, such as;

- piping dams to lower the water level
- fence systems around culverts
- destruction of dams
- fencing of vulnerable trees or crops
- designing riparian woodland or crops to be unattractive
- live trapping and relocation
- sustainable hunting programmes

There is no evidence from any country that the possibility of agricultural damage stopped a reintroduction from taking place or that, if limited damage was subsequently experienced, that removal of all beavers was ever considered. The range of benefits that beavers can bring have been judged to outweigh any costs.

7. FORESTRY

In the letter of 20 December 2002, reference was made to the proposed trial site's cSAC status. The question was asked as to whether the proposal is compliant with Article 6 of the Habitats Directive. We can confirm that we have been careful to ensure that it is. Article 6.3 of the Directive states '*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives….*' Please see Annex 2 of the licence application which provides a detailed appropriate assessment as required. The assessment includes an examination of possible beaver-woodland interactions.

We have not subsequently revealed any studies which have indicated that beaver activity is a cause for concern regarding the conservation of aquatic vegetation habitats in Europe. Indeed, as noted in the appropriate assessment, there are French cSACs where both beaver and lochs with aquatic vegetation habitats are qualifying interests. The relevant French specialist (Patrick Rouland, ONCFS) we contacted told us he had no evidence of beaver having a negative effect on such loch habitats and the macrophyte communities. He reported that the beavers tend to concentrate feeding activities more in the loch edge/ riparian zones rather than in the more open loch areas. Furthermore, a team of freshwater ecologists from the University of Glasgow surveyed the lochs at Knapdale in 2002. They informed to us that, although beavers would be likely to feed on some of the aquatic plant species present, they did not *'...consider there to be any grounds for concern regarding threats posed by beaver to the survival of macrophyte vegetation in the lochs examined'*. However, as a precautionary measure, aquatic macrophytes will be

monitored as part of the trial and action (including implementation of the exit strategy) could be undertaken if the site integrity was being affected (see appropriate assessment for details).

8. SALMON

8.1 General overview

Section 2 described the sensitivity in selecting a suitable trial site, especially one which provided relatively good natural containment for the beaver population. SNH accept that the trial site selected does not contain a river in which Atlantic salmon are present, although initial surveys suggest one or two burns being used by sea trout. However if the trial took place on a salmon river, which tend to be in relatively large catchments, then the released beavers would have the potential to colonise any part of the whole catchment. Similarly a trial area would have had to be the whole catchment making the management of the project extremely difficult. We believe that a degree of natural containment is important for a trial site, hence the requirements are quite specific overall.

The previous SNH-commissioned review on the effect of European and North American beavers on fish and fisheries is relevant. This concluded that beavers can have positive effects on some fish species in some places and negative effects in others.

Experience and evidence from Norway (which has a population of approximately 70,000 beavers), a comparable situation to Scotland where salmon and other fishing is highly regarded both nationally and internationally, is that beavers have no significant adverse impact on Atlantic salmon.

Salmon and beavers co-existed in Scotland, and across Europe, for thousands of years in the past, albeit with larger fish populations (and beaver populations) than now. Beavers do not always build dams in burns/lochs where there is sufficient water depth and, when they do dam, only do so on smaller burns (maximum width of about 10m, but usually in narrower burns). Salmon are known to be able to negotiate natural and artificial barriers in burns and contend with dynamic and temporary effects on spawning areas, features which can sometimes also result from the presence of beavers. River flow rates also vary over the seasons and beaver dams become easier for fish to negotiate during periods of higher flow rate.

Indeed there could also be positive effects on freshwater and migratory fish in that it would provide the impetus for the management, enhancement and expansion of riparian woodland and other habitats. Without the beavers this is something that could take a considerable time. The presence of beavers could mean that public expenditure on this work would be more supported to the general public. Funding from NGO and other sources may also be more forthcoming with beavers used as a charismatic symbol of riparian woodland restoration.

8.2 Specific Experience

Norway: The only completed European study which specifically examined the effect of beaver dams on salmon (and trout) migration that SNH is aware of was a small

project carried out by scientists based in Norway with an interest in beavers. The lead scientist had applied to the Norwegian Department of Nature Management for funding but was refused on the grounds that the proposal did not address a significant Norwegian management issue (interestingly, funding is available for studies into otters and salmonids since the perceived threat from the expanding otter population to salmon stocks is deemed more important). Beavers are ignored as an issue by anglers in Norway with the odd report, less than one/year, of a dam causing a problem. There appears to be minimal conflict between beavers and salmon fishing interests.

The Norwegian study was carried out over one year on a tributary stream of a small river very similar to those on the west coast of Scotland. The spawning stream was 1.3m wide and shallow (c.25 cm) with pools and riffles on a gravel substrate and had riparian trees along the banks. There were four beaver dams on the stream along a 250m length. Using electro-fishing, 0+ and 1+ age group salmon and trout were found all along the stream, including between the dams and above the highest dam. There were young, growing, salmon above all the dams. The work is preliminary and from just one site but salmon in Norway commonly spawn in small streams, often in wooded areas.

A Masters dissertation project is currently being completed in Norway (Telemark University College) which involved a study on the effects of beaver on fish and fisheries, including salmon. Work has included an assessment of attitudes of fishermen and some fieldwork. We have been informed that the preliminary results are that most landowners who have beaver living on their tributaries do not perceive them as a fisheries problem, or any other sort of significant problem.

No work had been undertaken in Norway on the issue of beavers and salmon until recently because there were no obvious areas of conflict. The two recent studies were, instead, prompted by the discussions surrounding the proposed Scottish beaver trial reintroduction.

SNH will pursue the opportunity for joint research with Norway if the trial proceeds. The trial will provide a period in which not only to carry out joint work but also to examine in more detail beaver and fish interactions in Norway and other European countries.

(Denmark: The Denmark trial included the monitoring of fish species, including trout, but salmon are not present at the trial site (see 3.2)).

9. PUBLIC HEALTH

9.1 Giardia and Cryptosporidium

We have found no reported instances of European beavers causing health problems in humans from *Giardia* or *Cryptosporidium*. Based on the European experience, European beavers are not viewed as a significant human health problem. However as part of the trial, SNH, in conjunction with Argyll and Bute Council (ABC) and Scottish Water, are carrying out pre-release monitoring of the quality of the private water supplies (in terms of potential pathogens) and the water courses in the trial area to be able to assess the possible effect of beavers on public health. ABC are

undertaking a regular programme of water sampling and analysis to build up the picture of the water quality prior to releasing beavers to be able to compare it with the post-release situation. This will provide information on public health issues for consideration as part of all the issues at the end of the trial. One of the criteria for the exit strategy is risk to public health. In regard to public health risks SNH are guided by the Environmental Health Department of ABC and Scottish Water.

The results of the ABC public health monitoring undertaken to date will shortly be published by Morrison (in press) in an SNH report (Trial re-introduction of the European beaver to Knapdale: Public health monitoring 2001-3. Scottish Natural Heritage Commissioned Report F02AC327). Morrison states *"In public health terms,* Giardia, Cryptosporidium *and other microbiological parameters are naturally occurring in the environment and within animal and human populations. The general advice to reduce the risk to public health is to ensure hands are properly washed and water boiled before consumption."*

Also; "*The views of Professor G Morris, Scottish Centre for Infection and Environmental Health (SCIEH), were sought. He indicated that, subject to the beavers undergoing appropriate quarantine and screening, the introduction of a limited number of animals and the provision of monitoring and controls, the project will not pose a significant additional public health risk. He further indicates that the risk of increased human cases of Giardiasis is significantly low that it should not be considered an obstacle to beaver introduction.*

The work to date has established the water quality within the Knapdale area and provides a baseline for comparison purposes should the project receive Scottish Executive consent. Having considered the information to date, Argyll and Bute Council Public Protection Service are of the opinion that subject to controls, the introduction of the beaver will not pose a significant risk to public health. However, monitoring of public health issues will become a key priority at the time of introduction and effective screening, tracking and other controls and monitoring systems will be necessary to objectively assess the impact on public health."

The view of the Assistant Chief Veterinary Officer, WL Gardner, in September 1999 in a letter to SNH was that *'Apart from the common finding of mites on imported beavers which are readily treated with insecticides, and the possibility of rabies, we have no information to suggest that imported beavers would be affected by other conditions which would result in animal or public health problems. One of my colleagues Mr Honeyman has carried out further research into potential pathogens in beavers which may affect man and animals. Most of these conditions are either already present in the UK or are readily treatable and do not pose a serious problem*.'

It is worth comparing Scotland and Norway in terms of incidences of human Giardiasis to put the disease into perspective. In Scotland, which has a population of about 5 million, the SCIEH recorded 296-427 laboratory reports of infections in humans per year, during 1991-2000 (also 568-954 reports of *Cryptosporidium* per year). In Norway, population 4.5 million, there were 454 reported cases in 1999. Of these 399 (88%) were cases where people acquired the disease abroad. No waterborne outbreaks of Giardiasis have so far been registered in Norway, a country

with 70,000 beavers and a population well known for their pursuit of outdoor activities. Despite this large beaver population there have been no references to beavers being suggested as a source of *Giardia* infection. This is despite *Giardia* cysts being found frequently in Norwegian surface waters. It appears therefore that there is a similar level of Giardiasis in Norway as that in Scotland, despite no beavers being present in Scotland.

Information we have received from North American *Giardia* specialists has highlighted that the major source of *Giardia* infection in humans is from other human sources. The term "beaver fever" was apparently invented by a section of the press in the 1970s and indicates simply that beavers exist in the area where many people camp, hike and may, on occasion, become infected.

We are aware of one study where the incidence of *Giardia* and other pathogens have been examined in a resident European beaver population. This was undertaken in Norway where a large sample of beavers, 241 in total, were tested for *Giardia.* All were negative (also negative for other potential pathogens, *Cryptosporidium, Salmonella* and *Campylobacter;* 133-235 beavers tested).

If the proposed reintroduction does proceed then, in the light of the results of the above study on the incidence of *Giardia* on the donor population, and the fact that the animals will be quarantined for 6 months during which they would be treated for any *Giardia* present, we can be fairly confident that any released beavers will be *Giardia*-free. However, they may not remain free of *Giardia* if they should pick up the parasite at Knapdale (*Giardia* and *Cryptosporidium* have been recorded in the Knapdale area, as they are across Scotland, indicating the presence of animal excretors in the area e.g. sheep, deer). The area is used by local visitors and tourists and is also used by domestic and wild animals such as sheep, cows, dogs, deer, otter, small mammal species, etc. The area has a high annual rainfall and so any faecal material containing cysts would be quickly washed into the water.

9.2 Bites to Humans

Regarding the likelihood of bites, beavers are wild mammals and as with any wild animal there may conceivably be circumstances, such as when cornered or defending young, when they might attempt to bite people in close proximity. However like most other wild mammals their main defence will be avoidance. In addition beavers are usually active in the evening and at night and so direct contact with humans would be further reduced. The only report of such an occurrence SNH has seen was a press report in 'The Scotsman', in June 2001, from Finland where somebody followed a beaver in a river and was bitten. We have communicated with numerous European specialists over the years and have never heard of any other instances of beavers biting humans, apart from when they are being captured, and when handled in captivity. Therefore there seems to be a very low risk to the general public from any released beavers.

10. MANAGEMENT OF THE TRIAL BY SNH

An SNH Project Group, chaired at Director level, will oversee the management of the whole trial reintroduction project including financial management, internal/external reporting and other aspects of reintroduction not part of the Knapdale trial. The

project will be included in operational plans, budgets, financial and other corporate management systems. SNH has wide experience of managing long term projects, (e.g. Site Condition Monitoring, Natura, NNR Review, etc.), and of other reintroduction projects (e.g. white-tailed eagle and red kite).

At the local level there will be a dedicated Field Officer. Following recent discussions with Scottish Wildlife Trust (SWT) and Mammals Trust UK (MTUK), both organisations have expressed interest in funding/ managing the Field Officer post.

The Knapdale Beaver Management Group, chaired by the SNH Area Manager, will comprise SNH, FE, SWT, Argyll & Bute Council, and the major funder MTUK. This group will be responsible for the overall running of the Knapdale trial.

A Local Community Liaison Group, chaired by a community representative and serviced by SNH, will be set up if a licence is received by SNH. It will be made up from representatives of key community interests and private individuals. Its role will be for information exchange and liaison over the trial and also to provide the opportunity for local people to participate actively in the potential for socio-economic benefits in the local area, in particular in terms of tourism. The importance of good local communication is evident following our discussions with European colleagues. We intend to be open and inclusive, to invite local involvement and be able to respond to any problems in a fast and practical way.

If the licence application is approved SNH will wish to discuss with Scottish Executive officials at an early stage how the results from the trial and other information should be disseminated and discussed more widely so that there is an ongoing process of information provision and consideration of the results. The alternative is to leave consideration until the end of the trial.

11. INTERPRETATION AND EDUCATION

The primary purpose of the proposed Knapdale project is to undertake a scientific trial to determine the effects of beaver, and the ecology of beavers, in Scotland. However SNH and our Management Group partners recognise that, if it proceeds, there will be considerable public interest in the project resulting in an increase in visitors to FE's Knapdale site. At this stage it is difficult to be certain which parts of the trial area will be used by released beavers. Despite this uncertainty it is essential that interpretive information is provided to visitors at Knapdale. In this respect the current presence of an existing small, informal, information centre at Knapdale and the system of walks and cycle routes make this easier to achieve. However a balance will have to be made between encouraging visitors to learn about beavers and the trial, and limiting the disturbance of the beavers themselves so as not to compromise the aims of the scientific trial. The most sensitive period will be when the beavers are first released and settling into their new territories after being in quarantine. Once the beavers have settled it is likely that they will be able to tolerate a level of disturbance, based on experience from Europe.

Proposals for initial interpretation for the first two years have been discussed and agreed with FE. Once the beavers have established themselves it will then be possible to develop a fuller interpretative plan for the whole trial period. Throughout

the trial period the interpretive material will be reviewed to allow the progress of the trial and new information on the beaver families to be reported to the public. The scale of the interpretation will partly be influenced by the local community, both organisations and individuals, as they decide to what extent they wish to develop the potential socio-economic benefits of the trial.

In the event of the trial proving to be a success, and a decision being made to maintain the beavers at Knapdale after the trial, then there could be considerable potential in developing the beaver viewing and related wildlife tourism facilities in the Knapdale area which would have socio-economic benefits for the local area and Argyll in general. Successful examples elsewhere of wildlife tourism include sea eagles on Mull and ospreys at Loch of the Lowes and Loch Garten. A visitor survey at the North Kessock Tourist Information Centre in 2000, for example, found that the red kites reintroduced to the area attract extra visitor spending totalling £116,000 per year to the local economy. A visitor survey at the Symond's Yat Rock Peregrine Project estimated that the viewing scheme attracted extra visitor spending of £551,000 to the Forest of Dean area in 1999. These types of projects have all brought considerable benefits to local communities. However such plans will be dependent on the outcome of the trial.

Interest has already been expressed by the local primary school in being involved with the project, and this will be taken forward if the trial proceeds. There is likely to be great interest in the project from schools generally and material will be produced for them including the likelihood of a beaver website to provide information. The British Embassy in Oslo has already made an initial approach to SNH offering assistance in arranging joint Norwegian-Scottish educational projects, such as school exchanges, which would be related to the beaver trial.

Part of the role of the proposed Field Officer will be interpretation and education in the local area, and this element is likely to increase as, or if, the trial progresses.

12. EXTERNAL FUNDING

12.1 Background

Since it is now three years since the original Business Case was presented, it will be necessary to update the figures, and ensure the latest business case guidelines are addressed, prior to the project commencing on the ground. SNH will therefore do this as a separate exercise if and when a licence is received. Since it is not possible to predict when such a licence will be issued, this approach seems to be the best way to ensure the financial details will be absolutely up to date.

12.2 Likelihood of support

This is a high profile and novel project that will generate a high level of media interest, along with a range of opportunities for PR activity. SNH will identify companies which may provide cash support for the project (companies that may use the characteristics of the beaver to promote their products and services). Examples include financial services utilising the marketing opportunities associated with 'home-builders' or the industrious nature of the beavers, and the use of the phrases 'beavering away' or 'busy as a beaver'.

It is acknowledged that the shortfall cost (approximating to £12,900 per annum of the trial, see 2002 Business Case) remains a risk to the progression of the project once and if a licence has been issued. However SNH remains confident that, assuming the licence application is approved, the remaining funds can be secured from the corporate sector through in-kind and cash support. Furthermore, during a meeting in December 2004, both MTUK and SWT offered their considerable expertise in further fund-raising.

All future proposals will adopt the key principles outlined in the 'Sponsorship Guidelines' issued by Scottish Procurement Directorate (July 2003) and the SNH procedural guidance on 'Joint Working with the Commercial Sector' (draft).

Economic impacts of the beaver

Supported by:
The Wild Britain Initiative

2007

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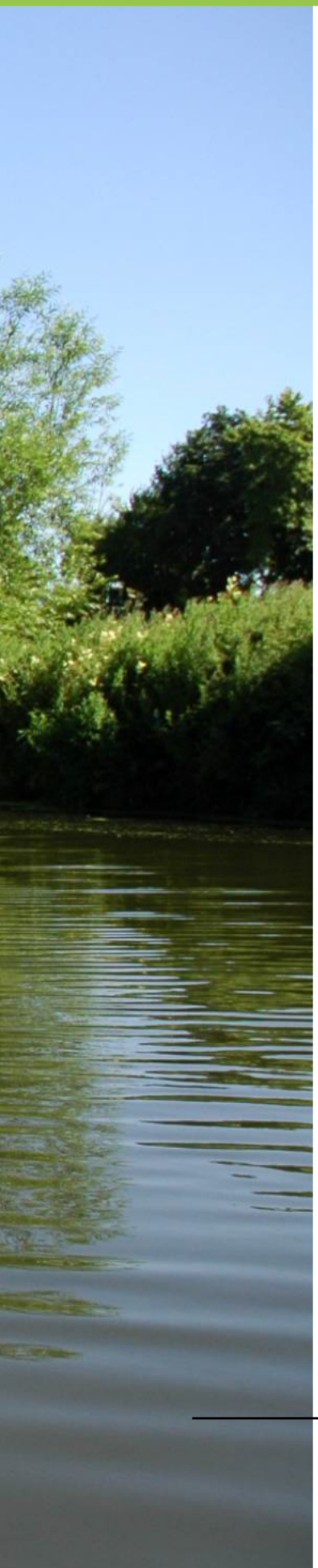
Summary



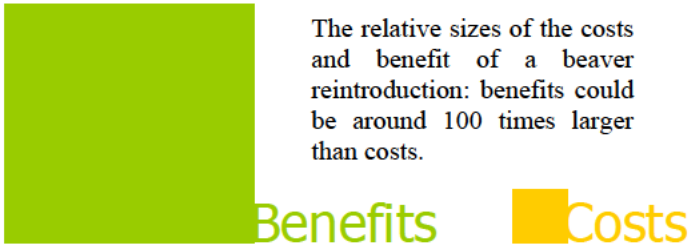
The European beaver (*Castor fiber*) was once widespread throughout Asia and Europe. It was prized for its fur, the castoreum it produces (for use in medicines and as a base aroma in perfumes) and its meat (which could be eaten by Catholics on Fridays as a fish). Such a useful animal was naturally hunted intensively; the last beaver in Britain is believed to have been relieved of its pelt in the 16th century. By the 20th century only 8 small populations remained on mainland Europe, holding about 1200 beaver.

Today through reintroduction schemes and natural range expansion beavers have returned to 23 of the 29 European states from which they had been lost. Britain remains among the 6 nations without beaver. In Britain reintroduction proposals remain controversial despite no major issues arising from reintroductions in other countries. Among the many potential benefits of a beaver reintroduction, supporters of the scheme cite their potential draw as an attraction for wildlife tourism. In the UK wildlife tourism is a thriving and significant industry [1-5]. For example, visitors to Wales who come specifically for the wildlife spend approximately £13.8 million per annum[1] and in the West of Scotland, the gross tourist income from whale watching alone has been estimated at £7.8 million per annum [6].

This study used questionnaires and economic tools to begin to measure the potential economic impact beavers might have on wildlife tourism in Britain. It was in effect a scoping study and so its predictive powers are limited. Its aim was merely to begin to consider the relative sizes of the costs and benefits.

We found that these benefits could be substantial. **A beaver release site might bring** (tourism multiplier included) **~over £2 million per year into the local economy, whilst a pessimistic estimate could still yield ~£3/4 million**. Focused eco-tourism could further enhance these benefits, for example, just **seven operators in Scotland could inject** (tourism multiplier included) **over £1 million into the local economy adjacent to reintroductions**. Statistical analysis showed that including an enigmatic species, such as the beaver, in a tourism holiday increases its merit by **£63** per person.

In comparison **the potential damages that might be caused by beavers appear small**. Negative economic impacts reported from previous reintroductions varied widely and were not related to area, beaver population size or the amount of time beavers had been in areas. Therefore we were not able to accurately predict likely economic impacts for the UK. However, the order of magnitude of the costs indicated by case studies might be considered low, rarely rising above 10,000 euros/annum/region and in the majority of cases being insubstantial.



The relative sizes of the costs and benefit of a beaver reintroduction: benefits could be around 100 times larger than costs.

[1] Spending figure provided by C. Hughes, Wales Tourist Board.

Campbell RD, Dutton A& Hughes J. 2007. Economic impacts of the beaver. Report for the Wild Britain Initiative. 28 pages.

Analysis of case studies and previous reintroductions indicate that to obtain the greatest benefits from a beaver release the following points should be considered:

1) General interest should be raised by involving the public pre-reintroduction
2) Local landowners, chambers of commerce and other interested parties should be consulted beforehand on relevant developments
3) The use of a well thought out visitor centre should be considered to provide a focus to the reintroduction
4) Such ecotourism projects should highlight the wild and natural aspects of the experience and avoid creating a 'theme park'
5) Projects in different locations should differentiate their products to cater to different markets, for example some sites may concentrate on providing more isolated and "natural" experiences whilst others cater for visitors requiring more support
6) Ecotourism should generally be practiced at the grassroots level for the benefit of the local community, (but note point 7)
7) A cohesive face of ecotourism in England and Wales should be offered to the public through the formation of an umbrella association along the lines of the Wild Scotland initiative
8) Thorough discussion and careful planning will be required to minimise the potential imbalance between the recipients of benefits from reintroduction and those that experience conflict with the beaver

With forethought, prior consultation and planning, a beaver reintroduction should bring significant monetary benefits into the local economy and communities that could greatly outweigh any potential negative impacts. The remaining challenge is the design of frameworks to mitigate and compensate real costs and dispel myths regarding perceived costs.

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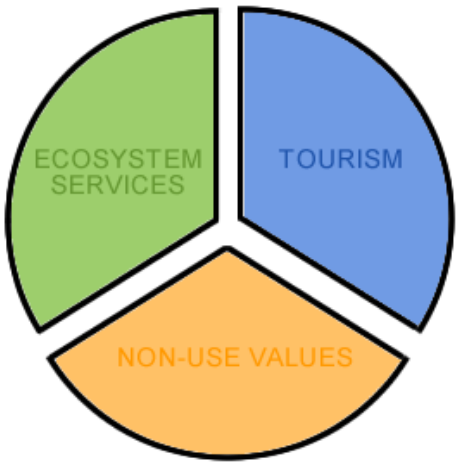
Introduction



Due to its foraging and engineering activities, **the European beaver (*Castor fiber*) can be considered a keystone species of significant importance to the maintenance and creation of wetland ecosystems** [7]. Unfortunately these same characteristics may lead to conflict with human land-use. On the other hand beavers are charismatic animals that are appealing to wildlife watchers.

These three factors will all contribute toward the economic impacts of a beaver reintroduction. This small scale study seeks to estimate the relative sizes of these economic impacts through our own original research and with reference to previous work by others. Such quantifications are fraught with difficulty and we stress that any figures provided should not be taken as exact measures, but as rough illustrations of the potential magnitude of the impact on tourism revenues (blue in figure here).

This report does not present a full cost-benefit analysis of beaver reintroductions as it does not fully account for conservation and environmental issues or the public conscience (orange and green in figure here). However accounting for these benefits should only strengthen the case for reintroduction of the beaver since the relatively slight costs to the economy described later on in this report, are even more fully outweighed by benefits.

The study concentrated on four main aspects:

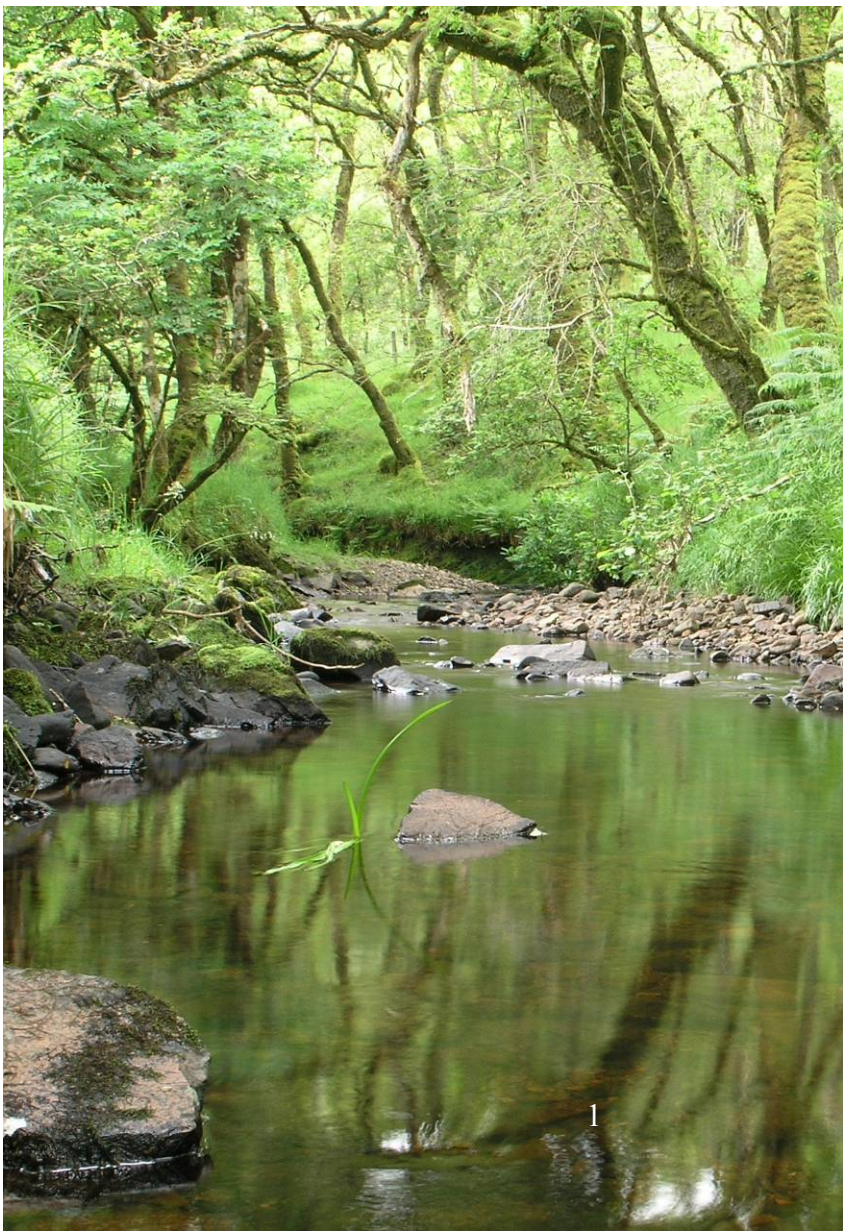
1) A questionnaire survey of experiences of beaver managers and researchers in other European countries

2) An analysis of projected visitor expenditure at wildlife attractions in the UK

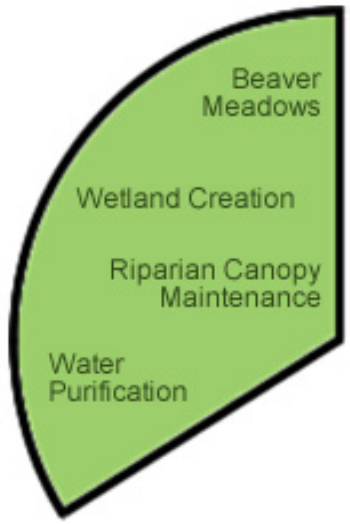
3) A questionnaire survey of the experiences and expectations of wildlife holiday providers

4) A hedonic (revealed preference) analysis of actual wildlife package tours.

Detailed methodologies are provided the appendices.



non-market benefits



The environment around us often provides benefits to us that are not immediately apparent or are expensive and difficult to emulate, termed 'ecosystem services'. Wetlands created by beaver activity can deliver a broad range of ecosystem services. Currently wetlands are known to:

1. **reduce erosion**

2. **reduce pollution** by trapping sediments and by trapping excess nutrients and potentially dangerous chemicals in these sediments

3. **regulate peak discharge** on river systems after heavy rain

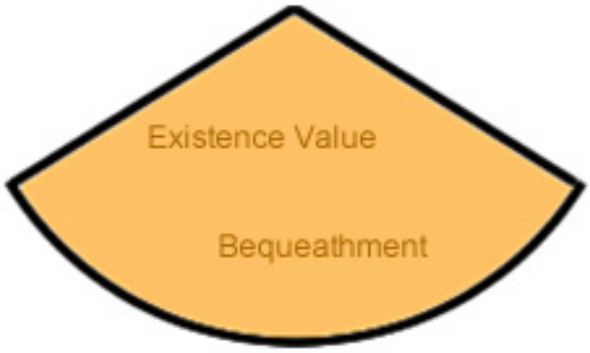
4. **maintain or raise the water-table** by storing water

By creating wetlands through their damming behaviour, beavers can greatly assist the provisioning of these ecosystem services. Calculating the value of these services to humanity is difficult and beyond the scope of this report, however the only published attempt (to our knowledge) at valuing beaver created wetlands indicate that the benefits are high: In Lativia in 1982 it was calculated that, based on a population of 100,000 animals, by the year **2000 beavers would have created or conserved 150 km^2 of wetlands valued at £1 billion** as fixed capital [8]. Furthermore, through this, **32 million m^3 of water would be purified annually which would have cost around £120 million to do artificially**. In Tatarstan, beavers are currently being harnessed to reduce the infilling of Lake Raifa from river eroded sediments [9].

The potential for water storing in beaver dams has further application. **Floods** in England and Wales such as those that occurred in the autumn/winter of 2000 have been **estimated to cost the economy around £600 million per annum** [10]. Such flood events are expected to increase in frequency in the future due to climate change [11] and this has encouraged the UK Environment Agency (EA) to reassess its flood management strategies. The EA's River Severn flood management strategy scoping report [10] indicates the need for a more holistic approach to flood management including, for example, preventing peak flow from tributaries coinciding, together with changes in reservoir operating regimes and storage volume to provide flow attenuation.

The dam building behaviour of beavers occurs mainly in smaller tributaries and may provide many of the services outlined in the EA report. It is potentially an extremely useful tool for future holistic flood management systems in many river catchments throughout Britain, including the River Severn. No study has been conducted to examine the economics of **beavers as flood management tools**, but the economic benefits may be considerable.

Other benefits that may be derived from the presence of beavers also revolve around their modification of the local habitats. Beavers do not always create dams however they can add biodiversity value to their local riparian habitat in their actions as ecosystem engineers. By removing trees, shrubs and other shading vegetation they may improve the structural diversity of the local area. This has the potential to benefit birds, invertebrates and other fauna of riparian habitats [7, 12].



Where the public are willing to pay for something even though they may derive no direct benefit or use, then it has 'existence value'.

One estimate of the monetary value of the beaver to the Scottish public suggests that a **beaver reintroduction on top of a large scale forest restoration could be worth as much as £101 per household** [13]. Under that model the forest restoration alone was worth £35 per household, meaning that **the beavers added £66 per household**.

Two other models were produced to estimate the project value per household whilst allowing for a compensation cost to people who view the reintroduction negatively. Accounting for compensation requirements, the better fitting of these two models still indicated the mean value per household for both the forest and the beaver was £67 and for the forest alone £37 This means that **just to have the knowledge that beavers had been reintroduced in Scotland** (not necessarily to experience them) would still be worth £30 to each household. This potentially **amounts to more than £65 million** across Scotland's households.

Even though we might not expect any single person or group of people to directly benefit from ecosystem services or the simple existence of beavers, from this research we can see that the presence of beavers can have considerable value to humans.

experiences from beaver managers and researchers

We asked people involved in the research and/or management of beaver populations in mainland Europe for their experiences with tourism and the beaver. We did this to attempt to build a picture of the current situation in countries with beaver populations and to see whether anything could be learned. See *Appendix I* for further information on our methods and *Appendix II* for a brief overview of some of our results.

- Two participants gave an estimate of annual visitor numbers to an actual centre of 3000 and 8500 (mean = 5750)
- Two participants gave details of entrance fees for the centres, these being €2.50 and €1.25 / person (£1.66 and £.0.83 respectively; mean = £1.25)
- Five respondents said they conducted guided tours.
- Three participants provided further details estimating that the number of people that took the tour ranged from 50 to 5,000 / year (mean = 1,850) at a cost of up to €2.50/person (mean = €1.25 or £0.83).
- In addition, all sites provide free public access to the release sites.
- Four participants gave estimates of the total number of visitors to their sites, these ranged from 500 to 30,000 / year (mean = 11500)

We can estimate the further impact of visitors on the local economy using figures from previous research into tourism. A study [4] by the Royal Society for the Protection of Birds (RSPB) found that **visitors to RSPB reserves in the UK spent an additional £41 each over and above any entrance fees** in 1998. This equates to **£50** at 2006 prices [14]. We can use this to estimate potential expenditure at European beaver reintroduction sites.

For a conservative minimum estimate of income we assume that the site and centre are free with the only people paying anything being those willing to go on a tour. Using the above figures this gives a minimum annual expenditure of **£94,035.50** (1850 tour participants × (£50 additional spend + £0.83 tour fee). However, if *all* visitors are spending £50 on local goods and services this may increase beyond a potential **£575,000** (11,500 visitors × £50).

If we add Surrey Research Group's regional tourism multiplier of 1.3256 to these figures [15] (see Box 1.), then we arrive at an expenditure range of £124,653.46 - £762,220 indicating that the **benefits to the local economy from one European beaver centre could be around £¾ million per annum when using arguably pessimistic visitor number estimates** .

Beavers could represent a significant attraction to wildlife tourists in the UK. Single species wildlife attractions in the UK tend to attract considerably more visitors and may charge a higher entrance fee. For example:

- The Osprey Centre at Loch Garten in Scotland attracted **33,048 visitors in 2005** with an entrance fee of £3 per adult [5] and
- The Red Kite Centre in Wales attracted **33,350 visitors** in 2004 (up 13.9% from the previous year) and charged £2.50 per adult [2].
- If these visitor numbers were comparable to a European beaver site, then **the income to the local economy would be approximately 3 times that of the figure we estimated for a European site (i.e. ~ £2.25 million / year)**.

Box 1: Tourism multipliers

The money brought into a region from tourism stimulates further growth as that money circulates through the local economy. This effect is known as the 'multiplier effect'. There are several different types of multiplier including tourism multipliers, but they all essentially follow the same principles: At the first stage, tourists spend an amount on local products, hospitality, accommodation and goods. This revenue from tourism is then spent on government revenue, business transactions and household income. From these three categories some tourism revenue leaks out of the local economy as it is spent on services or products from outside the local region (import purchases). The remaining revenue gets spent again in local area and again, some leaks out through import purchases. This cycle of spending continues until there is virtually no revenue remaining from the original injection.

The Surrey Research Group's 1993 multiplier [15] used here was developed for *Highlands and Islands Enterprise*, *Scottish Enterprise*, the *Scottish Tourist Board* and the *Scottish Office Industry Department*. Calculation of multipliers is an exhaustive process and highly dependant on local conditions. On the other hand, the cost of producing them precludes the use of constantly updated and regionally specific multipliers. For this reason it is common for multipliers to be used for a longer period of time and in regions beyond those in which they might be considered accurate. For our purposes it is unnecessary to concern ourselves too deeply with this loss of accuracy since we are only trying to illustrate the general size of the impacts expected, but are using the most accurate figures available to us. Nevertheless we would not wish to mislead readers into using these figures as accurate predictions.

A more accurate prediction of the potential revenue that may be created by a beaver reintroduction to the UK can be gained by examining the economic impact of current wildlife attractions. Reviewing the visitor profile and spending at current wildlife attractions gives an indication of income available that may be accrued, for example from admissions.

Table 1. Data on the profile of visitors to wildlife attractions in the UK [2, 19, 20]. Numbers in brackets denote the sample size of attractions providing information. Please note the different group structures used by the different tourist boards as this will affect visitor statistics (see Appendix III).

	Visitor attraction group	Total no. of visitors	Origin of visitors				Distribution of visitors		Average adult admission /parking charge
			N	Overseas %	Local %	Other %	Free sites	Paid sites	
England (2006)	Nature reserves, wetlands, wildlife trips, safari parks, zoos, aquariums, aviaries	13,100,000 (94)		4*	73*	24*	51%** (735)	49%** (1254)	£7.41 (61)
Scotland (2005)	Nature reserves, wetlands, wildlife trips	403,309 (20)	(12)	14	35.9	50	71% (12)	29% (8)	£4.49 (5)
Wales (2006)	Country parks and visitor centre, forest parks, gardens, nature reserves, wetlands, wildlife trips	3,985,996 (48)	(30)	6.3	63.6	30.1	78% (29)	22% (19)	£3.46 (17)

* Data from "Origin of visits by category 2006" Factsheet provided by VisitBritain.
**Data from "Sector structure and visits by standard adult entry charge 2006" Factsheet provided by Visit Britain. Data shows visits to all visitor attractions not just the wildlife based attractions.

In addition to admission charges visitor centres and associated retail and food outlets can potentially bring substantial revenue for operators. For example, the National Trust, which has the largest membership of any UK charity, earns **£6.2 million / year** from retail and catering at its visitor centres alone. This is equivalent to £4 / visitor. RSPB, which also has a very large membership, earns around **£10 million / year** from its retail operations, though this includes an online shop. The Wildfowl and Wetlands Trust has nine visitor centres that in 2004, received a total of 788,210 visitors (ranging from 15,501 to 184,466 visitors at each of the centres), netting the trust £1.7 million in admissions and **£489,000 in sales revenue** (a total of £2.78 / visitor). Data from Wales shows that ancillary income at a site may **more than double the income from admission charges** (See Table 2.).

Table 2. Potential additional site-based revenue per person

	Admission	Donation	Catering	Retail	Other	Total
Scotland (N=5)	£4.49	£1.44	£0.24	£0.60	£0.00	**£6.77**
Wales (N=17)	£3.46	£0.19	£2.77	£1.76	£0.10	**£8.28**

The England Biodiversity Group recently developed the "Wildlife Attraction: Visitor Expenditure Model" [16]. See *Appendix III* for details of the method used (also see User Guide [17] and Model Assumptions [18]) to estimate the economic contribution an attraction could make to the local community. Combining this model with visitor statistics provided annually by the three tourism boards of England, Scotland and Wales [2, 19-20] (See Table 1) allowed us to hypothesise the impact of a beaver reintroduction in different regions of the UK (See Table 3). This data shows that a beaver site could provide a potential net income in England of **£1.25 million with site-based income such as admission charges increasing this to over £2 million.**

Table 3. Projected income from a beaver reintroduction site based in the UK. Total income was calculated from the net regional income, based on the 'Wildlife Attraction: Visitor Expenditure Model' [16], and potential admission income plus additional site income where information was available.

	Mean annual no. of visitors to a wildlife attraction*	Number of visitors used in model*	Net impact in region (£)	Mean admission charge	Potential admission income	Additional site income (from table 2)	Total income
WALES	83,042	82,950	541,252.00	3.46	287,007.00	399,819.00	1,228,078.00
SCOTLAND	20,165	20,180	279,413.00	4.49	90,608.20	46,010.40	416,031.60
ENGLAND**							
East (24)	102,315	102,270	1,090,613.00		757,820.70		1,848,433.70
East Midland (3)	110,502	110,600	1,270,801.00		819,546.00		2,090,347.00
North East (3)	24,028	23,970	260,377.00		177,617.70		437,994.70
North West (7)	203,738	203,740	2,206,766.00		1,509,713.40		3,716,479.40
South East (11)	135,150	135,240	1,595,056.00	7.41	1,002,128.40	Unknown	2,597,184.40
South West (18)	241,132	241,070	2,879,909.00		1,786,328.70		4,666,237.70
West Midlands (5)	41,552	41,475	483,700.00		307,329.75		791,029.75
Yorkshire and Humber (1)	21,036	21,100	4,350.00		156,351.00		380,701.00
MEAN			1,251,446.50		814,604.46		2,066,050.96

* See Appendix III for explanation of calculations
**Numbers in brackets denote the sample size of attractions providing information on visitor numbers to attractions in that area.

experiences and predictions from providers of wildlife holidays

We asked companies that provide wildlife based holidays in the UK and mainland Europe to British people, about their operations in general and about their experiences of providing tours that enabled people to view beavers. We also asked the companies if they would be willing to offer tours in the UK that would involve beavers and what they predicted the costs, spending and customer numbers would be. We asked these questions to gain a picture of how wildlife holiday providers currently operate across Europe and to also establish how these same operators would be expected to operate were beavers to be released into the UK. See *Appendix I* for further information on our methods and *Appendix II* for a brief overview of some of our results.

Providers of wildlife holidays were keen to offer UK based holidays to areas into which beavers are released. All holiday providers replied that they would offer beaver related holidays if they were released into the countries in which they currently offered tours, except one which specialised in marine and coastal tours.

Furthermore, **some providers would be willing to expand into new geographical regions were beavers reintroduced**. Of those companies not currently operating in the respective countries: 12% would consider adding holidays to England, 10% would consider adding Scotland and 17% would consider adding Wales (an increase in providers of 66%, 10% and 150% respectively in each country).

The economic input to local economies from beaver related holidays could potentially be substantial. If we add up the figures on client numbers, package price, percentage of this price that is spent locally and the extra that clients are likely to spend on accommodation, food, gifts and other products, then we can arrive at a rough estimate of the input into the local economy that these tour companies would have.

We will consider Scotland closely since we received the most responses from there. It also has arguably the most developed wildlife tourism industry with respect to the sort of overnight and longer breaks we are referring to and has a high proportion of overseas visitors (Table 1). Wales and England may benefit more from day trips which make up a large percentage of breaks in the UK (for example, in 2002/3, over 100 million day trips were taken in the English countryside compared with 25-30 million overnight stays [21]).

Seven of the companies that would offer such holidays in Scotland provided enough information to estimate the gross income they might expect. In total the estimate comes to **£800,965 per year from 7 operators** (Table 4). If we **add the regional tourism multiplier** [15] of 1.3256 to these figures (see Box 1), then the benefits to the local economy might rise to **£1,061,759 per year**.

Of the 10 companies that indicated they would or might offer tours in Scotland, we asked whether they would consider offering a tour to Knapdale were beaver to be released there. To our knowledge none of the companies currently offer a tour to the Knapdale area and six companies indicted they would (however one company added the proviso that there shoudn't be a large visitor centre built at the site).

In general, **providers were positive about the knock-on effect the beaver might have for other tourism**. When asked what they thought the impact would be of a beaver release in generating clients for other wildlife and/or non-wildlife holiday packages in the area local to the release, respondents graded the impact on average as 4 out of a maximum of 5.

Beaver holidays in Europe: Nine of the 20 tour operators we spoke to already offered holidays in Europe that included the opportunity to view beavers. This figure includes one company which takes tours to the Ham Fen beaver project in Kent, SE England. Therefore **at least one of these nine companies had already begun offering trips to an area directly as a result of a beaver reintroduction.**

Our results, indicate that:

- Wildlife tour operators have the potential to inject considerable income into local economies.
- At both the national and local level, the beaver has the potential to attract wildlife tour operators who have not previously operated in the area.
- In support of this notion; tour operators also believe that the presence of beavers would generate further non-beaver related wildlife tourism for the area local to a release site.

Table 4: Expected likely revenue in Scotland from wildlife holiday providers.

These data were obtained from survey results where we asked 10 wildlife tour companies whether they would offer trips to see beavers in Scotland, were they to be released there. We then asked them to estimate the likely pricing, client numbers and local spending in different sectors. We then used these figures to predict the likely revenue for the local economy these companies would create. Not all companies were able to provide all the data necessary for these calculations. Therefore, we extrapolated from those companies that were able to provide all the data to arrive at the bottom line (*Expected total revenue from all interested companies surveyed*).

Variables: Type of beaver holiday offered	**No. of companies**
No. offer as tour highlight	3
No. offer as tour extra	3
No. offer as both tour highlight and extra	3
No. possibly offer as tour extra	1
Total No. Companies	**10**
From these companies:	
% providers expecting some non-UK clients	36%
% of clients from outside UK	24.2%
Mean number of clients / year	369.0
Mean group size	9.44
Mean entire package length (days)*	5.33
Mean package price	£477.25
Mean % of price spent locally	87.5%
Mean client extra local spend	£190.00
of which spent on travel	£76.57
of which spent on accommodation	£38.00
of which spent on food	£32.29
of which spent on gifts	£29.50
of which spent on other	£13.64
No. Companies where *all* the above information supplied	7
Expected revenue from above companies	£800,965.00
Expected mean revenue per company	£114,423.57
Expected total revenue from all interested companies surveyed	**£1,144,235.71**

* Tours of more than 1-2 days tend to include more than one species and therefore longer tours may include other species and areas.

The availability of information for Scotland is at least partly a reflection of Scotland's (particularly the Highlands' and the West Coast's) status as the top wildlife destination in the UK. However, it may also be due to the **highly organised nature of Scotland's wildlife tour operators**. For example, tour operators in Scotland present a fairly cohesive face in the form of the *Wild Scotland* website[2]. Five of the 48 tour operators approached during the course of this study were found from this website via *Google*. We could not find an equivalent website for companies operating in England or Wales. Thus, obtaining information on companies operating in Scotland was relatively easy.

The larger population centres in or near England and Wales may provide a large customer base within easy access of a release site in these countries. Indeed, **locals make up the majority of visitors to wildlife attractions (Table 1).** Additionally, in 1994 **informal day trips to the countryside represented 14% of the total value of tourism to the English economy and generated £9 billion in revenue** [22]. Therefore, we might expect short independent trips to play a larger role and guided trips a smaller role in tourism in England and Wales because of the ease of access.

This suggestion is corroborated by a study on visitor numbers to RSPB reserves in 1998 and 1999 [5]. Of their top 20 (which between them received on average over 800,000 visitors annually between 1998 and 1999) 13 are in England and 4 in Wales compared with just 3 in Scotland (of which two are in central Scotland, and therefore nearer the large population centres).

hedonic pricing analysis: an independent verification of our results

Figures on tourism and beavers obtained from our study could potentially be inaccurate simply due to pessimistic or optimistic responses from our questionnaire. To obtain an independent verification of our results, we conducted an analysis on the pricing structure of actual holidays offered by holiday providers. The assumption is that the price of a product is dependant upon its characteristics. For a car price dependant characteristics might include the safety features, maximum speed and fuel consumption; whilst for eco-tourism we might include accommodation, food and (we would hope) the species you are likely to encounter including beaver.

The analysis took information on 120 holidays from wildlife tour brochures. We then attempted to tease out the degree to which beaver influence the price through statistical techniques as described in *Appendix I*. In order to do this we estimated the increase produced in the price of the holiday when another large charismatic mammal is added to the itinerary. A list of 6 such mammals was created based on whether they had: *a)* been lost to the UK, *b)* weighed over 20 Kg and *c)* were, arguably, charismatic. These were: bear, beaver, bison, elk, lynx and wolves and were called the '*big-6*'. We used this *big-6*, instead of just single species because the low overall numbers recorded for each single species in holiday packages (all less than ¼ of holidays) would not have allowed a robust statistical analysis.

- In accordance with the responses from our questionnaires, beavers are commonly regarded as an attractive species by providers.

- Beaver were mentioned in 20 (17%) of the brochures, wolf in 26 (%), bear in 21 (17.5%), lynx in 19 (16%), elk in 18 (15%) and bison in 11 (9%).

- In total, 43 (36%) of the holidays mentioned one or more of these six species including, 30 (25%) mentioning two or more and one holiday mentioning all six species.

[2] *http://www.wild-scotland.org.uk*

- The high frequency of reference to the beaver in the brochures may be an indication of one of the advantages this species has to wildlife tourism, rather than simply an indication of the beavers' popularity (according to the tour operators, wolf, bear and lynx tend to attract more queries from potential customers than the beaver does). **The beaver is relatively easy to view** (particularly when compared to the elusive carnivores) and the lack of guaranteed success in viewing European carnivores was frequently highlighted by tour operators in their brochures.

Our model related the destination country, holiday length, the number of meals provided and the number of charismatic mammal species (from the *big-6*) listed in the brochure to the price. This model proved to be fairly accurate in predicting the price of a holiday[3]. It was also realistic in that the price increased with each of the quantifiable variables.

- In this model **the *big*-6 mammals contribute significantly to the holiday prices, as the holiday price increased by approximately £63 per person every time one of the *big-6* mammal species was added to the trip itinerary**[4].
- This estimate of effect on price is likely to be fairly conservative because of the statistical tool used[5].

The test used will attribute all the variation it can to the destination country first before it attributes any variation to the other (quantifiable) variables. Therefore, if countries with the largest populations of the *big-6* (and therefore the countries most likely to have *big-6* holidays) are also intrinsically more expensive due to higher travel costs (e.g. eastern Europe) or higher living costs (e.g. Scandinavia) than the UK, then an increase in holiday prices are going to be attributed to these factors first and the presence of any of the *big-6* mammals after.

We might expect that some wildlife tour operators would be optimistic in their predictions of tourism in relation to the beaver, particularly if they could benefit from the presence of beavers in the UK and they thought that a positive response in this study might influence any decision to release beavers. However, the hedonic pricing analysis presented here indicates that this is not the case.

- **Based on our analysis, it appears that the *chance* of viewing any of these mammals really does increase the value of a holiday package considerably.**

tourism and the beaver overview

Our results indicate that the **beaver could bring substantial tourism benefits** to a reintroduction area and present a useful addition to the UK's expanding environmental tourism market. To inject a note of caution here; researchers and managers did not generally grade the economic benefits of beavers very highly. This may be in part due to benefits being spread throughout the community and therefore less obvious or less direct than, for example, a factory or other single large employer in the area. Regional economic benefits of a beaver reintroduction are likely to be smaller scale and more dispersed as they are based on tourism revenue throughout the region. However, we may expect that their presence could provide benefits to local economies that would make **having this species a worthwhile goal even before environmental and biodiversity benefits are taken into consideration**.

[3] This model explained 92% of the variation in holiday price (R^2=0.9, $F_{(32, 87)}$= 32.278, P<0.001)
[4] β = 62.96±17.33 SE, P<0.001
[5] type I GLM

Costs, Perceptions and Mitigation

We asked experts involved in the research and/or management of beaver populations in mainland Europe for their experiences of land-use conflict, mitigation methods and public perception of the beaver. This was done in order to build a picture of the current situation in countries with beaver populations and to see whether anything could be learned from their experiences. See *Appendix I* for further information on our methods and *Appendix II* for a brief overview of some of our results.

The area covered by each expert ranged from single sites to countrywide population management. It must therefore be noted questionnaire responses varied due to differences in the size of the beaver population being considered (from 20 to >100,000) and the region being influenced.

Based on the questionnaire responses from beaver managers and researchers, **conflict between beaver and human land-use generally appears to be low-level**. For example, though all land-use categories we asked about had experienced some conflict with the beaver in at least one of the respondents areas, when asked to grade the severity of this conflict (where it occurred) from '1' (low) to '5' (high), the mean grade given was 1.5.

We will go through each land-use category and examine the costs, perceptions and mitigation methods used. Overviews of the reported cost ranges are given in Fig. 1 and mitigation methods used are given in Table 5.

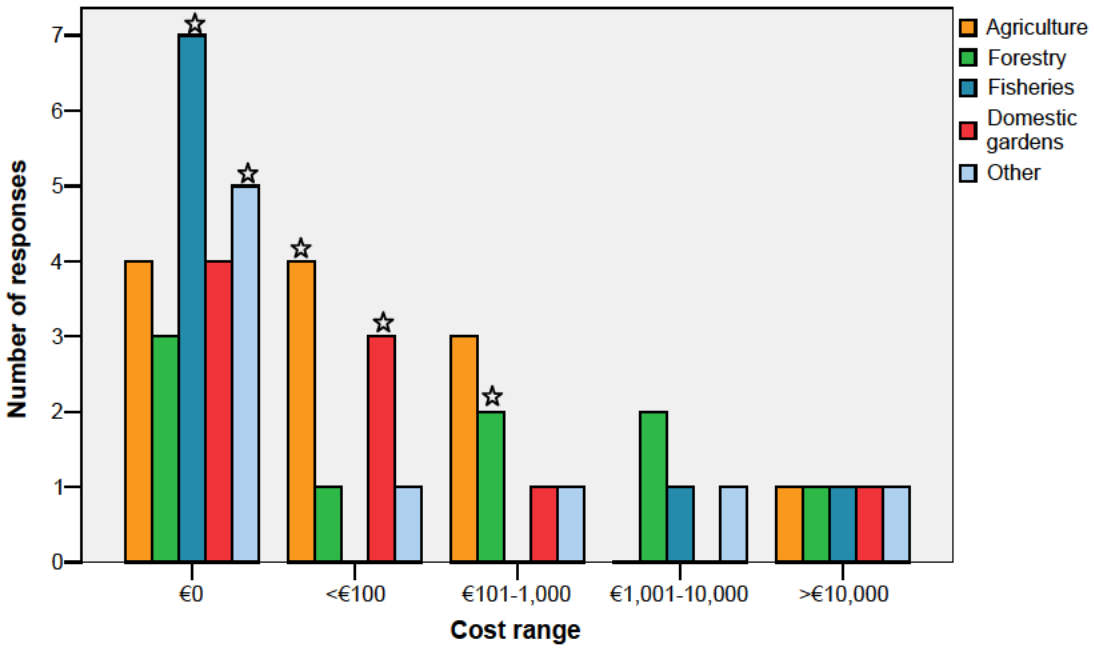


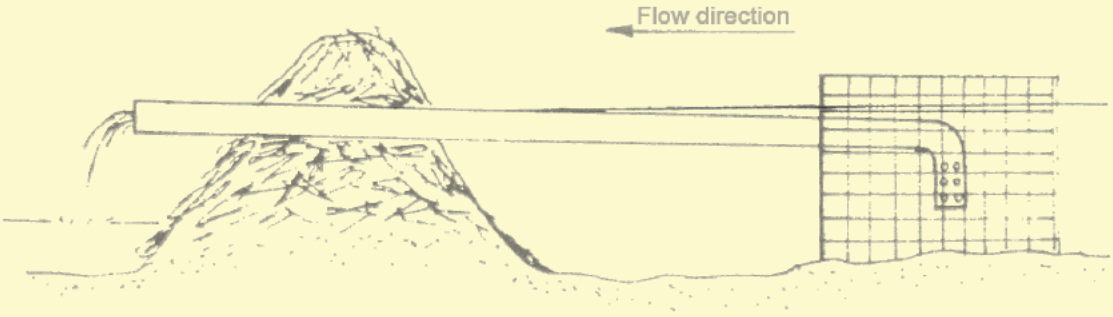
Fig 1. Reported cost per beaver population by land-use category. Stars indicate that the bar represents the median (i.e. typical) cost range for the land-use

agriculture

- Prior to reintroductions, 37.5% of respondents reported concerns being raised about conflict with agricultural objectives.
- Agricultural conflict appeared to be small scale with a median (i.e. typical)[6] range of €1-100 per annum per beaver population.
- Most conflict appeared to be from beavers foraging on crops (53% of respondents reported that this occurred in their region) or loss of agricultural land due to flooding.
- However, the low costs indicate that such events were localised and small scale.
- In agricultural conflicts the most commonly utilised mitigation methods aimed to reduce flood risk through dam removal and instillation of flow devices (see Box 2).

Box 2: Flow devices

A flow device (otherwise know in North America as a 'beaver deceiver') is a device that is used to drain water from a beaver pond without the beavers being able to work out where the water is escaping and then blocking the flow. The device usually consists of a system of pipes (and sometimes fencing or mesh) that either has an inlet some distance upstream from the dam or that has an inlet that is protected in such a way as to make effective damming of the inlet pipe impossible.



Example of a flow device, from Nitsche [23].

forestry

- Prior to reintroductions, 37.5% of respondents reported concerns being raised about conflict with forestry objectives.
- With a median cost of €101-1,000 per population, reported costs of conflicts were higher than for all other land-use types, but still relatively low given that the figures represent annual costs.
- Again, most conflict appeared to be due to the foraging activity of beavers (60% of respondents reported some felling of commercial trees) or loss of forestry land and trees due to flooding.
- However, again, conflict generally appears to be localised and small scale, given the low median cost value.
- Except for translocations, all mitigation methods considered were utilised (see Table 5), with dam removal being the most common method applied.

[6] The median value is the measure of the mid-point of a range of numbers and is not the same as the mean or average value. We frequently use medians instead if means in this report because many of the figures we are describing are from questions where respondents were required to indicate the range of values that best described their answer, instead of giving an absolute value. The median is frequently used to indicate an average where data sets may be skewed by high outliers or if analysing ranges of values rather than discrete figures.

fisheries

- Prior to reintroductions, concerns about conflicts with fisheries were only reported by one respondent.
- Similarly, where beaver populations were established, conflict was among the lowest reported with the majority of respondents reporting no conflict occurring.
- Two respondents reported greater costs, one as a result of a single incident involving a breached fish pond leading to the loss of commercial fish stock.
- Mitigation methods employed were mainly dam removal, but also occasionally the use of flow devices (see Box 2) or the cull or translocation of problem animals.
- Though not mentioned by respondents in this context, fish pond banks can also be protected (see below).

domestic gardens

- Conflict with domestic gardens was not a concern raised prior to beaver reintroductions.
- Where beaver populations were established, conflict was again limited with a median annual cost of €1-100 per beaver population.
- Most conflict probably arises from the occasional felling of ornamental trees (53% of respondents reported this) and possibly occasional flooding events.
- Resulting mitigation methods employed were predominantly the fencing of gardens, orchards or individual trees and, to a lesser extent, the removal of dams.

other land-uses

- Conflicts with land-uses other than those mentioned above were low. There were only 4 other instances of different conflicts mentioned.
- The three highest costs specifically concerning three separate incidences in The Netherlands and the Czech Republic of digging of dykes and pond banks resulting in their breaching and the flooding of surrounding land.
- Similar occurrences have been noted in Lithuania [24] and it therefore appears that such incidences are a possibility in low-lying areas and measures should be taken to minimise this risk were beavers to be introduced into such areas.
- However, these incidences still appear to be rare and can be regarded as the extreme end of the economic spectrum of beaver-human conflict.
- Mitigation methods employed involved the strengthening and restructuring of at risk dykes and pond banks using metal mesh, together with other more usual mitigation methods.

perception

Public perception of the beavers are predominantly positive (76% responses, N=17) **and rarely negative** (6%). Current public interest in beavers was generally moderate (53% of responses, N=17). This level of interest varied compared with the public interest during the actual reintroduction period, being higher in 33% (N=12), higher to unchanged in 8%, unchanged in 25% and lower in 33% of responses.

These low levels of conflict are possibly because **beaver behaviour limits human conflict.** The reason for this should be fairly obvious: beavers are an aquatic species that are known as 'central-place foragers' [12], that is to say, they use water as a 'central-place' for transport and safety and tend to restrict their activity to the vicinity of the water. For example, **95% of beaver cut trees were found within 5m (16ft) of water** in Denmark [25] and two separate Norwegian studies found that mean-maximum foraging distance from water was 40m (130ft) [26] and that **beaver foraging declined exponentially with the distance from water** [27]. Furthermore, their highly developed territorial behaviours help maintain their populations at a low density [28]. Damming, the behaviour that has perhaps greatest potential to create

conflict, only occurs in smaller streams. In North-western Russia, dams were maintained by, at most, 53.6% of Eurasian beaver colonies [29]. When damming occurred, it has resulted in a mean flooded area per beaver colony of around only 0.75 ha (1.85 acres) in Estonia [30] and 1 ha (2.47 acres) in Poland [31]. The same Estonian [30] and Polish [31] studies found that approximately only **10% and 3-4.5%,** respectively, **of colonies were causing conflict between beavers and humans**. This limited conflict may explain why public opinion of the beaver was generally positive.

Openness to the public about a beaver reintroduction may minimise negative public perception. One respondent commented that **lack of transparency during reintroductions had caused problems** because land-users (in this case, fruit tree growers) were unprepared when conflict arose. The respondent went on to say that had these growers been forewarned, they could have taken measures to prevent beaver damage (see below) and furthermore, provisioning growers with materials to protect at risk trees would have created goodwill between land-users and wildlife managers.

mitigation

A number of mitigation techniques can successfully reduce conflict between the beaver and human land-use (Table 5). Overall fencing of property was the most commonly utilised method, followed by dam removal and then application of water flow devices ('beaver-deceivers' [32]; see Box 2). Obviously, fencing larger parcels of land is more expensive and thus for agriculture and forestry, fencing was considerably less popular as a mitigation technique. In general, offensive mitigation techniques such as dam removal (as opposed to defensive techniques such as fencing) were more frequently used. Only one of the nine respondents reported the use of compensation to resolve conflict. Using deterrents, an alternative mitigation technique to protect trees from damage, was not mentioned, probably because it is fairly new concept. This technique involves painting the lower trunks of trees with a clear sand-based paint that herbivores find unpalatable. One example is *Wöbra-biber* made by the German company *Flügel*[7]. A 10kg drum, which could protect approximately 60-70 trees cost for several years, costs € 90.50 (**about £ 0.91 / tree**). This technique may provide a cheap alternative to fencing or netting.

Another method of minimising conflict through mitigation may be the provision of a **beaver advice line** or **website** in the UK that people could call or access to obtain advice on the best methods of mitigation or to report conflict. Sources of advice such as these are frequently used in North America[8] and one has recently been implemented for Wales - the Beaver Information Exchange (www.beaverinfo.org).

Based on this survey, most mitigation techniques employed are non-lethal. This may be largely due to EU laws banning the culling of beavers in many countries. However, non-lethal control would appear to be a very sensible strategy given that, as with many territorial species, culling a problem animal will only provide relief until another almost inevitable fills the resulting gap. A Polish study [31] found that of the 3-4.5% of beaver colonies caused conflict. Most (87%) damage had occurred at the same sites for more than 5 years indicating that problems are specific to certain habitat sites, not transitory depending on beaver behaviour. **Non-lethal mitigation at established conflict sites would therefore be a workable, efficient method to minimise conflict**.

[7] www fluegel-gmbh.de
[8] For example, the Ministry for Environment of the Government of British Columbia in Canada offer a 24 hour free-phone number (1-800-663-9453) to which people can report wildlife conflict.

Table 5: Mitigation techniques utilised.

Mitigation techniques applied during conflict with various land-uses according to 14 questionnaire responses. Figures *above the double line* form a matrix that represents the number of responses mentioning the mitigation technique in connection with the particular land-use. Figures *below the double line* (last two rows) represent the number of respondents that mention the mitigation technique and the consequent total percentages of respondents that reported the use of that mitigation technique.

Land-use	Cull	Trans-location	Removal of dams	Flow devices	Fencing	Compen-sation	Other
Agriculture	3	3	6	4	2	1	0
Forestry	3	0	7	2	3	1	0
Fisheries	1	1	4	1	0	0	0
Gardens	2	0	4	0	9	0	0
Other	2	2	3	1	0	0	2
No. respondents	3	4	7	4	9	1	2
% of respondents using technique	23	31	54	31	69	8	15

overview of costs, perception and mitigation

As with other wildlife, beavers can come into conflict with human land-use. However, it is also apparent that **the economic cost of such conflict is likely to be low**.

- Estimated annual regional costs (in Euros) of beaver mediated damage varied widely, however, the majority of estimates were clumped toward the lower end of the scale (ranging between €0 and €1,000 per population) and the median (typical) costs were all within this range (Fig. 1).

- Furthermore, one respondent stated that **in Sweden, research into quantifying beaver-mediated damage is not generally considered a worthwhile use of funds because conflict between beavers and land-users is so low.**

- Our figures are not dissimilar to those reported for total (all land-use) compensation claims from beaver conflict in Norway between 1914 and 1925 totalling 32,500 Norwegian kroner (NOK) [33] which is equivalent to NOK 64,000 / annum or c. €8,000 (£5,500) / annum in today's prices.

- There was no correlation between the number of beavers and the annual costs of land-use conflict[9].

- Similarly, there was no correlation between land area and the annual costs of land-use conflict[10].

- **Public perception of beavers is predominantly positive.**

- **Several non-lethal mitigation techniques exist, and can be effectively used**, to reduce conflict particularly at sites of persistent damage.

[9] Spearman's rank correlation; $r_s = 0.49$, N=10, P=0.15
[10] Spearman's rank correlation; $r_s = 0.05$, N=10, P=0.89

Conclusion and Recommendations

This small investigation merely scoped the relative sizes of the costs and benefits of beaver reintroduction. As such the figures presented are not likely to be accurate, but instead indicate a rough estimate of the likely costs and benefits of a reintroduction. Despite the study's limitations **the balance sheet in terms of the relative sizes of the economic costs and benefits we estimated present a very healthy positive balance in favour of beaver reintroductions.** The economic benefits from tourism alone may factor in the millions of pounds with the establishment of a visitor centre at a release site potentially drawing over a million pounds into the local economy and revenue from commercial tour operators injecting a further six or seven figure sum into the economy. Based on the questionnaire responses, it does appear that the annual cost of a beaver population is likely to remain below thousands of pounds, a small fraction of the potential benefits – and potentially further reduced by the application of appropriate mitigation techniques. Although some of the income would have been spent in the UK by UK citizens anyway, the beaver has the potential to attract visitors from other countries and indeed the beaver may strengthen the UK's position in the international market as a destination for not only culture, but also environmental tourism. Certainly, at the local level, it would appear that beavers have the potential to attract visitors who otherwise may not have visited the locality.

The extent of benefits versus costs will of course depend on how the wildlife tourism is managed. Recommendations for best practice include:

1. **Involve and inform the wider public about the reintroduction.** Their awareness of the project will not only help its smooth running, but also increase utilisation of related tourism ventures.

2. **Inform local land-holders of any reintroduction of animals.** In the Netherlands this was not always done and as a result not only were land-holders unable to prepare any mitigation schemes where required but when any conflict arose land-holders were arguably less tolerant of damage.

3. **Use a well thought-out, eco-friendly visitor centre at a key location.** This may provide a focus for tourism. Many tour operators thought that the Osprey centre at Loch Garten, Scotland provided a good example of such a centre. The centre consists of a hide, shop and environmentally friendly toilets.

4. **Too many tourists can spoil the experience for some and degrade the environment.** Tourism related environmental degradation is a recognised problem. Furthermore, one tour operator we spoke to indicated that their company would not include a beaver reintroduction site in its itinerary where that site had a visitor centre. The reason given is that their clients required a 'wild' experience that a visitor centre could not provide. However, as mentioned above, visitor centres can be a good method of attracting many tourists. We suggest that a suitable balance is sought between catering for those that simply want to see the beavers and those that want to see beavers as part of a wider wildlife experience.

5. **Ecotourism may be best practiced at the grassroots level.** Visitor centres may provide a focus for tourism, but the most efficient method to maximising tourism benefits at the local level would be to involve local tourism stake-holders in the project.

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6. **A cohesive face of ecotourism in both England and Wales should be offered** to the public through the formation of an umbrella association. Several Scottish wildlife tour operators cited the formation of Wild Scotland (an association of wildlife tourism operators, see *www.wild-scotland.org.uk*) as a critical factor in the development of wildlife tourism in Scotland. Furthermore, through its website, it provides an easily accessible interface with the member operators.

7. **Further discussion is needed to evaluate ways of reducing the potential mismatch** between those that benefit from the presence of the beaver (e.g. the local tourism industry) and those that are likely to experience the greatest conflict with the beaver (e.g. local landowners).

Economic Cost-Benefit analyses can be used to help guide policy makers through tough environmental decisions where the right decision is not always easy to see. They will generally attempt to value all of the market based costs and benefits and then add to these non-market benefits. Assessing how the public would like to trade their desires for their environment against other goods, such as clean air against cheap and abundant energy is a difficult business.

The difficulty does not lie in whether or not a beaver reintroduction would pass a cost-benefit analysis or not, it almost certainly would. It is instead that those who would economically benefit from beaver related tourism may not be the same individuals that experience conflict with the beaver. Moreover, whilst the costs might be negligible on a regional scale they would concern the small number of individuals who might shoulder them. This is a common problem with any environmental issue, and there is no easy answer to the problem. However involving local stakeholders from the early stages of a reintroduction project is usually the most important step that could be taken to minimise this imbalance.

We have not presented a thorough cost-benefit analysis. Specifically we have not tried to estimate the non-market benefits such as the sheer joy of knowing that an animal exists, and we do not claim that the figures presented are particularly accurate. On the other hand the relative sizes of the costs and benefits are fairly clear. The results of environmental cost-benefit analyses rarely show such large differences between costs and benefits. So with the public's support it is fairly clear that a reintroduction would improve the welfare of the British people overall.

The remaining challenge is the design of frameworks to mitigate and compensate real costs and dispel myths regarding perceived costs to reassure sections of the population who believe the reintroduced beaver would leave them worse off.

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Appendix I: Methods used in this study

Three sub-projects formed the core of this study, these being: two questionnaires, one to professionals working with beaver management or research and one to providers of wildlife tours; and a hedonic (revealed pricing) analysis of wildlife package tours.

Questionnaire to beaver managers and researchers

The questionnaire consisted of two sections. The first section dealt with the history of the beaver and its economic impacts in the respondents' geographical region. In particular, participants were asked about conflict between beavers and five categories of land-use; agriculture, forestry, fisheries, domestic gardens and 'other'. Further details were asked concerning conflict, the mitigation methods employed to reduce conflict and also the benefits noted from the presence of beavers. The final question in this section asked what public concerns had been voiced prior to beavers being translocated into a region. The second section dealt with current public opinion of the beaver and the respondents' experience with ecotourism in relation to the beaver. In particular, participants were asked about visitor numbers to specific beaver sites, perceived economic impacts from tourism and, if the local economy had received little benefit from any tourism, the reasons why this might be the case.

The questionnaire was sent to 57 managers and researchers across Europe. When sending the questionnaires, we simply asked that recipient's completed the questionnaire and return it via post, fax or email. We did not provide stamped return envelopes. Managers and researchers were selected for their contribution to the scientific literature on the beaver and / or their involvement in symposia on research and management of the beaver, such as the International Beaver Symposium.

Questionnaire to providers of wildlife holidays

The questionnaire consisted of three main sections. The first section dealt with the respondents' business, such as company age and size, number of customers and the company's reaction to previous reintroductions of any species. The second with a potential reintroduction of the beaver into the UK and, in particular, asked whether the operator would include a reintroduction program in its itinerary, the number of customers it might expect were it to offer such trips and the money that they would expect clients to spend over and above the price of the holiday. Operators were also asked at what price they would set a UK beaver holiday and the proportion of income from this tour that would be spent locally to the tour location. The third section dealt with the respondents' experiences with the beaver when operating in the rest of Europe. In addition, we asked respondents specific questions concerning the proposed reintroduction of the beaver into Knapdale in Scotland. At the time of data collection, the Knapdale proposal had not yet been refused by the Scottish Executive.

The questionnaire was sent to 42 operators based in the UK and four other based in other parts of Europe. When sending the questionnaire, we told recipients that we would get in touch via telephone within a few days to conduct an interview following the questionnaire. All companies were chosen because they operated in the UK and / or the rest of Europe and targeted customers from the UK. Companies were selected from adverts found in *BBC Wildlife Magazine*, the *Responsible Travel* website (www.responsibletravel.com) and searches conducted in *Google* (www.google.co.uk).

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Hedonic pricing index

Environmental goods are rarely traded directly in markets since they are normally classed as public goods. Public goods are goods such as street lighting, where it is difficult to prevent people from using them and having an extra person using them does not significantly diminish the benefits it imparts on all other users. Public authorities considering the most appropriate amounts of money to spend on these goods have a number of economic tools at their disposal. One of these methods is hedonic pricing.

It is founded on the basic premise that the market price of a good is simply a reflection of the values of its characteristics. If a house is within the catchment area of a particularly good school then we might expect that to be reflected in the price. So by taking the prices of houses in an area and comparing them to their relative characteristics we can tease out the effect of one of these characteristics. For a house this will involve looking at the size, age, proximity to public transport and so forth along with what school catchment it is in.

This method has been used since its conception to consider even less tangible goods such as those pertaining to the natural environment or even the value of a life. In this instance we used eco-tourism holidays and the species mentioned within them to tease out the impact that large charismatic mammals have on the price which holiday providers are able to charge. This is done statistically using some form of multivariate regression analysis, such as a Generalised Linear Model (GLM).

We obtained brochures (either hardcopy or web-based) from 14 of the 46 tour providers mentioned above. From a total of 120 European holidays (including UK holidays) offered by these companies, we recorded holiday offer price, country of destination, length (days), mean daily number of meals provided and whether the brochure mentioned any of the following mammal species: Bear (*Ursus arctos*), beaver, bison (*Bison bonasus*), elk (*Alces alces*), lynx (*Lynx lynx*) and wolf (*Canis lupus*). We choose these six species over others because they were once found in the UK but are now extinct in the wild, they are large (>20kg) and are arguably charismatic. Therefore other large and potentially charismatic mammal species such as the red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*) were excluded as they are currently found living wild in the UK. We called these six species the '*big-6*'.

Statistical analyses

All analyses were conducted in SPSS (v.13) or SAS. Analysis of the questionnaire data beyond finding mean values was done using Spearman's rank correlation or linear regression. Where an analysis was done on ranged variables, the median of ranges was used.

Hedonic pricing was analysed using a type 1 general linear model (GLM) with holiday price as the dependent variable, destination country as the fixed factor and all other variables as covariates. The six mammal species were lumped together as a cumulative variable (0-6). This was done because there was significant positive colinearity between these species (Spearman's rank correlations, $P<0.01$ for all cases), except between bear and elk and bear and bison. By lumping these species together, we were essentially examining holidays that were specifically targeting customers whom wished to see large charismatic mammals. Additional comparisons of means was conducted using the non-parametric Mann-Whitney *U* test.

The two-tailed *P* value of 0.05 was used as the cut-off point for significant results in all analyses.

Appendix II: Overview of questionnaire responses

Managers and researchers of beaver populations

We received 18 replies to the questionnaire, a reasonable response rate of 34%, though not all respondents answered all questions. Respondents' regions of experience ranged from an entire country to a large reserve within a country and came from a total of 14 European countries, these being Belgium, Coatia, the Czech Republic, Denmark, Finland, France, Germany, Norway, Poland, Russia (two participants), Serbia and Montenegro, Sweden (three participants) and the Netherlands (two participants). Reintroductions of beaver from other countries had occurred in eleven of these respondents' regions of experience, seven regions had experienced reintroductions from other parts of the country and in two regions (in Germany and Norway), beavers had never been expatriated. Some regions had experienced combinations of these events, hence the numeric mismatch.

On average, 160 beavers were released over the course of the programs (range from 2 or 3 to 1,500 with a median of 51 animals) and the current beaver population sizes in the respondents regions averaged c. 20,200 animals (range from just 20 to >100,000, median = 2,000 animals). Population growth rates post-release (where known) averaged c.18% (range from 5% to 42). Current population growth rates average c. 16% (range from 0% to 30%).

Providers of wildlife holidays

We obtained 20 responses to this questionnaire, a good response rate of 48%. These responses represent a broad range of tour operations from 'one man' outfits to those employing 600 FT staff (mean 40 FT staff) and from companies offering just one tour option per year to those offering over 100 holidays per year (mean 57 holidays). Likewise, the number of customers taken per year was quite broad, from 40 to 4,000 (mean 980 customers). Most customers came from the UK (mean 81%) with a small proportion coming from other European countries (mean 7%) and non-European countries (mean 12%). The holidays the companies offered encompassed a variety of types but were predominantly 'wildlife only' (72% offered these) followed by 'bespoke', 'wildlife and culture' and 'other' holidays types (44% each). Tour operators' charges were between the ranges of £10-200 to £2,000+ per holiday (the median or typical range was £501-£1,000). Some operators were able to give estimates for the sum they spend on travel, accommodation, food, guides and 'other' spending. Based on the medians of the ranges given for these categories, it appears that the most money gets spent on accommodation (27%) and guides (26% of the total spending in the four categories), followed by travel (24%) food (16%) and 'other' (6%). The tour operators generally appeared to be ethically minded with 72% being members of a non-governmental organisation dealing with conservation and 73% financially contributing towards conservation in some form. However, this figure drops to 65% and 55% respectively if you assume that those that do not contribute to conservation in some form simply ignored the question.

Appendix III: Wildlife attractions – Visitor expenditure model

The Wildlife Attraction: Visitor Expenditure Model was developed by SQW for the England Biodiversity Group. For this analysis we ran the model for a beaver reintroduction separately for Wales and Scotland, then for separate regions of England as defined in the model, but excluding London.

The reintroduction site was hypothesised to have the following characteristics:

- a remote rural site;
- contain over 3 distinct wildlife habitats (we assumed that at any site at least 3 of the following would be present – dry grassland / wet grassland / marsh, fen, reedbed / lakes / rivers and streams / native broadleaved woodland / native coniferous woodland / lowland bog / upland bog)
- be the best site in the UK for viewing this species

The following assumptions were also made:

- Due to the charisma and appeal of the iconic beaver it was assumed that the site would thereby attracting enthusiasts and general visitors alike.
- It was presumed that the site would be open to visitors all year and assumed that visits during peak season would be approximately 4 times greater than in the low season.
- The "Mean annual no. of visitors to a wildlife attraction" (See table 3) for Scotland and Wales was calculated by dividing the total number of visitors to wildlife attraction by the number of sites providing information (see table 1). Due to the different attractions within each group this does not represent a comparable market. Numbers may also be an overestimate because of the inclusion of zoos in the wildlife attraction definitions. However numbers were accepted as the best available estimate of potential visitor numbers.
- For England the "Visitor Attraction Trends England 2006." [19] provides information on the number of visits made to a selection of wildlife attractions in each geographical region. The "Mean annual no. of visitors to a wildlife attraction" (See table 3) for each region in England was calculated from this data. As with Scotland and Wales, data is not comparable due to the different group structure and there is potential that this is an overestimate because of the inclusion of zoos in many of the wildlife attraction definitions. However numbers were accepted as the best available estimate of potential visitor numbers.
- The "Number of visitors used in model" (see table 3) shows the final number of visitors used in the Wildlife Attraction model. Instead of inputting the total annual number of visitors the model requires an estimate of weekly visitor numbers for high and low season, stipulating high season as 9 weeks and low season as 43 weeks. And using these figures to calculate the annual visitor number. By manipulating high and low season visitor numbers (keeping a ratio of approximately 4:1) we kept visitor numbers as within 100 of the regions annual mean as calculated from the tourist board data.
- No data was available for spending power of holiday makers versus day-trippers to such a site so the model's region-based default figures were accepted.

RISK ASSESSMENT:

PROPOSED SCOTTISH BEAVER TRAIL, KNAPDALE, ARGYLL

BEAVER EFFECT & IMPACT	WHAT /WHERE AT RISK?	MITIGATION MEASURES/CONTROLS	ACTION BY	RISK RATING **H**igh/ **M**edium/ **L**ow
Flooding				
1.Detrimental flooding caused by damming	(i) Crinan Canal – feeder burns (ii) Neighbouring private property (iii) FCS estate infrastructure	• Active field monitoring of beaver locations and activity by project field staff. • Removal of dams if location considered to have potential negative impact. • If required, fencing of key points to prevent beaver access/egress. • Recapture and relocation of animals if beaver activity considered to potentially have negative impact. • Insurance cover in place.	Field Officer Field Officer Field Officer Field Officer Steering/Local Management Groups	(i) Low (ii) Low (iii) Med
2. Detrimental flooding caused by burrowing	(i) Crinan Canal (ii) Neighbouring private property (iii) FCS estate infrastructure	• Active field monitoring of beaver locations and activity by project field staff. • If required, fencing of key points to prevent beaver access/egress. • Recapture and relocation of animals if beaver activity considered to potentially have negative impact. • Insurance cover in place.	Field Officer Field Officer Field Officer Steering/Local Management Groups	(i) Med (ii) Low (iii) Low
3.Potential bank collapse caused by burrowing	(i) Crinan Canal (ii) BW feeder lochs	• Active field monitoring of beaver locations and activity by project field staff. • If required, fencing of key points to prevent beaver access/egress. • Recapture and relocation of animals if beaver activity considered to potentially have negative impact. • Insurance cover in place.	Field Officer Field Officer Field Officer Steering/Local Management Groups	(i) Med (ii) Med

Public health				
4.Spread of water borne pathogens in drinking water supply (eg *Giardia*, *Cryptosporidium*).	(i) Public water supply: Kilduskland reservoir (ii) Private water supplies (11): Oakbank Farm, Scotnish Farm, Scotnish Lodge, Dounans, Leac na Ban, Seafield Farm, Gallachoile, Barnluasgan, Craglin, Gartnagrenach & Tigh-na-grian	• Public health monitoring of water supplies by Argyll & Bute Council Public Protection Services. • Screening of beavers in quarantine and post release • Active field monitoring of beaver locations and activity by project field staff. • If required, fencing of key points to prevent beaver access/egress. • Recapture and relocation of animals if beaver activity considered to potentially have negative impact.	A & B Council RZSS/Field Officer Field Officer Field Officer Field Officer	(i) Low (ii) Low
Forestry and agriculture				
5.Damage to notable trees	(i) FCS estate (ii) Neighbouring private forestry interests	• Fencing of key points to prevent beaver access/egress. • If required, fencing of key points to prevent beaver access/egress. • Insurance cover in place.	Field Officer & FCS Field Officer Steering/Local Management Groups	(i) Low (ii) Low
6.Damage to forestry	(i) FCS estate (ii) Neighbouring private forestry interests	• Active field monitoring of beaver locations and activity by project field staff. • Insurance cover in place.	Field Officer & FCS Steering/Local Management Groups	(i) Low (ii) Low
7.Damage to crops	(i) Neighbouring private property – crops	• Active field monitoring of beaver locations and activity by project field staff. • If required, fencing of key points to prevent beaver access/egress. • Insurance cover in place.	Field Officer Field Officer Steering/Local Management Groups	(i) Low
Fish				
8.Migrating fish impeded by damming	(i) Efferent/afferent burns from west side of Loch Coille Bharr and efferent burn from Loch Linne (ii) Outwith trial area: River Add – upstream & tributaries (salmon & sea trout)	• Active field monitoring of beaver locations and activity by project field staff. • If required, fencing of key points to prevent beaver access/egress.	Field Officer & AFT Field Officer	(i) Low (ii) Low
9.Salmonid spawning area(s) impacted by damming and flooding	(i) Outwith trial area: River Add – upstream & tributaries (salmon & sea trout)	• Active field monitoring of beaver locations and activity by project field staff. • Insurance cover in place.	Field Officer & AFT Steering/Local Management Groups	(i) Low

Designated features				
10.Significant detrimental impact upon designated features of SAC/SSSI	(i) Taynish and Knapdale Woods SAC (marsh fritillary butterfly, western acidic oak woodland, otter, lochs with aquatic vegetation). (ii) Knapdale Woods SSSI (breeding birds, bryophytes, dragonflies, lichens, loch trophic range, upland oak wood).	• 'Appropriate Assessment' monitoring of features by SNH. • Active field monitoring of beaver locations and activity by project field staff. • Removal of animals if beaver activity considered to have significant negative impact.	SNH Field Officer	(i) Low-Med (ii) Low-Med
11. Significant detrimental impact upon Scheduled Ancient Monuments (SAMs)	(i) 13 SAMs within trial area (1 at Loch Coille Bharr). (ii) 124 Unscheduled SAMs within trial area.	• Active field monitoring of beaver locations and activity by project field staff. • Monitoring of SAMs by Field Officer, FCS and Historic Scotland, as part of agreed SAM Management Plans. • Protection of features if considered practicable and a high risk of negative impact. • Removal of animals if beaver activity considered to have significant negative impact.	Field Officer Field Officer, FCS & Historic Scotland	(i) Low (ii) Low
People				
12. Significant detrimental impact on trial due to marked increase in visitor numbers to trial area.	(i) Beavers (ii) Designated site features	• Information and media campaign to manage visitors. • Interpretation, recreation and access management plan development and implementation. • Monitoring of visitor numbers.	Steering/Local Management Groups FCS FCS	(i) Low (ii) Low
13. Significant detrimental impact on local area infrastructure due to marked increase in visitor numbers to trial area.	(i) Road and car parking capacity and condition.	• Information and media campaign to manage visitors. • Interpretation, recreation and access management plan development and implementation. • Monitoring of visitor numbers.	Steering/Local Management Groups FCS FCS	(i) Low-Med

Beavers				
14. Road traffic accidents and near misses due to beaver activity near roads.	Injury to general public and beavers. (i) B8025 Bellanoch – Tayvallich Road. (ii) Barnluasgan – Achnamara Road (iii) B841 Cairnbaan – Crinan Road	• Active field monitoring of beaver locations and activity by project field staff. • If required, road signage to alert drivers of beaver presence. • If required, fencing of key points to prevent beaver access/egress. • Insurance cover in place.	Field Officer Field Officer and A&B Council Field Officer & FCS Steering/Local Management Groups	(i) Low - Med (ii) Low - Med (iii) Low
15. Beaver related human injuries	(i) Bites from poorly handled animals. (ii) Fall/trip resulting from contact with animal (iii) Immersion in water resulting from monitoring activity	• Only trained personnel to handle animals as required. • All necessary PPE, first aid and required equipment with personnel. • Minimum of two personnel when handling animals. • All work in or close to water requires buoyancy aids and training	RZSS & Field Officer RZSS/SWT RZSS & Field Officer RZSS/SWT	(i) Low (ii) Low-Med (iii) Low- Med
16. Loss of/damage to radio tag transmitters, leading to loss of individual beavers.	(i) Beavers within and outwith trial area.	• Active field monitoring of beaver locations and activity by project field staff. • Regular inspection of radio tags and operation, and replacement if necessary. • Recapture and relocation of animals if beaver activity considered to potentially have negative impact.	Field Officer Field Officer Field Officer	(i) Low - Med
17. Beaver mortality/injury	Disease, nutrition, predation, accident (i) Beavers in quarantine. (ii) Beavers within and outwith trial area.	• Regular observation and inspection of animals by veterinary/skilled personnel during quarantine and trial periods. • Suitable management intervention *if necessary* for sick, injured, malnutrioned animals, in post release phase.	RZSS & Field Officer RZSS & Field Officer	(i) Low -Med (ii) Low - Med

FCS = Forestry Commission Scotland, AFT = Argyll Fisheries Trust, RZSS = Royal Zoological Society of Scotland, SWT = Scottish Wildlife Trust, A&B Co = Argyll & Bute Council

ACTIONS REQUIRED / REMINDERS (if any)	**ACTION BY (date)**

RISK RATING (Guide only)

	LIKELY	PROBABLE	REMOTE	IMPROBABLE
SERIOUS	High	High	Low	Low
CONSIDERABLE	Medium	Medium	Low	Low
MINOR	Low	Low	Low	Low
NEGLIGBLE	Low	Low	Low	Low

LIKELY - Happens repeatedly, expected
PROBABLE - Will happen several times
REMOTE - Unlikely though conceivable
IMPROBABLE - Highly unlikely

RISK ASSESSMENT PREPARED BY: Simon Jones, SBT Project Manager DATE: Oct 2007 REVIEW DATE:

SIGNATURE:

SUMMARY

This is an application to Scottish Government by The Royal Zoological Society of Scotland and Scottish Wildlife Trust (the Principle Applicants) for a licence under section 16(4) of the Wildlife and Countryside Act 1981, as amended, to release European beaver, *Castor fiber*, for a trial re-introduction in Knapdale, Argyll.

Evidence suggests that the European beaver was resident in Scotland until about the 16th century, when it was persecuted to extinction by over-hunting. Since 1995, Scottish Natural Heritage has been investigating the potential for restoring this species to the native fauna of Scotland. This work is in line with requirements on the UK Government, under Article 22 of the 'Habitats Directive'. If re-introduced, evidence suggests beavers would have a beneficial effect on Scotland's wider biodiversity as a result of the effects of their foraging and engineering activities on woodland and aquatic habitats.

SNH have compiled a suite of information with regard to the scientific plausibility and desirability of conducting a re-introduction. A national consultation commissioned by SNH in 1998 demonstrated that a majority of the public were in favour of a re-introduction although some concerns were expressed by certain interest groups. Therefore a scientifically monitored, time-limited and site specific trial re-introduction is proposed by The Scottish Beaver Trial in order to:

- Study the ecology of the beaver in the Scottish environment
- Assess the effects of beaver activities on the environment, including a range of land uses;
- Generate information during the proposed trial release that will inform a potential further release of beavers at other sites with different habitat characteristics;
- Explore the environmental education opportunities that may arise from the trial itself and the scope for a wider programme should the trial be successful
- Determine the extent and impact of any increased tourism generated through the presence of beaver

A good quality site for a trial re-introduction has been identified at Knapdale, mid Argyll, which is managed by Forestry Commission Scotland. A satisfactory level of support for a trial re-introduction at Knapdale has been received during a local consultation. A suitable donor population has been identified in Norway and Norwegian expertise is available for the capture of animals. Strategies have been drawn up to ensure the proper management of the beavers in quarantine prior to release and post release at Knapdale.

The proposal is to collect three beaver families from the donor country in autumn 2008. There will then follow a six month period of quarantine. Three beaver families will then be released at Knapdale in spring 2009. They will be studied for a five year period until spring 2014.

The cash cost of the core scientific project will be in the region of £800,000 for the six year period beginning April 2008. The Principle Applicants request that Government grants a licence for the trial release of European beaver into the wild in Scotland at Knapdale, Argyll, under Section 16(4) of the Wildlife and Countryside Act 1981 as amended.

1 INTRODUCTION

Written and archaeological evidence suggests that the European beaver was once widely distributed throughout mainland Scotland. Beaver remains are not well preserved and these records provide limited information on the precise distribution and population status of the species in Scotland before they became extinct. However, an investigation into its history shows that the beaver was resident in Scotland until the 12th century, although there is strong evidence that it persisted until a much later date, possibly the 16th century (Conroy & Kitchener 1996).

The extinction of beaver in Scotland, and across the whole of Britain, has been attributed largely to hunting for its valuable pelt and the medicinal properties of the secretion from the castor sacs (the 'castoreum'). Habitat destruction is considered to have been a contributory factor in the decline although this was probably secondary to the effects of hunting.

The demise of the species in Scotland mirrors the pattern of decline elsewhere in Europe and, by the end of the 19th century, the European beaver was close to extinction across its range. Only three small and isolated relict populations survived in western Europe at this time (in Norway, France and Germany). However, re-introductions and translocations of the species have now taken place in 21 European countries.

The European beaver is the focus of new action over the next 5 years as described in the Species Action Framework launched in 2007 by the (then) Scottish Executive and petitioned by the public and published by Scottish Natural Heritage.

The Royal Zoological Society of Scotland (RZSS) is a registered charity founded in 1909 in Edinburgh and currently has a membership of 24,000. RZSS has since developed its' two living collections at Edinburgh Zoo and the Highland Wildlife Park which in total welcome over 700,000 visitors each year. It has an award-winning environmental education programme conducted at its' two main sites and through a nationwide outreach initiative and an extensive international conservation programme.

The Scottish Wildlife Trust (SWT) is a registered charity with the objective of advancing the conservation of Scotland's biodiversity for the benefit of present and future generations. With over 30,000 members, SWT manages 123 wildlife reserves totalling 20,000 hectares, conducts practical conservation work and provides a voice for wildlife at national and local levels. The work of the Trust is carried by a combination of volunteers and staff. Local presence is provided by a network of 21 members centres and there are 22 children's groups. Funding comes from grants, membership subscriptions, donations and legacies.

1.1 Aims

To undertake a scientifically monitored trial re-introduction of the European beaver to Knapdale, mid-Argyll, for a five year period in order to:

- Study the ecology and biology of the European beaver in the Scottish environment
- Assess the effects of beaver activities on the natural and socio-economic environment.
- Generate information during the proposed trial release that will inform a

potential further release of beavers at other sites with different habitat characteristics;

- Determine the extent and impact of any increased tourism generated through the presence of beaver
- Explore the environmental education opportunities that may arise from the trial itself and the scope for a wider programme should the trial be successful

2 Statutory and Strategic Framework

Article 22 of the European Community *Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna* (Council Directive 92/43/EEC, the 'Habitats Directive') states that Member States shall;

'study the desirability of re-introducing species in Annex IV that are native to their territory where this might contribute to their conservation, provided that an investigation, also taking into account experience in other Member States or elsewhere, has established that such re-introductions contributes effectively to re-establishing these species at a favourable conservation status and that it takes place only after proper consultation of the public concerned.'

European beaver is listed on Annex IV. No work is currently planned for the restoration of any other species listed in Annex IV of the Habitats Directive.

The Habitats Directive requires that any restoration should take place only after 'proper consultation of the public concerned'. Such a consultation was undertaken by SNH in 1998 in order to gather views on the desirability and acceptability of restoring beaver to Scotland. The results of this consultation were published by SNH (Scott Porter Research & Marketing Ltd, 1998). A further local consultation was undertaken in 2000 once the proposed Knapdale trial site had been announced.

In addition to the original licence application in 2002, further evidence was supplied by SNH to the then SE in January 2005 in response to questions on the impact of beavers on habitat components within the release area. This case remains valid within the context of this licence application and is provided in Annex 3.

The local consultation was repeated in the autumn of 2007 prior to this second application being submitted, the detail of which is appended as Annex 4

As described above the European beaver has been included in the SNH Species Action Framework with the following justification:

"*The European beaver meets criterion 1b of the Species Action Framework as a species for conservation action. It is listed on Annex IV (and Annex II) of the EC Habitats Directive. The Directive requires European Union Member States to study the desirability of reintroducing such species where they have become extinct. The beaver also qualifies for the Species Action List since we now have a large amount of ecological information on the species which can inform management actions. Effective species management action can be identified, namely the identification of a suitable site and the running of a reintroduction project, subject to the receipt of a licence. The beaver is a charismatic species which would serve to raise wider biodiversity issues such as riparian woodland management, aspen restoration, wetland biodiversity and dead wood habitat. There are few species which have such significant influences on ecosystem function and health*"

The current proposal for a study is in line with requirements on the UK Government under Article 22 of the Habitats Directive to consider the desirability of re-introducing species listed on Annex IV.

The current Scottish Forestry Strategy (2006) includes a clear desire to deliver on the following biodiversity values:

• Help to halt the loss of biodiversity, and continue to reverse previous losses
• Increase awareness and public enjoyment of biodiversity, especially close to where people live or visit
• Improve the knowledge of, and evidence base for, biodiversity and ensure biodiversity considerations are integrated into decision-making.

2.1 Legal position

As the European beaver is not resident in the wild in Scotland, any animals which are released will receive no specific protection under domestic conservation law.
The beaver is not currently resident within the UK and is not, therefore, covered under any domestic legislation. Consequently it receives no specific legal protection in Scotland.
Current domestic legislation makes it illegal to release to the wild any animal which is not ordinarily resident in Great Britain (Section 14 of the Wildlife & Countryside Act 1981 (as amended)). Any release, therefore, would have to be approved and licensed by Government.

The European beaver is currently listed on Annexes II (animal and plant species of Community interest whose conservation requires the designation of Special Areas of Conservation) and IV (animal species of Community interest in need of strict protection) of the Habitats Directive. This confers wider protection on the European beaver where it is currently resident on the Continent but does not oblige protection in Britain for a non-resident species. Given the very limited nature of the current study, no proposals are being presented nor thought necessary for any permanent amendments to domestic legislation at this stage.

However, in view of this, consideration must be given to the long-term status of the species in Britain should the trial be successful then it may become appropriate that a case be considered for the addition of the species to the appropriate schedule of both the Wildlife & Countryside Act 1981 (as amended) (Schedule 5) and The Conservation (Natural Habitats, &c.,) Regulations 1994 (Schedule 2). The former would be required to implement the Bern Convention in Britain whilst the latter would be required to comply with the obligations of the Habitats Directive for a resident species. Decisions on this matter would be a subject for the Scottish Government to consider.

Trial animals will remain the property of the project partnership until such times as they are removed (if the trial is unsuccessful) or they are considered to be a resident part of the British fauna. The latter will require an assessment of the species' status following the period of the trial. This will require full scientific support for consideration by the Government.

The proposal presented by RZSS/SWT is for the release of a small number of European beavers at Knapdale Forest to allow a trial re-introduction scientific study. Domestic legislation makes it illegal to release into the wild any animal which is of a kind not ordinarily resident in Great Britain (Section 14 of the Wildlife & Countryside

Act 1981 (as amended)). Any restoration, therefore, is subject to approval and licence under Section 16 of this Act.

2.2 Public Consultation

Work was completed initially to confirm the historical presence of beavers in Scotland (Conroy & Kitchener, 1996). This was followed by research to identify the extent of habitat suitable for beavers across Scotland (Webb *et al*. 1997) whilst a desk-based research study was conducted simultaneously to develop a method of assessing specific sites against the suitability for supporting viable beaver populations (Macdonald *et al* 1997). The likely impacts of beaver occupation on local hydrology and native fish populations were investigated through literature reviews and collation of information from countries where beavers are already resident (Gurnell, 1997; Collen, 1997). A recent study suggests that the presence and activities of beaver have very little negative impact of salmon and sea trout reproduction (Parker et al 2007)

This information was used to support the conduct of the national consultation held in 1998 (Scottish Natural Heritage, 1998). During the national consultation, the proposal was put that a 'full' re-introduction of the European beaver take place. Three types of survey were undertaken during the consultation;

1. In a 'passive public' opinion survey involving 2,141 interviews, 63% of the general public supported a re-introduction, 12% were against, and 25% had no view.

2. A total of 1,944 written responses were received during a 'pro-active public' survey. Overall, 86% of this sample was in favour of the re-introduction. A smaller majority of land managers and those with interests in forestry supported re-introduction. However there was a lack of support from those with interests in fishing and agriculture.

3. A total of 281 consultees were also approached of which 144 (51%) responded. Reactions were mixed. Conservation and academic sectors were the most supportive, fishing/angling interests the least supportive.

The outcome of this consultation was subsequently placed in the public domain for discussion (Scott Porter Research & Marketing Ltd, 1998). The consultation demonstrated that a majority of the public were in favour of a re-introduction but certain interest groups raised a number of specific concerns. Consequently, the SNH Board agreed in November 1998 to progress with the development of a scientific trial re-introduction for a fixed period and in a limited area to test the feasibility and effects of beavers being re-introduced to a Scottish environment. During the national consultation process, Forestry Commission Scotland (FCS) had suggested that the FCS estate could be used for a trial, subject to certain conditions, and this proposal was re-visited at a later stage (see below).

Following the Board decision, further work (Kitchener & Lynch, 2000) was conducted to investigate the most suitable source of beavers for re-population of Scotland through the comparison of fossil remains in Britain with extant populations in Europe and Scandinavia. A review, commissioned jointly with FCS, collated the evidence on the likely impact of beaver presence on woodland habitats (Reynolds, 2000) and a predictive model was developed to ascertain the number of animals required for a re-

introduction and the potential survival of the released animals (Rushton *et al.* 2000). All of the above information has been published.

Prior to confirming the site currently proposed (Knapdale Forest), a Geographic Information System (GIS) study was commissioned by SNH to identify sites which were suitable for a trial release (Carss *et al*. 1999). This work refined the earlier assessment of suitable habitat, setting additional criteria specific to a trial situation, e.g. containment, provision for research on impacts of land uses. Following this, in 1999, SNH entered discussions with FCS over the possibility of conducting a trial on its land-holding. Two potentially suitable sites were identified through GIS-analysis (see Section 2.1) and were subsequently examined in greater detail (Daniels *et al* 2000). Of these, Knapdale Forest was considered to be the most suitable. An approach was made to FCS on this basis whereupon the Forestry Commissioners agreed in principle to host a trial conducted by SNH, subject to a number of conditions which will be linked to a lease agreement for the site in Knapdale Forest. The trial will therefore take place on the FCS estate at Knapdale.

The Scottish Beaver Trial is a collaboration between Scottish Wildlife Trust and The Royal Zoological Society of Scotland. There will be two tiers of management for the project with initial planning, consultation and national overview being the responsibility of the Beaver Steering Group. The implementation of the work on the ground will be the responsibility of the Beaver Project Team. A stakeholder forum has been established to allow others to feed into the management process. A local beaver supporters group will be established and enabled to contribute practically to the trial.

RZSS, SWT, in collaboration with its partner organisations, will maintain an engagement with local community and wider public through the following mechanisms:

- regular issue of press releases to local and national media throughout duration of trial. In general we aim to establish a good and open relationship with the media, particularly locally;
- co-operate as far as possible with the makers of television documentaries who are interested in the project;
- regular issue of a newsletter to the local community throughout the trial;
- the provision of interpretation and educational materials.
- involvement of universities in research projects at Knapdale e.g. for student dissertations.
- provision of local interpretation and education for interest groups on-site and off-site;
- involvement of the local schools in the project.
- the provision of local volunteering opportunities connected with various aspects of the trial.
-

2.3 Local Consultation

A local consultation process in the Knapdale area was initiated in October 2007. The feedback received at the time of production of this licence application is provided in annex 4

3 LOCATION

3.1 Site identification

Work to identify a specific trial site on FCS land-holdings was undertaken in 2000. SNH conducted a GIS analysis using data sets produced by the Institute of Terrestrial Ecology (ITE) (Webb *et al.* 1997). A key enhancement of the analysis was that an improved woodland dataset (the Millennium Woodland Database) which highlighted suitable beaver habitat across Scotland north of the central belt. This distribution was overlaid with FCS land-holdings data. While the initial report demonstrated that high quality release sites were both numerous and widespread, a short list of FCS sites was identified, and for each site a preliminary assessment was made as to its ecological and practical suitability. Following further examination and discussions between SNH and FCS staff, the initial list was shortened to three specific sites; Knapdale, Loch Awe and Loch Shiel.

Knapdale was finally judged to be more suitable for a trial for additional practical and logistical reasons and remains the favoured site for the proposed release in 2009.

3.2 Knapdale

SWT have over 25 years of experience of working in partnership with FCS at Knapdale and through the work of both staff and local volunteers have extensive knowledge of this particular area.

The proposed trial site includes a SSSI (Knapdale Woods SSSI), notified for its breeding birds, bryophytes, lichens, dragonflies, loch trophic ranges and upland oak woodland. It is also part of a wider SAC (Taynish and Knapdale Woods) put forward for its oak woodland, freshwater lochs, marsh fritillary butterfly *Euphydryas aurinia* and otter *Lutra lutra* interests. At the time of the previous licence application in 2002 an 'appropriate assessment' of the proposed trial at Taynish and Knapdale Woods SAC was undertaken, in terms of Articles 6.3 and 6.4 of the Habitats Directive, as enacted through Regulations 48 and 49 of the Conservation (Natural Habitats etc.) Regulations 1994 (the 'Habitats Regulations'), for the trial re-introduction of the European beaver *Castor fiber* to Taynish and Knapdale Woods SAC.. On the basis of the analysis undertaken, it was considered there will be no adverse impact on site integrity as a result of the trial re-introduction of the European beaver to Knapdale. To provide further reassurance, particularly regarding cumulative impacts which cannot be precisely modelled in advance, a monitoring programme will form an integral part of the trial. This will measure overall changes, if any, in each qualifying feature against baselines established before the trial begins. The results will be formally assessed against the conservation objectives every 6 months. An exit strategy (see Section 7.6) for the project has been incorporated into the project in case the trial needs to be terminated at any time.

The Knapdale peninsula (see map in annex 1) in mid Argyll is bounded to the north by the Crinan Canal, the south by east and west Loch Tarbet, on the east by Loch Fyne and on the west by the Sound of Jura. The landform of the northern part of the locality containing the trial site, Knapdale Forest, is dominated by a unique landscape comprising a whole series of northeast – southwest aligned ridges (knaps) and small valleys (dales) which range in altitude from sea level to 276 m. The western sea bound and central sections of Knapdale Forest (the 'core area' where the beavers will be released, OS grid reference NR7990) are heavily bisected by the knaos and a series of sea and freshwater lochs. The freshwater bodies extend from small lochan up to 2 km long lochs which are interconnected and

drained by small burns streams draining to the sea in a southern direction.

The semi-natural vegetation of Knapdale in the late 19th century comprised a complex mosaic of broadleaf woodland dominated by abandoned oak coppice and small patches of improved grazing (and arable fields). The higher elevation land was comprised of *Calluna/Molinia* dominated by heather and grass sheep walks. 20th century afforestation by the FC mainly in the 1930s-50s, but continuing up until the early 1980s, resulted in Knapdale Forest. A range of conifer species primarily Norway and Sitka spruce were established on open ground and as a replacement for broadleaf woods which were felled, inter and under planted. From 1985 onwards following a major review of broadleaf forest policy a major programme of conifer harvesting and felling to recycle has taken place in the core area of native woodland in Knapdale. This has been accompanied by a major effort by FCS forest ranger staff to reduce the resident deer population from levels in excess of 20 deer per km^2. This has resulted in significant levels of natural regeneration of native woodland. Broadleaves, predominantly birch *Betula* spp., and to a lesser extent willow *Salix* spp., alder *Alnus glutinosa* and hazel *Corylus avellana* are mainly associated with the lochs. Oak *Quercus* spp., sycamore *Acer pseudoplatanus* and scattered aspen *Populus tremula* also occur but are mostly confined to the Fairy Isle and Bàrr Mor peninsulas in the south west of the area.

The core area of the site for the beaver trial, which is dominated by the interconnecting freshwater loch system and associated broadleaf-dominated woodland, covers approximately $15km^2$. Within this there is currently about 15km of riparian habitat suitable for beaver. This figure is expected to increase as FCS continue their programme of habitat restoration. The landform and resultant hydrology coupled with the distribution of forest and riparian habitats suitable for beavers will provide a reasonable prospect of natural containment. The steep escarpment along the north boundary, the conifer plantations to the east and west and the saltwater lochs to the south and west are the main barriers to beaver movements. The short watercourses are the likely routes for beaver movement around the site although beavers have been recorded moving short distances across seawater when dispersing.

The area also forms part of the North Knapdale National Scenic Area and the forest also hosts a number of low key FCS recreation facilities comprising an information and interpretation centre, a series of walking and cycling trails and several public car parks.

The site has been notified as a SSSI and is part of a wider SAC (Taynish and Knapdale Woods) put forward for its oak woodland, freshwater loch, marsh fritillary butterfly *Euphydryas aurinia* and otter *Lutra lutra* interests. The area also lies within the North Knapdale National Scenic Area. The forest also hosts a number of low key FE recreation facilities comprising an information and interpretation point, a series of walking and cycling trails with onsite interpretation. The lochs are fished by local angling associations. The whole site is subject to FCS's policy of open access exercised under the FCS bylaws. These access and recreational opportunities are important locally as a resource for communities and tourists. Knapdale is a working forest where a range of forest operations will be ongoing. These will be undertaken in accordance with a forest design plan approved by FCS following consultation with key stakeholders (including SNH) and local communities. The SSSI/pSAC are managed in accordance with a specific plan agreed by SNH. All forest management is undertaken to the standards set by the UK Forest Standard and UK Woodland Assurance Scheme independently audited by Forest Stewardship Council (FSC).

The Knapdale Forest, like much of the surrounding area is rich in archaeological history and remains. The trial area contains 13 Scheduled Ancient Monuments (SAMs) and 125 Unscheduled Ancient Monuments (USAMs). All scheduled sites are recognised within the forest design plan and are covered by legally binding SAM management plans between FCS and the national governing body, Historic Scotland. The trial partners will work with Historic Scotland to ensure that the trial causes no significant detrimental impact upon the sites' archaeological heritage.

In light of the fact that FCS are continuing with its programme of conifer removal within much of the potential trial area; the deer population is under control and regeneration of native woodland is good. The Knapdale Forest has the following advantages as a trial site:

- it is ecologically suitable for beaver;
- it provides a range of terrestrial and freshwater habitats and species which can be evaluated
- natural containment is relatively good;
- it is a working forest, which will allow an assessment of beaver presence on forestry practices;
- there is one main owner, FCS;
- there is good access for field workers and visitors;
- local SNH and FCS offices are nearby;
- local people are generally supportive and interested (see details below);
- visitor facilities are already on site;
- visitor disturbance is likely to be low in the core part of trial site;
- Knapdale is a Special Area of Conservation (SAC) and therefore there may be opportunities to seek relevant European funding.

3.3 Release points

Three beaver families will be released in Knapdale at suitable release points that are adequately far apart to provide each colony with sufficient riparian habitat in its territory. This has to take into account the fact that beavers set up a territory that they will defend. Territory sizes vary depending on a number of variables but colony densities of 1.5, 0.5 and 0.1 colonies per km length have been estimated in good, quite good and mediocre beaver habitat in Europe. Based on published information and the views of Norwegian specialists who have seen the site, the quality of habitat at Knapdale is considered to be relatively good, but it remains to be seen what territory size the beavers establish. However RZSS will continually review the viability of this population and if necessary, augment with addition imported animals

The three initial release points are:

1. Creagmhor Area

This site comprises Creagmhor Loch (about 1.2km of bank) and an 'un-named loch' (about 0.5km of bank) immediately to the west, together with associated inflow, outflow burns. The un-named loch has softer banks than Creagmhor and probably provides a greater extent of suitable riparian bank into which the beavers could burrow. The south west outflow end of Creagmhor provides the greatest extent of soft riparian bank in this water body. The two lochs are not connected but are separated by about 70- 80m and a gentle ridge dominated by mature heather. It is likely that the beavers will be able to move between these two water bodies - however, if released at Creagmhor, it may take some time for them to move to the

un-named loch since there is no connecting burn. Movement by beavers from Creagmhor may also take place along the outflow burn in a SW direction.

The un-named loch is close to Loch Fidhle to the west, and is connected by its outflow stream. However there is a steep 25-30m drop between the two water bodies which may be sufficient to put off beavers moving downstream.

2. Loch Linne Area

The site comprises Loch Linne and the connected Loch Fidhle (about 4km of bank). There is a peaty peninsula between the two lochs that may be particularly suitable for a burrow/lodge site. The loch is extensive and appears to have good quality habitat, perhaps even sufficient to hold two or, even, three colonies.

3. Loch Coille Bharr

Loch Coille Bharr is the largest of the freshwater lochs highlighted for release and has at least 5km of wooded riparian bank.. A footpath goes around the loch but is quite distant from the shore at some sections at the SW end. Beaver specialists from Norway have suggested that this loch will be able to support two colonies of beavers (Duncan Halley, pers. comm.).

It should be noted that none of these lochs are feeder lochs for the Crinan Canal.

The extent of suitable habitat has been shown to be more than adequate for the three beaver families to be translocated to the site, and will allow for some expansion of the population within Knapdale. This has been confirmed by beaver specialists who have seen the site. The site should be sufficient to allow for any expansion of the beaver population over the five year field trial period. Experience with other European re-introductions has shown considerable variability in population increase rates.

Knapdale has relatively good natural containment. It is bordered to the north by a ridge, with most watercourses around the release sites flowing in a general southerly direction towards the coastline. The west and east sides are bordered by high density conifer plantation and are not suitable beaver habitat. Since beavers tend to restrict their movements to riparian areas, it is hoped that they will therefore stay within the Knapdale catchment while the carrying capacity of the site allows.

An agreement on behalf of the project partnership of RZSS and SWT has been drawn up with Forest Commission Scotland to accommodate the trial release on FCS property at Knapdale.

4 BUSINESS CASE

Following the consultation process the period of the trial following release of the beavers in Spring 2009 was increased from three to five years. For costing purposes the total length of the project is six years starting April 2008.

The total cost of the project is approximately £1,292k. A full breakdown of the estimated costs are provided in Annex 2. A major element of this cost is for

monitoring and research (£655k) the majority of which will be led, carried out and paid for by SNH. Should the licence be granted discussions will be held with SNH to quantify this figure more accurately.

In addition the budget for interpretation and communication of the project has been increased substantially (£140k) again to reflect feedback from the consultation exercise.

The Licence applicants anticipate funding the cost of this project from fundraising. Initial soundings from a variety of foundations, trusts and other organisations indicate a high level of enthusiasm for this project. Mammals Trust (UK) (PTES) has indicated that it would be prepared to commit approximately £150k to the project.

5 PUBLIC HEALTH

5.1 Disease and water quality

Beavers, like all wild mammals, have the potential to transmit disease. They have been associated in the public press with the human water borne diseases caused by *Giardia* and *Cryptosporidium,* and the fish parasite *Gyrodactylus salaris*. The former two are already present in Scotland and are an issue in terms of public health whilst the latter is an issue for fisheries. It is difficult, of course, to assess to what extent, if any, beavers will pose an increased/additional risk to public health through the spread of disease as there is little information from Europe on this subject. However, the pathogens listed above will be sampled for during the course of the quarantine period of the beavers to ensure that the released animals are disease free.

The question of disease-free animals being infected after release to the wild obviously poses a question of whether their presence enhances transmission of disease above that usually encountered. For this reason, RZSS and SWT will be working in partnership with the Public Health Department of Argyll and Bute Council, (ABC), to ensure regular monitoring of the area as part of the regime of public health control. Sampling was conducted in 2001 and will be repeated prior to any approval to release of beavers in order to obtain baseline data for comparison. A range of pathogens will be tested for within this programme. The design of protocols for public health monitoring is being led by Argyll and Bute Council and a quote for this work is expected in due course.. In terms of any impacts on water quality and/or water supplies RZSS/SWT will be guided by advice from ABC and Scottish Water. During the course of the trial, water quality samples will also be analysed from appropriate control sites in order to detect whether contamination occurs in the absence of beavers.

The concern has also been raised that the introduction of beavers will result in the introduction of *G. salaris* to our native population of salmon. However, the advice received indicates that this is a parasite of fish which requires a fish host to survive. Beavers are considered to be only potential external carriers of the parasite (i.e. *G. salaris* does not parasitise beavers). Government precautions will be followed to ensure that any animals are free from the parasite before leaving quarantine. Subject to approval of this licence aplication, animals will be taken from a Norwegian population which is currently reported as being in an area free of *G. salaris.*

6 Impact

6.1 Environmental Education

The first UK beaver reintroduction offers a unique opportunity for both media interest in the progress of the beaver families in Knapdale and for environmental education programmes locally and via appropriate electronic media. The RZSS education programme has been developed and is delivered by a team of expert Education Officers. It has experience of teaching all age and ability groups, developing educational activities for zoo visitors, and of field work in the UK and abroad. In 2007 RZSS was awarded the prestigious Sandford Award, by the Heritage Education Trust in recognition of our commitment and expertise in education supporting our natural heritage.

Throughout the trial 'Bringing Beavers Back' a dedicated RZSS module aimed at schools will be conducted both at the living collections and through the national outreach programme.

One of SWT's principal objectives is to encourage people to see, learn and enjoy wildlife and to create opportunities for greater involvement in wildlife conservation. It has significant experience in informal and formal education programmes involving its extensive network of wildlife reserves, visitor centres, ,children's groups, local members centres, volunteers and a wide range of public events, publications and electronic media.

The Forestry Commission operates its Forest Education Initiative which also has the capacity to communicate the story of beavers in Scotland.

The scope for a new on-site visitor centre for interpreting beavers in Knapdale has been considered and offers an ideal platform for local interpretation and public engagement and as a hub for beaver-oriented wildlife tourism.

The project will have the opportunity to establish measures for understanding public opinion regarding the return of beavers as well as the general rehabilitation of Scotland's natural heritage. The re-establishment of a number of raptor species in Scotland has captured a sense of responsibility and ownership towards key habitats and species. The continuation of this process is paramount for the achievement of the 2030 Vision of the Scottish Biodiversity Strategy.

6.2 Socio-economic

One of the aims of the trial release is to determine the extent and impact of any increased tourism generated through the presence of beaver.

A recent report to the Wild Britain Initiative illustrates the potential positive socio-economic impact that beavers could have across the UK and is appended in Annex 6 to this application.

The Argyll and Bute Council has identified the following objectives in its Corporate Plan 2007-2011 and beyond:

Argyll and Bute: Leading Rural Area
Vibrant Communities
• safe supportive communities with positive culture and sense of pride in the area

• vibrant local economy that is based on core attributes of the area, flexible and open to new opportunities
• a sense of history with a view to the future
• high quality public services and leisure/community facilities that attract people to settle in Argyll and Bute

Outstanding Environment

• high quality environment that is valued, recognised and protected
• the environment is respected as a valued asset that can provide sustainable opportunities for business
• an area that is accessible, yet retains its remote character

Forward Looking

• communities that are culturally rich with a desire to excel
• proactive communities where local people and organisations look for and create opportunities
• partnership working across all sectors to coordinate developments, market Argyll and Bute and remove constraints that limit possibilities
• communities that learn and use that knowledge

Tourism plays a major role in the local economy. There are significant opportunities to further develop tourism in Argyll and Bute, with an emphasis on the area as a 'quality destination' using the distinctive character of the area and key events to create higher quality jobs and to extend the tourism season

In the Scottish Executive strategy on tourism*: Scottish Tourism - The Next Decade* recognizes the importance of tourism as Scotland's biggest business – and emphasises the need for business entrepreneurship, product development and innovation. The wider Scottish tourism industry employs more than 200,000 people, contributes about £4.2 billion to the economy each year, and has ambitious plans for growth (a 50% increase in tourism revenue by 2015).

A recent study by Campbell et al (2007) suggest that the cost of damage caused by beavers in mainland Europe was rarely more than €10,000 per annum, per region. The study estimates that the potential revenue from beaver based wildlife tourism in Scotland alone would exceed £1.1million.

6.3 Biodiversity

Over the past decade Scotland has reinforced it's commitment to nature conservation through a series publications. In the 1997 document *Biodiversity in Scotland: The Way Forward*, produced by The Scottish Office, it states that 'The Government is committed to taking action in partnership with others to safeguard and where possible to enhance Scotland's biodiversity'. This commitment is further emphasised in Scottish Executive's 2001 policy statement *The Nature of Scotland* ; 'We are committed to sustainable development as part of all our policies, and a commitment to Scotland's biodiversity is an essential part of that'. Launched in 2004 The Scottish Biodiversity Strategy sets the stage for achieving a 2030 vision of Scotland as a world leader in biodiversity conservation. More recently the SNH Species Action Framework identifies the possible reintroduction of the European beaver as one of the priority actions for Scotland.

Beavers are a missing element of our native biodiversity and were lost due to human activities. Arguments have been proposed, therefore, that we have a moral responsibility to consider their restoration. However, beavers are also important keystone species in forest and riparian ecosystems. Their role as waterway

engineers - modifying their environment to make it more suitable for them to live in - has measurable benefits to other species. This is perhaps most significant through the creation of beaver ponds behind dams and through their foraging habits. Beaver ponds can act as sediment traps on rivers, help to reduce floods by increasing water storage, help to neutralise acid run-off, provide extra food and pools for fish, and create additional habitat for other aquatic wildlife. Their foraging behaviour can result in a coppiced woodland-type habitat in riparian areas, prevent the invasion by scrub of valuable wetlands and provide dead wood for invertebrates. Therefore if re-introduced they would have a beneficial effect on Scotland's wider biodiversity also. While no causal relationship was found, Elmeros et al (2003) reported an increase in otters following the successful reintroduction of beavers in Denmark.

7 PROJECT PLAN

7.1 Donor Country

7.1.1 Source population

The International Union for the Conservation of Nature (IUCN) has strict Guidelines on the reintroduction of species. The guidelines recommend that, as far as possible, the taxonomically closest population should be used in any re-introduction. SNH are following these guidelines, hence a report (Kitchener & Lynch, 2000) was commissioned to study the morphometric comparison of the skull of fossil British and extant European beavers, *Castor fiber*. The general conclusion of this study was that the skulls of Scandinavian beavers are the most morphologically similar to fossil British beavers.

A concern about using Scandinavian beavers for a re-introduction is that they are based on few founders from a Norwegian relict population and display low genetic diversity. However, researchers have not observed any problems in an intensively studied population in southern Norway that can be linked to low genetic diversity.

7.1.2 Environmental factors

Kitchener & Lynch (2000) recommended that it would 'perhaps be beneficial to select animals which survive in a similar climate with a similar selection of food plants and trees'. Telemark County, the proposed location of the source of beavers for the project, is in a relatively mild region of Norway and, although winter temperatures are lower than mid Argyll, it is anticipated that animals from this area will readily adapt. Beavers are highly opportunistic with respect to food plant choice would be able to utilise similar vegetation types in Scotland. Another advantage of using Scandinavian animals is that they will have adapted to a similar pattern of photoperiodism as found in Scotland.

7.1.3 Practical issues

Collection of donor stock will be done in conjunction with staff from Telemark College, Norwegian University of Science and Technology,. This offers a number of benefits:

- The participation of experienced and respected beaver ecologists
- The availability of animals which have a known life history. This may include the possibility of obtaining animals which are already implanted with radio transmitters (subject to equipment compatibility), thus reducing such intervention at a later stage. Many of the animals will also be tagged externally (ear-tags);

- The opportunity to select animals from rivers known to be free of diseases, such as *Gyrodactylus salsii* and *Giardia*;
- There is a history of co-operation on re-introduction work between Norway and Scotland. Norway provided the donor stock of White-tailed Eagles for the successful Scottish re-introduction (1968, 1975 -1985 and subsequently).

The main issues which will arise with the use of Norwegian animals are the more complex importation requirements due to the non-EU status of Norway. However RZSS has extensive experience in the movement of animals throughout the wider European region and has already been granted a licence for the import of wild caught beaver from Norway.

7.2 Procurement of release animals

A minimum of three family groups of beavers will be removed from the donor population and transported during autumn 2008 and retained in quarantine for six months, with a view to a release in spring the following year.

Family units of beavers consist of four to six animals on average (an adult pair, and up to two or three offspring of the current year and one or two offspring of the previous year). This would result in the capture of up to about 18 animals .

There is inevitably some risk that during the quarantine period there may be some animal mortality. RZSS and SWT, after consultation with relevant specialists, would consider not releasing any family to Knapdale which loses one or both adults during the quarantine period (the surviving animals from these families would instead have to be returned to the donor country or housed in a collection). Norwegian researchers currently use hand-netting as their preferred means of capturing animals. This is considered to be an efficient and safe means of obtaining target animals whilst they are fully visible (thereby minimising capture stress and risk). The use of targeted hand-netting may, however, incur additional time and expense to ensure the capture of whole family units. All efforts will be made to ensure whole family units are collected.

7.3 Quarantine

The importation of beavers falls under the Rabies (importation of Cats, Dogs and Other Mammals) Order 1974 (as amended). Consequently imported animals would be subject to statutory containment in approved quarantine facilities for a period of six months.

Prior to departure from country of origin all release animals will have undergone appropriate health screening to reduce substantially the risk of carriage of animal borne disease or the transportation of animals in suboptimal health. An appropriate quarantine facility has been identified.

7.4 Release

Prior to release all animals will be fitted with a number of identifying and tracking features. Each beaver will have numbered ear tags, radio-tags fitted to the tail and subcutaneous microchip responders should external tags fail or be lost. Two options are available for the release of animals: ‘hard release’ or ‘soft release’. ‘Hard release’ involves the direct release of animals to the wild from the transit cages. It presents a more cost-effective method of release but has the potential to expose the animals to greater stress, and thereby possibly enhanced susceptibility to disease and mortality factors. ‘Soft release’ involves the use of artificial lodge structures to provide shelter

for released animals. Whilst this is a more expensive and time-consuming method, it provides the potential to i) reduce stress to the animals by providing instant shelter and ii) reduce the need for animals to seek out shelter iii) reduce the risk of animals moving away from the specific re-introduction loch site.

The project will implement both soft and hard release approaches and take the opportunity to compare the efficacy of both methods at different release points.

7.5 Beaver Management

7.5.1 Containment options

It is important to reiterate that this application is for a licence to conduct a trial release of beavers in Knapdale. As such, the requirement for appropriate project staff on the ground is paramount. There will be adequate project staff based in Argyll to conduct the day to day management of the trial and to respond to emergent needs as they occur. Additional support staff will be available from both SWT and RZSS should interventions occur such as the capture of beavers moving outwith the release site.

The primary aim of the trial is to establish, for study, a population of beavers within an agreed study site. However, as the beaver is a mobile species, there can be no guarantee (despite the provision of artificial lodges) that they will remain faithful to this particular site on release. Consequently provision is in place for deliberate containment of the animals.

Several methods are available by which the movement of released animals may be restricted (see below). Each of these methods presents some risk of animals escaping from the site undetected. Consequently, it must be recognised that there is no absolutely assured method of confining the animals. In accepting this principle, a priority of the trial is to ensure sufficient staff and resources are available to enable efficient monitoring of each of the animals following release both within and immediately surrounding the trial site.

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There are three main approaches to containing released animals:

- physical barriers, e.g. fencing,
- habitat manipulation or
- capture and removal of animals straying beyond the accepted boundaries of the study.

Given the size of site which is required to investigate the characteristics of dispersal, it is unlikely that the integrity of a fence of sufficient length could be maintained at the standard required for containment. Nor is it desirable given that the primary purpose of the trial is to study beavers in the wild. Thus, whilst fencing may be suitable for fencing particular outflows of the release lochs initially and for small areas for other management reasons, this is not a viable option to restrict animal movement over, or from, the whole study site.

Habitat manipulation to deter/attract beavers along preferred routes has also been considered. However, given the capacity of the species to modify its environment to suit its needs, such an approach is likely to be costly and meet with limited success. Consideration should be given to investigating this method as a tool in long-term management, but it cannot be relied upon as a sole method of containment.

The third option, for the identification and removal of animals straying beyond the

agreed boundaries of the study, although expensive, is potentially the most reliable and efficient method of containment available. This is the option which will be used at Knapdale. All the released adult animals will be radio tagged individually for the purpose of identification and tracking, which will significantly increase the likelihood of detecting individual movements over an extended period of time (consideration is also being given to the use of remote data logging equipment capable of storing data from a number of antennae simultaneously).

7.5.2 Movement of animals outwith the trial area

The likelihood of individual detection by this method is particularly feasible given the limited number of animals which are required for the trial study.

It is still very likely that some animals will try to move outwith the trial area. The released animals will be radio-tagged and so any such movements should be detected, whereupon they will be trapped and retrieved. However, due to the possibility of tags failing, or young animals dispersing prior to being tagged, the possibility of un-tagged animals moving beyond the area must be considered. The tendency of the animals to remain close to the water and leave obvious feeding and engineering signs will assist with finding animals outwith the agreed boundary. In such cases, it is anticipated that the individual beavers would be reported to SNH within a relatively short period, aided by liaison with adjacent land owners and managers e.g. farmers, British Waterways staff (who manage Crinan Canal north of Knapdale), anglers, FCS staff, etc. Training in beaver ecology and behaviour will be offered at a local level by SWT and RZSS early on within the trial, in order to assist local landowners and managers recognise beaver field signs.

Whilst every effort will be made to contain the animals within the study area, provision will be made for the rapid and efficient removal of animals straying outwith the trial area. This will be implemented where animals take up residence in an area against the wishes of the landowner, or are considered to be causing unacceptable levels of damage.

Beaver trapping techniques have been well tested on the Continent. The safest and most efficient techniques are netting and the use of a cage-type trap. The latter has been developed by beaver specialists in Germany and is based on traps used for foxes and badgers. It can be used on land or in shallow water, is easy to set, and does not harm the animals or people. A similar system was deployed successfully by RZSS to retrieve a beaver found to be at large in Perthshire in August 2007.

Netting techniques have been developed in Norway. This involves the use of hand held nets used from boats or on land to trap the beavers. Netting is generally undertaken at night and spotlights used to locate the animals. This, too, has been found to be an effective technique, particularly in lochs and large river systems.

Trapping will be by the use of live-traps set on beaver runs. Trapped beavers will be returned to the trial area. It is anticipated that most animals will be returned to the location from which they strayed. However, in the case of unidentified animals (see above), suitable sites will be sought within the study area for re-release. Radio-tags will be checked, or fitted to untagged animals, to investigate the incidence of repeat offenders.

Movement of such animals will take into account the social nature of the species and, therefore, the need for integration into existing areas or social groups.

Alternatively they may be housed in a collection (previous agreement will be sought with the host quarantine facility to house a maximum number of straying animals). Under circumstances where these options are not available, the animals will have to be humanely destroyed (see below).

Whatever situation arises a holding enclosure will be made available by RZSS for transfer of animals from the trial to the captivity site.

The situation may arise when trapping is either unsuitable or unsuccessful for the removal of beavers from outwith the trial site. In this situation, animals will be darted or shot (experience from mainland Europe indicates that beavers are easy to control in this way). Shooting would be used as a last resort for any 'untrappable' beavers, where a landowner/manager requests rapid removal of the animal (and the conditions preclude trapping as an efficient means), or where no other way is identified of dealing with the situation.

7.6 Exit strategy

An exit strategy is an integral part of the project plan, although the Steering Group firmly believe that this will be a successful project. This may be implemented either during the trial if major insurmountable problems occur, or at the end of the trial. The reasons for considering implementation of an exit strategy are as follows:

1. Unsustainable and detrimental effects arise as a result of the re-introduction of beavers to the trial area;

2. There is an insupportable level of mortality in released animals as a result of persecution, human intervention or natural mortality attributed to trial procedures;

3. The security of the site is compromised to the serious detriment of the animals.

These criteria apply equally to forestry, agriculture, fishery, archaeological or conservation interests, as well as presenting options for implementation of an exit strategy where there appears to be serious risk to the health or status of released animals or their progeny.

There are four options described below:

Option 1: Repatriation of animals to the country of origin/transfer to other re-introduction programmes.

Option 2: Housing of animals in zoological collections

Option 3: Capturing, neutering and returning animals to live their life span in the wild.

Option 4: Humane control of animals

Methods of humane control are well known and the option would require the collection, or hunting, of all known animals for destruction.

Although relatively easy to implement, the ethical issues surrounding the control of animals introduced for the purpose of a scientific experiment need to be considered carefully.

7.7 Research and monitoring strategy

The research and monitoring programme has four main objectives:

- To determine the impact of beavers on the natural landscape and ecological components of the release site including mink;
- To ensure that any success or failure of the trial is measurable;
- To provide data for the purpose of informing a predictive model of any subsequent expansion of the trial or full nationwide beaver reintroduction.
- To contribute to our understanding of beaver biology
- To determine the socio-economic impact of the beavers in the local area through its contribution to tourism, employment etc

Upon granting of the licence and in conjunction with SNH, the initial priority for the research programme will be to establish baseline data on the main biotic indicators as described in sections 7.7.4 to 7.7.7.

With regard to the designated status of the Knapdale area, all bar one of the notified features of the SSSI and SAC have already had baseline Site Condition Monitoring carried out on them by SNH within the past five years.

An effective monitoring programme is imperative to ensure that sufficient and appropriate information is collated during the trial to underpin an informed decision on the feasibility and viability of restoring a widespread population of beavers to Scotland. Moreover, in order to ensure that the monitoring programme is effective, a protocol will be in place prior to the release of any animals to the study area.
Regular measurements will be made on the health and status of the beaver population, their behaviour and changes to environmental conditions locally both prior to and following the release of beavers. Subsequent comparison of this information will identify changes to local landscapes which may be attributed to specific aspects of beaver occupation or behaviour.

The use of GIS will play an important role throughout the whole project in the interrogation, analysis and presentation of data. Initially all existing survey information will be collated and, where appropriate, placed on GIS. The identification of release sites and habitat suitability has employed the use of GIS in a recent study in Austria (Maringer & Slotta Bachmyer 2006).

A paper entitled ‘Trial Re-Introduction Of The European Beaver To Scotland: Scientific Issues’ was submitted to SNH’s Scientific Advisory Committee (SAC) for consideration. A review of the findings of this paper is required

The presence of beavers in Scotland will also provide the opportunity to extend studies into aspects of beaver biology such as selective foraging (Haarberg & Rosell 2006), territorial scent marking (Rosell & Thomsen 2006), (Rosell & Sander 2006), (Kaltenegger D, 2003), territory and group size (Campbell et al 2005), space use and movement patterns (Herr & Rosell 2004)

7.7.1 Animal Health

The Beaver Project Team will be responsible for the health and welfare of the released animals and their progeny throughout the trial. Wherever possible, remote, non-invasive techniques will be used to assess the health status of individuals. Analysis of faecal material will provide information on gut parasite burden and cortisol as a measure of stress. Similar research will be conducted in Norway to provide comparative benchmarking data.

Individual release animals will be recaptured on an annual basis in order to assess overall body condition, external parasite load, dentition and the measurement of blood parameters.

7.7.2 Beaver ecology

Individual adult animals will be tagged, for the purpose of tracking and identification. Information on their health and status will be collected at regular intervals. The following parameters will be measured:

- Survival;
- Breeding success/fecundity;
- Distribution/dispersal;
- Interactions with other species.
- Understanding the biology of beavers.

Measurements of these elements will be made using field observations. Tagging of new individuals will require trapping and handling at suitable periods. In addition, the information collated through practical observations and surveys will provide a dataset which may be used to refine the accuracy of the initial predictive population model.
The distribution and habitat use by beavers will be monitored, providing information on

- Feeding areas;
- Types of food;
- Use of burrows and lodges.

As well as observing the impact of beavers on land use, measurements will be made to ascertain the impact of such activities on beavers, e.g. forestry practice and angling activities.

7.7.3 British Waterways

Close liaison with British Waterways staff will be a key part of the project in order to identify potential problems at an early stage. Potentially vulnerable sites, e.g. supply lochs and inflow/outflow burns, will be checked on a regular basis by project staff, and there will also be regular liaison with British Waterways staff.

7.7.4 Damming behaviour

In order to gauge the impacts of any dams built, it will be necessary to measure the frequency of construction and maintenance of beaver dams. Consequently, the following will be investigated during the course of the trial period:

- frequency of dam construction;
- seasonality of dam construction;
- method and dimensions of dam construction;
- the relative stability (longevity) of dams;
- the potential for major sediment pulses and downstream erosion as a result of single or multiple dam failures.
- effect of dam building on surrounding habitat (e.g. tree removal, flooding impacts)
- the efficacy of management removal of dams as a means controlling undesired dam locations

Measurement of these elements will be carried out primarily through direct, non-invasive observations. Information on dam construction will be associated with habitat information (see below) to determine any characteristics commonly attributable to siting or construction of dams.

7.7.5 Terrestrial and aquatic habitats

As well as monitoring the success/failure of the establishment of the beaver population, information will be collated at regular intervals from which to assess the ecological effects of beaver occupation locally. This will be measured on two scales; changes within the core range of beaver colonies, and gross changes at the level of the study site.

Terrestrial vegetation surveys will be undertaken in the riparian areas, and more detailed information will be collected on the distribution and abundance of tree species which beavers may use for food or engineering purposes. Detailed habitat maps prepared prior to the release of beavers will be used to record changes to the landscape during the course of the study. These will take into account any seasonal effects or trends in foraging behaviour noted throughout the course of the trial period (tracking changes through release and establishment phases). Existing information is currently being collated and new surveys are planned for spring 2008.

Parallel to the early stages of the proposed trial a separate activity is to be conducted under the obligations of the EU Water Framework Directive. Across Scotland, and specifically Argyll, River Basin Management Plans are to be drafted and subjected to consultation. The information generated through the monitoring of the beaver trial reintroduction will inform and make reference to the RBMP process and objectives.

A co-ordinated programme of work to effectively monitor the aquatic and semi-aquatic habitat over the trial period will be developed by April 2008. This will include the development of methods for monitoring aquatic/semi-aquatic macrophytes, water chemistry/quality and freshwater invertebrates at Knapdale during the trial period which will contribute towards an assessment of the effect of the beaver re-introduction to Knapdale. The programme will ensure the monitoring of these aquatic features is done in an integrated and cost-effective manner and that they link to other monitoring studies being undertaken at Knapdale as part of the beaver project. An initial baseline survey for aquatic macrophytes will be undertaken in summer 2008.

Physical ‘in-river’ and loch habitat parameters will also be measured. Primarily these will address:

- levels of sediment transport along the water course;

- the source of sediment stored/accumulated within beaver ponds;
- any changes in water level locally;
- the stability of banks occupied by beavers;
- alterations to the watercourse network attributable to the creation of beaver canals or re-routing existing watercourses;

7.7.6 Features of conservation interest

Baseline monitoring of the resident otter population will begin prior to the release of beaver. Otters are valued by the local community and the effect of beavers on the otter population was raised as a concern during the local consultation.

The Beaver Steering Group is aware of the current presence of American mink within the Knapdale area and will be investigating ways in which additional mink control can be facilitated through delivery and management of the beaver trial.

The proposed trial area contains part of the Taynish and Knapdale SAC and entire the Knapdale Woods SSSI. All features of the SAC and SSSI are subject to Site Condition Monitoring by SNH and the continuation of this process during and after the trial period will be vital in order to evaluate the impact of the beavers upon these important habitats and species. RZSS and SWT will work closely with SNH and FCS to ensure that such monitoring is delivered during the trial period.

Otter, *Lutra lutra* are an Annex II species identified within the Taynish and Knapdale Woods SAC. They are also highly valued by the local community and the effect of beavers on the otter population was raised as a concern during the local consultation. As part of SNH's Site Condition Monitoring process, a baseline survey of the resident otter population was last undertaken in 2005, when the population (which is mostly associated with the coast around Loch Sween, rather than within the freshwater bodies of the proposed trial area) was found to be in favourable condition. It will be necessary to ensure that the otter population is monitored during and after the trial period. The non-native mink is also a species present in the area and its detrimental impact upon native species is of great local concern. It is advisable to ensure that mink are monitored at the same time as the local otter population.

Marsh fritillary butterfly, *Euphydryas aurinia* is another Annex II species identified within the Taynish and Knapdale Woods SAC. The species was last surveyed in 2006 under Site Condition Monitoring requirements, when it was found to be in favourable condition. The majority of the local population is found outwith the trial area, in the Taynish NNR, but a small population is found in the heart of the trial area around Barnluasgan. It will be necessary to monitor this species during and after the trial.

The site is notified as an SSSI for its dragonfly interest, particularly for Hairy Dragonfly, *Brachytron pratense* and Beautiful Demoiselle, *Calopteryx virgo*. It is predicted that both species may benefit from the activities of beavers, such as the opening up of riparian areas and the increase in availability of dead vegetation for egg laying. Site Condition Monitoring of the dragonfly assemblage was last carried out in 2003, when the feature was recorded in favourable status. The monitoring of dragonfly species will also be undertaken within the trial period, again in co-ordination with Site Condition Monitoring requirements.

7.7.7 – Archaeological features

The Scheduled Ancient Monuments within the trial area already have an inspection regime in place as agreed in the relevant SAM Management Plans, and FCS and Historic Scotland staff will continue with this monitored programme with any additional impacts related to beaver activity recorded and if necessary acted upon.

7.7.8 Land uses

One of the key aims of the trial is to investigate the potential effect of beaver occupation on the landscape and current land uses. Knapdale will provide an excellent opportunity to examine beavers alongside ongoing forest management. It will include effects on infrastructure such as culverts, roads and ditches. Knapdale also has some small areas of rough grazing land within private land holding which could perhaps allow some examination of how they utilise this land use type. Land use information will be mapped prior to the release of beavers.

Biotic factors which influence freshwater loch fisheries will be monitored at Knapdale. Consequently, research on these topics will provide a basis for developing an understanding of the impact of beavers on water bodies, for example the change in water conditions around a beaver dam. It could be argued, however, that this research will be conducted largely on static water systems and, as such, will have limited applicability to flowing systems, such as salmonid rivers.

7.8 Risk Assessment

The detailed risk assessment document is provided in Annex 6

7.8.1 Potential damage to agriculture

Given the limited number of burns within and adjacent to the trial area, it is anticipated that flooding would be unlikely to present a major problem. However, monitoring of vulnerable sites should allow the early detection of dam building behaviour and/or the identification of offending animals. Flooding effects can be tempered by the use of pipes although experience from the Continent suggests that this only delays the problem as beavers may construct another dam adjacent to this.

Feeding on crops is only likely to occur when they are within close vicinity of freshwater (20-60 metres). . Feeding on agricultural crops is unlikely to be a problem given that within Knapdale, there is a very low level of agricultural crop occurrence compared with a wide range of wild food plants in or adjacent to water.

7.8.2 Potential damage to forestry and woodland

The flooding of forestry land is not anticipated to present a significant problem given the hilly terrain of the trial site and the limited number of burns within and adjacent to the trial area. Also, the same principles of early detection apply as above. FCS staff will also be present within the trial site to assist project staff in the early detection of potential problems.

It is not anticipated from experience elsewhere that there will be much, if any, direct damage to the commercial conifers of Knapdale Forest.

Monitoring of riparian and other broadleaves will be carried out in the trial area as

part of the project and if unacceptable damage occurs remedial action will be taken which could include removal of offending beavers and/or fencing of vulnerable areas. A recent study of the impact of reintroduced beavers in Croatia suggested that 75% of young pedunculate oaks(*Quercus robur*) were undamaged (Margaletic 2006)
Liaison will be maintained with neighbouring land managers to detect flooding and tree damage at an early stage.

7.8.3 Fishing interests

Liaison with the local angling club which has a lease on most of the trial lochs will be an ongoing part of the project and should help to identify any problems at an early stage. To date some fishing licences have not been reissued by FCS and therefore impact on fishing interests has already been reduced. In addition the anglers have other sites in the local area, outwith the trial site, and will be able to report any signs of straying beavers. Due to the local habitat characteristics the trial release in Knapdale will not provide sufficient data on the impact of beavers and their activities on salmon fisheries. This investigation will need to be considered when selecting a second release site in phase II of the project. However, as part of stakeholder liaison organisations responsible for local fisheries interests will be invited to take part in the Knapdale Beaver Forum.

7.8.4 Water supplies

Private water supplies that might be at risk from dams, e.g. burn supplies, will be regularly checked by project staff and dams and offending beavers which may set up residence in these burns will be removed. Any problems in water quality or pathogens will be detected via the monitoring carried out for RZSS by Argyll and Bute Council, and necessary remedial action taken on their advice.

7.8.5 Health and Safety of project personnel

Project partners have a responsibility to secure the health and safety of all staff and others who may be affected by its operations. This includes project staff and volunteers working on the project.

FC as the landlord will place certain responsibilities upon the Project Partnership as tenant. Equally FE will have responsibilities as landlord to the Project Partnership and other tenants, contractors and the public. These arrangements will be vested in the lease to be drawn up between the partnership organisations.

All field staff and volunteers will be provided with full training on specific methods which should be adhered to, to ensure safe working conditions for all staff. This will include methods of handling animals safe access in riparian environments, dealing with conflict. Protective equipment, including radio equipment, will be provided to those working in the field.

7.9 Criteria for success/failure

During the trial, information will be collated, both on the scientific and socio-economic implications of the trial, and presented for consideration by the Beaver Steering

Group at the end of the trial period. This information, and the views of the Groups, will subsequently be presented to Scottish Government for consideration on whether the trial has been successful or demonstrated limitations. Then SNH will make a recommendation over future action and consult external parties and the Scottish Government to agree the way forward.

Criteria for success:

- Survival of introduced animals is similar to successful re-introduction programmes elsewhere in Europe at similar period of population establishment.
- A stable or increasing core population is achieved within the limits of the study site.
- The beaver population demonstrates a positive contribution to ecosystem function
- Beaver re-introduction is integrated with habitat management/restoration.
- The impact on the economy of the area as a result of the presence of beavers is positive

Criteria for failure:

- Mortality levels preclude establishment of a population.
- Significant and unsustainable damage is incurred by the ecosystem within the study site.
- The area suffers significant economic loss as a result of beaver activities
- Costs of project/damage/management significantly exceed expectations

7.10 Project management structure

Principle Applicants
RZSS, SWT

The Beaver Steering Group:
Members include RZSS, SWT, SNH, FCS and independent experts
Purpose: To advise the project team, to provide direction and support, and to co-ordinate all activities concerned with the success of the enterprise. To report every six months to Scottish Government on project progress.

The Beaver Project Team
Purpose: To implement the project on the ground including import and quarantine, release and monitoring of beavers, production of newsletter and to lead on local environmental education. To report each month to the Beaver Steering Group on project implementation progress.

7.11 Staffing

Project staff will be provided by both SWT and RZSS with recruitment of additional personnel as required.

8 TIMESCALE

- Autumn 2008 – beavers captured and brought to UK for quarantine

- Spring 2009 – beavers released at Knapdale.
- 2009 - 2013 – continuous monitoring and evaluation of trial by RZSS an SWT, in consultation with other appropriate parties and production of report for consideration by Scottish Government
- Spring 2010 - feasibility study begins on possible second release site for phase II of beaver reintroduction
- 2012 - if granted second release of beaver at new location
- 2014 - decision on beavers in trial area

9 COSTS

Because the project is a trial release, it will necessarily have a higher than normal cost because of the intensive monitoring and management intervention requirement.

The project budget takes into account the following cost centres:

Site preparation

Beaver capture, transport and quarantine

Project management

Education/Interpretation

Monitoring

A full project budget is provided in Annex 2

10 CONCLUSION

RZSS and SWT consider that a scientific trial at Knapdale is the appropriate way to proceed to help determine the suitability of the re-introduction of beavers to Scotland. The proposed trial incorporates adequate safeguards for the natural and cultural heritage and land and water interests and its scientific approach will provide sound information to help guide future decisions. RZSS and SWT requests that Government grants a licence for the trial release of European beaver into the wild in Scotland at Knapdale, Argyll, under Section 16(4) of the Wildlife and Countryside Act 1981 as amended.

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ANNEXES

Annex 1 Map of Knapdale Trial Area

Annex 2 Business Case and Finance Spreadsheet

Annex 3 SNH Response to the Minister's letter of 20 December 2002

Annex 4 SWT report on the local consultation Oct/Nov 2007

Annex 5 Economic Impacts of the beaver, Report for Wild Britain Initiative (2007)

Annex 6 Risk assessment

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May 2008

BEAVER REINTRODUCTION PROJECT

I refer to your application submitted to the Scottish Government on 21 December 2007 for a licence under section 16(4) of the Wildlife and Countryside Act 1981, to release European beaver for a trial reintroduction in Knapdale, Argyll.

I am pleased to be able to tell you that we have decided to grant a licence for the project as set out in your application.

The licence allows the Scottish Wildlife Trust and Royal Zoological Society of Scotland to release up to four families of beavers (each family to comprise not more than two adults and their kits) within the Knapdale release site as defined in the application. The release of the beavers will not take place until 2009. There will then a period of five years to assess the viability of the reintroduction. Any further releases of beavers at the end of the trial or in relation to any other trial will require a further licence from the Scottish Government. The decision on whether to grant any further licence is a matter for the Scottish Government.

The licence is subject to a number of conditions set out in the attached annex. These relate to the management of the project, the potential impact on the protected areas and species within the release site and the arrangements for post release monitoring.

We have received a number of letters from individuals and national organisations expressing serious concern about the potential impacts on their properties and businesses. I recognise that many of their concerns may only be assessed in the context of an actual trial taking place. However I attach great importance to the project maintaining a channel of communication by which the concerns of local businesses and property-owners are taken into account, and, where possible, conflicts are averted before they occur.

I wish the beaver reintroduction project every success, and I look forward to the opportunity to see these charismatic animals at home in the Scottish countryside

MICHAEL RUSSELL MSP
Minister for Environment

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ANNEX

BEAVER REINTRODUCTION PROJECT

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2) The release of the beavers will not take place until 2009.

SNH Role

3) SNH to coordinate a monitoring programme in collaboration with the project partners through an appropriate group, and involving SNH's Scientific Advisory Committee. The group, chaired by SNH, will maintain a suitable level of scientific independence from the other project groups.

   SNH, in collaboration with the group, will:

   - Collate information on behalf of the Scottish Government (SG).
   - Assess and approve all research, survey and monitoring projects associated with the project (including those projects which SNH will not necessarily lead on, e.g. public health), thereby ensuring limited resources are directed at addressing the core objectives of the trial.
   - Coordinate research, survey and monitoring projects to ensure collaborative opportunities are identified, data is collated in compatible formats, disturbance to beavers minimised and detrimental effects to nature conservation interests avoided (e.g. SAC, SPA, species etc.) .
   - Ensure all data and information collated during the trial has joint ownership and is made publicly available.
   - Produce a pre-release monitoring programme and a post-release monitoring programme by the year of the release, both plans to be submitted to the SG

   SNH will also lead, in collaboration with other partners where appropriate, on specific projects relating to the monitoring and modelling of the beaver population, and the monitoring of the effects of beaver.

4) SNH to report to the SG on whether the conditions of any licence are being fully addressed on the ground.

Beaver management

5) We would recommend the collection and quarantine of a fourth family as a useful back-up, in case of any mortality during the quarantine period. Beaver mortality during quarantine is not uncommon.

6) We would strongly recommend that all animals are 'soft released', with all precautions taken to limit the risk of individuals dispersing away from the trial area, and details to be agreed with SNH.

7) We would strongly recommend one simultaneous release of all the animals at the start of the trial, rather than a series of phased releases. This will help to ensure that the animals have the opportunity to establish territories at the same time, and it reduces the risk of animals dispersing away from the trial area.

8) Consideration should be given as to whether all animals which move outwith the proposed trial area should be removed, or just those where the land owners request it.

9) Localised mink control should be considered during the initial establishment of the population to protect beaver kits. The details of any mink trapping must be agreed with SNH to take account of SAC qualifying interests and European Protected Species

Project management

10) The European beaver is included within the Species Action Framework (SAF). All species identified on the SAF have an implementation plan which sets out objectives, actions and tasks which need to be undertaken. It identifies also lead partners for each task and sets out resourcing issues. The European beaver is the only one of the 32 SAF species for which a plan has not yet been drafted because a project has not yet been approved. SWT/RZSS to draw up an implementation plan with its partners and SNH, and the plan must be made publicly available (e.g. on the SAF web pages).

11) SNH should be represented on the "Beaver Steering Group" and a "Beaver Project Team" as observers.

12) The licence applicants should ensure they have in place a forum to allow the views of lthe local community, including local businesses and property-owners, to be fed into the decision-making processes for the project.

13) The length of the collection and quarantine element of the project is one year, and the fieldwork element of the project is five years. The applicants need to plan for work extending into year seven to allow time for all monitoring work to be completed, and analysed.

14) Once the beavers are released, the licence applicants must be able to ensure that they can implement the key elements of the trial, as set out in their application, and address any conditions set by the SG. If resourcing is insufficient to continue the trial as agreed, then the exit strategy will need to be implemented.

15) The role of the Field Officer should include regular monitoring of 'sensitive' areas to ensure potential problems are avoided. This to be discussed and agreed with relevant adjacent land owners and relevant public bodies (including British Waterways, Historic Scotland, FCS, and SNH).

16) A training event should be held in the Knapdale area immediately prior to the release of animals. This will ensure relevant project staff and local people are fully aware of,

and prepared for, practical beaver management issues which may arise during the project.

17) Discussions, involving the project group members and SNH, to be held with the local FES District to ensure future management of woodland takes into account beaver issues.

18) Arrangements must be put in place by the licence applicants to ensure that local businesses and properties have a clear route to pursue compensation claims for damage caused by the beavers during the period of the trial.

19) The exit strategy must be implemented at any time if this is considered necessary by the SG. The SG will consult with the licence applicants and with the monitoring team led by SNH before deciding that the exit strategy should be implemented.

Research, Survey and Monitoring

20) A suite of tracking methodologies should be employed, rather than relying too heavily on radio-tracking techniques, which may have a number of practical and animal welfare limitations. This will be addressed through the monitoring programme to be led by SNH.

21) Argyll and Bute Council to lead on public health monitoring (in discussion with Scottish Water), with relevant veterinary advice from RZSS. SNH's role would be to ensure that any monitoring is effectively and efficiently coordinated with other elements of the overall monitoring programme.

22) SNH to discuss with the licence applicants the potential role of the full-time Field Officer in collating data for some aspects of the scientific monitoring work.

Mitigation of impact on protected sites and species

23) Beaver dam construction on burns to be carefully monitored and SNH to be informed immediately once new dams are created. An assessment will then be made by SNH on a case by case basis and, if judged necessary, management of the dam will be required.

24) Beaver dam construction on loch outflows to be carefully monitored and SNH to be informed immediately once new dams are created. If beaver dams are constructed on the outflows of oligo-mesotrophic lochs within the SAC, then the natural water levels of the lochs must be maintained, either through the use of beaver-specific devices which can be incorporated to manage water flow, or through removing the dam. The details to be discussed and agreed with SNH.

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29) If divers are breeding on Loch Clachaig in any year then checking for beavers must be carried out without any disturbance to the breeding birds. Black-throated diver is listed on Schedule 1 of the Wildlife & Countryside Act 1981, as amended, therefore, prior to any survey work, relevant project staff must apply for a licence from SNH.

30) A visitor management plan must be agreed and implemented prior to the release of beaver and during the lifetime of the project (addressing issues such as signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.). This plan and the design of associated facilities must be discussed with and agreed with SNH.

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Landscape and Habitats Division
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May 2008

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Landscape and Habitats Division
Scottish Government
May 2008

Trial reintroduction of European beaver to Knapdale Forest – Advice and Recommendations to the Scottish Government by Scottish Natural Heritage.
8 May 2008.

DOCUMENT 1

LICENCE APPLICATION TO THE SCOTTISH GOVERNMENT FROM SCOTTISH WILDLIFE TRUST AND ROYAL ZOOLOGICAL SOCIETY OF SCOTLAND RELATING TO A PROPOSED TRIAL REINTRODUCTION OF EUROPEAN BEAVER TO KNAPDALE FOREST - SNH COMMENTS AND RECOMMENDATIONS.

CONTENTS:

1. INTRODUCTION

The following document sets out general comments, specific comments and recommendations relating to the licence application package submitted by RZSS and SWT.

The Scottish Government may wish to use the SNH recommendations set out at the end of this document, if judged appropriate, as conditions in any licence provided to RZSS/SWT. Note there are also recommended conditions listed in Document 2 (SNH's appraisal of the proposal in relation to possible effects on Taynish and Knapdale Woods SAC and Knapdale Lochs SPA) and Document 3 (SNH's appraisal of the proposal in relation to possible effects on Knapdale Lochs SSSI, Knapdale Woods SSSI, European Protected Species, Schedule 5 species, Badger and Knapdale NSA).

2. GENERAL COMMENTS

- A large proportion of this application appears to be based on the previous licence application submitted to Scottish Executive in January 2002 by SNH. However there are variations.

- As already discussed with officials of the SG, SNH should coordinate the independent monitoring element of the trial (the monitoring and

modelling of the beaver population, and the monitoring of the effects of beaver) and possibly have a role to coordinate overall research, survey and monitoring. We suggest that this should involve the setting up of an appropriate group chaired by SNH which includes representatives of relevant project partners. This will ensure that work is prioritised to provide answers to the key questions relating to the reintroduction of beavers to Scotland. It will also ensure data ownership belongs to the overall project, and can be made publicly available. Details are provided in recommendation 'a' of the Recommendations section below.

- SNH could then report to the SG on whether the conditions of any licence are being fully addressed.

- SG may also wish to consider setting up and chairing a group which could meet occasionally to discuss progress with, and input to, the trial. Representation of the group may be drawn from various conservation, land use and freshwater sectors. SNH could provide reports on the monitoring of the trial to such a group.

- We envisage that SNH would be members of both the Beaver Steering Group and the Beaver Project Team, as observers.

- It is important to stress the need for involvement of the local community in the project. The discussion on the consultation should recognise the concerns of some of the local community and ensure that they are involved in the direction of the project in future. The application does refer to local involvement, including a Knapdale Beaver Forum, and the role of this forum should be stressed as an important part of the management of the project

- The project is for six years, one year preparation and five years of trial release. This seems to assume that all the assessment and monitoring work will be finished well before the end of year six to give time for the SG to make a decision. Assuming that five years is the length of the fieldwork element of the trial, the project should, in reality extend into year seven to allow time for all monitoring work to be completed, analysed and made widely available to help inform any decision over trial.

3. SPECIFIC COMMENTS

The following comments refer to the main document of the licence application package submitted by RZSS and SWT.

p.1 – Summary - Reference is made to the collection of three beaver families. There may be merit in adding a fourth family as a useful back-up, in case of any mortality during the quarantine period. If all four families survive, then the fourth family could be released or kept in captivity.

p.3 – Section 2 - Statutory and Strategic Framework - Reference is made to the information provided in Annex 3 of the licence application. This is a document originally produced by SNH and which is described as still being "valid". Although this is largely the case, it should be noted that this SNH document was produced in early 2005, and some of the information is now out of date. We have, however, produced an update on the European experience with beaver as part of this package of advice to the SG.

p.4 – Section 2.1 – Legal position - Reference is made to the legal protection which may be applicable to beaver during any trial. We understand this issue is being clarified by the SG.

p.4 – Section 2.1 – Legal position - It states that the "Trial animals will remain the property of the project partnership". We assume they will actually be the property of the licence applicants, RZSS and SWT. Again, we understand this issue is being clarified by the SG.

p.4 – Section 2.1 – Legal position - Reference is made to the issue of species protection which may be applied to beaver in the longer term. This could include consideration of the addition of beaver as a European Protected Species (EPS) on Schedule 2 of The Conservation (Natural Habitats, &c) Regulations 1994, as amended. EPS of animal are derived from Annex IV of the Habitats Directive. It is worth noting that European beaver is also listed on Annex II of the Habitats Directive. Again we understand that the legal status of the animals is being clarified by the SG.

p.6 – Section 2.2 – Public consultation
p.24 - Section 7.8.3 – Fishing interests
p.25 – Section 7.10 – Project Management Structure
Sections 2.2 and 7.10 refer to a proposed "Beaver Steering Group" and a "Beaver Project Team" (to implement work on the ground). Section 7.8.3 also refers to a "Knapdale Beaver Forum", and Section 2.2 refers to a "stakeholder forum" which we understand are the same - apparently this has already been established "to allow others to feed into the management process", although we are unaware of how this forum has been operating and who is represented on it. Finally, Section 2.2 refers to a "beaver supporter's group" to allow people to "contribute practically to the trial".

SNH agrees the need for the Beaver Steering Group and a Beaver Project Team, and we envisage being represented on these groups as observers. There is also a need for the involvement of the local community in the project. The proposed Knapdale Beaver Forum would therefore play an important part of the management of the project, as would any associated, more informal beaver supporter's group which could encourage wider local involvement.

In addition to these groups, we anticipate an independent group chaired by SNH to lead on the scientific monitoring. (see General Comments, and Recommendations 'a' and 'c', for more details)

p.6 – Section 2.2 – Public consultation - A proposal is made for wide engagement. While this is to be encouraged, it needs to be done in such a way that it does not undermine the core purpose of the trial, and does not have a detrimental impact on the SAC and SPA qualifying interests, the notified features of the SSSI or any other such features. Therefore the proposed involvement of film crews, universities etc. will need to be carefully planned and coordinated (the issue of visitor management is addressed in SNH's appraisal of the proposal in relation to possible effects on Taynish and Knapdale Woods SAC and Knapdale Lochs SPA, enclosed with this document). In the case of university involvement, there is also a need to ensure all data is shared and made publicly available, which can be done via the proposed monitoring group to be chaired by SNH.

p.6 – Section 2.3 - Local consultation – It is important, once and if the project is approved, to clarify precisely how the project will incorporate feedback from the local consultation into the trial design. This issue is referred to, in general terms, in the Local Consultation report (Annex 4 of the licence application package).

p.7 – Section 3.2 - Knapdale - Reference is made to the previous appropriate assessment. Note that the SG is the competent authority for this new licence application, with advice from SNH.

p.8 – 1st line – Section 3.2 - Knapdale - Note that some of the lochs in the eastern part of the trial area flow north-east towards the Crinan Canal (i.e. the feeder lochs for the canal), rather than towards the south.

p.9 – Section 3.3 – Release points - The proposal is to release three families, which RZSS will review and augment if necessary. Efforts should be made to undertake one simultaneous release to ensure that the animals have the opportunity to establish territory at the same time. Consideration should be given to capturing and quarantining a fourth beaver family from Norway (see comments for page 1 above). The first animals released are likely to set up larger territories than those coming later, the consequence being that any further releases of new animals will result in an increased likelihood of the new animals being unable to establish territories, and therefore dispersing away from the site (this is unlikely to be such an issue for related juveniles of the existing families when they leave their parental groups to set up territories in the Knapdale area).

p.10 – Section 3.3 – Release points - Reference is made the extent of suitable habitat at Knapdale. Although the licence applicants do not refer to it, SNH have already modelled future beaver expansion at Knapdale and assessed this issue (Rushton, S, South, A & Lurz, P 2000 Predicting the outcome of a proposed re-introduction of the European beaver *Castor fiber* at Knapdale, Argyll*. SNH Commissioned Report* F022AC327, Battleby). The study concluded that the mean population size after 5 years, starting with three families, was between 26-28 animals, as predicted by two types of models. The carrying capacity of Knapdale was judged to be around 18 families (assuming approx. four animals per family). It is recommended that

SNH maintains an overview of such beaver models in order that this can be made into a publicly available tool for Government and others.

p.10 – Section 3.3 – Release points - It is stated that "An agreement on behalf of the project partnership of RZSS and SWT has been drawn up with Forest Commission Scotland to accommodate the trial release on FCS property at Knapdale", It may be necessary for the SG, and SNH, to see and comment on this in due course, in order to ensure it complies with the conditions set out in any licence.

p.10 – Section 4 – Business Case – The monitoring and research element is set at £655K and the "…majority of which will be led, carried out and paid for by SNH." It should be emphasised that this figure has not been discussed or agreed with SNH.

The interpretation and communication costs are £140K – Although SNH sees the need for this element of the project, it needs to be emphasised that the project is a trial, with an exit strategy built in if required. Consequently this needs to be considered when planning the lifespan of any interpretation and communication infrastructure.

The overall project will be expensive, with so far no clear indication over how it will be funded. It is reasonable, however for the RZSS and SWT to argue that they need the certainty of a licence before they can fully engage in detailed fundraising. This can of course continue over the lifetime of the project. Once the beavers are released, the licence applicants must be able to ensure that they can implement the key elements of the trial, as set out in their application, and address any conditions set by the SG. If resourcing is insufficient to continue the trial as agreed, then the exit strategy will need to be implemented.

p.11 – Section 5.1 – Disease and water quality - RZSS/SWT propose to work with ABC on public health monitoring, a proposal which SNH supports. RZSS veterinary expertise may be of value in this regard. However, the independence of the public health monitoring will be important and we agree that ABC (in discussion with Scottish Water) should lead on this element, as stated. SNH's role would be limited to ensuring that any monitoring is effectively coordinated with other elements of the overall programme. Note that baseline public health monitoring has already been undertaken at Knapdale, and was published by SNH, (Morrison, A 2004 Trial re-introduction of the European beaver to Knapdale: public health monitoring 2001-3. *SNH Commissioned Report* 77, Battleby)

p.12 – Section 6.1 – Environmental education - In order for SNH to consider the proposal in relation to possible effects on Taynish and Knapdale Woods SAC and Knapdale Lochs SPA, further details were required, since the building of facilities, and visitor management, could have a 'significant effect'. Following confirmation with the SG, SNH therefore approached SWT and received further information on this issue. This information has been incorporated into "SNH's appraisal of the proposal in relation to possible

effects on Taynish and Knapdale Woods SAC and Knapdale Lochs SPA" which is enclosed with this document.

p.12 – Section 6.2 - Socio-economic - There are no specific proposals as to whether this might be investigated further during the trial. However, SNH has recently approved funding for a new SNH PhD based at the Scottish Agricultural College/ University of Edinburgh, entitled 'Evaluating the socioeconomic implications of species reintroductions in Scotland'. If the beaver trial is approved, the studentship could be directed to give particular attention to the project.

p.13 – Section 6.3 – Biodiversity – Reference is made to the "SNH Species Action Framework" (SAF - although this is not only an SNH initiative, but one which a range of partners can contribute to). The applicants refer to the first aim set out in the SAF implementation plan for beaver, i.e. the reintroduction of beaver. However, they could also have usefully referred to the second aim of establishing associated conservation programmes for habitats and species. This omission is perhaps understandable since it is not part of the trial itself. It is worth noting, however, that there is the potential for the trial at Knapdale, particularly once it is well underway, to be used to stimulate wider thinking in relation to riparian woodland and wetland restoration, and to the management of species associated with these types of habitats.

p. 14 – Section 7.1.1 – Source population - Following recent scientific research, there has been discussion as to whether Norway necessarily has to be the sole source in biological terms. However, we would still support the use of Norwegian animals, as it is certainly an appropriate biological source.

p.14 - Section 7.1.3 - Practical issues,
p.15 - Section 7.4 - Release,
p.17 - Section 7.5.1 - Containment Options,
p.17 - Section 7.5.2 - Movement of animals outwith the trial area –
Reference is made to implanted tags. Following recent discussions with a range of specialists (also see Document 4), we believe a suite of tracking methodologies should be employed, rather than relying too heavily on radio-tracking techniques, which may sometimes have a number of practical and animal welfare limitations. Since the tracking of animals is an important element in the scientific monitoring, and practical management, of the beavers, it will be necessary to develop a suitable methodology which may use a range of techniques (such as various types of electronic transmitters, PIT transponders, visible tags, regular surveys, training and use of partners/public to report field signs etc.) This should be included as an element in the overall monitoring programme to be addressed by the proposed group chaired by SNH.

The Field Officer should regularly survey particularly 'sensitive' areas as a routine part of their job (e.g. Crinan Canal and its feeder lochs etc).

p.15 – Section 7.1.3 - Practical issues – It states "The opportunity to select animals from rivers known to be free of diseases, such as *Gyrodactylus salsii*

and *Giardia*". It should be noted that this statement may not be strictly correct - although research to date has not detected *Giardia* in beavers from the proposed donor site, this does not mean to say that the entire river area (or some beavers in the catchment) is free of it. However, the issue of possible disease or parasite transmission should be covered in their proposals for quarantine after the import of the animals.

p.15 – Section 7.2 – Procurement of release animals - "A minimum of three family groups…" As stated above, we would recommend four family groups.

p.15 – Section 7.4 – Release – The applicants suggest the use of hard and soft release explain methods to allow a comparison (soft release techniques involve a period of acclimatisation to the environment into which the animal will eventually be released, whereas in hard release the animals are introduced straight into the wild with no transitional phase). However, this is a trial reintroduction, with containment of animals a key issue. It does not seem appropriate, therefore, to test different release methods in this trial. SNH recommend that a soft release should be used as this should decrease the likelihood of animals moving away from the trial area.

p.16 - Section 7.5.1 – Containment options – Reference is made to habitat manipulation. In light of the fact that there are still substantial stands of conifer plantation (which are unsuitable habitat for beaver) within the central part of the trial area, we would recommend that discussions are held with the local FES District to ensure future management of woodland takes into account beaver issues (i.e. balancing of beaver containment and dispersal within the site, with management for designated site interests etc.)

p.17 – Section 7.5.2 - Movement of animals outwith the trial area – The proposal is that animals outwith the trial area will be removed if the landowner wants it. Therefore consideration should be given as to whether all animals which move outwith the proposed trial area should be removed, or just those where the land owners request it. Clearly, this is an issue of practical management for the project to resolve in detail, taking the advice of any advisory group that may be established.

p.17 – Section 7.5.2 – Movement of animals outwith the trial area – It states "Training in beaver ecology and behaviour will be offered at a local level by SWT and RZSS early on within the trial, in order to assist local landowners and managers recognise beaver field signs." SNH supports the need to educate, train and support project workers and other local people who may need to be aware of, or are interested in, beaver issues. We suggest that the project partners hold an organised training event in the Knapdale area immediately prior to the release of animals, which could involve experts from Europe who have had practical experience with beaver management issues.

p.18 – Section 7.6 – Exit strategy – The legal issues surrounding some of the exit strategy options proposed, (e.g. humane destruction), will need to be

confirmed, as part of the clarification currently being sought from lawyers by the SG.

It is highly unlikely that repatriation of animals to their country of origin (part of option 1) will be possible. It would be helpful if the project partners could confirm what their preferred option is in relation to the exit strategy.

p.19 – Section 7.7 – Research & monitoring strategy – This issue will require careful coordination. Consideration is required as to what is essential and what is desirable. Clearly the aims of the research and monitoring programme should be to address the overall objectives of the trial, and it is therefore important that all individual projects, of SNH and all project partners, are coordinated and contribute towards these aims (see Recommendation 'a').

We consider that the full-time Field Officer post will, in addition to providing on the ground management support for the project, be in an ideal situation to collate data for some of the monitoring work (e.g. hydrology). If the licence is approved, we will discuss this further with the licence applicants. Any programme of pre-release monitoring would ideally start during the late spring/summer months.

p.20 – Section 7.7.1 – Animal health – Reference is made to individual release animals being recaptured on an annual basis for testing. In fact, as stated above, if radio tracking methods are used, then some animals may need to be recaptured more frequently to allow the replacement of batteries on transmitters.

p.20 – Section 7.7.2 – Beaver ecology
p.21 – Section 7.7.5 - Terrestrial and aquatic habitats
p.22 – Section 7.7.6 – Features of conservation interest
p.23 – Section 7.7.8 – Land uses
Details on these aspects can be agreed in due course as part of the overall coordination of the monitoring elements of the trial by SNH.

p.20 – Section 7.7.3 – British Waterways – We agree that there is an important need for the Field Officer to regularly survey the canal, feeder lochs and burns, and indeed to visit any other 'sensitive' areas on a regular basis. This should be made a condition of any licence.

p.22 – Section 7.7.6 – Features of conservation interest - Reference is made to the presence of mink at Knapdale. It should be noted that mink have been recorded predating beaver kits, and there is therefore a risk to any kits at Knapdale. In light of this, some localised mink control should be considered during the initial establishment of the population, although this would need to take account of the presence of otter (a European Protected Species and a qualifying feature for Taynish and Knapdale Woods SAC). The details of any mink trapping can be discussed with SNH in due course.

4. SNH RECOMMENDATIONS

The Scottish Government may wish to use these recommendations, if judged appropriate, as conditions in any licence provided to RZSS/SWT.

SNH Role

a) SNH to coordinate a monitoring programme in collaboration with the project partners through an appropriate group, and involving SNH's Scientific Advisory Committee. The group, chaired by SNH, will maintain a suitable level of scientific independence from the other project groups.

   SNH, in collaboration with the group, will:

   - Collate information on behalf of the Scottish Government.
   - Assess and approve all research, survey and monitoring projects associated with the project (including those projects which SNH will not necessarily lead on, e.g. public health), thereby ensuring limited resources are directed at addressing the core objectives of the trial.
   - Coordinate research, survey and monitoring projects to ensure collaborative opportunities are identified, data is collated in compatible formats, disturbance to beavers minimised and detrimental effects to nature conservation interests avoided (e.g. SAC, SPA, species etc.) .
   - Ensure all data and information collated during the trial has joint ownership and is made publicly available.
   - Produce a pre-release monitoring programme and a post-release monitoring programme by the year of the release, both plans to be submitted to the SG

   SNH will also lead, in collaboration with other partners where appropriate, on specific projects relating to the monitoring and modelling of the beaver population, and the monitoring of the effects of beaver.

b) SNH to report to the SG on whether the conditions of any licence are being fully addressed on the ground.

c) The SG may wish to consider setting up and chairing a group which could meet occasionally to discuss progress with, and input to, the trial. Representation of the group may be drawn from various conservation, land use and freshwater sectors. SNH could provide reports on the monitoring of the trial to such a group.

Beaver management

d) We would recommend the collection and quarantine of a fourth family as a useful back-up, in case of any mortality during the quarantine period. Beaver mortality during quarantine is not uncommon.

Therefore, if a licence is approved, it should permit the release of up to four families.

e) We would strongly recommend that all animals are 'soft released', with all precautions taken to limit the risk of individuals dispersing away from the trial area, and details to be agreed with SNH. (For more details see SNH's appraisal of the proposal in relation to possible effects on Taynish and Knapdale Woods SAC and Knapdale Lochs SPA).

f) We would strongly recommend one simultaneous release of all the animals at the start of the trial, rather than a series of phased releases. This will help to ensure that the animals have the opportunity to establish territories at the same time, and it reduces the risk of animals dispersing away from the trial area.

g) Consideration should be given as to whether all animals which move outwith the proposed trial area should be removed, or just those where the land owners request it.

h) Localised mink control should be considered during the initial establishment of the population to protect beaver kits. The details of any mink trapping must be agreed with SNH to take account of SAC qualifying interests and European Protected Species

Project management

i) The European beaver is included within the Species Action Framework (SAF). All species identified on the SAF have an implementation plan which sets out objectives, actions and tasks which need to be undertaken. It identifies also lead partners for each task and sets out resourcing issues. The European beaver is the only one of the 32 SAF species for which a plan has not yet been drafted because a project has not yet been approved. If the licence is given, SWT/RZSS must draw up an implementation plan with its partners and SNH, and the plan must be made publicly available (e.g. on the SAF web pages www.snh.org.uk/speciesactionframework).

j) We support the setting up of a "Beaver Steering Group" and a "Beaver Project Team" as described. We envisage that SNH would be represented on these groups as observers. The local community also needs to be involved in the direction of the project, hence we see merit in establishing a "Knapdale Beaver Forum", and an associated "Beaver Supporter's Group".

k) If the length of the collection and quarantine element of the project is one year, and the fieldwork element of the project is five years, then the applicants need to plan for work extending into year seven to allow time for all monitoring work to be completed, analysed and consulted on and for a decision to be made by the SG on the outcome of the trial.

l) Once the beavers are released, the licence applicants must be able to ensure that they can implement the key elements of the trial, as set out in their application, and address any conditions set by the SG. If resourcing is insufficient to continue the trial as agreed, then the exit strategy will need to be implemented.

m) The role of the Field Officer should include regular monitoring of 'sensitive' areas to ensure potential problems are avoided. This to be discussed and agreed with relevant adjacent land owners and relevant public bodies (including British Waterways, Historic Scotland, FCS, and SNH).

n) A training event should be held in the Knapdale area immediately prior to the release of animals. This will ensure relevant project staff and local people are fully aware of, and prepared for, practical beaver management issues which may arise during the project.

o) The application states that an agreement on behalf of the project partnership of RZSS and SWT has been drawn up with FCS to accommodate the trial release on FCS property at Knapdale. It is therefore recommended that the SG, with advice from SNH, is given the opportunity to ensure the agreement addresses any conditions set out in a licence.

p) Discussions, involving the project group members and SNH, to be held with the local FES District to ensure future management of woodland takes into account beaver issues

Research, Survey and Monitoring

(Also see recommendation 'a' above)

q) A suite of tracking methodologies should be employed, rather than relying too heavily on radio-tracking techniques, which may have a number of practical and animal welfare limitations. This will be addressed through the monitoring programme to be led by SNH.

r) Argyll and Bute Council to lead on public health monitoring (in discussion with Scottish Water), with relevant veterinary advice from RZSS. SNH's role would be to ensure that any monitoring is effectively and efficiently coordinated with other elements of the overall monitoring programme.

s) SNH to discuss with the licence applicants the potential role of the full-time Field Officer in collating data for some aspects of the scientific monitoring work.

From:	Marion Whitelaw (Marion.Whitelaw@snh.gov.uk)
To:	Hugh.Dignon@scotland.gsi.gov.uk (Hugh.Dignon@scotland.gsi.gov.uk);
CC:	Colin A Galbraith [redacted] Martin Gaywood (Martin.Gaywood@snh.gov.uk); Dave Batty (Dave.Batty@snh.gov.uk);
Date:	08-05-2008 14:50:39
Subject:	BEAVER LETTER AND ATTACHMENTS

Message:

Dear Hugh

Please see letter and attachment re beavers

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Attachments:

4th beaver attachment for letter to HD - use this version.doc
3rd beaver attachment for letter to HD - final use this version.doc
2nd beaver attachment for leter to HD - final use this version.doc
1st beaver attachment for letter to HD - final use this version.doc
beavers - letter to Hugh Dignon.doc

SCOTTISH NATURAL HERITAGE

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Hugh Dignon
Nature Conservation Species Team
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8 May 2008

Dear Hugh

PROPOSAL BY THE SCOTTISH WILDLIFE TRUST AND THE ROYAL ZOOLOGICAL SOCIETY OF SCOTLAND TO UNDERTAKE A TRIAL RE-INTRODUCTION OF EUROPEAN BEAVER TO KNAPDALE, ARGYLL

We have now reviewed the application and I am pleased to be able to send you our comments on the license application, our assessment in relation to the Natura interest (SAC and SPA), and in relation to the SSSI interest. I attach also a report outlining our understanding of the experience of beaver reintroduction in other parts of Europe.

I attach 4 documents:

1 Comments on the license application.

2 Comments on the Natura interest.

3 Comments on the SSSI interest.

4 The European experience document.

It is important that I add some covering comments to these documents, and do so specifically in relation to our assessment of the interactions between beavers and the Natura and SSSI interest.

Given the nature of the application we have adopted a very precautionary approach to our assessment. Where we have judged there to be any possibility of the project leading to a change in the existing species assemblage or habitat complex in the trial area, then we have undertaken a full assessment. In doing this we have considered

the potential for both positive and negative changes. The consequence of this approach has been a very detailed scrutiny of the project and a fine-grained consideration of possible changes.

In completing this work this we have followed the standard methodology for such assessments of Natura sites. This has been a three part process as follows:

1 Determine whether the proposal is directly connected with or necessary to site management for conservation, if not,

2 Determine whether the proposal is likely to have a significant effect on the site either individually or in combination with other plans or projects; and if so then,

3 Make an appropriate assessment of the implications (of the proposal) for the site in view of the sites conservation objectives.

We have, consequently, undertaken assessments for each part of the Natura interest in turn.

The key conclusion to this evaluation is that the proposed project should, with some relatively minor management measures put in place, have no real impact on the existing interest. We recognise also that some of the issues raised can only be addressed once the project is underway, e.g. visitor management or the long-term future of any artificial lodges built to facilitate the initial release of animals.

Clearly the management of the project will be of considerable importance should the trial proceed and we continue to encourage the applicants to liaise throughout the duration of the project with a range of bodies at the national level, as well as with the local community in Mid Argyll.

We have considered also the role of SNH should the project go ahead. We suggest that we might have a role as observers on any project management group and that we might co-ordinate any monitoring work developed to evaluate the progress of the trial. This would allow an independent view; and would ensure direct reporting to you, as well as ensuring the public availability of any data collected as part of the trial.

Please let me know if you need any further information from us at this stage.

Yours sincerely

[redacted]

Professor Colin A Galbraith
Director of Policy and Advice

Trial reintroduction of European beaver to Knapdale Forest – Advice and Recommendations to the Scottish Government by Scottish Natural Heritage.
8 May 2008.

DOCUMENT 2

SNH'S APPRAISAL OF THE PROPOSAL IN RELATION TO POSSIBLE EFFECTS ON TAYNISH AND KNAPDALE WOODS SAC AND KNAPDALE LOCHS SPA.

CONTENTS:

1. INTRODUCTION

In December 2007 a partnership of the Royal Zoological Society of Scotland (RZSS) and the Scottish Wildlife Trust (SWT) submitted a licence application to Scottish Government (SG) for the release of European beaver *Castor fiber* to Knapdale Forest, mid-Argyll, for the purposes of a trial reintroduction.

Under domestic legislation, it is an offence to release into the wild any animal which is of a kind not ordinarily resident in Great Britain (Section 14 of the Wildlife and Countryside Act 1981 (as amended)). In order for a trial reintroduction to proceed at Knapdale, a licence is therefore required from the Scottish Government.

A proportion of the proposed trial reintroduction area (defined as that part of Knapdale Forest owned by FCS) lies within part of the Taynish and Knapdale Woods SAC. Also, part of Knapdale Lochs SPA (Loch Clachaig) is situated within the proposed trial reintroduction area. Animals will be released at three specific lochs within the SAC but it is possible, during the five year trial, that they may move to other parts of the overall trial area including other parts of the SAC, and Loch Clachaig within the SPA. No other Natura sites occur within the proposed trial area.

This document provides SNH's advice to the Scottish Government in relation to the appraisal of the proposal in relation to the SAC and SPA in line with the requirements of Article 6.3 of Council Directive 92/43/EEC (the 'Habitats Directive'), as transposed by regulation 48 of the Conservation (Natural Habitats, &c.) Regulations 1994, as amended (the 'Habitats Regulations').

This appraisal will be restricted specifically to the proposed trial as described in the licence application submitted by RZSS and SWT.

SNH has a standard approach when dealing with proposals potentially affecting Natura sites, which reflects the legal stages set out in Regulations 48 and 49 of the Habitats Regulations. The three main steps which need to be addressed are:

> *Step 1:* Is the proposal directly connected with or necessary to site management for nature conservation? - If it is judged that the answer is no, then the next step has to be addressed.
>
> *Step 2:* Is the proposal likely to have a significant effect on the site? - This is a relatively simple decision, but it is an important step. It is like a scoping stage to remove proposals which can be easily dismissed from further consideration. A significant effect may be positive or negative. If it is judged that there is likely significant effect, then the next step has to be addressed.
>
> *Step 3:* Can it be ascertained that the proposal will not adversely affect the integrity of the site? - An 'appropriate assessment' by the appropriate

competent authority is required at this stage. This involves an assessment of the implications for the site's conservation objectives (identified in section 4 of this document). The answer to this question might be yes, but could require certain conditions to be put in place.

This document addresses all three steps.

Since this appraisal covers the trial project as described in the licence application, this means that once the trial has been completed, a consideration of the effects of any retention of beavers at Knapdale on the qualifying interests of the Taynish and Knapdale Woods SAC and Knapdale Lochs SPA will need to be undertaken. This will need to be considered as part of a wider assessment as to whether beavers should be reintroduced to Scotland.

2. THE PROPOSAL

The licence application proposes that beavers will be captured in Norway in autumn 2008, placed in quarantine for a six month period and then three to four families will be released at Knapdale in spring 2009. The proposed release sites are Loch Coille Bharr, Loch Linne/ Loch Fidhle and Creagmhor Loch/ small unnamed loch immediately to the west. This will be followed by a five year period of monitoring which will run until Spring 2014. An exit strategy is an integral part of a project plan.

The application states that the primary aims of the trial reintroduction are to:

- Study the ecology of the beaver in the Scottish environment;
- Assess the effects of beaver activities on the environment, including a range of land uses;
- Generate information during the proposed trial release that will inform a potential further release of beavers at other sites with different habitat characteristics;
- Explore the environmental education opportunities that may arise from the trial itself and the scope for a wider programme should the trial be successful;
- Determine the extent and impact of any increased tourism generated through the presence of beaver.

The proposed trial location is within the area of Knapdale Forest managed by Forest Enterprise Scotland (FES). Part of this area falls within the northern, Knapdale component of the Taynish and Knapdale Woods SAC. It is not proposed to release beavers within the southern, Taynish component of the SAC which is separated from the Knapdale component by approximately 0.5km of sea. Part of Knapdale Lochs SPA lies within the proposed trial area, although in a separate catchment to the proposed release sites.

3. THE QUALIFYING INTERESTS FOR TAYNISH AND KNAPDALE WOODS SAC AND KNAPDALE LOCHS SPA

The Habitats Directive Annex I habitats for which Taynish and Knapdale Woods SAC has been classified is shown below.

HABITATS DIRECTIVE ANNEX I HABITATS FOR WHICH THE SITE HAS BEEN DESIGNATED AS AN SAC	***EU CODE FOR HABITATS DIRECTIVE ANNEX I HABITAT TYPE***	***ABBREVIATED TERM USED IN THIS DOCUMENT***
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	**H91A0**	**OAK WOODLAND**
Oligotrophic to mesotrophic standing waters with vegetation of the *Littoreletea uniflorae* and/or of the *Isoëto-Nanjuncetea*	**H3130**	**OLIGO-MESOTROPHIC LOCHS**

The Habitats Directive Annex II species for which Taynish and Knapdale Woods SAC has been classified are shown below.

HABITATS DIRECTIVE ANNEX II SPECIES FOR WHICH THE SITE HAS BEEN DESIGNATED AS AN SAC	***EU CODE FOR HABITATS DIRECTIVE ANNEX II SPECIES***	***COMMON NAME USED IN THIS DOCUMENT***
Lutra lutra	**S1355**	**OTTER**
Euphydryas (Eurodryas, Hypodryas) aurinia	**S1065**	**MARSH FRITILLARY BUTTERFLY**

The Birds Directive Annex I species for which Knapdale Lochs SPA has been classified is shown below.

BIRDS DIRECTIVE ANNEX I SPECIES FOR WHICH THE SITE HAS BEEN DESIGNATED AS AN SPA	***COMMON NAME USED IN THIS DOCUMENT***
Gavia arctica	**BLACK-THROATED DIVER**

4. CONSERVATION OBJECTIVES FOR TAYNISH AND KNAPDALE WOODS SAC AND KNAPDALE LOCHS SPA

Conservation objectives for the SAC and SPA, in relation to Article 6.3 of the Habitats Directive, and regulation 48 of the Habitats Regulations, are given below.

Habitats Directive Annex I habitats

To avoid deterioration of the qualifying habitats (listed below) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favorable conservation status for each of the qualifying features; and

To ensure for the qualifying habitats that the following are maintained in the long term:

- Extent of the habitat on site
- Distribution of the habitat within site
- Structure and function of the habitat
- Processes supporting the habitat
- Distribution of typical species of the habitat
- Viability of typical species as components of the habitat
- No significant disturbance of typical species of the habitat

Qualifying Habitats:
- Oak woodland
- Oligo-mesotrophoc lochs

Habitats Directive Annex II species

To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favorable conservation status for each of the qualifying features; and

To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

Qualifying Species:
- **Otter**
- Marsh fritillary butterfly

Birds Directive Annex I species

To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and

To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

Qualifying Species:
- **Black-throated diver**

5. LEGISLATIVE REQUIREMENTS FOR EUROPEAN SITES

The following stages need to be considered as required under Article 6.3 of the Habitats Directive and regulation 48 of the Habitats Regulations, and laid out in Revised Circular 6/95:

- Determine whether the proposal is directly connected with or necessary to site management for conservation; and, if not,
- determine whether the proposal is likely to have a significant effect on the site either individually or in combination with other plans or projects; and, if so, then
- make an appropriate assessment of the implications (of the proposal) for the site in view of that site's conservation objectives.

The proposal is not directly connected with or necessary to site management for nature conservation. Hence, further consideration is required.

It is therefore necessary to consider whether the proposal to reintroduce European beaver is likely to have a significant effect on the Taynish and Knapdale Woods SAC and Knapdale Lochs SPA.

SNH's advice is that the proposal is likely to have a significant effect on the qualifying interests of the SAC and the SPA. SNH's view is that, as a consequence, the Scottish Government is required to undertake an appropriate assessment of the proposal for the SAC and SPA in view of the sites' conservation objectives for their qualifying interests.

SNH's appraisal of whether it can be ascertained that the proposal will not adversely affect the integrity of the site is outlined in the following sections. Five separate appraisals are provided, together with a summary, as follows:

- 6.2 Appraisal: Taynish and Knapdale Woods SAC - Oak woodland
- 6.3 Appraisal: Taynish and Knapdale Woods SAC - Oligo-mesotrophic lochs
- 6.4 Appraisal: Taynish and Knapdale Woods SAC – Otter
- 6.5 Appraisal: Taynish and Knapdale Woods SAC – Marsh fritillary butterfly
- 6.6 Appraisal: Knapdale Lochs SPA – Black-throated diver
- 6.7 Summary of appraisals as to whether it can be ascertained that the proposal will not adversely affect the integrity of the sites

6. APPRAISAL AS TO WHETHER IT CAN BE ASCERTAINED THAT THE PROPOSAL WILL NOT ADVERSELY AFFECT THE INTEGRITY OF THE SITES

6.1 General issues

The trial reintroduction, as described in the licence application, will result in a number of potential issues that SNH considers will contribute to significant effect in the context of Regulation 48 (1). There are other issues not explicitly referred to in the licence application which SNH also considers will be relevant to the appropriate assessment. These issues can be broadly summarised as follows:

Issues relating to beaver activities:

- *Effects of beaver grazing activities, trampling etc. on qualifying interests.*
- *Effects of habitat modification behaviour (e.g. damming, canal construction, lodge construction) of beavers on qualifying interests.*
- *Effects of beaver presence on behaviour and ecology of resident qualifying interest species and qualifying habitat 'typical species'.*

Issues relating to human activities associated with the beaver project:

- *Construction of artificial lodges by project staff to reduce risk of beaver dispersal immediately after release.*
- *Erection of fencing by project staff to reduce risk of beaver dispersal immediately after release, and to exclude beaver from specific areas.*
- *Other potential effects (e.g. disturbance of qualifying interest species and qualifying habitat 'typical species') resulting from fieldwork activities of beaver project staff, associated contractors, researchers, film-makers etc.*
- **Effects of increased visitor pressure, including addition of small-scale interpretative facilities.*

(*Note: The following appraisal assumes relatively low levels of visitors in the early stages of the project, and the simple interpretative facilities such as self-guided, or guided visits. If there are plans for other visitor facilities, a further appraisal will be required).

To provide some context, a GIS analysis has been undertaken by SNH using National Vegetation Classification (NVC) survey data collected in 2003. The analysis included data for the Knapdale component and the Taynish component of the overall SAC – this is because the proposal is to release beavers to the

Knapdale component and exclude them from the Taynish component for the duration of the trial. The analysis also included the use of ‘buffers’ (bordered zones artificially created by GIS) around freshwater features. Beaver activity is heavily weighted to the riparian zone, particularly the area up to 10m from water edge. However they can also forage, albeit much less frequently, up to 100m from the water edge. Buffers were therefore produced for 10m and 100m from freshwater edge, and separate analyses of NVC data undertaken for the areas within them (note: beaver will forage further afield under unusual circumstances, e.g. to reach aspen stands, but 10m and 100m buffers are deemed to be realistic for the purposes of this analysis).

It is very unlikely that all the areas within the 10m buffer, and especially the 100m buffer, will be affected by beaver during the trial period.

The main results of the analysis can be summarised as follows;
(Note - National Vegetation Classification (NVC) Woodland community codes used below are; ‘W’ = woodland communities; ‘M’ = mire communities; ‘H12a’ = a heathland community; ‘S3’ = tussock-edge swamp; ‘U’ = acid grassland):

- The overall area of Taynish and Knapdale Woods SAC is 966ha (587ha in the Knapdale component, plus 379ha in the Taynish component), of which 85ha (8.8%) is within the 10m buffer of the Knapdale component of the SAC, and 231ha (23.9%) within 100m buffer (note that 63ha of the area within both the 10m and 100m buffers is open water).

- The total area of Taynish and Knapdale Woods SAC woodland as defined by NVC 'W' communities, is 447ha. Out of this total of NVC ‘W’ communities, 8ha (1.9%) lies within the 10m buffer of Knapdale, and 61ha (13.6%) within 100m buffer of Knapdale (therefore 98.1% of all the SAC’s NVC 'W' communities lie outwith the 10m Knapdale buffer, and 86.4% outwith the 100m buffer)

- Of the 8 ha of NVC 'W' communities within the 10m buffer of the Knapdale component, 73% is NVC sub-community W17b, 21% is W7b, 3% is W11b (plus smaller areas of other sub-communities)

- Of the 61 ha of NVC 'W' communities within the 100m buffer of the Knapdale component, 72% is NVC sub-community W17b, 9% is W7b, 10% is W11b (plus smaller areas of other sub-communities)

- Within the 10m buffer of Knapdale, the main NVC habitat types are:
- ‘Open water’: 63ha (6.5% of overall SAC area)
- 'W': 8ha (0.9% of overall SAC area)
- 'M': 6ha (0.6% of overall SAC area)
- ‘Felled’: 4ha (0.4% of overall SAC area)
- plus less than 2ha of conifer plantation, ‘H12a’, ‘S3’, U.

- Within the 100m buffer of Knapdale, the major main NVC communities are:

- ‘Open water’: 63ha (6.5% of overall SAC area)
- 'W': 61ha (6.3% of overall SAC area)
- 'M': 32ha (3.3% of overall SAC area)
- ‘Felled’: 43ha (4.4% of overall SAC area)
- plus less than 17ha of conifer plantation, ‘H12a’, ‘S3’, U.

Further details on the habitat types within the ‘open water’ category are included in Section 6.3.

6.2 APPRAISAL: TAYNISH AND KNAPDALE WOODS SAC - OAK WOODLAND

6.2.1 Introduction

The overall SAC has an area of approximately 966ha. However, the proposal is to undertake the trial in the Knapdale component of the SAC (587ha). The Taynish component of the SAC lies to the south-west of the Knapdale component and, at their closest point the two components are approximately 0.5km from each other across an area of sea.

Beaver activity is very much weighted towards freshwater riparian areas. The majority of their time, and foraging effort, is spent either within water or within 10m of water edge. They may occasionally forage up to a few tens of metres away from water edge.

The GIS analysis set out in section 6.1 indicates that there is about 23ha of terrestrial habitat within 10m of freshwater edge within the Knapdale component of the SAC (2.3% of the overall SAC area) which, potentially, could be affected by beaver grazing activities (ranging up to 23.9% of the SAC area within the 100m buffer). Within this 23ha, 8ha can be defined as NVC woodland communities, which is 0.8% of the overall SAC area and 1.9% of the overall area of NVC woodland communities in the SAC.

However, it should be noted that it is not possible to undertake a direct read-across from the NVC communities to the Annex I qualifying interest. The Annex I interest of oak woodland, CORINE code 41.53 (full name 'old sessile oak woods with *Ilex* and *Blechnum* in the British Isles'), is described in the Interpretation Manual of European Union Habitats (April 2003) as having the corresponding NVC woodland communities W10 (not recorded at Taynish and Knapdale SAC), W11 and W17. Even so, some patches categorised by these NVC communities at Knapdale may not necessarily have oak present, and other tree species may be more dominant. For the purposes of this appraisal the precautionary approach has been taken, and the assumption made that all areas covered by these NVC communities relate to the oak woodland qualifying interest.

However, there may be areas within the SAC covered by other NVC communities which could also be important to the conservation objectives of the oak woodland qualifying interest, for example if they contribute to the functional connectivity of the qualifying interest or to overall site integrity. Beaver may also affect non-woodland NVC communities, for example though foraging in areas of mire, areas of recently felled conifer plantation etc.

Beaver activity within the riparian zones will include grazing, both on the aquatic, semi-aquatic and ground flora (especially in the warmer months) and on woody

species (especially during the cooler months). Woody plants with diameters of 3-8cm are grazed most frequently, although plants outwith these size categories can also be grazed. It is anticipated that the majority of woody species found within the riparian zones will be suitable for beaver.

Beavers usually have the entrances of their dens/lodges underwater. In situations where existing water levels are insufficiently low, they may dam to raise the water levels. There is therefore the possibility that, in some areas under certain circumstances, water will be raised with some areas of riparian habitat affected. This is expected to be most likely to occur along some of the shallow, interconnecting burns within the trial area.

Grazing activity and changes in local hydrology, could affect certain patches of woodland, including 'typical species' of oak woodland, primarily those associated with stands of mature trees such as lichen assemblages.

Impacts caused by human-related activities associated with the project could include increased visitor pressure, and localised effects of small-scale constructions such as the building of artificial lodges.

European beaver is a natural component of woodlands in Europe. This is reflected by the fact that there are 580 SACs within the EU (within nine Member States) where both beaver and Habitats Directive Annex I "temperate forest" habitats are both identified as SAC interests (it is not possible to do this analysis specifically for oak woodland, which is a "temperate forest" habitat, as this Annex I habitat type only occurs in Britain and Ireland).

Therefore there is a likely significant effect from the proposed trial due to beaver grazing activities and altering of water levels, plus the effects of small-scale works by beaver project personnel, and increased visitor numbers.

6.2.2 Conservation Objectives

In order to determine the effects of the proposal on site integrity, the conservation objectives which apply to the oak woodland interest are examined in turn below.

The conservation objectives are to ensure for the qualifying habitat, oak woodland, that the following are maintained in the long term;

Extent of the habitat on site

The analysis above indicates that the terrestrial area that is more likely to be potentially affected by beaver grazing activity is the 23ha within 10m of freshwater (2.3% of the overall SAC area). Eight hectares of this falls within the NVC 'W' woodland community type. Not all of this area will, in practice, be affected by beaver during the trial as beavers will be less active further away from their dens/lodges.

The SAC consists of intricate mosaics with woodland stands, heavily influenced by site topography. In terms of the issue of dam building by beaver, the topography, which is dominated by a series of parallel hills and valleys, is such that the vast majority of the qualifying woodland interest is situated on land above the height that would be affected by any localised flooding. Dam building on the outflows of lochs will not be an issue assuming the recommended mitigation set out for the oligo-mesotrophic lochs habitat qualifying interest is applied (see section 6.3). This mitigation will ensure that loch water levels will be maintained around current levels during the trial.

However, in addition to the lochs there are also interconnecting freshwater burns running throughout the SAC which beavers may dam in some places. Many sections of the interconnecting burns are on higher gradients which beavers are less likely to dam (beavers prefer gradients of less than 2%). The majority of the lengths of burns within the SAC flow through areas bordered by habitat described in NVC surveys as conifer plantation, felled or recently felled conifer plantation, mire and heather dominated. Some of these habitat types (such as conifer plantation) are clearly not such important components of the oak woodland interest and so if they became wetter as a result of dam building this would not be judged to be affecting site integrity. If burns adjacent to woodland areas were dammed, and became flooded, then there will be localised changes to the woodland. This could be beneficial, such as increases in standing dead wood (and the habitat of associated typical species) which is usually limited in native woodlands. However if a dam was created in an area where the extent of the woodland affected was judged to be of concern, then the dam will require to be regulated or removed prior to flooding of the area. This will require the monitoring of dam building during the trial, and SNH to be quickly informed. SNH will make judgements on a case by case basis.

In the longer term any dams that are created would eventually be abandoned and water levels would subsequently decrease to previous levels, and the habitat types within previously inundated patches would change again.

We expect no adverse impact on the extent of qualifying woodland habitat if the recommended mitigation is addressed, rather some change in its structure and species composition in some localised riparian areas.

Distribution of the habitat within site

Beaver activity will tend to be restricted to relatively narrow, riparian zones and the animals will rarely move through, or have any effect on, most of the area of oak woodland distributed throughout the site. In all, 97.7% of the overall SAC area is outwith the 10m buffer of terrestrial habitat fringing freshwater areas in which beavers are most likely to be active (in addition to freshwater habitat itself). There may be localised changes to structure and species composition but the distribution of the overall habitat within the site will not be adversely impacted.

Structure and function of the habitat
The speed of regeneration of natural woodland from previous sitka spruce stands may be slightly checked in places by beaver grazing but such effects are likely to be very localised. A particularly large-scale programme of conifer removal a few years ago has resulted in very dense birch stands in some places. The effect of beaver grazing in areas of dense regeneration is expected to be the opening of patches of birch, thereby allowing other species to move in. Much of the regeneration is on the drier areas of the SAC, which are less likely to be targeted by beavers.

The oak woodland within the SAC is already characterised by a wide range of ground and field layer vegetation. Further diversification, on a small scale, of these woodland layers through beaver activity is considered to be compatible with this conservation objective.

Processes supporting the habitat
Short, medium or long-term changes in the vegetative structure and/or hydrology of localised areas of riparian woodland as a result of beaver activity would not affect the integrity of existing patterns of natural woodland development and, indeed, could increase the overall conservation value of the site (for example, by increasing the amount of standing dead wood and fallen dead wood, thereby increasing habitat for dead wood 'typical species'). Such changes would be compatible with this conservation objective.

It is highly likely that the European beaver was once a natural component of this habitat type. The trial will therefore result in the restoration of what was likely to have once been one of the more significant and influential species of Scottish woodland.

Effects on typical species of the habitat (distribution, viability and disturbance)
Adverse impacts on the distribution of most typical species is not expected. There may be some 'typical species', however, which could be more affected.

A small number of aspen trees *Populus tremulus* are known to occur in the Faery Isles. The species is preferentially selected by beaver as a food source. However, the communities associated with the aspen of the Scottish west coast are not as unique as aspen in eastern Scotland. Although it is likely that they support some species of the characteristic *Lobarion* and *Graphidion* communities – as do most broadleaved tree species in this area – it is not believed that they do so to the extent of being integral to the habitat. There are also no obvious freshwater bodies in the Faery Isles area, and consequently it is not expected that beaver will move into this part of the SAC.

Impact on the bryophyte assemblages is not judged to be a problematic issue. Much of the bryophyte resource of particular conservation interest is associated with rocks and boulders, rather than trees.

There are stands of hazel *Corylus avellana* of high conservation value that are known to be within the distance from freshwater that beaver can forage (e.g. the stand of hazel to the north-east of Loch Barnluasgan). The tree diameters of the hazel are within the sizes most frequently grazed by beaver. These hazel stands are important for their lichen assemblages.

Since beaver could, potentially, affect these hazel stands and their associated 'typical species' of lichens, it will be necessary to arrange for suitable protection for these in localised areas (to exclude beaver, not deer), following discussion with SNH. This would ensure that this component of the site will not be adversely impacted.

The issue of beaver dam creation is addressed under the 'Extent of the habitat' heading above. If beaver dams were built on burns near stands of hazel, then the mitigation described would ensure the site will not be adversely impacted.

Beavers will not significantly disturb typical species of the habitat. However, the presence of people, and dogs etc., can result in disturbance to some animal species under certain scenarios. The issue of visitor management linked to the beaver proposal is therefore relevant to this conservation objective.

There are proposals to develop visitor facilities at the site. This would largely be targeted at the provision of visitor information and interpretation within the existing FCS buildings at Barnluasgan (NR791909) and Barr an Daimh (NR796917), where the majority of visitors would be channelled through the use of signage and existing parking facilities. The aim is to manage visitors at the existing information and interpretation 'honeypots', and to avoid large increase of visitors moving into the more sensitive areas of the SAC.

There are already designated public footpaths, cycling tracks etc within the SAC area. For those visitors who wish to move away from the FCS facilities, provision will need to be put in place to allow self-guided and guided walks which are designed to utilise these existing public footpaths.

On the basis that an overall visitor management plan is agreed and implemented prior to the release of beaver and throughout the project (e.g. signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.), and this plan and the design of associated facilities are discussed with SNH, the site will not be adversely impacted.

Note that this appraisal assumes relatively low levels of visitors in the early stages of the project, and the provision of the interpretative facilities as described

above. If there are plans for other visitor facilities (e.g. there is a future proposal for a hide to be set up near a beaver lodge – but this cannot be assessed until the location of any proposed hide is known, which in turn cannot be identified until the beavers set up a lodge), a further appraisal will be required.

6.2.3 SNH Advice in relation to effects on oak woodland

Background

The proposal consists of a trial reintroduction of European beaver to Knapdale. This lies partly within Special Area of Conservation (SAC) classified for Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (referred to elsewhere in this document as oak woodland).

The site's status as a classified SAC under the EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the “Habitats Directive”), means that the Conservation (Natural Habitats, &c.) Regulations 1994 as amended, (the “Habitats Regulations”) apply. The requirements are summarised in SE Circular 6/1995 as amended June 2000 and include, at paragraph 12:

"The Regulations (48) require that, where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated."

SNH’s advice is that this proposal is likely to have a significant effect on the qualifying interest of the site. **However SNH would further advise the Scottish Government that on the basis of the appraisal carried out to date, that if the proposal is undertaken strictly in accordance with the following conditions, then the proposal will not adversely affect the integrity of the site.**

a) Beaver dam construction on burns to be carefully monitored and SNH to be informed immediately once new dams are created. An assessment will then be made by SNH on a case by case basis and, if judged necessary, management of the dam will be required.

b) Stands of hazel, which hold significant communities of ‘typical species’ of lichens, should be protected where necessary using appropriate methods and following discussion and agreement with SNH.

c) A visitor management plan must be agreed and implemented prior to the release of beaver and during the lifetime of the project (addressing issues

such as signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.). This plan and the design of associated facilities must be discussed and agreed with SNH.

It should be noted that Scottish Government is required to undertake an appropriate assessment of the implications of the proposal for the site in view of the site's conservation objectives for its qualifying interest(s). This assessment may be based on the above appraisal by SNH but the Scottish Government may wish to carry out further appraisal before completing the appropriate assessment.

6.3 APPRAISAL: TAYNISH AND KNAPDALE WOODS SAC - OLIGO-MESOTROPHOC LOCHS

6.3.1 Introduction

The overall SAC has an area of approximately 966ha. However, the proposal is to undertake the trial in the Knapdale component of the SAC (587ha). The Taynish component of the SAC lies to the south-west of the Knapdale component and, at their closest point the two components are approximately 0.5km from each other across an area of sea.

Beaver activity is very much weighted towards freshwater riparian areas. The majority of their time, and foraging effort, is spent either within water or within 10m of water edge. They may occasionally forage up to a few tens of metres away from water edge.

Within the SAC there are eight freshwater lochs within four different main catchments:

- Lochan Taynish – 11.2ha area, perimeter of 2km. The 1989 Freshwater Loch Survey classified it as a Type 2 loch (Palmer *et al.* 1992). Based on these results it has also been described as a Group C2 type oligotrophic loch (Duigan *et al.* 2006). It was described as in "favourable condition" on the basis of 2004 SCM (Site Condition Monitoring) results.

- Loch Barnluasgan – 5.3ha area, perimeter of 1.2km. The 1989 Freshwater Loch Survey classified it as a Type 3 oligotrophic loch (Palmer *et al.* 1992). Based on these results it has also been described as a Group D type oligotrophic loch (Duigan *et al.* 2006). The invasive species *Elodea canadensis* was recorded. *E. canadensis* was also recorded in the loch during the 2004 SCM survey, at a frequency of 2%. However, it was considered naturalised (unlike in Loch Coille-Bharr, see below). The loch was described as in "favourable condition" on the basis of the 2004 SCM results. It is upstream of Loch Coille-Bharr.

- Loch Coille-Bharr – 33.4ha area, perimeter of 4.4km. The 1989 Freshwater Loch Survey classified it as a Type 5A loch (Palmer *et al.* 1992). Based on these results it has also been described as a Group D type oligotrophic loch (Duigan *et al.* 2006). The invasive species *E. canadensis* was recorded in the loch for the first time during a 2004 SCM survey, at a frequency of 4%. The loch was therefore described as in "favourable condition (at risk)" on the basis of the 2004 SCM results. It is downstream of Loch Barnluasgan.

- Un-named loch (100m east of Loch Fidhle) – 1.2ha area, perimeter of 0.6km This loch was not surveyed as part of the 1989 Freshwater Loch

Survey or the 2004 SCM survey. Murphy *et al.* (2002) surveyed the loch but did not classify the loch type due to a lack of data on submerged areas. It is upstream of Loch Linne/Loch Fidhle.

- Loch Fidhle – 3.6ha area, perimeter of 0.9km. This loch was not surveyed as part of the 1989 Freshwater Loch Survey or the 2004 SCM survey. Murphy *et al.* (2002) surveyed the loch and classified it as a Type 5B loch (Palmer *et al.* 1992). This is a mesotrophic loch habitat type. Loch Fidhle is immediately east of, and connected to, Loch Linne and downstream of the un-named loch described above.

- Loch Linne – 16.5ha area, perimeter of 3.1km. The 1989 Freshwater Loch Survey classified it as a Type 3 loch (Palmer *et al.* 1992). Based on these results it has also been described as a Group C2 type oligotrophic loch (Duigan *et al.* 2006). It was described as in "favourable condition" on the basis of the 2004 SCM results. Loch Fidhle is immediately east of, and connected to, Loch Linne, and downstream of the un-named loch described above.

- Creagmhor Loch – 5.3ha area, perimeter of 1.2km. This loch was not surveyed as part of the 1989 Freshwater Loch Survey or the 2004 SCM survey. Murphy *et al.* (2002) surveyed the loch and classified it as a Type 2 loch (Palmer *et al.* 1992). This falls within the oligotrophic to mesotrophic loch habitat type.

- Dubh Loch - 0.3ha area, perimeter of 0.3km. This small lochan was not surveyed as part of the 1989 Freshwater Loch Survey, the 2004 SCM survey or by Murphy *et al.* (2002). The loch type has not been classified. It is approximately 100m east of Loch Coille-Bharr, although there is no obvious surface connection to it.

Therefore, of the lochs identified above, Lochan Taynish, Loch Barnluasgan, Loch Coille-Bharr, Loch Linne/ Fidhle and Creagmhor Loch are known to fall within the oligotrophic to mesotrophic habitat type. Note that Lochan Taynish is within the Taynish component of the SAC from which beaver will be excluded during the trial.

The proposal states that beaver families would be released at sites on the edge of Loch Coille-Bharr, Loch Linne/Fidhle and Creagmhor Loch. Therefore, since the former two are connected other standing waters situated upstream within the SAC, it is likely that beavers could be active in all the lochs within the Knapdale component of the SAC at some time during the trial period.

Potential beaver effects relevant to this habitat type include grazing activities. Beaver will feed on a wide range of terrestrial, aquatic and semi-aquatic plant

species. Consequently they are expected to graze on submerged species, floating species, emergents, and littoral species.

Beavers usually have the entrances of their dens/lodges to be underwater. In situations where existing water levels are insufficiently low, they may dam to raise the water levels. This is expected to be most likely to occur along some of the shallow, interconnecting burns within the trial area. In the case of the standing waters, the water levels are already sufficiently high for beaver, and they are less likely to dam. However, it is possible they may attempt to dam outflows of the standing waters and raise water levels by a limited amount (i.e. water levels would not have to be raised as much as for a shallow burn). Water levels in the lochs are known to vary. SNH monitored water levels through monthly checking of fixed stage boards at all of the lochs within the Knapdale component of the SAC between 27/6/02 and 12/10/05. The following gives an indication of water level variation recorded for each loch during this period:

- Loch Barnluasgan - 34cm
- Loch Coille-Bharr - 33cm
- Unnamed loch (east of Fidhle) - 12cm
- Lochs Linne/Fidhle - 41cm
- Creagmhor Loch - 22cm
- Dubh Loch - 27cm

The effect of any dam construction at the outflow may be to produce higher levels than at present.

Any damming of burns upstream of the standing waters may result in decreases in the sediment load, although this is expected to be minor. Changes to water chemistry are expected to be limited within the standing waters since they are relatively large, and effects will be buffered.

European beaver is a natural component of freshwater ecosystems in Europe. This is reflected by the fact that there are 98 SACs within the EU (within seven Member States) where both beaver and oligo-mesotrophic lochs, of the type found at Knapdale, are both identified as SAC interests. There are also other SACs where other types of Annex I standing water interests occur with beaver.

In summary, there is a likely significant effect from the proposed trial due to beaver grazing activities and potential altering of water levels. Issues relating to visitors to the beaver project could also have a significant effect, particularly in relation to disturbance of typical species.

6.3.2 Conservation Objectives

In order to determine the effects of the proposal on site integrity, the conservation objectives which apply to the oligo-mesotrophic lochs interest are examined in turn below.

The conservation objectives are to ensure for the qualifying habitat, oligo-mesotrophic lochs, that the following are maintained in the long term;

Extent of the habitat on site
The SAC consists of intricate mosaics of aquatic macrophyte, and other semi-aquatic and emergent plant communities within the standing waters of the site. Based on the European experience, this heterogeneous pattern of vegetation is expected to be maintained.

A study of beaver effects on aquatic macrophytes has been undertaken at a Scottish site where animals are kept in large enclosures (Jones 2006). Beaver-proof exclosures placed in and around a well-developed loch system were used to examine the effect of grazing on macrophyte communities over two years. Aquatic macrophyte species richness was found to be slightly higher outside than inside the exclosures, in both sampling years. When the annual datasets were combined, the results showed the same trend, although the higher species richness outside than inside the exclosures was not significant. Beavers had no discernible impact on *Potamogeton natans* which was the dominant macrophyte at the site. Beavers fed on the basal shoots and rhizomes of a number of emergent species, including *Iris pseudacorus, Menyanthes trifoliata, Equisetum fluviatile* and *Carex rostrata.* The areas affected were <1% of the total area of vegetation so such impacts were judged to be negligible compared with the sort of impacts that would be associated with storms, natural failures of floating macrophyte rafts etc. More recently it has become evident at the study site that beavers redistribute fragments of these species so there are now floating rafts formed from detached fragments in places where no vegetation had existed previously.

We expect no adverse impact on the extent of qualifying standing water habitat, rather some localised changes to species composition and structure in some specific areas.

Distribution of the habitat within site
The response as set out for the above conservation objective also applies here.

Structure and function of the habitat
In the bays/inlets of the lochs where natural succession might normally affect aquatic plant communities, beaver activities are likely to result in a local reduction of edge scrub invasion and a maintenance of open water areas. This will also apply to small standing water bodies such as the small Dubh Loch (although we cannot confirm that this particular water body is an oligo-mesotrophic loch). Beaver grazing on riparian trees and shrubs is expected to result in localised, patchy reductions in shading in some areas thereby increasing aquatic macrophyte growth on a small scale.

Water levels in the standing waters are already relatively high, in terms of requirements for beavers. Beaver damming of outflows is therefore not as likely as the damming on the shallow interconnecting burns, although still possible. At the moment there is some existing natural variation in water levels on these lochs (e.g. monitoring of water levels at Loch Barnluasgan has shown variations of 34cm over a 28 month period). The presence of a beaver dam on the outflow would reduce the existing water level fluctuation, and possibly increase levels above those at present. In the longer term any dams that are created would eventually be abandoned and water levels would subsequently decrease to previous levels.

We believe that the damming of loch outflows will probably not be detrimental, and may possibly be beneficial. However, we propose that this issue is investigated as part of the trial within those lochs not part of the SAC. While this issue is investigated further, if beaver dams are created on the SAC loch outflows, then they will either be removed, or regulated (e.g. using pipe systems) so that the water levels are within the usual natural range. This would ensure the site will not be adversely affected.

Processes supporting the habitat

The issue relating to the possible damming of outflows, described above, also applies here. The effects of damming outflows on water quality in lochs with low nutrient levels, which are not receiving anthropogenic nutrient inputs, would not be expected to be large.

The construction of beaver dams upstream of standing waters may result in minor, localised alterations to quantities and timing of silt inputs to lochs. This reduction of silt input could be more significant and beneficial to the oligo-mesotrophic lochs during large-scale disturbance of soils, for example during forestry operations to remove conifer.

The presence of beavers may have some effect on the aquatic plants in this habitat type, possibly beneficial. Some localised and small scale modification of species abundance and structure in the lochs would be compatible with the conservation objective.

North American beaver *Castor canadensis* is known to feed extensively on *Elodea* spp. *Elodea canadensis*, an invasive non-native species, which has been recorded in Lochs Barnluasgan and Loch Coille-Bharr (and was identified during SCM as a reason for categorising Loch Coille-Bharr loch as “favourable condition – at risk”). European beaver is expected to feed on *Elodea canadensis* and, by ensuring the invasive plant does not become too dominant, may be able to play a role in reducing any potential detrimental impacts on native species.

It is highly likely that the European beaver was once a natural component of this habitat type in Scotland, as it currently is in mainland Europe. The trial may therefore result in the restoration of what was likely to have once been one of the more significant and influential 'typical species' of oligo-mesotrophic lochs.

Effects on typical species of the habitat (distribution, viability and disturbance)

Beaver will feed on a wide range of terrestrial, aquatic and semi-aquatic plant species. Consequently they are expected to graze on submerged species, floating species, emergents, and littoral species. Beavers will tend to mix their diet, rather than concentrate on individual species. The lochs within the SAC contain intricate mosaics of aquatic macrophytes, and other semi-aquatic and emergent plant communities within the standing waters of the site. It is expected that the overall distribution of the typical species of vegetation in the lochs will be maintained (further details in 'extent of habitat on the site' above). Similarly, the overall distribution of associated invertebrate and vertebrate typical species is expected to be maintained.

Beavers will not significantly disturb typical species of the habitat. However, the presence of people, and dogs etc., can result in disturbance to some animal species under certain scenarios. The issue of visitor management linked to the beaver proposal is therefore relevant to this conservation objective.

There are proposals to develop visitor facilities at the site. This would largely be targeted at the provision of visitor information and interpretation within the existing FCS buildings at Barnluasgan (NR791909) and Barr an Daimh (NR796917), where the majority of visitors would be channelled through the use of signage and existing parking facilities. The aim is to manage visitors at the existing information and interpretation 'honeypots', and to avoid large increase of visitors moving into the more sensitive areas of the SAC.

There are already designated public footpaths, cycling tracks etc within the SAC area. For those visitors who wish to move away from the FCS facilities, provision will need to be put in place to allow self-guided and guided walks which are designed to utilise these existing public footpaths.

On the basis that an overall visitor management plan is agreed and implemented prior to the release of beaver and throughout the project (e.g. signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.), and this plan and the design of associated facilities are discussed with SNH, the site will not be adversely impacted.

Note that this appraisal assumes relatively low levels of visitors in the early stages of the project, and the provision of the interpretative facilities as described above. If there are plans for other visitor facilities (e.g. there is a future proposal for a hide to be set up near a beaver lodge – but this cannot be assessed until

the location of any proposed hide is known, which in turn cannot be identified until the beavers set up a lodge), a further appraisal will be required.

6.3.3 SNH Advice in relation to effects on oligo-mesotrophic lochs

Background

The proposal consists of a trial reintroduction of European beaver to Knapdale. This trial area lies partly within Special Area of Conservation (SAC) classified for oligotrophic to mesotrophic standing waters with vegetation of the *Littoreletea uniflorae* and/or of the *Isoëto-Nanjuncetea* (referred to elsewhere in this document as oligo-mesotrophic lochs).

The site's status as a classified SAC under the EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the “Habitats Directive”), means that the Conservation (Natural Habitats, &c.) Regulations 1994 as amended, (the “Habitats Regulations”) apply. The requirements are summarised in SE Circular 6/1995 as amended June 2000 and include, at paragraph 12:

"The Regulations (48) require that, where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated."

SNH’s advice is that this proposal is likely to have a significant effect on the qualifying interest of the site. **However SNH would further advise the Scottish Government that on the basis of the appraisal carried out to date, that if the proposal is undertaken strictly in accordance with the following conditions, then the proposal will not adversely affect the integrity of the site.**

a) Beaver dam construction on loch outflows to be carefully monitored and SNH to be informed immediately once new dams are created. If beaver dams are constructed on the outflows of oligo-mesotrophic lochs within the SAC, then the natural water levels of the lochs must be maintained, either through the use of beaver-specific devices which can be incorporated to manage water flow, or through removing the dam. The details to be discussed and agreed with SNH.

b) A visitor management plan must be agreed and implemented prior to the release of beaver and during the lifetime of the project (addressing issues such as signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.). This plan and the design of associated facilities must be discussed and agreed with SNH.

It should be noted that Scottish Government is required to undertake an appropriate assessment of the implications of the proposal for the site in view of the site's conservation objectives for its qualifying interest(s). This assessment may be based on the above appraisal by SNH but the Scottish Government may wish to carry out further appraisal before completing the appropriate assessment.

References

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6.4 APPRAISAL: TAYNISH AND KNAPDALE WOODS SAC - OTTER

6.4.1 Introduction

A survey for otter was undertaken at Taynish and Knapdale Woods SAC in September 2003 for the purpose of Site Condition Monitoring (SCM). The survey was also a contribution to the Fourth National Otter Survey of Scotland (Strachan 2004). Taynish and Knapdale Woods SAC was assessed to be maintaining favourable status for otter, with no potential threats noted. Five survey sites were visited, all with signs of otters including resting sites and potential breeding dens. In total 49 spraints were found of various ages, confirming regular use of the habitat. Some of the spraints on the coast consisted entirely of crab, suggesting the possible presence of cubs.

The SCM survey found that the rocky shores to Loch Sween and the associated woodland cover provide favourable habitat for otters. However, it was judged unlikely that the freshwater lochs of Knapdale could maintain otters in isolation from prey-rich coastal areas adjacent to Loch Sween, due to their limited fish biomass. The freshwater lochs at Knapdale, therefore, are not thought to provide sufficient prey for all the needs of the local otter population.

Information from Europe indicates that the presence of beaver does not appear to be detrimental to otter, and indeed may be beneficial. For example, the Danish trial reintroduction of beaver to Klosterheden Forest included an assessment of the effect on the resident otter population. No negative effects were observed on the otter population. The number of locations with evidence of otter presence has increased throughout the catchment following beaver reintroduction. After the beavers were released at the site, otter was put forward as a Habitats Directive Annex II interest at the SAC at Klosterheden, and it is the view of the Danish Forest and Nature Agency that the otter interest can be maintained in the presence of beavers.

European beaver is a natural component of freshwater ecosystems in Europe, and beaver and otter are often recorded in the same areas. This is reflected by the fact that there are 396 SACs within the EU (within eight Member States) where both beaver and otter are both identified as Annex II SAC interests.

There is a likely significant effect from the proposed trial due to beaver grazing activities and potential altering of water levels. Issues relating to visitors to the beaver project may also have a significant effect, particularly in relation to disturbance.

6.4.2 Conservation Objectives

In order to determine the effects of the proposal on site integrity, the conservation objectives which apply to the otter interest are examined in turn below.

The conservation objectives are to ensure for the qualifying species, otter *Lutra lutra*, that the following are maintained in the long term;

Population of the species as a viable component of the site
European beaver and otter do not compete directly for resources. Otter is a predatory species, beaver is herbivorous. Otter and beaver territories will overlap. There are occasional records of otter predation on beaver.

Information from Europe indicates that the presence of beaver does not appear to be detrimental to otter, and indeed may be beneficial. This is believed to be linked to the habitats that are created where beaver has been active, such as ponds, localised wetland areas etc., which are also good quality habitat for otter and otter prey.

There will therefore be no adverse impact on the population of the species as a viable component of the site.

Distribution of the species within the site
As described above, European information indicates that the presence of beaver will not affect otter distribution adversely. It is possible that an increase in wetland habitat may result in some localised increases in the overall area where otters are most likely to actively forage.

In terms of the effect of increased human activity associated with the project, the relatively small-scale activity of project workers will generally have no effect as otter can tolerate low levels of disturbance. The construction of artificial lodges, and the erection of fencing does have the potential to affect otter distribution at a local scale. This will mean sites to be affected in this way will need to be surveyed to check for the presence of otter holts/couches, and beaver fences must be designed to avoid otter pathways, or constructed to allow otter to cross them. Artificial lodges could be removed completely at the end of the trial, or left *in situ*, since otter may eventually use abandoned lodges as holts.

The integrity of the site will not be adversely affected, in relation to otter, if the proposed mitigation is addressed.

Distribution and extent of habitats supporting the species
Beaver activities can result in increased wetland habitat suitable for amphibians and some localised changes to fish populations. Amphibians may be important seasonal sources of prey for otter populations. A net benefit to otter, in terms of provision of foraging habitat, is expected as a result of beaver activities.

Coastal otter populations require access to freshwater bathing pools in order to remove salt from their fur, thus maintaining thermal efficiency. Beaver activities could result in increased numbers and area of freshwater pools that could potentially be used by otter as bathing sites. Abandoned beaver lodges and dens may be used by otter as holts.

The issue of artificial lodge construction and fence erection is dealt with above. There will be no adverse impact on the distribution and extent of habitats supporting otter, if the proposed mitigation described in the above section is addressed.

Structure, function and supporting processes of habitats supporting the species
This is dealt with in the section above.

No significant disturbance of the species
Beavers will not significantly disturb otter. However, the presence of people, and dogs etc., can result in disturbance to otter at certain levels and under certain scenarios. The issue of visitor management linked to the beaver proposal is therefore relevant to this conservation objective.

There are proposals to develop visitor facilities at the site. This would largely be targeted at the provision of visitor information and interpretation within the existing FCS buildings at Barnluasgan (NR791909) and Barr an Daimh (NR796917), where the majority of visitors would be channelled through the use of signage and existing parking facilities. The aim is to manage visitors at the existing information and interpretation 'honeypots', and to avoid large increase of visitors moving into the more sensitive areas of the SAC.

There are already designated public footpaths, cycling tracks etc within the SAC area. For those visitors who wish to move away from the FCS facilities, provision will need to be put in place to allow self-guided and guided walks which are designed to utilise these existing public footpaths.

On the basis that an overall visitor management plan is agreed and implemented prior to the release of beaver and throughout the project (e.g. signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.), and this plan and the design of associated facilities are discussed with SNH, the site will not be adversely impacted.

Note that this appraisal assumes relatively low levels of visitors in the early stages of the project, and the provision of the interpretative facilities as described above. If there are plans for other visitor facilities (e.g. there is a future proposal for a hide to be set up near a beaver lodge – but this cannot be assessed until the location of any proposed hide is known, which in turn cannot be identified until the beavers set up a lodge), a further appraisal will be required.

6.4.3 SNH Advice in relation to effects on otter

Background

The proposal consists of a trial reintroduction of European beaver to Knapdale. This lies partly within Special Area of Conservation (SAC) classified for otter *Lutra lutra*.

The site's status as a classified SAC under the EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive"), means that the Conservation (Natural Habitats, &c.) Regulations 1994 as amended, (the "Habitats Regulations") apply. The requirements are summarised in SE Circular 6/1995 as amended June 2000 and include, at paragraph 12:

"The Regulations (48) require that, where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated."

SNH's advice is that this proposal is likely to have a significant effect on the qualifying interest of the site. **However SNH would further advise the Scottish Government that on the basis of the appraisal carried out to date, that if the proposal is undertaken strictly in accordance with the following conditions, then the proposal will not adversely affect the integrity of the site.**

a) The methods, and the location, design and construction of structures, required for the 'soft release' of beavers (e.g. artificial lodges and fencing) must take into account local otter activity. The same applies to the erection of fencing for any other purpose during the trial (e.g. the exclusion of beavers from sensitive areas). This must be discussed and agreed with SNH.

b) A visitor management plan must be agreed and implemented prior to the release of beaver and during the lifetime of the project (addressing issues such as signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.). This plan and the design of associated facilities must be discussed and agreed with SNH.

It should be noted that Scottish Government is required to undertake an appropriate assessment of the implications of the proposal for the site in view of the site's conservation objectives for its qualifying interest(s). This assessment

may be based on the above appraisal by SNH but the Scottish Government may wish to carry out further appraisal before completing the appropriate assessment.

References

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6.5 APPRAISAL: TAYNISH AND KNAPDALE WOODS SAC – MARSH FRITILLARY BUTTERFLY

6.5.1 Introduction

A survey for marsh fritillary butterfly was undertaken at Taynish and Knapdale Woods SAC in August 2004 for the purpose of Site Condition Monitoring (SCM). The SAC was assessed to be maintaining favourable status for the butterfly. A total of 214 larval webs were counted (47 webs per hour of searching). The area of habitat judged suitable within the SAC was estimated to be approximately 10ha, restricted to the coastal grassland area in the southern part of the Taynish component of the SAC.

The proposal is to undertake the trial in the Knapdale component of the SAC only. The Taynish component of the SAC lies to the south-west of the Knapdale component and, at their closest point the two components are approximately 0.5km from each other across an area of sea. However, three larval webs were found near Loch Barnluasgan in autumn 2006, and three adults in summer 2007. These are the first records of the species within the Knapdale component of the SAC since the site was designated. There is also a historical 1972 record of marsh fritillary from NR787908, by the north-west tip of Loch Coille-Bharr.

Management for marsh fritillary butterfly aims to create a mosaic of vegetation, mainly within the an optimal sward height of 5-15cm (sub-optimal heights of 15-25 cm), with some longer, tussocky vegetation which provides shelter for larval webs. Devil's bit scabious *Succisa pratensis* is the larval food plant. Suitable habitat is presently maintained at Taynish by light cattle grazing. However vegetation in ungrazed areas has become too rank and *Succisa pratensis* has been suppressed by *Molinia*. It is uncertain whether suitable habitat can be restored in such areas in the absence of grazing.

Highland cattle and Hebridean sheep have recently been introduced as seasonal grazers at the Loch Barnluasgan site where the butterfly has just been recorded,

Marsh fritillary butterflies tend to live within metapopulations, and demonstrate cyclical, fluctuating population numbers linked to parasite population numbers and the weather. "Core" parts of the metapopulations persist even during the poor years, although surrounding "satellite" colonies may become temporarily extinct. The theory is that such satellite colony areas may be re-colonised from animals dispersing away from core colonies in good years, if the habitat is suitable. A core part of the SAC's metapopulation is within the south Taynish area. It seems likely that the newly recorded Loch Barnluasgan population is a satellite colony, and it remains to be seen whether it can persist within poor years.

European beaver and marsh fritillary butterfly are often recorded in the same areas on the European continent. This is reflected by the fact that there are 57 SACs within the EU (within seven Member States) where both beaver and marsh fritillary butterfly are both identified as Annex II SAC interests.

There is a likely significant effect from the proposed trial due to beaver grazing activities. Issues relating to visitors to the beaver project may also have a significant effect.

6.5.2 Conservation Objectives

In order to determine the effects of the proposal on site integrity, the conservation objectives which apply to the marsh fritillary butterfly interest are examined in turn below.

The conservation objectives are to ensure for the qualifying species, marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia*, that the following are maintained in the long term;

Population of the species as a viable component of the site

The vast proportion of the SAC's marsh fritillary population is on the Taynish component of the site. However, the trial will only take place within the Knapdale component.

Beaver activity is very much weighted towards freshwater riparian areas. The majority of their time, and foraging effort, is spent either within water or within 10m of water edge. They may occasionally forage up to a few tens of metres away from water edge. Most of the marsh fritillary butterfly population is more than 10m distance from freshwater edge, and therefore away from areas within which beavers would be most frequently active.

Even if beavers were to be active within such areas, their grazing activity would have an overall beneficial effect (or at the very least, neutral), through reducing the encroachment of shrubby and shading species.

There will therefore be no adverse impact on the population of the species as a viable component of the site.

Distribution of the species within the site

As described above, the Taynish component of the population will not be affected. The Knapdale component of the overall SAC population, newly discovered at Loch Barnluasgan, now forms an important part of the overall distribution of the species.

Beaver will not be released at Loch Barnluasgan but, since the proposed release site of Loch Coille-Bharr is downstream, it is expected that they will reach the loch during the trial. The activity of beaver is expected to be beneficial as

described above. There will therefore be no adverse impact on the population of the species as a viable component of the site.

Distribution and extent of habitats supporting the species
The presence of devil's bit scabious *Succisa pratensis* is essential, within a mosaic of vegetation, mainly within the optimal sward height of 5-15cm (sub-optimal heights of 15-25 cm), with some longer, tussocky vegetation which can provide shelter for larval webs. The activity of beaver is expected to be beneficial (or at the very least, neutral), as described above. There will therefore be no adverse impact on the population of the species as a viable component of the site.

Structure, function and supporting processes of habitats supporting the species
This is dealt with in the section above.

No significant disturbance of the species
Beavers will not significantly disturb marsh fritillary butterfly.

In terms of visitors coming to see the beaver project, there are already designated public footpaths, cycling tracks etc within the SAC area. For those visitors who wish to move away from the FCS facilities, provision will need to be put in place to allow self-guided and guided walks which are designed to utilise these existing public footpaths.

There is currently a footpath that is located around Loch Barnluasgan and runs close to the area within which marsh fritillary butterfly has recently been recorded. However, on the basis that an overall visitor management plan is agreed and implemented prior to the release of beaver and throughout the project (e.g. signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.), and this plan and the design of associated facilities are discussed with SNH, the site will not be adversely impacted.

Note that this appraisal assumes relatively low levels of visitors in the early stages of the project, and the provision of the interpretative facilities as described above. If there are plans for other visitor facilities (e.g. there is a future proposal for a hide to be set up near a beaver lodge – but this cannot be assessed until the location of any proposed hide is known, which in turn cannot be identified until the beavers set up a lodge), a further appraisal will be required.

6.5.3 SNH Advice in relation to effects on marsh fritillary butterfly

Background

The proposal consists of a trial reintroduction of European beaver to Knapdale. This lies partly within Special Area of Conservation (SAC) classified for marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia.*

The site's status as a classified SAC under the EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the “Habitats Directive”), means that the Conservation (Natural Habitats, &c.) Regulations 1994 as amended, (the “Habitats Regulations”) apply. The requirements are summarised in SE Circular 6/1995 as amended June 2000 and include, at paragraph 12:

"The Regulations (48) require that, where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated."

SNH’s advice is that this proposal is likely to have a significant effect on the qualifying interest of the site. **However SNH would further advise the Scottish Government that on the basis of the appraisal carried out to date, that if the proposal is undertaken strictly in accordance with the following conditions, then the proposal will not adversely affect the integrity of the site.**

a) A visitor management plan must be agreed and implemented prior to the release of beaver and during the lifetime of the project (addressing issues such as signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.). This plan and the design of associated facilities must be discussed and agreed with SNH.

It should be noted that Scottish Government is required to undertake an appropriate assessment of the implications of the proposal for the site in view of the site’s conservation objectives for its qualifying interest(s). This assessment may be based on the above appraisal by SNH but the Scottish Government may wish to carry out further appraisal before completing the appropriate assessment.

6.6 APPRAISAL: KNAPDALE LOCHS SPA – BLACK-THROATED DIVER.

6.6.1 Introduction

The SPA is composed of a cluster of breeding lochs of which Loch Clachaig is the only one within the proposed trial area. Loch Clachaig is not one of the proposed release sites for the beavers, nor is it within the same catchment as the release sites. However it is possible that beavers may move to this loch during the trial period. The loch has an artificial nesting raft although the shore could also be used by black-throated divers.

The trial will be for five years plus up to one further year to assess the results, meaning six breeding seasons could be affected. There are key periods during the diver breeding season that could overlap with the activities of the beavers and/or indirectly by disturbance from project staff or others checking for beaver occupancy.

European beaver is a natural component of freshwater ecosystems in Europe in which the diver may also occur. Similarly, the black-throated diver is also recorded living in the same areas as the North American species of beaver.

Impacts of beavers could be to raise the water level of the loch by damming outflow burn(s) that could flood diver nests with eggs. Otherwise, fluctuations in water levels are a normal experience for divers at breeding lochs. The loch is a reservoir for the Crinan Canal but British Waterways (BW) do not draw down water during the breeding season to avoid impacting on the divers.

The key period of the year would be nesting, egg laying and incubation. Divers sometimes lay replacement clutches and so the breeding season can be prolonged in some years.

Therefore there is a likely significant effect from the proposed trial due to beavers altering water levels at times during the breeding season and from disturbance to adults and young during the breeding season.

6.6.2 Conservation Objectives

In order to determine the effects of the proposal on site integrity, the conservation objectives which apply to the black-throated diver interest are examined in turn below.

The conservation objectives are to ensure for the qualifying species, black-throated diver, that the following are maintained in the long term;

Population of the species as a viable component of the site

The site supports four pairs of breeding divers and therefore Loch Clachaig is an important component to ensure that the population is maintained. Dam building

in the outflow burns during the breeding season could cause changes in water levels that might flood nests with eggs or prevent adults brooding young. This would only occur if the birds nested on the shore. However most breeding attempts use the artificial raft which is anchored and is able to move up and down with changing water levels. Beavers could have a direct impact if dam building took place during the nesting period. A dam established before breeding and which maintained a near constant water level would not have an impact. An increase in water level is unlikely to have an adverse impact on divers through indirect impacts to fish prey. Under natural conditions fluctuations occur and outwith the breeding season major fluctuations occur due to the usage by British Waterways for the Crinan Canal. If damming were prevented during the crucial part of the breeding season then there would be no adverse impact from beavers.

There is also the potential for disturbance from project staff and others checking the area for beaver activity during the breeding season. There is an existing track up to the loch but the level of usage is low. Any project activity during the breeding season should be confined to the outflow burns to check for beaver activity

Distribution of the species within the site
The loch is one of several breeding lochs used by breeding divers. The birds would use the lochs and attempt to nest irrespective of fluctuations in water level and so the distribution of birds in the site would not be affected during the period of the trial. However their breeding distribution in the site would be affected as would the overall breeding success of the site. Therefore, as above, if damming was prevented during the key part of the breeding season and monitoring activity minimised then there would be no direct adverse impact from beavers.

Distribution and extent of habitats supporting the species
The only physical impact the beavers would have on the loch itself is by raising the water level but this would not affect the divers. The loch is an oligotrophic hill loch and contains few macrophytes and it, or its outflow burns, are unlikely to be colonised by beavers during the trial period. Therefore there will be no adverse impact on the distribution and extent of habitats supporting the breeding divers.

Structure, function and supporting processes of habitats supporting the species
The habitats supporting the breeding divers at the loch are the loch itself, water level and the prey fish. Beavers are only likely to have an impact on the water level and that can be dealt with as above.

No significant disturbance of the species
Already dealt with above.

6.6.3 SNH Advice in relation to effects on black-throated diver

Background

The proposal consists of a trial reintroduction of European beaver to Knapdale. This lies partly within Special Protection Area (SPA) classified for its breeding black-throated diver, *Gavia arctica.*

The site's status as a classified SPA under the EC Directive 79/409/EEC on the Conservation of Wild Birds (the "Birds Directive"), means that the Conservation (Natural Habitats, &c.) Regulations 1994 as amended, (the "Habitats Regulations") apply. The requirements are summarised in SE Circular 6/1995 as amended June 2000 and include, at paragraph 12:

"The Regulations (*48*) require that, where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated."

SNH's advice is that this proposal is likely to have a significant effect on the qualifying interest of the site. **However SNH would further advise the Scottish Government that on the basis of the appraisal carried out to date, that if the proposal is undertaken strictly in accordance with the following conditions, then the proposal will not adversely affect the integrity of the site.**

a) Outflow burns of Loch Clachaig to be checked for beaver activity annually in March before the return of divers; if a dam is present consult SNH to determine whether it needs to be removed

b) No dam building by beavers in outflow burns of Loch Clachaig to be permitted during the period April to July inclusive. Any dams being built during that period should be removed without disturbance to the divers.

c) If divers are breeding on Loch Clachaig in any year then checking for beavers must be carried out without any disturbance to the breeding birds. Black-throated diver is listed on Schedule 1 of the Wildlife & Countryside Act 1981, as amended, therefore, prior to any survey work, relevant project staff must apply for a licence from SNH.

It should be noted that Scottish Government is required to undertake an appropriate assessment of the implications of the proposal for the site in view of the site's conservation objectives for its qualifying interest(s). This assessment

may be based on the above appraisal by SNH but the Scottish Government may wish to carry out further appraisal before completing the appropriate assessment.

6.7. SUMMARY OF APPRAISALS AS TO WHETHER IT CAN BE ASCERTAINED THAT THE PROPOSAL WILL NOT ADVERSELY AFFECT THE INTEGRITY OF THE SITES

6.7.1 Introduction

Sections 6.2 – 6.6 provide separate appraisals for each SAC and SPA qualifying interest. In each case, SNH's advice is that this proposal is likely to have a significant effect on the qualifying interest of the site. However SNH further advises the Scottish Government that on the basis of the appraisal carried out to date, that if the proposal is undertaken strictly in accordance with certain conditions, then the proposal will not adversely affect the integrity of the site.

This final section, therefore, provides a collation of all the relevant conditions (section 6.7.3 below). We recommend that the Scottish Government considers including these conditions as part of any licence issued to the applicants.

6.7.2 Conservation Objectives

The conservation objectives are to ensure for the qualifying habitats, oak woodland and oligo-mesotrophic lochs, that the following are maintained in the long term;

- Extent of the habitat on site
- Distribution of the habitat within site
- Structure and function of the habitat
- Processes supporting the habitat
- Distribution of typical species of the habitat
- Viability of typical species as components of the habitat
- No significant disturbance of typical species of the habitat

To ensure for the qualifying species, otter, marsh fritillary butterfly and black-throated diver, that the following are maintained in the long term;

- Population of the species as a viable component of the site
- Distribution of the species within the site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

6.7.3 SNH Advice in relation to effects on the SAC and SPA qualifying interests

Background

The proposal consists of a trial reintroduction of European beaver to Knapdale. This lies partly within Special Area of Conservation (SAC) classified for:

- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (referred to elsewhere in this document as oak woodland).
- Oligotrophic to mesotrophic standing waters with vegetation of the *Littoreletea uniflorae* and/or of the *Isoëto-Nanjuncetea* (referred to elsewhere in this document as oligo-mesotrophic lochs).
- Otter *Lutra lutra*,
- Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia.*

It also lies partly within Special Protection Area (SPA) classified for:

- Black-throated diver *Gavia arctica.*

The site's status as a classified SAC under the EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the “Habitats Directive”), and as a classified SPA under the EC Directive 79/409/EEC on the Conservation of Wild Birds (the “Birds Directive”), means that the Conservation (Natural Habitats, &c.) Regulations 1994 as amended, (the “Habitats Regulations”) apply. The requirements are summarised in SE Circular 6/1995 as amended June 2000 and include, at paragraph 12:

"The Regulations (*48*) require that, where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated."

SNH’s advice is that this proposal is likely to have a significant effect on the qualifying interests of the sites. **However SNH would further advise the Scottish Government that on the basis of the appraisal carried out to date, that if the proposal is undertaken strictly in accordance with the following conditions, then the proposal will not adversely affect the integrity of the sites.**

a) Beaver dam construction on burns to be carefully monitored and SNH to be informed immediately once new dams are created. An assessment will then be made by SNH on a case by case basis and, if judged necessary, management of the dam will be required.

b) Beaver dam construction on loch outflows to be carefully monitored and SNH to be informed immediately once new dams are created. If beaver dams are constructed on the outflows of oligo-mesotrophic lochs within the SAC, then the natural water levels of the lochs must be maintained, either through the use of beaver-specific devices which can be

incorporated to manage water flow, or through removing the dam. The details to be discussed and agreed with SNH.

c) No dam building by beavers in outflow burns of Loch Clachaig to be permitted during the period April to July inclusive. Any dams being built during that period should be removed without disturbance to the divers.

d) Outflow burns of loch Clachaig to be checked for beaver activity annually in March before the return of divers; if a dam is present consult SNH to determine whether it needs to be removed

e) Stands of hazel, which hold significant communities of 'typical species' of lichens, should be protected where necessary using appropriate methods and following discussion and agreement with SNH.

f) The methods, and the location, design and construction of structures, required for the 'soft release' of beavers (e.g. artificial lodges and fencing) must take into account local otter activity. The same applies to the erection of fencing for any other purpose during the trial (e.g. the exclusion of beavers from sensitive areas). This must be discussed and agreed with SNH.

g) If divers are breeding on Loch Clachaig in any year then checking for beavers must be carried out without any disturbance to the breeding birds. Black-throated diver is listed on Schedule 1 of the Wildlife & Countryside Act 1981, as amended, therefore, prior to any survey work, relevant project staff must apply for a licence from SNH.

h) A visitor management plan must be agreed and implemented prior to the release of beaver and during the lifetime of the project (addressing issues such as signage, interpretive information in existing buildings, provision for self-guided and guided walks etc.). This plan and the design of associated facilities must be discussed with and agreed with SNH.

It should be noted that Scottish Government is required to undertake an appropriate assessment of the implications of the proposal for the site in view of the sites' conservation objectives for their qualifying interests. This assessment may be based on the above appraisal by SNH but the Scottish Government may wish to carry out further appraisal before completing the appropriate assessment.

Trial reintroduction of European beaver to Knapdale Forest – Advice and Recommendations to the Scottish Government by Scottish Natural Heritage.
8 May 2008

DOCUMENT 3

SNH'S APPRAISAL OF THE PROPOSAL IN RELATION TO POSSIBLE EFFECTS ON KNAPDALE LOCHS SSSI, KNAPDALE WOODS SSSI, EUROPEAN PROTECTED SPECIES, SCHEDULE 5 SPECIES, BADGER AND KNAPDALE NSA.

CONTENTS:

1. KNAPDALE LOCHS SSSI

The qualifying feature of breeding black-throated diver is covered by the appraisal for the Knapdale Lochs SPA (see SNH's appraisal of the proposal in relation to possible effects on Taynish and Knapdale Woods SAC and Knapdale Lochs SPA).

2. KNAPDALE WOODS SSSI

The qualifying features are;

- Upland oak wood
- Bryophyte assemblage
- Lichen assemblage
- Breeding bird assemblage
- Loch trophic range
- Dragonfly assemblage

The upland oakwood, bryophyte assemblage, lichen assemblage and loch features are covered by the appraisal for the qualifying interests of the Taynish and Knapdale Woods SAC.

Breeding bird assemblage – The main habitat changes caused by beavers will be felling of trees and shrubs and the creation of wetlands/ flooded areas within their range The majority of woody material cut by beavers tends to be of small diameter (approximate range of 3-8cm) but they will fell larger trees. Most of their feeding and other activity takes place in water or within 10m (less frequently up to 100m) of freshwater edge. The proposed release sites will be on the lochs. The beavers might dam outflow or inflow burns and thus flood presently dry or damp areas. This could lead to the death of any trees/ shrubs in that area and/ or decrease the areas of open ground within the forest mosaic. Overall we do not consider this to be a significant risk to the breeding bird assemblage.

Impacts, if any, to the breeding bird assemblage are likely to be very localised. Impacts to species using large trees or trees away from water are likely to be negligible There could be some minor impacts to bird species using the smaller trees and scrub, on the fringes of the water. However the beavers are unlikely during the trial to remove that entire habitat in their territories and there will be similar habitat present elsewhere in the SSSI away from the areas used by beavers. The increase in open ground around the lochs and any increase in wetland/flooded areas might lead to an increase in species of those habitats. In conclusion there is not likely to be an adverse impact to the overall breeding bird assemblage in the SSSI due to the beavers.

Dragonfly assemblage – A number of species are recorded from the SSSI with the hairy dragonfly *Brachytron pratense* and the beautiful demoiselle, *Calopteryx virgo* being of most interest. The other species are well distributed in the mid-Argyll and Argyll areas. *B. pratense* breeds on the edge of the bigger lochs and its larval stages utilise floating detritus. If there was a lack of such material through beaver feeding activity then this might have an adverse impact on this species. On the other hand, removal of encroaching scrub on the water's edge with a corresponding reduction in shading might have a beneficial effect on the species. Any potential raising of water levels by beavers is unlikely to have an impact. This species should be monitored for presence/absence and evidence of breeding in the trial site and the SSSI as a whole.

C. virgo uses small burns and rivers and the adults display in the dappled sunshine created by trees/ shrubs along these burns. If the tree cover closes over and reduces the sunshine, the site is not used and conversely open burns are also not used. The species has been recorded in the SSSI but it is declining due to the tree and shrub regeneration along the burns. Therefore patchy removal of scrub by beavers is likely to have a beneficial effect on this species. Raising of water levels by damming of burns could perhaps affect the species if the water became too deep for adults to lay their eggs on submerged weed or the weed disappeared. This species should be

specifically monitored for presence/ absence along specific sections of enclosed and open burns.

3. EUROPEAN PROTECTED SPECIES

The following European Protected Species (as listed on Schedules 2 and 4 of The Conservation (Natural Habitats, &c.) Regulations 1994, as amended) are found in the trial area;

- European otter *Lutra lutra*
- Bat species - Vespertilionidae
- Wildcat *Felis silvestris*

Otter is present in the trial area both within and outwith Taynish and Knapdale Woods SAC (where it is an Annex II qualifying interest). The relationship between otters and beavers is covered by the appraisal for the qualifying interests of the Taynish and Knapdale Woods SAC.

Bat species - Daubenton's bat, Natterer's bat and pipistrelle bat species – are present in the SSSI and could use the trial area for feeding and roosting in trees and buildings. There is no evidence from elsewhere in Europe that beavers have had any adverse impact on bat species. Tree roosts will be in larger and older trees which have the necessary cracks/rotten areas. The chances of beavers felling a large tree with an occupied roost are very low, given most activity is close to water where there are generally fewer larger trees. Raising water levels will only create more areas for feeding. Overall, beavers will have no adverse impact on the favourable conservation status of bat species in the area.

Wildcat has been, and probably still is, present in the trial area. Given the behaviour and habitat requirements for this species it is difficult to envisage how beavers would have an adverse impact on wildcat. Therefore it is judged that beavers will have no adverse impact on the favourable conservation status of wildcat.

4. SCHEDULE 5 SPECIES

There are several species of mammal, protected under Schedule 5 of the Wildlife and Countryside Act 1981, as amended, present in the trial area; pine marten, red squirrel and water vole.

Pine marten and red squirrel are very unlikely to be affected by the presence of beavers The risk of felling a tree that has been occupied by these species is extremely low. Therefore beaver will have no adverse impact on these species.

Water vole habitat is protected, rather than the animal itself. The species is semi-aquatic and any effects of beavers are likely to be neutral or beneficial by increasing habitat. However habitat is probably not a limiting feature in the

trial area. There will not be any competition for food. Overall there will not be an adverse impact to water vole.

5. BADGER

Badgers are present in the trial area. They tend to have large territories in Argyll with more than one sett complex. The setts tend to be on better-drained ground, e.g. slopes and not in areas that would be susceptible to flooding by beaver activity. There might be a small loss of foraging area. However overall there will be no adverse impact to badgers.

6. KNAPDALE NSA

Key characteristics of the NSA are;

- Grained topography from NW-SE
- Heavily wooded glens
- Freshwater and sea lochs
- Mosaic of habitats and enclosed landscapes
- Tightly grained and forested hills

The western part of the trial area is within the NSA. The effects of the beavers will be extremely localised within their territories. The main landscape effects will be the local removal of trees and shrubs, that will regenerate, and creation of wetland/flooded areas. None of these activities will have an adverse impact on the integrity of the NSA.

7. SNH RECOMMENDATIONS

The Scottish Government may wish to use this recommendation, if judged appropriate, as conditions in any licence provided to RZSS/SWT.

a) *Brachytron pratense* to be monitored within the SSSI and the trial site as a whole. *Calopteryx virgo* should be monitored along specific sections of enclosed and open burns. This can be done through the monitoring programme for the project.

Other recommendations relevant to these natural heritage interests are already addressed through SNH's appraisal of the proposal in relation to possible effects on Taynish and Knapdale Woods SAC and Knapdale Lochs SPA.

Trial reintroduction of European beaver to Knapdale Forest – Advice and Recommendations to the Scottish Government by Scottish Natural Heritage. 8 May 2008.

DOCUMENT 4

BEAVER REINTRODUCTION. SUMMARY UPDATE ON THE EUROPEAN EXPERIENCE.

CONTENTS:

1. INTRODUCTION

- There are now 24 European countries that have reintroduced European beaver. There is therefore a wealth of experience to draw on in planning a Scottish reintroduction. We are unaware of any proposals to reverse reintroduction decisions in any European country.

- Article 22(a) of the Habitats Directive also states that the reintroduction of Annex IV species (such as European beaver) should take into account the experience in other EU Member States.

- SNH have already undertaken extensive consultation with relevant specialists across Europe over the issue of beaver reintroduction. Reviews commissioned by SNH, drawing on the European (and, to a lesser extent, the North American) experience, have been published and are identified in Annex 1. The European experience was also highlighted in the previous Knapdale

licence application submitted by SNH, in particular following a specific request by the previous Deputy Environment Minister, Allan Wilson MSP to provide more information on the issue. SNH's response to the previous Deputy Environment Minister was submitted in January 2005 (this has also been included as Annex 3 of the current RZSS/SWT licence application). Therefore this summary report is additional to the previous work undertaken.

- This document summarises new information on the European experience collated during October 2007 – April 2008. Most of this information was obtained through correspondence with known specialists based in several European countries.

- It should be noted that European specialists were asked, specifically, to address particular concerns that have been reported in relation to the effect of beavers. This short report also concentrates on those countries where beaver management issues have been highlighted in the past. Consequently, the experiences of countries where beaver management concerns are not judged to be such a significant issue are not highlighted to the same extent.

2. RECENT PUBLICATIONS

There have been a considerable number of publications on beaver ecology and beaver management since 2005. It is worth highlighting a few specific examples.

2.1 University of Oxford 'WildCru' report on Economic Impacts of Beaver

- Campbell, R, Dutton, A, & Hughes, J (2007). Economic Impacts of Beaver. Report for the Wild Britain Initiative

- This new study has just been published. It used questionnaires and economic tools to begin to measure the potential economic impact beavers might have on wildlife tourism in Britain. It was in effect a scoping study and so its predictive powers are limited. Its aim was merely to begin to consider the relative sizes of the costs and benefits. The authors accessed information from a range of European countries

- WildCru concluded that these benefits could be substantial. A beaver release site might bring (tourism multiplier included) over approximately £2 million per year into the local economy, whilst a pessimistic estimate could still yield approximately £0.75 million. Focused eco-tourism could further enhance these benefits, for example, just seven operators in Scotland could inject (tourism multiplier included) over £1 million into the local economy adjacent to reintroductions. Statistical analysis showed that including an enigmatic species, such as the beaver, in a tourism holiday increases its merit by £63 per person.

- In comparison WildCru concluded that the potential damages that might be caused by beavers appear small. Negative economic impacts reported from previous reintroductions varied widely and were not related to area, beaver

population size or the amount of time beavers had been in areas. Therefore it was not possible to accurately predict likely economic impacts for the UK.

- The relative sizes of the costs and benefit of a beaver reintroduction were estimated - benefits could be around 100 times larger than costs.

2.2 Norwegian beaver management manual

- Halley, D.J. & Bevanger, K. (2005). The beaver – management for hunting, wildlife and environmental resource. A handbook of modern methods for practical management of beaver populations. NINA Report 21.61 s. *In Norwegian.*

- Methods for managing beavers have been set out in a recent publication published by NINA (Norwegian Institute for Nature Research).

- Norway is not in the EU and so the Habitats Directive Annex IV provisions do not apply. However, many of the methods set out in the manual (many of them based on methods developed in other parts of Europe and in the USA by beaver management specialist Skip Lisle) are applicable to the wider European situation e.g. harvesting strategies, lethal and non lethal trapping techniques, methods to protect trees, and methods to protect culverts and regulate beaver damming activities. If there were to be any future, localised management issues following a Scottish beaver reintroduction , then some of the methodologies identified would be appropriate, for example:
  - Live-capture methods e.g. “dazzle-netting” technique
  - Tree protection measures e.g. to protect individual trees or areas of trees
  - Crop protection methods e.g. use of standard portable electric fence, standard stock netting
  - Culvert protection e.g. “beaver deceiver” designs
  - Damming issues e.g. removal or flow-regulating pipe systems

2.3 Briefing paper produced by the Salmon and Trout Association

- Anon (2008). Reintroducing beavers into the UK. Briefing paper published by the Salmon & Trout Association.

- We received a copy of this document in April 2008. It was produced with input from European specialists. We understand it will be placed on the Salmon and Trout Association’s web site (http://www.salmon-trout.org/index.asp) in the near future.

- The Association concludes the briefing note with the following text: “Beavers have the ability to bring enormous benefits to the ecology of our watercourses. They have profound and far-reaching impacts on geomorphology, nutrients, sediment, biodiversity and could help offer flood protection. The reintroduction of beavers has the ability to achieve many

targets under current political drivers such as WFD and the Habitats Directive. The practicality and benefits of introducing beavers will depend on the location and topography of the local area. We therefore feel that reintroduction should be considered on a catchment basis, and in conjunction with a comprehensive management plan and funding stream".

3 TRACKING METHODOLOGIES

3.1 Radio –tracking

- Beaver radio tracking methodologies have been further tested and refined by Telemark University College, Norway, generally recognised as a centre of beaver ecological expertise in Europe. There are pros and cons with many of the techniques. Transmitter attachment remains an issue – the Telemark University College method involves punching a hole through the beaver tail, so there are animal welfare (and possibly Home Office licensing) issues that will need to be addressed for any Scottish study. A recent Czech study has encountered high mortality in beavers that has been tentatively linked to the tagging.

3.2 Tracking without transmitters

- In the Czech Republic the beaver monitoring mainly involves non-intrusive identification of winter activity patterns to help determine beaver territories. Beavers in the Danish trial reintroduction are monitored using field signs, and assessments of population size are made through regular, coordinated, visual counts. This does not provide detailed, continual locational information on all beavers but does provide a good estimate of population numbers, a regular assessment of territory locations and an opportunity to liaise with local land owners. Local volunteers are used in the Danish monitoring, which thereby stimulates local interest and involvement.

4 BALTIC STATES

- The flat landscapes and landscape history of the Baltic States are very different to those of Scotland.

- In the Soviet period in particular, many of the extensive forest bogs that used to be present were drained for forestry or peasant agriculture. The drains, roads and culverts were generally of limited quality and so vulnerable to beaver activities in such a flat landscape - blocking one narrow ditch in a branching sequence can flood a large area.

- Finland also has flat landscapes, and a large population of beavers, but has a more developed infrastructure, agriculture, and forestry practices. Beavers there are much less problematic.

4.1 Lithuania

- Very large population of about 100,000 animals, with about 1-2 individuals per square km of the country.

- Intensively exploited, with over 10,000 beaver skins sold/year.

- Beaver tourism opportunities have not been established. Generally negative perception of beaver to date, but this is believed to be starting to change since Lithuania joined the EU and the European importance of the species has become an issue.

- Foresters claim significant damage to timber crops from flooding, although beaver specialists believe it is usually pioneer birch stands which are most affected.

- In agriculture, beavers will dam drainage routes – however, post-Soviet land reform has meant many of these drainage routes are no longer used.

- There are instances of beavers damaging fish pond banks.

- Otter populations are believed to benefit from the presence of beaver, as do amphibian populations. Beaver lodges are important to small mammals sheltering from winter conditions. The abundance and diversity of the ground surface dwelling beetles is higher in beaver “meadows” than in control habitats.

- No known public health issues reported

5 CZECH REPUBLIC

- Population of about 1500-2000 animals

- A national beaver management plan was drafted in 2006 for the Ministry of Environment, and is expected to be ratified shortly and implemented from 2008.

- Ensuring good communication between beaver workers and land users (e.g. foresters) has been important, and reduces the likelihood of conflict situations developing. Land owners are more likely to be content to accommodate beavers if they are kept informed, are aware of management techniques and know how to contact beaver specialists to request assistance if required.

- Beavers can graze on 5-15cm diameter saplings within 10m of water edge – therefore foresters are encouraged to plant saplings away from the water edge and/or fence them.

- In agricultural areas beavers may establish territories on large rivers where there are few/no trees – they will graze on a range of crops if planted close to the river edge, although there are relatively few complaints as damage tends to be limited. Localised flooding from beaver activities probably has more effect than grazing on crops.

- Electric fencing works well in excluding beavers, and beavers will avoid the same areas for some months after the fence is removed

- The main area of conflict appears to relate to fish ponds used in aquaculture. We understand there have been a small number of breaches in pond banks caused by beaver. Consequently reintroduction is not being recommended in regions where there are high numbers of ponds e.g. in the Upper Vltava and Luznice River areas of south Bohemia.

- Tourism opportunities have not been developed yet.

- No known public health concerns reported

6 DENMARK

- A trial reintroduction began in Denmark in 1999 at Klosterheden Forest, Jutland with the release of 18 animals. By autumn 2006 there were at least 86 individuals in 25-26 territories, and they have spread from the Flynder river in Klosterheden to three neighbouring rivers outwith Klosterheden.

- There are now thought to be about 100 individual beavers, based on April 2007 survey results.

- Danish Forest and Nature Agency staff have recorded an increased number of contacts with landowners, primarily in relation to areas of arable land affected by flooding from beaver dams – Agency staff have therefore removed some dams.

- Tourism and visitor interest remains high at Klosterheden – in 2005 there were 72 excursions and guided tours run by the Agency with 2,064 participants

- There are no reported public health concerns, nor concerns with regard to beaver effects on Natura sites in the area

- In September 2007 the Agency applied for permission to release beavers in Northern Sealand. The farmers' organisation has informed the relevant forest district that they have no objections to the release of beavers in their area as long as the beavers will be managed in the same way as at Klosterheden. A decision is awaited from Government.

7 GERMANY - BAVARIA

- Bavarian beaver population is now approximately 10,000 animals in 2,500 territories.

- The specialists charged with beaver management in Bavaria have informed us that they never hear of problems from two thirds of the beaver territories. In the remaining territories, any problems reported can usually be satisfactorily resolved.

- In about 10% of their casework they have to remove the beavers (e.g. situations involving sewage plants, beavers in villages, beavers in commercial fish ponds etc.).

- About 500 beavers per year are removed. Most of them are killed, as opportunities to use them in reintroduction projects become fewer.

- There are occasional issues with fish ponds – not just from beaver but also from other burrowing mammal species. Therefore, the water management agencies responsible for dykes use mesh guards to make them resistant to burrowing activities (rather than apply for permits to remove beavers).

- Agricultural damage is still generally small. A poll organised by the farmers' association in 2000 reported a total annual cost arising from beaver activity of just a few thousand Euros (although note there was no independent assessment of these reports). Apparently this is about the same amount caused by roe deer on Bavarian roads in one hour.

- The Bavarian fishermen association published findings in 2005, that fish densities in areas with dead-wood created by beaver are up to 80 times higher than outside.

- Beavers are used in tourism, but so far on a small scale through local initiatives – there are plans to increase beaver tourism potential in 2008. In other parts of Germany, there is more extensive use of beavers in tourism e.g. canoe tours.

- There is no commercial or recreational hunting of beavers in Germany.

- No known public health concerns reported.

8 NETHERLANDS

- The number of conflict situations remains low e.g. occasional reports of felling/bark stripping of fruit trees.

- Effects on dykes – Since SNH was last in touch with Dutch colleagues in 2005, there has been one case in which a beaver dug a hole into the foot of a dyke. The cost of restoring this was about 10,000 Euros.

- No known public health concerns reported.

- No studies on economic effects, but beaver spotting opportunities are believed to be an added attraction to wildlife watchers who visit the reintroduction areas.

9 NORWAY

9.1 General fishery issues

- Duncan Halley, beaver specialist based at NINA, has referred to statements in which it is claimed that, when examining beaver-fishery interactions, Norway is not a good parallel for fisheries in Scotland because the streams are in very steep sided valleys where the side streams are not useable by salmon because of the high gradient. This does appear to be the case in the west coast fjords of Norway (Stavanger-Kristiansund) but there are no beavers in these areas. However, most of the major salmon river systems (Gaula, Orkla, Namsen, Stjørdalsela, Numedalslaget, etc.) look similar to Scottish systems in general topography - these rivers all have beavers, together with salmon and sea trout spawning in tributary streams. On none of these streams are beaver dams considered a problem for fish stocks.

9.2 Norwegian study of beavers in salmonid river catchment

- Parker, H. & RØnning, O. C. (2007). Low potential for restraint of anadromous salmonid reproduction by beaver *Castor fiber* in the Numedalslagen river catchment, Norway. *River Research and Applications* 23, 752-762.

- View is that this study has close parallels to a future Scottish situation.

- The paper surveys the whole Numesdalslaget river system in SE Norway. It is a typical U-shaped valley with a main stream and tributaries, colonised by beavers from 1957 and with a mature, apparently stable, capacity beaver population, not limited by hunting pressure which is locally light. It is a major sea trout/salmon sport fishing river (apparently not dissimilar to the more heavily wooded sections of the Spey or Dee). There is a large spate every year during snowmelt, and often one or more smaller ones in rainy periods in autumn.

- Of the 87 tributaries on the catchment, 51, all wooded (on average 72% with broadleaves, mainly birch, willow & aspen), were surveyed (the rest were mostly above the tree line and not suitable beaver habitat). Only 15 tributaries had ever had records of any beaver dams. In 2003, there were only 3 colonies in total on these tributaries, which had built 5 dams between them. The main river was much more heavily occupied by beavers, and the population there much more stable - densities on the main river were ten times greater and there were no dams. Side stream dams were unusual and ephemeral, often washing out and the territories also typically being occupied rather ephemerally, only 1-3 years.

- In such catchments the bulk of the population tends to live on the main river and on any lakes; Duncan Halley's (NINA) view is that this would be the case in Scotland too, especially as a much greater percentage of tributaries small enough to dam are treeless.

- Although none of the 14 landowners in the Numesdalslaget catchment derive any hunting revenue from beavers, 64% were unreservedly positive about beavers, 29% had encountered occasional conflicts but were generally positive, 7% (one individual) was unhappy with their presence.

- The paper also assessed the potential for dams to cause restraint on salmonid reproduction. It was concluded there would be little effect.

10 NATURA SITES

- The European beaver is an Annex II species on the EC Habitats Directive. An assessment was therefore undertaken on the number of SACs with beaver present in EU Member States. A further analysis was made to ascertain whether European beaver occurred on any SACs in Europe where the qualifying interests identified for Taynish and Knapdale Woods SAC (which forms part of the proposed trial reintroduction site) also occurred.

- The four qualifying Annex I habitats and Annex II species for which Taynish and Knapdale Woods has been classified as an SAC are as follows:

  - *Lutra lutra* – otter
  - *Euphydryas (Eurodryas, Hypodryas) aurinia* – marsh fritillary butterfly
  - Oligotrophic to mesotrophic standing waters with vegetation of the *Littoreletea uniflorae* and/or of the *Isoeto-Nanjuncetea* (described as "lochs with aquatic vegetation" in table below)
  - Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

- The analysis could not be undertaken with "Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles" as this habitat only occurs in the British Isles. Therefore those European SACs with beavers which also had at least one other type of Annex I "temperate forest" feature (i.e. those with a "91-" Annex IV habitat coding) present were included in the analysis instead.

- The results are provided in Table 1 below.

A	B	C	D	E	F
EU Member State	**No. of SACs where beaver present**	**No. of SACs in column B where otter also present**	**No. of SACs in column B where marsh fritillary also present**	**No. of SACs in column B where "lochs with aquatic vegetation" also present**	**No. of SACs in column B where "temperate forests" also present**
Austria	18	10	8	9	18
Czech Republic	7	3	0	0	5
Germany	411	259	19	48	349
France	99	29	20	31	79
Hungary	8	8	1	3	8
Lithuania*	4	0	2	0	0
Netherlands	4	0	0	1	4
Poland	82	71	6	5	80
Slovenia	3	1	0	0	2
Slovakia	42	15	1	1	35
TOTAL	**678**	**396**	**57**	**98**	**580**
% of beaver SACs in which other features occur		58.4	8.4	14.5	85.5

Table 1. Number of SACs in EU Member States where beaver is present as an Annex II interest. Information is also provided on the numbers of those SACs where the qualifying interests identified for Taynish and Knapdale Woods SAC also occur. (Lithuania has an exception from the Annex II requirements for beaver – however, there are four beaver SACs listed – it is uncertain why this is so)

- Five countries have exceptions from the Annex II requirements because of their large beaver populations and do not have to submit SACs for which beaver is identified. They are Finland, Sweden, Latvia, Estonia and Lithuania (*note from the table that Lithuania has four beaver SACs listed – it is uncertain why this is so, and may be a reporting error).

- A similar analysis was undertaken by SNH as part of its licence application package of 7 January 2002. At that time there were only 85 beaver SACs in Europe, distributed between four countries. This has now increased to 678 SACs distributed between ten countries. About 61% of the beaver SACs occur in Germany.

- One of the four countries with beaver SACs from the 2002 analysis was Belgium. However, because the beaver reintroductions there had been unofficial and illegal, the listing of beaver was subsequently removed from all Belgian SACs. There are therefore no Belgian beaver SACs in the current list.

- In addition to the ten EU Member States listed in the table, plus the four others with Annex II exceptions, and Belgium, there are a further three Member States which also have beaver present: Denmark, Luxembourg and

Spain. All three of these countries are still in the very early stages of beaver reintroduction or natural colonisation and therefore it is likely that sites of sufficient quality to support SAC status have yet to be established.

- Note that the vast majority of European SACs where beaver occurs (85.5%) have some type of Annex I "temperate forest" habitat feature present. The majority also have otter present (58.4%) – this is significant in that there is a widely acknowledged view amongst European specialists that beaver presence can have a beneficial effect on otter, for example through the creation of additional wetland habitat which can provide sources of otter prey. There are 98 SACs (14.5%) where beaver and the "lochs with aquatic vegetation" feature which occurs at Taynish and Knapdale Woods, both occur – however, note there may be other SACs where other types of Annex I standing water features also occur.

11 CONCLUSIONS

- Reintroduction work and other beaver conservation action has continued across Europe. There has been a recent, significant increase in the number of SACs for which beaver is identified as an Annex II species, and a significant increase in the number of EU Member States with beaver SACs.

- Research and management methodologies continue to be developed, and there are good sources of information on best practice. There are certain issues where specific countries have particularly useful experiences which could be useful in a Scottish context e.g. the methods employed in the 'trial' and 'full' reintroduction in Denmark, the development of a national beaver management plan in the Czech Republic.

- Baltic States – These have been highlighted by others recently as examples of where beavers can cause significant damage. It is clear that are many examples of beaver conflict (e.g. damming of drainage routes, damage to fish pond banks, impact on forestry) in the Baltic States. However, it should be noted that the flat landscape, and landscape history, is completely different to that of Scotland. In Lithuania alone there are also 100,000 beavers i.e. an extremely high population in a relatively small country – the high numbers, densities and colonisation rates are different to what would happen in any Scottish reintroduction.

- Effects on land uses – The issue of dykes/canals has been raised again recently as the proposed reintroduction site at Knapdale is close to the Crinan Canal. There are records of beavers damaging the bank of a dyke in the Netherlands, and fish pond banks in several other countries, as a result of burrowing activities. There are also, as we were already aware, cases of beaver grazing and damming activities impacting on forestry and agriculture, usually on a localised level close to water edge. Therefore this highlights the importance of ensuring any beaver reintroduction is carefully designed e.g. planning the location of release sites, identifying 'buffer zones' from which animals should be removed, establishing suitable monitoring programmes, establishing local beaver management expertise (utilising the experience and

methods developed by Europeans e.g. Gerhard Schwab in Bavaria), communicating with land owners and managers etc.

- Fisheries –The recent Norwegian study demonstrated that the majority of land owners in a study catchment where both beaver and salmonids occur are positive about the presence of beavers. Further information on the fishery issue was collated for the previous SNH licence application (see Annex 2).

- We continue to find no reports of public health concerns relating to European beaver.

- The development of beaver tourism opportunities across Europe varies. In the majority of cases it appears to be relatively small scale and localised (exceptions include Denmark). This is an area where Scotland could take a lead, utilising existing experience in developing wildlife watching opportunities.

- The recent University of Oxford 'WildCru' report concludes that, taking into account the possible costs associated with reintroducing beaver, a reintroduction could bring significant overall economic benefits.

Annex 1. SNH publications - European beaver

SNH Publication Series	Authors	Publication date	Title	Contract no
SNH REVIEWS				
Review no. 49	J Conroy & A Kitchener	1996	The Eurasian beaver (*Cf*) in Scotland: a review of the literature and historical evidence	SNH/110A/95/IBB
Review no. 85	Gurnell, A	1997	Analysis of the effects of beaver dam-building activities on local hydrology	RASD/026A/97/IBB/ SRP
Review no. 86	Collen, P	1997	Review of the potential impacts of re-introducing Eurasian beaver *Cf* L. on the ecology and movement of native fishes, and the l kely implications for current angling practices in Scotland	RASD/026/97/IBB
Review 126	Reynolds, P.	2000	European beaver and woodland habitats: a review	E006278
Review 127	Kitchener, A and Lynch JM	2000	A morphometric comparison of the skulls of fossil British and extant European beavers, *Castor fiber*	BAT/97/98/19
SNH RESEARCH, SURVEY AND MONITORING REPORTS				
RSM no. 93	Macdonald, D. *et al.*	1997	Development of a protocol for identifying beaver release sites	RASD/010/96/IBB
RSM no. 94	Webb, A. *et al.*	1997	Identification and assessment of possible beaver sites in Scotland	RASD/010/96/IBB
RSM no.121	Scott Porter Research & Marketing Ltd	1998	Re-introduction of European Beaver to Scotland: results of a public consultation	BAT/97/98/134
RSM no.153	Rushton, S. *et al.*	2000	Predicting the outcome of a proposed re-introduction of the European beaver (*Castor fiber*) to Scotland.	BAT/97/98/61
SNH COMMISSIONED REPORTS				
Commissioned Report	Rushton, S. *et al.*	2002	Predicting the outcome of a proposed re-introduction of European beaver *Castor fiber* at Knapdale, Argyll.	ROAME no. F022AC327
Commissioned Report no. 26	Armstrong, H.M. *et al*.	2004	Testing methods for monitoring beaver impacts on terrestrial vegetation in Knapdale	ROAME no. F02AC327_01
Commissioned Report no. 77	Morrison, A.	2004	Trial re-introduction of the European beaver to Knapdale: public health monitoring 2001-3	ROAME no. F02AC327
OTHER SNH PUBLICATIONS				
	Scottish Natural Heritage	1998	Re-introduction of the European beaver to Scotland: A public consultation. SNH, Battleby.	