

Annex C Information on protected species

1 How to identify potential lamprey habitat in Special Areas of Conservation

The life cycle of all three species of lamprey (the brook lamprey *Lampetra planeri*, the river lamprey *Lampetra fluviatilis* and the sea lamprey *Petromyzon marinus*) found in the UK includes a sedentary larval stage during which the juvenile lamprey (known as ammocoetes) remain buried in areas of sandy silt in the margins of rivers and streams. The duration of the larval stage and so length of time that immature lamprey remained buried differs between the species; brook lamprey may remain in their nursery habitat for approximately six and a half years, river lamprey for three to five years and sea lamprey for approximately five years. However, the habitat preferences of the ammocoetes of all three species are the same:

- Optimal habitat for juvenile lamprey is defined as stable fine sediment or sand $\geq 15\text{cm}$ deep with low water velocity and the presence of organic detritus.
- Sub-optimal habitat for juvenile lamprey is defined as shallow sediment, often patchy and interspersed among coarser substrate.

There is an emerging school of thought that sea lamprey ammocoetes may also occupy habitat in deeper areas of water, but that research into this is ongoing. The likelihood of lamprey habitat existing in still water bodies, significantly in the vicinity of points where flowing water enters or leaves, should not be overlooked.

Areas of optimal habitat are likely to support relatively high abundances of lamprey ammocoetes that underpin the long-term sustainability of the river or stream's population. However, the significance of areas of sub-optimal habitat, for the distribution of lamprey within a catchment for example, should not be underestimated.

Optimal or sub-optimal habitat is likely to occur in slower flowing reaches of rivers and streams, or in the margins of faster flowing reaches, where under normal flow conditions relatively low flow velocities result in accumulations of fine sediment. Man-made structures such as bridges with abutments and/or piers in the channel may provide suitable hydraulic conditions for the development and long-term maintenance of lamprey habitat. Highly localised areas of suitable habitat may also develop in the lee of in-stream obstacles such as boulders and fallen trees. In such situations, high flows may alter the exact location of lamprey habitat within a reach; high flows may partially or completely remove it or lead to the development of entirely new areas. The location and extent of lamprey habitat may therefore vary with time, and thus emphasise the need for up-to-date survey information.

Adult lamprey require suitable holding areas and clean spawning gravels, similar to those used by spawning salmonids during their freshwater phase. In the absence of up-to-date lamprey habitat information for the stretch of river that would be directly or indirectly affected by a proposed hydropower scheme, a walkover survey to identify areas of potential juvenile (and adult) lamprey habitat should be undertaken. The survey should be conducted in normal flow conditions. Areas that appear suitable should be labelled accordingly on a hard copy map as 'optimal' or 'sub-optimal' and their position recorded using a GPS. This information may be used subsequently to direct the effort of any electric fishing survey for lampreys.

Areas of potential lamprey spawning habitat that might be affected by the development and/or operation of a hydropower scheme should also be labelled on the aforementioned hard copy map and their position recorded using a GPS. Spawning habitat requirements and timings are different for each of the three species and details are given in Natural England's document *Ecology of the River, Brook and Sea Lamprey*: <http://naturalengland.etraderstores.com/NaturalEnglandShop/IN104>

Anecdotal evidence of spawning activity may, in some instances, be available and this can be used to direct initial sampling effort.

2 How to undertake a semi-quantitative electro-fishing survey for lampreys

The sedentary larval stage of lamprey life cycles provides the best opportunity for sampling to determine presence/absence and abundance data. For the purposes of assessing the likelihood of impacts from the development and/or operation of hydropower schemes, a semi-quantitative survey will suffice.

The areas of optimal and sub-optimal habitat identified during a walk-over survey should be targeted. The electric fishing technique used to survey lamprey ammocoetes differs from that used for other fishery surveys and the Natural England document *Monitoring the River, Brook and Sea Lamprey* should be referred to for exact details: <http://naturalengland.etraderstores.com/NaturalEnglandShop/IN104>

In each distinct area of optimal or sub-optimal habitat surveyed, the species and length in millimetres of any captured ammocoetes should be recorded. Note that because of the difficulties associated with differentiating between *L. planeri* and *L. fluviatilis* in the field, it is accepted that data for these species will be recorded as simply *Lampetra* sp. A key for lamprey identification is provided in the Natural England document *Identifying Lamprey: A Field Key for Sea, River and Brook Lamprey*: <http://naturalengland.etraderstores.com/NaturalEnglandShop/IN108>

The area (in m²) of each distinct sampling location should be recorded to enable the calculation of minimum density estimates (individuals/m²).

The species and habitat data gathered from each sampling location should usually just be recorded using the type of proforma shown in Appendix 1 of the aforementioned English Nature document.

3 How to undertake a survey for freshwater pearl mussels

Standard survey methods have been developed for this species through a number of previous projects funded by Scottish Natural Heritage. These have been adapted for more site-specific projects and the following is a full version of methods for employing at specific sites.

Licensing and access permission

Freshwater pearl mussels are fully protected under the Wildlife and Countryside Act (1981). Therefore all surveyors must be licensed by SNH. Surveyors must have secured access permission from land owners before any fieldwork is undertaken. Given the ongoing threat that illegal activity, including pearl fishing, poses to freshwater pearl mussels it is considered good practice that surveyors notify the nearest police station about their survey prior to going out on site. For more information about illegal activity affecting pearl mussels, and what to do if any is detected, visit the SNH website: www.snh.org.uk/pubs/detail.asp?id=1365

Health and safety

All surveyors will have legal responsibilities under the Health and Safety at Work Act to ensure the health and safety of their employees and any other person who may be affected by their actions or omissions. All surveyors should be trained in safe working practices. It is recommended that surveyors work in pairs, and that they each wear a life jacket and thigh waders (to discourage work in deeper, fast-flowing water) and use a special wading and mussel gathering staff.

Field season

Survey work can only be undertaken in periods of low water flow. On larger rivers, opportunities for survey work can between October and March may be limited.

Site selection

The length of river to be surveyed will vary depending on the nature of the proposed project. Where there is river engineering proposed (such as bank protection or work on the river bed), then typically it will be the area of river bed directly affected by the project, together with a minimum of 0.1km upstream and 0.5km downstream which may be indirectly affected (the 'survey site'). Where a development will result in reduced flows over a river reach, the length of the affected reach (the 'survey site') should be surveyed for the presence of freshwater pearl mussels.

Survey of the area likely to be directly affected by proposed engineering project

The entire river bed should be surveyed in this part of the survey site. This can be done by laying out a 1m x 1m grid, and counting and measuring all mussels in each grid square. Searches for hidden and juvenile mussels should also be carried out in 20% of the squares in which visible mussels are recorded.

Survey of the downstream area likely to be indirectly affected by proposed project

A general survey of the river and its substrate types within the survey site should be made, by walking along the river bank and/or by wading in the water. The aim is to identify specific areas that are most likely to harbour mussels, by using information on their habitat preferences from previous studies and experience. Information on the habitat preferences of mussels is from Natural England's document *Ecology of the Freshwater Pearl Mussel*, but it is important that surveyors have past experience of working with freshwater pearl mussels:

<http://naturalengland.etraderstores.com/NaturalEnglandShop/Product.aspx?ProductID=3211a435-9d7c-4695-8a0a-169708f0830b>

Once the surveyor has found a suitable area, they should enter the river at the nearest point and conduct a search, concentrating on the most favourable substrate types so as to optimise search efficiency. To ensure compatibility with other surveys, they should search:

- using a glass-bottomed viewing bucket;
- under favourable conditions, ie bright light, clear water, low flow regime;
- in water sufficiently shallow for safe wading;
- in an upstream direction, checking favourable sites, eg in the shelter of cobbles, boulders or overhanging banks;
- by moving loose debris and trailing weed gently aside, but without disturbance of the river bed.

Negative results

If the surveyor doesn't find any mussels in a specific search area, they should move the search to other suitable areas within the survey site. Even if they do not find mussels anywhere in the survey site, the surveyor should still record site information on a standard recording form as described below. A copy of the standard recording form is available in Appendix A of Natural England's document *Monitoring the Freshwater Pearl Mussel*:

<http://naturalengland.etraderstores.com/NaturalEnglandShop/Product.aspx?ProductID=650cd48a-58a8-4761-870d-f72cb4104a51>

Positive results

If the surveyor finds a live mussel or dead shell, then they should conduct a systematic search as follows:

Within the area where mussels are found, one transect 50m long by 1m wide should be searched, and laid out so as to traverse the main area of suitable habitat. If an initial search of the whole transect indicates that there are likely to be fewer than 250 mussels, all mussels should be counted.

If there are too many mussels in the transect to count accurately (ie >250), 1m x 1m quadrats should be laid at 10m, 20m, 30m, 40m, and 50m intervals. Counts and measurements of the mussels in these five quadrats are used to provide an extrapolated estimate for the whole 50m transect.

At 10m, 20m, 30m, 40m, and 50m along the transect, a 1m x 1m quadrat is laid on the substrate. All mussels visible within the quadrat mussels are counted and then removed (to be replaced in the same quadrat later). Loose stones and debris are then dislodged to reveal any hidden mussels and, in particular, to search for any juveniles. All these mussels are measured along their longest dimension to the nearest 1mm (using dial callipers). Measurement of the mussels allows a size/age profile to be produced. It is particularly important to establish whether juvenile mussels are present, indicating active recruitment at that location. A pearl mussel is considered 'juvenile' if it is ≤ 65 mm long; mussels ≤ 30 mm long are likely to be under five years old and their presence is especially important as they indicate recent recruitment.

For each 50m transect, site details are recorded on a standard recording form. These include:

- an eight-figure grid reference;
- average width and depth(m);
- substrate composition (based on the widely used Wentworth Scale);
- main types of adjacent land-use, bankside vegetation, evidence of impacts;
- details of any discussions with local people concerning the river.

At least one photograph should be taken to indicate the position of the transect in relation to the river bank.

Standard abundance terms

The surveyor should report using the following abundance categories:

No. of live mussels per 50m x 1m transect	Abundance level
0	E
1 - 49	D
50 - 499	C
500 - 999	B
≥1000	A

Spreadsheets

The surveyor should provide a spreadsheet form that is compatible with existing spreadsheets containing pearl mussel data. Therefore it is suggested that they should provide the following data:

- mussel numbers in each 50m transect:
 - sampling point code;
 - date;
 - grid reference;
 - no. live mussels in each quadrat and total transect;
 - no. dead shells;
 - % of juvenile pearl mussels (≤65mm) in each 50m transect;
 - no. pearl mussels ≤30mm in each 50m transect etc.
- measurements of pearl mussel shell dimensions:
 - sampling point code;
 - date;
 - measurements.

They should also supply similar information for any area of riverbed that will be directly affected by a proposal.

A notes column should also be provided in the above spreadsheet, including information about potential or actual threats, particularly evidence of recent, illegal pearl fishing, and management issues which may be relevant to the pearl mussel population. Any juvenile salmonids observed during pearl mussel surveys should also be recorded in the 'notes' column.

Summary habitat information principally describing the river width, water depth, and substrate types (linked to the sampling point code and grid reference), should also be included as a separate spreadsheet.

Deep water survey

A technique has been developed for surveying visible mussels in deep water (>1m). Information is available from SNH: www.snh.org.uk/pubs/detail.asp?id=950

4 How to undertake a survey for otters

Otters are widespread in Scotland and may occur in any watercourse, including small upland burns. An otter survey should therefore be carried out in relation to any hydro-electric development.

The survey should cover the whole of the development site, focussing on:

- the riparian zone along any of the watercourses that will be affected by the development;
- the margins of any affected areas of standing water;
- the footprint of any areas that will be inundated as a result of the development and where any new infrastructure such as access roads and turbine houses are proposed.

The survey should extend 250m both upstream and downstream of the development site, on both sides of the watercourse. It is important that all otter shelters and resting places are identified; these often occur close to the water, but also in sites such as reed-beds, peat hags, or in piles of rocks (including rock-amour) some distance from open water.

Where a new access road is proposed, the survey should extend at least 100m upstream and downstream of any watercourse crossing points to ensure that the final route does not impact on otter shelters or, if this is unavoidable, that a licence is sought from the Scottish Government and appropriate mitigation put in place.

Surveyors can conduct an otter survey at any time of year, but if water levels are (or have recently been) very high, or if there was heavy rain the week before the survey, it may need to be repeated. This is because signs of otters may have been lost, giving a false indication of their absence.

The surveyor should record all evidence of otter activity within this area. They should concentrate on the margins of the watercourse/loch and immediate bank-side habitats up to 10m from the water, and search this zone thoroughly. Wading may be necessary to examine features such as root cavities and over-hanging vegetation.

The type of habitat and its value for otters should be recorded. Signs of otters include spraints (droppings), anal jelly, footprints, paths, slides, holts (underground structures), 'lie-ups', above-ground resting sites ('couches') and feeding remains. Particular care should be taken to survey under and around bridges for otter spraints and tracks, as they are often found in these locations. These signs should be mapped, preferably using a hand held GPS unit. Otter sightings are unlikely, but should be recorded.

Areas of mud and soft sand are ideal for finding footprints. Spraints are often found in conspicuous places such as ledges or stones under bridges, rocks/boulders mid-channel, and on prominent rocks and grassy hummocks.

Otters frequently use the same sprainting and feeding sites on a regular basis, and the locations of all signs (spraints, feeding remains, tracks, etc) should be recorded. Regular sprainting sites such as mossy boulders often show brown 'burn' marks due to the frequent presence of spraints. In moorland areas, particularly near the coast, traditional spraint sites can appear as small bright-green grassy mounds, due to years of nutrient enrichment.

Crevices, overhangs and open rock structures (either man-made or natural) are often favoured by otters as lying up sites. Check any rock casings, ruined buildings, bridge structures, overhanging heather-covered banks etc for resting sites and associated signs of otter presence.

Any so-called 'potential' holts or lying-up places that may be affected by the proposed works (within 30m), should be investigated further, or the proposed scheme modified such that they will not be affected in any way. The term 'potential holt/shelter' is not helpful in respect of licensing consultations and should be avoided in this context. A potential holt or shelter has no legal protection as, by definition, there is no confirmation of otter usage. Otter holts/shelters are not always marked with spraints and if these structures are discovered during a survey and don't show any other signs of current otter use then they may be categorised as potential holts, but remain unprotected unless further survey confirms otter use. Where such features are identified, the surveyor is advised to undertake a repeat visit at least three months prior to any work commencing on site, to enable a licence to be applied for and processed, should evidence of occupancy come to light. If occupancy cannot be demonstrated, it is clearly best practice to avoid unnecessary damage.

In some cases further detailed information may be required, for example determination of breeding in the area. In this case surveyors can set out sand traps for footprints to identify whether young otters are present. It should not normally be necessary, but where further information on otter holts is needed, lights or an endoscope can be used to view inside the structure. In this case, the surveyor should contact SNH for advice about the need for a licence.

What should be included in the survey and mitigation report?

In many cases, the report need not be a long one, but the following should be included within a competent survey:

- a one-page executive summary;
- the date/s and the amount of time spent in the field;
- the weather conditions and any relevant water levels/ground conditions;
- the qualifications and/or experience of the surveyor;
- a summary of the legal protection afforded to otters;
- large-scale maps showing the area searched including any limitations, such as access restrictions;
- photographs of otter holts or other key areas;
- locations of any signs of otters or otter sightings;
- locations of otter holts or resting places;
- a summary of any signs of otters found, and its importance in terms of the known otter distribution for the area;
- the potential impact of the development on otters;
- recommended mitigation proposals;
- a summary of residual impacts (ie what would the impacts be if the mitigation is adopted?);
- as the otters are an European protected species, a recommendation on whether a licence application needs to be made to the Scottish Government, based on the summary of residual impacts.

5 How to undertake a survey for water voles

Although water voles are widespread throughout Scotland, their distribution is patchy with most animals now thought to be restricted to upland/peatland habitats. They are not present on most of the off-shore islands². Upland sites should always be considered for survey in relation to hydro-electricity developments.

The survey should be designed cover all suitable habitats within the development site, focussing on:

- the riparian zone (up to 10m from the water) along the watercourses (including ditches) that that will be affected by the development;
- the margins of any affected areas of standing water;
- the footprint of any areas that will be inundated as a result of the development and where any new infrastructure such as access roads and turbine houses are proposed.

An initial desk survey should be undertaken to identify whether the species is likely to be present on or near the development site. The Local Record Centres and the National Biodiversity Network can provide some information on water vole distribution: www.nbn.org.uk

There are also two national surveys of water voles, published by the Vincent Wildlife Trust in 1993 and 2003. More information on water voles is available in the SNH on-line publication *Conserving Scotland's Water Voles*: www.snh.org.uk/publications/on-line/wildlife/voles/default.asp

For large-scale hydro-electric developments, a trawl should be made for information on the site and a radius of 2km around the development.

²A notable exception is the group of Reisa islands in the Sound of Jura, where water voles can be found at very high densities.

If the desk study suggests that voles may be present, a more detailed survey should identify the location of any water vole burrows and associated habitat, and thereby inform the design and location of the scheme to minimise any impacts. In upland areas, the use of a GIS can be invaluable in selecting areas for survey, provided data on slope and soil type (presence of peat) are available.

If evidence of water voles is found, ideally the survey should place the site in the context of the wider population: is it part of a larger (meta) population, or is the colony on the development site the only population in the area? Finally, if mitigation is required, the survey should provide a baseline for further monitoring. Water vole colonies that are located around the margins of lochs prone to water level fluctuations (as a result of proposed hydro-electric development), are particularly prone to impacts and will require carefully planned mitigation and monitoring.

Water voles have specific habitat requirements and their distribution is heavily influenced by the presence of feral American mink, such that the two species rarely coexist at the same locality. In upland areas, their preference is for peat-dominated flat or gently-sloping areas, usually <3% gradient. Sections of watercourse with an average gradient of >10% can be excluded from the survey, as can sections dominated by a rock substrate or where the banks are predominately stony and unsuitable for excavating burrows. In lowland areas water voles tend to be restricted to small watercourses, often overgrown drainage ditches, but other areas of slow-flowing or standing water with dense bank-side and marginal vegetation may be used if mink are rare or absent in the area.

With the exception of those areas initially eliminated as unsuitable for water voles, the whole of the development site should be surveyed. For small sites, an extra 50m upstream and downstream of the development should be surveyed. For larger schemes affecting several 100 metres (or kilometres) of riparian habitat that result in noticeable water level fluctuations and lead to population fragmentation and habitat loss, it would be appropriate to survey for 500m both upstream and downstream of the site.

Water vole surveys rely on the signs of the animal. These include droppings, latrines³, feeding stations (with leaves and stems which have been eaten off at each end), burrows with grazed 'lawns', above ground nests, paths and footprints. Sightings are unlikely but should be recorded.

It is possible to calculate indices of abundance from latrine counts, however the relationship between the population index and latrine counts varies according to habitat type, see page 76 of the SNH report *The ecology and conservation of water voles in upland habitats*: www.snh.org.uk/pubs/detail.asp?id=460

Therefore, the mathematical function used to derive population size from latrine counts must be appropriate for the particular geographical area or habitat type concerned. Ideally, latrine counts should not be undertaken within two weeks of heavy rainfall.

Water voles can move seasonally from place to place, so any old signs of their presence should be recorded. Their signs are most obvious when they are breeding, so surveys should be carried out during this time. Surveys in the lowlands can be undertaken between April and October. In upland areas, surveys are not recommended before May or after September, the optimum months being June–August inclusive. In some cases, it is preferable to survey twice – once early in the season, and once near the end, to get a more comprehensive result. The survey should be carried out in good weather as flooding or heavy rain will remove signs that water voles are present.

Survey work should normally include both banks of a watercourse, unless there is a good reason why this is not necessary. Water voles can temporarily abandon a site if it is disturbed, so survey works immediately after ground disturbance should be avoided.

The watercourses should be split into 500m lengths. For each length, the location of field signs should be recorded, and ranked abundant, frequent, scarce or none. The number of latrines should be counted.

Special attention needs to be given to detecting water vole signs in upland areas as the animals may frequently occupy very narrow watercourses (<1m in width) and even subterranean channels through the peat. Signs can frequently be obscured by overhanging vegetation and so a very thorough search is required.

³A latrine is defined as more than one dropping.

Photographs 1 and 2: Examples of good water vole habitat



Photograph 3: Example of unsuitable water vole habitat (but still likely to be used by otters):



Further information on water vole surveys refer to: *Water Vole Conservation Handbook. Second Edition. Strachan, Rob, and Moorhouse, Tom. Wildlife Conservation Research Unit. 2006*

What should be included in the survey and mitigation report?

A competent survey should include the following:

- a one page executive summary;
- the date/s and the amount of time spent in the field;
- the weather conditions and any relevant water levels/ground conditions;
- the qualifications and/or experience of the surveyor;
- a summary of the legal protection afforded to water voles and the practical implications of this;
- large-scale maps showing the area searched, including any limitations, such as access restrictions;
- photographs of any water vole evidence;
- locations of water vole signs, sightings, and their burrows;
- a summary of any water vole evidence found and its importance in the context of the wider meta-population in the area;
- the potential impact of the development on water voles;
- recommended mitigation proposals;
- summary of residual impacts (ie, what would the impacts be if the mitigation is adopted?);
- details of any checks of information from Local Record Centres, the National Biodiversity Network, or other sources;
- a count of water vole latrines for each 500m section surveyed;
- locations of signs of mink;
- a map and description of the habitats, including the substrate of the banks of the water courses and the shore of lochs;
- the depth, width and current of the water courses.