A10.2 Legislation, Conservation Status and Biology

This appendix presents detailed information pertinent to the legislative and conservation status of the habitats and species outlined in Chapter 10, Section 10.2 (Approach and Methods). Specific information on the biology of a receptor is provided where applicable.

1 Legislative and Policy Framework

1.1 International Conventions and Directives

Ramsar Convention

1.1.1 The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention or Wetlands Convention) was adopted in Ramsar Iran in February 1971 and came into force in December 1975. The Convention covers all aspects of wetland conservation and comprises three elements of activity: the designation of wetlands of international importance as Ramsar sites; the promotion of the sustainable use of all wetlands in the territory of each country; and international co-operation with other countries to further the sustainable use of wetlands and their resources.

The Convention on Biological Diversity (CBD)

1.1.2 The Convention on Biological Diversity (CBD) was adopted at the Earth Summit in Rio de Janeiro, Brazil in June 1992, and came into force in December 1993. It was the first treaty to provide a legal framework for biodiversity conservation, with three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from the use of genetic resources. Contracting Parties are required to create and enforce national strategies and action plans to conserve, protect and enhance biological diversity. The UK Government ratified the Convention and published the UK Biodiversity Action Plan (UKBAP) in 1994, and to compliment the UKBAP, separate biodiversity strategies for each of the devolved governments have been subsequently developed including the Scottish Biodiversity Strategy, launched in 2004.

The Bern Convention

1.1.3 The requirements of the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) came into force in 1982. The Convention imposes legal obligations on Member States to ensure conservation and protection of wild plant and animal species that are listed within the Convention which number over 500 wild plant species and more than 1000 wild animal species. These requirements are implemented in UK law through the Wildlife and Countryside Act 1981 (as amended).

The Bonn Convention on Conservation of Migratory Species of Wild Animals 1979

1.1.4 The Convention aims to achieve the effective management of migratory species across national or jurisdictional boundaries and is implemented in the UK by the Environmental Protection Act 1990.

The Birds Directive (79/409/EEC)

1.1.5 The European Union (EU) Directive on the Conservation of Wild Birds (79/409/EEC) was adopted in 1979. The Birds Directive is a primary tool for delivering EU obligations under the CBD, the Ramsar and Bonn Convention. The Birds and Habitats Directives require Member States to take a number of measures/actions in order to protect all bird species, their sites and their habitats, and these include: measures to conserve and maintain all naturally occurring bird species across the EU through the designation of Special Protection Areas (SPAs) for species listed on Annex I of the Directive and migratory species.

European Union Directive (92/43/EEC) (Habitats Directive 1992)

1.1.6 The EU Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive, 1992) is the means by which Member States meet obligations made as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). The Directive introduces a range of measures including the protection and surveillance of habitats and species. The main aim of the Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance.

1.1.7 The 189 habitats listed in Annex I of the Directive (76 of which occur in the UK; 23 of these are afforded 'priority' status as they are judged to be in particular danger of loss (Article 1)) and the 788 species listed in Annex II, are protected by means of a network of sites. Each Member State is required to prepare and propose a national list of sites for evaluation in order to form a European network of Sites of Community Importance (SCIs). Once adopted, these are designated by Member States as Special Areas of Conservation (SACs), and along with SPAs classified under the EC Birds Directive, form a network of protected areas known as Natura 2000.

Urban Waste Water Treatment Directive (91/271/EEC)

1.1.8 The Urban Wastewater Treatment Directive regulates the collection and treatment of waste water from domestic and industrial sources and protects the environment from the negative effects of urban waste water and discharges.

Water Framework Directive (WFD) (2000/60/EC)

1.1.9 The Water Framework Directive (WFD) recognises that ecosystem health is the most effective way to assess the environmental quality status of a watercourse. The WFD came into force in December 2000 and has moved the focus away from chemical water quality targets. It requires that all inland and coastal watercourses in Europe do not deteriorate from their current condition and reach at least 'good' ecological status by 2015 (not including heavily modified or artificial waterways, which must reach 'good' ecological potential). Under the WFD, the ecological status of watercourses is therefore now the focus of river management and impact assessment.

1.1.10 The WFD sets out a river basin management planning process. For each River Basin District (RBD) a River Basin Management Plan (RBMP) will be prepared, implemented and reviewed on a six-year cycle. Appropriate objectives are to be established in the RBMP. River Basin Characterisation (RBC) required by Article 5 of the Directive is an important early part of this process which, for each RBD, requires the following:

- analysis of its characteristics;
- review of the impact of human activity on the status of the waterbodies within the RBD; and
- economic analysis of water use.

1.1.11 The environmental objectives that need to be achieved under the Directive are summarised as:

- achievement of good ecological status and good surface water chemical status by 2015;
- achievement of good ecological potential and good surface water chemical status for heavily modified water bodies (HMWBs) and artificial water bodies (AWBs);
- prevention of deterioration from one status class to another; and
- achievement of water-related objectives and standards for protected areas.

1.1.12 Waterbodies are identified as being at risk if they are likely to fail any of these environmental objectives.

Environmental Protection Act 1990

1.1.13 This Act aims to provide protection and conservation of the natural environment. A number of provisions are set out within this Act, one pertinent to this development being to make provision for the improved control of pollution arising from certain industrial and other processes.

EC Freshwater Fish Directive (2006/44/EC)

1.1.14 The Freshwater Fish Directive seeks to protect freshwater bodies identified by Member States as waters suitable for sustaining fish populations. Member States classify the waters as cyprinid or salmonid and set physical and chemical water quality objectives. This Directive will be repealed in 2013 by the EC Water Framework Directive when waters currently designated under the Freshwater Fish Directive will become protected areas under the Water Framework Directive.

European Eel (Council Regulation (EC) No 1100/2007 establishing measures for the recovery of the stock of European eel)

1.1.15 In response to the decline of eels the EU proposed an Eel Management Plan in 2004 which entered into force in 2007. The aim of the plan is to protect and ensure the sustainable use of European eel stocks. A key objective is to ensure that at least 40% of the potential production of adult eels (potential production refers to pristine conditions) escape to the sea. Under the resulting Council Regulation each Member State is required to create separate management plans for each river basin district.

The Agreement on the Conservation of Populations of European Bats (Eurobats)

1.1.16 The agreement on the conservation of populations of European bats was concluded in 1991 and came into force in 1994 under the auspices of the Convention on Migratory Species of Wild Animals. The agreement which recognises that endangered migratory-species can be properly protected only if activities are carried out over the entire migratory range of the species and aims to protect all 45 species of bats identified in Europe through legislation, education, conservation measures and international co-operation.

1.2 National Legislation

The Wildlife and Countryside Act 1981 (WCA) (as amended)

1.2.1 The Wildlife and Countryside Act (WCA) 1981 (as amended) is the principal mechanism for wildlife protection in the UK, originally aimed at consolidating and amending previous legislation to implement the requirements of the Bern Convention and the Birds Directive. The statutory designation of Sites of Special Scientific Interest (SSSI) is the main site protection measure in the UK established under the WCA.

Wildlife and Natural Environment Bill (to be introduced to the Scottish Parliament 2010)

1.2.2 The Scottish Government closed consultation on their proposed Wildlife and Natural Environment Bill on 4th Sept 2009. The Bill aims to address anomalies in current wildlife legislation provision to make it more efficient and effective, and to enhance the sustainable management of the natural environment for the public interest. The consultation addressed policy on deer management, game law (game licensing and poaching), invasive non-native species, muirburn, the administration of species licensing, the implementation of Ministerial commitments on snaring, the protection of badgers and a number of issues relating to the operation of SSSI statute. The Bill is on the Scottish Parliament's Legislative Programme for 2010 and is therefore a material consideration for the project. However, there is little implication for the project based on drafts sent for consultation.

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)

1.2.3 The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) transpose Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (EC Habitats Directive) into national law. The Regulations came into force on 30 October 1994 which were subsequently amended in 1997. The Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European sites.

1.2.4 The Regulations also make it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2 of the Regulations, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4. However, these actions can be made lawful through the granting of licenses by the appropriate authorities. Licenses may be granted for a number of purposes (such as science and education, conservation, preserving public health and safety), but only after the appropriate authority is satisfied that there are no satisfactory alternatives and that such actions will have no detrimental effect on wild population of the species concerned.

1.2.5 In Scotland the Regulations were amended in 2004 (SSI/475/2004), 2007 (SSI/80/2007, SSI/349/2007) and 2008 (SSI/2008/17, SSI/2008/425).

Surface Waters (Fishlife) (Classification) (Scotland) Amendment Regulations 2007

1.2.6 In compliance with the EC Freshwater Fish Directive 2006/44/EC and in exercise of the powers provided by sections 30B and 104(1) of the Control of Pollution Act 1974 the above Regulations prescribe a system for classifying and monitoring the quality of inland waters in Scotland which need protection or improvement to support fish-life. These regulations are likely to be altered once the Freshwater Fish Directive is repealed in 2013 and is likely to be replaced by national orders to be developed instead under the WFD.

Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003

1.2.7 This Act affords protection through a number of orders to which planning authorities must adhere. Under Order 23 (Part 1: Protection of young salmon) any person who knowingly takes, injures or destroys; places any device or engine for the purpose of obstructing the passage of, any smolt, parr, salmon fry or alevin shall be guilty of an offence. In addition, any person who knowingly injures or disturbs any salmon spawn; or disturbs any spawning bed or any bank or shallow in which the spawn of salmon may be, shall be guilty of an offence.

Nature Conservation (Scotland) Act (NCSA) 2004

1.2.8 This Act requires Scottish Ministers to publish a list of habitats and species considered to be of principal importance for biodiversity. The Scottish Biodiversity List was subsequently published in 2005 and is intended to be a tool for public bodies and others doing their biodiversity duty and as an important source of information and guidance for all.

1.2.9 The Act has three parts:

- Part 1 promotes the conservation of biodiversity whereby all Scottish public bodies and office holders will be obliged to ‘further the conservation of biodiversity’ in the course of exercising their functions;
- Part 2 revises the designation of the SSSI system for protecting Scotland's most precious natural places; and
- Part 3 enhances the existing species protection provisions of the WCA 1981 (as amended) by adding the word ‘recklessly’ to legislation regarding killing, injury or disturbance of protected species so that ‘intent’ no longer needs to be proven.

Protection of Badgers Act (PBA) 1992

1.2.10 Badgers are legally protected from intentional cruelty (such as badger-baiting) and from the results of lawful human activities (such as housing, road or other developments), under the Protection of Badgers Act (PBA). The PBA consolidates all previous legislation including the Badgers Act 1973 (as amended) and the Badgers (Further Protection) Act 1991.

1.2.11 Badgers are also given protection from killing or taking by certain means under Schedule 6 of the WCA 1981 (as amended) (Reid, 2002). Under the legislation, badgers are afforded protection from wilful or attempted killing, injuring and interference with the badgers' sett. The PBA defines a badger sett as 'any structure or place which displays signs indicating current use by a badger'.

Water Environment and Water Services (Scotland) Act 2003 (WEWS)

1.2.12 The WEWS (Scotland) Act 2003 was the first act in Scotland to implement the WFD. This act has subsequently been augmented by the Controlled Activities Regulations (CAR) as stated below. This act sets out the key principles and instructions for WFD implementation in Scotland, for example confirming the Scottish Environment Protection Agency (SEPA) as leading the River Basin Planning and Characterisation Processes and implementing the majority of necessary regulatory controls.

Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR)

1.2.13 This act is the implementation in Scotland of the WFD as detailed above. These Regulations came into force in April 2006, and apply to inland waters and wetlands linking to lochs or rivers (although they may be extended to cover all wetlands). CAR is based on a three-tier system. General Binding Rules (GBRs) outline low risk activities for which, if best practice is followed, no further action is required. Registration of activities is required for activities not covered by GBRs that pose a low risk individually, but cumulatively could cause harm. Authorisation by SEPA is required for all other purposes.

1.3 Planning Policy

1.3.1 An assessment of planning policies relevant to nature conservation is presented in Appendix A20.1 of Chapter 20 (Policies and Plans).

1.4 Biodiversity Action Plans (BAPs)

1.4.1 The UKBAP 1994 is the UK's response to the Global Convention on Biological Diversity 1992. It includes a set of action plans/programmes to conserve and enhance biodiversity.

1.4.2 The UK Biodiversity Steering Group has published individual action plans for 45 priority habitats and some 400 of our most threatened and endangered species. These Habitat and Species Action Plans (HAPs and SAPs, respectively) have been developed to guide conservation action for the ecological feature concerned. The presence of a HAP or SAP reflects the fact that the habitat or species concerned is in a sub-optimal state and requires conservation action. It does not imply any specific designation or level of importance, but establishes a framework for the conservation of the habitat and identifies current factors causing loss and decline of that feature. Furthermore, implementation of BAPs, whether at the UK or local level, is perceived as a fundamental requirement for public bodies to meet their obligations under the relevant national legislation.

1.4.3 UKBAP Priority Habitats are distinct from Annex I Habitats listed in the EU Habitat Directive and include those habitats identified by the UK Steering Group as being particularly important or that are vulnerable to habitat loss and damage, and for which conservation action should be targeted.

1.4.4 In order to set priority habitats requiring conservation action in context, a classification of broad habitat types has been developed (DETR, 1995c). In the most recent classification (Jackson, 2000), 37 broad habitat types have been identified, 20 of which occur in Scotland.

Local BAPs

1.4.5 Local BAPs (LBAPs) integrate the conservation measures provided in the UKBAP to enhance biodiversity at the local and regional level. LBAPs are implemented through planning policy, identifying habitats and species of particular value or endangerment at the local or regional level. BAPs in the UK have no statutory status, but provide a framework for implementing conservation requirements.

1.4.6 Fife and City of Edinburgh BAPs cover the study area of the proposed scheme:

- The Edinburgh LBAP is implemented through the Edinburgh Biodiversity Partnership, involving local authorities, environmental, forestry, farming, land and education agencies, businesses and individuals involved in biodiversity in the Edinburgh area.
- The Fife LBAP is implemented by the Fife Biodiversity Partnership which involves both environmental organisations and individual members of the public with an interest in biodiversity.

1.4.7 West Lothian has not notified any habitats or species and has therefore not produced a detailed BAP. Instead, West Lothian Council has produced a strategic BAP, outlining strategic objectives in terms of the conservation and management of habitats and species.

Trunk Road BAP

1.4.8 The Trunk Road BAP was produced in 2000 in response to the need to management the biodiversity interest of the Scottish trunk road network. However, the BAP was only circulated for consultation and as a result has not been implemented into policy. The objective of the BAP is the protection of natural heritage and Scottish biodiversity throughout the network involving the participation of a range of stakeholders such as authorities, communities and industries to protect biodiversity.

Locally Important Sites

1.4.9 District Wildlife Sites (DWS), Local Wildlife Sites (LWS), Sites of Importance for Nature Conservation (SINC) and Sites of Interest to Natural Science (SINS) are sites of local conservation interest designated by local planning authorities. Such sites are afforded a measure of protection in local development plans (Chapter 20: Policies and Plans).

1.5 Non-Statutory Guidance

Scottish Biodiversity Strategy

1.5.1 The Scottish Biodiversity Strategy (Scottish Executive, 2004) places a duty of care on public bodies to further the conservation of biodiversity in Scotland, the execution of which is implemented through the LBAPs.

Scottish Biodiversity List

1.5.2 The Scottish Biodiversity List was developed to meet the requirements of Section 2 (4) of the NCSA 2004 and includes a list of species and habitats considered to be of principal importance for the purposes of biodiversity in Scotland. The list provides a guide to empower decision-makers such as public bodies, including local authorities, in implementing their duty to further the conservation of biodiversity in Scotland.

National Planning Policy Guidance (NPPG) 14: Natural Heritage

1.5.3 National Planning Policy Guidance (NPPG) 14 gives guidance on how the Government's policies for the conservation and enhancement of Scotland's natural heritage should be reflected in land use planning. The guidance states that there may be opportunities to enhance the natural heritage through the development process by careful siting and design of developments, and by providing for wildlife on development sites and that natural heritage is a material consideration in the assessment of development proposals.

1.5.4 NPPG 14 outlines planning guidance in relation to the conservation and enhancement of Scotland's natural heritage. NPPG 14 makes the presence of a protected species or habitats in addition to biodiversity habitats/species, a material consideration in the assessment of development proposals and requires planning authorities to take particular care to avoid harm to species or habitats protected under the WCA 1981, European Directives and/or identified as priorities in the UKBAP.

Planning Advice Note (PAN) 60: Planning for Natural Heritage

1.5.5 Planning Advice Note (PAN) 60 provides guidance on good practice in relation to conservation and natural heritage in Scotland. It covers the protection of biodiversity, designated sites and the wider natural heritage, with the provision that all development effects can be material considerations in the planning process. It includes the provision that full regard should be given to the natural heritage in development control, that mitigation is required for any adverse effects, and that the precautionary principle should be applied where development effects are uncertain.

2 Terrestrial Habitats

2.1 Biology

2.1.1 Terrestrial habitats are plant communities which have a recognised ecological function and boundary. Their simplest definition is a place where an animal lives, but they can also have specific plant species associated with their species assemblage. Often named after the dominant plant species in the community e.g. oak woodland, they make readily definable ecological units for ecological assessment and study.

2.2 Legal and Conservation Status

2.2.1 Semi-natural habitats are conferred protection by the following international and national statutes and guidance which recognise the ecological value of the habitats and provide protection or promote policies that guide their conservation:

- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- Habitats Directive 1992;
- NCSA 2004;
- NPPG 14;
- Scottish Biodiversity List;
- Scottish Biodiversity Strategy; and
- WCA 1981 (as amended).

BAPs

2.2.2 Within the Edinburgh LBAP a number of plant species have been identified as priority species: two species of trees and shrubs, 26 species of flowering plant and eight species of fern and lower plant.

Some of these species have individual SAPs whilst other species are targeted through HAPs. The SAPs and HAPs include targets and objectives that incorporate habitat management actions. Species targeted in this way include bluebell (*Hyacinthoides non-scripta*) and maiden pink (*Dianthus deltoides*).

2.2.3 Local HAPs (LHAPs) provide national and local targets and objectives for UK and regional priority habitats, UK broad habitats that are locally important in the context of West Lothian, Fife and Edinburgh Councils and other locally important habitats. They incorporate action for associated priority species. In Edinburgh, HAPs which are relevant to the current study have been developed for Built-up Areas and Gardens, Rivers and Streams, Coastal and Marine, Farmlands, Lochs and Ponds, Rock Faces, Semi-natural Grasslands, Wildlife Corridors, Woodlands and Reedbeds.

2.2.4 In Fife HAPs which are relevant to the current study have been developed for Coastal, Farmland, Rivers, Standing Water, Unimproved/semi-improved Grassland, Urban and Built Habitat, Wetlands and Woodland.

2.2.5 West Lothian Strategic BAP outlines HAPs for Rivers and Streams, Farmland, Woodlands and Peat Bogs.

2.3 Badger

Biology

2.3.1 Badgers (*Meles meles*) are widespread in the UK but patchily distributed in Scotland. The British population has been estimated at approximately 250,000 adults who produce approximately 172,000 cubs a year (Harris et al., 1995). Since that survey, there is evidence to suggest that badger populations have increased steadily both in Scotland and the UK as a whole (Battersby, 2005).

2.3.2 Badgers normally live in social groups. Social group size can vary considerably but typically averages five animals per group (Neal & Cheeseman, 1996). Badgers live in complexes of underground tunnels and chambers called setts, which are excavated in a variety of locations including woodlands, hedge banks, drainage ditches, quarries, railway embankments or other suitable locations with well drained and diggable soil.

2.3.3 Badgers are nocturnal and their diet is principally made up of earthworms, which are caught on pasture or in woodland, particularly on wet nights. Badgers require a steady supply of food throughout the year so when conditions are unsuitable for catching worms, other food such as fruit, bulbs, cereals, root crops, insects, rabbits, amphibians and small mammals become more important.

2.3.4 Badger territories are based around a main sett but there may also be several auxiliary setts within the badgers' territory. These will be used at varying times of the year. Territory sizes vary from as little as 15ha to over 300ha (Kruuk, 1989). Territory size is often dependant upon the availability of suitable foraging habitat and the proximity of other neighbouring badger social groups. Larger territories are found where social groups are less dense and this is often concomitant with widely spread or sub-optimal foraging patches. Territorial boundaries are marked by dung pits. These boundaries are regularly patrolled and actively defended from trespassing badgers.

2.3.5 Mating can take place at any time of year however the main peak period is during the spring. Normally only the dominant female in a social group breeds each year. Litters of two to three cubs are born in February or March, regardless of the time of mating. The independence of the time of cub birth from time of mating is on account of delayed implantation, which is a process whereby the fertilised eggs can remain in a state of suspended development until triggered to continue development by environmental cues. This ensures that cubs are born at the most appropriate time of year for their survival. Cubs are able to forage independently after around 15 weeks.

Habitat Requirements

2.3.6 To form a social group or population, badgers require habitat where they can excavate their main sett and successfully forage. The quality of foraging habitat will determine the number of badgers within a social group. The density of social groups/populations is governed by a combination of suitable sett-making habitat and suitable foraging habitat within the landscape as a whole. Good sett-making and good foraging habitat results in densely distributed social groups/populations (consequently with small territories) and a high overall badger population.

2.3.7 Suitable sett-making habitat requires areas of well drained, diggable soil, relatively free of human disturbance and with cover for badgers emerging from their sett.

2.3.8 The quality of foraging habitat is likely to be governed by the density of short grassland for foraging, the richness of grassland in terms of its population of earth worms and the availability of alternative food resources when 'worming' conditions are unsuitable.

2.3.9 Other factors that can affect the mortality rates of badgers, such as deliberate persecution, the presence of roads with high night time traffic flows or other physical barriers to movement, can adversely affect the quality of the landscape for badgers and consequently the distribution of social groups/populations.

Legal and Conservation Status

2.3.10 Badgers are protected from intentional cruelty (such as badger-baiting) and from the results of lawful human activities (such as housing, road or other developments) under the legislation/guidance:

- NCSA 2004;
- NPPG 14;
- PBA 1992; and
- WCA 1981 (as amended).

2.3.11 Derogations under the PBA 1992 in respect to the destruction and disturbance of badger setts can only be undertaken under licence through consultation with Scottish Natural Heritage (SNH) (the licensing authority).

BAPs

2.3.12 Given the common and widespread distribution of badger populations within the UK, badgers are not listed as a priority species in the UKBAP. They are however on both the Edinburgh and Fife LBAPs. In addition they are listed on the Trunk Roads BAP and have recently been included on the 'Scottish Biodiversity List' under the NCSA 2004 as a species considered to be of principal importance for the purpose of biodiversity conservation in Scotland.

2.4 Bats

Biology

2.4.1 There are 16 species of bat (Order Chiroptera) known to be resident in the British Isles, ten of which have been recorded in Scotland (Gorman et al., 1996):

- common pipistrelle bat (*Pipistrellus pipistrellus*);
- soprano pipistrelle bat (*Pipistrellus pygmaeus*);
- Nathusius' pipistrelle bat (*Pipistrellus nathusii*);

- brown long-eared bat (*Plecotus auritus*);
- Noctule bat (*Nyctalus noctula*);
- Leisler's bat (*Nyctalus leisleri*);
- Daubenton's bat (*Myotis daubentonii*);
- Natterer's bat (*Myotis nattereri*);
- whiskered bat (*Myotis mystacinus*); and
- Brandt's bat (*Myotis brandtii*).

2.4.2 Common and soprano pipistrelle, brown long-eared and Daubenton's bat have been recorded within the study area (NBN Gateway). The Distribution Atlas of Bats in Britain and Ireland (Richardson, 2000) includes the potential presence of whiskered bat which is considered likely to be found throughout Scotland. Brown long-eared is common and widespread throughout Great Britain. Noctule bat is known to be present in southern Scotland.

2.4.3 Bats have evolved a number of features connected with their ability to fly and their nocturnal activity patterns (Kunz, 1982). Bats have a complex sonar system known as echolocation that enables them to find their insect prey and navigate around their environment. Echolocation involves emitting a rapid series of high frequency calls and then interpreting the returning echoes to build up a picture of their surroundings.

2.4.4 Bats' habitat requirements vary widely both on an individual and species level although certain features such as woodland edge and freshwater pools are often focal points for foraging as the highest densities of bats will be found where insects are plentiful (Walsh et al., 1996a and 1996b). Of the bats present in Scotland, Natterer's and brown long-eared bats mainly forage in woodland environments whilst Daubenton's forage chiefly in areas associated with water. Pipistrelle bats are generalist in their feeding strategies and forage around water bodies, woodlands, hedgerows and pasture (Altringham, 2003).

2.4.5 Linear habitat features such as rivers, hedgerows, roads and woodland edges are important to bats, which use these as landmarks in order to commute from one location to another (Schofield & Mitchell-Jones, 2003). Distances that bats travel between roosts and foraging areas are variable both within and between species. For example, brown long-eared bats may travel up to 2.8km from the roost site but spend most of their time foraging within 0.5km of the roost, whereas pipistrelles may forage up to 5.1km from the roost. Other British species may travel further than this (Entwistle et al., 1996).

2.4.6 Bats utilise different roosts at different times of the year and, between late October and March, they hibernate. This requires an unexposed roost with a stable temperature, typically a cave, cellar or tunnel. Around March, the bats emerge and move to their summer roosts, typically within man-made structures or suitable crevices in trees. Some of these roosts are used for substantial periods of time, whereas others serve as 'transitional roosts' and are used for only one or two days. Mating takes place between late August and early December, either at the winter hibernating site or at autumn mating sites. Births occur the following summer. The numbers of bats utilising roosts can vary from single bats to hundreds of bats in a nursery colony or hibernation site (Altringham, 2003).

Legal and Conservation Status

2.4.7 All British bat species and their roosts are protected under the following legislation and guidance:

- Bern Convention (with the exception of common pipistrelle) 1979 (Appendix II);
- Bonn Convention 1979;

- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Schedule 2 - which requires that they are given full legal protection);
- EUROBATS 1994;
- Habitats Directive 1992 (Annex IV); and
- NCSA 2004.

2.4.8 Derogations under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) in respect to the destruction and disturbance of bat roosts can only be undertaken under licence through consultation with Scottish Government (the licensing authority).

2.4.9 Bat populations have declined considerably during the last century with Britain's native species having been exposed to significant changes in their preferred habitats. Drainage of wetlands, woodland clearance and agricultural intensification has led to loss of roosting sites and reduction in insect abundance and diversity. However, more recent research has suggested that the population trend and estimated UK population size of the five species known or thought to occur in the vicinity of the proposed scheme are increasing, stable or unknown, as shown in Table 2.1.

BAPs

2.4.10 Soprano pipistrelle, noctule and brown long-eared bats are currently listed as priority species under the UKBAP, and soprano pipistrelle has a UKSAP.

2.4.11 Any development must take into account that there is a legal obligation to ensure that no impacts will cause a decline in bat populations. In addition, any development must have regard to the targets and objectives of the LBAP and UKBAP for the species concerned.

2.4.12 LBAPs list a number of management prescriptions considered necessary for the attainment of these targets including:

- the identification and proper management of habitat associated with roosts;
- the improvement of riverine management and development of bankside vegetation and riparian woodland;
- the erection of bat boxes to supplement natural roosts;
- the monitoring of bat populations; and
- the offering of advice to landowners on appropriate habitat management practices.

2.4.13 The Edinburgh SAP for bats has the following objectives and targets for common pipistrelle bats, soprano pipistrelle bats, Nathius' pipistrelle bats and Daubenton's bats:

- to maintain populations and distribution of bats through habitat management and roost protection through planning casework and advice;
- to survey and monitor populations;
- to identify roost sites where possible;
- to work with land and property owners/managers to identify suitable sites for the provision and erection of bat boxes; and
- to provide advice on the suitable management of different habitats which are beneficial to bat species.

2.4.14 The West Lothian Strategic BAP does not outline specific SAPs for bat species. The Fife LBAP has SAPs for common pipistrelle bats, soprano pipistrelle bats, Natterer's bats, Daubenton's bats and brown long-eared bats. These set out targets for bats as a group through the implementation of short, medium and long term objectives such as:

- the protection of known sites by the prevention of habitat loss and degradation;
- to set in place effective monitoring programmes;
- develop a coherent and accessible bat database to enable protection of sites;
- to develop a project to promote good land management and provision of suitable habitat for the benefit of bats;
- to use innovative methods of mitigation such as the incorporation of bat bricks into new developments; and
- to continue to educate all relevant parties on the habitat requirements of bats.

Table 2.1: British Bat Species Populations and Status

Common Name	British Red Data Book status	UK Conservation Status[1]	UK Population Estimate [2] (Scottish estimate)	Regional Status[2]	UK Population Trend[3]	LBAP Status
Daubenton's Bat	Common	Not Threatened	560,000 (40,000)	Less Common	Increasing	Edinburgh Fife West Lothian
Whiskered Bat	Common	Vulnerable; scarce	64,000 (1,500)	Rare	Stable	n/a
Brandt's Bat	Common	Vulnerable; scarce	30,000 (500)	Rare	Stable	n/a
Natterer's Bat	Fairly Common	Not Threatened	148,000 (17,500)	Less Common	Increasing	Fife West Lothian
Leisler's Bat	Scarce	Vulnerable; scarce	28,000 (250)	Rare	No trend data	N/A
Common Pipistrelle Bat	Common	Not Threatened	2,430,000 (n/a)	Common	Colony counts declining, field counts increasing.	Edinburgh Fife West Lothian
Soprano Pipistrellle Bat	Common	Not Threatened	1,300,000 (n/a)	Common	Declining	Edinburgh Fife
Nathusius' Pipistrelle Bat	Rare	Not Threatened	16,000 (n/a)	Rare	No trend data	Edinburgh
Brown Long Eared Bat	Common	Not Threatened	245,000 (27, 500)	Common	Declining	Fife West Lothian
Noctule bat	Uncommon	Vulnerable; relatively common in small numbers	50,000 (250)	Rare	Declining	n/a

1. after Hutson, 1993
2. after Battersby 2005
3. after MacDonald & Burnham 2007 and BCT 2006

2.5 Terrestrial Breeding Birds

Biology

2.5.1 Birds are a highly adaptable group of vertebrates and have, over the course of the last 65 million years, colonised almost every ecosystem present on earth from hot deserts to the frozen Antarctic.

2.5.2 There are approximately 10,000 species of bird worldwide with over 200 species occurring in the UK (depending on the season and weather conditions). Bird assemblages are grouped according to whether they are resident or migratory. Migratory birds can be further divide into breeding, over-wintering and staging bird species assemblages.

2.5.3 The hearing range of birds is similar to that of humans, between 20 and 20000 Hz. There is no obvious consensus on the levels of sound which could cause disturbance to a range of bird species, with cited values ranging from 42dB(A) to 117dB(A). Many studies quote dB(A) (A-weighted decibels) which are commonly used for the measurement of environmental and industrial noise as well as assessing potential hearing damage and other effects of noise. In the absence of a clear threshold value, the noise levels which potentially cause disturbance to birds are assumed to be similar to thresholds set for people. In humans, hearing damage can begin with prolonged exposure of sounds of 85dB(A) (Bregman & Edell, 2001).

Legal and Conservation Status

2.5.4 Resident and migratory bird populations within the UK are protected under the following legislation:

- Birds Directive 1979 (the identification and classification of SPAs for rare or vulnerable species, as well as for all regularly occurring migratory species, paying particular attention to the protection of wetlands of international importance is listed in Annex I of the Directive);
- Conservation (Habitats, &c.) Regulations 1994 (as amended);
- Habitats Directive 1992;
- Natura 2000;
- NCSA 2004; and
- WCA 1981 (as amended);
- the WCA 1981 (as amended) and NCSA 2004 taken together ensure that all wild birds, their nests and eggs are protected, which, with respect to the proposed scheme, makes it an offence to intentionally or recklessly kill, injure or take any wild bird;
- take, damage or destroy the nest of any wild bird while it is in use or being built;
- take or destroy the egg of any wild bird; and
- disturb any wild bird listed on Schedule 1 while it is nest building or is at (or near) a nest with eggs or young; or disturb the dependent young of such a bird.

2.5.5 WCA Schedule 1 (WCA1i) bird species are protected by legal penalties at all times.

2.5.6 The Acts additionally provide protection for SSSI, in particular those that are designated for the presence of wild bird populations.

BAPs

2.5.7 UKBAP outlines action for 27 species of bird of conservation importance/concern and can be viewed at www.ukbap.org.uk. Edinburgh LBAP can be viewed at http://www.ukbap.org.uk. The

Scottish Biodiversity List includes 25 species of bird that are present in 5 or fewer sites in Scotland and can be viewed at http://www.biodiversityscotland.gov.uk.

2.5.8 In Fife, LSAPs have been implemented for skylark (*Alauda avensis*), reed bunting (*Emberiza schoeniclus*), corn bunting (*Miliaria calandra*), tree sparrow (*Passer montanus*), grey partridge (*Perdix perdix*), bullfinch (*Pyrrhula purrhula*) and song thrush (*Turdus philomelos*).

JNCC Birds of Conservation Concern 2002 - 2007

2.5.9 The leading government and non-government conservation organisations in the UK have jointly reviewed the population status of 247 bird species that are regularly found within the UK using data from national monitoring schemes.

2.5.10 On the basis of seven quantitative criteria, each species was placed on one of three lists:

- Red: globally threatened, have had a historical population decline in the UK from 1800 - 1995, a rapid (> or = 50%) decline in UK breeding population over the past 25 years or a rapid (> or = 50%) contraction of UK breeding range over the past 25 years;
- Amber: historical population decline from 1800 to 1995, but are recovering; population size has more than doubled over the past 25 years, a moderate (25-49%) decline in UK breeding population over the past 25 years, a moderate (25-49%) contraction of UK breeding range over the past 25 years, a moderate (25-49%) decline in UK non-breeding population over the past 25 years, or species with unfavourable conservation status in Europe also known as Species of European Conservation Concern (SPEC); or
- Green: no identified threat to their population status.

2.5.11 Of the 247 species reviewed, 40 species were red-listed, 121 were amber-listed and the remaining 86 were green-listed. A full description of the study can be viewed at http://www.jncc.gov.uk.

2.6 Terrestrial Wintering Birds

2.6.1 All birds receive the same level of protection within the UK in terms of their inclusion within the WCA 1981 (as amended). A description of the biology, legislation and conservation status of birds is detailed in Section 2.5 (Terrestrial Breeding Birds).

2.7 Otter

Biology

2.7.1 The European otter (*Lutra lutra*) is the only otter native to the UK (Mason & Macdonald, 1986). The diet of otters varies but fish generally comprise over 80% with other prey including birds, amphibians, molluscs, crustaceans and small mammals. Otters generally favour riparian habitat although they may travel several miles over land to reach waterbodies or to cross between river catchments (Jefferies, 1988). In the UK otters tend to be largely nocturnal where they occur in freshwater habitats (Kruuk, 1995; Environment Agency, 1999; Grogan et al., 2001) and diurnal in coastal areas (Kruuk, 1995).

2.7.2 Otters occupy a home range, which is a well-defined area where they feed, rest and reproduce (Woodroffe, 2001). The size of an otter's range depends on the quality of the habitat and food supply (Kruuk, 1995). A typical home range may include a river, side streams, ponds and adjacent woodlands and wetlands.

2.7.3 Otters mark their range by defecating (sprainting) in these areas. Otter spraint is often found in conspicuous locations such as under bridges, on prominent rocks and overhanging tree roots or boughs (Mason & Macdonald, 1986; Environment Agency, 1999), and is generally located near important otter resources (Kruuk, 1995).

2.7.4 Home ranges may contain up to 30 resting sites and several sites may be used in an area with a plentiful food supply. These resting sites take a variety of forms including underground dens or 'holts', located in places such as cavities in the roots of bankside trees, piles of logs, flood debris, drains, caves and holes in rock-falls. Otter holts sometimes have one entrance underwater and at least one entrance above the high water mark, but may be located well away from the water's edge. The more secure sites used for breeding are usually safe from disturbance and frequent flooding, and may be some distance from water with females taking care not to leave any signs of their presence. Otters may also frequently use resting sites above ground in reed beds, tall herb vegetation and scrub. These above ground resting sites are often referred to as 'couches' (Environment Agency, 1999).

Legal and Conservation Status

2.7.5 The otter is classified by the International Union for the Conservation of Nature (IUCN) as a 'near threatened' species (IUCN, 2001), and numbers of otters killed on UK roads are of serious concern (Philcox et al., 1999).

2.7.6 Otters are protected under:

- Bern Convention;
- Conservation (Habitats, &c,) Regulations 1994 (as amended); and
- NCSA 2004.

2.7.7 Under the above legislation it is an offence to inter alia: intentionally and/or recklessly kill, injure or take otters; deliberately disturb otters (whether in a holt/couch or not); and/or intentionally or recklessly obstruct damage or destroy otter holts or couches (JNCC, 2006).

2.7.8 The European sub-species of otter is listed as 'globally threatened' on the IUCN/World Conservation Monitoring Centre Red Data List (JNCC, 2006).

2.7.9 Derogations under the Conservation (Habitats, &c.) Regulations 1994 (as amended) in respect to the destruction and disturbance of otter resting places can only be undertaken under licence through consultation with Scottish Government (the licensing authority).

BAPs

2.7.10 The UK Biodiversity Steering Group identified the otter as a species of conservation concern resulting in a number of guidelines being drawn up to protect otters and their habitat. The targets of the ensuing UKSAP for otters, are:

- to maintain and expand existing otter populations; and
- by 2010 restore breeding otters to all catchments and coastal areas where they have been recorded since 1960.

2.7.11 Otters were generally widespread in Scotland in the 1970s however very low populations were recorded in lowland areas and south-central Scotland (Chanin, 2003).

2.7.12 The otter is a priority species in the UKBAP and is listed as LBAP species in Fife and City of Edinburgh BAPs. West Lothian is in the process of creating a biodiversity management plan but has no plans to develop an otter BAP.

2.8 Water Vole

Biology

2.8.1 Water voles (*Arvicola terrestris*) are the largest of the British voles. Most water vole populations are associated with waterbodies including rivers, ponds, land drains and marshland. They show a preference for permanent slow-flowing water bodies with densely vegetated banks where they feed upon the aerial stems and leaves of waterside plants. During the winter, roots, bark and rhizomes represent an important part of the water vole's diet. Water voles are usually found within 2m of the water's edge where they dig burrows into soft banks.

2.8.2 Female water voles are territorial and defend their resources from other females. In contrast, male water voles do not defend territories. Territorial ownership is marked by discrete latrine sites consisting of flattened piles of droppings topped with fresh ones. The length of home ranges can vary from 30m to 150m for females and 60m to 300m for males (Strachan & Moorhouse, 2006).

2.8.3 Water voles are found throughout England, Wales and Scotland. In the UK most populations are found below an altitude of 50m (Harris et al., 1995). The British water vole population has suffered a steady decline throughout the 20th Century owing to habitat destruction and agricultural intensification. This decline has been rapidly accelerated in recent years through predation by feral American mink (*Mustela vison*). Research has shown that abundant mink populations can easily decimate water vole colonies through predation rendering areas of potentially suitable habitat un-inhabitable for water vole.

2.8.4 Two national surveys undertaken by the Vincent Wildlife Trust from 1989 - 1990 and 1996 - 1998 have highlighted a serious population decline in water vole with the loss of 88% of the remaining water vole population in only seven years. The 1990 Scottish population was estimated at 2,374,000 whilst the 1998 population was estimated at only 354,000 (Jefferies, 2003).

Legal and Conservation Status

2.8.5 Water voles are protected under:

- NCSA 2004; and
- WCA 1981 (as amended) (Schedule 5 of in respect of Section 9(4) only).

2.8.6 Considered together, the above acts make it an offence to intentionally or recklessly:

- damage or destroy or obstruct access to any structure or place which water voles use for shelter or protection; and
- disturb water voles while they are using such a place.

BAPs

2.8.7 Water vole has been identified for priority action by the Biodiversity Steering Group (United Kingdom Biodiversity Partnership, 2005). The water vole is a priority species in the UKBAP and is listed in Fife and City of Edinburgh LBAPs.

2.9 Red Squirrel

Biology

2.9.1 Red squirrels (*Sciurus vulgaris*) can be found in broadleaved woodland (comprising small-mast tree species such as silver birch (*Betula pendula*), ash (*Fraxinus excelsior*), willow, aspen (*Populus tremula*), alder (*Alnus glutinosa*), yew (*Taxus baccata*) and hawthorn (*Crataegus monogyna*)), but tend to be found at higher densities in mature coniferous woodland. In coniferous woodland, their

optimum habitat requirement is mature species such as Scots pine (*Pinus sylvestris*), Norway spruce (*Picea abies*) and European larch (*Larix decidua*), with a preference for mature Scots pine. The size and type of woodland and the connectivity between woodland patches are important factors in maintaining the persistence of red squirrels and they are not usually found in immature plantations of Sitka spruce (*Picea sitchensis*) (at the thicket stage), but can be found in mature, thinned plantations.

2.9.2 The last 50 years have seen a drastic decline in red squirrel populations and distribution in the UK. The red squirrel is the only squirrel native to the UK and Scotland holds the core of this population with an estimated population of around 120,000 (Harris et al., 1995). The other species present in the UK is the grey squirrel (*Sciurus carolinensis*) that was introduced to Britain in the 19th century from North America. The continuing spread of grey squirrels is regarded as a major threat to red squirrels as they occupy a similar ecological niche and so are in direct competition for habitat and food resources.

Legal and Conservation Status

2.9.3 Red squirrels receive enhanced statutory protection under:

- Bern Convention 1979 (Appendix III);
- NCSA 2004; and
- WCA 1981 (as amended) (Schedules 5 and 6).

2.9.4 Taken together, the above legislation makes it an offence to:

- intentionally or recklessly kill, injure, take or possess a wild red squirrel;
- intentionally or recklessly damage, destroy or obstruct access to any structure or place used by a red squirrel for shelter or breeding;
- intentionally or recklessly disturb a red squirrel while it is occupying a structure or place that it uses for protection;
- sell, offer for sale, expose for sale or have for the purpose of sale, any red squirrel, or to infer that red squirrels can be bought or sold; and
- kill or capture red squirrels by indiscriminate methods such as snaring or poisoning.

BAPs

2.9.5 The red squirrel is listed on the UKBAP as a priority species and has a UKSAP. The red squirrel is considered to require local action to conserve and enhance populations in the Fife LBAP and therefore also has a LSAP. Furthermore, the Scottish Red Squirrel Action Plan (2006 - 2011) has been prepared under the auspices of the UKBAP.

2.10 Amphibians

Biology

2.10.1 There are six species of amphibian native to mainland Britain (three species of newt, two species of toad and one species of frog).

2.10.2 Amphibians require areas of permanent or semi-permanent bodies of water for breeding, egg laying and larval development. Eggs are either deposited in open water (frogs), entwined around vegetation (toads) or between folded leaves (newts). The eggs mature into embryos which in turn develop into larvae (tadpoles in the case of frogs and toads). The larvae then metamorphose into adults after several weeks.

2.10.3 Breeding takes place between February and May, followed by dispersion of adults. Frog and toad leave their breeding waterbodies in March and April respectively and newts in late summer. Adults of all species do not return to the waterbody until the following year after over wintering at hibernation sites. Hibernation sites are typically less than 500m from the waterbody (for frogs and newts) and up to 1km for toads (Beebee & Griffiths, 2000). In this respect, terrestrial habitat is equally important to amphibians as aquatic habitat. Larvae remain in the waterbody until they develop into juveniles. The juveniles leave the waterbody dispersing into the surrounding habitat, normally between July and September the same year. Some of these individuals will not return to the natal pond, instead dispersing to other waterbodies. Adult common frog (*Rana temporaria*) and palmate newt (*Lissotriton helveticus*) larvae can over winter in the waterbody.

2.10.4 Ideal feeding areas include woodland, scrub, rough grassland and gardens with a diversity of habitats. Hibernacula are sought in terrestrial features such as dead wood found along hedgerows, in woodland and as accumulated matter beside streams or on floodplains. Root systems of scrub and trees, including dead roots are also used, as are crevices and gaps in the earth, under rocks and in stone walls.

2.10.5 Amphibian species resident in one isolated waterbody are recognised as comprising a population. However, where amphibian species are associated with two or more waterbodies, within 300m of each other, the ponds are considered to support a metapopulation of the species concerned. These metapopulations are also considered to be connected and combined together and are considered to belong to the same deme, as there will be interchange of individuals between waterbodies and gene mixing within the population utilising the waterbodies. The distribution of ponds and the importance of metapopulations is often key to the survival of amphibian species within geographical areas. Habitat loss, such as destruction of ponds, can result in sink and source populations becoming isolated and more vulnerable to localised extinction.

Legal and Conservation Status

2.10.6 All species of amphibian native to the British Isles receive some legal protection, although the degree and type of protection varies between species, these include:

- Conservation (Habitats, &c.) Regulations 1994 (as amended);
- NCSA 2004; and
- WCA 1981 (as amended) (Section 9 (5)).

2.10.7 The above legislation makes it an offence to sell, barter, exchange, transport for sale and advertise to sell or buy. Great crested newt (*Lissotriton cristatus*) and natterjack toad (*Epidalea calamita*) are also subject to additional protection from the intentional killing, injury and disturbance to their habitats through their inclusion in the Conservation Regulations 1994 (as amended).

2.10.8 Derogations under the Conservation (Habitats, &c.) Regulations 1994 (as amended) in respect to the destruction and disturbance of great crested newt habitat can only be undertaken under licence through consultation with Scottish Government (the licensing authority).

BAPs

2.10.9 Common toad (*Bufo bufo*) is currently listed as a priority species under the UKBAP. Although not a UKBAP priority species, palmate newt is listed as a Species of Conservation Concern in the UKBAP (DETR, 1995 a, b).

2.10.10 Great crested newts have been identified in the UKBAP as being sufficiently threatened to require an individual UK wide SAP. LSAPs have been implemented in Fife and Edinburgh. In West Lothian the great crested newt has been listed as a priority indicator species.

2.10.11 Common frog is a Fife LBAP species whilst common toad is a Fife and Edinburgh City Council LBAP species.

2.10.12 The Edinburgh LSAP identifies the following objectives for great crested newts:

- increase the population of great crested newts in Edinburgh;
- survey other potential sites to identify new populations; and
- develop a network of suitable habitats as appropriate.

2.11 Reptiles

Biology

2.11.1 There are six species of reptile native to the UK, comprising three species of lizard and three species of snake. These are the common lizard (*Zootoca vivipara*), sand lizard (*Lacerta agilis*) and slow-worm (*Anguis fragilis*), and the smooth snake (*Coronella austriaca*), grass snake *(Natrix natrix*) and adder (*Vipera berus*). In addition introduced species may be encountered occasionally, arising from escapes or illegal releases (English Nature, 2004).

2.11.2 Reptiles have a variable body temperature, which depends on the surrounding temperature and their behaviour. They move to open areas in order to bask in the sun and once a favourable temperature is reached they move off to forage. Depending on the species' dietary needs, the habitats required may include areas of coarse grassland, scrub, woodland, or wetland. Generally lizards feed on invertebrates such as insects, and snakes feed on vertebrates, such as amphibians and small mammals. Reptiles also require refuges and hibernacula, such as well-vegetated areas, piles of rubble and logs.

2.11.3 The common lizard, slow-worm and adder are widespread throughout Scotland (Reading et al., 1995; Reading et al., 1996) and are known to occur within the vicinity of the proposed scheme with the exception of adder, which is absent from much of central Scotland. There are historical records of grass snake within the vicinity of the City of Edinburgh dated 1874 however there have been no records of this species since then (National Biodiversity Network Gateway, 2008).

Legal and Conservation Status

2.11.4 Common lizard, slow-worm and adder are common and widespread in Britain and receive limited protection under:

- NCSA 2004; and
- WCA 1981 (as amended).

2.11.5 Taken together the above legislation makes it an offence to intentionally/recklessly kill or injure the above reptile species.

BAPs

2.11.6 Common lizard, slow-worm and adder are currently listed as UKBAP priority species. The species are not however included in the national, Fife, Edinburgh or West Lothian LBAPs, although adder is listed as a Species of Conservation Concern (UKBAP, 2000).

2.12 Terrestrial Invertebrates

Biology

2.12.1 Invertebrates comprise an enormous group of organisms, both in terms of number of species and number of individuals. There are almost 30,000 species of macro invertebrates in Britain, excluding groups whose members are all microscopic. For insects alone, there are an estimated 14,000 species which occur in Scotland. In comparison with other taxa very little is known of

species distribution, abundance and hence relative importance, in terms of local biodiversity in Scotland.

2.12.2 Invertebrates are important in both ecosystem functioning and in agricultural systems. As herbivores, predators, parasites and prey species, they are a vital element in terrestrial food chains. At the base of many food chains, arthropods are important components of the diets of invertebrates and birds, and are also an integral part of the nutrient and energy processing abilities of the soil (Coleman & Crossley, 1996). They also present an important contribution to agricultural systems through pest control and pollination.

2.12.3 The evaluation of habitats for overall potential for terrestrial invertebrates is a more practical method of assessing nature conservation value than individual species surveying. Ideal feeding areas include woodland, dead wood, scrub, marshy grassland, rough grassland and areas with a mosaic of habitats. Bare earth and early successional stages of vegetation can provide nesting and sunning habitats and are often of value to specialist invertebrates. Overwintering habitats are sought in terrestrial features such as field margins with long rank grassland, piles of dead wood, hedgerows, low dense scrub, below rocks and in stonewall crevices.

Legislation and Conservation Status

2.12.4 Terrestrial invertebrates are protected in the UK under the following legislation:

- Conservation (Habitats, &c.) Regulations 1994 (as amended); and
- WCA 1981 (as amended).

2.12.5 In general, very few species of invertebrate are directly protected by law in the UK. Twenty-five species of butterfly and eight moths are currently listed under Schedule 5 of the WCA 1981 (as amended). Six of these butterflies and all of the moths are fully protected by this legislation. All others are protected from sale only.

2.12.6 Marsh fritillary (*Euphydryas aurinia*) and large copper (*Lycaena dispar*) (now considered extinct in the UK) are listed on Annex II & IV respectively of the Conservation (Habitats, &c.) Regulations 1994 (as amended), whose conservation requires the designation of SACs. The large blue (*Maculinea arion*), is also listed under Annex IV requiring strict legal protection.

2.12.7 Many key butterfly and moth sites are protected through the designation of legally protected sites, including SACs, SSSIs and Local Wildlife Sites (SINC/SINS); the latter being protected through the planning process.

BAPs

2.12.8 There are 24 species of butterfly and 152 species of moth currently listed as a priority under the UKBAP.

2.12.9 Both small pearl bordered fritillary (*Boloria selene*) and tiger beetle (*Cicindela ocellata rectilatera*) have SAPs within the Fife LBAP. Small pearl bordered fritillary also has a SAP within the Edinburgh LBAP. Other invertebrate species are covered by HAPs.

Red Data Book Category 3 (RDB 3)

2.12.10 Red Data Book Category 3 Rare (RDB 3) are taxa with small populations in Great Britain that are not at present endangered or vulnerable, but are at risk. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. Species which are estimated to exist in only fifteen or fewer 10km squares. This criterion may be relaxed where populations are likely to exist in over fifteen 10km squares but occupy small areas of especially vulnerable habitat (Shirt, 1987).

Nationally Scarce Category A

2.12.11 Notable A (Na) taxa which do not fall within RDB categories but which are nonetheless uncommon in Great Britain and are thought to occur in 30 or fewer 10km squares of the National Grid or, for less well recorded groups, within seven or fewer vice-counties (Eversham, 1983).

Nationally Scarce Category B

2.12.12 Notable B (Nb) taxa which do not fall within RDB categories but which are nonetheless uncommon in Great Britain and are thought to occur in between 31 and 100 10km squares of the National Grid or for less well recorded groups, between eight and 20 vice-counties.

Nationally Scarce Taxa

2.12.13 Notable (N) taxa which do not fall within RDB categories but which are nonetheless uncommon in Great Britain and are thought to occur in between 16 to 100 10km squares of the National Grid. Species within this category are often too poorly known for their status to be more precisely estimated.

Scottish Biodiversity List

2.12.14 The Scottish Biodiversity List (SBL) is a list of flora, fauna and habitats considered by the Scottish Ministers to be of principal importance for biodiversity conservation. The publication of the Scottish Biodiversity List satisfies the requirements of Section 2(4) of the NCSA 2004. Section 4 species (SBL S4) are present in five or fewer 10km squares or sites in Scotland.

3 River Habitat

3.1 Biology

3.1.1 River Habitat Survey (RHS) is a method used to assess the physical structure of freshwater streams and rivers and provides a broad assessment of habitat quality.

3.2 Legislation Status

3.2.1 The WFD (European Directive 2000/60/EC) requires Member States to take action to ensure that all watercourses in Europe reach at least 'good' ecological status by 2015. The WFD also requires that watercourses' ecological status does not deteriorate from current condition. Any modifications to a river channel and/or riparian corridor may require prior approval by SEPA under the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2005 (refer to Chapter 9: Water Environment for more detailed information).

3.3 Aquatic Macroinvertebrates

Biology

3.3.1 Aquatic macroinvertebrates are commonly used to provide a holistic assessment of river health (Wright et al., 1984). Traditional water quality measures such as pH, dissolved oxygen, nutrient levels and toxic substances provide a snapshot of environmental conditions at the moment the samples are taken. However, as water quality conditions are variable; this type of monitoring can fail to detect occasional changes or intermittent pulses of pollution.

3.3.2 In contrast, biological monitoring provides an integrated assessment of ecosystem condition. The composition of an aquatic macroinvertebrate community will reflect the ambient environmental conditions of a site and the assemblage of animals present reflects the cumulative impacts on the river ecosystem over time. Aquatic macroinvertebrate samples, combined with an understanding

of the available river habitat (observed versus expected) can provide an overall assessment of the ecological health of a watercourse.

Legislation and Conservation Status

3.3.3 A number of aquatic macroinvertebrates are afforded legislative protection in the UK through the following legislation:

- Conservation (Habitats, &c.) Regulations 1994 (as amended);
- WCA 1981 (as amended); and
- NCSA 2004.

3.3.4 Certain aquatic macroinvertebrate species are afforded protection through Schedule 5 of the WCA 1981 (as amended), namely, the dragonfly Norfolk hawker (*Aeshna isosceles*) and the glutinous snail (*Myxas glutinosa*). Part 3 and Schedule 6 of the NCSA 2004 makes amendments to the WCA 1981 (as amended), strengthening the legal protection for threatened species.

BAPs

3.3.5 There are approximately 63 species of conservation concern which are listed as a priority on the UKBAP or are subject to a Biodiversity Action Plan.

3.3.6 The Edinburgh LBAP priority species list includes two species of invertebrates that are associated with wetland habitats, the larvae of the large red damselfly (*Pyrrhosoma nymphula*) and the cranefly (*Tipula gimmerthali*).

3.4 Freshwater Macrophytes

Biology

3.4.1 Freshwater ecosystems represent a significant landscape feature in Scotland (Ferrier & Edwards, 2002) management of which is crucial to Scotland's biodiversity. Macrophytes, which contribute to the overall ecological status of freshwaters, are present throughout Scotland in still waters and moving waters and comprise a large number of species and hybrids to which new records are continually being added to.

3.4.2 Macrophytes are important for the functioning of aquatic ecosystems, providing substrate for aquatic/semi aquatic species and protection from predation for fish as well as breeding habitat. They contribute to good water quality by locking sediments/chemicals in their roots and reducing impacts of erosion and sedimentation and exhibit a range of tolerances to chemical and physical characteristics.

3.4.3 Plant assemblages in aquatic systems vary according to physical parameters (e.g. depth, temperature). This can result in distinct habitat zones; from the margins of the bank where all the plants are aerial with only their roots in the water, to the point where all macrophytes are totally submerged (e.g. charophytes).

Legislation and Conservation Status

3.4.4 A number of freshwater macrophyte species are afforded national protection in the UK through the following legislation:

- Conservation (Habitats, &c.) Regulations 1994 (as amended);
- NCSA 2004 (Part 3, Schedule 6); and
- WCA 1981 (as amended) (Schedule 8).

BAPs

3.4.5 Ten macrophyte species are listed as rare/notable in the Edinburgh LBAP, these are: channelled crystalwort (*Riccia canaliculata*), magellanic bog-moss (*Sphagnum magellanicum*), ragged-robin (*Lychnis flos-cuculi*), tufted loosestrife (*Lysimachia thyrisflora*), bogbean (*Menyanthes trifoliata*), flat-stalked pondweed (*Potamogeton friesii*), stream water-crowfoot (*Ranunculus penicillatus*), Northern yellow-cress (*Rorippa islandica*), green figwort (*Scrophularia umbrosa*), and pillwort (*Pilularia globulifera*). It should be noted that pillwort is an internationally threatened species that is declining throughout its range (Western Europe) and is the only macrophyte species listed on the Edinburgh LBAP that is currently subject to a species action plan. Variegated horsetail (*Equisetum variegatum*) is the only aquatic macrophyte listed in the Fife LBAP.

3.5 Freshwater Fish

Biology

3.5.1 There are 42 species of fish found in Scottish freshwater and of those species, 16 have been introduced (Maitland, 2007). Many of Scotland's native freshwater fish exhibit diadromous life stages (which includes individuals moving from marine to freshwater to breed: anadromous e.g. salmonids and lamprey or vice versa, catadromous e.g. eels). Of those species found in the Forth catchment, seven are afforded legislative protection. A brief summary of their biology is provided below.

Atlantic salmon (*Salmo salar*)

3.5.2 Historically, the Atlantic salmon was widely distributed in all countries whose rivers enter the North Atlantic, but in recent decades, poor water quality, habitat degradation and obstructions to their natural passage in rivers have caused a restriction to their natural range (Hendry & Cragg-Hine, 2003). Some Atlantic salmon populations have reached critically low levels.

3.5.3 Atlantic salmon are widely distributed in northern and southwestern England, Wales and Scotland. The fish utilise rivers and burns for reproductive and nursery phases and the marine environment for adult development and rapid growth (Mills, 1991). Spawning usually occurs in November and December, and requires minimal disruption to the salmon's natural passage upstream to spawning grounds. Atlantic salmon require particular conditions within their spawning habitats incorporating clean, well-oxygenated water flowing over clean gravel or cobble substrate (Shelley, 2004).

3.5.4 Juvenile salmon require a habitat with abundant cover provided by the substratum and, to a lesser extent, aquatic vegetation and undercut banks. During development, older parr exhibit a preference for deeper water and utilize pools below riffles, particularly during winter, where they become territorial. Juvenile salmon remain in freshwater for one to three years before migrating to sea as smolts. After residing for up to three years in the sea they return to freshwater to spawn (Shelley, 2004).

Brown/sea trout (*Salmo trutta*)

3.5.5 The natural range of brown trout was originally European. However, introduction for sport purposes has significantly expanded their geographical range (http://www.marlab.ac.uk). Brown trout are potamodromous and as such migrate and spawn only within freshwater. Spawning takes place from late autumn to December in clean gravel beds of moderately flowing riffles. Eggs can take up to four months to hatch depending on temperature and location (i.e. lowland/highland streams). Fry emerge from the gravels and develop into parr and young adults within a two year period. Brown trout are highly territorial and require cover in the form of overhanging banks and vegetation.

3.5.6 Sea trout differ in life history from brown trout in that they exhibit anadromous behaviour. Juvenile trout typically aged two to three years migrate down river systems toward the sea and in the process undergo physiological change known as smoltification, during which time the individuals

become highly silvered and develop the ability to tolerate salt water. After only a couple of months at sea, a number of sea trout return to freshwater as finnock (juvenile sea trout, around 25cm). After spawning they may go back to sea and return to spawn in subsequent years. Mature fish (25-40cm) return each year to spawn. Post spawning adults are known as sea kelts. During spawning periods (late autumn onwards), sea and brown trout can be found on the same spawning areas.

3.5.7 The seasonal timing of sea trout returning from the sea depends on their place of origin. Adults which originate from the upper reaches of a catchment typically begin their upstream migration in April to June, spending most of the summer in the main river before moving upstream to spawn in autumn when high water levels allow.

European eel (*Anguilla anguilla*)

3.5.8 Eel populations have declined substantially across much of Western Europe in recent years and stocks are now considered to be outside safe biological limits.

3.5.9 European eel are catadromous, migrating from freshwater to their spawning grounds in the Sargasso Sea. Larval eels arrive in Scottish estuaries during February (Wheeler, 1969) at which stage they are transparent and are referred to as glass eels. As they enter the rivers they become pigmented and are known as elvers.

3.5.10 Eels feed on benthic invertebrates, although some individuals become piscivorous as they grow. Research has shown that eels are relatively insensitive to sound (Turnpenny et al., 1993) but that they are negatively phototaxic (Hadderingh et al., 1999) and as such they are commonly nocturnal and are hidden during the day. Eels spend a considerable period feeding and growing in freshwater (from seven to 19 years), before turning silver and heading seawards in the autumn. Eels are present throughout the Forth catchment, including the River Almond and small tributary streams (Davies et al., 2004).

Brook lamprey (*Lampetra planeri)*

3.5.11 Brook lamprey spend their entire lives in freshwater, although individuals may carry out local potadromous migrations to spawn. There is a tendency for the larvae (ammocoetes) to drift downstream during development (Wheeler, 1969). Spawning occurs during early April at partially shaded sites, in excavated depressions in sand and gravel. Brook lamprey spend six years buried in the sediment feeding on organic matter before metamorphosing into adults. Adult brook lamprey do not feed, and die after spawning (semelparous).

River lamprey (*Lampetra fluviatilis*)

3.5.12 River lamprey breed in freshwater in April and May and inhabit freshwaters throughout their larval stage. Spawning sites commonly have sand and gravel substrata, flowing water and are usually at least partly in the shade (Wheeler, 1969). Adults create a nest by removing pebbles using their oral sucker, and excavate sand by shaking the tail.

3.5.13 River lamprey ammocoetes live buried in silty habitats where they feed on organic matter for approximately five years. In early autumn river lamprey ammocoetes metamorphose into the adult form, usually around 120mm in length, and migrate downstream to the sea. Adult river lamprey are parasitic, feeding on the blood and tissue of other fish, before returning to rivers to spawn. Once in the river the adult river lamprey lose the ability to feed and die after spawning.

Sea lamprey (*Petromyzon marinus*)

3.5.14 Sea lamprey breed in freshwater in May and June. Spawning requires a gravel substratum and clean fast-flowing water, but adjacent silty areas are also required for the larvae. Sea lamprey ammocoetes live buried in silty and sandy substrates for around five years, feeding on organic matter (Wheeler, 1969).

3.5.15 In late summer the ammocoetes metamorphose into the adult form, usually 150-200mm in length, during which phase they are referred to as transformers. After metamorphosis the adult sea lamprey migrate downstream to the sea and become parasitic, feeding on the blood and tissue of other fish. Maturity is reached after one or two years at sea, at which point the adults, now 600-800mm in length, return to rivers to spawn. Once in the river adult sea lamprey lose the ability to feed and die after spawning.

Bullhead (*Cottus gobio*)

3.5.16 Bullhead is a benthic species and is found in predominantly stony streams with a moderate to fast flow creating oxygen rich conditions (Tomlinson & Perrow, 2003). Bullhead is only present in a relatively few catchments in Scotland (including the Forth catchment) (Maitland & Campbell, 1992). Spawning occurs between February and June when females lay eggs in nests under stones created by the male. Hatching occurs up to 30 days later when young fry disperse by drifting in the river current at approximately 9mm in size (Tomlinson & Perrow, 2003).

3.5.17 The cryptic colouring and sedentary lifestyle of bullhead make them ideally suited to thrive in complex habitats with plenty of shade and cover. Adult bullhead take up territories amongst large stones, woody debris or tree roots which provide shelter from piscivorous birds and fish. The coarse large stones and woody substrate are also required for the young bullhead where they seek refuge amongst the interstitial spaces. Potential threats commonly associated with population declines include chemical water pollution, habitat deterioration and deposition of fine sediments.

Sensitive periods for fish

3.5.18 According to the biology and behaviour of the above fish species, sensitive periods exist during the calendar year, when certain activities, in specific parts of their habitat, could have an impact on the population. These sensitive periods are summarised in Table 2.2.

Table 2.2: Sensitive Periods for Freshwater Fish

	Jan		Feb		March		April		May		June		July		Aug		Sep		Oct		Nov		Dec	
Salmon:																								
Adult migration to freshwater																								
Spawning																								
Egg incubation																								
Smolt migration to sea																								
Brown/Sea trout (st):																								
Spawning																								
Egg incubation																								
Smolt migration to sea					st	st	st	st	st															
Migration to freshwater							st	st	st	st	st	st	st	st	st	st	st	st	st	st				
Bullhead:																								
Spawning																								
Egg incubation																								
Minnow:																								
Spawning																								
Egg incubation																								
Three-spined stickleback:																								
Spawning																								
Egg incubation																								
Stone loach:																								
Spawning																								
Egg incubation																								
Eel:																								
Glass eel immigration to f/w																								
Silver eel emigration																								
River lamprey:																								
Spawning																								
Ascending adults																								

	Jan		Feb		March		April		May		June		July		Aug		Sep		Oct		Nov		Dec	
Larval drift																								
Ammocoetes **																								
Metamorphosis*																								
Brook lamprey:																								
Spawning																								
Ascending adults																								
Larval drift																								
Ammocoetes**																								
Metamorphosis*																								
Sea lamprey:																								
Spawning																								
Ascending adults																								
Larval drift																								
Ammocoetes**																								
Metamorphosis*																								

*ammocoetes are when buried during metamorphosis and remaining sessile in sediment, highly sensitive to physical damage at this stage.

**when migrating downstream from nursery areas

Legislation and Conservation Status

3.5.19 Fish species are afforded protection under one or more of the following conservation legislative frameworks:

- Conservation (Habitats, &c.) Regulations 1994 (as amended);
- European Eel (Council Regulation (EC) No 1100/2007);
- Salmon and Freshwater Fisheries Act (Consolidation) (Scotland) 2003; and
- Surface Waters (Fishlife) (Classification) (Scotland) Amendment Regulations 2007.

3.5.20 The WFD, through the aim of preventing the ecological status of watercourses from deteriorating from existing conditions (see Section 3: River Habitat for further information) is likely to benefit fish species.

3.5.21 The Conservation Regulations 1994 (as amended) place a duty on the Secretary of State to propose a list of sites which are important for either habitats or species (listed in Annexes I and II of the Habitats Directive respectively) to the European Commission. Under this legislation, Annex II species within European sites designated through the implementing regulations are afforded legal protection. In this catchment, protection is afforded to those Annex II fish species (Atlantic salmon, sea lamprey, river lamprey and brook lamprey) present in the River Teith SAC.

3.5.22 All freshwater fish species are protected under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act (2003). Atlantic salmon, bullhead, sea lamprey, river lamprey and brook lamprey are all listed in Annex II of the EC Habitats Directive which requires the designation of SAC. Atlantic salmon and river lamprey are also listed on Annex V of the EC Habitats Directive which lists species whose taking in the wild and exploitation may be subject to management measures.

BAPs

3.5.23 Atlantic salmon, brown/sea trout and European eel are priority species of conservation concern in the UKBAP and have a significant commercial importance (Table 3.1). River lamprey and sea lamprey are also species of conservation concern in the UKBAP. Atlantic salmon, brown/sea trout and river lamprey, have LSAPs for the City of Edinburgh.

Table 3.1: Inclusion of Species in Conservation Legislation

Common name	Salmon and Freshwater Fisheries Act (Consolidation) (Scotland) Act 2003	EC Habitats Directive		UKBAP	Edinburgh LBAP
		Annex IIa	Annex Va		
Atlantic salmon	Y	Y	Y	Y	Y
Brown/sea trout	Y	N	N	Y	Y
European eel	Y	N	N	Y	N
Minnow	Y	N	N	N	N
Three-spined stickleback	Y	N	N	N	N
Stone loach	Y	N	N	N	N
Bullhead	Y	Y	N	N	N
Sea lamprey	Y	Y	N	Y	N
River lamprey	Y	Y	Y	Y	Y
Brook lamprey	Y	Y	N	N	N

Note: Y= included, N= not included.

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