WATER AND WETLAND

SEPA

FALLS OF BRUAR

If landscapes were sold like the sheets of character of my boyhood, one penny plain and twopence coloured, I should go to the length of twopence every day of my life.

ROBERT LOUIS STEVENSON

WATER AND WETLAND

Introduction

Tayside has a rich heritage of water and wetlands and their associated species. This diversity is due in large part to a complex geology and varied landscape. The division of the area by the Highland Boundary Fault is, for example, one feature which gives rise to some of the most valuable habitats in Tayside such as Reekie Linn and the Den of Airlie. The interface between upland and lowland is one of the reasons for the high biodiversity value of the Lowes chain of lochs, a resource of international significance.

Tayside is dominated (and largely defined) by the catchment of the River Tay. The Tay system drains the largest area of any river in Scotland and its flow is the largest in Britain. Other large river systems rising in the mountains drain the northeast of the region, notably the North and South Esks, whilst smaller systems, such as the Angus coastal burns rise in the lowlands and are of a very different nature. Associated with these river networks is a wealth of standing waters, from the very large, deep highland lochs to small ponds and lochans and flood plain habitats such as wet woodlands, swamp and marshes, flood meadows and reedbeds. These are of intrinsic interest, of course, but it is important to remember that wetlands, and particularly running waters, often contribute to valuable habitat mosaics. Thousands of kilometres of burns, for example, provide linking wildlife corridors between other terrestrial habitats and heighten their interest and biodiversity. The margins of rivers and standing waters form the transitional zone between the aquatic and terrestrial environment. They frequently give rise to a valuable mosaic of habitat features. Therefore the boundaries between the habitats discussed in this section, and those in other sections are, by necessity, indistinct.

The fundamental feature of wetland habitats is their dependence upon inputs of freshwater. The quality and quantity of those inputs may be determined by distant activities such as atmospheric emissions of acid forming gases, land management for agriculture, forestry and development, or upstream abstraction of water for hydropower or potable supply. The wide range of activities and the impacts arising from them may present major challenges to the management of river systems and associated wetlands, requiring the co-operation of many organisations and individuals. Already the waters and wetlands of Tayside have a rich cultural heritage; the waters of the Tay and other rivers and lochs have been harnessed for the operation of mills, dye-works, distilleries and hydro-power and man's influence on the natural heritage character of wetlands is still strong.

The following sections describe some of the water and wetland habitats in Tayside, discuss the threats they face and propose actions to improve their status. Because these habitats are so widespread and accessible there is much scope for involvement of the people of Tayside, who for the same reasons are well placed to enjoy the benefits of those improvements.

Mesotrophic Lochs WW1

LORNE GILL/SNH

LOCH LEVEN

INTRODUCTION

Mesotrophic lochs were identified by the UK Biodiversity Group as a key habitat of particular national importance that required specific work over and above that detailed in the standing open waters broad habitat plan. Much of the Standing Open Waters Habitat Action Plan therefore applies, but issues particularly relevant to mesotrophic lochs are examined here.

DEFINITION

Mesotrophic lochs are defined either as those with a moderately rich plant nutrient environment, particularly nitrogen and phosphorus, or those having a range of submerged plant communities, principally NVC (National Vegetation Classification) types 5A and 5B.

Type 5A is characterised by Shore-weed *Littorella uniflora*, Alternate flowered water milfoil *Myriophyllum alterniflorum*, Stoneworts *Nitella spp.*, Small pondweed *Potamogeton berchtoldii* and Canadian pondweed *Elodea canadensis*, (an alien species). Type 5B is characterised by Floating pondweed *Potamogeton natans*, and White water lilies *Nymphaea alba*.

However, lochs may be historically mesotrophic but have been subsequently changed to eutrophic by human activity. This type of loch has been included within this Plan as it may be possible in the long term to return them to a more natural nutrient status.

CURRENT STATUS AND EXTENT OF HABITAT

There are several mesotrophic lochs in Tayside, mainly located along the fringe of the uplands. These are listed under key sites, together with a brief assessment of their current status. It is apparent from the list that many lochs that were probably historically mesotrophic have now become eutrophic and others are threatened by nutrient enrichment. The Lowes chain of lochs between Dunkeld and Blairgowrie, which is of international significance, remains of high quality, but is threatened. Remediation of culturally eutrophic lochs is usually difficult, but efforts are being made, for example, to restore Loch Leven to a more natural nutrient status.

Naturally mesotrophic lochs are severely threatened and positive action is required to ensure the survival of this important habitat. Formerly mesotrophic lochs which have lost their characteristic animal and plant communities are not regarded as a national priority for remediation as it is considered that resources are best directed at maintaining and improving relatively unimpacted examples.

WW1 Mesotrophic Lochs

KEY SITES

The national rarity and decline of naturally mesotrophic lochs means that all of those present within the region merit inclusion as key sites. However, a few that particularly stand out are the Lowes chain of lochs between Dunkeld and Blairgowrie (Craiglush, Lowes, Butterstone, Clunie and Marlee), the Black Loch at Cleish, and Loch Moraig. These represent relatively unpolluted or pristine examples. Loch Leven, possibly once a mesotrophic loch, but now highly eutrophic, is of considerable importance and represents a classic example of the challenges faced in restoring lochs such as these to their natural status.

Loch Moraig (SSSI) -	Mesotrophic, very high quality. A naturally mesotrophic loch, but there are indications that land use within the catchment is having an effect on the ecology of the loch.
Black Loch, Cleish (SSSI)	Mesotrophic, very high quality. The only known naturally mesotrophic loch in Tayside that has had no recent agricultural improvement or afforestation within its catchment.
The **Lowes** chain of lochs of between Dunkeld and Blairgowrie of international significance (SSSIs and increasing candidate SAC):	- **Loch of Craiglush** - oligo/mesotrophic, high quality. - **Loch of Lowes** - mesotrophic, high quality, but indications of increasing nutrient levels. - **Butterstone Loch** - mesotrophic, high quality, but indications of nutrient levels. - **Loch Clunie** - mesotrophic, high quality, but indications of elevated nutrient levels. - **Loch of Drumellie or Marlee** - mesotrophic, high quality, but indications of increasing nutrient levels.
Loch of Lintrathen (SSSI)	Mesotrophic/eutrophic, artificial loch.
Long Loch of Lundie (SSSI)	High quality, mesotrophic with notable fringing fen.
Crombie Reservoir	Artificial waterbody.
Loch Monzievaird	Status uncertain.
Drumore Loch (SSSI)	Mesotrophic loch.
Laird's Loch (SSSI)	Status uncertain.
Loch Leven (SSSI, SPA, RAMSAR)	Now eutrophic, may historically have been mesotrophic. Still of very high conservation value.
Rescobie Loch	Eutrophic, may historically have been mesotrophic.
Balgavies Loch	Eutrophic, may historically have been mesotrophic.

Slender Naiad

A Naiad, the water nymph and lake dweller of Greek myth, is found in Scotland...

An inconspicuous plant, the wonderfully named Slender Naiad *Najas flexillis* is typically found growing submerged in clear mesotrophic lochs where there is soft silty substrata.

Classed as 'scarce' in Britain, all the UK populations are now only found in Scotland. Most of these populations are found on the islands off the west coast, but there are a few sites on the mainland. Tayside's only known population is found in the Lunan chain of lochs. It is thought to be in decline because of eutrophication, but it may also be due to excessive growth of other plants such as the invasive Canadian pondweed *Elodea canadensis.*

VALERIE JAMES

Mesotrophic Lochs WW1

NATURE CONSERVATION IMPORTANCE

Mesotrophic lochs are frequently of particular nature conservation importance for the exceptionally diverse plant communities they support and for rare species such as Slender naiad ***Najas flexilis***. Most mesotrophic lochs have SSSI status and the Lowes chain of lochs is a candidate Special Area of Conservation (SAC) for its populations of Slender naiad. These designations reflect the importance and scarcity of this habitat.

KEY SPECIES

Some species, such as the Slender naiad are very characteristic of mesotrophic lochs and their distribution is restricted to these types of waterbodies. They, therefore, merit inclusion as key species for their nationally important populations.

Many of the key species associated with mesotrophic lochs such as the Common scoter ***Melanitta nigra***, Black-necked grebe ***Podiceps nigricollis*** and the Osprey ***Pandion haliaetus*** are also associated with other open standing water, but mesotrophic lochs provide good habitat and may maintain significant populations.

P = UK Priority species **C** = UK species of conservation concern

Mammals	Water vole	*Arvicola terrestris*	**P**
	Otter	*Lutra lutra*	**P**
	Daubenton's bat	*Myotis daubentoni*	**C**
Birds	Common scoter	*Melanitta nigra*	**P**
	Osprey	*Pandion haliaetus*	**C**
	Black-necked grebe	*Podiceps nigricollis*	**C**
	Whooper swan	*Cygnus cygnus*	**C**
	Wigeon	*Anas penelope*	**C**
	Gadwall	*Anas strepera*	**C**
	Pink-footed goose	*Anser brachyrhynchos*	**C**
	Greylag goose	*Anser anser*	**C**
	Pochard	*Aythya ferina*	**C**
	Goosander	*Mergus merganser*	**C**
Amphibians	Palmate newt	*Triturus helveticus*	**C**
Plants	Slender naiad	*Najas flexilis*	**P**
	Slender stonewort	*Nitella gracilis*	**P**
	Pillwort	*Pilularia globulifera*	**P**

NATIONAL BIODIVERSITY CONTEXT

There is a UK Habitat Action Plan for mesotrophic lochs. This has the following objectives:

- Maintain the characteristic plant and animal communities of current mesotrophic lochs.
- Identify and implement effective remedial action to address nutrient enrichment and pollution in mesotrophic lochs by 2010.

ECOLOGY AND MANAGEMENT

The ecology of mesotrophic lochs is critically dependent on nutrient levels. The diverse macrophyte communities they support are due to the excellent conditions they have for rooted plant growth. The moderate levels of nutrients they have encourage plant growth, whilst not generally being sufficient to cause algal blooms which can shut light out from rooted plants. Maintenance of natural nutrient levels is, therefore, a key element in the management of mesotrophic lochs. To achieve this a catchment based approach is required.

WW1 Mesotrophic Lochs

CURRENT FACTORS CAUSING LOSS OR DECLINE

All the factors affecting the habitat detailed in the Standing Open Waters statement can apply to mesotrophic lochs, but the single factor which is probably the greatest and most active threat is cultural eutrophication. This may be due to direct nutrient inputs from sewage or because of increased nutrient run-off from land due to agriculture, forestry and amenity use.

Catchment land use may be a significant influence in mesotrophic lochs with ploughing up of grassland and under-drainage potentially increasing the possibility of soil erosion and with a consequent increase in water-borne sediments. Settled sediments may introduce nutrients into the system and sediments in suspension can cause turbidity resulting in poor light transmission to rooted plants. This can increase the chances of algal dominance and consequent declines in the rooted plant communities.

Fisheries management can alter the natural integrity of mesotrophic lochs in various ways. Competition from introduced fish can also alter the native species composition. The structure of the food web can be altered - for example leading to increased predation on the invertebrates that graze algae.

MAIN THREATS TO KEY SPECIES

Otter	Nationally significant factors: - Pollution of watercourses, especially by PCBs. - Insufficient prey associated with poor water quality. Factors that may be locally important in Tayside: - Impoverished bankside habitat features needed for breeding and resting. - Incidental mortality, primarily by road deaths and drowning in eel traps.	
	UK importance of Tayside population:	**Moderate**
Water vole	- Loss and fragmentation of habitats. - Disturbance of riparian habitats. - Predation by mink. - Pollution of watercourses and poisoning by rodenticides.	
	UK importance of Tayside population:	**Moderate**
Common Scoter	- Eutrophication may affect food availability. - Fish stocking may have lead to increased competition for invertebrate food in some sites. - Predation by mink and foxes. - Afforestation and secondary effects such as sedimentation. - Illegal egg collecting.	
	UK importance of Tayside population:	**High**
Grass wrack pondweed	- Eutrophication. - Neglect and drying out of ditches. - Increased recreational use of watercourses, including boat use and associated disturbance and pollution.	
	UK importance of Tayside population:	**Probably extinct in Tayside**
Slender naiad	- Restrictions on light penetration because of heavy weed and algal growth, and nutrient enrichment from point sources such as sewage works, fish farms and diffuse agricultural sources.	
	UK importance of Tayside population:	**High**

Mesotrophic Lochs WW1

Slender stonewort	Reasons for decline uncertain but the following are thought to be contributory factors: - Pollution from agricultural run off. - Acidification associated with afforestation in some catchments. - Encroachment of scrub and other vegetation at some sites. UK importance of Tayside population: **High**
Pillwort	- Nitrate/phosphate pollution and the associated increase in the growth of competitive species. - Abandonment of its main habitats, especially changes in grazing which lead to less disturbance. - Modification of water level regimes - Introduction of non-native competitive plants. UK importance of Tayside population: **High**

Common Scoter

The Common Scoter is anything but common nowadays; it is in fact the only duck to be included in the UK Red List and is highlighted in the UK Priority Species list.

It breeds on a few freshwater lochs in Northern Scotland and winters around the UK's coast. The male is our only totally black duck; its striking black and yellow bill can be seen at a very long range. Six of the top 14 over-wintering sites are in Scotland with Tayside holding important concentrations. Many more pass through on migration.

More and more UK BAP Lead Partners are becoming involved in local issues. 2002 sees the Common Scoter BAP Steering Group meeting in Edinburgh to discuss priority conservation issues with all those concerned with safeguarding this species.

JAMES SHARPE/WWT

OPPORTUNITIES AND CURRENT ACTION

Policy and Legal Status

Reference should be made to the policy and legal status section for standing open waters which also applies to mesotrophic lochs. Most mesotrophic lochs are notified as SSSIs and the Lowes chain of lochs is a candidate SAC.

Management, Research and Guidance

Specific ongoing actions detailed under the UK HAP for Mesotrophic Standing Waters include:

- Establishing water quality objectives and nutrient standards appropriate for mesotrophic lochs.
- Reviewing water resource uses where SSSI lochs are affected by excessive abstraction.
- Complete programmes for notification of mesotrophic loch SSSIs by 2001.
- Compile a priority list of lochs requiring remedial treatment.
- Ensure that all SSSI mesotrophic lochs have a site management plan implemented by 2005.
- Agree conservation strategies and consenting protocols for mesotrophic loch SSSIs with relevant statutory and non-statutory agencies.

WW1 Mesotrophic Lochs

Current Action

- Site Management Statements have been prepared by SNH for Loch Moraig, Black Loch (Cleish), Loch of Craiglush, Loch of Lowes, Butterstone Loch, Loch Clunie, Loch of Drumellie or Marlee, Loch of Lintrathen, Long Loch of Lundie, Drumore Loch, Loch Leven and Laird's Loch.
- A Catchment Management Plan exists for Loch Leven.
- The Loch of Lintrathen is managed as a wildlife reserve by the SWT.
- Loch of the Lowes is owned and managed by the SWT as a nature reserve.
- SAC and FWAG provide advice to landowners to help minimise the impact of agriculture in these sensitive catchments.
- Scottish Nature have undertaken studies of Black Necked Grebe and implemented management targets for nesting sites.
- SWT have produced a management plan for Balgavies Loch.

Opportunities

The UK HAP for Mesotrophic Standing Waters provides the framework and guidance for action at a local level to maintain or improve the quality of mesotrophic lochs. The identification of mesotrophic lochs as a key habitat clearly indicates a need for organisations with statutory responsibilities to prioritise resources for the protection of this habitat and for other organisations to recognise its importance.

A catchment level approach is required if the vitally important nutrient status of these lochs is to be maintained at, or returned to, near natural levels.

Considerable information already exists for the Lowes chain of lochs, a resource of international significance. Considerations are currently being made about the best approach to a catchment management scheme involving relevant organisations, interested parties, local farmers and residents.

OBJECTIVES AND TARGETS

	Objectives	Targets
1	Identify and implement effective remedial action to address nutrient enrichment and pollution in Tayside mesotrophic lochs by 2010.	Prepare Catchment Management Plans on a prioritised basis involving both statutory and non-statutory organisations. Seek to have these plans adopted by the Local Authority to inform planning decisions and provide a framework for integrated management. By 2011. Improve or maintain the water quality classification of all mesotrophic lochs in Tayside. Ensure that all SSSI mesotrophic lochs have a site management plan implemented by 2005.
2	Maintain the characteristic plant and animal communities of current mesotrophic lochs in Tayside.	Contribute information to the national inventory of mesotrophic lochs which provides information on environmental quality, biodiversity quality, impacts on biodiversity etc. By 2006. Ensure no net loss in area or reduction in quality of mesotrophic loch habitats.

Mesotrophic Lochs WW1

Stakeholders

- Landowners, land managers and advisors, developers, angling clubs, tourists and local users.

ACTION FOR BIODIVERSITY

		Action - Mesotrophic Lochs	Deliverers		To take place by	Meets Objective No.
			Lead Partners	Partners	02 03 04 05 06 07 11 16	
LBAP Ref.	**A**	**Policy and legislation**				
WW1	1	Ensure that all mesotrophic lochs meet EU Directives in terms of designations for wildlife, importance and/or quality.	SNH SEPA		#	2
WW1	2	Following a survey of mesotrophic lochs designate important sites as 'Local Wildlife Sites' as appropriate and incorporate them into the planning system.	SWT	SNH PKC DCC AC	#	1
WW1	3	Contribute to the development of policies within land use development plans to safeguard the particular wildlife interest of mesotrophic lochs.	PKC DCC AC	SNH SEPA TBP	# # # # # # #	1, 2
	B	**Site safeguard and management**				
WW1	1	Ensure that all Tayside SSSI mesotrophic lochs have a site management plan implemented by 2005.	SNH		#	1
	C	**Advisory**				
WW1	1	Provide advice for managers and users of mesotrophic lochs to promote the biodiversity conservation of this habitat.	TBP		# # # # # # # #	1
	D	**Research and monitoring**				
WW1	1	Review current water quality data to determine current status of the Lowes chain of lochs.	SEPA		#	2
WW1	2	Establish a monitoring programme to assess long term trends in the nutrient status of mesotrophic lochs in Tayside.	SEPA		#	2
WW1	3	Monitor the delivery of the action plan yearly and in detail every 5 years, starting in 2003.	TBP		#	
WW1	4	Continue Site Condition Monitoring for SACs and SSSIs.	SNH		# #	
	E	**Promotion and Awareness-raising**				
WW1	1	Ensure widespread awareness of the biodiversity significance of mesotrophic lochs by dissemination of literature provided by the UK steering group.	TBP		# -	1

Mesotrophic Lochs

This illustrative map shows a few key examples of the habitat. Please note that many sites of interest are privately owned and owners' permission should be sought for any access.

Rivers and Burns WW2

LORNE GILL/SNH

GLEN ARTNEY, PERTHSHIRE

DEFINITION

Rivers and burns are flowing watercourses and in their natural state are dynamic systems continually modifying their form.

The rivers and burns habitat consists not only of the watercourse itself - the "wetted channel", but also the bank and associated land or riparian zone.

This definition provides for overlap with Habitat Action Plans for other habitats closely associated with rivers such as Wet Woodland. These valuable habitats are covered by other action plans which should be referred to in conjunction with this one.

Key Features

Rivers and burns support a wide range of plants and animals. A watercourse's biodiversity is determined by its mosaic of features, geographical area, underlying geology and water quality. The rivers and burns in Tayside tend to be fast-flowing and nutrient poor and hold a wealth of habitats and rare wildlife. The Highland boundary fault separates the metamorphic bedrock of the highlands and the old red sandstone underlying the lowlands. The rivers and burns rush down the Highland mountains and only after breaching the Highland boundary fault with famous waterfalls such as Reekie Linn and Rumbling Bridge do they begin to slow slightly and meander across the lowlands. In the lowland stretches the rivers deposit silt on land underlain by relatively more nutrient rich sandstone. Here they have created fertile agricultural land such as that in the lowlands of Angus which the North and South Esks flow through.

In addition to their intrinsic value rivers and burns also act as important wildlife corridors, enabling dispersion and migration of species. They allow mobile species to utilise patchy areas of habitat and interconnect fragmented populations. They are particularly valuable in Tayside with a total length of over 5,000km not only making them essential to wildlife but also a familiar and important part of everyone's environment.

The River Tay has the largest mean average annual flow of any river in the UK in terms of volume at nearly 200 cubic metres per second. Many of its tributaries are significant rivers in their own right and include the Lyon, Tummel, Isla, Almond and Earn. In addition the Rivers North and South Esk and the Dighty Water drain the Angus and Dundee areas on their way to the North Sea. All the rivers of the Tayside catchment eventually converge on the Firth of Tay.

CURRENT STATUS AND EXTENT OF HABITAT

Tayside rivers and burns have a rich natural heritage and provide numerous resources. Many parts of the system have been modified in urbanisation and for agriculture, forestry and industries such as hydro-power generation. However, the majority of rivers and burns maintain good water quality and rich, diverse habitats.

Habitat Quality

The River Habitat Survey (RHS) assesses the physical structure of watercourses, including the channel, the banks and the river corridor. A survey of Scottish sites undertaken between 1995 and 1997 revealed that of 34 RHS sites on major rivers and burns in Tayside, 56% were 'semi-natural', 8% were 'predominantly unmodified', 18% were 'obviously modified' and 18% were 'significantly modified'. No sites were 'severely modified'. Compared to the rest of Scotland, these results confirm the relative good health of Tayside's rivers and burns.

Water Quality

SEPA currently classifies about half of mainland Scotland's rivers (over 50,000 km) based on their chemical and biological quality. SEPA's river classification scheme, as applied to 1996 monitoring data, shows that about 91% of the classified river length was of excellent or good water quality. The remaining 4,000 km of rivers were classified as polluted (defined as fair, poor or seriously polluted). In 2000, of a total monitored Tayside river length of nearly 800km, about 75% were classed as either of excellent or good water quality. Less than 3% were classed as poor or seriously polluted.

KEY SITES

Tayside has an abundance of high quality rivers and burns. Many of these have features which, if not necessarily unique, are uncommon in the United Kingdom. Although this section highlights key sites within the Tay catchment, the whole catchment can itself be viewed as a key site. Reaches of unmodified rivers adjoined by natural or semi-natural habitat are not uncommon in Tayside and all can justifiably be regarded as being of importance. In a similar fashion the whole area could be regarded as a key site in the UK and European context for the Freshwater Pearl Mussel *Margaritifera margaritifera*.

There are a number of sites in the Tay catchment which stand out in the national context for their intact or unique habitat, their size or for the diversity or rarity of the species they support:

River Tay pSAC	A large site that includes all key parts of the river and its tributaries accessible to Salmon *Salmo salar*. The site is also of international importance for its populations of Otter *Lutra lutra*, Sea lamprey *Petromyzon marinus*, River lamprey *Lampetra fluviatilis*, and Brook lamprey *Lampetra planeri*.
South Esk cSAC	This site was designated for its internationally important populations of Salmon and Freshwater Pearl Mussel.
Craighall Gorge SSSI on the River Ericht	A river gorge containing a diverse assemblage of species, including the River Jelly Lichen *Collema dichotomum*. There is an excellent continuity of habitat from a high quality river into broad-leaved, mixed and yew woodland.
The **Den of Airlie** SSSI, River Isla	Similar in many ways to Craighall Gorge.
The **Lunan Burn** system between Dunkeld and Blairgowrie	The lochs on the system are discussed further in the Mesotrophic Lochs Habitat Action Plan, but the burn itself, especially between Clunie and Marlee lochs (SSSI), is the best example of a lowland burn in Tayside.
Meikleour SSSI, River Tay	A section of the River Tay in the lowlands with large shingle banks adjoining unimproved lowland pastures and fen vegetation. This area is important for the diversity of habitats and species it supports, including over-wintering wildfowl.

Shingle Islands cSAC	An area of shingle banks and islands formed by the River Tummel and Tay showing a variety of transition and mosaic communities from bare shingle, grassland and important fluvial alder woodlands. It has an extremely high biodiversity in terms of flowering plants, lichens, mosses and liverworts.

NATURE CONSERVATION IMPORTANCE

The **Freshwater Pearl Mussel** (FWPM) *Margaritifera margaritifera*, is a filter-feeding bivalve mollusc with a compressed kidney-shaped, black-brown shell; it may grow to 15cm in length. It is one of our longest living invertebrates - perhaps up to 140 years, although normally living between 80 - 100 years.

Fertilised eggs develop into tiny bivalve larvae called glochidia. In late summer the female sheds these into the water column. An estimated 0.01% of perhaps 3 million per female will survive to be inhaled by a host salmonid fish where they lodge on the gills. The following spring the juvenile mussels fall off into clear, calcium-poor, fast flowing rivers where they have to find a fine gravel site amongst large stones in which to partially bury themselves. There they will grow and mature. Perhaps only 1% of the juvenile mussels will survive, but adults have few natural predators and can tolerate moderate disturbance.

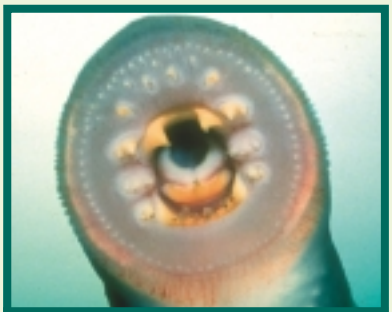
SUE SCOTT

Myth has it that the Romans invaded Scotland in search of pearls.

FWPM populations have declined by about 90% across Europe in the last 20 - 30 years and Scotland now accounts for 60% of the remaining vulnerable population. On a European scale causes of the decline include pollution, nutrient enrichment and acidification of the water; siltation of gravel beds; decline of host salmonid populations; habitat destruction through river engineering; and overfishing for pearls. In the Tay Catchment the main problem has been overfishing. The FWPM is protected under the Wildlife and Countryside Act, so it is illegal to purposefully kill or injure them. Although fishing for pearls was banned in 1998, it still goes on and actions are being taken to ensure it is stopped. Any publicity of sites containing pearl mussel can act as a stimulus for illegal fishing, so caution over publicity is required. SNH's surveys and monitoring are establishing the locations and health of populations. These, together with general awareness raising, will help to improve prospects for the FWPM's long term survival in Tayside.

Strictly speaking, lampreys are not true fish at all, but form a separate, more primitive group of jawless vertebrates. These ancient fish superficially resemble eels and have a large sucker-like mouth as adults. Fossils - clearly recognisable as lampreys - have recently been found in 500 million year old rocks in China.

There are three species: **Brook lamprey** *Lampetra planeri* live entirely in fresh water; **River lamprey** *Lampetra fluviatilis* and **Sea lamprey** *Petromyzon marinus* migrate downstream to the sea, returning to spawn later in their lifecycles. They hatch in gravel riverbeds and migrate as larvae to silty parts of the river. Here they live in burrows and filter feed, helping to keep the water clean. As adults they leave these nursery grounds and ultimately migrate and spawn.



SEPA

The most unusual and unfamiliar fish of the Tay.

The numbers and distribution of lampreys have declined in some parts of Europe because of increased pressure on the habitats on which they rely. These include water pollution, siltation clogging gravel beds used for spawning, and river engineering that may destroy important habitats or impede migration. However, the Tay's catchment size and suitable habitat mean that it supports an important population of all three lamprey species.

Actions being taken to ensure long term survival of the lampreys includes avoiding disturbance of spawning and nursery areas; avoiding migration impedance; carrying out surveys and monitoring to establish locations and health of populations; awareness raising.

KEY SPECIES

Key species have been selected for Tayside for a number of different reasons. Tayside contains nationally or internationally important populations of some species, including River jelly lichen and Freshwater Pearl Mussel.

Ospreys *Pandion haliaetus* and Otters *Lutra lutra* have been selected as species representing a success story, illustrating what can be achieved. The Atlantic salmon is of economic importance and a notable feature of the region's rivers. Other species, including the stiletto fly *Thereva lunulata*, are nationally rare and their distributions uncertain, but they have been recorded in our region in the past. A locally important species, the Daubenton's bat *Myotis daubentoni*, feeds on insects flying over the rivers and roosts nearby in the hollow limbs of old trees.

P = UK Priority species **C** = UK species of conservation concern

Mammals	Water vole	*Arvicola terrestris*	**P**
	Otter	*Lutra lutra*	**P**
	Pipistrelle bat	*Pipestrellus pipistrellus*	**P**
	Daubenton's bat	*Myotis daubentonii*	**C**
Birds	Goosander	*Mergus merganser*	**C**
	Dipper	*Cinclus cinclus*	**C**
	Kingfisher	*Alcedo atthis*	**C**
	Osprey	*Pandion haliaetus*	**C**
Fish	Salmon	*Salmo salar*	**C**
	Sea trout/brown trout	*Salmo trutta*	
	Sparling/smelt	*Osmerus eperlanus*	**C**
	Sea lamprey	*Petromyzon marinus*	**C**
	River lamprey	*Lampetra fluviatilis*	**C**
	Brook lamprey	*Lampetra planeri*	**C**
	Allis shad	*Alosa alosa*	**P**
Invertebrates	a cranefly	*Rhabdomastrix laeta*	**P**
	a stiletto fly	*Spiriverpa lunulata*	**P**
	a stonefly	*Brachyptera putata* poss extinct	
	Freshwater pearl mussel	*Margaritifera margaritifera*	**P**
Plants	River water-crowfoot	*Ranunculus fluitans*	**C**
	River jelly lichen	*Collema dichotomum*	**P**
	Ear-lobed dog-lichen	*Peltigera lepidophora*	**P**
	Spruce's bristle moss	*Orthotrichum spruce*	**P**

NATIONAL BIODIVERSITY CONTEXT

The UK BAP provides guidance for the direction Local Habitat Action Plans can take with the conservation of rivers and burns. Its recommendation is:

Maintain and improve the quality, state and structure of all UK rivers and streams and their associated flood plains. Restore degraded river systems taking account of water quality and quantity, structure and hydraulic connection with the floodplain.

Rivers and Burns WW2

In the UK Habitat Statement for Rivers and Streams measures to consider further include:

- Development and implementation of integrated catchment management plans including work on nutrient budgeting.
- Use existing measures such as the Rural Stewardship Scheme Water Margin option to support the appropriate management of rivers and streams and their associated habitats, in particular flood plains.
- Review the powers and duties of water management institutions to manage water for nature conservation objectives.
- Integrated working between agencies and landowners to provide guidance and training.

There are UK BAP priority species associated with this habitat and they, along with the key species of conservation concern, can benefit from the actions undertaken for rivers and burns.

ECOLOGY AND MANAGEMENT

The information for this section is detailed elsewhere: see particularly the Management, Research and Guidance section of this Plan.

CURRENT FACTORS CAUSING LOSS OR DECLINE

The ecology of a river or burn is dependent on the quality and quantity of its water and on the nature and quality of the instream and riparian habitat. Man's influence through many different factors can sometimes be detrimental, but sensitive management can mean that the biodiversity and the physical structure and functioning of rivers and burns are retained.

Factors Affecting Water Quality - Pollution

Pollution is a significant threat to the biodiversity of rivers and burns. SEPA detailed in its 1999 State of the Environment Report the seven most important causes of polluted water in Scotland. The most important factor nationally causing water pollution in rivers was sewage effluent.

Diffuse and point source agricultural pollution are the most significant influences on water quality in Tayside. They pose a serious long-term threat to lochs and are of concern for rivers. Current projections suggest that by 2010, on a national level, diffuse agricultural pollution may be the most important cause of river pollution.

Whilst licensing is required for sheep dip disposal there is still concern regarding the policing and monitoring of this. Sewage effluent, urban drainage, mine drainage and industrial effluent are not significant impacts on the major rivers in Tayside, although a few stretches are affected. Overgrazing of riparian corridors is a problem on some stretches, for example, the Isla, Tilt and Lyon. This makes soil erosion more likely and reduces the abundance and diversity of terrestrial invertebrates which are an important food source for some fish, including Salmon.

Factors Affecting Water Quantity

There are three main categories of pressures affecting water quantity in rivers:

- Groundwater abstraction.
- Surface water abstraction.
- Flow regulation.

Groundwater abstraction via boreholes has increased dramatically in Scotland in the last two decades. Groundwater abstractions in Tayside predominantly take place for agricultural purposes in the lowland areas. In the absence of a comprehensive scheme for controlling abstractions from groundwater there are no means of ensuring that aquifer fed rivers are guaranteed protection.

Surface water abstraction for various purposes has a major impact on a number of Tayside rivers. The most significant of these are those for hydro-electric purposes, with the River Garry being the most marked example. Drinking water abstractions such as the one from the River Earn take significant amounts of water.

Agricultural irrigation has a marked impact on many of the Angus coastal burns which can run dry. Fish farms, too, abstract significant amounts of water. In contrast to some other river systems, however, industrial abstraction is not significant in Tayside.

Hydro-electric power generation has led to significant flow regulations in parts of the Tay Catchment. Dams change the dynamics of a system and this can be very detrimental to a river's biological, chemical and physical integrity if they are poorly managed. However, impacts can be minimised and altered systems can remain rich in habitats and species, the Dunalastair Reservoir SSSI being a good example.

Case Study

Hydro-Electricity Generation in Tayside

Hydro-electricity schemes can be a sustainable form of power generation. The potential of Tayside was recognised as early as the 1930s. There are now two major schemes in the Tay catchment, namely the Breadalbane and Tummel schemes. They maximise the use of a relatively small amount of water to produce about 3.3 % of Scotland's annual power requirements.

The Tummel Valley scheme has nine power stations and includes the Rivers Garry, Tummel, Errochty and Lochs Rannoch, Tummel and Ericht. The Breadalbane scheme develops the water resources of the mountainous region around Lochs Lyon, Tay and Earn, with a total of seven main power stations.

LORNE GILL/SNH

LOCH LYON, PERTHSHIRE

Scottish and Southern Energy operate these hydro-electricity schemes and take great care to minimise any detrimental impacts on the habitats and species of the Tay Catchment. Water flow patterns have to be modified to make efficient use of the available power. However, compensation flows are used to ensure sufficient flows remain downstream of a dam and 'freshets' can mimic natural spates. Many of the power stations also have fish ladders and screens to minimise the impedance of, particularly, migrating salmon. They may also have fish counters which can provide invaluable information about the health of salmon populations.

Factors Affecting Physical Quality

The quality of habitats in or near water is an important measure of the overall quality of the aquatic environment. The physical condition of river channels is subject to a wide range of pressures and some have been degraded to varying degrees in Tayside. Damage may occur by direct modification of the habitat structure by river engineering involving flood defence, erosion control or drainage work. Indirect impacts result from land management practices such as grazing, ploughing or the application of herbicides. Habitat destruction and simplification can occur when the following examples are used inappropriately - culverting, dredging, "hard" engineering works, construction and operation of dams and

reservoirs, bank reinforcement, excessive "gardening" and inappropriate bank management (including overgrazing) leading to bankside and instream habitat destruction.

Engineering and river management works may lead to habitat fragmentation rather than its total loss. For instance, culverting or the construction of weirs may render watercourses impassable to fish and other wildlife. Loss of bankside habitat due to hard engineering or agriculture may damage the value of a river as a wildlife corridor. Flood defence work may separate the river from its floodplain habitat, preventing seasonal inundation of valuable wetland habitats. An important issue for Tayside is the amount of ad-hoc and uncoordinated bank and river engineering works undertaken for both fisheries and agricultural purposes. A more co-ordinated catchment or whole river approach, together with 'soft' engineering options, dramatically lessens detrimental impacts. River restoration work is also appropriate in some places, with for example, the re-introduction of more natural bends and ox-bows.

Biological Pressures

The self-colonising plants such as Giant hogweed, Himalayan balsam and Japanese knotweed are already familiar features on some sections of river in Tayside, notably around Perth. Less well-known species such as Australian swamp stonecrop are also significant threats. Invasive plants such as these can dominate bankside vegetation to the exclusion of native species. Certain species can form stands dense enough to prevent access, for example, for recreation and may pose a health hazard. Other species, including non-native ornamental species, may be planted as an environmental "improvement" and some for amenity value, such as cultivated grass species, which are also often mown to the very edge of the riverbank.

Japanese knotweed forms dense stands on the River Earn and often prevents fishermen going down to good fishing spots. On areas of the lower Dighty Burn, Giant hogweed forms impenetrable stands; its sap can produce a blistering burn on contact with skin. In the summer it produces broad leaves and large flower heads that suppress all other riparian vegetation, leaving banks exposed and vulnerable to erosion by winter spates.

Animal species may have been introduced by a variety of means. American mink are present on many rivers and represent a major threat to waterfowl and Water voles ***Arvicola terrestris***. The non-native Bullhead fish and other species such as the Signal crayfish are already present in Scotland and have the potential to thrive in Tayside rivers. Rainbow trout are raised on fish farms in the catchment and escapees compete against the native Sea and Brown trout ***Salmo trutta*** for food and habitat.

Invasion by alien species may represent one of the most significant long-term threats to running waters because once established their elimination may prove impossible. In many cases the spread of alien species requires human intervention, for instance the selling of invasive plants through garden centres or the deliberate introduction of fish species. Lack of awareness is frequently a key issue. Any removal programme will require a co-ordinated approach between interested groups and organisations and the work starting upstream of all the areas suffering invasion.

Recreational Pressures

Increasing recreational pressures such as walking, angling, boating and watersports are likely to cause disturbance to species such as Otters ***Lutra lutra*** and breeding wildfowl. Areas particularly popular for recreational access such as shingle banks may have a high degree of disturbance. This could lead to disruption to nesting birds and damage to colonies of invertebrates which use these habitats. Vehicular access, in particular, can rapidly cause serious damage to fragile habitats. Pressures to open up areas to ease angling access may result in the removal of important riparian vegetation.

At Nature Reserves such as the RSPB's Loch of Kinnordy access is managed so that people can enjoy their time there whilst causing minimal disturbance to the fauna and flora. This is done in part by only opening some areas up with footpaths and by providing hides. The new Access Code, along with other Codes of Practice, will also help to raise awareness of these issues.

Urban Watercourses

Within an urban area the riparian zone is frequently replaced with either a built environment or landscaped open space "amenity" areas, both of which may be of limited biodiversity and conservation value. Culverts, bridges, weirs and hard engineering of channels, as well as poor water quality and low flows, can also threaten the continuity of these important wildlife corridors. However, if urban rivers, burns and the adjacent riparian zone are sensitively managed they can provide valuable habitats for many species and act as a recreational and educational resource for the community. A separate Urban Waters Habitat Action Plan will provide details of action that can be taken for rivers and burns in an urban environment.

Climate Change

A potential threat which may over-ride all the others is climate change. This may alter the character of rivers by a rise in temperature or changes in throughput of freshwater and could produce wide-ranging effects such as accelerated plant growth and colonisation by non-native species. More important is the likely amount of soil run-off in autumn/winter from arable fields in light of the forecasts for increased autumn rainfall and resultant sediment loads. Changes in flooding patterns may lead to pressures for increased flood defences and loss of seasonal inundation of riparian habitats.

MAIN THREATS TO KEY SPECIES

Otter	National factors have been identified in the UK Species Action Plan - - pollution of watercourses, especially by PCBs - insufficient prey associated with poor water quality Probably neither are significant in Tayside. Locally important factors in Tayside are - - impoverished bankside habitat features needed for breeding and resting - incidental mortality, primarily by road deaths and drowning in eel traps	
	UK importance of Tayside population:	**Moderate**
Water vole	- Loss and fragmentation of habitats. - Disturbance of riparian habitats. - Predation by mink. - Pollution of watercourses and poisoning by rodenticides.	
	UK importance of Tayside population:	**Moderate**
Pipistrelle Bat	- Reduction in insect prey abundance because of high intensity farming practices and inappropriate riparian management. - Reduction in insect-rich feeding habitats and flyways due to loss of wetlands, hedgerows and other suitable habitats. - Loss of winter roosting sites in buildings and trees. - Disturbance and destruction of roosts, including loss of maternity roosts by inappropriate use of toxic timber treatment chemicals.	
	UK importance of Tayside population:	**Moderate**
Allis/Twaite shad	- Pollution. - River and estuary barriers. - Overfishing. - Habitat destruction.	
	UK importance of Tayside population:	**Uncertain** - not known whether it breeds in Tayside rivers.

Rivers and Burns WW2

A water beetle *Hydroporus rufifrons*	- Loss of unimproved pasture. - Damage to waterside marginal pool complexes. - Inundation through impoundment for reservoirs. UK importance of Tayside population: **Uncertain**
A cranefly *Rhabdomastix hilaris*	- Removal of sandy sediment from rivers and riverbanks for aggregate. - Deepening and canalisation of watercourses. - Water abstraction from rivers resulting in changes in sedimentation. UK importance of Tayside population: **Uncertain**
A stiletto fly *Thereva lunulata*	- Removal of sandy sediment from rivers and riverbanks for aggregate. - Deepening and canalisation of watercourses. - Water abstraction from rivers resulting in changes in sedimentation. UK importance of Tayside population: **Uncertain**
A stonefly *Brachyptera putata*	- Acidification in headwaters and upland lochs. - Agricultural pollution from modern insecticides used in sheep and cattle farming. - Decline in water quality due to eutrophication from sewage and agricultural run-off. UK importance of Tayside population: **uncertain** - historic records for Rannoch area
Freshwater Pearl Mussel	- Poor water quality and nutrient enrichment (which also effects the numbers of host fish) - Habitat removal and alteration through development, drainage schemes, flow regulation and fisheries management. - A decline in populations of host fish. - Conifer planting, exacerbating the effects of river acidification. - Pearl fishing - now illegal. - Poor land management in the catchment (including overgrazing leading to sedimentation from soil erosion). UK importance of Tayside population: **High**
River jelly lichen	- Eutrophication of rivers leading to the species being replaced by algae. - Increased silt loads in rivers and streams. - Water acidification. - Reduced water levels caused by water abstraction (including small-scale hydro-electric schemes). UK importance of Tayside population: **High**
Ear-lobed dog lichen	**Known only from one location - factors not identified.**

OPPORTUNITIES AND CURRENT ACTION

Policy and Legal Status

Rivers and burns are offered better protection than many natural habitats by several pieces of legislation, both UK and European. Gross pollution is largely under control through discharge consents and codes of conduct and efforts are now turning towards the control of non-point sources such as road/housing development and agricultural run-off which have the potential to cause "diffuse pollution". In parallel with this there is a growing recognition of the importance of river habitats not only in supporting physical structures for wildlife, but as key components giving resilience to the system as a whole - enabling pollutants, for instance, to be processed and rendered harmless. These latter areas of activity are not covered by current legislation and a co-operative approach is therefore needed to achieve effective management.

Various statutory bodies have a role in the current actions to maintain and improve the status of rivers and burns in Tayside. These include the Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) Scottish Executive Environment and Rural Affairs Department (SEERAD), Tay, Esk and Forth District Salmon Fisheries Boards (TDSFB, EDSFB and FDSFB), Local Authority Planning Units, Scottish Water and the Forestry Commission (FC).

Some areas of rivers and burns in Tayside are designated under the various natural heritage conservation acts and all are controlled waters under the various pollution control acts.

Legislation and associated policy which can provide or encourage protection of rivers and burns in Scotland includes:

- Natural heritage conservation legislation including the designation of Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).
- UK Biodiversity Action Plan.
- Planning legislation and policies.
- Pollution control legislation.
- Agri-environment schemes such as the Rural Stewardship Scheme.

Some of the Acts which provide the framework for these functions are given below.

- Rivers (Prevention of Pollution)(Scotland) Act 1951
- Rivers (Prevention of Pollution)(Scotland) Act 1965
- Control of Pollution Act 1974
- Control of Pollution (Amendment) Act 1989
- Salmon and Freshwater Fisheries Act 1975
- EC Directive on the Conservation of Wild Birds (Directive 79/409/EEC)
- Wildlife and Countryside Act 1981
- Water Act 1989
- The Town and Country Planning (Scotland) Act 1997
- Environmental Protection Act 1990
- The Flood Prevention and Land Drainage Act 1997
- Natural Heritage (Scotland) Act 1991
- Wildlife and Countryside (Amendment) Act 1991
- EC Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (Directive 92/43/EEC)
- Conservation (Natural Habitats) Regulations 1994

Rivers and Burns WW2

- Environment Act 1995
- Scottish Office Circular 6/1995, Habitats and Birds Directives.
- Urban Wastewater Treatment Directive.

Management, Research and Guidance

At a national level most of the regulatory bodies, in addition to their core regulatory duties, are actively involved in management, research and guidance activities relating to rivers and burns. Many other organisations such as the Farming and Wildlife Advisory Group (FWAG), Scottish Agricultural College (SAC), Scottish Wildlife Trust (SWT), World Wide Fund for Nature (WWF), and Royal Society for the Protection of Birds (RSPB) not only conduct research and provide advice and guidance but some also manage rivers and burns for conservation purposes. Many landowners and estates manage the resources under their control to enhance biodiversity. Numerous individuals put in considerable amounts of time in voluntary work helping to manage or create important areas for conservation, recording wildlife or becoming acknowledged experts for various species.

In Tayside comparatively few rivers and burns are actively managed with the specific intention of enhancing biodiversity, although options under the Rural Stewardship Scheme and the promotion of good management practice by organisations such as SEPA, FWAG, SAC and WWF are leading to more sensitive management of rivers and their associated riparian zones. Rivers in Tayside are often managed for fisheries purposes and well directed fisheries management aimed at restoring degraded instream and riparian habitat can have considerable consequential biodiversity benefit. Inspiration for further management for conservation can be gained from the successful projects that already exist.

Current Action

- Environmental grants for farmers such as those available under the Rural Stewardship Scheme have encouraged and funded the modification of farming activities to help protect watercourses.
- SNH produce site management statements for SSSIs, undertake a 6 yearly programme of site condition monitoring and are undertaking to have most designated sites under positive management schemes in the forthcoming 10 years.
- Esk and Tay District Salmon Fishery Boards carry out scientific work and employ fishery managers to enhance the potential of the salmonid fishery.
- SEPA routinely assesses the ecological and water quality in all of Tayside's rivers.
- Some wildlife reserves include rivers e.g. Balnaguard Glen (SWT reserve) and Blackspout Wood (Perth and Kinross Council).
- The WWF Wild Rivers project demonstration sites show examples of how rivers can be managed to support biodiversity.
- FWAG and SAC have undertaken 20 Farming and Water Management Plans in Tayside.
- Perth and Kinross Council, in partnership with SEPA's Habitat Enhancement Initiative, developers and local volunteers have undertaken a restoration project on the Craigie Burn in Perth.
- Flood Appraisal Groups promote environmentally sensitive flood alleviation schemes.
- The River Restoration Centre provides advice to organisations and individuals about habitat restoration projects and practices.

WW2 Rivers and Burns

FURTHER OPPORTUNITIES

Together with other existing initiatives the implementation of the Local Biodiversity Action Plan, the designation of Special Areas of Conservation, implementation of options under the Rural Stewardship Schemes and the introduction of the Water Framework Directive will provide a stronger mechanism for the protection and enhancement of rivers and burns than has ever previously existed. New statutory objectives will exist for the ecological status of rivers and burns, putting responsibilities upon statutory bodies which have previously been outwith their remits. To achieve these objectives, partnership approaches will be required and there is, for the first time, the very real prospect of integrated management for Tayside's rivers and burns.

OBJECTIVES AND TARGETS

	Objectives	Targets
1	Conserve river and burn systems supporting semi-natural assemblages of animals and plants in both the channel and the riparian zone.	Establish and maintain an inventory of rivers and burns which provides information on environmental quality, biodiversity quality, impacts on biodiversity etc. By 2006. Ensure no net loss in area or reduction in quality of natural river habitats.
2	Maintain and improve water quality standards according to Scottish Environment Protection Agency River Classification System.	Improve or maintain the water quality classification of all rivers and burns in the region.
3	Identify and address, on a site by site basis, the factors having a detrimental effect on aquatic biodiversity, including the quality of the physical architecture, water quality and the impact of non-native species.	Prepare Catchment Management Plans for all main watercourses involving both statutory and non-statutory organisations. Seek to have these plans adopted by the appropriate Local Authority to inform planning decisions and provide a framework for integrated management. By 2011.
4	Increase public awareness of biodiversity, the wildlife value of river and burns and their importance as an asset to the community.	Set up public awareness programme. Establish communications with residents, groups, community councils, farming groups and local environment groups etc. to provide a forum for discussion and to understand their wishes for their local environment. By 2007.
5	Encourage good management practice by river users/interests.	Exchange views and disseminate best management practice guidelines to river and land managers.

Stakeholders

- Landowners, land managers, including the hydro-power industry, and advisors; developers; angling clubs; tourists and local users.

Rivers and Burns WW2

ACTION FOR BIODIVERSITY

		Action - Rivers and Burns	Deliverers		To take place by								Meets Objective No.
			Lead Partners	Partners	02	03	04	05	06	07	11	16	
LBAP Ref.	**A**	**Policy and legislation**											
WW2	1	Ensure that all statutory water quality and discharge standards are maintained and where necessary improved.	SEPA Scottish Water					#					2
WW2	2	Seek to develop and promote policies to control alien species and favour establishment of appropriate native species.	SEPA	SNH PKC DCC AC Angling Groups DSFBs, Land-owners				#					3
WW2	3	Develop policies to promote soft engineering of rivers as an alternative to harder options. Emphasise a presumption against further culverting and promote re-opening of culverted burns.	PKC DCC AC SEPA	SNH Scottish Water DSFBs	#				#				1
WW2	4	Develop policies to ensure an agreed consistent approach to in-river works, river channel and bank maintenance.	SEPA PKC DCC AC Scottish Water DSFBs	SNH					#				1
WW2	5	Ensure that adequate consultation takes place when developments are proposed in river catchments.	PKC DCC AC	SEPA SNH	#	#	#	#	#	#	#	#	3
WW2	6	Contribute to the development of policies within land use development plans to safeguard rivers and burns and associated wildlife in the region, with no net loss of this habitat promoted.	PKC DCC AC SEPA	SNH TBP	#	#	#	#	#	#	#	#	3
WW2	7	Develop and implement Catchment Management Plans as directed in the Water Framework Directive.	SEPA	PKC DCC AC Scottish & Southern Electricity, DSFBs							#		5
WW2	8	Complete SAC designation process in consultation with all interested parties.	SNH		#	#	#						
	B	**Site safeguard and management**											
WW2	1	Implement policy, through management work, for control of alien species.	Community Groups Angling Groups	SEPA SNH PKC DCC AC				#	#	#			3
WW2	2	Ensure that existing nature reserves and SSSIs which include rivers are managed appropriately.	RSPB SNH SWT	PKC DCC AC	#	#	#	#	#	#	#	#	1
WW2	3	Encourage fisheries interests to establish management schemes which enhance populations of important local fish species but not to the detriment of biodiversity. Ensure these management actions are included in catchment plans.	SEPA	SNH Angling Groups DSFBs, Fisheries Research Services Freshwater Lab		#	#	#	#	#	#	#	1
WW2	4	Maintain or introduce appropriate fishery management.	Angling Groups DSFBs	SEPA, PKC DCC, AC		#	#	#	#	#	#	#	1
WW2	5	Encourage appropriate management of rivers and their banks in existing developments in urban areas.	SEPA		#	#	#	#	#	#	#	#	1, 5

WW2	6	Promote adoption of SUDS (Sustainable Urban Drainage Systems) principles such as swales, infiltration basins, detention/retention ponds, wetlands, reedbeds in new developments.	PKC DCC AC Scottish Water		#	#	#	#	#	#	#	#	1
WW2	7	Encourage better management and protection of watercourses on farmland and forestry, such as buffer strips etc.	FWAG SAC	SEPA	#	#	#	#	#	#	#	#	3, 5
WW2	8	Encourage the full implementation of the Forestry Commission Water Guidelines i.e. buffer strips and the strategic planting of broadleaf trees along watercourses.	Forestry Commission			#	#	#	#	#	#	#	5
WW2	9	Where possible continue to minimise detrimental impacts of hydro-power schemes on riverine habitats and species; where appropriate provide fish ladders to allow migration of salmon; ensure sufficient flows remain downstream of dams and use freshets to mimic natural spates as directed by the Water Framework Directive.	Scottish & Southern Energy	SEPA DSFBs					#				
	C	**Advisory**											
WW2	1	Provide advice for managers and users of rivers and burns to promote the conservation of biodiversity of this habitat.	TBP		#	#	#	#	#	#	#	#	5
WW2	2	Promote best practice in farming, including use of Agric. CoPs and encourage the preparation and implementation of Farm Waste Management Plans.	FWAG SAC	SEPA	#	#	#	#	#	#	#	#	5
WW2	3	Develop guidelines for best practice in fishery management.	SEPA (HEI)			#							1,5
	D	**Research and monitoring**											
WW2	1	Review current water quality to identify causes of down grading, particularly where biodiversity priorities may be important.	SEPA				#						3
WW2	2	Continue to monitor the impact and extent of acidification in the region.	SEPA	SNH				#					3
WW2	3	Monitor impact of diffuse pollution such as phosphates, nitrates etc.	SEPA	SNH				#	#	#			3
WW2	4	Survey rivers and burns in the region and designate, where possible, important sites as 'Local Wildlife Sites' and incorporate them into the planning system.	SWT	PKC DCC AC							#		1, 3
WW2	5	Continue river habitat surveys.	SEPA	SWT		#	#	#	#	#			3
WW2	6	Continue Site Condition Monitoring for SACs and SSSIs.	SNH		#	#	#						
WW2	7	Review data on rivers as a precursor to the preparation of Catchment Management Plans and updating of existing CMPs as directed by WFD.	SWT SEPA DSFBs PKC DCC AC	SNH Local Biological Records Centre		#	#	#					1, 3, 5
WW2	8	Establish whether there are self-maintaining populations of Allis/Twaite shad in Tayside.	SNH	Fisheries Research Services Freshwater Lab							#		3
WW2	9	Encourage and support local community projects and involvement	TBP	SEPA SNH PKC DCC AC		#	#	#	#	#	#	#	4, 5
WW2	10	Monitor the delivery of the action plan yearly and in detail every five years, starting in 2003.	TBP			#	#	#	#	#	#	#	

Rivers and Burns WW2

	E	Promotion and awareness-raising				
WW2	1	Provide a regular progress report to raise awareness and report good practice management for biodiversity in river and burn habitats.	TBP		# # #	4
WW2	2	Liaise with and compile a list of private landowners and local interest groups who would be receptive to participation in discussions about local rivers and burns.	TBP	SNH SWT SEPA FWAG	#	4, 5
WW2	3	Compile an information resource of key legislative, policy, management, guidance and research documents to be available for public consultation at key locations e.g. libraries, museums, council offices.	TBP	SNH SWT SEPA	#	5
WW2	4	Consider action required to raise awareness of this habitat amongst key stakeholders and devise plans to implement.	SNH SWT TBP	PKC DCC AC RSPB SEPA	# #	5
WW2	5	Raise awareness amongst the anglers of the differences in angling law in Scotland, compared with those south of the border.	Angling Groups DSFBs		# # # # # # #	5
WW2	6	Undertake awareness raising training for Competent Authorities to help with planning issues.	SNH	DSFBs SEPA SEERAD	# # #	3, 5

Rivers and Burns

This illustrative map shows a few key examples of the habitat. Please note that many sites of interest are privately owned and owners' permission should be sought for any access.

Standing Open Water WW3

SIMON BROAD

LOCH ERICHT

DEFINITION

The standing open water habitat includes not only the open water but also to some extent the associated habitat around the water's edge. This definition obviously provides considerable scope for overlap with other Habitat Action Plans such as Wet Woodland, Wet Grassland and Freshwater Reedbeds. These habitats are considered more fully in their own Habitat Action Plans and it is important to recognise the transitions between them and refer, where necessary, to the appropriate HAPs.

Standing open waters include natural systems such as lochs, lochans and pools, as well as man-made waters such as reservoirs, ponds and gravel pits. The open water zone lies beyond the limits of swamp vegetation, but may contain submerged, free-floating or floating-leaved plants.

The range of standing open water types within this broad category means that only a general overview of some of the issues is possible within this Action Plan, but a separate Plan has been developed for the key habitat of Mesotrophic Lochs and future Plans will be developed for habitats such as Eutrophic Lochs, and Ponds, Pools and Lochans.

KEY SITES

The vast range and diversity of standing open water in Tayside means that there are many candidates for key sites. Mesotrophic lochs are a UK priority habitat and these are discussed in detail in the Mesotrophic Lochs Action Plan. Some sites which represent excellent examples of their kind or have particularly notable features are detailed below.

Loch Laidon	A dystrophic peaty loch.
Loch Tay	A large oligotrophic loch and the largest loch in Tayside without any form of impoundment.
Loch Brandy	A high altitude oligotrophic loch with notable moss and liverwort populations and rare insects.
Loch Con	A high altitude oligotrophic loch supporting a diverse bird fauna, including rarities and with islands which demonstrate the sort of vegetation which may be expected at this altitude in the absence of grazing pressure.
Dunalastair Reservoir	A completely artificial shallow loch of considerable conservation value, including its plants and bird populations and some notable rarities.
Dun's Dish	A eutrophic loch with extensive surrounding swamp vegetation and notable ornithological interest.

WW3 Standing Open Water

Loch Leven	Internationally important wintering and breeding wildfowl, diverse aquatic and riparian vegetation, invertebrate populations and an internationally famous trout fishery.
Carsebreck Lochs	Second only to Loch Leven in Tayside for their wintering wildfowl populations.

CURRENT STATUS AND EXTENT OF HABITAT

Scotland has a large number of standing waterbodies with an estimated 150,700 ponds, pools ands lochans up to 2 hectares and 4,500 lochs greater than 2ha. Standing waters in Tayside cover a total of 134.66km^2 and reflect much of the diversity found nationally. They range from large oligotrophic lochs such as Loch Tay (27.3km^2) and Loch Rannoch (18.96km^2) to smaller waterbodies such as Butterstone Loch (0.44km^2) and pools of a few metres across.

Water quality of Lochs in Scotland and Tayside

There are 150 lochs in Scotland with a surface area above 1 km^2 and 3,788 lochs over 0.04 km^2. Scottish Natural Heritage (SNH) has identified around 27,000 lochs large enough to feature on the Ordnance Survey 1:50,000 scale maps with a surface area greater than approximately 0.0001 km^2.

In 1995 SEPA's loch water quality classification scheme was applied to all 150 lochs over 1 km^2, together with 23 smaller lochs of particular local interest. The majority of lochs (143) were not significantly affected by human activity and were classified as 'excellent/good', but 27 were found to be significantly altered by human activity and classified as 'fair', whilst three were either 'poor' or 'seriously polluted'. Of those lochs classified as 'fair', twenty (53 km^2) were affected by eutrophication and ten (57 km^2) by acidification.

In Tayside, 20 lochs were classified: 15 (97.41km^2) were 'excellent/good', and 5 (30.87km^2) 'fair'. This was due to the effects of eutrophication on Loch Earn, Loch Leven, Loch of Lintrathen and Loch of the Lowes, and through acidification at Loch Laidon.

NATURE CONSERVATION IMPORTANCE

Standing waterbodies provide important and very rich habitats, particularly for aquatic invertebrates, wetland plants and amphibians. They are also used by a variety of mammals and birds. The importance of waterbodies and surrounding habitat in supporting rare species is underlined by several freshwater UK Biodiversity Action Plan (UK BAP) species. In Scotland these include: Great crested newt *Triturus cristatus*, Pillwort *Pillularia globulifera* and Slender naiad *Najas flexilis*. For other BAP species such as Water vole *Arvicola terrestris*, Otter *Lutra lutra*, Common scoter *Melanitta nigra*, Arctic charr *Salvelinus alpinus* and Brown trout *Salmo trutta* standing waterbodies may be a substantial component of the species' habitat. Within the broad range of standing water types naturally mesotrophic and eutrophic lochs are considered of key national importance for biodiversity.

Water vole

This species has suffered one the most catastrophic declines of any British mammal with a predicted loss of 98% of its entire population in recent years. In the past it was found from Lowland Perthshire and Angus to high altitude catchment areas such as Ben Lawers and Glen Lyon. Recent surveys on some of these sites have concluded that they are locally extinct throughout most of their former range.

Water voles will use most types of freshwater systems: lochs, ponds, slow-moving rivers, raised bogs, marshes and wetlands, lowland drainage ditches and headstreams up to 600m. They eat a variety of waterside vegetation such as rushes, sedges and grasses and in late autumn save food in underground chambers to eat during the winter months when frost and snow cover the ground for long periods.

ALLAN ROSS

Standing Open Water WW3

KEY SPECIES

P = UK Priority species **C** = UK species of conservation concern

Mammals	Otter	*Lutra lutra*	**P**
	Water vole	*Arvicola terrestris*	**P**
	Daubenton's bat	*Myotis daubentoni*	**C**
Birds	Common scoter	*Melanitta nigra*	**P**
	Osprey	*Pandion haliaetus*	**C**
	Black-necked grebe	*Podiceps nigricollis*	**C**
	Whooper swan	*Cygnus cygnus*	**C**
	Wigeon	*Anas penelope*	**C**
	Gadwall	*Anas strepera*	**C**
	Pink-footed goose	*Anser brachyrhynchos*	**C**
	Greylag goose	*Anser anser*	**C**
	Pochard	*Aythya ferina*	**C**
	Goosander	*Mergus merganser*	**C**
	Red-breasted merganser	*Mergus serrator*	**C**
	Black-throated diver	*Gavia arctica*	**C**
	Shoveler	*Anas clypeata*	**C**
Amphibians and Reptiles	Great crested newt	*Triturus cristatus*	**P**
Fish	Atlantic salmon	*Salmo salar*	**C**
	Brown trout	*Salmo trutta*	
	Arctic charr	*Salvelinus alpinus*	**C**
Invertebrates	Northern damselfly	*Coenagrion hastulatum*	**C**
	a diving beetle	*Hydroporus rufifrons*	**P**
Plants	Slender naiad	*Najas flexilis*	**P**
	Slender stonewort	*Nitella gracilis*	**P**
	Pillwort	*Pillularia globulifera*	**P**
	Hooker's liverwort	*Haplomitrium hookeri*	**C**

Standing open waters have an important visual and aesthetic value and can also have considerable amenity value. The amenity use of open waterbodies includes activities such as fishing, shooting, boating and other watersports.

NATIONAL BIODIVERSITY CONTEXT

There is a UK Broad Habitat statement for Standing Open Water. This gives the following conservation direction:

Maintain and improve the conservation interest of standing open waters, through the use of integrated management plans, and the sensitive management of adjacent land. Create new standing open waters, of maximum wildlife benefit, where possible.

WW3 Standing Open Water

In addition to the broad habitat statement for open standing waters, UK Habitat Action Plans exist for the key habitats of eutrophic and mesotrophic standing waters. A local Habitat Action Plan for Mesotrophic Lochs is included in this LBAP; a local Plan for Eutrophic Lochs will be developed at a later stage. Oligotrophic and Dystrophic Lochs and other types of standing open water do not yet have their own separate UK HAPs.

ECOLOGY AND MANAGEMENT

Standing waters are usually classified according to their nutrient status and this can change naturally over time. Three main types of standing waters are commonly recognised. These are oligotrophic (nutrient poor), mesotrophic (of intermediate nutrient status) and eutrophic (nutrient rich), although gradations between these types occur. Other types include dystrophic (highly acidic and occurring in peaty areas), marl lochs (rich in lime and containing low concentrations of phosphorus), brackish water (occurring in coastal areas), and temporary water bodies. The four main types of lochs occurring in Tayside are summarised below.

Type of Open water	Description	Local Examples
Dystrophic	Highly acidic in peaty areas. May contain restricted flora and fauna.	Lochs on Rannoch Moor
Oligotrophic	Nutrient poor. Usually clear water due to low plankton levels.	Loch Ericht, Loch Rannoch, Loch Tay
Mesotrophic	Intermediate nutrient status. Very high biodiversity. May contain outstanding plant communities. Frequently, but not exclusively, occurs at the boundaries of uplands and lowlands.	Loch of the Lowes, Loch Moraig, Black Loch of Cleish
Eutrophic	Nutrient rich. Support large plankton populations and may be prone to algal blooms. Rooted plant communities may largely be confined to shallow water due to poor light penetration. Typical of lowland areas.	Kinnordy Loch

Maintenance of nutrient status at or near natural levels is seen as a key issue in the management of standing waters and a number of lochs in Tayside have become degraded by excessive nutrient inputs. Loch Leven is a prime example, but most smaller lowland lochs and some of the larger oligotrophic lochs display signs of elevated nutrient status.

CURRENT FACTORS CAUSING LOSS OR DECLINE

There are many pressures upon the aquatic environment resulting from industry, including mining; agriculture; forestry; and other human activity, especially population pressure. These cause environmental impacts which in turn determine the quality of any particular part of the aquatic environment. The response of any given water body is unique, with some being relatively resistant to change whereas others are more sensitive. Factors that ultimately affect biodiversity may be of a physical, chemical or biological nature. Some of the factors that are significant to standing waters are detailed below. The factors may merge and the categories overlap.

Pressures affecting water quality

Pollution is a significant threat to standing open water biodiversity. In its 1999 State of the Environment Report SEPA listed the seven most important causes of polluted water in Scotland:

- Sewage effluent
- Agriculture - diffuse sources
- Acidification
- Urban drainage
- Mine drainage
- Agriculture - point sources
- Industrial effluent

Standing Open Water WW3

From the SEPA survey of the 150 lochs in excess of 1km^2 and the 23 smaller lochs the diffuse causes of pollution such as agriculture, acidification, and forestry affected over 80% of those classified as fair, poor or seriously polluted. Agriculture has, for example, contributed to the decline in the quality of Loch Leven. Acidification has affected Loch Laidon. Sewage effluent and freshwater fish farming were the most significant point source discharges. Forfar Loch has, for example, suffered pollution from sewage discharges, although recent remedial works have made significant improvements. Urban drainage, mine drainage and industrial effluent are not significant factors in Tayside for any of the larger lochs, but obviously have the potential to affect smaller waterbodies.

Probably the most significant threat to the water quality of standing waters in Tayside is the process of cultural eutrophication. This results from pollution caused by the release of nutrients from point or diffuse sources, for example sewage treatment works effluents, runoff from farmland and urban areas.

Eutrophication leads to increased algal growth but effects on other plant and animal life depends on the initial condition of the waterbody. In oligotrophic and mesotrophic waterbodies, eutrophication leads to loss of species dependent on low nutrient status, but in eutrophic waters increased enrichment can lead to complete elimination of submerged aquatic plants and consequent damage to a wide range of species through loss of habitat. Smaller lowland lochs such as Rescobie Loch tend to be most sensitive to eutrophication, but it may also affect larger waterbodies such as Loch Leven.

Pressures Affecting Water Quantity

Changes in hydrology, for example abstraction of surface or ground water, or drainage, can seriously affect the habitat and reduce biodiversity. Most of the major lochs in Tayside are impounded for drinking water or hydroelectric purposes. The impoundment may have created an entirely new loch such as Loch Errochty or altered the level of an existing loch such as Loch Ericht. It is, however, important to remember that impoundment has also created large numbers of smaller lochs and ponds many of which are of considerable conservation value. Dunalastair reservoir, Loch Moraig and Drumore Loch SSSIs are excellent examples. How the waterbody is subsequently managed following impoundment may be crucial to its biodiversity value. For instance, artificially fluctuating water levels due to drinking water or hydro-electric schemes such as those in Lochs Garry and Ericht can lead to the loss of relatively stable littoral zones - often the most diverse and productive zones of large, deep lochs. In other lochs such as Rannoch and Tummel more natural water levels are maintained, despite these being part of hydro-electric schemes.

Pressures Affecting the Physical Quality of the Habitat

Complete habitat loss is a major threat particularly to small open standing waters. The loss may be due to natural processes of siltation which may be more pronounced in shallow ponds. Waterbodies may also be lost to in-filling for industrial and urban development, neglect or deliberate draining.

Pressures from agriculture can lead to bank trampling and erosion and the loss of riparian zones because of cultivation right up to the water's edge. Similarly, urbanisation and road development can have similar effects.

Biological Pressures

Non-native plant species such as Canadian pondweed, Japanese knotweed and Giant hogweed are already firmly established in Tayside, but other less well-known invasive plants such as the Australian swamp stonecrop, Water pennywort and Water fern have the potential to cause serious habitat loss and damage to native species.

Many fish species present elsewhere in the UK such as the Ruffe would thrive in Tayside lochs to the detriment of the indigenous wildlife. For example, lochans on Rannoch Moor have been stocked with a variety of coarse fish and roach have become established in Loch Tay. Even fish already common in Tayside, such as pike and perch, can be spread inappropriately to lochs with subsequent harmful effects. Stocking with trout for fishing can alter the ecology of a loch or pond with possible detrimental affects.

Zebra mussels are an invertebrate species already firmly established in some Irish loughs with the potential to dominate loch faunas. American mink are well established in Tayside and represent a serious threat to many bird species and to Water voles. Canada geese can be very aggressive towards other waterfowl, threatening their breeding success. Their recent arrival on some lochs favoured by Black-throated divers may represent a threat to the latter. Artificially high numbers of Mallard released for shooting can cause serious degradation of standing waters because of the increased nutrient loading.

WW3 Standing Open Water

Invasion by alien species may represent one of the most significant long-term threats to standing waters because once established their elimination may prove impossible. In many cases the spread of alien species requires human intervention, for example the selling of invasive plants through garden centres or deliberate introduction of fish species. Lack of awareness is therefore a key issue.

Recreational Pressures

Increasing recreational pressures such as walking and dog walking, angling, boating and watersports, are likely to cause erosion to the banks of popularly visited lochs and ponds, as well as disturbance to particular species such as breeding wildfowl. Vehicular access to the water's edge may cause damage. Ponds used for fishing and shooting may not support high biodiversity if insensitively managed, but this need not necessarily be the case.

RSPB

Otter

Regular surveys have shown that otters are making a comeback to areas where they were in decline previously. Glimpses of these charismatic animals are becoming a fairly common occurence in some Tayside areas.

Climate Change

A potential threat, which may over-ride all others, is climate change. This may alter the character of water bodies by a rise in temperature or changes in throughput of fresh water. This could produce wide-ranging effects such as accelerated plant growth and colonisation by non-native species.

MAIN THREATS TO KEY SPECIES

Otter	Nationally significant factors: - Pollution of watercourses, especially by PCBs. - Insufficient prey associated with poor water quality. Factors that may be locally important in Tayside: - Impoverished bankside habitat features needed for breeding and resting. - Incidental mortality, primarily by road deaths and drowning in eel traps.	
	UK importance of Tayside population:	**Moderate**
Water vole	- Loss and fragmentation of habitats. - Disturbance of riparian habitats. - Predation by mink. - Pollution of watercourses and poisoning by rodenticides.	
	UK importance of Tayside population:	**Moderate**
Common scoter	- Eutrophication may affect food availability. - Fish stocking may have lead to increased competition for invertebrate food in some sites. - Predation by mink and foxes. - Afforestation and secondary effects such as sedimentation. - Illegal egg collecting.	
	UK importance of Tayside population:	**High**
Great crested newt	- Loss of suitable breeding ponds. - Loss and fragmentation of terrestrial habitat. - Pollution and toxic effects of agrochemicals.	
	UK importance of Tayside population:	**Moderate**

Standing Open Water WW3

Grass wrack pondweed	- Eutrophication - Neglect and drying out of ditches. - Increased recreational use of watercourses, including boat use and associated disturbance and pollution.
	UK importance of Tayside population: **Probably extinct in Tayside**
Slender naiad	- Restrictions on light penetration owing to heavy weed and algal growth and nutrient enrichment from point sources such as sewage works, fish farms and diffuse agricultural sources.
	UK importance of Tayside population: **High**
Slender stonewort	Reasons for decline uncertain but the following are thought to be contributory factors: - Pollution from agricultural run off - Acidification associated with afforestation in some catchments. - Encroachment of scrub and other vegetation at some sites.
	UK importance of Tayside population: **High**
Pillwort	- Nitrate/phosphate pollution and the associated increase in the growth of competitive species. - Abandonment of its main habitats, especially changes in grazing which lead to less disturbance. - Modification of water level regimes - Introduction of non-native competitive plants.
	UK importance of Tayside population: **High**

OPPORTUNITIES AND CURRENT ACTION

Policy and Legal Status

Various statutory bodies have a role in the current actions to maintain and improve the status of standing open waters in Tayside. These include the Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) Scottish Executive Environment Rural Affairs Department (SEERAD), Tay, Esk and Forth District Salmon Fisheries Boards (TDSFB, EDSFB, and FDSFB), Local Authority Planning Units, Scottish Water and the Forestry Commission (FC).

Many standing open waters in Tayside are designated under the various natural heritage conservation acts and the vast majority are controlled waters under the various pollution control acts.

Legislation and associated policy which can provide or encourage protection of waterbodies in Scotland includes:

- Natural heritage conservation legislation including the designation of Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).
- UK Biodiversity Action Plan.
- Planning legislation and policies.
- Pollution control legislation.
- Agri-environment schemes such as the Rural Stewardship Scheme.

Some of the acts that provide the framework for these functions are given below.

- Control of Pollution Act 1974
- Salmon and Freshwater Fisheries Act 1975
- EC Directive on the Conservation of Wild Birds (Directive 79/409/EEC)

- Wildlife and Countryside Act 1981
- Water Act 1989
- Environmental Protection Act 1990
- The Town and Country Planning (Scotland) Act 1997
- Natural Heritage (Scotland) Act 1991
- Wildlife and Countryside (Amendment) Act 1991
- EC Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (Directive 92/43/EEC)
- Conservation (Natural Habitats) Regulations 1994
- Environment Act 1995
- Scottish Office Circular 6/1995, Habitats and Birds Directives
- Urban Wastewater Treatment Directive
- The Flood Prevention and Land Drainage Act 1997

Case Study

Loch of the Lowes

The Loch of the Lowes is a wildlife reserve famous for its breeding ospreys and owned by the Scottish Wildlife Trust (SWT). The visitor centre and viewing hide have attracted over 1 million visitors since their opening in 1970, making a substantial contribution to tourism in Tayside. Local residents have always taken a keen interest in the loch and over 60 of them volunteer every year in the visitor centre and during the 'around the clock' osprey egg watch.

LORNE GILL/SNH

The SWT originally purchased the loch in 1969 because of its importance as the largest mesotrophic water body in the Perth and Kinross Council area and its associated highly diverse submerged aquatic flora. Eleven species of Pondweed *Potamogeton,* both Yellow and White water lilies *Nuphar lutea* & *Nymphaea alba* and the Red Data Book plant Slender naiad *Najas flexis* have been recorded. The loch's special status is reflected by a multitude of designations including SSSI, NCR, ESA and NSA. Most recently it has been included as a candidate SAC covering a chain of lochs linked by the Lunan Burn.

The mesotrophic state of the loch remains the prime management objective for Loch of the Lowes and the whole Lunan Loch chain. In the near future SWT hopes to work closely with SNH, SEPA and other partners towards a positive management of the catchment areas for the lochs. In particular, there are plans to develop the visitor centre to take on a wider educational role in support of the Lunan Loch cSAC, making the link between ospreys, the water of the lochs and positive water management.

Standing Open Water WW3

Management, Research and Guidance

Most of the regulatory bodies, in addition to their core regulatory duties, are actively involved in management, research and guidance activities relating to standing open waters. Many other organisations, such as the Farming and Wildlife Advisory Group (FWAG), Scottish Agricultural College (SAC), Scottish Wildlife Trust (SWT), WWF in Scotland, and the Royal Society for the Protection of Birds (RSPB) not only conduct research and provide advice and guidance, but also manage significant numbers of standing waters for conservation purposes.

Many landowners and estates manage the resources under their control to enhance biodiversity.

Numerous individuals put in considerable amounts of time in voluntary work helping to manage or create important areas for conservation, recording wildlife or becoming acknowledged experts for various species.

Current Action

Typical examples of actions currently undertaken by various organisations include:

- Some open water sites are managed for nature conservation by SWT, e.g. Loch of the Lowes.
- A catchment management plan exists for Loch Leven and involves a partnership of organisations. It contains some very valuable lessons and gives a local example to promote the value of good practice.
- Environmental grants for farmers, such as those available under the Rural Stewardship Scheme, have encouraged and funded the modification of farming activities to help protect watercourses.
- SNH produce site management statements for SSSIs.
- SEPA monitors the water quality of all lochs with a surface area in excess of 1km2 and a number of smaller lochs.
- North of Scotland Water Authority has completed an audit of existing information sources on land use and biodiversity for the Loch of Lintrathen and Backwater Reservoir, Angus.

Opportunities

In the UK Standing Open Water HAP measures to consider further include:

- Prepare water level management plans for the benefit of wildlife (particularly for key sites).
- Development and implementation of integrated catchment management plans.
- Use existing measures such as the Rural Stewardship Scheme Wetlands and Water Margins option to support the appropriate management of open waters and their habitats.
- Reduce acid emissions to reduce damage to open waters from acid rain.
- Carry out Environmental Assessments of developments that will have a significant impact on open waters and their associated habitats.

Together with other existing initiatives, the implementation of the Local Biodiversity Action Plan, the designation of Special Areas of Conservation, implementation of options under the Rural Stewardship Schemes and the introduction of the Water Framework Directive will all provide a stronger mechanism for the protection and enhancement of the biodiversity of standing open waters than has ever previously existed. New statutory objectives will exist for the ecological status of standing open waters putting responsibilities upon statutory bodies which have previously been outwith their remits. To achieve these objectives partnership approaches will be required and there is, for the first time, the very real prospect of integrated management for Tayside's standing waters.

WW3 Standing Open Water

OBJECTIVES AND TARGETS

	Objectives	Targets
1	Maintain and protect standing open water habitats supporting semi-natural assemblages of animals and plants in both the 'open water' and surrounding habitat.	Establish and maintain an inventory of standing open waterbodies which provides information on environmental quality, biodiversity quality, impacts on biodiversity etc. By 2006. Ensure no net loss in area or reduction in quality of natural standing open water habitats.
2	Maintain and improve water quality standards according to Scottish Environment Protection Agency Classification System and implement sustainable urban drainage systems in new and re-developments to protect natural and semi-natural standing open water habitats.	Improve or maintain the water quality classification of all standing open water in the region.
3	Identify and improve, on a site-by-site basis, the factors impairing appropriate biodiversity, including the quality of the habitat, water quality, and the impact of non-native species.	Prepare Catchment Management Plans involving both statutory and non-statutory organisations. Seek to have these plans adopted by the Local Authority to inform planning decisions and provide a framework for integrated management. By 2011.
4	Increase public awareness of biodiversity, the wildlife value of standing open water habitats and their importance as an asset to the community.	Set up public awareness programme. Establish communications with residents groups, community councils, local environment groups, etc., to provide a forum for discussion and to understand their wishes for their local environment. By 2007.

Stakeholders

- Landowners, land managers and advisors, developers, angling clubs, tourists and local users.

ACTION FOR BIODIVERSITY

		Action - Standing Open Water	Deliverers		To take place by	Meets Objective No.
			Lead Partners	Partners	02 03 04 05 06 07 11 16	
LBAP Ref.	**A**	**Policy and legislation**				
WW3	1	Ensure that all statutory water quality and discharge standards are maintained and where necessary improved.	SEPA Scottish Water		# # # # # # # #	2
WW3	2	Ensure that all standing open waters meet EU Directives in terms of designations for wildlife, importance and/or quality.	SEPA SNH	PKC DCC AC	#	2
WW3	3	Establish site-specific plans to achieve appropriate water quality, water resource use, fishery management for all important waterbodies, for example waterbodies which are under threat, vulnerable, have potential for nature conservation and/or restoration.	Angling Groups	SNH SEPA PKC DCC AC Landowners, DSFB	#	1, 2, 3

Standing Open Water WW3

WW3	4	Ensure that 'Total Phosphorus Water Quality for Scottish Freshwater Lochs' policy is followed when setting consent standards for discharges to lochs.	SEPA		#	#	#	#	#	#	#	#	1, 2
WW3	5	Following a survey of standing open waters designate important sites as 'Local Wildlife Sites' as appropriate and incorporate them into the planning system.	SWT	SEPA PKC DCC AC						#			1, 3
WW3	6	Seek to develop policies to control alien species and favour establishment of appropriate native species.	SEPA Angling Groups	SNH PKC DCC AC Landowners				#					1, 3
WW3	7	Contribute to the development of policies within land use development plans to safeguard standing open waters habitats and associated wildlife in the region, with no net loss of this habitat promoted.	PKC DCC AC SEPA	SNH Scottish Water TBP	#	#	#	#	#	#	#	#	1, 3
WW3	8	Ensure that adequate consultation takes place when developments are proposed in loch catchments.	PKC DCC AC	SEPA SNH	#	#	#	#	#	#	#	#	1
	B	**Site safeguard and management**											
WW3	1	Ensure that existing nature reserves and SSSIs which include standing open waters are managed appropriately.	SNH SWT RSPB	PKC DCC AC	#	#	#	#	#	#	#	#	1
WW3	2	Encourage appropriate management of standing open waters and their banks in existing developments in urban areas.	SEPA		#	#	#	#	#	#	#	#	3
WW3	3	In new developments, promote adoption of SUDS (Sustainable Urban Drainage Systems) principles such as swales, infiltration basins, detention/ retention ponds, wetlands and reedbeds.	SEPA PKC DCC AC Scottish Water		#	#	#	#	#	#	#	#	2, 3
WW3	4	Encourage better management and protection of standing open water on farmland and forestry, such as buffer strips etc.	FWAG SAC	SEPA Forestry Commission	#	#	#	#	#	#	#	#	3
WW3	5	Encourage the full implementation of the Forestry Commission Water Guidelines i.e. buffer strips and the strategic planting of broadleaves.	Forestry Commission							#			1
	C	**Advisory**											
WW3	1	Provide advice for managers and users of standing open waters to promote the conservation of biodiversity of this habitat.	TBP		#	#	#	#	#	#	#	#	1, 2, 3
WW3	2	Promote best practice in farming and encourage preparation and implementation of Farm Waste Management Plans.	FWAG SAC	SEPA	#	#	#	#	#	#			1, 2, 3, 4
WW3	3	Develop guidelines for best practice in fishery management.	SEPA (HEI)			#							1, 3
	D	**Research and monitoring**											
WW3	1	Continue Site Condition Monitoring for SACs and SSSIs.	SNH										
WW3	2	Review current water quality to identify causes of downgrading, particularly where biodiversity priorities may be important.	SEPA				#						3
WW3	3	Continue to monitor the impact and extent of acidification in the area.	SEPA						#				3
WW3	4	Monitor impact of diffuse pollution, such as phosphates, nitrates etc.	SEPA		#	#	#	#	#	#	#	#	3
WW3	5	Survey waterbodies in the region and designate, where possible, important sites as 'Local Wildlife Sites' and incorporate them into the planning system.	SWT	SNH PKC DCC AC								#	3, 1

WW3	6	Establish a targeted programme of standing open water surveys, most specifically focussed on the nutrient enrichment of Dunkeld-Blairgowrie Lochs cSAC.	SNH SWT	SEPA	# # #	3
WW3	7	Review data on standing open waters as a precursor to the preparation of Catchment Management Plans and updating of existing CMPs as required by the Water Framework Directive.	SWT SEPA DSFBs	SNH Local Biological Records Centre	#	3, 1
WW3	8	Monitor the delivery of the action plan yearly and in detail every 5 years, starting in 2003.	TBP		# # # # # # #	
	E	**Promotion and awareness-raising**				
WW3	1	Provide a regular progress report to raise awareness and report good practice management for biodiversity in standing open water habitats.	TBP		# # #	4
WW3	2	Liaise with and compile a list of private landowners and local interest groups who would be receptive to participation in discussions about standing open waters.	TBP	SNH SWT SEPA FWAG	#	4
WW3	3	Compile an information resource of legislative, policy, management, guidance and research documents to be available for public consultation at key locations e.g. libraries, museums and council offices.	TBP	SNH SWT SEPA	#	4

Standing Open Water

This illustrative map shows a few key examples of the habitat. Please note that many sites of interest are privately owned and owners' permission should be sought for any access.