



Scotland's National Nature Reserves

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The Story of Loch Leven National Nature Reserve

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Foreword

Loch Leven is one of 55 National Nature Reserves (NNR's) we have in Scotland. These are special places where some of the best of Scotland's wildlife is managed. Protecting the richness and diversity of NNRs is a priority but people are welcome to enjoy, explore and discover more about our rich natural heritage.

Situated midway between Edinburgh and Perth, Loch Leven NNR, lies at the heart of the old county of Kinross. This large, shallow freshwater loch is home to the largest concentration of breeding ducks in inland Europe. And from late summer right through until spring, tens of thousands of other wildfowl from many different countries also use it for short and long-term stopovers. Their presence gives Loch Leven year round interest and global importance.

The Reserve Story is one of a suite of documents used to manage the NNR. The Story describes the rich natural heritage of Loch Leven, introduces us to its long history and culture, and describes the land use and management before and since the NNR was declared.

A further document, The Reserve Proposals, outlines how we intend to manage the NNR in future years and we invite feedback on the Proposals. Your comments will help to inform the future management of the Reserve.

All of the documents are available on the Loch Leven page of the NNR website or can be obtained from the address below.

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Maps of Loch Leven NNR

Location Maps



Boundary of Loch Leven NNR¹



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1 Introduction to Loch Leven NNR

“Lough Leven is four mile square and sixteen miles about. So far the land is good, but here and there many high rocks and hills: in this lough is fish every day gotten for store, none in Britain like, and consider the bigness of it as also for fowl. There is a river they call the Leven running out of it eight miles to the sea, and in it is salmons... there be great store of all kinds of wildfowl, of wild geese there being continually seen 3,000 or 4,000, and swans many.”

Sir Chistopher Lowther, 1629.

Lying midway between Edinburgh and Perth, beneath the shadow of the Lomond Hills, Loch Leven is Scotland’s largest lowland loch and one of the most important sites for waterfowl in Britain. It is a unique environment that attracts, not only the largest concentration of breeding ducks found anywhere in the UK, but many thousands of migratory ducks, geese and swans every autumn and winter.

Britain has a mild climate compared to that of mainland Europe. The winters, moderated by the warming effects of the Gulf Stream, are less harsh than other areas of the same latitude. This makes Britain a favourable place for birds that breed in sub-arctic latitudes to winter, or stop over on migration. Because of this Britain holds important numbers of wildfowl and waders compared to mainland Europe. Loch Leven is less susceptible to freezing than lochs in Highland areas and is one of the first large, freshwater bodies, encountered by birds migrating from the north.



Loch Leven at harvest time

The NNR covers 1824ha, including 1300ha of loch and islands, a narrow strip of shoreline, wetlands and woodlands. It includes Vane Farm – managed by the Royal Society for Protection of Birds (RSPB).

The loch is an attractive centrepiece to Kinross-shire. Set in a mainly arable farming landscape against an impressive backdrop of Bishop Hill to the East and the prominent ridge of Benarty Hill to the South.

The catchment for the loch is the broad glacial valley extending westwards to the slopes of the Ochil and Cleish Hills. Two-thirds of the catchment is fertile farmland growing a variety of crops such as cereals, turf, broccoli and strawberries, as well as providing pasture for dairy and beef cattle.

Access to the Reserve

The NNR is within easy travelling distance of Scotland's central belt. The M90 runs close to its western shore and minor roads ring the Loch. The communities of Kinross, Milnathort, Wester and Easter Balgedie, Scotlandwell, Kinnesswood and Gairney Bank form a ring around the site.

The best place to enter the NNR is at Vane Farm where the RSPB have a visitor centre and café, marked trails and several large viewing hides. Access can also be gained at Kirkgate Park; the car park at Findatie (giving access to a short walk along the shore); and the car park at Burleigh Sands (connecting to paths through to Milnathort and Kinross and with a short path suitable for all abilities to the loch shore). A café at the Pier in Kinross caters for anglers and those waiting for the ferry over to Castle Island.



Local communities and access points

Management

Loch Leven NNR was first declared in 1964 by agreement with the owners of the loch, Kinross Estate. The Montgomery family has owned Kinross Estate, which includes Loch Leven, since 1770. In 2002 the NNR was re-declared and extended to include RSPB's Vane Farm Reserve.

In tandem with the NNR and under the terms of the agreement the Estate retains the traditional sporting uses of fly-fishing and wildfowling. Loch Leven is world famous for its trout fishing, and angling has been the economic mainstay of the loch for many years.

The day-to-day management of the loch is shared between SNH who manage most of the Nature Reserve, Kinross Estate who manage the fishing and shooting, Perth and Kinross Council who manage Kirkgate Park, and Historic Scotland who manage Castle Island and run the ferry. RSPB manage the Vane Farm section of the NNR and the River Leven Trustees are responsible for managing the loch's water levels.

Designations

In recognition of its international wildlife importance Loch Leven has a number of conservation designations. Because of the internationally important bird populations, the loch is part of the European Natura 2000 network classified as a Special Protection Area (SPA) and is also designated as a Ramsar site for its wetlands and bird interest. Under Scottish legislation it is notified as a Site of Special Scientific Interest (SSSI) for birds, plants, and insects. Table 1 summarises the features for which Loch Leven has been designated. See the appendices for further information on these designations.

In addition to the wildlife designations, the local planning authority has designated approximately two thirds of the shore as an Area of Great Landscape Value. Scheduled Monuments within the NNR include Lochleven Castle and St Serf's Priory. The Kinross House Designed Landscape includes Kirkgate Park and Kirkgate Point, both within the boundaries of the NNR.

Table 1 Designations and qualifying features for Loch Leven NNR

Feature description	Common name	Scientific name	Natura 2000 (SPA)	Ramsar	SSSI
Birds					
Supports over 20,000 wintering waterfowl			✓	✓	
Internationally important numbers of:					
	pink-footed goose	<i>Anser brachyrhynchus</i>	✓	✓	✓
Supports nationally important wintering populations of several other species of wildfowl:					
	shoveler	<i>Anas clypeata</i>	✓	✓	✓
	whooper swan	<i>Cygnus cygnus</i>	✓		✓
	cormorant	<i>Phalacrocorax carbo</i>	✓		✓
	gadwall	<i>Anas strepera</i>	✓		✓
	teal	<i>Anas crecca</i>	✓		✓
	pochard	<i>Aythya ferina</i>	✓		✓
	tufted duck	<i>Aythya fuligula</i>	✓		✓
	goldeneye	<i>Bucephala clangula</i>	✓		✓
	greylag goose	<i>Anser anser</i>			✓
Breeding bird assemblage					✓
Fen, marsh and swamp					
Wet unimproved pasture flanking the loch					✓
Invertebrates					
Rare beetles					✓
Rare flies					✓
Standing open water and canals					
Aquatic species representative of a eutrophic water body				✓	✓
Vascular plants					
Vascular plant assemblage, including the following species:					✓
	coral-root orchid	<i>Corallorhiza trifida</i>			
	Loch Leven spearwort	<i>Ranunculus flammula</i> <i>x reptans</i>			
	lesser water-plantain	<i>Baldellia ranunculoides</i>			
	holy grass	<i>Hierochloe odorata</i>			
	threadrush	<i>Juncus filiformis</i>			
	mudwort	<i>Limosella aquatica</i>			

2 The Natural Heritage of Loch Leven NNR

Loch Leven is one of Scotland's top natural assets; it is the largest naturally eutrophic (nutrient rich) loch in the UK. Due to its position, size, nutrient rich shallow waters, and comparatively undisturbed nature, Loch Leven has an ecosystem ideal for a wealth of plants, insects, and fish. These in turn support a wide variety of birds at different seasons, making the site important throughout the year.

Geomorphology

Loch Leven is one of a series of lochs of glacial origin between the Firth of Forth and the Highland Boundary Fault, lying in drift (glacial and river deposits). Glaciers stretching east from the Ochil Hills formed Loch Leven by eroding and hollowing out the underlying bedrock and leaving a shallow depression. At the end of the last ice age as the glaciers retreated, the whole area was washed with deposits of sand and gravel. The River Leven cut through these sediments damming the loch to the east and flooding the area.

The loch is mostly shallow with an average depth of only 4m. To the north and east there is an extensive shallow shelf but in the middle are two 'deeps', the North and South Deeps, 23.2m and 25.5m deep respectively. These are kettle holes formed during the retreat of glaciers.



Loch Leven from Benarty Hill

The shallow parts of the loch have a predominantly sandy bottom with a few stony stretches of shoreline. Clay and silty mud, however, are present in the deeps. There are several islands on the loch, the largest being St Serf's in the southeast. The second largest is Castle Island, lying a short distance east of Kinross, with a cluster of smaller islands around it.

The catchment for the loch is the broad glacial valley extending westwards for 145km² to the slopes of the Ochil and Cleish Hills. Four major burns drain the catchment: the North and South Queich, the Gairney Water and the Pow Burn. Along with several smaller streams these burns supply the loch. The outflow is the River Leven in the southeast corner, which flows into the Firth of Forth at Leven some 24km downstream, and is artificially managed through sluices.

Species

Loch Leven is internationally important for its bird life with around 35,000 waterfowl present in the winter months. Its location in the lowlands, its nutrient rich waters supporting abundant food sources, its safe island nesting sites and its large water surface (more than 13km²) are all factors that contribute to its attractiveness to birds. As a result the loch is used by a wide variety of water birds for feeding, breeding, moulting and roosting. The species and numbers of birds using the loch have changed over time as national populations and surrounding land use has changed.

The Reserve is subject to many bird spectacles: winter morning and evening flights of geese going to and from their roosts, the aerobatic displays of sand martins and swifts feeding over the water in the late summer, the fishing exploits of kingfishers and ospreys and rare migrants dropping in such as spoonbill and little egret.

Wintering birds

Loch Leven is a very important stopover for waterfowl migrating between their breeding and wintering grounds, offering relatively disturbance-free stretches of shallow water, a shoreline with abundant food, and flocks of other birds providing safety in numbers. Waterfowl use the loch to rest and refuel whilst migrating over longer distances, with peak bird numbers occurring during late autumn and early spring. Birds migrate to Loch Leven from Iceland, Greenland, Ireland, northern and central Europe, and Siberia. More than 35,000 waterfowl use Loch Leven including goldeneye, tufted duck, pochard, teal, gadwall, cormorant, and shoveler. As Loch Leven remains mostly ice-free in winter and has an abundance of feeding niches, many ducks of different species choose to stay over the winter at Loch Leven in nationally important numbers.



Geese in flight

The vast majority of the world's population of pink-footed geese breed in Iceland and Greenland and almost all of these winter in Britain, with sites such as Loch Leven providing important autumn and wintering staging posts. At times Loch Leven can support up to 20,000 pink-footed geese, nearly 10% of the world's population.

Although many geese may move south from the loch during the winter months, several thousands remain to graze on the grassland within the Reserve or on the neighbouring barley stubbles and harvested potato fields. The geese tend to roost at traditional spots around the shoreline of the loch.

Europe's wintering whooper swans breed in the sub-arctic region with the majority of the Icelandic population choosing Britain as their over-wintering destination. During the winter Loch Leven holds over 100 of these Icelandic birds, more than 1.5% of the British wintering population.

Loch Leven is one of five sites in Scotland of European wildlife importance for wintering cormorants and is the only inland site. It is likely that Loch Leven is a traditional long-established site for cormorants as suggested by the naming of one of the small islands as Scart Island, the old Viking name for cormorants.

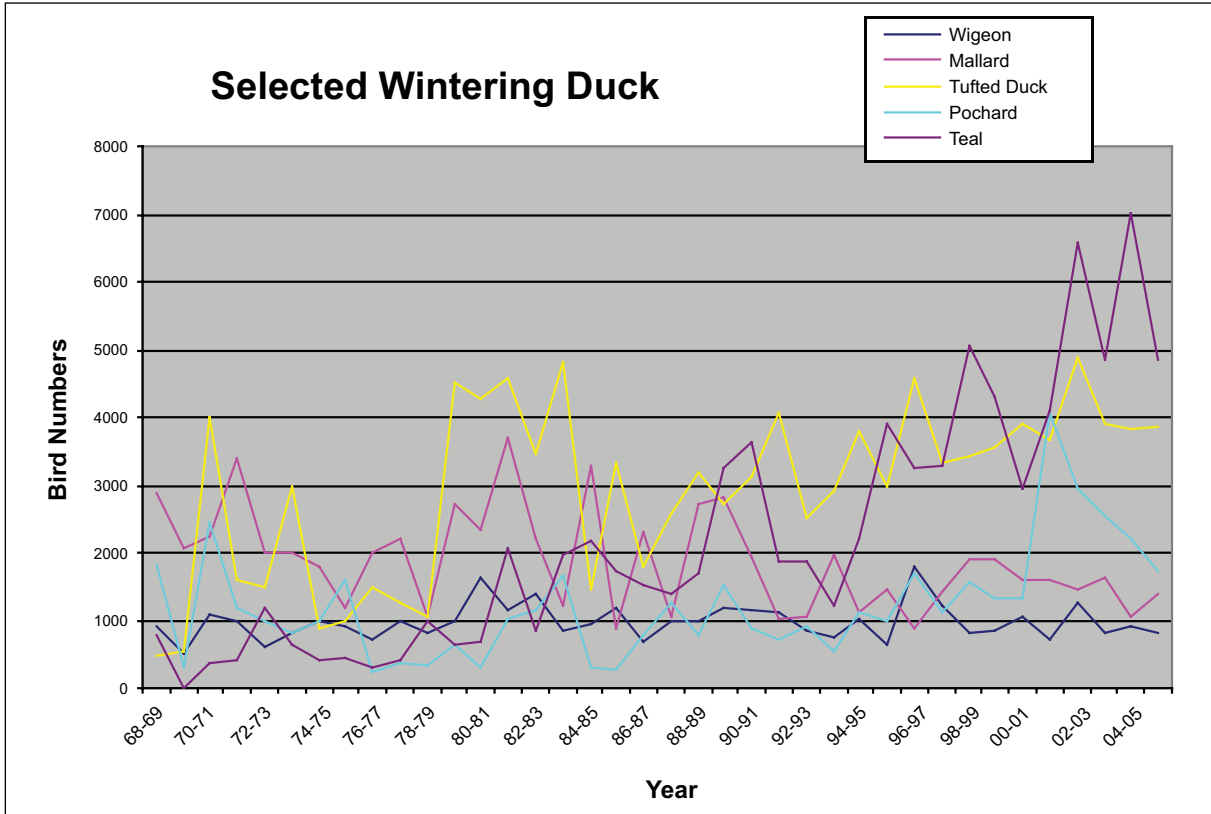
In the winter large flocks of curlew, lapwing, finches and common gulls can be seen feeding and sheltering around the loch.

Monthly wildfowl counts have been undertaken during the autumn/winter/spring since the inception of the NNR. Since the summer of 2003 the counts have been conducted every two weeks and have been done on a sectoral basis across the loch since November 2003. Results comparing Wetland Bird Survey (WeBS) count data for two periods 1980/81 – 1984/5 data with the period 1997/98 – 2001/02 show the following:

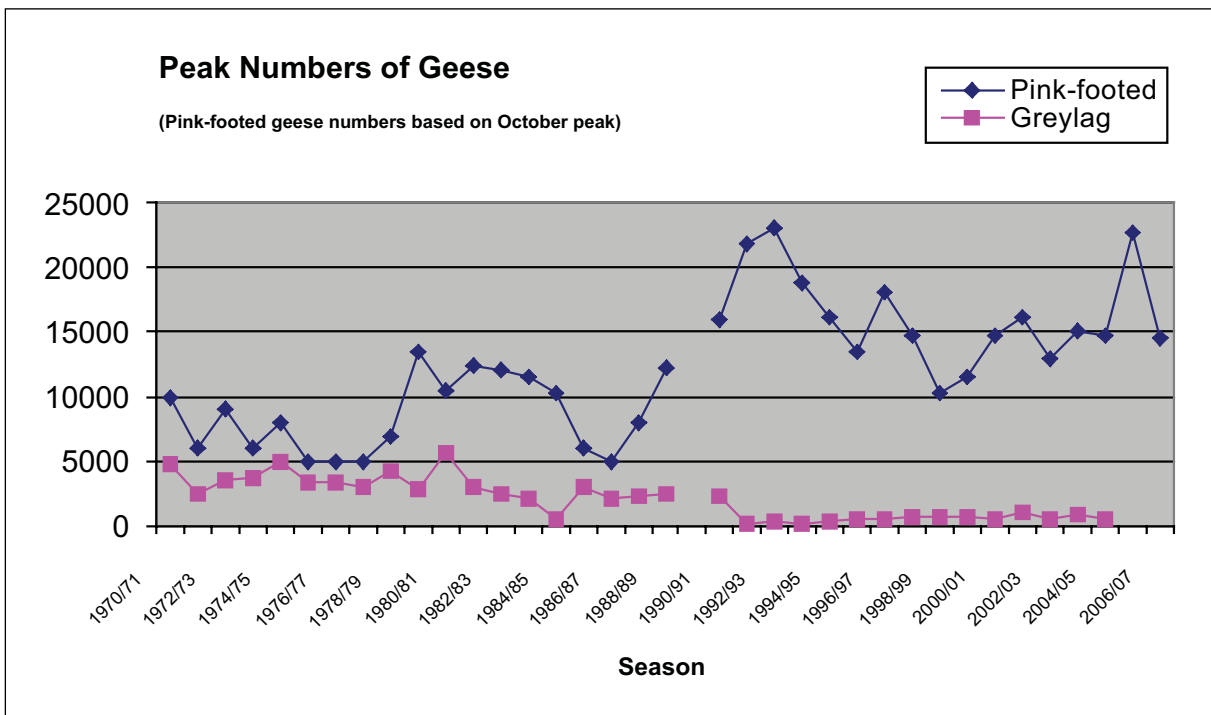
- for all species, numbers of birds on passage or over-wintering are either increasing or are remaining stable. Total numbers of wintering waterfowl have increased over the last 20 years. Counts from 1985/86 – 1989/90 give an average of 6,300 waterfowl on the loch whilst more recent counts have reached 10,000. Species that have increased in numbers include tufted duck, gadwall, teal and pochard, whilst goldeneye and shoveler numbers have remained stable.



Greylag geese



- Peak wintering pink-footed goose numbers have increased from approximately 11,000 to 13,500 birds.
- Greylag geese have declined in the same period from 2,590 to 726, reflecting a national re-distribution of this species.



- Whooper swan numbers have started to recover following a local population crash in 1990. Peak numbers for the recent 5-year period were 122, compared with 200 in the previous count period.
- Cormorants show an increase in their number from an average of 72 up to the winter of 1989/90 to 201 up to the winter of 1994/95. This was followed by a further increase in average to 269 up to the winter of 2002/3 with the peak number occurring in the winter of 2000/1. Since then there has been a downward trend to an average of 168 for the three winters 2003–2006.

Birds have benefited from the additional shelter provided by the gabion baskets installed along the southeast shore, which was suffering from erosion. Large congregations now gather in this area.

Breeding birds

With up to 1,000 nesting pairs, Loch Leven hosts one of the largest concentrations of breeding duck in inland Europe. The most numerous breeding duck species are tufted duck and mallard, with smaller numbers of gadwall, teal, shoveler and shelduck and occasional pintail and wigeon.



Gadwall

The large area of water offers space and security from human disturbance and predators, the shorelines provide cover for broods and the islands provide ideal nesting places. St Serf's Island, the most important nesting area, combines safety from disturbance and predators such as foxes and suitable nesting sites with the added benefit of a nesting colony of black-headed gulls. The gulls nest colonially and act together against predators in the area, driving them away and making the island a safer place for other species to nest.

As soon as the eggs hatch out, and often under the cover of darkness, the female duck takes her young (known as duck broods) to the shoreline around the edges of the loch and islands, often having to travel over large stretches of open water. The shoreline vegetation of reeds and overhanging willow offers shelter from predators and these are ideal places for the emerging flies on which the ducklings feed. These areas are known as duck "brood rearing" areas.

Dabbling ducks like mallard, shoveler, teal and gadwall, enjoy good feeding in the extensive shallows while the slightly deeper water is highly suitable for diving ducks such as tufted duck, and pochard.

In addition to the nesting ducks on St Serf's, there are also large gull colonies. The black-headed gull colonies are generally present in the north of the island and currently number around 4,500 adults on nests. In addition, lesser black-backed and herring gulls became fully established in the early 1980's and the colony of black-backed gulls appears to have stabilised at around 2,250 adults on nests.

Reserve staff have been monitoring breeding ducks at Loch Leven since the late 1960's.

- Between 1966 and 1970 all of the duck nests on St Serf's Island were intensively monitored and the total number of tufted duck nests ranged between 250 and 485 nests and averaged at 368 nests. Since then there have been a number of estimates of the number of nests on St Serf's. In 1981, there was the highest ever recorded count with over 550 nests however since then the population estimates have been slightly lower, with estimates taken between 1993 and 2004 averaging at 327 nests.
- The duck colony on St Serf's is also an important site for breeding mallard and although numbers vary from year to year mallard nesting numbers seem to have remained fairly stable over the decades. The average number of mallard nests on St Serf's between 1993 and 2004 was 429 nests, which is similar to the average of 441 nests found during the intensive work in the late 1960's.

- St Serf's Island is an important nesting site for gadwall with an average of 36 pairs in the late 1960's. Following those counts numbers increased up to around 50 pairs during the 1990's and although during the last few years their numbers have been fewer they continue to make up a significant proportion of the GB breeding population (7%).
- Wigeon is a species that has undergone a significant decline at Loch Leven as a breeding bird. During the late 1960's there were an average of 31 pairs breeding and in the early 1980's there were an average of 39 pairs. The population then crashed dramatically over the space of a couple of years and by 1986 only eight pairs nested on St Serf's.

Research work undertaken in the 1970's identified a lack of suitable duck brood rearing habitat on Loch Leven. The main recommendation for Reserve management was to alter the shoreline to establish more cover and improve it for ducklings and to keep human disturbance on the nesting area to a minimum. Although large numbers of ducklings had hatched out on St Serf's, there was only about 4km of fringing willows and reed beds scattered around the East of the loch and some islands, available as good brood rearing habitat. Counts of less than 100 ducklings were recorded in these areas. The lack of good brood rearing habitat was due to the effects of nutrient enrichment and due also to the introduction of cattle, horses and sheep to the shoreline since the late 1930's, which wiped out the fringing long vegetation and overhanging willows.

Subsequent removal of stock, the planting out of willow whips along the shoreline and additionally, the installation of the gabion baskets, during the 1980's and 1990's has resulted in the restoration of a narrow band of reed beds and willow carr to more than 10km shoreline.

Since culling of large gulls ceased in 1996, their numbers rose rapidly until they stabilised in 2001. Concerns have been expressed that this has resulted in increased predation of very young ducklings less than 10 days old and may also be pushing out black-headed gulls from areas they previously colonised. Further research work does not support this, as the numbers of tufted duck broods and brood size has not decreased in association with the establishment of the large gull colony.

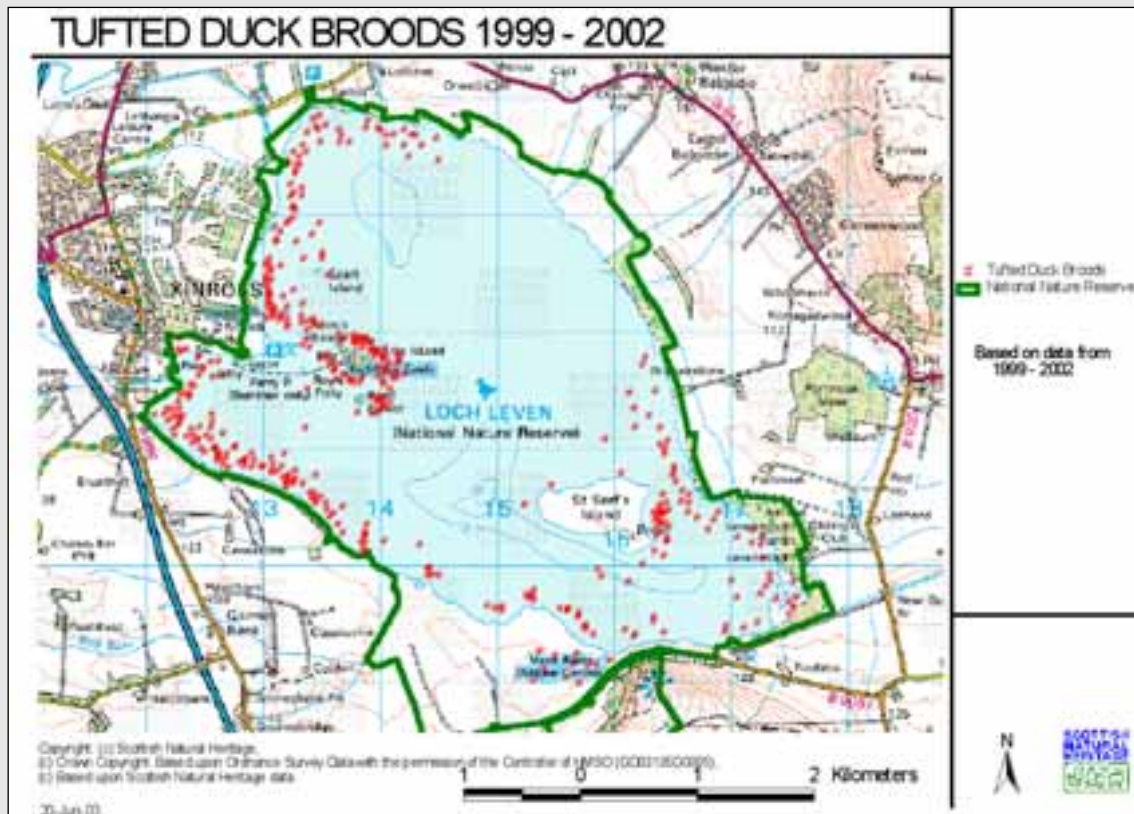
Tufted Duck

Records show that tufted duck first began breeding at Loch Leven in large numbers after 1850. It is now the most important breeding site in Britain, with nationally important numbers of up to 400 pairs nesting here, mainly in high densities on St Serf's Island. Numbers fluctuate from year to year and are regularly monitored.



Male tufted duck begin establishing territories on the loch, for feeding and attracting females, from early March until mid April. These territories are sites that will be the best places for raising young.

Tufted duck nest later than other duck species, with the peak egg laying period not occurring until late May/early June. They use the tussocky grass of St Serf's Island to build their nests in, under the protection of the resident black-headed gull colony that sees off predators such as rats, jackdaws or mink. After hatching the mother leads her young brood from the nest to the established territories around the shoreline where protection and plentiful food are found among the over-hanging or emergent vegetation. However, unlike other duck species tufted duck broods will also venture into more open water to feed.



The first tufted ducks begin to moult in late June, joined by birds from other areas, flocking together for safety in sheltered and disturbance free areas of the loch. In common with other wildfowl tufted duck moult all of their flight feathers in a short period and become flightless and very vulnerable at this time.

Around August, tufted duck from other breeding sites arrive at Loch Leven in large numbers leading to a peak count of these birds in September/October of up to 4,500. Tufted duck are diving ducks and feed in the deeper parts of the loch (4–5m).

Tufted duck marked at Loch Leven in the summer have been shown to disperse to Ireland for the winter, while some drakes born at Loch Leven have been recovered in Scandinavia and Germany, possibly having paired with females from these areas on their wintering grounds and returning with them to breed.

Moulting birds

Numbers of birds start to build up in August as many birds use the loch to moult, shedding their summer plumage and growing new feathers ready for the winter. As they are often flightless at this time they use the wide-open space of the loch to keep away from danger and stay on the water, gathered together in flocks. For example up to 600 mute swans use the loch to moult, forming spectacular white rafts visible from the surrounding hills.

Mammals

Loch Leven NNR is home to a variety of mammals. Otters use the burns that feed the loch and surveys have shown them to be present throughout the Reserve. The scarce water shrews and water voles inhabit banks of ditches and burns. The water voles are present in high densities in the few areas they occur around the loch but little is known of their status on the Reserve. Daubenton's bats feed low over the water around Castle Island and roost in the Castle along with their cousins the pipistrelle bats. As with many of the site's mammals Loch Leven is a refuge for these species within Kinross-shire.

Pest species of mink and brown rat are present on the Reserve and traditionally have been controlled.

Fish

The brown trout of Loch Leven are famous for their unusual colour and high quality. Trout feed on invertebrates, which in turn are supported by the large beds of aquatic plants. Other fish include perch, sticklebacks, minnows and pike.

The story of the survival and productivity of the brown trout in Loch Leven is extremely complicated and has been the subject of intensive study. Population estimates for Loch Leven remain in dispute with some survey work showing no population decline whilst other work, show that the reared trout make up a significant part of the total population. Various reasons for possible poor recruitment from wild stocks have been put forward. These include: poor juvenile survival in the burns, low numbers of adults returning to spawn in the headwaters, low survival in the loch, cormorant predation, loss of genetic integrity or perhaps an under-estimate of the wild trout population. The Estate has, during different times this century, supplemented the wild fish with hatchery-reared fish.

Plants

The site has an outstanding number of higher plant species that grow around the loch shore, including 3 species: coral-root orchid, Loch Leven spearwort and lesser water-plantain are listed on The International Union for the Conservation of Nature and

Natural Resources (IUCN) Red list for vascular plants. Other species, which are rated as “nationally rare” or “nationally scarce”, include holy grass, threadrush and mudwort.

Plants such as mudwort, threadrush, lesser water plantain and Loch Leven spearwort are plants of loch shores which depend on intermittently exposed areas of mud, sand or gravel and need some erosion or active management to keep these areas free from reeds and other aquatic plants. Holy grass smells strongly of marjoram and was of traditional cultural importance in medieval times as it was dried and used as incense or as a strewing herb in churches. It is present around the edge of the loch in marshes which occasionally flood.

Monitoring of thread rush and Loch Leven spearwort has shown that some populations of the thread rush appear to have been lost to reed bed and willow scrub, which may have been a result of the habitat enhancement work. The extensive population of Loch Leven spearwort is close to the existing gabions but does not seem to have been affected. Monitoring of holy grass has shown that it may have disappeared from several previous locations, possibly due to scrubbing over by willow and a coarsening of the vegetation. Nevertheless one major population and 4 other populations continue to be present.



Coral-root orchid

Recent monitoring has also rediscovered the presence of the nationally scarce coral-root orchid at one location on the Reserve and this is its only known site in Kinross-shire. The previous record dates from 1920.

Invertebrates

Invertebrates are a critical part of the ecosystem of Loch Leven with many birds, fish and other animal life depending on them. Hatches of small flies in the summer months form clouds of protein rich food for growing ducklings.

A host of aquatic snails and other invertebrates are supported by large quantities of submerged plants.

Some of these invertebrates are rarities, including *Thanatophilus dispar* a carrion beetle of the loch strandline, *Macrolea appendiculata*, a reed beetle whose larvae feed on the roots of water plants, *Anthicus scoticus*, a small ant beetle of strand line refuse, and *Chersodromia cursitans*, a small predatory fly found on the sandy shores of the loch.

Dragonflies and damselflies, abundant at the start of the 20th century, declined to a point where they were thought to be absent. This was in line with national and European trends on water bodies where enrichment of the waters was thought to be a significant factor. At the turn of the 21st century, with water quality recovering, the common hawker, common darter and black darter dragonflies and the blue-tailed, large red and common blue damselflies have all been recorded.



Large red damselfly

Habitats

The NNR comprises a range of habitats from open water with extensive floating beds of aquatic plants, through emergent and shoreline vegetation, bog, grassland, scrub, and finally mixed woodland reaching up to open hill. Seven well-vegetated islands punctuate the loch ranging in size from a few metres across to 42ha.

Open water

Loch Leven is unusual because it is large and naturally eutrophic (nutrient-rich) in contrast to most large lochs in Scotland, which are oligotrophic (nutrient poor). The loch was selected as a Ramsar wetland site primarily for its water birds but also because it is a particularly good example of its water body type.

Whilst the nutrient rich waters are important in supporting a great wealth of wildlife, nutrient levels that are too high start to cause problems within the ecosystem. The vegetation at Loch Leven has changed markedly over the 20th century reflecting a decline in the water quality due to nutrient enrichment from industry, sewerage treatment works and agriculture. Extensive reed beds and other emergent plants fringing the shore of the loch in the past had largely disappeared. The aquatic plants submerged within the loch have changed too in response to the changing nutrient status of the loch. However it has been the recurrent algal blooms, a response to the artificially high nutrient levels that have caused most alarm. Work through the Catchment Management Plan has arrested the decline and the loch is now showing signs of recovery.

Emergent and shoreline vegetation

Reedbeds occur in ungrazed, sheltered areas most notably at Levenmouth, the Factor's Pier, Reed Bower Island, and behind the gabions that protect the east shore.



Dusk at Loch Leven

The shoreline vegetation is particularly important for breeding wildfowl. The overhanging willows and tall emergent plants such as reed canary grass provide shelter for ducks from predators, disturbance, and bad weather. In parts of the more exposed shoreline smaller plants such as common spike rush predominate with occasional patches of Loch Leven spearwort.

Much of the focus of Reserve management has been to restore the extent of fringing vegetation and success can be measured by the increase in shoreline vegetation from a low of around 4km in the 1970's to over 10km in 2006.

Submerged aquatic vegetation

The submerged aquatic vegetation in Loch Leven has changed since the mid-19th century as the loch became progressively more eutrophic. However it still maintains its species-rich flora. The shallow nutrient-rich waters mean large beds of submerged plants can thrive. With almost half the loch less than 2m in depth, large beds of pondweeds, stoneworts and other aquatic plants can cover up to 45% of the loch surface.

Research during the 1970's clearly showed that nutrient enrichment, leading to algal blooms, had reduced the diversity of the loch's flora and fauna. Much has been achieved under the auspices of the Loch Leven Catchment Management Plan (LLCMP) and an earlier action programme to reduce phosphorus inputs to the loch and restore the water quality of the loch.

There is recent evidence of a recovery with the beds of pondweeds and stoneworts starting to extend back out into deeper water as the water clarity has improved. Macrophyte coverage in Loch Leven in 1999 was extensive in areas of the loch that were less than 2.0m deep. Two surveys in the 1990's both recorded 12 submerged and floating-leafed species and there was some localised increase in species richness. Work in 2006 recorded submerged plants at a depth of over 4.5m which is at the depths recorded by West in 1910.

This has had consequent impacts on the invertebrate diversity and abundance. The increase in cover of aquatic plants and associated abundance of insect life, especially aquatic snails, will ensure there is a continuing good supply of food for fish life, wintering waterfowl, breeding ducks and other birds such as swifts, swallows and osprey.



Aerial view looking southeast

Islands

The islands on Loch Leven are immensely important for breeding waterfowl species, providing sanctuary from predators such as foxes and being relatively disturbance free. The tussocky structure of the grassland on the islands provides ideal nest sites for these birds and the edges of the islands provide habitat and shelter for birds and other animals.

Grassland

The grassland habitat around the loch was formerly more extensive and the wet unimproved pastures around the loch contain nationally and locally rare plants. However with a decline in grazing, much of this habitat has been replaced by scrub. One of



Heath spotted orchid

these wet grasslands, Carsehall Bog, supports many orchids, such as lesser butterfly orchid and purple marsh orchid. Some scrub encroachment has occurred as grazing levels have reduced but light grazing has kept parts of the bog open for the grassland flowers to flourish.

Mixed woodland

Scots pine and birch form the majority of woodland within the Reserve providing habitats for the common woodland birds and nesting habitat for osprey. The largest areas of woodland are found at Levenmouth Plantation and the Black Wood together with the woodland on Vane Hill, now regenerating after grazing animals were removed in the late 1960's.

Summary

Loch Leven is a site that is celebrated for its internationally important birds but the unique nature of the loch – size, water type, and relatively undisturbed – makes it an important site for other wildlife. The habitats that surround the loch support rare and diverse plants, making the whole site interesting to the all-round naturalist.

3 History before the Loch became an NNR

Loch Leven’s natural history is inextricably linked with the cultural heritage of the area. Kings, Queens and noblemen have all had an influence on the present day make up of the site.

Timeline

Era	Activity
Iron Age?	Crannog or lake dwelling constructed (off Kirkgate Park).
5th Century	Records tell of a fortress or stronghold on Castle Island from this period.
6/7th Century	The first evidence of a religious habitation established on St Serf’s Island – a “Humble hallowed cell...” is recorded.
10th Century	Priory status is given to the St Serf’s religious settlement.
11th Century	Macbeth, King of Scotland, grants land to the monks of St Serf’s.
12th Century	Monks from St Andrews build the Priory on St Serf’s Island.
13th Century	The current Leven Castle was probably constructed around this time. It survived various sieges during the 14th century and was granted to the Douglas family in 1372 by King Robert II.
1314	King Robert I granted rights to the Abbot of Dunfermline to fish the loch with “one coble and two sets of four nets”
1560–1	The Priory on St Serf’s Island was abandoned.
1567–1568	The castle was used as prison for many years. The most famous prisoner held was Mary Queen of Scots, who in 1567 whilst imprisoned here, was forced to abdicate in favour of her infant son James VI. In 1568 she was helped to escape, and with her captors still inside, the castle keys were thrown into the waters of Loch Leven.
1675	Sir William Bruce (1630–1710) bought the Castle and a sizeable estate and then built Kinross House, overlooking the loch and the castle.
c.1770	Kinross House passed into the possession of the Montgomery family.
1827	An Act of Parliament was passed “for recovering, draining and preserving certain lands in the counties of Fife and Kinross; and for better supplying with water the mills, Manufactories and Bleach fields and other works situated on or near the River Leven in the said county of Fife.” Work building the sluices and lowering the loch was completed by 1831.
1873	Netting was stopped, since when only angling has been allowed on Loch Leven.
1901	The Society for the Protection for Birds (later to become the RSPB) appointed its first watcher, to protect breeding pintail on St Serf’s Island.
1959	Curling on the ice at Loch Leven – the last time conditions were suitable for The “Grand Match” or “bonspiel”, was 1959.

Cultural heritage

Castle Island has been fortified since the 6th century. However the stonework visible today is of a castle constructed around the 13th century. It has survived various sieges throughout its history and was used as a prison for many years, its most famous resident being Mary Queen of Scots who was imprisoned here in 1567 and escaped the following year. Lochleven Castle has been a ruin since the 18th century.

In 1675 Sir William Bruce bought the Castle, along with a sizeable estate and proceeded to build Kinross House, a fine Palladian mansion that overlooks the loch and castle.

Founded in 1668 Kinross Curling Club is reputedly the oldest in the world. In winters when six inches of ice occur on the loch traditional games are played on Loch Leven with the Loch Leven Province and Blairhill Trophy competitions being held. In hard winters the most famous of tournaments, the "Grand Match" or "bonspiel", has been staged at Loch Leven with 300 sheets of ice (8 curlers per sheet) being used. However, the last time conditions were suitable for this extravaganza was 1959.



Lochleven Castle

Land use history

Before the 1830's Loch Leven was surrounded by extensive marshes with a shoreline that was seasonally flooded. The extent of marshland is depicted on the early maps of the area, and it is known that bitterns, marsh harriers, and greylag geese bred around the loch in these areas.

In 1830 a major scheme was started which would see enormous changes in the loch. Designed to benefit industry, particularly the textile manufacturers alongside the River Leven and to drain the marshland around the Loch so that it could be used for farming, the scheme reportedly cost £40,000, nine times the original estimate!

The water level of the Loch was lowered by 1.5m and the sluices allow the level to be dropped a further 1.4m if required. This reduced the surface area of the loch by about a quarter and four new islands emerged as a result – Alice's Bower, Roys Folly, Scart Island and the Green Isle. The scheme also involved straightening the River Leven and the Gairney Water; their old meanders can still be seen on contemporary aerial photos.

After completion the level of the loch was no longer determined by local rainfall but instead by the demands of industry downstream, a situation that continues to the present day with water flow in the River Leven determined by the River Leven Trustees.

The drainage scheme allowed the marshes to be turned into farmland. Vegetation colonised the new shoreline, and records show there were extensive reed beds; in some places local farmers were cutting reeds for thatch as late as the 1930's.

In the 19th century plants more characteristic of oligotrophic (nutrient-poor) lochs were also recorded at Loch Leven, but typical plants such as lake quillwort, pillwort, and water lobelia had already disappeared by the early 20th century. In 1910, 20 species of submerged aquatic plants were recorded including eight species of pondweed (important food plants for waterfowl), five of which have now disappeared. Also at this time in some shallower muddy areas Canadian pondweed grew "*with such extraordinary vigour that in summer, when the plants are near the surface, it is very difficult to row a boat through them*". In fact during the 1940's it was reported that plant growth over much of the loch was so dense that channels had to be repeatedly cut to allow boats to pass.

After the Second World War the rate of nutrient enrichment accelerated. This was stimulated by increased fertiliser run off from the surrounding farmland and the discharge of domestic sewage and industrial effluent. The reduced water clarity confined plants to areas less than 2m deep. This led to a reduction in the diversity and numbers of plants in the loch. The remaining plants were typical only of nutrient rich waters. By 1965 many of the plants recorded in the early 1900's had gone. The decline in rough

stonewort from the prodigious growth in 1910 to sparse amounts in 1970–71 was probably a result of this process.

By 1972 little of the shoreline vegetation remained, coinciding with an increase in the number of cattle, sheep and horses grazing around the loch. Increased grazing pressure may have been one of the factors that caused the disappearance of the reed beds nutrient enrichment also weakens reeds. The reduction in vegetation exposed the shoreline to the ravages of wind, wave and ice causing erosion and preventing new plant growth. In the 1980's gabions (stone-filled metal cages) were installed in the southeast of the loch to provide protection from wave action, and reeds were able to re-establish behind these.

Research has shown that pollution of the loch's water has been partially responsible for triggering algal blooms. Since the 1970's a concerted effort has been made to improve the quality of the water discharged into Loch Leven, particularly to reduce phosphorus. Major reductions in phosphorus loading occurred in the late 1980's/1990's by addressing the source of these discharges. The woollen mill in Kinross, previously a major discharger of phosphorus, ceased their discharges and four sewage treatments works were improved, thus reducing the pollution to the loch. Pollution from agricultural land still contributes to the high phosphorus levels entering the loch. However improvements in water clarity and the return of aquatic plants to deeper water has occurred as water quality has improved.

The Fishery

The management of Loch Leven NNR is intimately linked with the management of the fishery. When the NNR was declared, the agreement allowed continued management of the fishery by Kinross Estate.

Throughout history Loch Leven has been renowned for its fish. In 1314 King Robert I granted rights to the Abbot of Dunfermline to fish the loch with "*one coble and two sets of four nets*" (a coble being a boat).

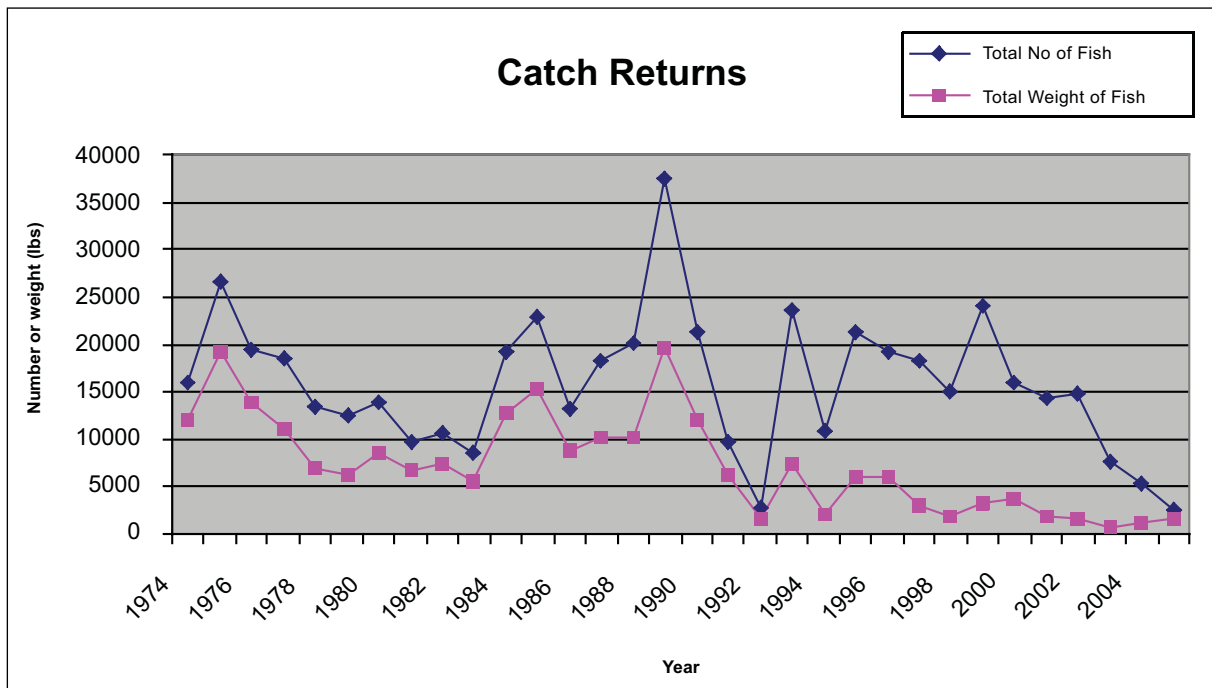
Historical records show brown and sea trout, salmon, pike, arctic char, perch, brook lamprey, flounders, and eels were present in the loch.

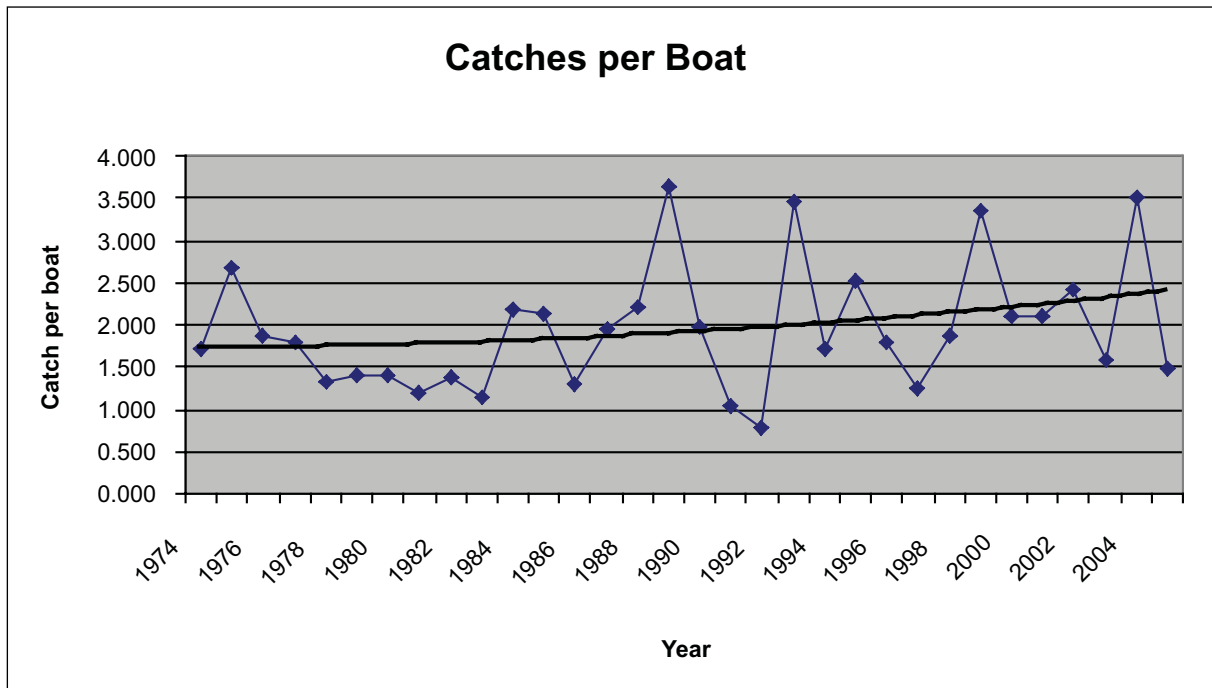
By 1831 the construction of the sluices and lowering the loch level by 1.5m resulted in a reduction in the number of species of fish within the loch with sea trout, salmon, and lamprey becoming isolated from the sea by physical barriers, and the arctic char dying out following the reduction in water levels. Eels, once fished by the tonne, became victims of pollution of the River Leven and disappeared in the 19th century with the rise in industrialisation in the area.



Fishing on Loch Leven

In the mid 1800's the commercial fishing was leased by "tacksmen", who caught the fish in large nets and exported them in wooden casks to Edinburgh, Glasgow and Manchester, as described in the two diaries of David Marshall (1847–1850 and 1859–1863). Netting was stopped in 1873, since when only angling has been allowed on Loch Leven.





Loch Leven was once regarded as the finest brown trout fishery in the world. At its peak catches reached 40,000 a year and provided sport for 50,000 anglers. Kinross Estate has kept angling records since 1872, recording catch by number and by weight every year. The general trend was increasing catches up to 1950's and a decline thereafter.

In 1882 Kinross Estate opened up rearing ponds to supplement the natural recruitment of brown trout to the loch; surplus fry reared in the ponds were sold to other fisheries. This appeared to have little effect on the catch by anglers and the practice was discontinued by 1936, when management of the loch became more passive. Controlling predators, netting pike, and preventing trout running the burns until the end of the legal fishing season became the main activities. In the 1970's catches began to decline, and in response the Estate reinstated the hatchery and fishponds in the 1980's.

As catches of trout continued to decline, the estate introduced North American rainbow trout in 1993 for the first time to supplement the fishery. Stocking with rainbow trout ceased in 2005 with the fishery once more seeking to become a place celebrated for brown trout.

Shooting of wildfowl has been a sport long exercised on the loch and Kinross Estate still continues this tradition with around 34 days shooting in the winter.

Summary

Loch Leven has been the major focus of Kinross-shire from the landscape, natural history and cultural perspective throughout history. It has undergone major changes, due to the exploitation of fish and water. Its size and islands have made it a place where “retreats” have been established – the religious settlement of St Serf’s Island and the fortress of Leven Castle.

Man has had a profound effect on the loch. The combination of industrialisation and agriculture has altered both the physical and chemical make up of the loch. Despite this effect, Loch Leven remains one of Scotland’s key landscape features and wildlife spectacles. The pressures on the loch and the need to protect this wildlife interest led to the designation of the NNR for research and conservation.

4 History of Loch Leven NNR

After the Countryside Act 1949 legislation came into being Loch Leven was identified as a key site to become one of the new NNRs, although it only gained this accolade 15 years later.

Key events in the story of the NNR

1949	The first proposal to establish a Nature Reserve was made by the Scottish Wildlife Conservation Committee.
1964	Loch Leven NNR was declared to “maintain its attraction for all species of wildfowl and to safeguard all the characteristics that go to form this unique habitat”. Byelaws were introduced with the aim of protecting the site.
1966	An extensive research programme was undertaken under the International Biological Programme (IBP), to measure the ecological process of the loch. This combined efforts of the Nature Conservancy (now SNH), the Freshwater Fisheries Laboratory, the Wildfowl Trust (now WWWT), and many others. The Royal Society of Edinburgh published the results in 1974.
1966–70	Major breeding duck research was undertaken that forms the baseline from which all further recording has been taken.
1967	The RSPB purchase Vane Farm as an education centre.
1982-84	The construction of a gabion reef along the east shore to provide erosion protection to a 2.2km stretch of shoreline and allow overhanging willows, reedbeds and lagoons to re-establish.
1992	A serious algal bloom temporarily closes the fishery and leads to the establishment of the Loch Leven Area Management Advisory Group set up to try to address the pollution problems of the loch.
1999	The Loch Leven Catchment Management Plan was produced designed to deliver a sustainable future for the loch, through influencing land use and river management practises within its catchment.
c1992	Pollution discharges from four sewerage treatment works and woollen mill ceased.
2002	The NNR was extended to include RSPB’s Vane Farm Reserve and re-declared through a new 25-year agreement with Kinross Estate Company.
2005	Publication of the Scottish Outdoor Access Code under the Land Reform (Scotland) Act advises on new rights of responsible access to the Scottish countryside and introduction of local access guidance for Loch Leven NNR.

Management of the Natural Heritage

Given that the majority of Loch Leven NNR is the loch, management of the habitats focuses mainly on the small fringing shoreline zone and islands. Throughout its history, the management of the NNR has focussed on safeguarding the important natural heritage interest. This has largely been achieved through keeping disturbance-free conditions and maintaining characteristic habitats suitable for wildfowl and plants.

Management works have included:

- erosion control – the gabion baskets installed in the 1980's. This has been successful in protecting the shoreline and creating well-vegetated still water lagoons and reed beds. These areas are used by waterfowl for feeding and safety;
- scrub control – Carsehall Bog is kept open by the removal of gorse, followed by traditional grazing;
- pest control – mink, rats and jackdaw are controlled to prevent predation on nesting birds. For a period large gulls were culled as it was thought to protect the breeding ducks. Following a review of the practice this was ceased in 1996, with the subsequent rise in large gull numbers reaching a stable level in 2000;
- encouraging shoreline vegetation through willow planting – this provides valuable habitat for duck broods as well as helping to prevent erosion;
- grassland management – grazing is let for 4 areas including the annual summer grazing of 100 sheep on St Serf's Island. Grassland at Carden Point, Orwell Marsh and Burleigh Sands is maintained by topping with machinery.

The RSPB have undertaken extensive management works, re-creating the wetlands between the visitor centre at Vane Farm and the loch, removing grazing from Vane Hill to allow the birch woodland to develop. Generally they manage land in a way favourable to birds that once bred or wintered in the area. A demonstration project of mire restoration was undertaken in the late 1990's.

Management of the water body as a habitat has been undertaken as part of a collaborative project in the whole of the Loch Leven catchment. In the late 1970's the first steps were taken to tackle the causes of nutrient enrichment (eutrophication). In 1992 major algal blooms on the loch lead to the formation of the Loch Leven Area Management Advisory Group (LLAMAG) in 1993 who set about trying to address pollution problems of the loch. By the late 1990's a number of measures had been taken but recovery will take many years to show. In 1999 the Loch Leven Catchment Management Plan was produced detailing action required in addressing the continuing problems with the water quality of the loch.

Research

In 1966 Loch Leven was selected to form part of a worldwide major research programme measuring the ecological process of the loch (the International Biological Project). This focussed on the flow of energy through the food chains up to fish and birds. The 5-year programme, involving 41 scientists from a wide range of organisations, highlighted the complexities of the site. Other very far ranging studies were also undertaken in relation to this on all aspects of the lochs ecology.

Since then research has continued on the Reserve with regular monitoring or surveys of:

- water quality;
- nesting duck;
- duck broods;
- breeding gulls;
- wetland birds (WeBS);
- wintering geese;
- cormorants and their impact on the fishery;
- rare plants and invertebrates; and
- submerged macrophytes.

The wealth of data and monitoring recorded and the long time period over which this has occurred makes Loch Leven of global importance for the study of freshwater ecology.



Studying birds at Loch Leven

Management for People

Public access to the loch is not a new issue. As long ago as, 1860 local people wanted access to the shore and loch and a celebrated case came to the Court of Session concerning the right to walk the shores and the public right to fish the loch. The decision went in favour of Sir Graham Montgomery against these wishes. The loch is still in private ownership but the 1964 Nature Reserve Agreement (NRA) brought in byelaws that gave people access to certain areas and kept large tracts of the Reserve undisturbed.

The purchase of land in 1968 at Findatie by the Nature Conservancy Council (now SNH) gave an opportunity to extend public access. Byelaws, introduced with the declaration of the NNR, sought to manage peoples' behaviour and access to the Reserve until they lapsed when new legislation was put in place. Until the advent of the Land Reform (Scotland) Act 2003 access for the public had been confined to a few controlled areas: Kirkgate Park, Burleigh Sands and Findatie and to Castle Island on the Historic Scotland boat. Management of these areas has been mostly concerned with keeping paths, signs and other infrastructure in good and safe condition.

Following introduction of the Land Reform (Scotland) Act 2003 and the Scottish Outdoor Access Code, SNH undertook detailed consultation regarding application of the access code at Loch Leven and opportunities for informal access to the site. SNH produced site-specific local access guidance for the Reserve in 2005, subsequently revised in 2006. This local access guidance welcomes responsible access on and around the loch and provides advice on minimising the risk of disturbance to birds when taking access both on water and around the loch.

The RSPB's land at Vane Farm, now part of the NNR, has been a key factor in bringing visitors to Loch Leven. Over 70,000 people per year use the facilities offered there and the RSPB run a variety of programmes for school children and volunteers. The visitor centre boasts a shop, café, observation room, an educational room, toilets, woodland trail, and hides placed around the re-created wetlands on the shores of the loch.

All previous management plans state the desire for greater awareness of the NNR in the local community. Events, interpretation material, and the Reserve Manager's talks to the local community have all been tried with varying degrees of success in getting the message across of the outstanding importance of this most valuable of wildfowl refuges. At a public meeting in 2004, which discussed future management of the Reserve, it was evident that local residents still do not generally understand this message.

Property management

Three different parties own the NNR. The loch and the majority of the surrounding shore fringe is owned by Kinross Estate, with Vane Farm visitor centre, the adjoining wetlands and Vane Hill in the ownership of the RSPB. SNH has ownership of a small area of land at Findatie.



Summary

The core issues of the Reserve, of balancing the needs of people and wildlife, have remained a common thread throughout the life of the NNR. Due to its complex nature Loch Leven NNR has required coordinated management and has proved to be a good example of partnership working. The various landowners, anglers & wildfowlers, researchers, countryside workers, conservationists, and the local communities have all played their part in its management. Together they will be absolutely crucial in ensuring the good management of the NNR for future generations.

Appendix 1 – National Nature Reserve

Scotland's NNRs are special places for nature, where many of the best examples of Scotland's natural heritage are protected. Nature comes first on our NNR (referred to as primacy of nature). These NNRs also offer special opportunities for people to enjoy and find out about the richness of our natural heritage. NNR are declared under the National Parks and Access to the Countryside Act 1949 or the Wildlife and Countryside Act 1981.

A new policy for NNRs in Scotland was developed in 1996. This Policy requires NNRs in Scotland to have four attributes, and to be managed for one or more of the three purposes.

The attributes are:

- **Primacy of nature** – The needs of nature will be placed at the heart of decisions about land-use and management of our NNRs. Nature conservation will be the overriding land use, although it may not be the sole purpose of management.
- **National importance** – It must be of national importance that the NNR be managed as a nature Reserve, for the protection of geological features, habitats or species found there.
- **Best practice management** – NNRs must be well managed, not only to safeguard the nature conservation interests, but also to provide for people's enjoyment and understanding.
- **Continuity of management** – Both research and management on NNRs require us to take a long-term view, so it is important that management continuity is assured.

The purposes are:

- **National awareness of NNRs** – On these Reserves people can take pride in the natural heritage 'on display' and come to understand it better and enjoy it to the full.
- **Specialised management of NNRs** – The character of the interest requires specialised and pro-active management that is best delivered by a nature Reserve.
- **Research-related NNRs** – These NNRs will offer opportunities for research into the natural heritage and its management which specifically require a nature Reserve location and which are not available elsewhere.

From 2000–2003 all of Scotland's NNRs were reviewed against this policy. As a result of the review there are now 55 NNRs in Scotland.

More information can be found at:

Policy statement: <http://www.snh.org.uk/pdfs/polstat/nnrpolicy.pdf>

NNRs – general information: <http://www.nnr-scotland.org.uk>

Appendix 2 – Site of Special Scientific Interest

The Site of Special Scientific Interest (SSSI) designation is the main nature conservation designation in Great Britain. The SSSI series has been developed over the last 50 years, and since 1981 has become the national suite of sites providing statutory protection for the best examples of British flora, fauna, geological and physiographical features. Originally notified under the National Parks and Access to the Countryside Act 1949, many SSSIs were renotified and others newly notified under the Wildlife and Countryside Act 1981. SSSIs continue under the Nature Conservation Act (Scotland) 2004, which further strengthens their protection and makes the system more user-friendly.

These sites are also used to underpin other national and international nature conservation designations. Most SSSIs are privately owned or managed; others are owned or managed by public bodies or non-government organisations. There are more than 1400 SSSIs in Scotland.

Web Links:

'The Nature of Scotland – A Policy Statement'

<http://www.scotland.gov.uk/library3/environment/nas-00.asp>

'People and Nature: A New Approach to SSSI Designations in Scotland'

<http://www.scotland.gov.uk/library/documents-w1/pandn-00.htm>

Guidelines for selection of biological SSSIs

<http://www.jncc.gov.uk/Publications/sssi/default.htm>

Site of Special Scientific Interest (SSSI)

<http://www.snh.org.uk/about/ab-pa01.asp>

List of Scottish SSSI

http://www.snh.org.uk/pdfs/protect/SSSI_02.pdf

Loch Leven Site of Special Scientific Interest

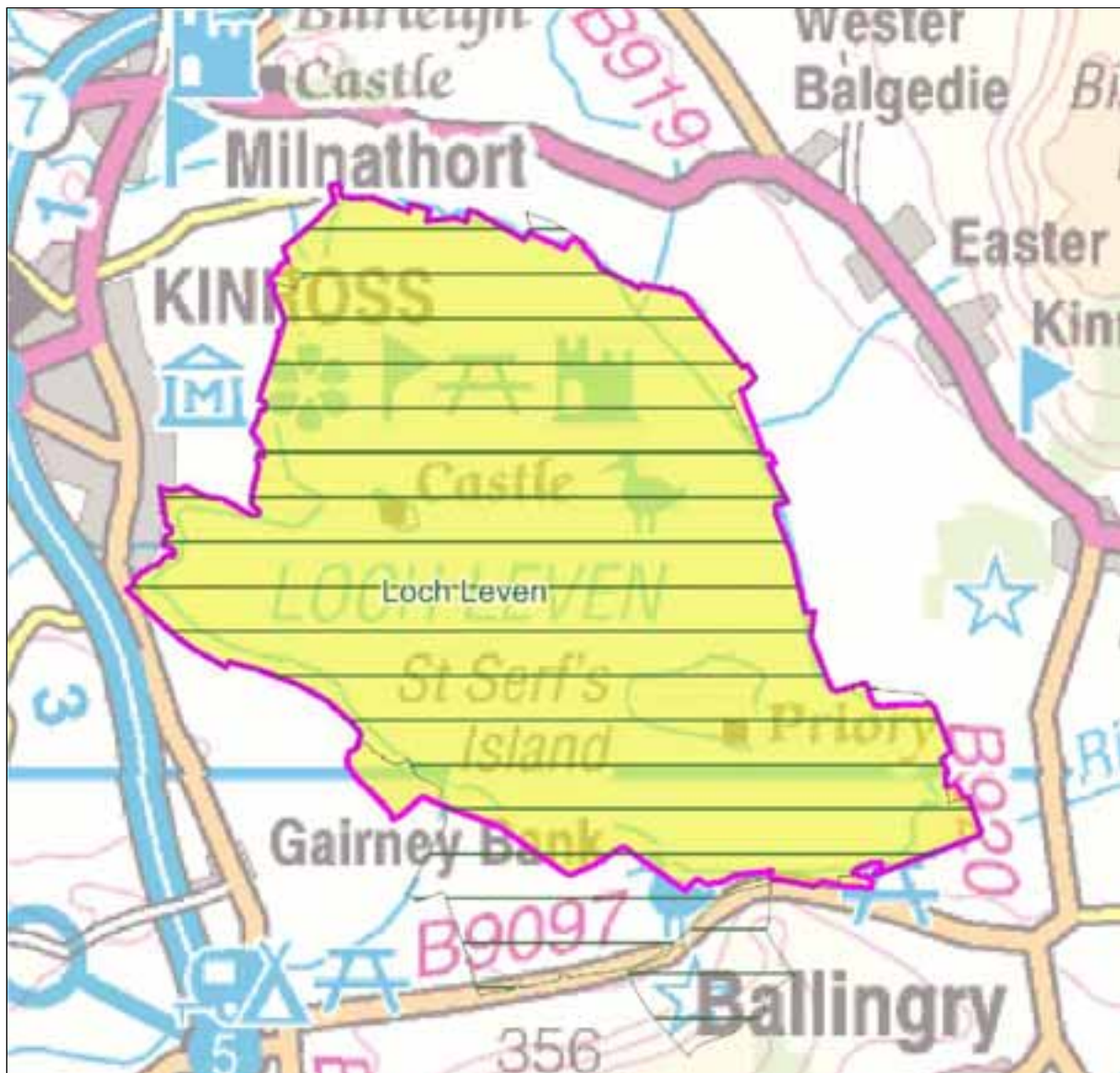
Country	Scotland
Unitary Authority	Perth & Kinross Council
Date Notified Under 1949 Act:	
Date Notified Under 1981 Act:	12 June 1985
Grid Reference	NO 150010
Area (Ha)	1,612ha



SSSI



NNR



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SSSI Citation text:

Ornithological

Loch Leven is an outstanding site for wintering and breeding wildfowl in Britain. It is the most important grey goose roost in Britain with internationally important numbers of Greylag and Pink-footed Geese. It also holds nationally important wintering populations of several other species of wildfowl and has exceptionally high breeding duck numbers.

Botanical

Loch Leven is outstanding for the number of higher plant species it supports. The wet unimproved pasture flanking the loch contains several plants of national and local rarity, and although the limnological interest of the loch itself has declined during the present century because of pollution, it still contains a wide range of aquatic species representative of a eutrophic water body, including several of local distribution in the district.

Entomological

Of interest principally on account of its rare beetles and flies.

Remarks

Nature Conservation Review Site, Grade 1.

Boundary amended with an increase of 15ha.

Part declared under Section 19 of the National Parks and Access to the Countryside Act 1949 as an NNR on 3 March 1964.

Part of the site was designated as a wetland site of international importance under the Ramsar Convention, 5 January 1976.

Appendix 3 – Natura 2000 sites

Special Protection Areas are areas classified under Article 4 of the European Community Directive on the Conservation of Wild Birds 1979 (EC79/409), commonly known as the Birds Directive. SPAs are intended to safeguard the habitats of birds, which are rare or vulnerable in Europe, as well as all migratory birds which are regular visitors. Together with Special Areas of Conservation (SACs), which are designated under the Habitats Directive for habitats and non-bird species, SPAs form the Natura 2000 network of sites. The Natura 2000 network is designed to conserve natural habitats and species of animals and plants which are rare, endangered or vulnerable in the European Community. Natura sites in Great Britain are protected via the Conservation (Natural Habitats &c.) Regulations 1994, which transpose the Habitats Directive into GB law and are relevant to both SACs and SPAs. Natura sites are also generally underpinned by the SSSI mechanism in the terrestrial environment. The Scottish Executive Rural Affairs Department Circular No. 6/1995 (Revised June 2000) on the Habitats and Birds Directives gives further details of how the Regulations apply in Scotland.

SNH acts as the advisor to Government in proposing selected sites for ministerial approval as proposed SPAs. SNH then consults with key parties over the site proposals on behalf of Scottish Ministers. The consultees, who include owners and occupiers of land, local authorities and other interested parties, are sent details of the proposed site boundaries and the species for which the site qualifies. SNH also negotiates the longer-term management of these sites. Following consultation, SNH forwards all responses to Scottish Ministers who then make a decision about whether to classify the site as a Special Protection Area.

The following websites provide further information:

Special Areas of Conservation

<http://www.jncc.gov.uk/ProtectedSites/SACselection>

Special Protection Areas

<http://www.jncc.gov.uk/UKSPA/default.htm>

Loch Leven Special Protection Area

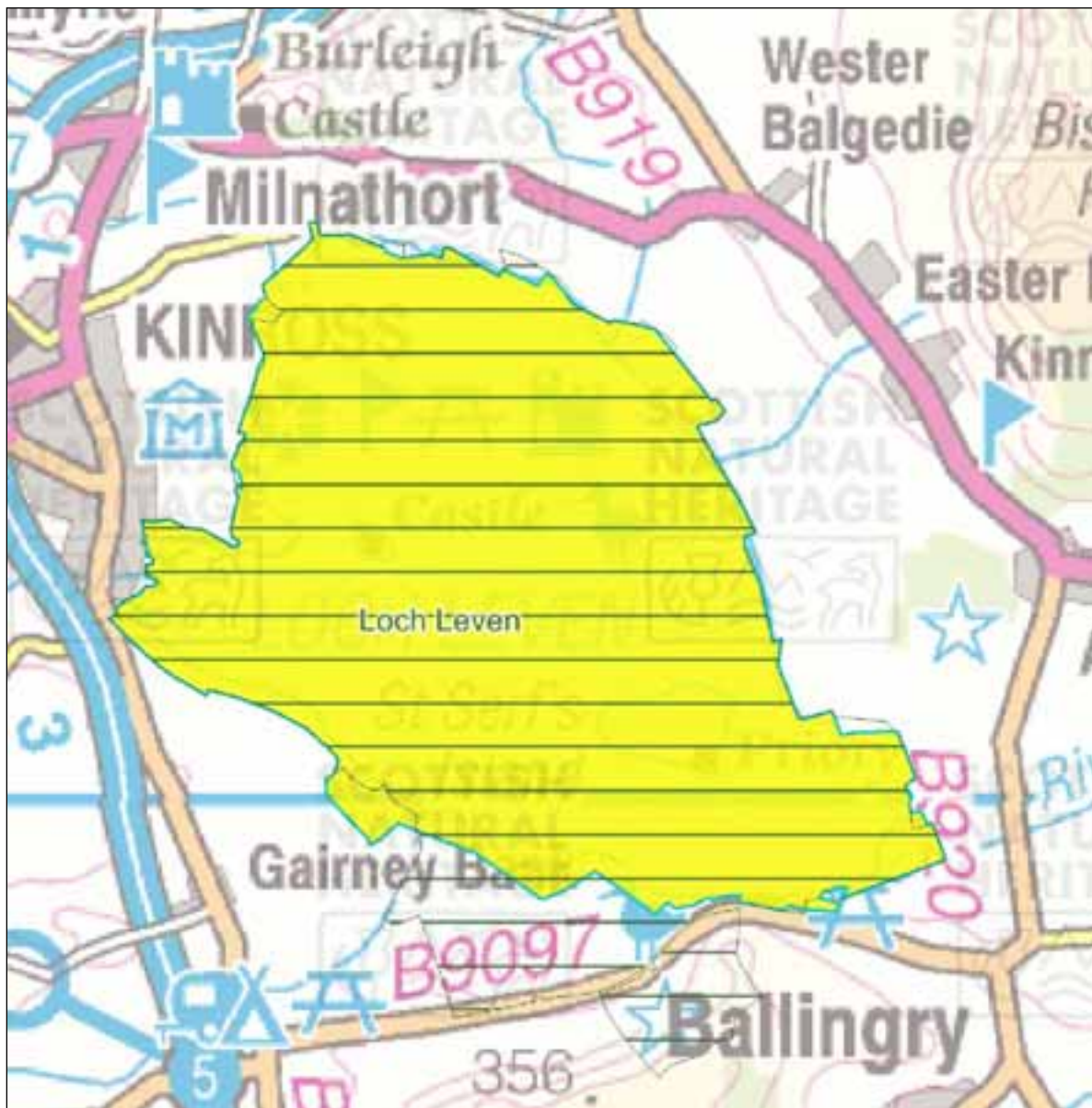
Country	Scotland
Unitary Authority	Perth and Kinross
SPA Status	Classified 27/03/2000
Latitude	56 11 48 N
Longitude	03 22 30 W
Spa Eu Code	UK9004111
Area (Ha)	1611.81
COMPONENT SSSIs	Loch Leven



SPA



NNR



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Loch Leven lies midway between the Forth and Tay estuaries in east-central Scotland. It is about 3km x 5km in extent and is the largest naturally eutrophic loch in Britain and Ireland. It is relatively shallow and is surrounded by farmland, with a diverse aquatic flora and shoreline vegetation. The loch contains several islands, the largest of which, St Serf's Island, has an area of about 46ha. The site supports internationally important wintering populations of waterbirds (swans, geese and ducks).

Qualifying interest:

This site qualifies under **Article 4.1** of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

Over winter;

Whooper Swan *Cygnus cygnus*, 101 individuals representing up to 1.8% of the wintering population in Great Britain (5 year peak mean 1991/2 – 1995/6).

This site also qualifies under **Article 4.2** of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

Over winter;

Pink-footed Goose *Anser brachyrhynchus*, 18,230 individuals representing up to 8.1% of the wintering Eastern Greenland/Iceland/UK population (winter peak mean).

Shoveler *Anas clypeata*, 520 individuals representing up to 1.3% of the wintering Northwestern/Central Europe population (winter peak mean).

Assemblage qualification: A wetland of international importance.

The area qualifies under **Article 4.2** of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl.

Over winter, the area regularly supports 32,177 individual waterfowl (5 year peak mean 1991/2 – 1995/6) including: Goldeneye *Bucephala clangula*, Tufted Duck *Aythya fuligula*, Pochard *Aythya ferina*, Teal *Anas crecca*, Gadwall *Anas strepera*, Cormorant *Phalacrocorax carbo*, Shoveler *Anas clypeata*, Pink-footed Goose *Anser brachyrhynchus*, Whooper Swan *Cygnus cygnus*.

Natura conservation objectives for Loch Leven

Special Protection Area

To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and

To ensure for the qualifying species that the following are maintained in the long term:

- population of the species as a viable component of the site;
- distribution of the species within site;
- distribution and extent of habitats supporting the species;
- structure, function and supporting processes of habitats supporting the species;
- no significant disturbance of the species.

Qualifying species:

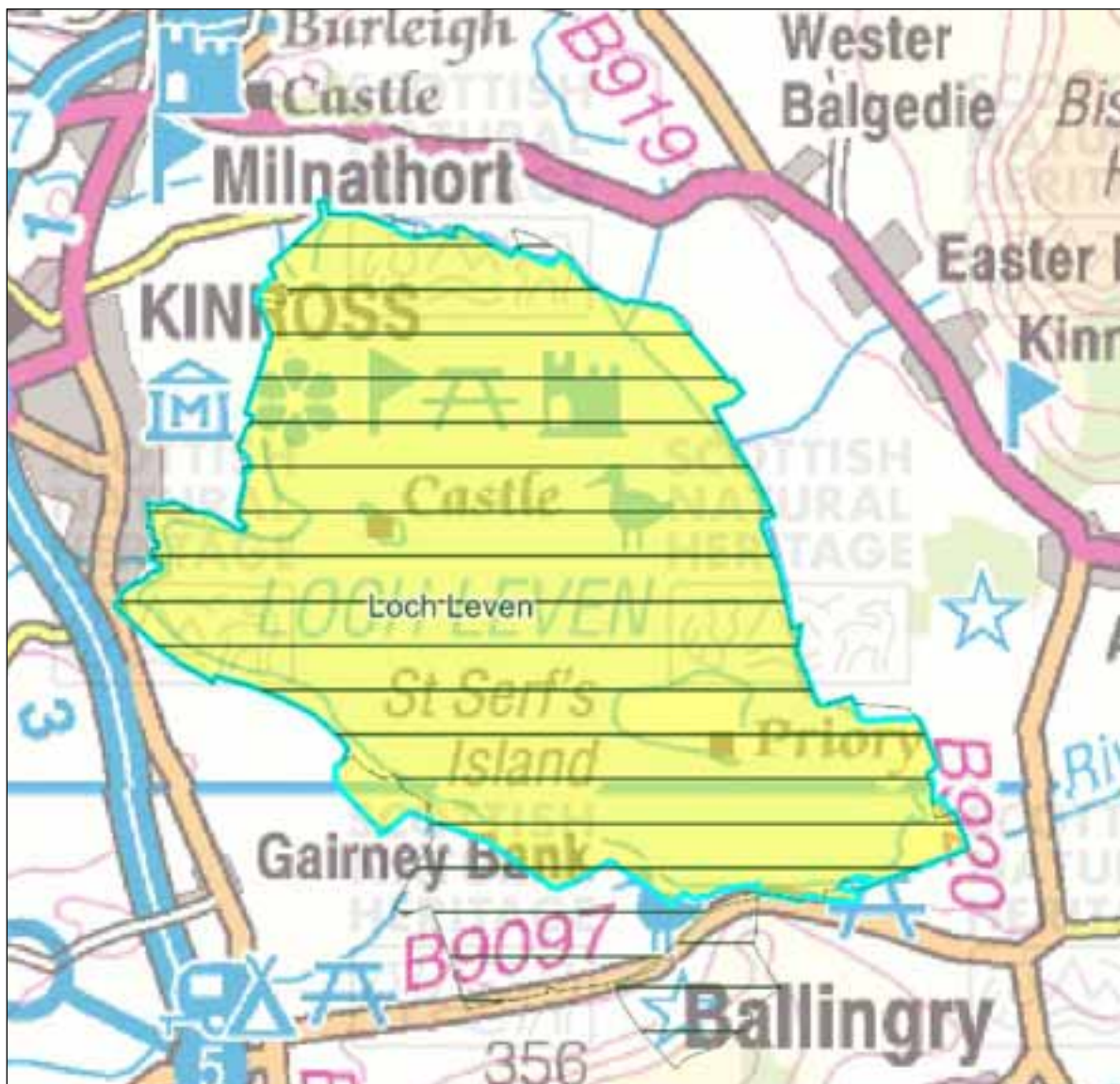
- Cormorant (*Phalacrocorax carbo*)*;
- Gadwall (*Anas strepera*)*;
- Goldeneye (*Bucephala clangula*)*;
- Pink-footed goose (*Anser brachyrhynchus*);
- Pochard (*Aythya ferina*)*;
- Shoveler (*Anas clypeata*);
- Teal (*Anas crecca*)*;
- Tufted duck (*Aythya fuligula*)*;
- Whooper swan (*Cygnus cygnus*);
- Waterfowl assemblage.

*indicates assemblage qualifier only

Appendix 4 – Ramsar sites

Ramsar sites are wetlands of international importance designated under the Ramsar Convention. In the UK, the first Ramsar sites were designated in 1976. Since then, many more have been designated. Compared to many countries, the UK has a relatively large number of Ramsar sites, but they tend to be smaller than many countries. The initial emphasis was on selecting sites of importance to water birds within the UK, and consequently many Ramsar sites are Special Protection Areas (SPAs) classified under the Birds Directive.

Loch Leven Ramsar site, Tayside (7UK007)



Ramsar site description:

Loch Leven in central Scotland is the largest natural eutrophic lake in Britain. It is a relatively shallow loch, surrounded by farmland, with a diverse aquatic flora and shoreline vegetation. Loch Leven supports outstanding assemblages of breeding and wintering wildfowl. The boundary of the Ramsar site follows that of the Loch Leven SSSI except for the exclusion of 4ha of SSSI towards the northern end of the loch.

Qualifying interest:

Loch Leven Ramsar site qualifies under **Criterion 1b** as a particularly good example of a naturally eutrophic loch. It is the largest loch of its kind in Britain and is unique in Britain being both large and shallow with only rare stratification.

Loch Leven Ramsar site qualifies under **Criterion 3a** as a wetland of international importance by regularly supporting a wintering waterfowl assemblage greater than 20,000 individuals (1993/94–1997/98 winter peak mean of 34,280).

Loch Leven Ramsar site qualifies under **Criterion 3c** by regularly supporting internationally important wintering populations of Icelandic/Greenlandic pink-footed geese *Anser brachyrhynchus* (1993/94–97/98 winter peak mean of 17,163, 8% of total population, all of which winters in Britain) and shoveler *Anas clypeata* (1993/94–97/98 winter peak mean of 509, 1% of NW European & 5% of British).

Area: 1,608ha

National Grid Reference: NO 145015

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Appendix 5 – Species

The Wildlife and Countryside Act 1981

This is a key Act, which makes it an offence to intentionally kill, injure, or take any wild bird or their eggs or nests (except for species listed in Schedule 2). Special penalties are available for offences related to birds listed on Schedule 1, for which there are additional offences of disturbing these birds at their nests, or their dependent young. The Act also prohibits certain methods of killing, injuring, or taking birds, restricts the sale and possession of captive bred birds, and sets standards for keeping birds in captivity.

The Act makes it an offence (subject to exceptions) to intentionally kill, injure, or take, possess, or trade in any wild animal listed in Schedule 5, and prohibits interference with places used for shelter or protection, or intentionally disturbing animals occupying such places. The Act also prohibits certain methods of killing, injuring, or taking wild animals.

The Act makes it an offence (subject to exceptions) to pick, uproot, trade in, or possess (for the purposes of trade) any wild plant listed in Schedule 8, and prohibits the unauthorised intentional uprooting of such plants.

The Habitats Directive

While the focus of the Habitats and Birds Directives is the creation of protected areas, both Directives acknowledge the importance of habitat and species protection in the wider countryside and make provisions to help achieve this. In particular, Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora requires Member States to take the requisite measures to establish a system of strict protection for the animals and plants listed in Annex IV of the Directive, wherever they occur within their natural range. There are more than a dozen European Protected Species in Scotland.

The Biodiversity Convention

The Convention on Biodiversity was adopted at the Earth Summit in Rio de Janeiro, Brazil in June 1992. In the UK the Government launched the UK Biodiversity Action Plan, a national strategy that identified broad activities for conservation work over the next 20 years, and established fundamental principles for future biodiversity conservation. A number of Biodiversity Action Plans (UKBAP) have been produced for selected habitats and species, and some areas have developed local biodiversity action plans (LBAP).

Red Data Book Species

Red Data Books list species that are threatened or endangered. In the past species in Britain were included as Red Data Book species if they occurred in fewer than 15 10km x 10km squares. Britain is moving towards the IUCN (The World Conservation Union) criteria which categorises species as Extinct, Extinct in the Wild, Critically Endangered, Endangered or Vulnerable.

JNCC has published the new Red Data List for Vascular Plants in April 2005 – it is available on the JNCC website and uses IUCN criteria.