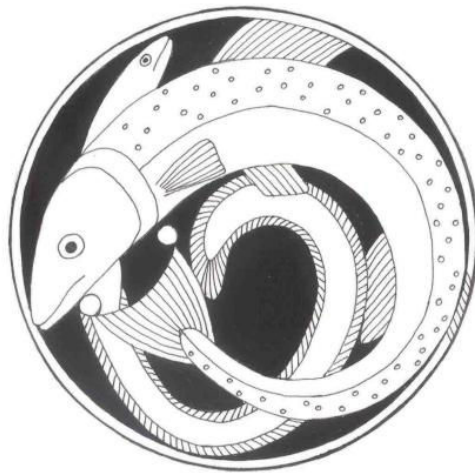


Lochaber Fisheries Management Plan

2008



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INTRODUCTION

This management plan takes strategic view of freshwater fisheries management in Lochaber and aims to encourage evidence-based best practice across the region. It is hoped the plan will provide a resource on which organisations and individuals can draw to ensure the conservation of freshwater habitats and the sustainable exploitation of healthy fish stocks in Lochaber.

The plan has been prepared by Lochaber Fisheries Trust (LFT), a charitable organisation dedicated to the provision of scientific information to inform fisheries management. The Trust has no statutory remit or direct control of fisheries management. Therefore, implementation of this plan will depend on partnerships with other organisations and individuals, notably the Lochaber District Salmon Fishery Board (LDSFB), Regional Fishery Sub-boards and management groups, fisheries proprietors, river managers, local anglers, the aquaculture industry, Scottish Government (SG), Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA), Forestry Commission (FC) and the Highland Council. All these stakeholders were invited to comment on drafts and contribute to the final plan.



AIMS AND OBJECTIVES

The management plan aims to produce a holistic approach to fisheries management in Lochaber incorporating current best practice and scientific knowledge. It presents an analysis of the problems faced by fish populations and freshwater habitats and suggests practical actions that can improve fishery and a structured plan to monitor fish populations and the effectiveness of management actions.

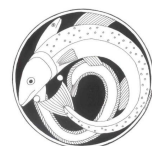
The key objectives for fisheries management in Lochaber are to:

- Collect and maintain baseline information on fish populations and freshwater habitats in Lochaber to inform commercial exploitation and conservation management
- Identify factors limiting fish populations and propose solutions or mitigation measures
- Maintain appropriate biodiversity of freshwater habitats
- Ensure the exploitation of commercial fish species is sustainable and responsibly managed
- Preserve the genetic diversity of fish populations
- Map and remove non-native species from freshwater habitats and prepare contingency plans to deal with the risk of future invasion of non-natives.
- Raise public awareness of fisheries, fish and freshwater environments

The plan sets out a vision for fisheries management in Lochaber for the next 5 years. It is not limited to work of the LFT, but includes all the management interventions required with suggested lead agencies. This implies no commitment from other agencies or individuals to carry out these actions, but merely identifies those with a relevant interest and capability. The plan will be constantly reviewed as more information becomes available and will be completely reviewed after 5 years with input from relevant groups.

This fisheries management plan does not exist in isolation. The Water Framework Directive (WFD) requires the SG to produce a River Basin Management Plan (RBMP) for the Scotland Basin District, which covers the majority of Scotland. Eight Area Management Plans are currently being produced that together will constitute the national RBMP. Lochaber is covered by two of these Area Management plans: the West Highland plan in the far north west of the region and the Argyll plan, which covers the majority of Lochaber. The plans take a holistic, river catchment-based approach to improving the water environment. Their scope is much wider than the fisheries issues discussed here, but there are obvious overlaps and synergies between the two.

The LFT is part of the Lochaber Biodiversity Group. The Lochaber Biodiversity Action Plan contains a number of objectives relevant to fisheries and freshwater management including: reducing erosion and siltation of watercourses; increasing riparian woodland and raising awareness of the importance of freshwater habitats amongst the public. Priority habitats and species listed in the plan include: oligotrophic lochs, active shingle rivers, salmon, sea trout, brown trout, arctic charr, lamprey and freshwater pearl mussels.



BACKGROUND INFORMATION

REGIONAL OVERVIEW

The Lochaber region covers an area of 5180km² and includes a number of major river catchments and many small rivers and burns. The major catchments are illustrated in Figure 1.

Lochaber is famed as a region of hills and high rainfall. The result is spate rivers with highly variable flow rates and often unstable substrates. The smaller rivers in the region rise and fall dramatically with changes in the weather and even the larger rivers experience little buffering in flow rates due to their steep catchments. Rivers in the region are relatively short with few major tributaries and small catchments compared to the large east coast rivers. The coastline is highly indented by numerous sheltered sea lochs that have provided the conditions required for the development of a large aquaculture industry in the region.

The geology of the area is dominated by Moine schists and granitic gneiss, resulting in nutrient poor soils and run off (Figure 2). Land use is limited to rough grazing on moorland heath throughout much of the region. Small areas of non-native conifer plantations are present across Lochaber. More extensive tracts of coniferous forestry are present in Glen Nevis, the upper reaches the Lochy catchment (Glen Spean, Glen Pean, Glen Dessary, Loch Arkaig) and Glen Finnan and Glen Hurich (Shiel catchment). Native broadleaves are also widespread across the region and many rivers and burns are well wooded along their banks.

Four Sites of Special Scientific Interest (SSSI) in Lochaber have been designated for their freshwater interest of national importance. In addition, there are two Special Areas of Conservation (SAC) in the region designated for their internationally significant populations of freshwater pearl mussels, and Loch Shiel is designated as a Special Protection Area (SPA) for black-throated diver. Table 1 summarises sites designated for their natural heritage interest relevant to fisheries interests.

Table 1. Summary of sites designated for their freshwater interest. Details of the other notified interests of the listed sites and designated sites in Lochaber not directly related to fisheries issues can be found through the SiteLink facility of the SNH website (www.snh.org.uk).

Site	Designation	Notified features/Qualifying interests
Ardnamurchan Burns	SAC	Freshwater pearl mussel
Glen Beasdale	SAC	Freshwater pearl mussel, otter
Loch Morar	SSSI	Oligotrophic loch
Loch Shiel	SSSI, SPA	Oligotrophic loch, black-throated diver
River Moidart	SSSI, SAC	Freshwater pearl mussel
Strontian River	SSSI	Oligotrophic river

SEPA have classified all Scottish rivers based on their ecological and chemical status. Six categories are recognised: high, good, moderate, poor, bad and unmonitored. Water bodies that have been subject to a high degree of human modification are



termed ‘heavily modified water bodies’ under SEPA’s scheme and it is their ecological potential rather than status that is classified and monitored. The classification of each individual river is provided in the following section summarising each catchment. More detailed information is available from the SEPA website: <http://gis.sepa.org.uk/rbmp/MapView.aspx>.

Fish Stocks

Salmon *Salmo salar*, sea and brown trout *Salmo trutta*, Arctic charr *Salvelinus alpinus*, brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus*, European eel *Anguilla anguilla*, stone loach *Nemacheilus barbatulus*, three-spined stickleback *Gasterosteus aculeatus* and flounder *Platichthys flesus* have been recorded in Lochaber and are native to north Scotland. Freshwater pearl mussels *Margaritifera margaritifera* are present in a number of Lochaber’s burns and rivers. In addition, minnow *Phoxinus phoxinus*, pike *Esox lucius* and rainbow trout *Salvelinus fontinalis* have been introduced and are established in the region. Salmon, sea trout, brown trout, pike and rainbow trout are exploited by anglers. Fisheries management in Lochaber is primarily directed at salmon and sea trout stocks with some management of brown trout fishing.

Status of Stocks

West coast stocks of salmon and sea trout suffered dramatic declines in the late 1980s and early 1990s. On some rivers rod catches of salmon and sea trout were reduced by up to 90%. There have been some signs of recovery on certain rivers, but others have shown no upward trend and migratory salmonid stocks on all rivers remain at historically low levels. It is important to acknowledge that rod catch data do not provide an accurate measure of fish population size and is subject to variation in catch effort. However, they are the best measure of fish returns available for most rivers in Lochaber, as only the Rivers Lochy and Morar have operational fish counters.

Data on eel populations in Lochaber are poor as in the rest of Scotland. Eel stocks across Europe have suffered massive declines in recent years and the International Convention on the Exploitation of the Sea (ICES) estimates that the number of glass eels reaching European rivers has declined to just 1% of its level in the mid 1980s. It is unclear whether this reflects the situation in north Scotland or not. Much of the decline in Europe has been attributed to commercial eel fisheries, of which there are none in Lochaber. However, changes in ocean currents have also been implicated in the decline of eels stocks and these would affect populations on the west coast of Scotland.

The most recent survey of lamprey populations in the region was carried out by SNH in 2003/4 as part of a national study. Brook lamprey were found on the Aline, Inverie, Shiel and in high numbers on the Lochy. River lamprey were recorded from the Shiel. Lamprey larvae that could not be identified as either brook or river lamprey were found on the River Scaddle. No lamprey larvae were found during surveys on the Ailort, Moidart and Strontian, though the LFT’s data indicate brook lamprey are present on the Strontian. Sea lamprey were not recorded in Lochaber. There are historical records of sea lamprey on the Lochy system, but local anglers report an absence of the species in recent years.



Populations of freshwater pearl mussels on the River Moidart, Ardnamurchan Burns and Glen Beasdale SACs are monitored every six years by SNH. In the most recent surveys carried out between 1998 and 2004, all three SACs were classed as being in unfavourable condition due to the small size of the mussel population and lack of young mussels present. Freshwater pearl mussels in rivers other than these designated sites are not routinely monitored.

There are no data available on the status of other fish stocks in Lochaber.

Ongoing monitoring of fish stocks and riparian habitats has generally been poor in recent years in Lochaber. In the past the LFT carried out routine electrofishing surveys of juvenile salmonids across the region. However, an unwillingness to fund this work has meant that recently juvenile surveys have been much less systematic and there are now significant gaps in the long-term datasets that had been collected since 1996. Habitat surveys have not been carried out on most rivers since 2000.

Fisheries Management Structures in Lochaber

A number of organisations play a role in fisheries management and the conservation of fish and freshwater environments in Lochaber:

Lochaber Fisheries Trust.

The LFT is an independent charity that provides objective scientific advice on fisheries management and freshwater conservation. LFT is part of RAFTS, a network of Fisheries Trusts and Foundations across Scotland.

Lochaber District Salmon Fisheries Board.

The LDSFB is the statutory authority charged with protecting and improving salmon fisheries in Lochaber. The Board is made up of elected riparian owners and employs a part-time clerk. It has powers to appoint bailiffs, raise levies on salmon fisheries, licence stocking and is a statutory consultee on certain developments that could impact on fisheries. In Lochaber much of the practical management function of Fisheries Boards has been devolved to the Morar and Shiel sub-boards and other management groups that cover individual river catchments. The LDSFB is a member of the Association of Salmon Fishery Boards (ASFB), an umbrella group of all Scotland's District Salmon Fisheries Boards.

River Proprietors.

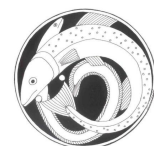
Rights to fish salmon and sea trout are bought and sold separately from land ownership, though in practice fishing rights are often held by adjacent landowners. Proprietors are required to pay a levy to the LDSFB based on the rateable value of their fish stocks. Many proprietors invest in improving and managing their fish stocks through stock monitoring, habitat improvement work, stocking and the employment of river managers and bailiffs.

Scottish Environment Protection Agency.

SEPA are a non-departmental government body charged with the protection of the environment. They are responsible for the implementation of the WFD, European legislation introduced in 2006 that seeks to improve the quality of water environments through the production of RBMPs and regulation of activities that can impact on water environments.

Scottish Natural Heritage.

SNH are the non-departmental government body that provides advice to government on nature conservation and oversees activities on sites designated for their natural



heritage interests. SNH also provides grants to conservation and community organisations for projects that improve the natural heritage.



Tripartite Working Group

The TWG was set up in 1999 with the aim of facilitating dialogue between the aquaculture industry and wild fish interests to allow the sustainable growth of both sectors. Under the direction of the TWG, Area Management Agreements (AMAs) have been set up to share information and best practice between local wild fish interests and aquaculture companies operating in a particular area. There are three AMAs in Lochaber:

- The Linnhe/Lorne/Etive/Sound of Mull/Sunart AMA was signed in 2002 and covers a large area including the southern part of Lochaber;
- The Ailort AMA was signed in 2007 and covers Loch Ailort;
- The Nevis AMA was signed in 2006 and covers Loch Nevis, Loch Morar and the coast south to Arisaig.

Current Fisheries Management Activities

The level of fisheries management activity varies greatly between rivers in Lochaber. The larger systems are able to employ dedicated staff and invest in management programmes. Smaller rivers rely on the voluntary input of anglers and other interested individuals and are thus less able to undertake resource-intensive management options.

Considerable effort is expended by river managers, bailiffs and volunteers in tackling poaching of salmon and sea trout in both coastal areas and on rivers. Both nets and non-permitted fishing are encountered regularly and successful prosecutions of offenders have been brought in recent years. Most rivers do not have warranted bailiffs, but many are regularly patrolled by local fishermen, who report incidents to local managers or the LDSFB.

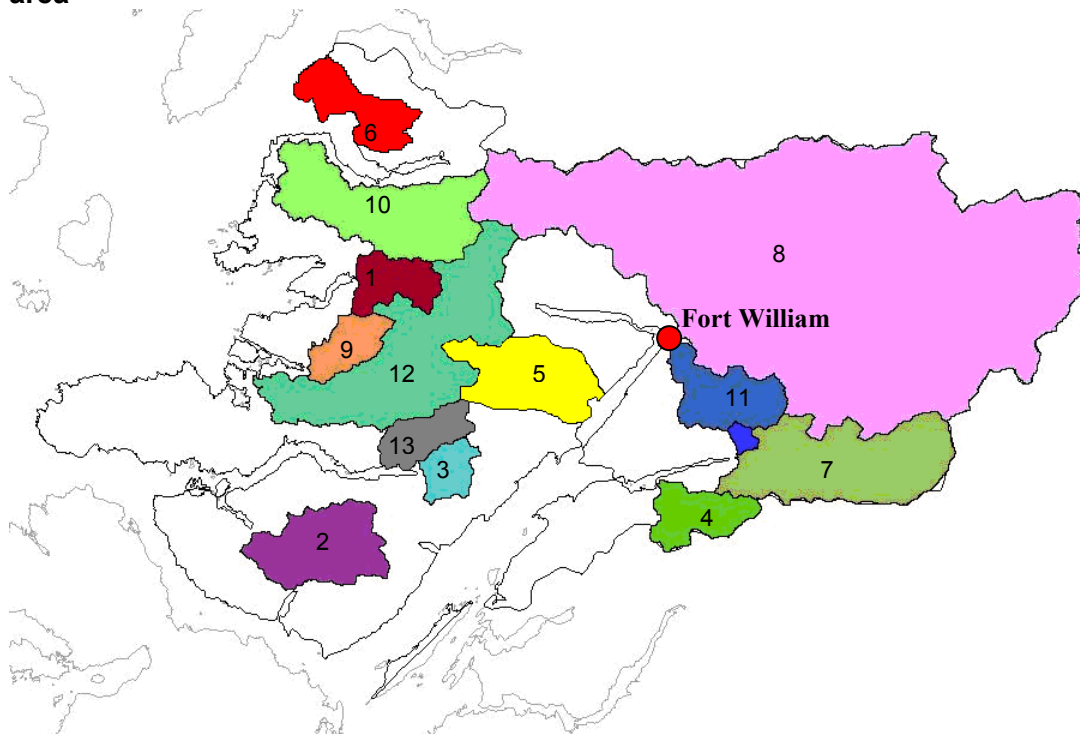
Artificial stocking of native salmon and sea trout is common in Lochaber. The stocking activity known to be taking place in Lochaber is summarised in Table 2. All stocking must be licenced by the LDSFB.

Predators of salmonids such as mergansers, goosanders and seals are protected by law and can only be shot under licence. In the past the River Lochy Association shot mergansers on the River Lochy under licence. Licences have not been applied for in recent years and shooting to scare rather than kill birds is the preferred tactic on most rivers.

Given the number and diversity of catchments within the Lochaber region, the physical characteristics, fish populations and fishery of each are described separately below.



Figure 1. Map of the major catchments in the Lochaber area



1	Ailort	8	Lochy
2	Aline	9	Moidart
3	Carnoch	10	Morar
4	Coe	11	Nevis
5	Cona and Scaddle	12	Shiel
6	Inverie and Guiserein	13	Strontian
7	Leven		

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Table 2. Summary of Artificial stocking carried out in Lochaber

River	Species	Native	Stage stocked
Abhainn na Coinnich	Sea trout	No – Lochy stock	Fed fry
Ailort	Sea trout	Yes	Fed fry
Aline	Salmon	Yes	Fed fry
Guiserein	Sea trout	No – Seafield Centre	Fed fry
Inverie	Sea trout	No – Seafield Centre	Fed fry
Lochy	Salmon	Yes	Fed fry and smolts
Moidart	Sea trout	Yes	Fed fry
Morar (suspended in 2007, decision still to be made about continuation)	Salmon and Sea trout	Yes	Salmon – fed fry Sea trout – ova and fed fry
Cona and Scaddle	Salmon and Sea trout	Yes	Fed fry
Shiel and Shiel tributaries	Salmon and Sea trout	Yes	Fed fry

INDIVIDUAL CATCHMENTS

1. River Ailort

WFD Classification: River Ailort – good; Loch Eilt – moderate.

▪ Catchment

The River Ailort stretches 3km between Loch Eilt and its outflow into Loch Ailort. The catchment is predominantly nutrient-poor rough grassland and heather moor with small areas of broadleaf trees and peatland.

Loch Ailort contains Scotland's oldest salmon farm, which began operation in 1967. The farm is sited 1km from the mouth of the Ailort and until recently was used as a broodstock and research facility. The Loch Ailort AMA was signed in 2007.

▪ Fish populations

Salmon, sea trout and eels have all been recorded in the Ailort catchment. Electrofishing surveys suggest the burns flowing into Loch Eilt provide important spawning areas for trout, but salmon spawning may be more concentrated on the mainstem of the Ailort.

▪ Fishery

The Ailort once supported one of Scotland's premier sea trout fisheries. Rod catch data show a severe decline of sea trout took place in the late 1980s, culminating in a collapse in 1989. Sea trout stocks remain at historically low levels. Native sea trout are stocked in the river as fed fry. Historically salmon fishing on the Ailort was of secondary importance but an established salmon fishery is also present on the river. Salmon rod catches declined at the same time as the sea trout, but the magnitude of the decline was less pronounced for salmon.

2. River Aline

WFD Classification: River Aline – Good; Rannoch River – poor.

▪ Catchment

The River Aline flows through the Morvern peninsula and drains into the Sound of Mull. It consists of two major tributaries, the Black water and the Abhainn a Ghlinne Ghil, which join with the outflow from Loch Arienas to form the River Aline. The catchment is mainly heather moorland with some rough grassland and improved grassland on the flatter ground. A large area in the west of the catchment has been planted with non-native conifers. The topography of the area is relatively rolling with much of the ground between 0 and 300m and only small areas rising up to 600m.

There are no artificial barriers to fish migration. Electrofishing surveys have shown juvenile salmon to be present above the Black Glen Falls, demonstrating that this natural obstacle is passable by salmon. A small run-of-the-river hydro scheme is proposed on the River Rannoch, which flows into Loch Aline just east of the River Aline.



Scottish Sea Farms operate a commercial smolt rearing site on Loch Arienas. A number of fish farms are present in the Sound of Mull, the closest, Fishnish, is 3km from the mouth of the Aline.

- **Fish populations**

Salmon, sea trout, brown trout, eel, minnow and brook lamprey have been recorded from the Aline catchment. Feeder streams of Loch Arienas and Loch Doire nam Mart appear to make up the most important trout spawning areas.

- **Fishery**

The River Aline catchment supports fisheries for salmon, sea trout and brown trout. Salmon fishing is concentrated on the mainstem of the River Aline and on the Abhainn a Glinne Ghil, upstream as far as Uilleann (NM7450). Sea trout fishing is practiced in the river and on Loch Arienas. Brown trout fishing is largely confined to Loch Arienas with occasional anglers also fishing the Black Water. Brown trout fishing has become more important on the loch since the declines in sea trout numbers in the 1990s. Smolt cages are present in Loch Arienas and some very large trout (up to 14lb) are now caught each year near the cages. Stocking of native salmon as fed fry began on the Aline in 2007.

3. River Carnoch

WFD Classification – Heavily modified water body, good ecological potential

- **Catchment**

The River Carnoch runs through a steep-sided river plain into Loch Sunart. Loch Sunart is designated as an SSSI, SAC and Marine Conservation Area for its natural heritage interest. The catchment is a mix of rough grassland and heather moorland with small patches of broadleaf woodland and some conifer plantation. A small hydroelectric scheme is currently being constructed on a tributary of the River Carnoch.

Three fish farms operated by Marine Harvest are currently present in Loch Sunart. A farm at the head of the loch near to the mouth of the Carnoch was relocated in 2006. The Loch Sunart farm sites are included within the Linnhe/Lorn AMA.

- **Fish Populations**

Salmon, sea trout, brown trout and eels are known to be present on the River Carnoch. Salmon and sea trout appear to be limited to the lower reaches of the river.

- **Fisheries**

The Carnoch supports a salmon and sea trout fishery with most fishing confined to the lower stretch of the river including the sea pool. In recent years salmon and sea trout numbers have been reported as being very low and juvenile electrofishing surveys confirm this with low densities of salmon and trout fry and parr present. All fishing is leased to the Strontian Angling Club, which provides a limited amount of voluntary bailiffing. Poaching on the sea pool has been a significant problem in the past.



4. River Coe

WFD Classification – moderate

▪ Catchment

The River Coe cuts through Glen Coe with the soaring ridges of Bidean nam Bam and Aonach Eagach on either side. The river contains both fast flowing torrent and gentle meanders with the shallow Loch Achtriochtan in the centre of the slow-flowing section. The catchment is mainly steep heather moorland, though the flat glacial valley bottom supports rough and improved grassland. There is some native and non-native broadleaf woodland and blocks of conifer plantations within the catchment.

Glencoe village sits at the mouth of the river where it flows into Loch Leven. The main A82 follows the path of the river and bridges it in two places. Improvement work is currently being carried out on the bridge at the western end of the Glen. There has been some concern that bank stabilisation work along the river has affected flow rates and may have damaged redds.

A large rock of approximately 15 tonnes is currently blocking the passage of fish at the lower falls. It is thought this rock was knocked into the river by a fallen oak tree ten years ago. Fallen trees have often formed temporary obstacles to migratory fish at the lower falls.

A fish farm is present in Loch Leven approximately 2km from the mouth of the river. Loch Leven is included within the Linnhe/Lorn AMA.

▪ Fish Populations

Salmon, sea trout, brown trout and minnow have been reported from the catchment. It is likely eels are also present. Until 1930, migratory salmonids could ascend only as far as the waterfall at Clachaig. Construction of a fish pass when the road was improved allowed access to large areas of spawning habitat upstream of the falls. Loch Achtriochtan was stocked with rainbow trout in the past, but this ceased 12 years ago.

▪ Fisheries

Salmon and sea trout are fished on the River Coe. Based on rod catch data, salmon and sea trout stocks collapsed in the early 1990s and signs of recovery have generally been short-lived. Six proprietors have fishing rights on the river. The Glencoe Angling Club fishes the lower reaches. The middle reaches of the river are owned by the National Trust for Scotland, who do not exercise their fishing rights at present.

Poaching has been a significant problem on the River Coe and incidents of poisoning with Cyamag have been reported.



5. Rivers Cona and Scaddle

WFD Classification – good

▪ Catchment

The Rivers Cona and Scaddle flow roughly parallel in an easterly direction until they converge shortly before entering Loch Linnhe. They both flow through catchments dominated by heather moorland with significant areas of native broadleaf and conifer woodland.

Two fish farms are present above the Corran Narrows on Loch Linnhe. The Gorston site is 2km north and the Ardgour site 3km to the south of the mouth of the rivers. Both farm sites are part of the Linnhe/Lorn AMA.

▪ Fish populations

Salmon, sea trout, brown trout, eels and lamprey are present in both the Rivers Cona and Scaddle.

▪ Fisheries

Salmon and sea trout fishing on the River Cona is owned and managed by Cona Glen Estate. The Scaddle fishery is also part-owned by the neighbouring Ardgour Estate. Salmon and sea trout fed fry, derived from native broodstock, are artificially stocked on both rivers.

6. Inverie and Guiserein

WFD Classification: Inverie – moderate; Guiserein – good.

▪ Catchment

Knoydart is a remote and hilly area and both the Inverie and the Guiserein flow through steep catchments of heather moorland. Land use is predominantly rough grazing for sheep and deer stalking. There is some native broadleaf woodland and areas of conifer plantation. Planting of native broadleaves is planned along parts of the Inverie. Movement of gravel on the Guiserein has resulted in the infilling of pools that are periodically excavated by the river manager. A small hydroelectric dam operates on the River Inverie. There are three fish farms on Loch Nevis operated by Scottish Sea Farms.

▪ Fish populations

Salmon, sea trout, brown trout and eels have all been recorded from the Guiserein. The Inverie supports the above species and populations of flounder, stickleback and brook lamprey. Migratory fish can only access the lower 10km of the Guiserein due to impassable falls.

▪ Fisheries

The Inverie supports a fishery for salmon, sea trout and brown trout owned and managed by Kilchoan Estate. Most fishing is carried out on the lower river, but there is also boat fishing on Loch an Dubh-lochan for brown trout. Historically the Inverie supported a large sea trout fishery, but sea trout are now scarce on the river. The



Guiserien supports salmon and sea trout fishing below the falls, though due to low stock numbers the river has been little fished in recent years. Fishing on the river is owned and managed by Inverguiserein Estate. Non-native sea trout from the Seafield Centre, Wester Ross, are currently stocked out on the Inverie and Guiserein as fed fry.

7. River Leven

WFD Classification – Highly modified water body, good ecological potential.

▪ Catchment

The River Leven catchment consists of steep-sided hills blanketed in heather moorland. The River flows into the head of Loch Leven, a narrow 10km sea loch that joins with the lower end of Loch Linnhe.

The area has been much modified by engineering works associated with power generation for the Alcan aluminium plant. The smelting plant in Kinlochleven is now closed, but electricity generation still takes place to power Alcan's smelter in Fort William. A large dam on the Blackwater Reservoir provides water for the turbines with the outflow discharging into the lower reaches of the River Leven. A smaller dam is present on Loch Eilde Mor, the outflow of which joins the River Leven approximately 1 km above its tidal limit. The Scottish Canoe Association is planning to install a pair of groynes on the lower reaches of the River Leven to create faster flows. A salmon farm is present towards the western end of Loch Leven approximately 8km from the mouth of the river.

▪ Fish populations

Salmon, sea trout, eels, flounder and minnow have all been recorded from the Leven. Migratory salmonids cannot ascend further than McKays falls about 2km above the tidal limit.

▪ Fisheries

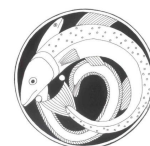
Salmon and sea trout are fished on the River Leven and brown trout fishing occurs on Loch Eilde Mor and Blackwater Reservoir. Fishing rights are leased to the Leven Angling Club, which provides voluntary bailiffing and management.

8. River Lochy

WFD Classification: River Lochy – highly modified water body, good ecological potential; River Spean - highly modified water body, good ecological potential; Loch Lochy - highly modified water body, good ecological potential; Loch Arkaig – high; River Loy – moderate; Rivers Pean & Dessary – good; Rivers Gloy & Roy – high.

▪ Catchment

The Lochy catchment is the largest in Lochaber and includes a number of sizeable tributaries, notably the Rivers Spean and Roy, and the large oligotrophic lochs Arkaig and Lochy. Loch Arkaig forms the upper part of the catchment with its principal tributaries, the Rivers Dessary and Pean flowing into its western end. The River Arkaig to the east of the loch joins with Loch Lochy, whose outflow is the main River



Lochy. The Rivers Spean and Roy both flow into the upper reaches of the Lochy from the east. The Lochy catchments covers a range of topography including high mountain ranges and the flat river plain through which the Lochy mainstem meanders. The majority of the catchment is moorland heath, but flat areas along the river plain are improved for silage and cattle grazing.

The Lochy catchment has been heavily modified by human activity. There are extensive areas of conifer plantation within the catchment particularly along Loch Arkaig, Glen Dessary, Glen Pean and Leanachan Forest to the south of the River Spean. The Caledonian Canal was constructed between 1823 and 1825. It branches off from Loch Lochy at Gairloch and runs parallel to the River Lochy for 7km before joining the sea at Banavie. The Mucomir Barrage is a large Hydro electric dam installed at the top of the River Lochy in the late 1950s. The dam incorporates a smolt pass to allow the downward migration of migratory salmonids and a Borland lift to allow the upstream migration of adults. The fish pass at the top of the Borland lift is fitted with a Mark 11 automatic fish counter. The Laggan dam at the top of the River Spean is used for electricity generation by Alcan. This dam was installed in 1919 and a considerable amount of water has been abstracted from the Spean ever since. Scottish Water abstracts water from the main River Lochy at Camisky for drinking water supply.

Marine Harvest operate salmon smolt rearing cages on Loch Arkaig. A rainbow trout farm is present at the southern end of Loch Lochy run by Scot Trout. There have been a number of rainbow trout escapes from the farm and rainbow trout are regularly caught in Loch Lochy, Loch Arkaig and the canal. There are two marine salmon farms in the upper Loch Linnhe above the Corran Narrows operated by Marine Harvest. The freshwater and marine farm sites are included in the Linnhe/Lorn AMA.

▪ **Fish populations**

Salmon, sea trout, brown trout, eel, brook lamprey, stickleback, flounder and stone loach have all been recorded from the Lochy catchment. Arctic charr are present in Loch Arkaig. Minnow and pike have become naturalised in the catchment and rainbow trout are regularly caught and have presumably come from the farm on Loch Lochy.

Salmon are known to migrate through the canal. The canal was drained in winter 2006 for maintenance and was found to contain brown trout, rainbow trout, pike and large numbers of eels.

▪ **Fisheries**

The River Lochy supports the largest salmon fishery in the region accounting for 85% of the salmon caught in Lochaber. Fishing of salmon and sea trout on the main river is owned by the River Lochy Association and let on a commercial basis. The RLA also owns fishing rights on the River Roy to protect important spawning grounds. Salmon and sea trout are also fished on the Rivers Roy, Spean, Dessary and Pean. The River Lochy Association employs a full time river manager, river watchers and bailiffs. They have undertaken an aggressive stocking programme in the past decade and stock hundreds of thousands of fry and smolts of native origin throughout the catchment.



The River Lochy suffered a dramatic decline in sea trout and salmon numbers in the 1990s. In recent years salmon rod catches have improved considerably, possibly due to improvements in lice management on Linnhe farm sites and the RLA's stocking programme. However, salmon numbers are still variable between years and grilse returns show a biannual cycle of good and poor years. Sea trout numbers have remained at historically low levels.

Lochs Arkaig and Lochy are fished for brown trout (including ferox trout) and pike. Loch Arkaig is covered by a protection order, but fishing on Loch Lochy is largely unregulated.

9. River Moidart

WFD Classification – good.

▪ Catchment

The River Moidart drains an area of relatively modest hills and meanders through a wide river plain before entering the shallow inlet of Loch Moidart. The catchment is dominated by heath and peatland, but there are also areas of broadleaves, non-native conifers and rough and improved grassland close to the river.

The River Moidart is designated as a SSSI and SAC for its internationally important population of freshwater pearl mussels.

A commercial salmon hatchery operates at the lower end of the River Moidart, abstracting water from the river.

▪ Fish populations

Salmon, sea trout, brown trout, eel, flounder, three-spined stickleback and minnow have all been recorded from the River Moidart. The freshwater pearl mussel population in the river have been classed as 'unfavourable, no change' by SNH following a survey in 1998.

▪ Fisheries

Salmon and sea trout are fished on the River Moidart. In the past sea trout was the most important species, but the decline in sea trout numbers seen in many west coast rivers since the 1990s has led to salmon becoming the more frequently caught species on the Moidart. The river does not have a dedicated fisheries manager, but the estates that own the fishing do invest in the fishery, and a programme of stocking native sea trout is currently underway.

10. River Morar

WFD Classification: River Morar – highly modified water body, good ecological potential; Loch Morar – high; Alt an Loin – poor; River Moeble – good.



- **Catchment**

The large oligotrophic Loch Morar is Scotland's deepest loch, and the river that drains it is, at just 400m long, the country's shortest salmon river. The main salmonid spawning areas on the system are the River Moeble and the many burns entering Loch Morar. Heather moorland and rough grassland dominate the catchment, which is used as rough grazing for sheep and deer stalking. There are small, scattered areas of broadleaves.

A dam at the top of the River Morar generates hydroelectric power for Scottish and Southern Energy. The station began operation in 1948 and in recent years the turbines have shutdown during the smolt run to prevent damage to fish stocks. A Vaki counter is present in the fish pass providing validated counts of fish ascending and descending through the pass. During the main smolt run, a rotary screw trap is used in the river to provide accurate estimates of salmon and sea trout smolt production from the system.

- **Fish populations**

Salmon, sea trout, brown trout, Arctic charr, eel, flounder, three-spined stickleback and minnow have all been recorded from the Morar catchment.

- **Fisheries**

The River Morar supports salmon and sea trout fisheries. Sea trout were historically the most important species on this river, but following the collapse of sea trout stocks on the west coast, salmon have gained greater prominence in the catch records. Loch Morar is fished for brown trout (including ferox), sea trout and occasionally salmon. There is a protection order in place on Loch Morar administered by the Loch Morar Liaison Group.

Management of salmonid stocks on Morar is overseen by the Morar District Salmon Fishery Sub-board. A full-time fisheries manager is employed to patrol the catchment, run any stocking activity and carry out other management and research work including the operation of the screw trap and Vaki counter. Voluntary assistance with poaching control is provided by the local angling club. Until 2007 native sea trout were stocked in the system as ova or fed-fry. The future of the stocking programme will be reviewed in light of the impact a two-year break in stocking has on adult return rates. Estimates of smolt output and adult returns of migratory salmonids on the Morar are the most accurate in the region due to the screw trap and Vaki counter data. This should provide valuable information about the efficacy of management interventions such as stocking, as well as important data on marine survival rates.

11. River Nevis

WFD Classification – moderate

- **Catchment**

The catchment of the River Nevis includes some of the country's highest mountains. Numerous fast-flowing burns run down the steep slopes to the bottom of the glacial



valley through which the Nevis flows. The hills are largely covered in heather moorland, though there has been extensive planting of non-native conifers along the length of the glen. The flatter land close to the river has been improved for cattle grazing and there is well-developed broadleaf woodland along the banks.

Glen Nevis is a popular tourist attraction and the river and its banks are regularly used by canoeists, walkers and cyclists.

- **Fish populations**

Salmon, sea trout, brown trout, eels and flounder have all been recorded from the Nevis. Salmon and sea trout are not able to ascend the lower falls 8km up the river and there are no reports of eels above this point.

- **Fisheries**

The Nevis has historically been fished for salmon and sea trout. Both stocks collapsed during the late 1990s and though salmon numbers have shown signs of sustained recovery, sea trout remain rare on the river. Poaching has been a problem on the lower stretches of the river in the past, possibly due to its proximity to Fort William. Native salmon fry are currently stocked in the river as fed fry.

12. River Shiel

WFD Classification: River Shiel - good; Hurich - moderate; Polloch - poor; Finnan - good; Slatach – good; Loch Shiel – good.

- **Catchment**

The Rivers Callop, Finnan, Slatach, Scamodale, Polloch and numerous smaller burns enter Loch Shiel, which drains to the sea via the 4km long River Shiel. The catchment is dominated by heather moorland. There are extensive areas of non-native conifer plantations, particularly in Glen Hurich and Glen Finnan with smaller patches of native broadleaf and conifer woodland. Loch Shiel is designated as a SSSI for its oligotrophic loch interest and as a SPA for its breeding population of black-throated diver.

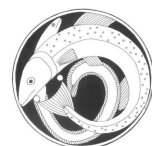
There are two salmon smolt rearing farms on Loch Shiel. These sites are currently not part of any AMA.

- **Fish populations**

Salmon, sea trout, brown trout, eel, river lamprey, brook lamprey, three-spined stickleback and minnow have all been recorded from the Shiel catchment.

- **Fisheries**

The River Shiel is fished for salmon and sea trout, though the dramatic decline in sea trout stocks in recent years has resulted in salmon being the major target species for anglers. Brown trout are also fished on the river in spring and early summer. The Rivers Polloch and Hurich are fished for salmon and sea trout and Loch Doilet provides brown trout fishing. The River Finnan historically supported a significant fishery, but only very limited fishing has been allowed in recent years to conserve depleted stocks. Loch Shiel is almost exclusively fished from boats due to its depth



and steep banks. In the past sea trout fishing was popular on the loch, though the decline in sea trout has been accompanied by an increase in large brown trout, which are now the major target species on the loch.

Sea trout suffered a catastrophic decline on the Shiel from the late 1980s. They have never recovered and only small numbers are seen in the catchment in any year. Salmon stocks also declined in the 1990s and remain at historically low levels.

Fisheries on the Shiel catchment are managed by the Shiel District Salmon Fishery Sub-board. A great deal of improvement work has been carried out by the Shiel Fishery Action Group, an organisation of local anglers and proprietors established in 2000. Restoration work has focused on a number of small hatcheries providing native fry and ova for stocking out on the system in recent years. There are no dedicated fishery managers on the Shiel, but a full-time employee of Loch Shiel Estate manages the fishery on the north bank of the River Shiel.

13. River Strontian

WFD Classification – good.

▪ Catchment

The Strontian River flows through a catchment of heather-clad hills, Atlantic oak woodland and conifer plantations to the sheltered Loch Sunart. The river has no major tributaries, but numerous burns run into it from the surrounding hills. Loch Sunart is designated as a SSSI and SAC partly for its marine interest, and the middle reaches of the River Sunart flow through the Ariundle Oakwoods National Nature Reserve.

In 2006 Scottish Water installed a weir on the Strontian River to provide drinking water for the village of Strontian. Construction of the weir resulted in significant problems with sedimentation. There are three salmon farms in Loch Sunart operated by Marine Harvest. These farms are covered by the Linnhe/Lorn AMA.

▪ Fish populations

Salmon, sea trout, brown trout, eel, brook lamprey and flounder have all been recorded from the Strontian.

▪ Fisheries

Salmon and sea trout are fished on the Strontian River mainly by the Strontian Angling Club with day permits available for visitors. Salmon and sea trout stocks collapsed in the late 1980s and since then there have been many years when no salmon or sea trout have been caught on the River. In 2006 fishing rights on the river were acquired by the Strontian Community Company. The Community Company and Angling Club have produced a restoration plan for the Strontian's salmon and sea trout populations based on habitat improvement and stocking of native fish.



FACTORS LIMITING FISH POPULATIONS

Most research and monitoring has focused on the survival of migratory salmonids and as a result this review will largely focus on salmon, sea trout. Other species will be considered where information is available.

The life cycles of salmon, sea trout and eels include both marine and freshwater phases. Salmon migrate to feeding grounds in the Atlantic Ocean and are thus affected by impacts on the high seas. Sea trout are thought to remain closer to shore and hence are more vulnerable to coastal influences. Both require high quality freshwater habitats for spawning and early growth. Eels spawn in the Sargasso Sea in the mid Atlantic. Their larvae migrate passively back to Europe transforming into elvers as they enter freshwater systems. Little is known about the spawning and migration of eels, but changes in marine currents and circulatory systems are likely to have a significant effect on their survival. Eels may spend up to fifty years in freshwater before migrating back to sea to spawn. They occupy a broader range of freshwater habitats and are more tolerant of poor water quality than salmonids.

MARINE SURVIVAL

Given the difficulties of conducting research at sea, relatively little is known about the survival of salmonids in the marine environment. Studies estimating smolt return rates suggest that marine survival is driving much of the decline in salmon and sea trout numbers. The North Atlantic Salmon Conservation Organisation estimates there has been a 75% reduction in the marine survival of salmon in the last 30 years. Factors such as sea temperature change, changes in food distribution, predation, disease and pollution are all implicated in affecting marine survival. It is likely that a suite of these factors and the cumulative effect of them have reduced marine survival.

There is presently little information about marine survival of salmonids from Lochaber's rivers. Reliable measures of smolt output and adult returns have been made on the River Morar in the past three years and will provide good estimates of marine survival rate once more years of data are collected. A project looking at the effect of the Mucomir Barrage on salmon migration from the River Lochy should yield good data on marine survival on stocked smolts from this system in future years.

Research into these areas requires huge resources and national and international cooperation. The SALSEA project brings together salmon interests from either side of the Atlantic and aims to establish the marine movements and distribution of salmon by capturing them at sea and tracing them to source rivers using genetic analysis. This will provide important basic information on how salmon use the marine environment and what factors could be reducing their survival rates at sea.

High seas fishery

A substantial mixed stock salmon fishery once operated off West Greenland. This fishery is now regulated by ICES and only a subsistence catch of approximately 20 tonnes is now taken off West Greenland. The Faroe Islands still retain their right to fish salmon at sea, but have followed ICES advice and no fishing has occurred in recent years. Coastal fishing for sea trout is a popular and unregulated sport along the



west coast of Scotland. The numbers taken by rod and line before they reach their spawning rivers is unknown.

Inshore fisheries

There are 15 licensed netting stations in Lochaber, of which approximately 75% are unused through agreements with wild fisheries interests. Exploitation rates at the remaining stations have not been released to the LFT. Given the location and timing of operation of some of the netting sites, it is likely they are exploiting mixed salmon stocks, making it difficult to assess their impact and ensure it is sustainable. There is currently no eel or elver fishery in the region, though the idea of netting elver on the Morar catchment was mooted some years ago.

Sea Lice

The indented coastline of the west coast of Scotland provides the ideal sheltered conditions for the development of salmon aquaculture. The expansion of fish farming in Lochaber and along the west coast coincided with declines in wild salmon and sea trout stocks and many have suggested a causal link. The proximate cause of this connection is thought to be sea lice *Lepeophtheirus salmonis* (Bjørn *et al.*, 2001; Butler, 2002; ICES, 1997; Tully *et al.*, 1993). Thousands of salmon held in sea cages could provide a reservoir for lice, increasing the number present in the environment and thus the rate of infestation on wild fish (Penston *et al.* 2008). Sea trout are thought to be particularly vulnerable to lice as they spend a greater time in the near shore areas where farms are located.

The effect of lice on the physiology and survival of sea trout and salmon has been well researched (Grimnes and Jakobsen 1996). Sea lice infection affects the ability of salmonids to cope with the transition from freshwater and sea water and life in the marine environment. A recent study indicated that 13 mobile stage sea lice was a high enough burden to initiate a physiological stress response in sea trout and post smolts (Wells *et al.* 2006).

LFT has been monitoring lice levels on wild sea trout post smolts since 1999. At two monitoring sites on Loch Linnhe there is a clear biannual pattern of lice burdens (Figure 2). This coincides with production cycles on fish farms; high lice levels are recorded on wild post smolts when farms on Loch Linnhe are in their second year of production. Many factors are likely to influence the prevalence and intensity of lice infestations on wild post smolts including water temperature and river levels. However, the cycling of lice burdens on fish in Loch Linnhe provides some of the most compelling evidence of a link between lice levels on wild and farm fish as no other environmental variable would show such biannual variation.

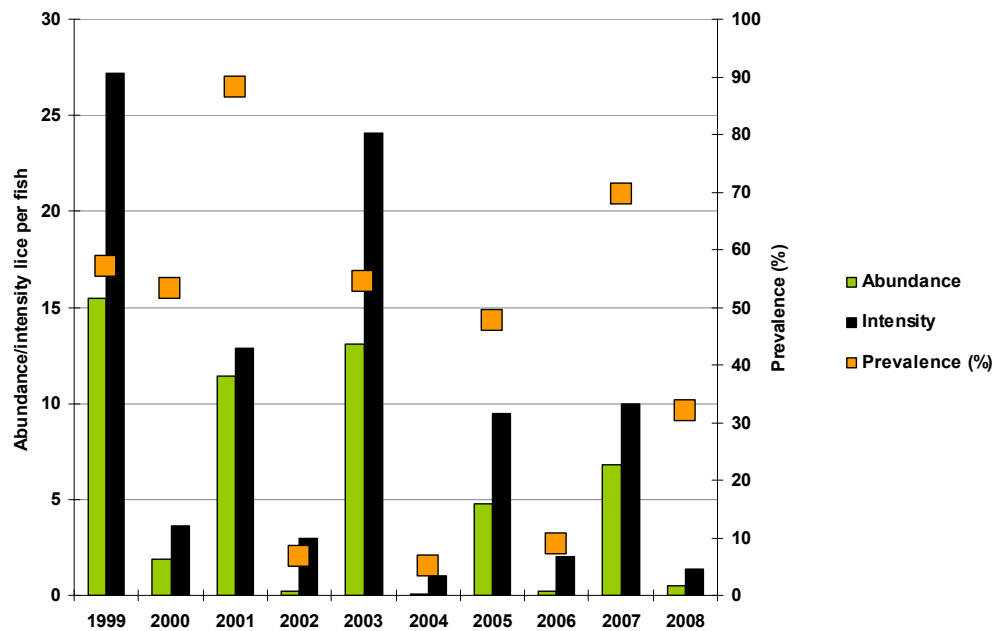
The control of lice levels on farms has improved in the last decade with the introduction of coordinated fallowing and improved in-feed and bath treatments. Such initiatives gathered pace with the creation of the TWG in 1999 and the signing of AMAs binding the aquaculture industry into best practice management. Improved lice control on farms has been reflected in the lice burdens recorded on wild post smolts with a general decline in lice levels imposed on the biannual pattern described above. Lice control on farms is heavily dependent on the in-feed treatment Slice (emamectin benzoate). Lice resistant to this treatment have been recorded from some farms and is likely to spread. The recent approval of Deltamethrin for use in Scottish



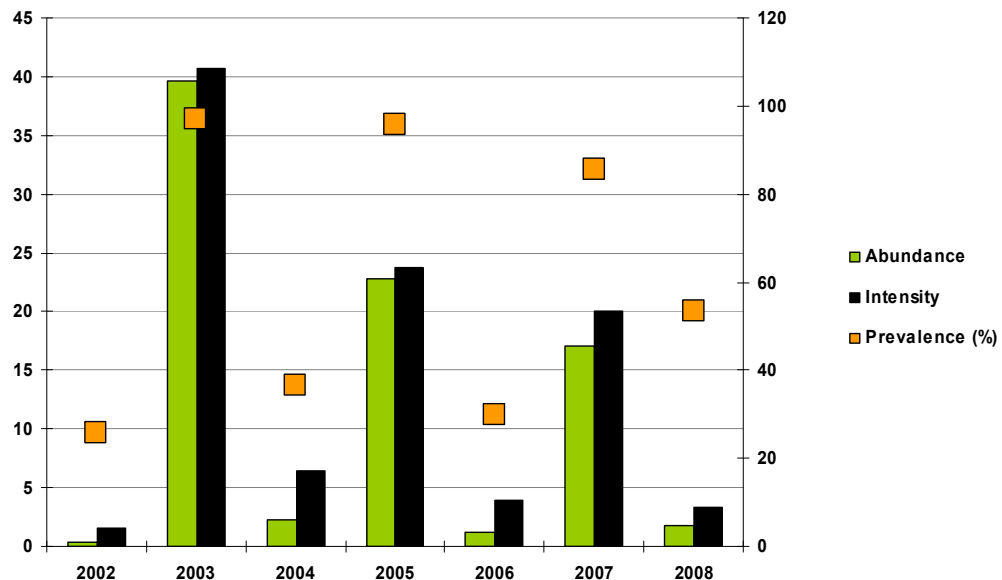
aquaculture should hopefully allow continued improvement in lice control in the face of Slice resistance.

Figure 2. Lice burdens on wild sea trout post-smolts caught by seine netting at Kinlocheil and Camas na Gaul on Loch Linnhe. Intensity = number of lice per infected fish; Abundance = number of lice per fish caught; Prevalence = percentage of fish carrying lice.

Kinlocheil



Camas na Gaul



Farm escapes

Wild salmon populations could also suffer from interactions with escaped farm fish. Farm escapes can compete with their wild counterparts on spawning grounds and disrupt local genetic adaptations in the wild population (Ferguson et al. 2007;



McGinnity et al. 2003; Naylor et al. 2005). Large scale escapes from marine farms have occurred along the west coast, though none have been reported from Lochaber in recent years. Farmed fish are frequently reported in the rod catch of rivers including the Lochy and Coe suggesting there may be repeated small scale escapes even in the absence of obvious breaches in farm cages or human error during fish transfer.

FRESHWATER SURVIVAL

Salmon and sea trout spawn in freshwater and spend at least one year in rivers, burns or lochs as juveniles. Eels spend the majority of their lives in freshwater and may live for over 50 years in the cold, low-nutrient systems of northern Scotland. Brown trout, brook lamprey, three-spined stickleback, stone loach and freshwater pearl mussels are restricted to freshwater and have little or no ability to move between catchments. All are adapted to the high quality nutrient poor freshwater habitats typical of the Highlands and are thus vulnerable to human influence on these habitats. Again, the majority of information available concerns salmonids and these species will form the focus of this review.

Barriers to migration

Salmon, sea trout, brown trout, eels and brook lamprey undertake upstream and downstream migrations along rivers in order to complete their life cycles. There are both natural and man-made obstacles to fish migration. Major obstacles have been described for each catchment in the section above. Natural barriers create freshwater habitats naturally devoid of certain fish species and such systems should be left. In contrast, man-made barriers can exclude fish from large areas of historical spawning habitat or reduce the salmon and sea trout smolt output of a river.

All hydroelectric dams are required to make provision for the movements of migratory fish where these are present. It is important to ensure that the fish passes or lifts in place allow the upstream movements of adults and the screening is adequate to prevent mortality or injury to ascending or descending fish.

The two most significant hydro-electric dams in Lochaber are the Mucomir barrage at the top of the River Lochy and the Morar dam. Both are operated by Scottish and Southern Energy and there is good communication between the company and fisheries managers. Past studies have shown that salmon and sea trout smolts are able to successfully negotiate the Mucomir barrage. However, there is anecdotal evidence that salmon smolts may congregate above the dam, delaying downward migration and exposing them to predators. There are concerns about the movement of sea trout smolts over the slip gate on the Morar dam as it drops into an area of rock and white water. SSE has designed a means of overcoming this problem and it is hoped work will commence in the near future.

A number of smaller hydro schemes are present in Lochaber and many are currently in the planning process. New schemes are regulated by the Fisheries Committee and SEPA to ensure minimum standards on fish passage, compensation flows and screening are met. LFT has contributed to a number of the newly proposed schemes to ensure the intakes and outflows are sited to minimise the effects on migratory fish. Of the existing small dams, the screening facilities on the Moeble dam (Morar catchment) are of concern and the LDSFB are working to improve this. LFT is



currently seeking funding to add a fish passage on the Allt Grigadale dam (Ardnamurchan) that prevents migratory fish accessing Loch Grigadale and spawning opportunities upstream.

Other potential obstacles include impoundment weirs, bridge structures, culverts and other engineering work. These are regulated by SEPA under the Controlled Activities Regulations (CAR), which state the presumption that provision should be made for the movement of migratory fish species.

Barriers to migration do not need to be physical. Recently a proposal to install groynes at the lower end of the River Leven to improve canoeing on the river received planning permission. The groyne height is below that covered by CAR and salmon and sea trout would be expected to jump such a height. However, the torrent created by the groyne would reduce the water temperature and potentially prevent or delay salmonids migrating upstream. The flow velocity created by the groyne would also prevent lamprey ascending the river. Neither river nor sea lamprey have been recorded from the Leven during recent surveys, but the presence of the groyne would effectively prevent any future colonisation.

Temporary barriers caused by the collection of trash in rivers can prevent fish migration. Such barriers occur regularly, particularly in areas where forestry is being harvested. Where followed, the FC's Forest and Water Guidelines should minimise these incidents during harvesting operations. A large rock knocked in by a fallen oak tree ten years ago is obstructing the lower falls on the River Coe. The rock weighs approximately 15 tons and removal will be difficult.

Abstractions and impoundments

The most significant abstraction in Lochaber is that taken from the Spean catchment for the Alcan aluminium works. This abstraction began in the 1920s and has probably resulted in a large decrease in fish habitat, but no data are available to support this. Major abstractions for public water supplies occur at Camisky (River Lochy), Onich (Abhainn Rìgh flowing into Loch Linnhe) and Strontian. Scottish Water have funded monitoring of fish populations on the Lochy mainstem and to date no adverse impact of the abstraction has been found. There were significant problems with sediment run off during the construction of the Strontian weir, but no further concerns have been raised about these abstractions. There are a large number of smaller abstractions throughout Lochaber for private water supplies and small industry. No problems have been reported regarding these. It is important that the impacts of all abstractions continue to be monitored. The extremely dry spring in 2008 caused severe reductions in flow on many rivers and burns. If such conditions become more common as a result of climate change, then the added burden of abstractions could cause burns to dry up or significantly reduce fish habitat. New and existing abstractions are regulated by SEPA under CAR.

Forestry

There are scattered blocks of non-native conifer plantations across Lochaber, but it is the smaller number of more extensively forested catchments that are of greatest concern to fish interests. Forestry has been linked to acidic flushes and low pHs in rivers that mobilise heavy metal ions and reduce fish survival and breeding success (La Croix, 1995; Hesthagen and Larsen, 1998). Shading from dense plantations can



also reduce the productivity of rivers. Planting and harvesting operations present the risk of sediment or trash entering watercourses and fertiliser application to the forestry can affect the water quality of adjacent lochs and rivers.

The Rivers Polloch and Hurich make up the most important spawning and juvenile habitat in the Shiel catchment. Glen Hurich is heavily forested and some of the planting reaches to the banks of watercourses, contravening FC's Forest and Water Guidelines. In 2006 the LFT prepared a report for FC on the riparian habitat on the Hurich and prioritised actions to reduce the impact of forestry on the freshwater habitat. These recommendations have been incorporated into the forest design plan and significant improvements in the buffer zones between the forestry and rivers have already been made.

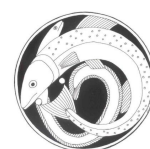
Diffuse pollution

Agriculture in Lochaber is small in scale and generally extensive. There are areas of improved grassland and cattle grazing, but the majority of the region is steep moorland used as rough grazing for sheep with little management input. Even the relatively flat managed farmland on the flood plains of the Rivers Lochy, Aline and Shiel receive little artificial nutrient input. As described above, sedimentation and raised nutrient levels can result from forestry operations. These should be minimised if FC's Forest and Water guidelines are followed regarding methods and suitable conditions for planting, harvesting and fertiliser application.

Commercial salmon smolt rearing facilities are present on Loch Arkaig, Loch Shiel and Loch Arianas and a rainbow trout farm is present on Loch Lochy. The aquaculture industry goes to great lengths to minimise food wastage, but some uneaten fish pellets will fall through the cages and the excrement of thousands of fish will raise nutrient levels in these naturally oligotrophic lochs. In addition, antibiotics and other therapeutants administered to farmed fish either in feed or as bath treatments will enter the Lochs. The impact of this diffuse pollution is unknown. Water quality monitoring is carried out by the aquaculture industry and SEPA and the LFT is not aware that significant problems have been discovered to date.

However, there is evidence that the presence of smolt farms does affect the ecological functioning of lochs. SSE have experienced greater problems with algal growth on hydro schemes in lochs with aquaculture facilities. There is anecdotal evidence that large brown trout are found in the vicinity of smolt cages, presumably attracted by waste food that enables faster growth rates. Brown trout and sea trout are the same species with the decision to migrate to sea dependent on growth rates, environmental conditions and genetic make up. Increased in the early growth rates of trout associated with the availability of high nutrient food from fish farms could reduce the number of individuals migrating to sea and thus the abundance of sea trout. Studies on hatchery and wild Norwegian fish support this possibility but it is difficult to establish on a large loch system.

The eggs of salmon, trout and lamprey in the gravel of river beds can be killed by sediment that reduces the flow of oxygenated water through the substrate. Sedimentation can result from engineering works, forestry operations, quarrying and the erosion of river banks. Problems with sedimentation were reported from the Strontian during the construction of the abstraction weir. The River Hurich has also



suffered from sediment input, though this may in part be a natural part of this catchment and not attributable to forestry operations. The LFT has been involved in monitoring work at the Glensanda super quarry where there are chronic problems with sediment entering some burns. Bankside erosion is evident on many rivers in Lochaber. Some of this is natural but the situation on rivers such as the Aline, Fionn Lighe and Inverie could be improved by the exclusion of stock from the bank edge.

Point source pollution

There are infrequent incidents of point source pollution into the freshwater habitats of Lochaber. These are dealt with by SEPA, and the LDSFB are notified where salmonids may be affected. Sources of pollution include industry, aquaculture and domestic wastewater and the impact will depend on the nature of the pollutant. Much of Lochaber is unlikely to be affected by these impacts as they are remote from industry. Rivers and burns around Fort William and other population centres are most at risk from point source pollution. No significant incidents have been reported to the LFT in recent years, but the potential remains for significant, if localised, impacts on fish populations and this risk must be managed.

Genetic pollution

Genetic studies on salmon have shown population sub-structuring at small spatial scales with genetic differences in fish separated by only a few kilometres (Verspoor et al. 2005). It is important that this within-species variation is preserved since it may represent local adaptation to environmental conditions or provide the diversity required for salmon as a species to withstand extinction threats. The LFT is taking part in a RAFTS and Fisheries Research Service (FRS) led project to collect genetic information on Scottish salmon stocks. The aim is to identify and map genetically distinct salmon populations between and within river catchments and allowing management to be directed at individual populations.

Population sub-structuring in other freshwater fish species has been less well studied. It is likely that loch trout and brook lamprey show localised genetic differences as gene flow between populations may be limited. Given that they breed in the Sargasso Sea and migrate to freshwater as passive glass eels, it is unlikely eel populations differ genetically between rivers. SNH are currently conducting a study into the degree of genetic divergence between populations of freshwater pearl mussels on different rivers.

Any introduction of fish or movement of fish between rivers has the potential to disrupt local genetic complexes. Salmon stocks used in the aquaculture industry are largely derived from Norwegian fish and have undergone artificial selection. The escape of farmed fish can introduce genetic pollution into wild stocks (Ferguson et al. 2007; Naylor et al. 2005). As stated above, adult farm escapees have been caught in Lochaber's rivers. Escapes from freshwater smolt farms also occur. Approximately 15 000 smolts escaped from a farm on Loch Shiel in autumn 2007. The likelihood of farm smolts migrating to sea, returning to freshwater and successfully spawning is small, but given the scale of some escapes some fish may survive to spawn and their time spent in the wild will make it difficult to distinguish them from wild fish. Escaped male smolts may also be capable of maturing in freshwater and fertilising eggs by stealth as seen in a proportion of wild male parr. By either means escaped



farm fish have the potential to affect the genetic make-up of wild populations, particularly when wild stocks in a system are seriously depleted.

Artificial stocking of salmon and sea trout is used as a management tool on many rivers in Lochaber as described in the previous section. The limitations and risks of stocking salmon have received much attention (Arahamian et al. 2003; Einum S. & Fleming I.A. 2001; McGinnity et al. 2003). It is vital that the broodstock used in these programmes is derived from the river that is to be stocked. This may apply to the level of individual tributaries on larger catchments. Most stocking on Lochaber's rivers uses native broodstock. However, a small number of rivers have used stock fish from other catchments and this should be stopped as soon as possible. Given the low numbers of salmon and sea trout present on some rivers, it may be necessary to rear broodstock from native parr or in exceptional circumstances use stock from other local rivers. As more information becomes available on the genetic structure of populations, sourcing broodstock to maintain the genetic integrity of populations will become easier.

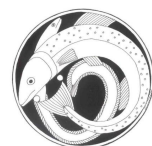
Invasive species

The introduction of non-native invasive species has the potential to upset the ecology of freshwater systems and threaten the survival of native species. Examples such as ruffe in Loch Lomond and signal crayfish in Galloway demonstrate the huge impact invasive species can have on Scottish freshwater environments. More worrying is the prospect of *Gyrodactylus salaris* spreading to Scottish Rivers and necessitating the sterilisation of rivers and devastating fisheries as seen in Norway. The importation of live fish and eggs and the movement of untreated angling and canoe equipment are felt to present the highest risk of introducing *Gyrodactylus* to Scotland.

At present, Lochaber is relatively free of non-native invasive species. Minnows and pike are present in the region, but their impact on native fish and freshwater species is largely unknown. Both species of knotweed are commonly found along rivers in Lochaber. The River Lochy Association has been trying to control knotweed along the River Lochy with support from the Esmee Fairburn Foundation and the LFT. There are no records of signal crayfish or most coarse fish occurring in Lochaber. They are spreading north through Scotland, however, and may arrive in the future.

River Habitat

Detailed habitat surveys have not been carried out on most of Lochaber's rivers for nearly a decade. These are required to identify problems such as erosion, substrate compaction and overgrazed riparian vegetation, which can all reduce the suitability of rivers for freshwater fish. Past surveys, walkover surveys and conversations with river managers suggest that generally river habitats in Lochaber are in good condition. Some would benefit from the exclusion of stock from river banks allowing the regeneration of riparian woodlands and bank stabilisation. A small number of watercourses in Lochaber have been heavily modified in the past. One such case is the lower reaches of the Glean Mama burn which has been straightened and its banks and beds lined with compacted stone. SNH are currently considering methods to restore the naturalness of this burn.



Poaching

Poaching occurs on the rivers of Lochaber, but the number of incidents is currently low relative to other Scottish rivers. The major rivers in the area have managers, ghillies or bailiffs that provide vigilance and deterrent. Historically the Rivers Coe and Strontian have suffered from poaching, but the situation seems to have improved in recent years. Netting has occurred on the Rivers Lochy and Spean and in the mouths of the Rivers Morar and Shiel. Small remote burns are most vulnerable to poaching and it is likely the problem is underestimated in these areas.

Predation

Predation is a natural occurrence and healthy fish stocks are able to withstand predation. Difficulties arise when other factors increase the number of predators or alter their behaviour raising the predation pressure on fish stocks. There is no evidence of an increase in seal or merganser numbers in the region, though some river managers have reported recent problems. The River Lochy Association has applied for and been granted a licence to shoot four mergansers annually over many years but shooting to scare is now the only method used by managers in the region.

Escapes of rainbow trout from the farm on Loch Lochy have resulted in an unnatural pool of predators in the loch, which are known to take salmon and trout.

Freshwater Pearl mussels

Scotland supports the majority of the European population of freshwater pearl mussels. Pearl fishing resulted in the rapid decline in this species and its extinction from many Scottish rivers. The species is afforded the highest protection in European law and pearl fishing has been illegal since 1998. Lochaber has a number of important populations of pearl mussels with three Special areas of Conservation designated for this species within the region. All proposals that would have a likely significant effect on pearl mussels in these areas must be assessed for their impact on this species in consultation with SNH.

As a sedentary species the pearl mussel is vulnerable to any engineering work conducted on the river bed or the excavation of substrate. Sedimentation events can also be lethal to this species by blocking gills and feeding apparatus. Although illegal, pearl fishing still takes place and the remote burns of Lochaber could provide the ideal location for this activity, though the LFT is not aware of any reports of illegal pearl fishing in Lochaber.

The life cycle of the pearl mussel includes a larval stage that is parasitic on the gills of juvenile salmonids. The impact on the salmonid host is thought to be minimal, but it ensures that the fate of the pearl mussel is wedded to that of the local trout and salmon populations. Therefore, as well as the factors detailed above, mussel populations are affected by many of the factors that affect salmonid populations previously discussed.



MARINE SURVIVAL

Marine conditions

More information on the factors affecting the marine survival of salmon, sea trout and eels is urgently required. Such research is beyond the abilities of fisheries interests in Lochaber and will require national and international cooperation. The Scottish Government Fisheries Directorate, SNH, FRS, the ASFB and RAFTS have a role to play in initiating, coordinating or funding this research. The collection of local data will form a vital part of this work. The LFT is currently collecting genetic samples that will enable salmon caught at sea to be traced to a particular region or river. For four years both smolt output and adult returns have been recorded on the River Morar. This provides valuable data on marine survival rates and the continuation of this project will provide a long-term dataset against which the effects of environmental and human-induced changes in the marine environment can be assessed.

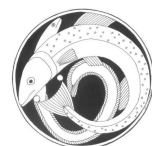
Action: Initiate and continue research on the marine behaviour and survival of migratory fish species. SG, FRS, SNH, ASFB, RAFTS, LFT.

Sea Lice

Lice levels on salmon and sea trout post smolts remain one of the greatest concerns for wild fish interests. Monitoring carried out by the LFT for the TWG suggests that lice burdens on wild sea trout can exceed those shown to kill fish in hatchery conditions. This monitoring needs to continue in order to build up a long-term dataset and measure the impact factors such as climate and the efficacy of lice control on farms have on the lice burdens of wild fish. Good data are available on the lice levels of wild sea trout post smolts in Loch Linnhe, but attempts to obtain samples from other areas in Lochaber have proved largely unsuccessful. It may be necessary to try different methods of monitoring lice levels such as plankton trawls to estimate the number of infective lice stages in the environment.

The biannual cycling of lice numbers on Loch Linnhe coincides with production schedules in local fish farms suggesting a link between lice levels on wild and farmed fish. Controlling lice on farmed fish would seem to be the best means of reducing lice burdens on wild fish. The TWG has provided a forum for discussion between wild fish and aquaculture interests. The result has been improved understanding and mutually beneficial initiatives. The aquaculture industry has voluntarily signed up to Area Management Agreements that stipulate coordinated lice treatments and synchronous fallowing on farms within a production area. Lice levels on farm fish are measured on a weekly basis and the results made available to signatories of the AMA. A target of 0.5 ovigerous lice per fish has been set as the industry standard. These initiatives are welcomed and the efforts made by the aquaculture industry should be acknowledged.

However, lice levels on wild fish are too high and further measures are needed. Lice levels on farms regularly exceed the 0.5 threshold and it is uncertain if this threshold level is sufficiently low to prevent high lice burdens on wild fish. Slice resistance has



been recorded in lice and is likely to become more widespread. The timing of lice treatments to farmed fish needs to be refined to prevent outbreaks and therapeutants should be used in combination to slow the evolution of resistance in lice. There can be a number of distinct production areas within an AMA across which synchronous fallowing occurs. These production areas often have little biological validity as currents and wild fish do not respect their boundaries. It is important to have synchronous fallowing and coordinated lice treatments across as large an area as possible and to design production areas with reference to water currents and fish migration routes.

The siting of fish farms at the head or narrows of sheltered sea lochs would intuitively seem to increase the risk of wild sea trout and salmon post smolts being exposed to infective lice stages. It is possible that even low levels of lice on such farms will represent an unacceptable reservoir of infection for wild fish and the relocation of farms is the only means of reducing this risk.

Actions: Continue monitoring lice levels on wild sea trout post smolts and investigate other methods of monitoring lice levels in areas where seine netting post smolts has not been successful. LFT, TWG, FRS.

Develop a better understanding of factors driving lice numbers on wild fish and how farm lice levels relate to wild fish burdens. LFT, TWG, FRS.

Continued participation in AMAs to ensure there is constructive dialogue and information sharing between wild fish and aquaculture interests. TWG, Aquaculture industry, LDSFB, LFT.

Press for synchronous fallowing and coordinated lice treatments over larger areas. LDSFB, LFT.

Support the relocation of farms out of sheltered long sea lochs and near the mouths of rivers. Aquaculture industry, SG, ASFB, LDSFB, LFT.

Farm escapes

The aquaculture industry's record on containment is poor. Greater investment in cages is required and further research into containment and predator-scaring technologies should be supported. Processes and staff training on fish farms should be regularly reviewed and improved to minimise the risk of escape. Contingency plans to be followed in the event of an escape have been produced for all farm sites. Whilst useful, the limitations of these plans should be acknowledged. In reality little practical can be done to contain fish once an escape has occurred and the focus should be on preventing escapes.

The Scottish Government currently publishes details of reported farm escapes to 'name and shame' the companies responsible. Whilst this provides an important incentive for farms to improve containment, further sanctions and even significant



financial penalties may be required to ensure the aquaculture industry is taking all practical steps to avoid escapes occurring.

Improved knowledge of the causes of escapes and their consequences are needed. Large escape events can often be attributed to a particular factor, but more needs to be known about the ‘drip-drip’ loss of fish from farm sites that is thought to occur and to account for many of the farm fish caught in Lochaber. Farm escapes are known to have a poorer spawning success than wild fish, but are capable of breeding. Research to quantify the level of introgression of farm genes into wild populations is urgently needed. This is particularly true where artificial stocking of wild salmon takes place on a river as it is vital the broodstock used in these programmes is native to the river. The LFT is currently involved in two such research projects on the River Strontian and the Shiel catchment. The capacity of the FRS Freshwater laboratory to carry out genetic analysis is currently limiting this work.

Actions: Greater investment in cages technologies and review of management processes on farms to prevent escapes. Aquaculture industry, Aquaculture research forum, FRS.

Introduction of penalties for poor practices that result in escapes. SG.

Research into the causes of escapes and their consequences. Aquaculture research forum, FRS, RAFTS, LFT.

High seas fisheries

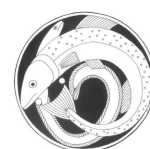
The exploitation of salmon at sea is inherently unsustainable since stocks are mixed and cannot be accurately linked to spawning success on an individual river. The value of an individual rod-caught salmon also far exceeds that of a sea-netted fish and much of the former is reinvested into rivers and fisheries management. Therefore, on both conservation and economic grounds, high seas fishing for salmon should continue to be prohibited.

Action: Ensure that Greenland and the Faroe Islands do not resume mixed stock net fishery. NASCO, SG, ASFB.

Inshore fisheries

Inshore salmon and sea trout netting operations also exploit stocks from a number of rivers and it is thus difficult to regulate fishing pressure on particular populations. In recent years angling interests have bought up many of the netting rights across Scotland to prevent them being used. Pressure to close the remaining stations has also been applied by wild fisheries interests and this should continue by targeting the largest netting operations and those closest to rivers of conservation concern. The Scottish Government Rural Affairs Department and Crown Estate have shown some willingness to withdraw the netting rights they lease as they come up for renewal.

The LDSFB is currently applying to the Scottish Government for an order to outlaw the killing of salmon in Lochaber before the 1st June. This would apply to both rod and net fisheries, though most rod fisheries have operated total catch and release before this date for many years. The measure is aimed at improving the survival of



multi sea winter salmon, which form a relatively small but genetically distinct and fragile part of salmon stocks in Lochaber's rivers.

The ASFB is currently trying to raise funds to operate the Strathy netting station the north Sutherland coast for research purposes. This could provide valuable data about the migratory paths of salmon to spawning rivers on the north and east coasts of Scotland by identifying source rivers of caught fish using genetic analysis. A similar, smaller research project has been proposed for a netting station on Skye. Although movements of salmon at sea are largely unknown, it is possible that fish from Lochaber and along the west coast pass Skye and could be caught by netting operations there. The conversion of the Skye netting station from a commercial to a research operation could potentially reduce the number of Lochaber salmon caught in nets and provide valuable data on their marine migration.

There are currently no commercial eel fisheries operating in Lochaber. With the current concern over declines in eel numbers and lack of knowledge of the status of eel stocks in Scotland, any proposals to open an elver fishery should be discouraged.

Action: Ensure that netting stations currently closed under agreement with rod fishery interests remain so. LDSFB, River proprietors, netting right holders.

Monitor numbers of fish taken in remaining netting stations. LDSFB, LFT, netting operators.

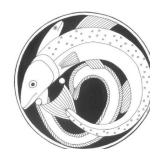
Restrict the killing of salmon until after 1st June across Lochaber. LDSFB, SG.

Look at impact of netting stations in the Hebrides on Lochaber fish possibly using genetic analysis. Skye District Salmon Fishery Board, ASFB, LDSFB, LFT.

Discourage any proposals to fish elvers in Lochaber. LFT.

FRESHWATER SURVIVAL

Many of the major threats to migratory fish species occur in the marine environment. However, improvements can be made to freshwater survival and productivity and these improvements are more easily realised than those at sea. There is a general need to carry out monitoring of fish numbers in fresh water in order to assess the health of populations and quantify the effects of possible threats and management interventions. Electrofishing surveys provide a proven method of surveying juvenile salmonid species and the LFT holds long-term datasets for the major rivers in Lochaber. It is important this monitoring continues in order to identify trends in salmon and trout numbers and evaluate restoration measures. Monitoring should be embedded into all management activities to ensure they are effective and resource efficient.



Electrofishing can also be used to measure the numbers or distribution of eels. Given concern over the paucity of knowledge about eel numbers, the gathering of baseline data on their distribution and population size is a priority. The LFT is currently conducting a three year survey of eels in Lochaber.

Monitoring of lamprey species and freshwater pearl mussels has been carried out by SNH in the past. This monitoring should continue to identify population trends and the impact of management and other activities on freshwater habitats. Lamprey larvae are often encountered during electrofishing surveys for other species and a means of compiling these data should be explored. It is important that pearl mussel populations outside of the three SACs for this species in Lochaber are also monitored as they make an important contribution to the national and regional population and may be genetically distinct from the mussels on the SACs.

Actions: Continue to collect data on juvenile salmonid numbers across Lochaber and use this to inform fisheries management. LFT, River proprietors.

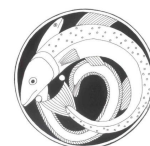
Survey the eel population of Lochaber to establish the health of this species and provide baseline data for future conservation efforts. LFT, SNH, SG.

Continue monitoring lamprey and freshwater pearl mussels. SNH, LFT.

Barriers to migration

Dialogue between wild fisheries interests and SSE, which operates the major hydroelectric installations in Lochaber, is good and should continue. A joint project between SSE, RLA and LFT beginning in 2009 will measure the overall impact of the Mucomir Barrage on smolt return rates from the River Lochy. A similar project on the River Shin in Sutherland suggested a large impact, providing impetus for future improvements to the dam and changes to the ongoing smolt stocking programme in the short term. SSE have also committed to carry out modifications to the Morar dam to ease the movement of sea trout smolts over the slip gate. This work is urgently needed and should occur as soon as possible.

The Water Framework Directive requires that migratory fish are able to pass all potential barriers such as dams and weirs. This legislation covers existing obstacles as well as new proposals. In addition, SEPA have money available through their restoration fund for the modification or removal of barriers to ease fish passage. Together these provide the opportunity to address barriers currently affecting fish distribution in Lochaber. The LFT has applied to SEPA for a grant to add a fish pass on the Allt Grigadale dam in Ardnamurchan, which currently prevents fish migrating upstream into Loch Grigadale and potential spawning grounds beyond. It is also hoped that SNH will support this project as the burn is designated as an SAC for freshwater pearl mussels. The WFD may also provide the leverage required to achieve improvements in the screening provision at the Moeble dam in the Morar catchment. The LDSFB are currently pursuing this issue.



Physical barriers to fish movements are well known and well regulated. More subtle barriers such as those created by temperature or chemical changes in the water are less well understood but have the potential to disrupt migration. Even temporary delays to migration can be significant if they increase exposure to predators. More research on these effects is urgently needed. Wild fish interests in Lochaber are concerned about the groynes proposed on the Leven as they could create such a temperature barrier. Invoking the precautionary principle, engineering works that modify river flows should be discouraged until it can be demonstrated they will not impede migration.

Temporary barriers to migration such as fallen trees and collection of trash should be identified as soon as possible and removed sensitively. Often a river may be only partly obstructed and in these cases it may be better to leave the obstruction rather than cause greater damage during the removal process. Operations with a high risk of creating barriers should be carried out carefully to minimise this risk. FC's Forest and Water Guidelines should be followed during harvesting operations to achieve this.

Actions: Carry out research project into the effect of the Mucomir Barrage on smolt return rates on the River Lochy. SSE, RLA, LFT.

Modify Morar dam to ease passage of sea trout smolts over the slip gate. SSE.

Install fish pass on the Allt Grigadale dam. LFT, SEPA, SNH.

Improve screening on the Moeble dam. Owner, LDSFB.

Continue to object to the proposed groynes on the River Leven. LDSFB, LFT, Leven Angling Association.

Avoid the creation of temporary barriers and identify and remove those that do occur where appropriate. FC, River managers, LFT, LDSFB.

Abstractions and impoundments

All significant abstractions are regulated by SEPA under CAR. Compensation flows should be at a level that maintains sufficient water flow and good water quality. Where possible Q90s (the water level exceeded 90% of the time on a given river) should be used as the minimum compensation flow rather than Q95s that were used in the past. SEPA should ensure that abstraction limits are not breached and prosecutions are brought where this does occur.

The impact of significant abstractions on fish populations should be monitored in the face of increasing variability in weather patterns due to climate change. In Lochaber the Scottish Water abstractions at Camisky (River Lochy), Onich (Abhainn Rìgh flowing into Loch Linnhe) and Strontian, and the Alcan abstractions from the Spean and Leven are the most significant.

The possibility of using the WFD to ensure there is a compensation flow from the Laggan dam into the River Spean should be explored. Significant fish habitat has



been lost since the dam was created in the 1920s and fish populations in the upper Spean would benefit from a guaranteed flow down the river.

Actions: Regulate abstractions and ensure compensation flows are sufficient to maintain the freshwater environment. SEPA.

Monitor the effects of significant abstractions on fish populations. LFT, Scottish Water, Alcan.

Instate compensation flow from the Laggan dam. Alcan, SEPA, LDSFB, LFT.

Forestry

Non-native conifer plantations have altered the face of the Scottish landscape and their impact on adjacent freshwater environments is profound and impossible to avoid completely. The FC's Forest and Water Guidelines set out best practice for forestry operations to minimise damage to freshwater. These should be strictly adhered to by all forest managers. Improved understanding of freshwater habitats and sensitive areas and seasons for fish populations amongst foresters would reduce the number of incidents of damage. The LFT is organising a training day to raise awareness about freshwater habitats in various groups including forestry workers.

FC's Forest and Water Guidelines recommend a 20m buffer zone free of non-native conifers along watercourses and the banks of water bodies. This should include all watercourses including small tributary burns. All new planting should adhere to this recommendation and existing planting should be restructured as soon as possible to achieve this. FC has been working in Glen Hurich to remove conifers from the edges of the River Hurich and Loch Doilet. This work is ongoing, but significant improvements have been made over the past two years.

Native broadleaves help to stabilise the banks of watercourses and provide a source of nutrient input. Planting or measures to encourage the regeneration of broadleaves along rivers should be considered by land and river managers with funding available from the SRDP.

Actions: Ensure all forestry operations adhere to Forest and Water Guidelines. FC, private forestry owners and managers.

Raise awareness of fisheries issues amongst foresters. LFT, FC.

Restructure existing forestry to create 20m buffer zones along watercourses. FC, private forestry owners and managers.

Establish native broadleaves along watercourses. FC, land and river managers.

Diffuse pollution

Diffuse pollution is not felt to be a significant or widespread threat to freshwater habitats in Lochaber, but it is important that environmental regulations and standards



for developments, agriculture and forestry are enforced. Adherence to SEPA's guidelines and FC's Forest and Water Guidelines should minimise problems with sedimentation and nutrient input. All engineering works should be designed to minimise sedimentation through the use of sediment traps and exclusion of machinery from bank faces. With the large number of hydro schemes planned in Lochaber it is important that track construction and pipeline installation is carried out carefully.

Erosion of riverbanks is a natural process and there should be a presumption against major reinforcement and stabilisation work. However, where erosion has been exacerbated by local land use practices, watercourses may benefit from remedial action. On the Rivers Aline and Inverie stock access to the river has resulted in unstable banks and reduced regeneration of native riparian woodland. Stock-proof fencing along the river edge would increase bank stabilisation and allow native broadleaf regeneration. The Scottish Rural Development Programme (SRDP) offers payments to farmers and landowners to support such work along water margins.

The impact of freshwater aquaculture sites on loch water quality should continue to be monitored. The oligotrophic nature of these water bodies is a key determinant of their biodiversity and ecology and any alteration in water quality could upset these fragile communities. The impact of freshwater aquaculture on fish populations needs to be researched, in particular the effect waste food and effluent could have on trout growth rates and life history strategies. Land-based smolt rearing facilities are found in Scotland and are common in other countries. Recirculation and filtering systems would allow land-based freshwater farm sites to operate with minimal impact on freshwater environments. Pressure should be placed on the Scottish Government and aquaculture industry to provide the investment needed for relocation on land.

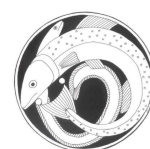
Actions: Enforce regulations and best practice guidelines to limit diffuse pollution from agriculture, forestry and new developments. SEPA, FC.

Encourage landowners and managers to exclude stock and promote native woodland regeneration along watercourses with possible funding from the SRDP. LFT, SGRPID, Landowners and land managers.

Monitor the effects of freshwater aquaculture facilities and lobby for their relocation to land-based sites. LFT, LDSFB, ASFB, SG, Aquaculture industry.

Point source pollution

The potential for major pollution incidents to affect the freshwater environments of Lochaber is relatively small but the consequences of such incidents could be locally catastrophic. Strict regulations apply to the use and handling of dangerous chemical and these should be enforced and illegal activities should be aggressively prosecuted. An early warning system and reporting chain should be kept up to date to allow a speedy assessment of any incident and appropriate mitigation measures to be put in place.



Actions: Enforcement of regulations regarding use of dangerous chemicals. SEPA.

Maintain an up to date reporting chain to provide specialist advice when pollution incidents do occur. SEPA, LDSFB, SNH, LFT.

Genetic pollution

Escapes from freshwater salmon and trout farms occur regularly and have the potential to interbreed with wild stocks and introduce foreign genes. Containment on freshwater farms needs to be improved and more knowledge is required on the frequency of small scale escapes and the level of genetic introgression that has already occurred. The inclusion of freshwater farms into Area Management Agreements would set down best practice and improve communication between wild fish and aquaculture interests. Negotiations aimed at incorporating the smolt-rearing facilities on Loch Shiel into the Loch Ailort AMA are currently underway.

The population sub-structuring seen in some salmonid species means that the mixing of wild stocks also has the potential to disrupt locally adapted gene complexes and reduce survival and productivity. Producing a map of the discrete genetic populations in Lochaber's rivers is an essential first step to prevent this and allow management to be directed at the appropriate level. The LFT is currently collecting genetic samples from juvenile salmon that will be analysed in the FRS Freshwater Laboratory with funding from SG and the Atlantic Salmon Trust (AST).

Stocking of artificially-reared salmon and sea trout from wild broodstock is a management tool used extensively across Lochaber (Table 2). It is an attractive option to many river manager and proprietors, but one whose success has not been well-demonstrated. There is an urgent need to monitor the outcome of stocking programmes in Lochaber given the resources devoted to stocking and the potential it has to damage existing wild stocks.

Stocking should be viewed as a temporary measure to kick start recovery or maintain a population until the cause of the decline can be addressed. It should not be used as a means to enhance salmon and sea trout levels above natural levels. In reality the reasons for the declines in salmon and sea trout stocks are largely beyond the ability of river managers or regional organisations to remedy. These circumstances may require stocking to be carried out over many years until long-term solutions to national and international problems affecting migratory fish can be put in place.

Most stocking programmes use broodstock from the river to be stock and it is essential all rivers move to using native stock as soon as possible. Where the number of adults returning to a river is small, it may be necessary to rear on smolts or parr to act as broodstock. As more information becomes available on the genetic structure of salmon populations in Lochaber, it may be necessary to re-examine the source of broodstock for stocking projects to ensure they do not provide a means of gene flow between distinct wild populations.

Artificial stocking also has the potential to introduce inbreeding depression, founder effects or domestication into wild populations. All could affect the survival and



performance of fish stocks and all can be minimised by careful design of stocking programmes, principally the use of sufficient numbers of fish as broodstock and stocking out early stages in the salmon life history cycle. Collection of broodstock can often be a limiting factor, but it is essential that a small number of individuals do not become represented in the wild population as a result of artificial stocking. Where adult broodstock is limited it may be necessary to grow on parr or use mature male parr to increase the breeding population size. The LFT and FRS can provide advice to river managers to ensure stocking programmes follow current best practice.

The River Strontain and the Shiel catchment are currently developing salmon restoration projects that will include stocking. For many years both systems have recorded low returns of adult fish and both may have suffered from introgression of farm fish given the proximity of aquaculture sites. There is a significant risk that broodstock taken from these rivers may be partly derived from farm fish and the stocking programme could cause farm genes to become widespread in the population. The LFT, with support from the AST, is assisting both rivers by attempting to identify parts of the catchments least affected by farm fish introgression from which broodstock should be derived.

Actions: Improve containment at freshwater aquaculture sites and incorporate freshwater farm sites into AMAs. Aquaculture industry, TWG.

Quantify the level of introgression of farm fish genes into wild populations. LFT, Aquaculture industry.

Ensure stocking is used appropriately and that programmes use native fish and are designed to minimise inbreeding, founder effects and domestication. LFT, LDSFB, FRS, River proprietors and managers.

Collect genetic data to minimise the risk of using fish of farm origin in planned stocking programmes on the Shiel and Strontian. LFT, AST, FRS.

Invasive species

Removing invasive species once they have become established is a difficult task. The eradication of minnows or pike from the region would in reality be impossible and restricting their spread is probably the best that can be achieved. Efforts are being made to eradicate Japanese knotweed from the banks of the River Lochy. A three year joint project between the RLA, Esmee Fairbairn Foundation and LFT began in 2008 with the repeated spraying of stands with glyphosate. The treatments have proved effective, but the species is persistent and colonises rapidly through rhizome fragmentation, hence a long-term commitment will be needed if large-scale eradication is to be achieved.

Lochaber is thankfully free of invasive species such as signal crayfish, ruffe and other course fish that have blighted river catchments in other areas of Scotland. To make sure this situation continues it is essential that contingency plans are prepared so that an effective response can be quickly mounted in the event of their spread into the



region. SNH will be providing funds to Fisheries Trusts for the preparation of such plans in 2009.

An important part of these plans will be awareness raising amongst river managers, anglers and other river users. This is essential for the early detection of invading species, which will greatly improve the chances of containment and eradication. A number of invasive freshwater species have spread through the deliberate or accidental actions of humans. For example, ruffe are thought to have been released into Loch Lomond by anglers as left over live bait. Educating the public and angling community about the concept of appropriate biodiversity and the damage that can be caused by introductions should greatly reduce this risk.

Gyrodactylus salaris is a potential invasive species that requires particular attention. Its potential consequences for Scottish salmon rivers are catastrophic. The measures recommended by the *Gyrodactylus* Task Force covering issues such as international fish movements and treatment of fishing gear used abroad should be implemented as soon as possible. For many years an awareness raising campaign amongst anglers and other river users has been taking place and knowledge of the species is generally good in these groups. However, it is important not to become complacent and efforts to stress the threat and distribute literature should continue.

Actions: Continue project to eradicate Japanese knotweed from the banks of the River Lochy. RLA, Esme Fairbairn Foundation, LFT.

Prepare contingency plans detailing the actions to be taken in the event of non-native species arriving in Lochaber. LFT, SNH.

Raise awareness of the damaging effects of non-native species amongst river managers, anglers and the wider public to provide an early warning system and reduce deliberate or accidental introductions. LFT, LDSFB, Angling associations.

Raise awareness of the potential threat posed by *Gyrodactylus salaris* and the measures that can be taken to reduce the risk. LFT, LDSFB, Angling associations, FRS.

River Habitat

For most rivers in Lochaber, no survey of the river habitat has taken place for over ten years. These surveys are essential for mapping important spawning grounds and areas of juvenile salmonid habitat, and for identifying factors limiting fish production such as barriers to migration, human-induced erosion or degraded bank side vegetation. The LFT is hoping to begin a programme of river habitat surveys in winter 2008 with the aim of covering all rivers in the next three years. The data collected will be used to map fish habitats, identify sensitive or vulnerable areas and those where river and land management could be improved.

The SRDP provides a funding mechanism that could allow land owners to improve riparian habitats for the benefit of fish populations and fisheries. The LFT hopes to work with landowners to prepare applications to the SRDP where this would be appropriate.



Actions: **Conduct habitat surveys on Rivers in Lochaber to identify areas of important fish habitat and factors limiting fish production. LFT, land owners and managers.**

Explore opportunities to use SRDP funding to improve riparian habitats. LFT, land owners and managers.

Poaching

Poaching is currently well-controlled in Lochaber due to the tireless efforts of bailiffs, river managers and anglers. The zero tolerance approach to poaching adopted by the LDSFB should continue and poachers should be aggressively prosecuted.

More remote and less frequently fished rivers may be more vulnerable to poaching and it is important to raise awareness amongst local anglers and landowners about the damage poaching can do and provide a mechanism through which they can report suspicious activity. Volunteer bailiffs and river watchers should be recruited and trained where possible.

Actions: **Maintain current bailiff patrols and prosecute poachers. LDSFB, River proprietors.**

Raise awareness about the damage poaching can cause and attempt to recruit more volunteer bailiffs particularly on more remote areas. LDSFB, River proprietors.

Predation

There is some concern amongst river managers and anglers about predation on salmon and trout, but little evidence that predator numbers have increased in recent years or are having a major impact on salmon or trout numbers. On a small number of catchments there may be problems with seal or bird predation particularly where weather conditions or obstacles delay or prevent fish migration. Before time and resources are directed at any perceived problem, it is essential to establish how effective predator control will be. Non-lethal deterrents should be used in preference to killing.

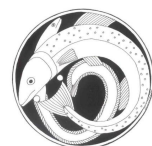
Escapes of rainbow trout from the farm on Loch Lochy may result in significant loss of salmon smolts and juveniles from the upper Lochy catchment. Improved containment of farmed trout would improve the situation, but relocation of such facilities to land may be the only way to ensure there is no leakage of fish.

Action: **Monitor predator numbers and assess opportunities for control. River proprietors and managers, LDSFB, LFT.**

Improved containment of rainbow trout on Loch Lochy.

Freshwater Pearl mussels

Freshwater pearl mussels require high quality freshwater habitats and healthy juvenile salmonids populations and so will benefit from many of the recommendations made above. There are also issues specific to mussels that need to be addressed separately.



Historical pearl fishing is responsible for much of the decline in this species in Scotland. Freshwater pearl mussels now receive full protection under the Nature Conservation (Scotland) 2004 and it is illegal to recklessly disturb this species or damage its habitat. However, remote rivers are still vulnerable to illegal fishing and it is essential to raise awareness amongst river users and the local public so that suspicious activity is reported to the police.

All developments in and around rivers have the potential to damage pearl mussel populations through riverbed disturbance and sedimentation. Impact assessments for developments should consider this potential and ensure measures are put in place to prevent damage or disturbance. There are three Special Areas of Conservation designated for pearl mussels and all developments within or outwith these sites that could affect the pearl mussel population will need to be appropriately assessed under the European Habitats Directive in consultation with SNH.

Actions: Raise awareness amongst river users and the wider public to ensure suspicious activity is reported to the police. Highland Constabulary, Partnership Against Wildlife Crime, SNH, LFT.

Assess the potential risk developments pose to mussels through substrate disturbance and sedimentation. SNH, SEPA, developers.

Awareness raising amongst public, owners and managers

Fish are difficult to see without specialist equipment and lack the obvious visual appeal of many bird, mammal or plant species. As such, outside of the angling community, there is little public awareness of fish ecology or conservation. Public support is crucial for any conservation programme and the value and fragility of Scotland's freshwater fish communities needs to be more widely understood. The LFT has received support from SNH and SG for its schools project 'Salmon in the Classroom' that teaches local school children about the salmon lifecycle and freshwater habitats. This has been extremely successful in the past and its continuation will allow the participation of more schools around Lochaber. The LFT has also run family days in partnership with Highland Council Rangers that have introduced local people and tourists to the fish and invertebrates present in Scottish Rivers. It is hoped to continue these in future years.

Improving knowledge of fish and freshwater ecology amongst anglers, land and river managers and foresters provide them with a greater understanding of the freshwater environment their impacts on it. Raising awareness of potential threats to fish populations, such as the introduction of invasive species, poaching, barriers to migration and sedimentation, would prevent some of them occurring and improve the speed with which these problems are identified by increasing the numbers of eyes and ears available. The LFT is organising a training for land managers, foresters, anglers and the wider public who wish to learn more about freshwater fish and the habitats they rely on.

The LFT is keen to develop a website that would provide information on the fish, fisheries and the freshwater habitats of Lochaber. This would provide a valuable



resource for managers, anglers and visitors to the area as well as a method of publishing research work and sharing good practice.

Actions: **Continue Salmon in the Classroom project. LFT, SNH.**

Organise family education days to introduce people to freshwater habitats. LFT, Highland Council Rangers.

Improve knowledge of freshwater ecology amongst anglers, foresters, land and river managers. LFT, angling associations, river managers, FC.

Develop website to provide information about Lochaber's fish, fisheries and freshwater habitats.



ACTION PLANS - CATCHMENT-SPECIFIC SUMMARIES

Many of the issues discussed above are common to all catchments within Lochaber. For example the lack of knowledge about non-salmonid fish species and the marine phase of migratory species affect all rivers in the region. Other factors are more specific to individual catchments, and these are discussed here.

AILORT

Concerns that sea lice have affected the marine survival of salmon and sea trout on the Ailort are frequently raised by wild fish interests. In 2007 the Loch Ailort AMA was signed covering the single fish farm on the loch and with the aim of improving the marine environment for salmon and sea trout, and other marine organisms. Although, Marine Harvest had been employing similar therapeutic treatments in this area, until recently it was a broodstock holding facility and thus no fallowing was carried out. Fallowing is believed to reduce the number of sea lice in an area. The use of the Loch Ailort farm has now changed and fallowing will be employed, which should ultimately benefit wild salmon and sea trout. Lice burdens on a small number of sea trout caught on rod and line on the Ailort suggest that high lice burdens do occur on wild fish in the area. Whether these lice levels are frequent or typical is unknown as it has so far proved impossible to obtain sample of sea trout post-smolts by seine net on Loch Ailort. Plankton trawls may provide a more successful means of monitoring lice levels on the loch. Discussion with local managers indicates that seal numbers may be of concern, and that seals are known to be taking salmonids.

There is no indication of any significant problems with the freshwater habitat on the Ailort. However, it has been seven years since the last electrofishing survey, and eight years since a habitat survey was carried out. This is a massive gap in the dataset and, apart from catch data, there is little indication as to how the salmon and sea trout populations are fairing, especially in relation to the ongoing stocking effort.

Summary of issues – Ailort catchment

Issues	Lead Agency	Priority
Marine Survival		
Find a method for recording lice levels in Loch Ailort	LFT	High
Freshwater Productivity		
Carry out juvenile salmonid surveys	Loch Eilt Time Share (LETS), LFT	High
Freshwater Habitat		
Carry out habitat surveys	LETS, LFT	High
Predation		
Concern over seal numbers	LETS	Low
Stocking		
Monitor success of current stocking programme	LETS, LFT	Medium



ALINE

The Aline is a well-managed catchment, with a stocking program in place. A consultant in the region has been carrying out electrofishing surveys to determine the success of the stocking. However, as with other catchments, few juvenile surveys have been carried out in recent years. A hydro electric scheme is being developed in the catchment (Rannoch River) and the LFT carried out electro-fishing surveys to determine populations of brown trout and eels. Habitat surveys have not been performed since 2000 and there is concern that livestock movements may be causing bank erosion. Further, there are natural barriers that local managers feel could be inhibiting salmonids movement that may only require small modifications to make passage possible.

Attempts have been made to identify a suitable site for seine netting sea trout post-smolts in order to measure lice burdens as part of the TWG monitoring programme. No suitable sites have been found to date. Given the number of fish farms present in the Sound of Mull, it is essential that lice data are collected and plankton trawls may provide a means of measuring lice levels.

Summary of Issues – Aline catchment

Issue	Lead Agency	Priority
Marine Survival		
Find a method for recording lice levels in the Sound of Mull	LFT	High
Freshwater Productivity		
Carry out juvenile salmonid surveys	Ardtornish Estate (AE), LFT	High
Freshwater Habitat		
Carry out habitat surveys	AE, LFT	High
Address any livestock-induced bank erosion identified in habitat surveys	AE, LFT	Medium
Obstructions		
Investigate barriers to salmonid migration and explore means of overcoming them	AE, LFT	Medium
Stocking		
Monitor recently initiated stocking program.	AE, LFT	Medium



RIVER CARNOCH

Marine survival may have been the main casual factor for the decline in salmon stocks in Loch Sunart. Nine salmon farm sites on Loch Sunart have been consolidated in recent years to leave three operating sites on the loch. Notably the farm at the head of the loch close to the mouth of the River Carnoch was closed recently. Attempts to seine net sea trout post smolts in Loch Sunart by the LFT have had variable success. Meaningful samples of fish were caught in 2006 and 2008, with the 66 fish caught in 2008 carrying worryingly high lice burdens. This monitoring needs to continue and it would be interesting to obtain a good sample size of fish when farm sites in Loch Sunart are in their first year of production, which has not been possible to date. Lice counts from farms in Loch Sunart were not high, but exceeded the target threshold for farms of 0.5 ovigerous lice per fish at some sites in 2008. Clearly wild fish on the rivers leading into Loch Sunart would benefit from improved lice control on farms.

There is some suggestion that the freshwater habitat on the River Carnoch River is poor with few pools or areas of spawning gravel. A full habitat survey would be needed to assess this. A small hydro scheme is under construction on the catchment. Whilst the proposal was assessed as acceptable to fisheries interests at the planning stage, it is essential that construction is carried out sensitively as per the method statement and that any problems during construction or operation are quickly identified and rectified.

Poaching has historically been a problem on the River Carnoch. Regular patrols and reporting by local anglers has helped to reduce poaching incidents and this vigilance should continue.

Summary of issues – Carnoch catchment

Issues	Lead Agency	Priority
Marine Survival		
Continue efforts to seine net sea trout post smolts and measure lice levels	LFT	High
Freshwater Productivity		
Carry out electrofishing surveys	Proprietor, LFT	High
Freshwater Habitat		
Carry out habitat survey and assess options for improving river	Proprietor, LFT	Medium
Poaching		
Continue watching the river and report suspicious activity to the police	Proprietor, local anglers	Medium



RIVER COE

Marine survival is again the main cause for concern on this catchment. The mouth of the River Coe opens into Loch Leven, close to where a salmon farm is located and thus there is suggestion that increased lice levels may be affecting the smolt run. Seine netting has been carried out by the LFT at the head of Loch Leven, but only a small number of post smolts have been caught precluding meaningful analysis of lice levels. Plankton trawls may provide a better means of measuring lice levels in this area.

A large obstruction is present on the lower part of the river, which would require major engineering works to remove. Removing the obstruction would open up large areas of spawning habitat, but has the potential to damage the river if not carried out sensitively. SEPA's restoration work under the WFD is currently targeted at removing obstructions and this may provide a possible source of funding and expertise for this operation. The LFT has received reports that bank works on the Coe have affected river flow and erosion resulting in the silting up of pools and trees falling into the watercourse. The LDSFB and SEPA have been notified of the bank works. A habitat survey would allow the downstream effects of the works on river habitat to be determined.

Numbers of returning salmon in the River Coe have increased relatively over the past few years however they are still 'historically' low. The River Coe Angling Club are exploring the possibility of stocking native salmon on the river, though plans are at an early stage.

Summary of issues – Coe catchment

Issues	Lead Agency	Priority
Marine Survival		
Find a method for recording lice levels in the Sound of Mull	LFT	High
Freshwater Productivity		
Carry out juvenile surveys	River Coe Angling Club (RCAC), LFT	High
Freshwater Habitat		
Carry out habitat survey	RCAC, LFT	High
Prevent further erosion due to bank works and look at means of stabilising banks	LDSFB, SEPA, LFT	Medium
Obstruction		
Explore means of removing obstruction at the lower falls	LFT, SEPA, RCAC	Low
Stocking		
Explore feasibility of salmon stocking programme	RCAC, LFT	Medium



CONA AND SCADDLE

There have been no routine electrofishing or habitat surveys carried out on the Cona or Scaddle in many years. Historical data and fisheries managers in the region indicate that the river is in healthy condition. It has been suggested that the catchment has naturally low productivity due to acidic waters caused by the geology of the area rather than acidification as a result of other activities. Thus, in line with other catchments, the Cona and Scaddle require baseline juvenile and habitat surveys to be carried out to determine the present state of the fisheries and potential limiting factors. Native salmon are currently being stocked on both rivers, but the success of the stocking has not been evaluated.

Marine survival is a concern for all rivers in the region. Good seine netting data have been collected relatively close to the mouth of the rivers at Camas na Gaul (approximately 7km NW of the river mouth) and this monitoring should continue to provide a measure of lice levels in the area. Lice burdens of sea trout post smolts at Camas na Gaul in years when farms on Loch Linnhe are in their second year of production are at levels that have been shown to stress fish and may affect survival. Improvements in lice control on the farms are needed, or the relocation of farm sites to the other side of the Corran Narrows may be necessary to safeguard wild salmonid populations.

Summary of issues – Cona and Scaddle

Issues	Lead Agency	Priority
Marine Survival		
Continue monitoring lice burdens of sea trout post smolts on Loch Linnhe.	LFT	High
Freshwater Productivity		
Carry out juvenile surveys	Proprietors, LFT	High
Freshwater Habitat		
Carry out habitat surveys	Proprietors, LFT	High
Stocking		
Monitor success of current stocking programme	Proprietors, LFT	Medium



INVERIE AND GUISEREIN

Electrofishing and habitat surveys have not been carried out on either the Inverie or Guiserein in a number of years. Such surveys are urgently needed to assess the current state of fish populations and freshwater habitats. Local managers and fishery proprietors have suggested there are specific problems with riparian habitats on the Inverie and Guiserein. Gravel movements on the Guiserein have necessitated the regular excavation of pools. The causes of the gravel movement need to be investigated so a long-term solution to the problem can be put in place. Bank stability on the Inverie is poor in places and the exclusion of livestock and planting of native broadleaves could reduce erosion. The SRDP may provide funding for such habitat improvement work. Stocking, using non-native fry sourced from the Seafield Centre in Wester Ross, has been used as a management strategy to combat declines in stocks of sea trout. The use of non-native stock and lack of monitoring is far from ideal and ways of obtaining native broodstock should be explored if stocking is to continue.

Declines in the numbers of salmonids returning to the Rivers Inverie and Guiserein during the late 80s coincided with the introduction of fish farming to Loch Nevis. Recent lice counts from farm fish in Loch Nevis are low relative to other farms in Lochaber. However, it has not been possible to measure lice levels on sea trout post smolts through seine netting due to difficulties locating a suitable site. Efforts will be made in the coming years to find a seine netting site on Loch Nevis, but plankton trawls may provide a better means of monitoring lice levels in this area.

Summary of issues – Inverie River and River Guiserein

Issues	Lead Agency	Priority
Marine Survival		
Find a means of measuring lice levels on Loch Nevis	LFT	High
Freshwater Productivity		
Carry out juvenile salmonid surveys	Proprietors, LFT	High
Freshwater Habitat		
Carry out habitat surveys	Proprietors, LFT	High
Investigate the causes of gravel movement on the River Guiserein and explore possible solutions	Proprietors, LFT	Medium
Tree-planting required to help prevent bankside erosion on Inverie River.	Proprietors, LFT	Medium
Stocking		
Cease stocking with non-native stock. Explore possibility of native stocking programme.	Proprietors, LFT	Medium



LEVEN

Of major concern on the River Leven is the imminent construction of a pair of groynes close to the mouth of the river that will improve white water conditions for canoeists. However, in doing so it is very likely that the passage of migratory fish will be detrimentally affected. If fish are unable to pass the barriers they will be forced to pass through a small gap in the groynes that will be fast running white water. While this may not be a problem for a large salmon, smaller grilse and sea trout could be prevented from passing, as would elvers. This could be catastrophic as if they move further down the river towards Loch Leven, where they would be open to predation. Further, increased activity on the river may affect spawning gravel, holding pools and angling effort. The LFT has advised the River Leven Angling Club on the matter, and they have the backing of the LDSFB, however, it seems that the project will continue, only once the groynes are in place can the LDSFB oppose the structures as being an obstacle to salmon movement.

Marine survival is also a concern for salmonid populations in the river. Loch Leven has an aquaculture facility close to the narrows where it joins Loch Linnhe, and the enclosed nature of the Loch has led to the suggestion that migrating salmon from the River Leven and the River Coe (see above) are picking up high numbers of lice as they have to pass the fish farm as they migrate into the open ocean. To date it has proved impossible to catch enough sea trout post smolts by seine netting to make a valid assessment of lice levels in the area. Efforts to seine net post smolts should continue, but plankton trawls should also be considered as a means of measuring lice levels.

Summary of issues – Leven catchment

Issues	Lead Agency	Priority
Marine Survival		
Collect data on lice levels on Loch Leven through netting sea trout post smolts or plankton trawls.	LFT	High
Freshwater Productivity		
Carry out juvenile surveys	River Leven Angling Club (RLAC), LFT	High
Freshwater Habitat		
Carry out habitat surveys	RLAC, LFT	High
Obstruction		
Lobby against the construction of groynes across the River Leven	RLAC, LDSFB, LFT	High



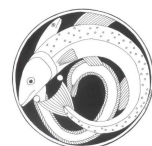
LOCHY

The River Lochy is the most productive river in the region. However, grilse returns on the river are variable and show a biannual rise and fall that coincides with production cycles on local fish farms and lice burdens measured on wild sea trout post smolts by the LFT. Reducing lice levels in Loch Linnhe is a crucial step in restoring wild salmonid stocks on the Lochy. This could be achieved by major improvements in lice control on farms in their second year of production, or may require the relocation of farms south of the Corran Narrows. The AMA process has improved relations between wild fish and aquaculture interests on this system and this dialogue should continue. Lice levels have shown a downward trend on Loch Linnhe since initiatives such as coordinated lice treatments and fallowing were introduced on farms. For this reason, proposals to split production areas within the Linnhe/Lorn/Etive/Sound of Mull/Sunart AMA that would reduce the area over which coordinated action is taken should be resisted. It is also vital that monitoring of lice levels on wild sea trout post smolts continue to assess the efficacy of lice control measures and maintain long-term datasets.

While routine juvenile sampling has not been carried out on the Lochy for a number of years, a regime of focussed sampling has been carried out to determine the effects of abstraction from the mainstem of the river by Scottish Water. This monitoring is due to end in 2008 and electrofishing surveys in both the mainstem and major tributaries will be required in the future to assess the health of fish populations and monitor the effect of the current intensive salmon stocking programme. The freshwater habitat on the Lochy catchment has not been surveyed since 2002. There are a number of habitat issues that are felt to be of minor concern in specific areas of the catchment. Problems with overgrazing and erosion on the River Roy have been discussed with local farmer and it is likely that fencing will be erected. Silt deposition on the River Lundy as a result of historical construction has been raised as a concern; however until a habitat survey is carried out we have no knowledge of the extent of this problem. There has also been an issue in relation to redd washouts in the catchment, some of which is suggested to be as a result of a changing climate, while dam freshets may also be responsible for the problem. Small areas of the catchment have been highlighted as potentially being affected by poor forestry management, and this, as well as the previously described problems could be assessed from habitat surveys of the rivers affected.

The Mucomir Barrage dams the River Lochy at its confluence with the Spean and is operated by Scottish and Southern Energy. Studies have shown that smolts and adult salmon and sea trout are able to negotiate the dam via the fish pass and Borland lift, but it is unclear if the barrage delays movement or affects survival. A study into the effect of the dam on smolt return rates is planned to begin in 2009. Abstraction of water from the upper River Spean and associated tributaries by Alcan has resulted in significant loss of fish habitat. This has been on-going since the late 1920s and it is only with the advent of the WFD that local managers feel they potentially have leverage to negotiate compensation flow.

River managers on the Lochy are concerned about the effects of predation on salmonid stocks particularly mergansers taking smolts, and seals taking kelts. However, no monitoring of predator numbers on the Lochy system has been made and it is unclear if predation pressure on fish stocks is stable, declining or increasing.



Summary of issues – Lochy catchment

Issues	Lead Agency	Priority
Marine Survival		
Continue monitoring of lice levels on wild sea trout post smolts on Loch Linnhe	LFT	High
Lobby for improvements in lice control on farms on Loch Linnhe in their second year of production.	River Lochy Association (RLA), LDSFB, LFT.	High
Freshwater Productivity		
Plan and carry out electrofishing surveys in the Lochy mainstem and major tributaries	RLA, LFT	High
Freshwater Habitat		
Carry out habitat surveys.	RLA, LFT	High
Address problems of overgrazing and erosion on the River Roy	Local Farmers, RLA, LFT	Medium
Investigate causes of silt deposition on the River Lundy	RLA, LFT	Low
Investigate redd washout due to rainfall and/or dam freshets.	RLA, LFT	Medium
Obstruction		
Investigate effect of Mucomir Barrage on smolt return rates	RLA, Scottish and Southern Energy, LFT	High
Abstraction		
Explore means of reducing or mitigating the effects of Alcan abstraction from the River Spea	Alcan, RLA SEPA, LFT	Medium
Forestry		
Improve forestry management practices on tributaries such as the Cour	FC, RLA, LFT	Low
Predation		
Investigate the impact of merganser and seal predation on salmonid numbers	RLA, LFT	Low



MOIDART

Electrofishing surveys carried out by the LFT as part of a regional eel survey and SNH's monitoring of the freshwater pearl mussel population were the first to be carried out in a number of years. It is important that routine electrofishing are carried out to assess the health of fish stocks and monitor the success of the current sea trout stocking programme. No major concerns with the concerns with the freshwater environment have been raised by local managers or noted during fish or pearl mussel surveys. However, it is a number of years since a habitat survey was carried out on the River Moidart and such a survey would be an important first step in ensuring the river is in good condition.

Predation has been raised as a concern by local managers in the Moidart region. There are no data relating to populations of mergansers, goosanders, cormorants or seals in the area with which to support these concerns. A survey of predators in the area would establish if predation pressure on fish stocks is high or increasing on the Moidart and warrants control measures.

Marine survival and the impact of sea lice on migratory salmonid stocks is of concern on the Moidart as elsewhere on the west coast of Scotland. Due to its geomorphology and large tidal range, there have been few attempts to seine net sea trout post smolts on Loch Moidart to measure lice levels. It may be possible to estimate the impact of lice on Moidart salmonids by measuring lice burdens of fish in Loch Ailort to the north or the Shiel estuary to the south. However, obtaining sea trout samples from these areas has not proved easy and plankton trawls may provide the only means of measuring lice levels in this area.

The River Moidart is a SAC for freshwater pearl mussels. Surveys in 1998 indicated that the freshwater pearl mussel population on the Moidart is in unfavourable condition due to the low number of individuals and lack of juvenile mussels. SNH are tasked with returning the freshwater pearl mussel feature into favourable condition. Addressing the apparently low densities of juvenile salmonids (that act as a host for the Glochidia stage of the mussel) on the Moidart or the loss of mussel Glochidia from the system due to the commercial salmon hatchery may improve the health of the mussel population.

Summary of issues – Moidart catchment

Issue	Lead Agency	Priority
Marine Survival		
Obtain data on lice levels in Loch Moidart	LFT	High
Freshwater Productivity		
Carry out electrofishing surveys of juvenile salmonids	Proprietors, LFT	High
Freshwater Habitat		
Carry out habitat survey	Proprietors, LFT	High
Predation		
Investigate predation pressure on salmonid stocks	Proprietors, LFT	Medium



Stocking		
Monitor effectiveness of current stocking programme	Proprietors, LFT	Medium
Freshwater pearl mussels		
Return freshwater pearl mussel population in the River Moidart to favourable condition	SNH	High



MORAR

A rotary screw trap is run each spring in the mainstem of the river to monitor salmon and sea trout output and a Vaki counter on the fish pass provides reliable counts of adult returns. The collection of these data should continue in the coming years to provide what will be the only accurate measure of salmon and sea trout marine survival in Lochaber. In common with other catchments in the region, there have been no electrofishing or habitat surveys on the Morar in recent years. Restarting such surveys is a priority as it will provide a measure of juvenile salmonid numbers and distribution and, together with the smolt and adult counts, allow a comprehensive picture of salmonid production on the Morar system.

Despite previous efforts to carry out seine netting in the area, a suitable location has yet to be found. Fresh attempts to net sites in Loch Nevis are planned for 2009 and any data on lice burdens of wild sea trout collected would be relevant to the Morar as the Loch Nevis farm sites are those closest to this river. Alternatively, plankton trawls may provide a means of measuring lice levels near the mouth of the Morar.

Until 2007 the Morar Sub-board ran a well-managed program of stocking sea trout and to a lesser extent salmon. Due to the closure of the Rubhanna hatchery facility, this has temporarily ceased. The enforced cessation of stocking will be used to assess the effectiveness and need for this management activity and a period of at least two years without stocking will be required to see any impact on smolt production. The Rubhanna hatchery is due to reopen on a commercial basis and the Morar Sub-board are negotiating with the operator to secure space in the hatchery to allow the stocking of wild sea trout and salmon to recommence if the need for it is demonstrated.

The present configuration of the slip gate on the Morar dam forces descending smolts against rocks in certain flow conditions. Scottish and Southern Energy will produce a proposal to rectify the problem in this financial year with the engineering work to be carried out in 2009/10. The screening provision on the River Meoble dam is thought to be ineffective. The LDSFB are currently pursuing this issue to ensure that the screening is legal.

Summary of issues – Morar catchment

Issue	Lead Agency	Priority
Marine Survival		
Find a means of measuring lice levels in the mouth of the Morar	LFT	High
Freshwater Productivity		
Carry out electrofishing surveys	Morar Sub-Board (MSB), LFT	High
Freshwater Habitat		
Carry out habitat surveys	MSB, LFT	High
Obstructions		



Make alterations to the slip gate on the Morar dam	SSE	High
Improve screening provision on the Moeble dam	LDSFB	
Stocking		
Monitor the effect of no stocking on smolt output from the Morar	MSB, LFT	Medium
Prepare facilities for rearing wild sea trout and salmon at the Rubhanna hatchery	MSB	Medium



NEVIS

The owner of the fishing rights on the River Nevis has employed an independent consultant to carry out juvenile salmonid and habitat surveys and advise on fisheries management issues. This investment should ensure that the river and its fisheries are managed responsibly. At present, small-scale stocking of salmon parr is carried out on the river, but this may be reviewed in the future.

The LFT has collected good data on lice burdens of wild sea trout post smolts on Loch Linnhe for a number of years. This monitoring should continue to assess the impact of changes in lice control on farms and environmental effects on lice levels in the loch. Catch returns from the River Nevis do not show the biannual cycling seen on the nearby Lochy, however, it is likely that Nevis fish are affected by lice in Loch Linnhe and would benefit from measures to reduce lice levels.

Glen Nevis is a popular area for recreation for both tourists and locals from nearby Fort William. A visitor centre in Glen Nevis provides a base for Highland Council Rangers that organise educational events for the public and school groups. This makes the River Nevis the ideal place to improve knowledge of fish and freshwater environments amongst the public. In the past the LFT and Nevis Rangers have organised family fun days to introduce people to the fish and invertebrate fauna of the river. Such events should be repeated in the future and other methods of providing visitors with information about the river should be explored.

Summary of issues – Nevis catchment

Issues	Lead Agency	Priority
Marine Survival		
Continue monitoring lice levels on sea trout post smolts in Loch Linnhe	LFT	High
Lobby for improvements in lice control on farms on Loch Linnhe in their second year of production.	LDSFB, LFT	High
Stocking		
Review need for current stocking programme	Proprietor, LFT	Medium
Education		
Develop events and projects to raise awareness of fisheries and freshwater habitats among the public	LFT, Highland Council Rangers	Medium



SHIEL

The decline in fish populations, particularly salmonids, in the Shiel catchment has been probably of greatest concern in the region. This once healthy system has been hit by numerous problems simultaneously which has reduced the number of returning fish dramatically. It is likely a number of factors have contributed to this decline and need to be addressed on the Shiel. As with most catchments in Lochaber, it is a number of years since electrofishing and habitat surveys have been carried out on the Shiel. These are required to identify factors limiting fish populations.

Forestry in the Polloch/Hurich sub-catchment of the Shiel is known to be a problem in relation to the freshwater habitat. Non-native conifer plantations owned and managed by the Forestry Commission has created problems with pH, siltation and shading of the riparian habitat. The LFT prepared a report for the FC in 2006 suggesting prioritised restructuring of the forestry to improve the river for fish. FC have made significant progress implementing these recommendations, and buffer zones of native broadleaves now exist along parts of the sub-catchment. Much work remains to be done and FC should continue this restructuring and incorporate fisheries concerns into future forest design plans. Monitoring of the effect of the forestry improvements on water quality and fish production should be carried out. This could include long-term monitoring of pH levels, egg box experiments, invertebrate sampling and electrofishing surveys of juvenile salmonids.

Despite a lack of fish farms in the surrounding marine environment – the closest is in Loch Ailort – it is believed that an increase in sea lice is a major factor in the decline in salmonid stocks in the Shiel catchment. To date it has proved impossible to obtain a meaningful sample of sea trout post smolts by seine net to record lice burdens. In 2002 three sea trout post smolts were caught on the Shiel by rod and line and examined by the LFT. They all carried high lice burdens, stressing the need to obtain a reliable measure of lice levels in the area. Plankton trawls may provide a means of doing this.

The escape of an estimated 15 000 salmon smolts from one of the farm sites on Loch Shiel in 2007 highlighted long held concerns that escaped farm smolts are infiltrating the system. It is suspected by local managers that there is a constant low level of farmed smolts escaping from the facilities in Loch Shiel due to sub-standard equipment and human error during a number of husbandry practices. Electrofishing surveys carried out over several years by the Shiel Sub-Board caught a number of smolts that were suspected to be of farmed origin. An investigation of the genetic make up of juvenile salmon in the Shiel catchment would allow the degree of introgression of farm genes into wild fish to be measured. This would not only quantify the scale of any problem, but would also be a vital step in any stocking programme to ensure that far genes are not being artificially propagated across the catchment.

The Shiel Sub-board are examining the options for a more coordinated stocking programme across the catchment. This needs to be planned carefully to ensure broodstock are of wild origin and stocked fish do not compete with wild-spawned fish.



Summary of issues – Shiel catchment

Issues	Lead Agency	Priority
Marine Survival		
Find a means of measuring lice levels in the Shiel Estuary	LFT	High
Freshwater Productivity		
Carry out electrofishing surveys	Shiel Sub-Board (SSB), LFT	High
Freshwater Habitat		
Carry out habitat surveys	SSB, LFT	High
Forestry		
Continue restructuring of forestry in Glen Hurich	FC, LFT	Medium
Monitor impact of forestry improvements on river habitat and fish populations	FC, LFT	Medium
Fish Farm Escapes		
Improve containment on smolt farms on Loch Shiel	Marine Harvest	High
Stocking		
Investigate genetic introgression of farm genes into wild salmon population	SSB, LFT, MH	Medium



STRONTIAN RIVER

The Strontian Community Company (SCC) have developed a comprehensive plan for restoring the rivers salmonid stocks. This is based on up to date electrofishing surveys and habitat studies. Juvenile salmonid numbers are critically low on the Strontian. The SCC is keen to set up a hatchery to initiate an Atlantic salmon stocking program on the river, however there are concerns that the stocks in the river have been infiltrated by escapees from nearby fish farms in Loch Sunart. Gentic samples have been taken from juvenile salmon in 2008 and will be analysed soon to assess this risk. Even if farm genes are not present in the wild population, obtaining sufficient broodstock will be difficult and even growing on parr from the Strontian may not provide the required number of breeding fish. There are also logistical difficulties with the setting up of a hatchery that will need to be overcome. However, stocking may be the only option on this river given current stock levels and the SCC's willingness to seek and follow scientific advice and acknowledged best practice is encouraging.

Scottish Water installed a weir on the Strontian River in 2006 and there were significant problems with sedimentation during construction. No increased sediment input has been reported since construction ended, but the impact of the weir through reduced flow rates and changes in flow rate should be monitored.

Ultimately, it is felt that marine survival may have been the main casual factor for the decline in salmon stocks in both the Strontian and Carnoch Rivers. Lice levels recorded on sea trout post smolts in Loch Sunart were high, particularly in 2008, and improved lice controls on farms in Loch Sunart would benefit wild salmonids. Monitoring of lice levels on Loch Sunart should continue in future years.

Summary of issues – Strontian catchment

Issues	Lead Agency	Priority
Marine Survival		
Continue monitoring lice levels on sea trout post smolts in Loch Sunart	LFT	High
Freshwater Productivity		
Carry out regular electrofishing surveys to monitor effects of restoration programme	SCC, LFT	High
Abstraction		
Monitor effects of Scottish Water abstraction on water flow	Scottish Water, SCC, LFT	Low
Stocking		
Analyse genetic samples from wild salmon parr to assess impact of farm genes	LFT, FRS	Medium
Set up hatchery facilities for stocking programme	SCC, LFT, MH, FRS	Medium
Consider options for obtaining broodstock for stocking programme	SCC, LFT, FRS	Medium



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CONSULTATION PROCESS

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GLOSSARY OF TERMS AND ABBREVIATIONS

AMA	Area Management Agreements
AMG	Area Management Group
ASFB	Association of Salmon Fisheries Boards
AST	Atlantic Salmon Trust
CAR	Controlled Activities Regulations
FC	Forestry Commission
Ferox	Adjective used to describe brown trout that feed exclusively on other fish and attain great size and age in Scotland's deep lochs.
FRS	Fisheries Research Service
ICES	International Convention on the Exploitation of the Sea
LDSFB	Lochaber District Salmon Fisheries Board
LFT	Lochaber Fisheries Trust
NASCO	North Atlantic Salmon Conservation Organisation
Oligotrophic	Nutrient poor
RAFTS	Rivers and Fisheries Trusts Scotland
RLA	River Lochy Association
SAC	Special Area of Conservation
Salmonid	Fish belonging to the family Salmonidae. Native Scottish species include salmon, sea/brown trout and Arctic charr
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SRDP	Scottish Rural Development Programme
TWG	Tripartite Working Group
WFD	Water Framework Directive

