

4 Fish Populations

4.1 Electrofishing data

ART has a comprehensive database of electrofishing survey results from across Ayrshire, although this is almost wholly restricted to the riverine environment and focussed primarily on salmonid fish and their habitat. Records of any other fish species recorded during these surveys are maintained. Data on fish populations within stillwaters is limited and is largely derived from anecdotal reports. This represents a considerable gap in the knowledge and understanding of fish populations in Ayrshire particularly as it is known that there have been many introductions of non-native fish species into stillwaters in the area.

The following table summarises the confirmed distribution of fish species recorded by ART staff during electrofishing surveys in Ayrshire. A question mark indicates that although this species has not been found by electrofishing in a particular management unit, they are thought likely to be present.

Fish species found during electrofishing surveys 2002-2008*							
Species	River Stinchar	Water of Girvan	R. Doon (Lower)	R. Doon (Upper)	River Ayr	River Irvine	River Garnock
SA	•	•	•	•	•	•	•
TR	•	•	•	•	•	•	•
E	•	•	•	Absent	•	•	•
MW	•	•	•	•	•	•	•
SL	Absent	•	•	Absent	•	•	•
ST	•	•	•	•	•	•	•
PR	Absent	Absent	•	?	•	?	?
LA (R)	•	•	•	Absent	•	•	•
LA (S)	?	?	?	Absent	•	?	?
FL	•	?	?	Absent	?	?	?
GR	Absent	Absent	Absent	Absent	•	Extinct	Absent
GU	Absent	Absent	Absent	Absent	Absent	•	Absent
RO	Absent	Absent	Absent	Absent	Absent	Absent	•

*Many other fish species have been found in Ayrshire. This table only lists those captured during electrofishing surveys.

Key to abbreviations

SA – Atlantic salmon *Salmo salar*

E – European eel *Anguilla Anguilla*

SL – Stoneloach *Noemacheilus barbatulus*

ST – Stickleback (three-spined) *Gasterosteus aculeatus*

PR – Perch *Perca fluviatilis*

sp.)

LA (S) – Sea lamprey (*Petromyzon* sp.)

Grayling *Thymallus thymallus*

Roach *Rutilus rutilus*

TR – Trout *Salmo trutta*

MW – Minnow *Phoxinus phoxinus*

LA (R) – River or brook lamprey (*Lampetra*

FL - Common flounder *Platichthys flesus*

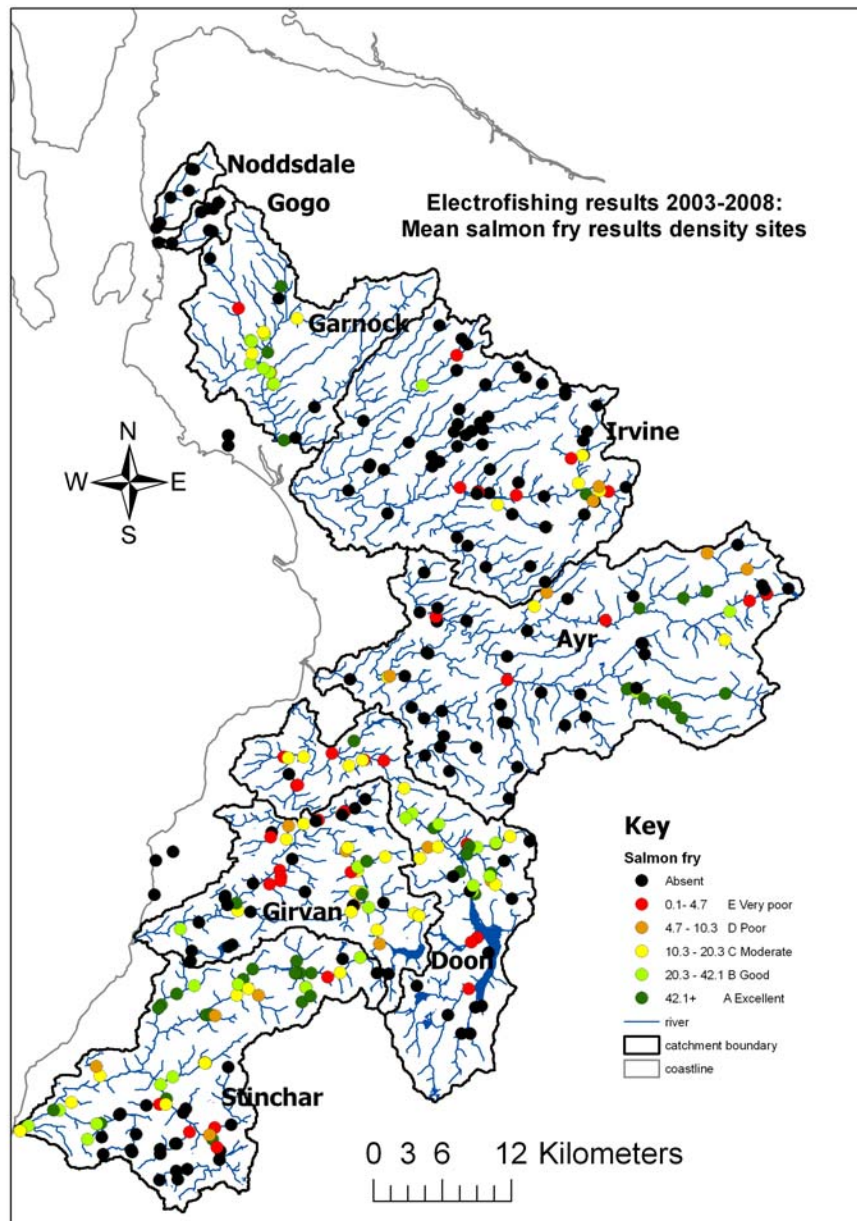
GU – Gudgeon *Gobio gobio*

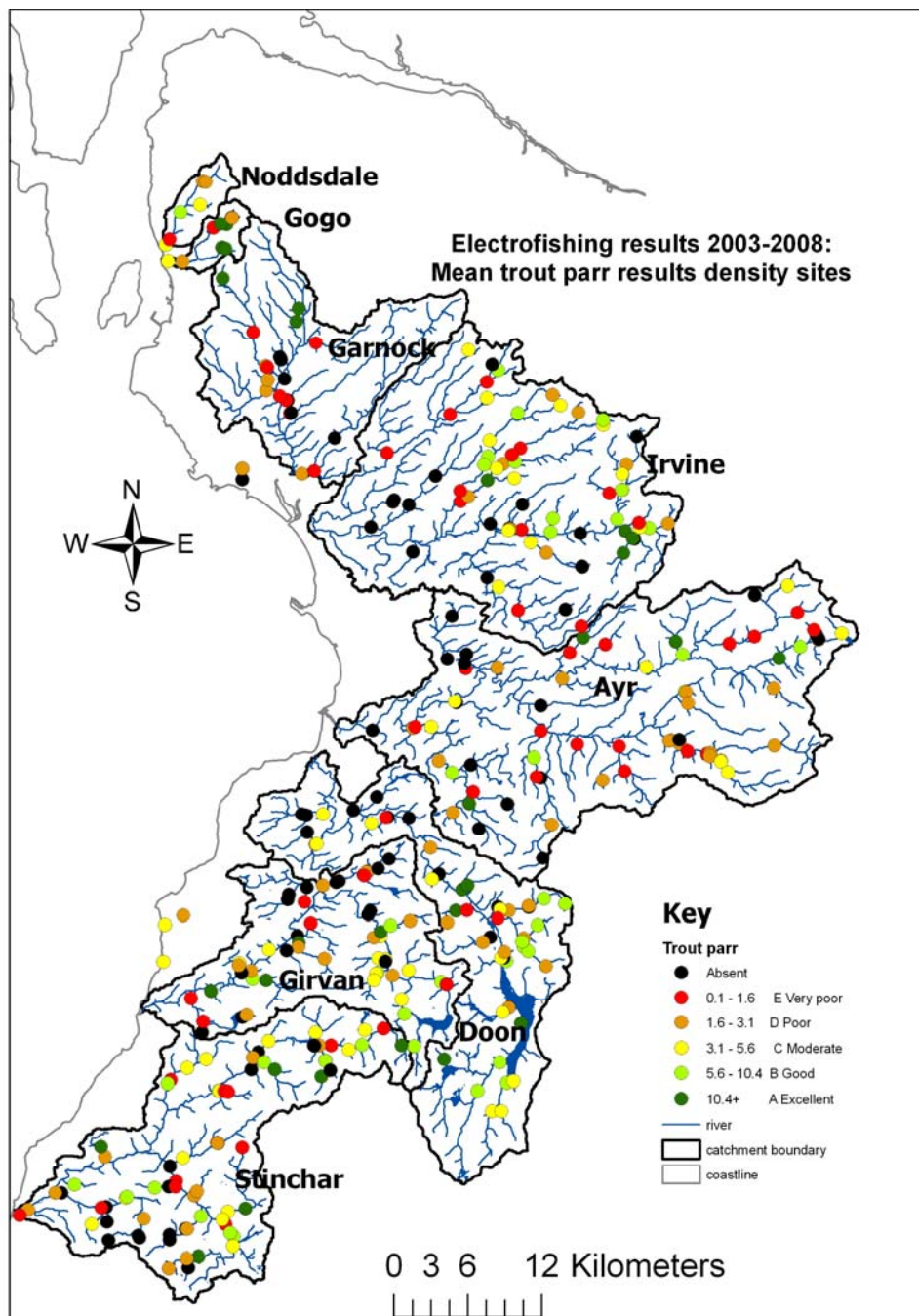
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4.2 Salmon and trout

ART have electrofishing data from 450 sites across Ayrshire, including almost every tributary. Electrofishing sites are either semi or fully quantitative sites from tributaries and upper main stem or timed electrofishing surveys from the larger main stem sites. All electrofishing is carried out following SFCC protocols. Each year a number of core sites are monitored and the data from these sites provide an invaluable record of trends in fish populations. The timed surveys are targeted primarily at prime salmon fry habitat, i.e. shallow fast flowing water and provide an index of fry numbers.

The maps below show the mean first run results of the electrofishing surveys for salmon fry (fish less than one year old), trout parr (one year and older) at density sites across Ayrshire. Some of the sites have been surveyed annually whilst others have been surveyed once. For sites with more than one set of results the mean has been calculated. The results are classified according to the Scottish national classification scheme¹.





It can be seen that there is considerable variation between sites with a full range of results from absent to excellent. Trout are much more wide spread than salmon with trout populations (resident trout only) present upstream of impassable obstructions. To date it has not possible to ascertain the relative contribution of resident (brown Trout) and migratory (sea trout) to the trout populations present at each site, although genetic analysis is likely to make this possible in the near future. Trout populations tend to be better in more upland habitat with poorer densities recorded in the lower reaches of the Garnock, Irvine, Ayr and Doon catchments and the north western part of the Girvan. This appears to correspond quite closely to the distribution of improved grassland (see Section 3 Catchment description).

The distribution of salmon is limited to accessible parts of the catchment, although stocking activities upstream of impassable obstructions may temporarily increase their

distribution. The range of salmon and other migratory fish species is largely restricted by natural obstacles such as waterfalls. However in a heavily populated and industrialised area such as Ayrshire it should be no surprise that there are many man-made obstructions such as weirs, dams, culverts etc, some of which are either partially or totally impassable. ART have carried out habitat surveys over all the main rivers in Ayrshire with the exception of parts of the River Irvine and has a detailed database of obstructions such as weirs, culverts etc. The map on the next page shows the locations of problematic weirs and dams known to ART, although there may be others. The southern rivers were much less affected by industrialisation of watercourses and there are very few weirs remaining. The main areas of concern are in catchments in north and central Ayrshire where there are many weirs, almost all of which are now redundant. Examples of problematic man made obstructions are shown below.



Black Rocks waterfall, Kilmarnock Water, where the plunge pool has been filled and capped with concrete



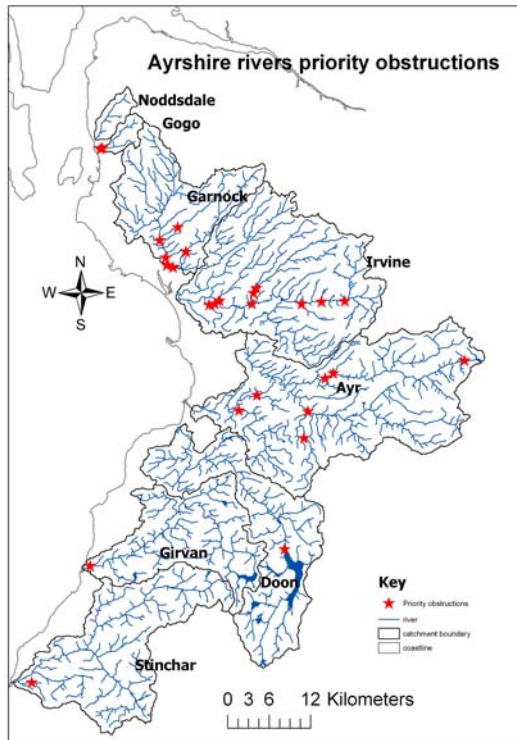
Sevenacres Weir, Lugton Water



Girvan Dykes

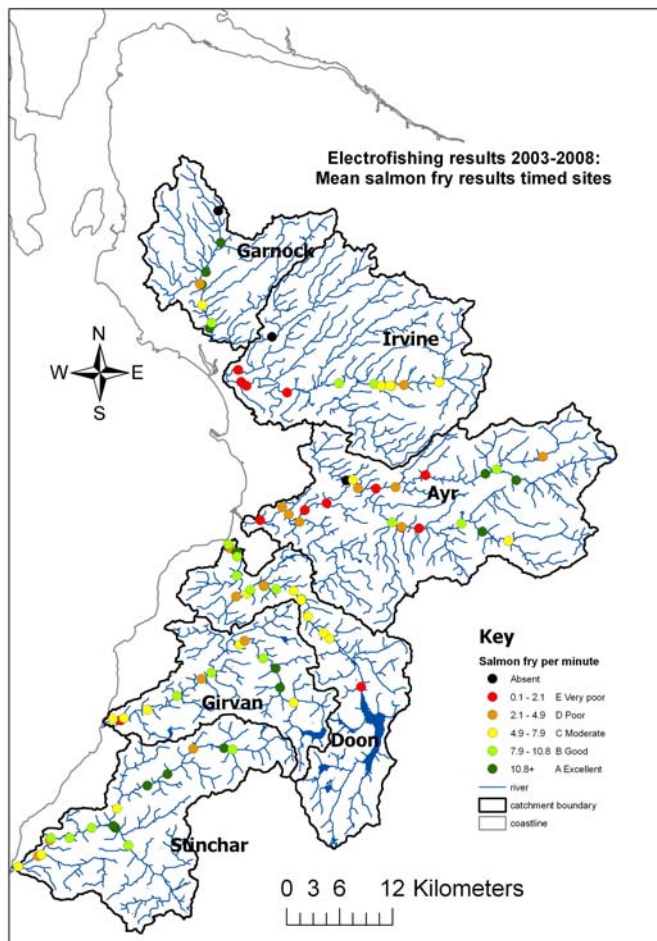


Upstream migrating salmon leaping at Anderson's hole, Catrine, River Ayr



Some of these obstructions are passable to migratory fish and have fish passes although they are far from ideal, e.g. Catrine Weirs, or have no operational fish pass but are passable to salmon under specific flow conditions, e.g. Sorn Weir. Others such as the modifications at Black Rocks waterfall on the Kilmarnock Water in Kilmarnock are considered effectively impassable denying access to a huge area of potentially very productive nursery habitat. Removing impassable obstructions and allowing migratory fish their full natural range is one of the most important management actions.

Electrofishing using a backpack or generator based equipment is limited to shallow and relatively narrow watercourses. In order to assess fish populations in main stem sites or larger tributaries the SFCC has developed a timed electrofishing protocol. ART utilise this protocol to monitor salmon fry numbers and the results of these surveys are shown in the map below. In this case the results are classified according to a quintile classification scheme derived from all Ayrshire timed results.



Mean results from timed electrofishing surveys

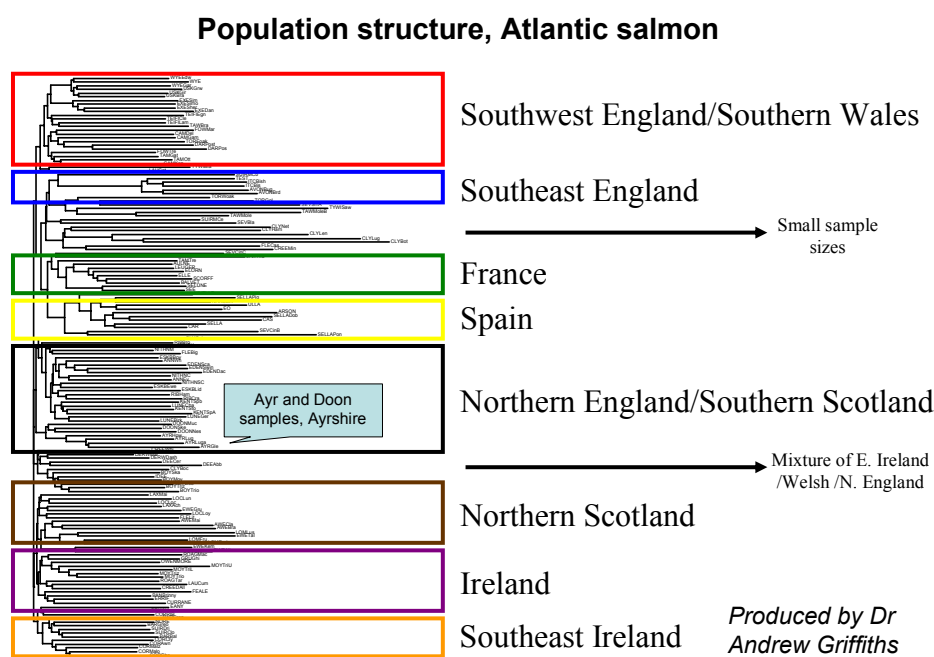
Most of these sites have been surveyed annually for a number of years. The Stinchar, Girvan and Doon results are generally at the upper end of the classification scheme whilst those in the lower Ayr and Irvine have been consistently poor with better results in the upper catchment. Data for the Garnock is from one year only (2005) when salmon fry densities in the main stem were generally good.

4.3 Genetics

Genetic analysis of fish stocks even within small waterbodies have been shown to exhibit distinct genetic differentiation. This has been widely studied in salmon populations due to their economic value. These genetic differences are maintained by the accurate homing instincts present in salmon populations, (94-98% homing typically exhibited²). All of the Ayrshire rivers are likely to have many different stocks of salmon, defined for example by the tributary of their origin, or physical features such as waterfalls. The strong homing instinct exhibited by salmon ensures that there is reproductive segregation of individuals into distinct groups based on place of origin³. The extended salmon spawning season that can be observed in the Ayrshire rivers (from early November through January) is the result of the genetic differences present within the local salmon populations. The early running salmon will breed with similar fish whilst the later running salmon will either spawn in different parts of the river or at different times, maintaining the genetic isolation.

Protection of the genetic diversity is essential for the health of salmon populations. The wide variations in run timing that occur in salmon populations can also be explained by genetic variation. The variation in run timing ensures that fresh fish arrive in our rivers from March to November, providing season long sport.

During the ASAP project genetic analysis of salmon samples demonstrated that the Doon and the Ayr salmon were on the same branch of the genetic tree, and are related to other rivers in the south west Scotland/north west England (see genetic tree below)(produced during the ASAP project).

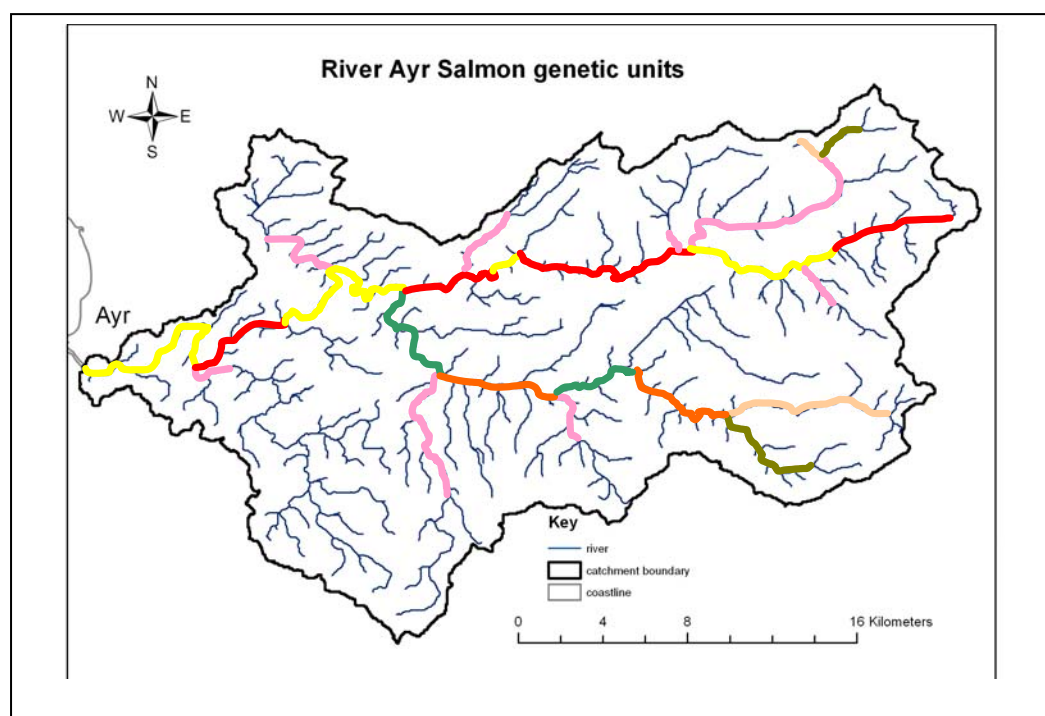


Genetic analysis is about to become a very important tool for the fishery manager. Genetic analysis will soon be able to provide information on many vital fishery management issues, including, effective population size, the number of individual populations, relative contribution of tributaries or areas of the river to smolt production, source of spring running fish and the contribution of stocking to overall production.

For these reasons ART consider that the collection of genetic material and analysis from across our catchments is an essential management action. Little is currently known about stock differentiation of salmon stocks in Ayrshire therefore management of the salmon population should operate on the precautionary principle with conservation of the genetic integrity of stocks utmost.

Through participation with RAFTS in the SALSEA project, ART hope to be able to produce a fine scale genetic map of salmon populations in Ayrshire. Salmon populations are known to be differentiated into different genetic stocks, often associated with geographic features such as waterfalls, rapids or long slow flowing river stretches. The map below highlights the locations of potential genetic units in the River Ayr catchment. There are no significant passable waterfalls in the River Ayr but there are a number of weirs which may have the same impact. ART will implement a sampling strategy based on the map below to create a detailed genetic

map of the salmon population in the River Ayr catchment. The River Ayr was selected for illustration here as it is the largest catchment in Ayrshire. Even in a moderate size river such as the Ayr, twenty four potential genetic units have been identified. Similar maps have been produced for all Ayrshire salmon populations.



4.4 Other fish species

The distribution of the some of the more common other fish species found during electrofishing surveys 2002-06 are shown in the maps on the next page.

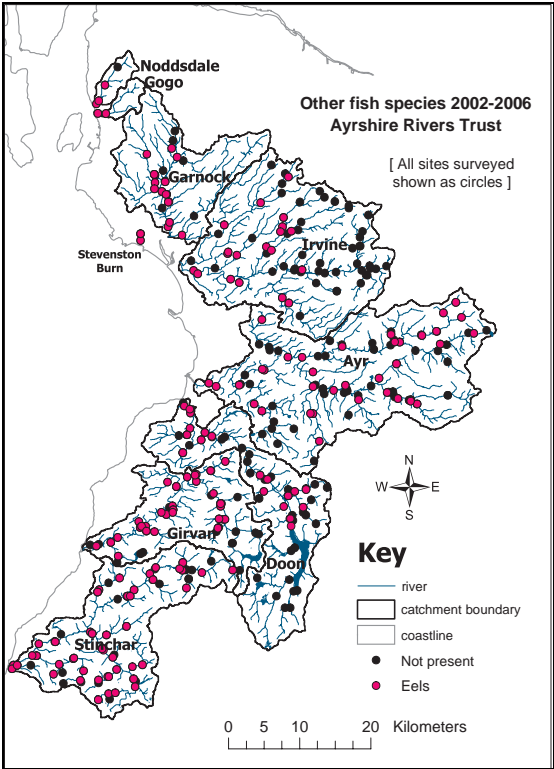
4.4.1. Eels

Eels are widespread and common in Ayrshire and have been found to be present in every management unit except the upper Doon. Migration into the upper Doon is probably prevented by Loch Doon dam, built in 1935 as part of the Galloway Hydroelectric Scheme. ART is not aware of any commercial fishing for eels in Ayrshire at present. There are anecdotal reports of small scale commercial fishing in some of the lowland Ayrshire stillwaters in the recent past. There is a great deal of concern across Europe regarding eel populations and the EU have asked member states to prepare Eel Management plans. As a conservation measure the Scottish Government has introduced legislation that prohibits fishing by any method for eels (*Anguilla anguilla*) in Scotland, except on application and under the authority of a licence granted by Scottish Ministers⁴.

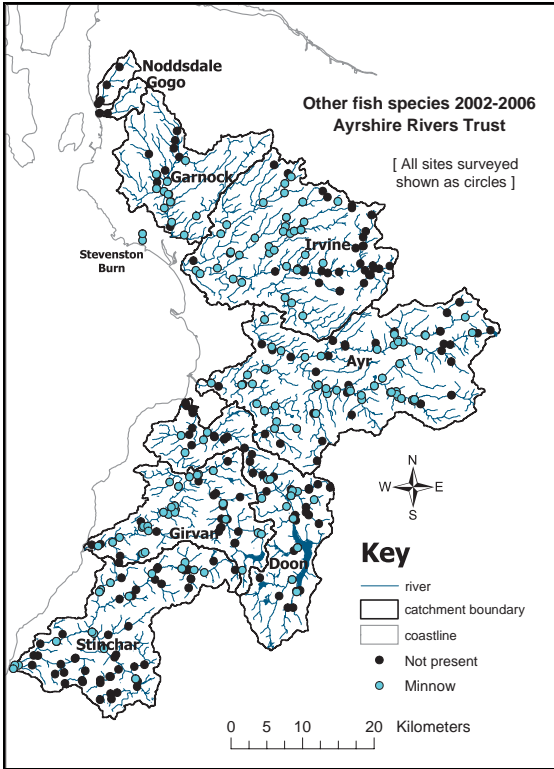
4.4.2. Minnows

Minnows are very common in Ayrshire and are present in every management unit. Their spread may have been accelerated by human activities, such as anglers using

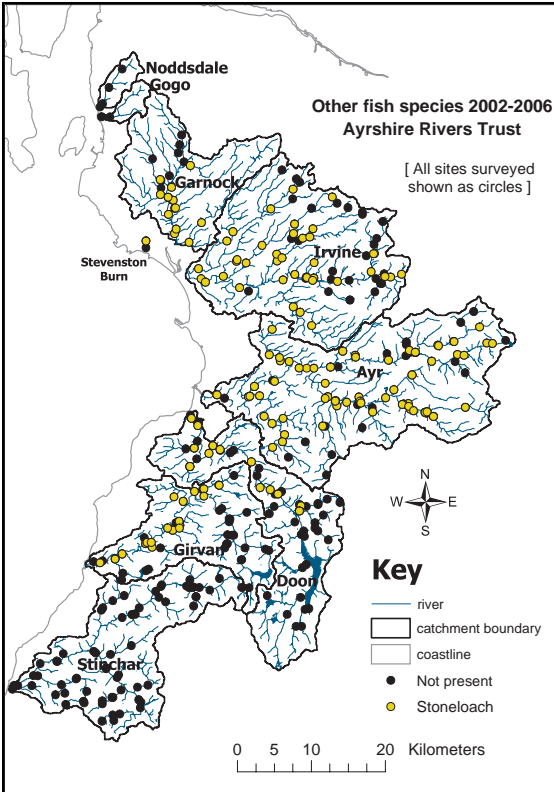
them for live-bait or introduction into garden ponds. Their status as a native species is questionable.



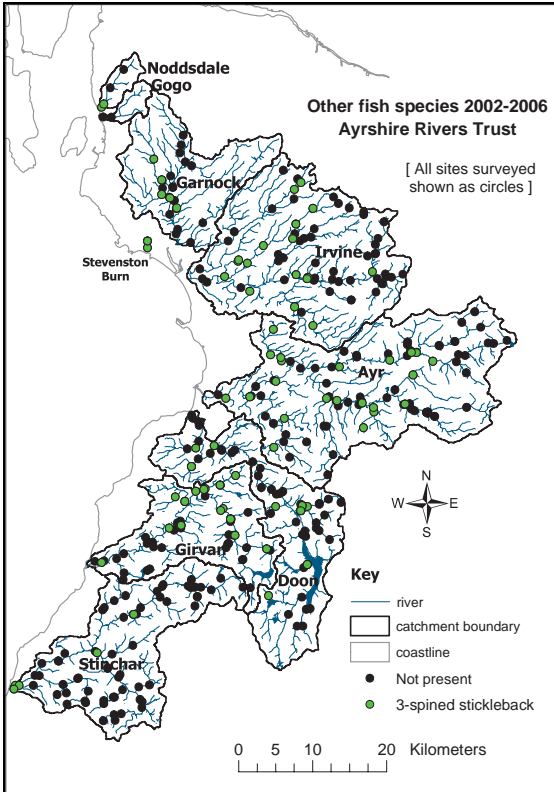
Eel distribution



Minnow distribution



Stone loach distribution



Three-spined stickleback

4.4.3. Stone loach

Stone loach are now very common in Ayrshire and are present in every management unit with the exception of the River Stinchar, upper River Doon and the Largs Burns. Their spread has been accelerated by human activities, especially live-bait fishing. The fact that they do not occur in all watercourses in Ayrshire lends weight to the argument that they are non-native in this area.

4.4.4. Three-spined Sticklebacks

Three-spined sticklebacks are common in Ayrshire and are present in every management unit. It is likely that their distribution is under recorded by ART as they often prefer slower flowing water and can be common in ditch type environments.

4.4.5. Grayling

Grayling are now only present in the Ayr catchment where they were introduced in the 1850's. They are present throughout the main stem of the River Ayr and in the Lugar Water as far upstream as Ochiltree, where the weir probably forms the upper limit. They were also introduced into the River Irvine at the same time as the River Ayr but are now thought to be extinct in that river. ART produced a report on Grayling Ecology in the River Ayr in 2003 ⁵. It was considered that current exploitation rates by anglers were relatively low and that there was potential for expansion of the fishery. Attitudes towards grayling have improved in recent years and they are now generally regarded as a valued part of the River Ayr fishery.

4.4.6. Arctic charr

Arctic charr are present in Loch Doon for which it is afforded SSSI status. The population is known to be under threat with acidification considered the major problem. Perch were introduced into the loch about 1970 and their presence may also add to the problems for the native charr. Surveys are completed on the loch on a regular basis as part of SNH's monitoring requirements. There is no fishery for the charr although they are caught occasionally by trout or perch anglers.



Charr caught in Loch Doon during scientific gill netting survey 2008

4.4.7. Pike

Pike are common in stillwaters across Ayrshire. Pike are also common in the upper reaches of the River Doon in the Dalmellington area where the slow flowing nature of

the river provides ideal habitat. There growing interest in pike angling in Ayrshire and there is an active branch of the Pike Anglers Club.

4.4.8. Perch

Perch are also present in many stillwaters across Ayrshire, often in the same waters as Pike. They are also caught regularly by anglers in the River Doon, although they are thought to be the result of migration from stillwaters rather than from breeding within the river.

4.4.9. Gudgeon

Gudgeon are present in the lower River Irvine and tributaries, thought to the result of introduction around 1970.

4.4.10. Lampreys

Juvenile brook lampreys are widespread and are often encountered during electrofishing surveys in Ayrshire. They are present in all management units with the exception of the Upper Doon.

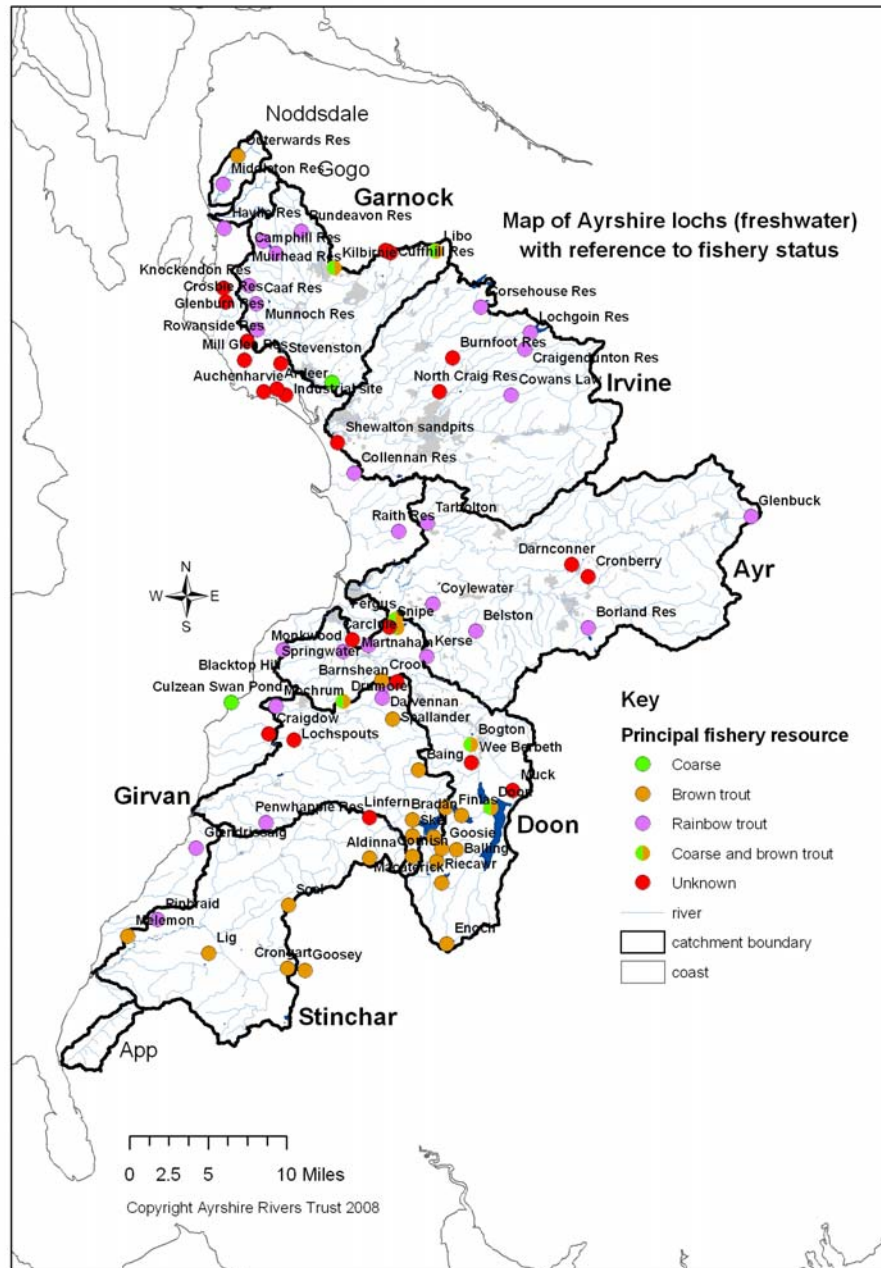
A single juvenile sea lamprey was found in the lower River Ayr in 2004. That record probably underestimates the distribution of sea lampreys as there have been a number of reports of spawning sea lampreys in the lower reaches of the River Doon and Girvan in recent years. The photo below shows spawning sea lampreys in the lower River Doon in 2008.



Three spawning sea lampreys River Doon 2008

4.4.11. Stillwater fish species

ART have very limited knowledge of fish populations within still waters in the area and what we do have is largely from anecdotal reports. There are many commercial trout fisheries stocked with rainbow and brown trout. The map below shows the current status of our knowledge.



Known stillwater fish population status

There are many other fish species present in some of the stillwaters shown above. Roach are present in many stillwaters and are found in the River Irvine and Lugton Water. Eglinton Loch contains a range of coarse fish species including bream, roach, rudd and carp. Commercial coarse fisheries have been established and they support a wide range of self sustaining coarse fish populations. There is growing interest in coarse fishing in Ayrshire and without effective regulation there is a risk that the spread of non-native species will continue.

4.5 Ayrshire Fisheries

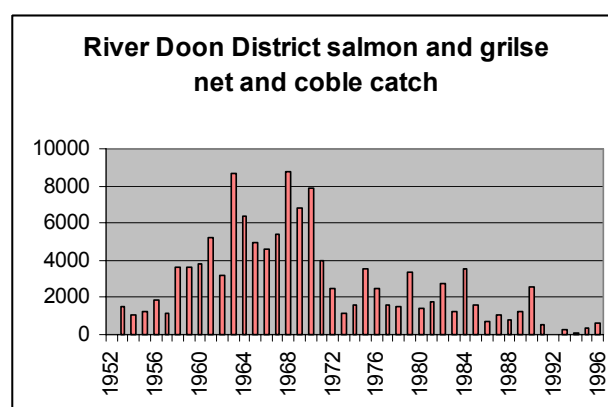
The freshwater game fishery in Ayrshire consists of salmon, trout and sea trout fishing in the six major rivers and the larger coastal burns. The River Ayr also has a grayling fishery. The river fisheries consist of a mixture of private beats and club waters, ranging from full commercial letting, syndicated beats or club water for members with day ticket availability. Stillwaters fisheries range from artificial ponds stocked with trout/coarse fish to club waters (often the naturally occurring small stillwaters). Some of the lowland coarse fish lochs are largely unregulated and are regarded as free fisheries. There is a Freshwater Fish Protection Order in force covering angling in the Irvine, Gogo, Noddsdale and parts of the Garnock catchment

The history of fisheries in Ayrshire were researched using a number of sources including the Statistical accounts, DSFB records, local netting, estate and angling club records, personal communications and the FRS Statistical Bulletin. Very little reference to any freshwater fishery, other than the well established salmon and sea trout fishery, were found. The salmon and sea trout fishery consisted of a coastal and estuary net fishery and a rod and line fishery in freshwater, with one reference to netting in freshwater.

There are currently four District Salmon Fishery Boards (DSFB's) within Ayrshire, responsible for managing salmon fisheries on the Rivers Stinchar, Girvan, Doon and Ayr. The Irvine and Garnock fishery area has never had a DSFB, although there is currently an active Improvement Association consisting of many of the angling clubs on the river. The Girvan, Doon and Ayr also had Improvement Associations in the past although they all wound up in the 1990's.

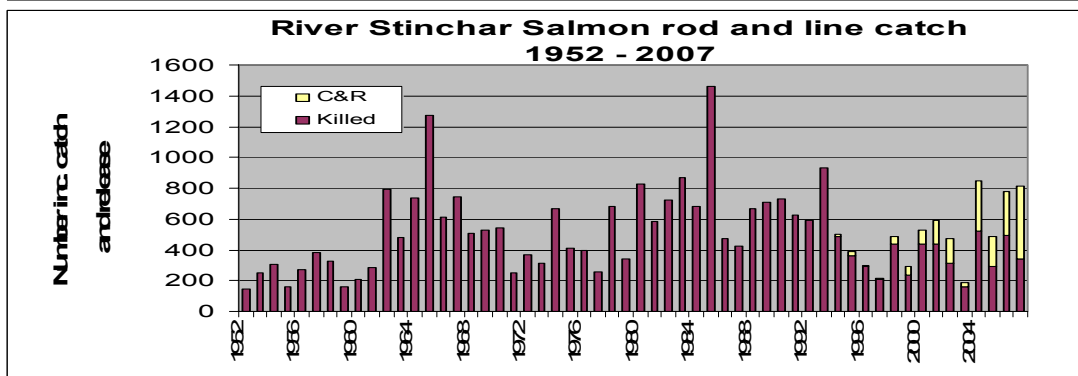
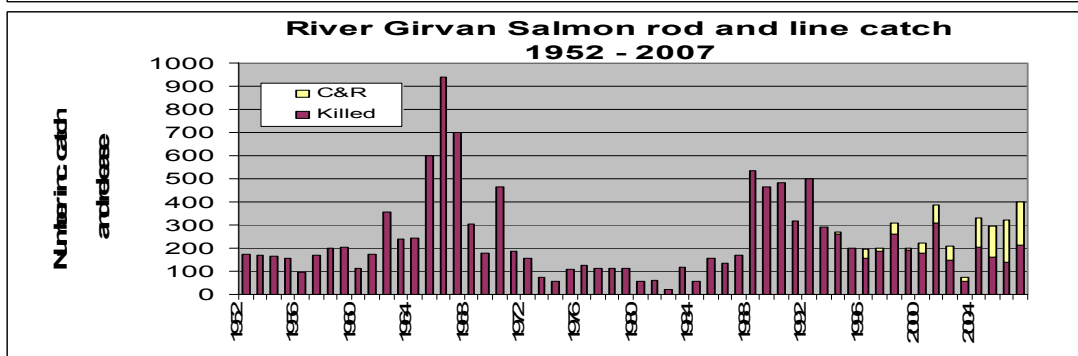
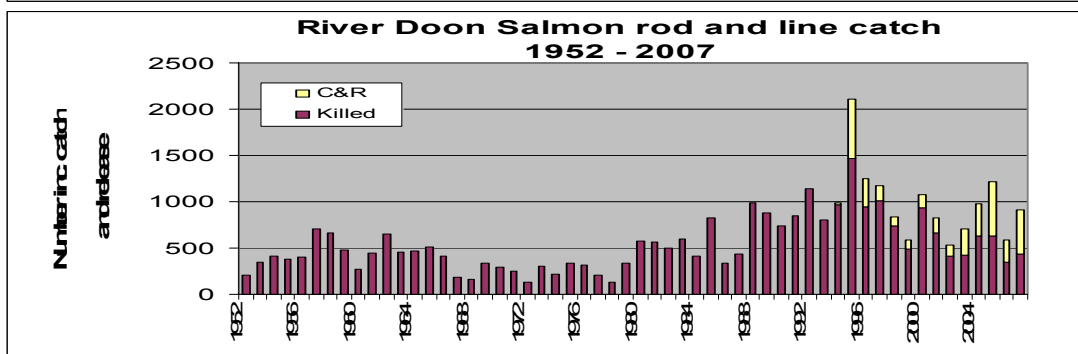
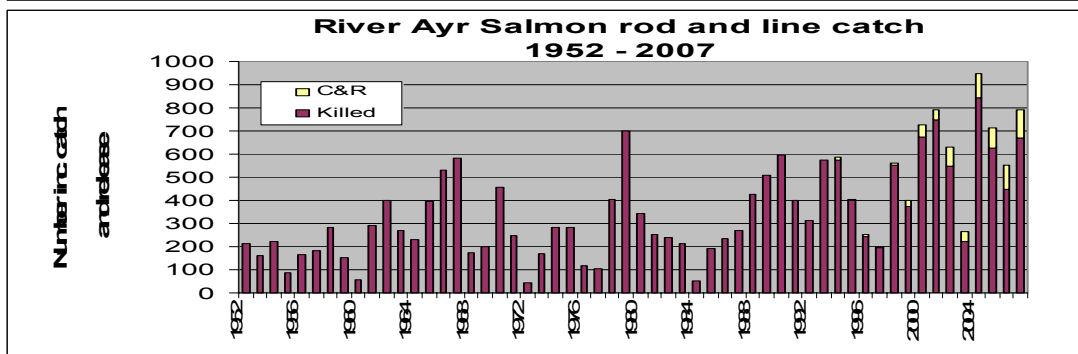
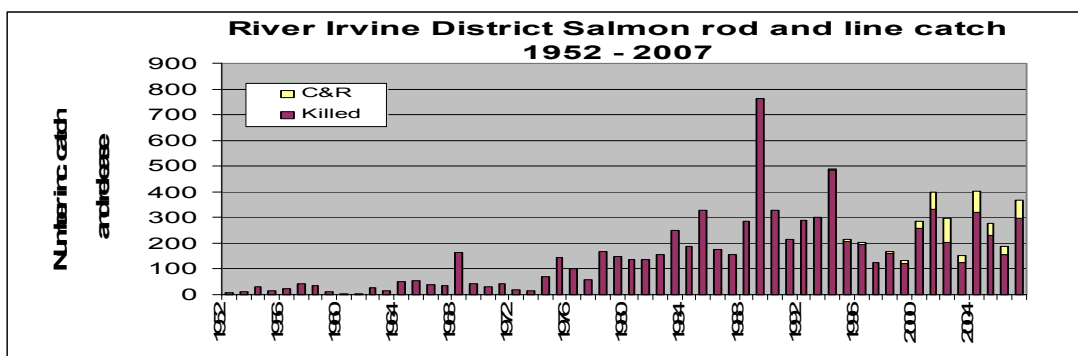
The salmon and sea trout net fishery in Ayrshire has a long history, with the earliest reference found dating from the 1791-99 Statistical Account, where mention is made of a considerable salmon fishery at the mouth of the River Stinchar (<http://stat-acc-scot.edina.ac.uk/link/1791-99/Ayrshire/Ballantrae>). During the 19th century there was a fixed net fishery covering the entire Ayrshire coastline. The Fifteenth Annual Report of the Fishery board of Scotland (Fishery Board of Scotland, 1896), contains a map showing the locations of all salmon fixed nets on the Ayrshire coast. The map shows that nets were present all the way along the coast with a concentration in the Stinchar and Girvan Fishery Districts. To the north of the mouth of the River Girvan there were 30 to 35 fixed nets per 5 miles of coastline. Such an high intensity fishery effort suggests that the fishery was either very productive and/or lucrative.

There was a highly professional and efficient netting operation centred on the Doon estuary and Ayr beach, run by the Carson family, Girvan, between 1938 and 1984, when the netting rights were sold. Netting in the Doon district ended in 1996. This fishery was the most productive in Ayrshire with the net and coble catch peaking at over 8700 in the 1960s. There is currently no legal salmon or sea trout netting within Ayrshire.



Various reports suggest that fishing with rod and line in the rivers of Ayrshire was an established sport more than two hundred years ago. The Statistical Account for the Muirkirk parish <http://stat-acc-scot.edina.ac.uk/link/1791-99/Ayrshire/Muirkirk> mentions angling by rod and line citing the negative impact of the poaching by “destroying the more moderate sport of the angler, who seldom fails to pour forth blessings liberally on them, as he returns home with a basket much lighter than usual”. Other reports in the same series refer to the deleterious effect of the industrialisation of Ayrshire’s rivers that occurred at that time. The Statistical Accounts of Scotland (1791-1799) for the Galston parish <http://stat-acc-scot.edina.ac.uk/link/1791-99/Ayrshire/Galston> on the River Irvine states that the “scarcely one salmon a season can be caught by the rod, whereas 20 or 30 years ago, any skilful person, might for his amusement, have killed scores of them”. The main reason given for the decline was the damage done by the mill dams which had been erected on the river.

The most consistent and longest running data set for salmon and sea trout catches is the Statistical Bulletin Scottish Salmon and Sea Trout catches, produced by Fisheries Research Services ⁷. Graphs of the rod and line salmon catch for each of the five fishery districts are shown in the graphs below.



There is no consistent pattern for salmon rod and line catches across Ayrshire. The peak rod catches on the River Doon occurred in the nineties, following the closure of the netting station and the breaching of the weir at the tidal limit. The high rod and line catches seen in the Girvan and Stinchar in the sixties were not recorded in the Doon, probably due to the major salmon netting fishery in the tidal reaches.

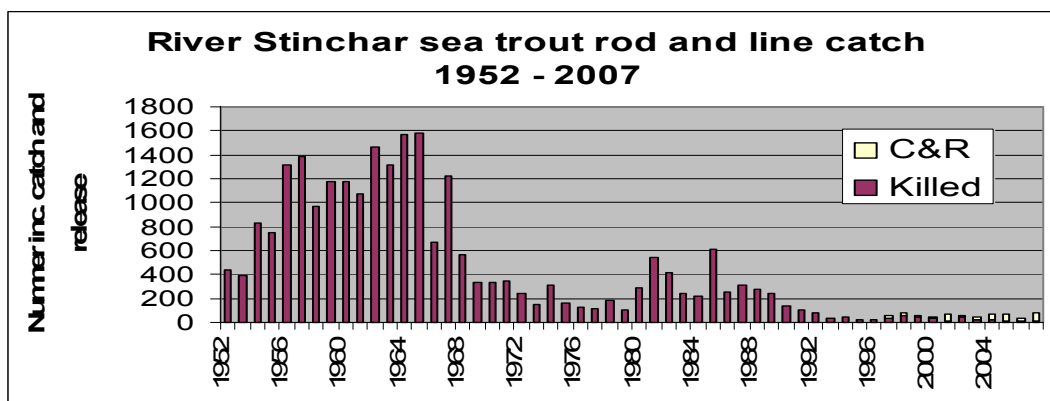
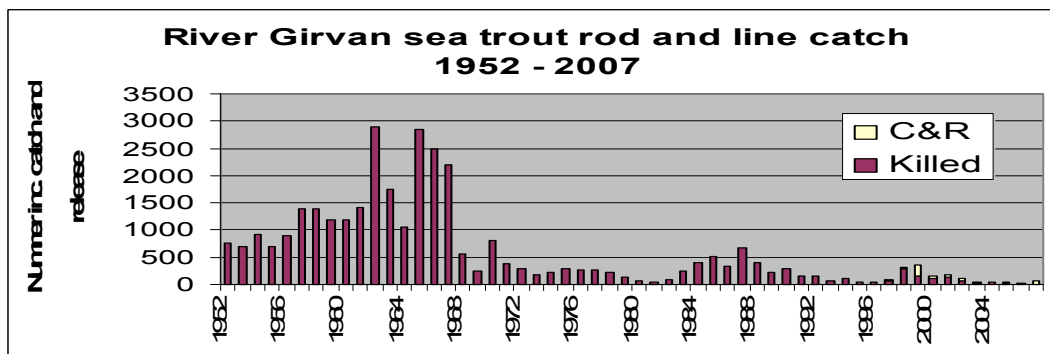
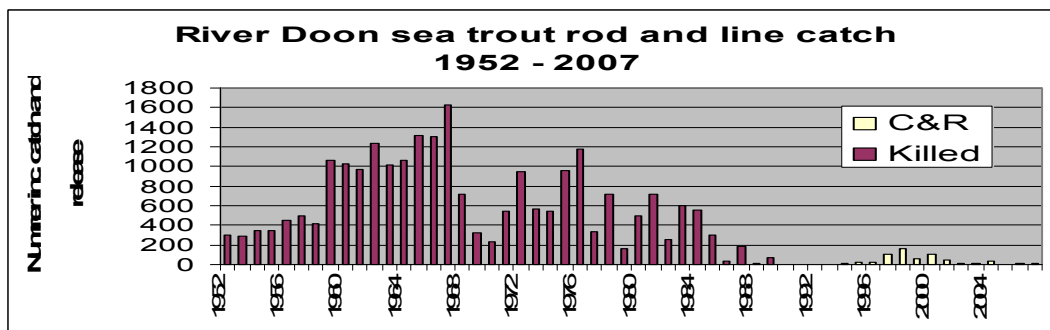
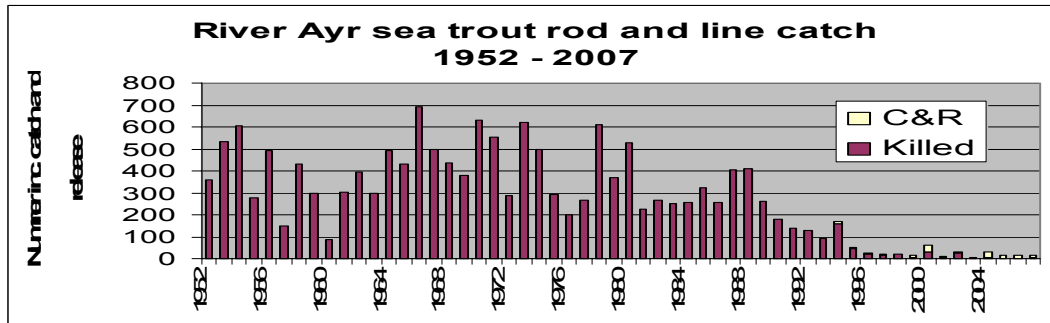
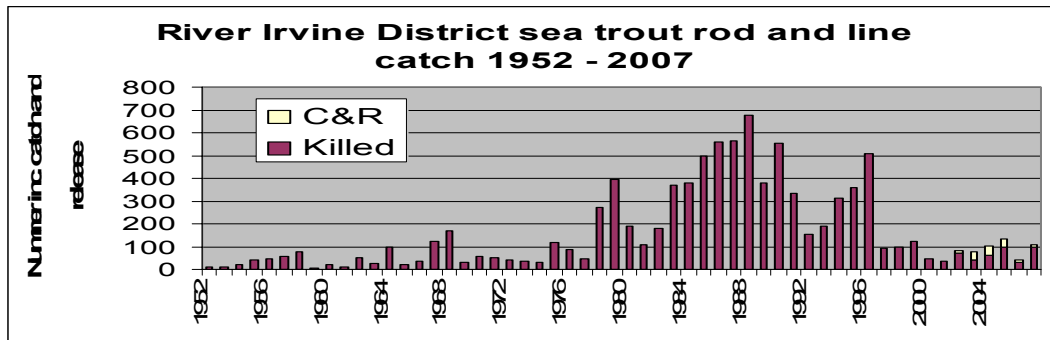
On the River Ayr rod and line salmon catches have been increasing in recent years. There have been a number of management actions such as the installation of a fish pass at Catrine Weir, which opened up a huge area of first class habitat to salmon.

On the River Girvan there was a period of very high salmon catches in the sixties followed by a dip in the seventies and a crash in the eighties. There was a major pollution incident in the middle reaches of the River Girvan in 1979 (upwelling from a redundant coal mine), which killed all fish downstream of that point⁸. In recent years catches have been relatively stable.

Although the overall abundance of adult salmon returning to Ayrshire rivers may be less than in previous years the trend for the salmon rod fishery is positive. The rivers in the north of Ayrshire could still be categorised as being in a post-industrialisation recovery phase and further improvements in the performance of the salmon fisheries in Ayrshire can be expected

Whilst the salmon rod and line catches show no particular pattern across Ayrshire there is a definite pattern for the sea trout fishery. Returns from all fisheries show a dramatic decline, with a collapse in catches in all rivers during the last two decades. Prior to the collapse night time sea trout fishing was very productive and it is likely that recorded catches were only a fraction of the actual catches.

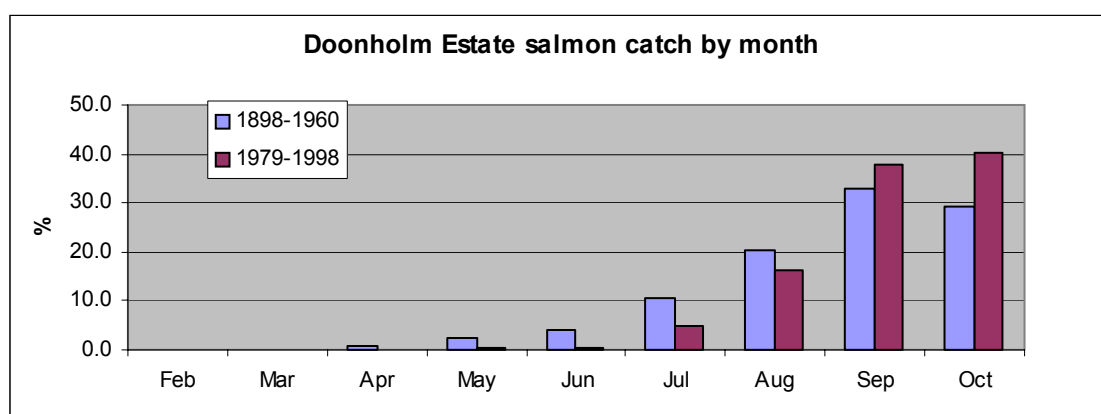
There is no single obvious explanation for the collapse in the sea trout population and fishery. The fact that it seems to have affected all catchments suggests that it is a marine problem. The Stinchar catchment has escaped the worst of the diffuse pollution problems impacting the more agricultural catchments and habitat quality, even in lowland burns is generally still good. The 2007 Stinchar electrofishing report⁹ found low densities of trout fry in almost all the tributaries surveyed, although salmon fry densities at the same site were generally good to excellent. Habitat and water quality at almost all these sites was excellent and highly suitable for juvenile trout. The low stock of adult migratory trout in the Stinchar is likely to be a significant factor in the apparent poor juvenile recruitment recorded.



4.5.1 Seasonality of salmon runs

The Ayrshire rivers are recognised for being summer and autumn fisheries with the overwhelming majority of salmon to the rod and line fishery being caught in the months of August, September and October. There is however a small run of late spring salmon, particularly on the Girvan, Doon and Ayr.

ART were provided with the salmon catch records from Doonholm Estate in the lower River Doon, covering two periods from the late 1800s. Analysis of the salmon catch shows that during each period the most productive months were August, September and October. At Doonholm almost all the fish recorded in April and May were taken between 1920 to 1927. Data from a neighbouring beat, Cassillis, also showed a similar period of good spring catches, although it extended from 1914 to 1927. The Doonholm Estate records cover two periods, 1898 to 1960 and 1979 to 1998. The graph below indicates that salmon catches have generally become later with the most productive month in the latter period being October whereas it had previously been September. Almost 18% of the season total was caught before the end of July in the period 1898 -1960, but only 5.5% in the latter period.



In summary there is a long history of salmonid fisheries in Ayrshire, with good records available for salmon and sea trout, primarily through the FRS statistical bulletins, but also from estate records. The availability of these records reflects the economic importance of salmon and sea trout fisheries. Records for other species are limited with brown trout records available from a number of local sources.

4.6. Fish hatchery operations

There is a long history of stocking into watercourses within Ayrshire. All the DSFB's have a hatchery dedicated to restocking of salmon and sea trout within their respective catchments. Broodstock are now sourced entirely from within the catchments although the Ayr DSFB's has recently undertaken a sea trout enhancement program imported sea trout ova from a source in the north west highlands.

Within the River Irvine catchment there are two hatcheries operated by clubs or private individuals. In addition to the salmon and sea trout stocking undertaken by the DSFB's there is a long tradition of stocking brown trout into the rivers, although this is now restricted largely to the Garnock, Irvine and Ayr, primarily on club waters.

This aspect of fishery management has recently come under the control of FRS through the 2008 fish movement legislation.

References

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