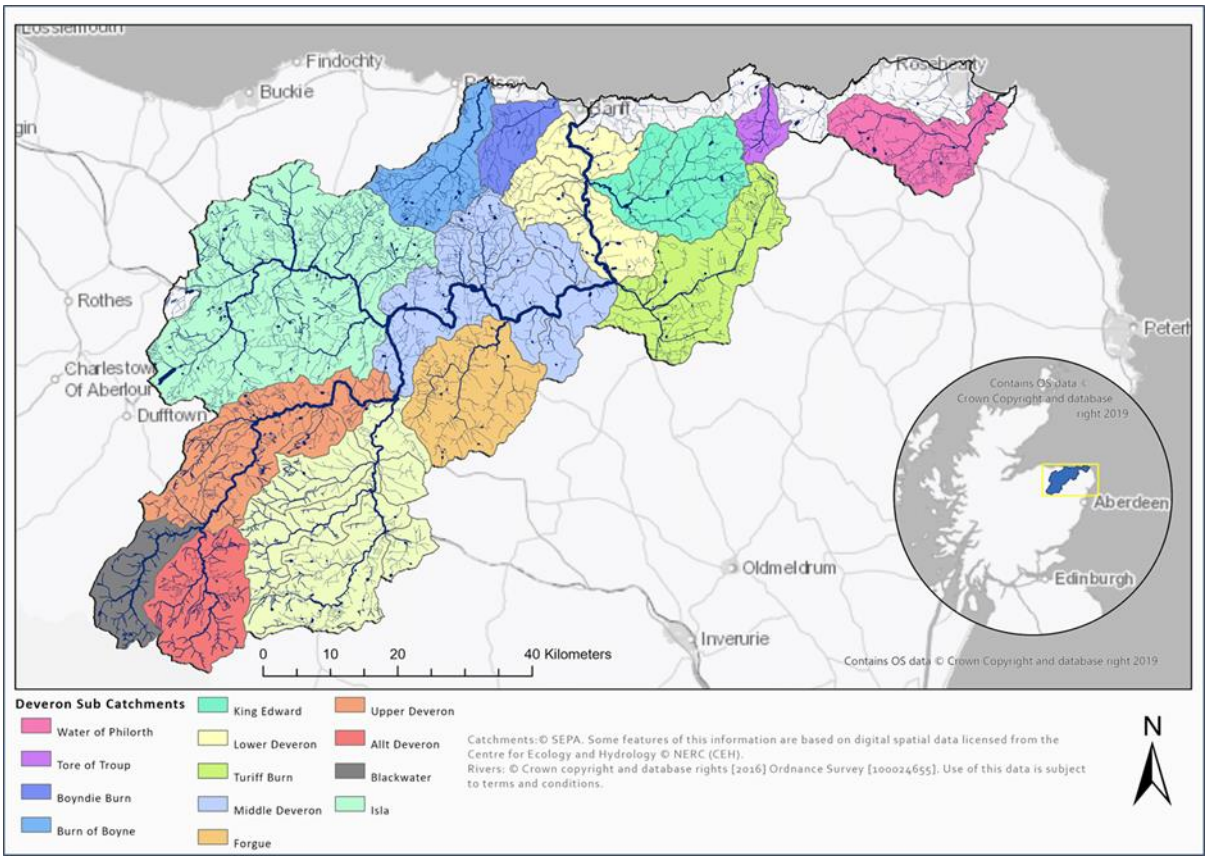
DEVERON
BOGIE
& ISLA
RIVERS CHARITABLE TRUST

River Deveron Fisheries District Management Plan 2020-2023



Prepared by The Deveron, Bogie and Isla Rivers Charitable Trust

August 2020

Table of Contents

1. Fisheries Management in the Catchment

To help manage the local fisheries district in a broad and structured manner the Deveron, Bogie and Isla Rivers Charitable Trust (DBIRT), in consultation with the River Deveron District Salmon Fishery Board (RDevDSFB), Deveron Scientific Advisory Board, Fisheries Management Scotland (FMS) and stakeholders, have written a Deveron Fisheries District Management Plan (DFDMP).

The DBIRT is a charitable trust approved in September 2001 (SC032131) which works in tandem with the RDevDSFB on the management of the Deveron Fisheries District. Deveron Bogie and Isla Rivers Trust (DBIT)

The Trust's objectives are:

- *To conserve, protect, enhance rehabilitate salmon sea trout and trout and other indigenous species of animal, bird, insect and plant life and more generally to promote the ecological cycle on and around the Rivers Deveron, Bogie and Isla together with the water courses, banks, riparian lands, catchment areas and seaboard (as outlined in the attached map) for the benefit of the inhabitants and visitors.*
- *Advance the education of the public in relation to the conservation and protection of the area by conducting and commissioning research into the plant, bird, insect and animal life in the area, and to publish and disseminate the results for the public benefit.*

The DFDMP will be delivered by the DBIRT on behalf of the RDevDSFB, which is the statutory body originated by the Salmon Fisheries Act of the 19th century and has management responsibility between Cowhythe Head and the Water of Philorth. River Deveron District Salmon Fishery Board (RDevDSFB)

Salmon fisheries in Scotland are owned either by individuals or by clubs or associations. The costs of the local administration, protection and improvement of these fisheries are financed by those owners. The District Boards finance their activities by levying a rate, on the owners. The owners elect their representatives to the Board at triennial elections. The current rateable value of the Deveron is £171,025. The annual budget set by the RDevDSFB is £71,830 which is funded by an assessment income from the owners of 42p in the pound. This is reviewed annually.

1.1. Strategy

The strategy of this plan is to establish a framework for sustainable management of the districts fish stocks and to maintain and enhance the quality, extent and status of its riverine habitats. The plan will be delivered by the DBIRT and has the following objectives (See Appendix 1 for detailed actions):

Objective 1:	*Manage exploitation of fish stocks to maximise the number of salmon, sea trout and brown trout reaching their spawning grounds.*
Objective 2:	*Manage predation at natural levels within the River Deveron District to minimise the losses of juveniles, in particular smolts, and maximise the number of adult salmon, sea trout and brown trout reaching their spawning grounds.*
Objective 3:	*Ensure that fish populations within the Deveron are as healthy and free of disease as possible.*
Objective 4:	*Maintain the genetic integrity of the Deveron fish populations and sub populations.*
Objective 5:	*Monitor, control and where possible eradicate Invasive Non-native Species (INNS) that threaten the biodiversity and ecological functionality of the River Deveron and its riparian zone.*
Objective 6:	*Ensure the water quality of the River Deveron and sub catchments is the best possible for fish populations and the wider ecology.*
Objective 7:	*Ensure there is enough water in the river to maintain its ecological function, the fishery and in particular to maximise the spawning potential of wild fish and the subsequent survival of their offspring.*
Objective 8:	*Make the catchment resilient to climatic warming to maintain, where possible, water temperatures that are optimal for fish populations.*
Objective 9:	*Protect and restore natural in-stream habitat diversity to maintain ecological diversity and maximise wild fish production.*
Objective 10:	*Restore and maintain natural riparian vegetation to improve ecological diversity, provide bank side cover for fish and provide a barrier to agricultural land use and contaminated run-off.*
Objective 11:	*Remove or make passable all remaining man-made obstacles to fish passage.*
Objective 12:	*Protect, and promote the restoration, where possible, of the inshore marine habitat for salmon and sea trout.*
Objective 13:	*Conduct routine annual surveys to monitor fish populations, invertebrate populations, water and habitat quality.*

Objective 14:	*Advance the education of the public in relation to the conservation and protection of the area by conducting and commissioning research into the plant, bird, insect and animal life in the area, and help to publish and disseminate the results for the public benefit.*
Objective 15:	*Promote the River Deveron as a rod and line fishery and inspire the next generation of anglers.*

1.2. Plan duration

The DFDMP is for the period 2020-2023 and sets out a range of priority objectives to complete. As data are gathered and objectives are achieved the plan will be updated bi-annually. The DFDMP is designed to link together with other existing management plans such as the River Basin Management Plan (SEPA) and the North East Scotland Local Biodiversity Action Plan. The DFDMP will sit alongside and be used in conjunction with the web-based salmon pressures tool that has been developed by MSS and FMS. This tool uses 10 interactive online story maps to describe and map the pressures on Atlantic salmon in Scotland on both a national and catchment scale.

This plan was developed in consultation with:

River Deveron District Salmon Fishery Board (RDevDSFB)
Fisheries Management Scotland (FMS)
Deveron Scientific Advisory Board (DAB)
Scottish Environment Protection Agency (SEPA)
Scottish Natural Heritage (SNH)
Marine Scotland Science (MSS)

2. Catchment and population description

The river Deveron is a celebrated salmon, sea trout and brown trout fishery and is one of the top salmon fisheries in Scotland. The Deveron is situated in North East Scotland within the counties of Aberdeenshire and Banffshire and has an overall catchment area of 1266 km² (489 miles^2) and a length of 96 kms (60miles). The Deveron fisheries district (1496 km² / 578 miles^2) comprises of the river Deveron and its tributaries and all other watercourses which discharge into the Moray Firth on Aberdeenshire's north coast, between Cowhythe Head and the Water of Philorth. The fisheries district contains four coastal river systems are namely, namely the Boyndie Burn, the Water of Philorth, Burn of Boyne and the Tore Burn (Map 1).

The Deveron rises on the edge of the Grampian Mountains (600m (1968 ft) above sea level) (Map 2) in the heather moorland of the Cabrach. The Upper Deveron flows from the source to the confluence with the river Isla and is characterised as a narrow, fast-flowing river through a steep sided valley. The Upper Deveron has two significant tributaries, the Blackwater, which meets the Allt Deveron in the Cabrach and the River Bogie, which joins just downstream of Huntly. The middle Deveron flows from the confluence with the river Isla (Rothiemay) to the confluence of the Turriff water (Turriff), where the land use is mixed farming with arable and stock (Map 3). The Lower Deveron flows from the Turriff water confluence to the estuary at Banff, where it discharges into the Moray Firth. The land use within this area is predominantly arable. The two main Deveron tributaries are the River Bogie which joins at Huntly and the River Isla which joins just prior to Milltown of Rothiemay.

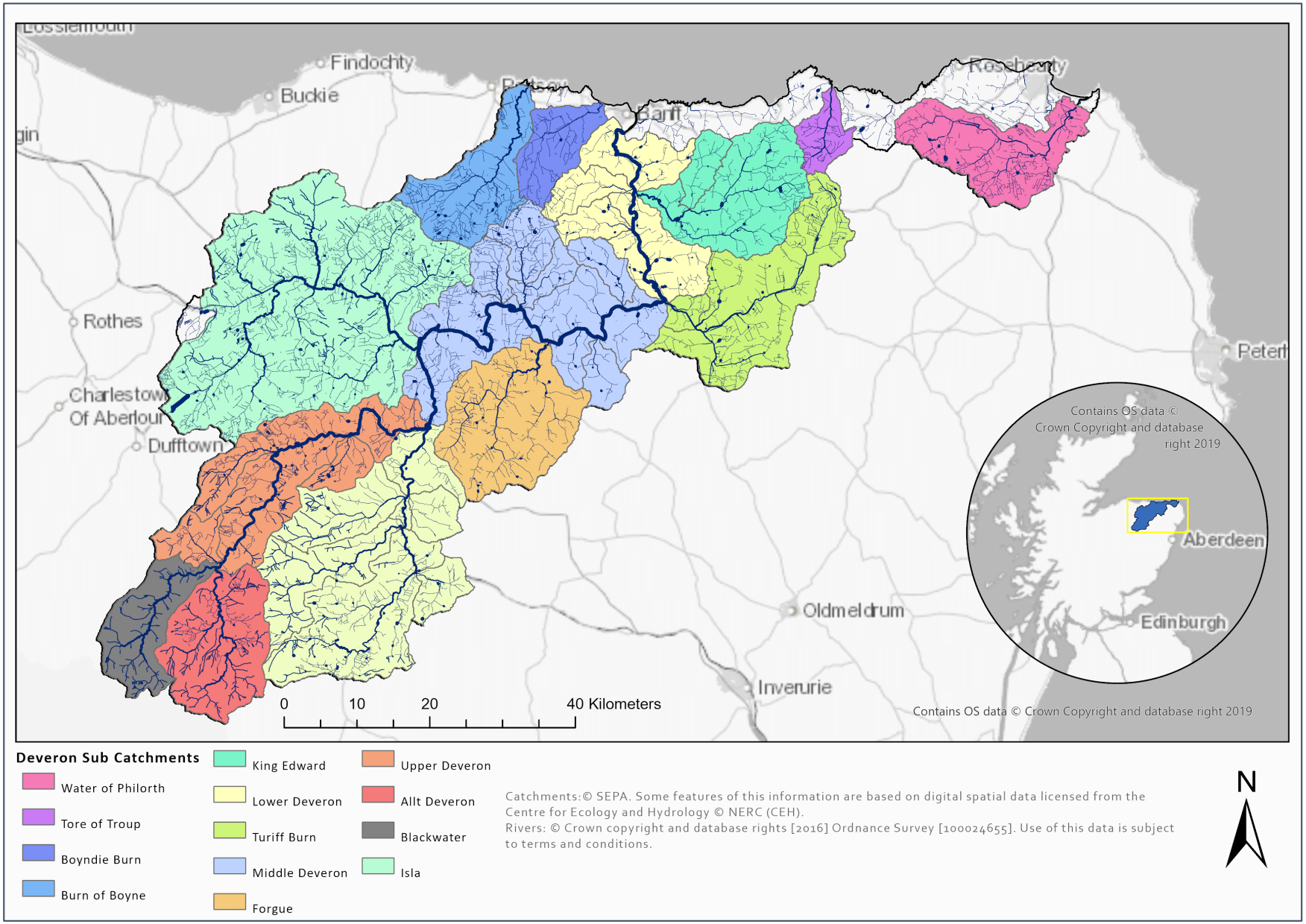
The River Bogie rises on the eastern edge of the Cabrach moorland and flows through predominately arable and grazing land. Many of its tributaries are relatively small in size with the exception of those such as the Kirkney water and Ness Bogie which rise within the heavily afforested area known as the Clashindarroch.

The River Isla rises at Drummuir and flows north through Keith where the Distilleries extract water for cooling processes. The StrathIsla includes tributaries which flow over a multitude of land types including heather moorland, arable and grazing land.

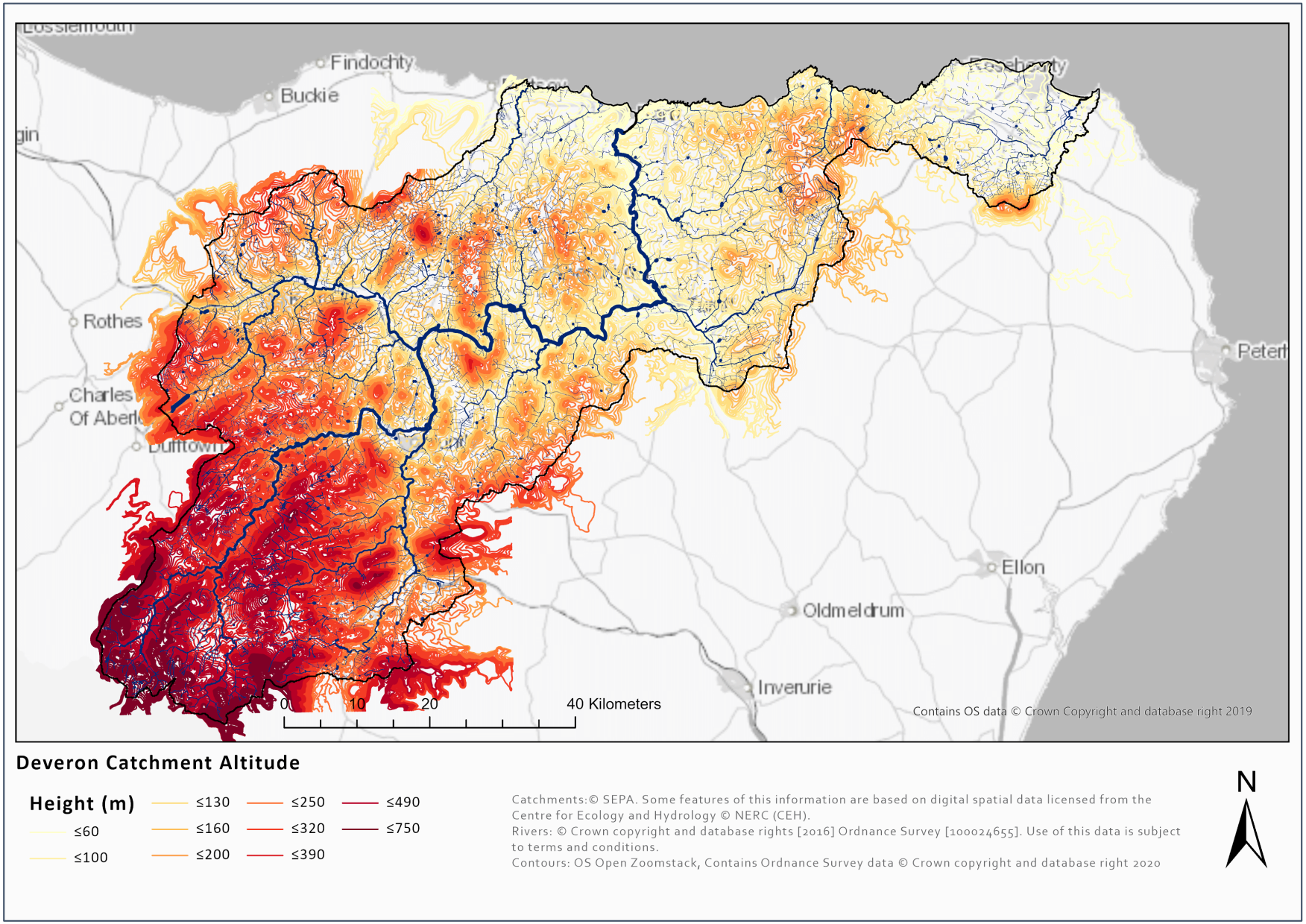
The Deveron contains 8 small lochs, the most significant of these being Loch Park (Drummuir), in the Isla catchment.

The Burn of Boyne rises at Badenyouchers, itself backing on to the Isla catchment at Edingight. It flows for 10 km (6.2 miles) via Canterbury Bridge at Muir of Canerbury through Milton of Tillynaught and Lintmill Bridge before discharging into Boyne Bay, adjacent to Cowhythe Head, at the western extremity of the RDevDSFB's purview.
The Tore burn, also known as the Tore of Troup, rises in the Moss at Glasslaw and discharges some 6 km (3.7 miles) later into Cullykhan Bay.
The Water of Philorth rises on the northern slopes of Waughton Hill to the south of Fraserburgh. It flows northeast for 12km (7.5 miles), receiving the Water of Tyrie, and enters the Moray Firth at the eastern end of Fraserburgh Bay.
The Boyndie Burn rises at Cairns of Ord and flows north east for 7km (4.4 miles) via Inverboyndie and enters the Moray Firth at Boyndie bay.

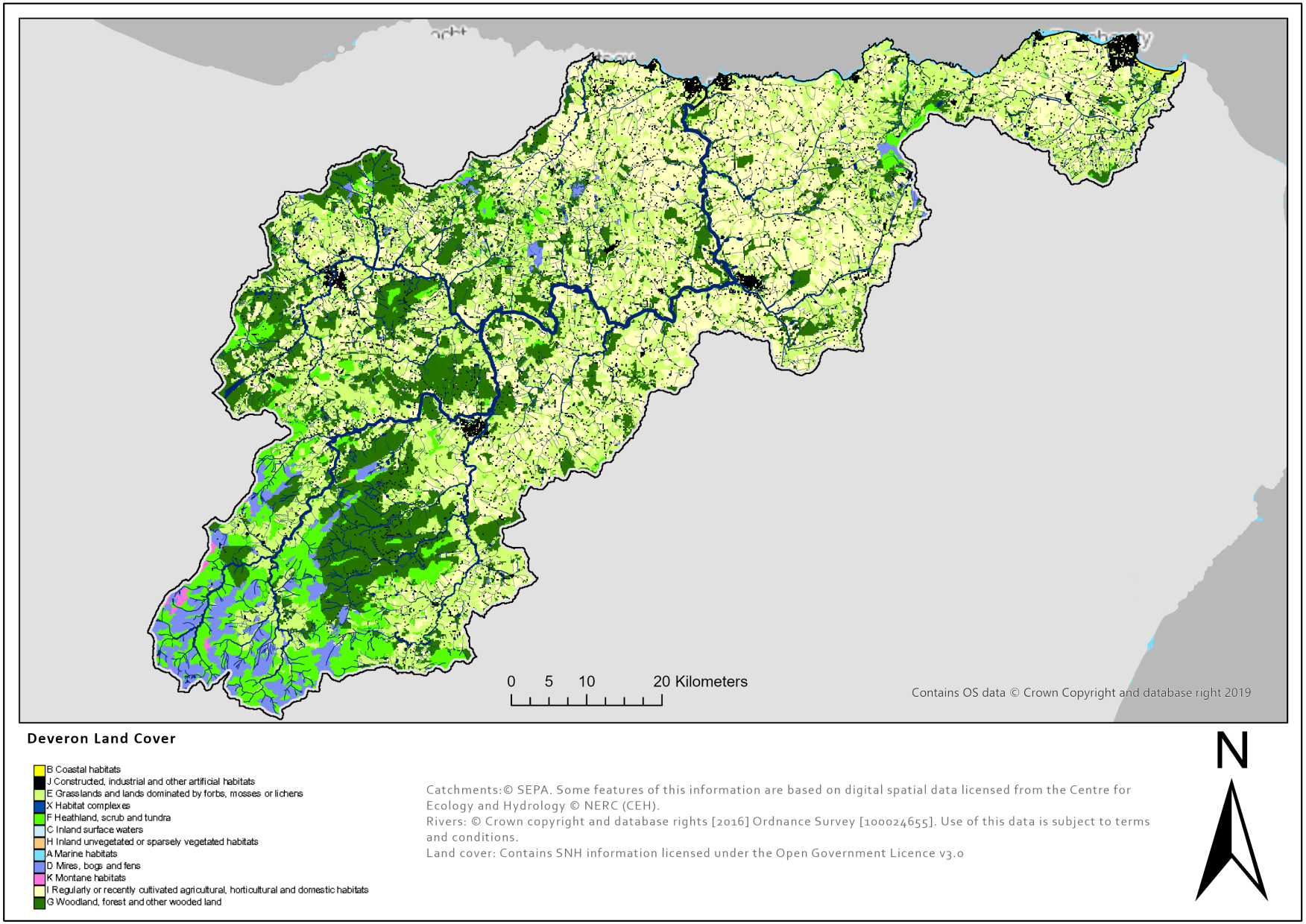
Map 1. Deveron Catchment and sub catchments



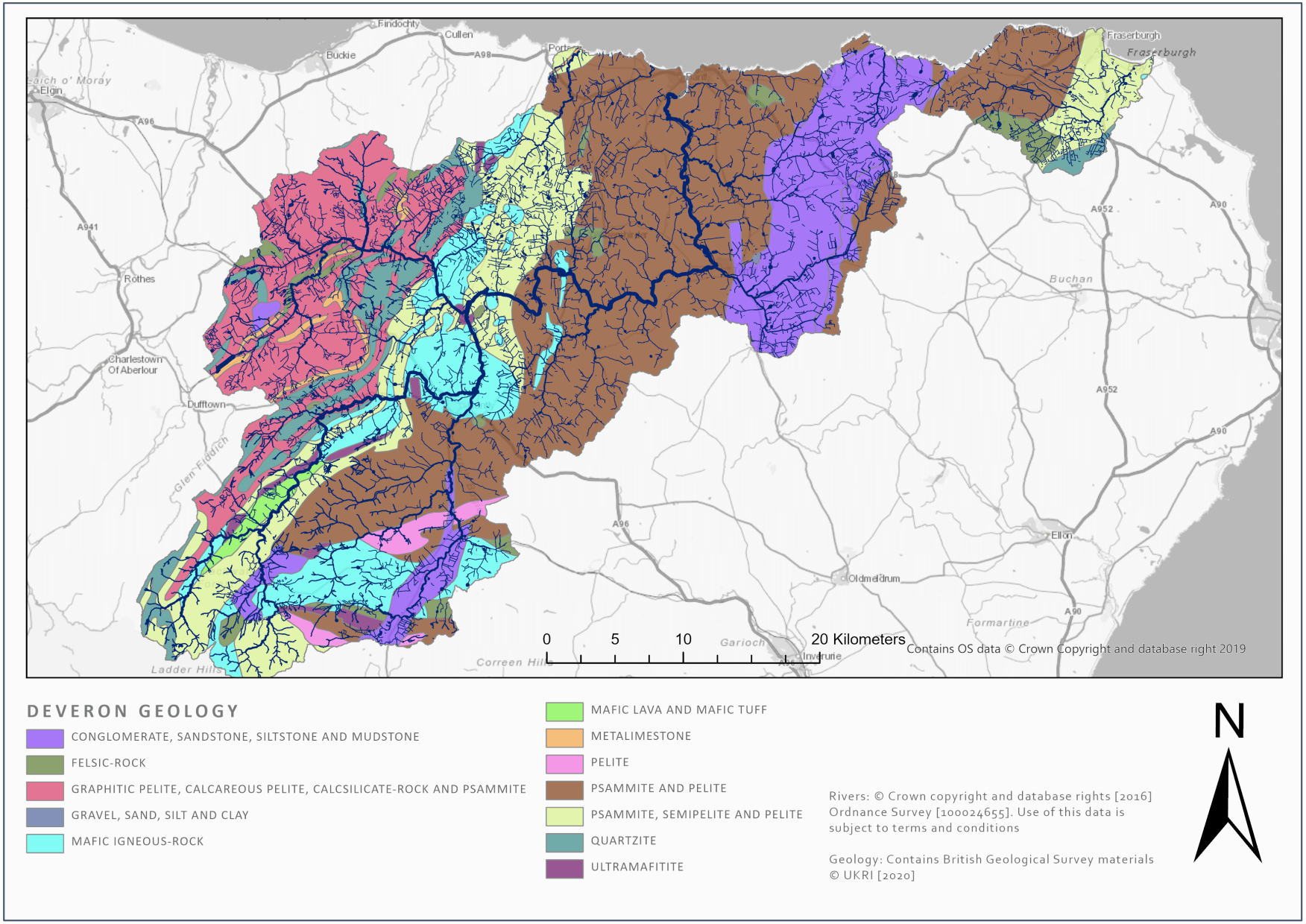
Map 2. Deveron Catchment Altitude



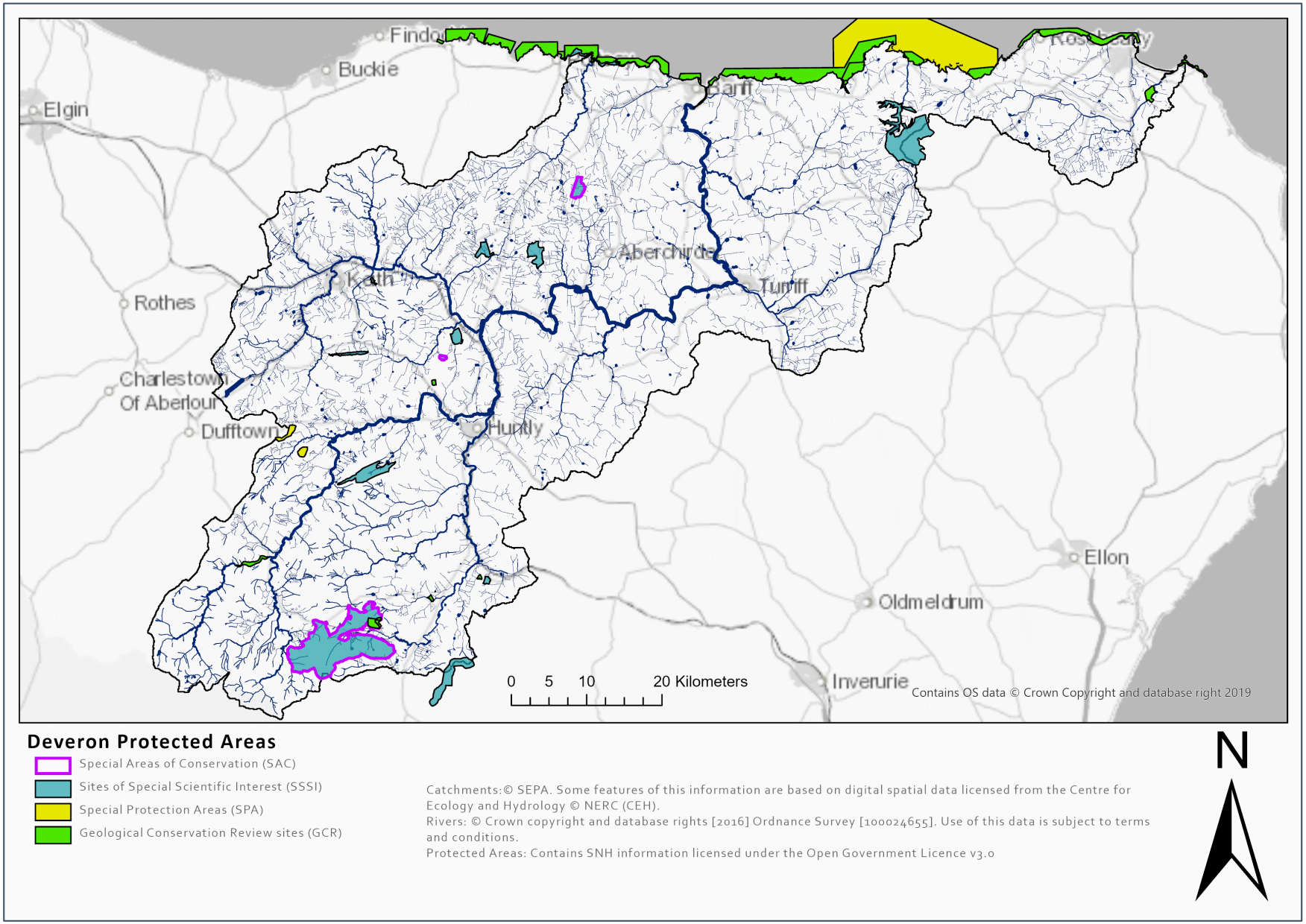
Map 3. Land Cover in the Deveron Catchment



Map 4. Deveron Catchment Geology



Map 5. Deveron Catchment Designated Protected Areas



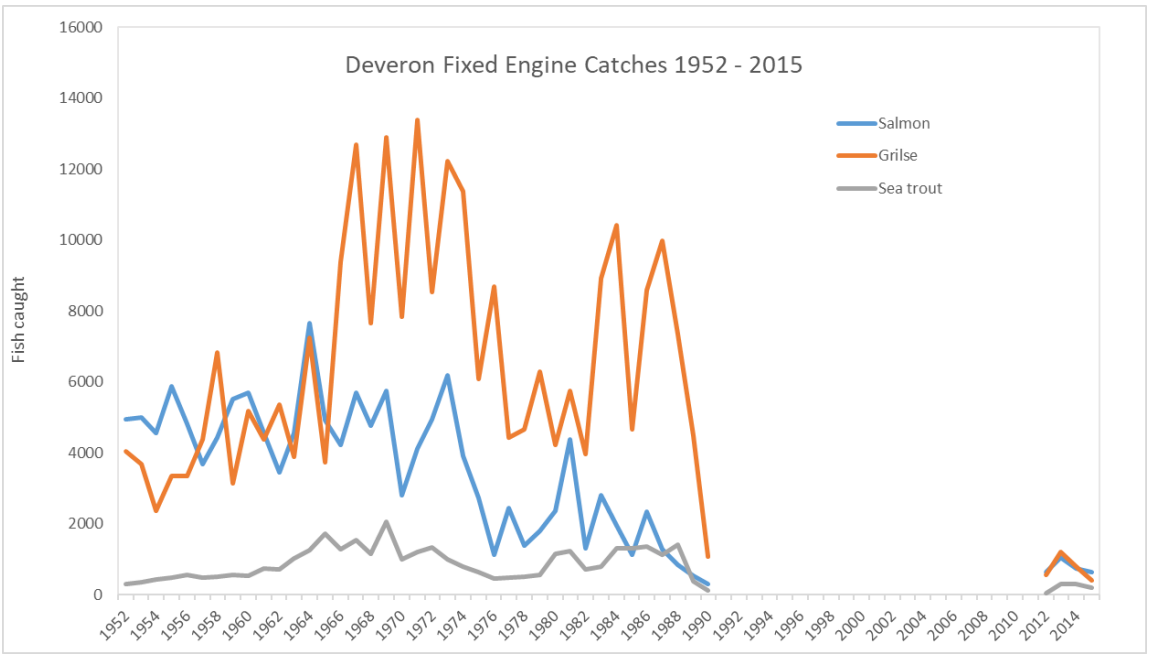
2.1. Commercial salmonid fisheries

Deveron and Moray Firth fish stocks were targeted by commercial fisheries for many hundreds of years. The Moray Firth region's commercial net fisheries gradually declined from 1851 to 1987 (Shearer 1986). In more recent years, from 1952 – 2002, the reported Moray Firth net & coble catch declined from 48,301 to 874 whilst the fixed engine catch declined from 62,714 to 72. There was a 90% decline in net fishing effort over the same time period that has been associated with a decline in numbers of salmon returning to the coast. There was also a short-lived drift net fishery in the Moray Firth and elsewhere off the Scottish coast, which was banned in 1962 to conserve salmon. A pelagic long-line fishery also was banned because of its by-catch of immature fish and kelts.

The inland net fisheries began to be replaced by the more profitable rod & line fisheries from 1800 onwards, leading to the restriction of fixed engines (netting operations), first to the estuaries and then to the coast. The removal of the cruives (fish traps) from the Deveron was accomplished in February 1898 (Grimble, 1899). The cruives were situated approximately two miles from the river estuary within the fishing beat named the Wrack. The remaining commercial fixed engine netting rights in Banff bay and within the Deveron were then purchased and ceased by proprietors in 1906. However, due to unforeseen circumstances the coastal fixed engine netting rights were resurrected and exercised again.

In 1991 three of the remaining active netting stations were purchased by the Atlantic Salmon Conservation Trust (Scotland) and the RDevDSFB and were closed indefinitely to conserve salmon stocks. Two stations were also leased by the RDevDSFB from 1991 to 2011 and not operated. In 2012 the two stations were purchased and reopened and operated for 3 years as a commercial operation (Graph 1a) until the Conservation of Salmon (Scotland) Regulations 2016 came into force, which prohibited the retention of salmon in coastal waters (section 3.1). The total declared fixed engine catches from 1952 to 2015 are shown below in Graph 1a.

Graph 1a Total fixed engine catches for Deveron coast 1952-2015



2.2. Recreational salmonid Angling

Salmon and sea trout angling within the Deveron fisheries district was historically and still is to this day a very popular pastime. Revenue produced by local and visiting anglers is of major importance to the local economy. To put this into context, a survey of the economic impact of angling within the neighbouring Spey catchment in 2003, indicated an annual value to the region of £12.6million per year and 420 full time equivalent jobs. The report estimated that each salmon caught by rod and line contributed £970 to household incomes (Butler et al. 2009).

There are 3 local angling associations within the River Deveron catchment:

- **Banff Angling Association (Est 1943)** has rights to fish the lowest section of the Deveron (1200 metres), which results in primarily sea trout (including finnock) being the main target species.
- **Turriff Angling Association (Est 1923)** owns the rights to fish approximately 1200 metres of the Deveron and have the right to fish approximately 1200 metres of the Turriff Burn which is owned by Turriff Community Fishings.
- **Huntly Fishings (Est 1890)** have rights to fish the Deveron (3 miles, double bank), Bogie (6 miles, double bank) and the Isla (3 miles, single bank).
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There are also two other angling clubs in operation within the Deveron district, Portsoy Angling Association which fishes the Boyne Burn and also the Fraserburgh Angling Club who fish the Water of Philorth.

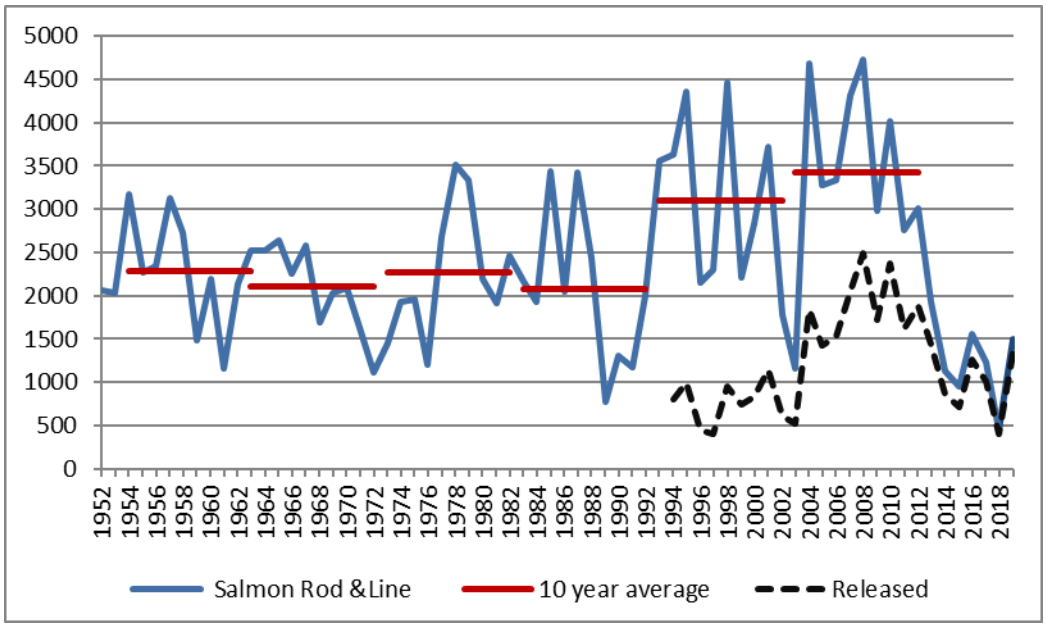
2.2.1. Angling statistics

Information on adult salmon and sea trout catches is available in the form of rod catch data, which is compiled by Marine Scotland Science (MSS) at Montrose. The annual collection of salmon and sea trout catch data has taken place since 1952 as a record of the salmon and sea trout fisheries throughout Scotland. The data is now collected by statute under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003. The annual reported numbers of salmon, grilse and sea trout caught in the Deveron catchment between 1952 and 2019 using rod and line (retained & released) are shown in Graphs 2a and 3. Catch returns are affected by factors other than the availability of fish stocks, such as weather patterns, timing of returning adults and fishing effort; but they may be used, in conjunction with other information, as an indication of fish abundance.

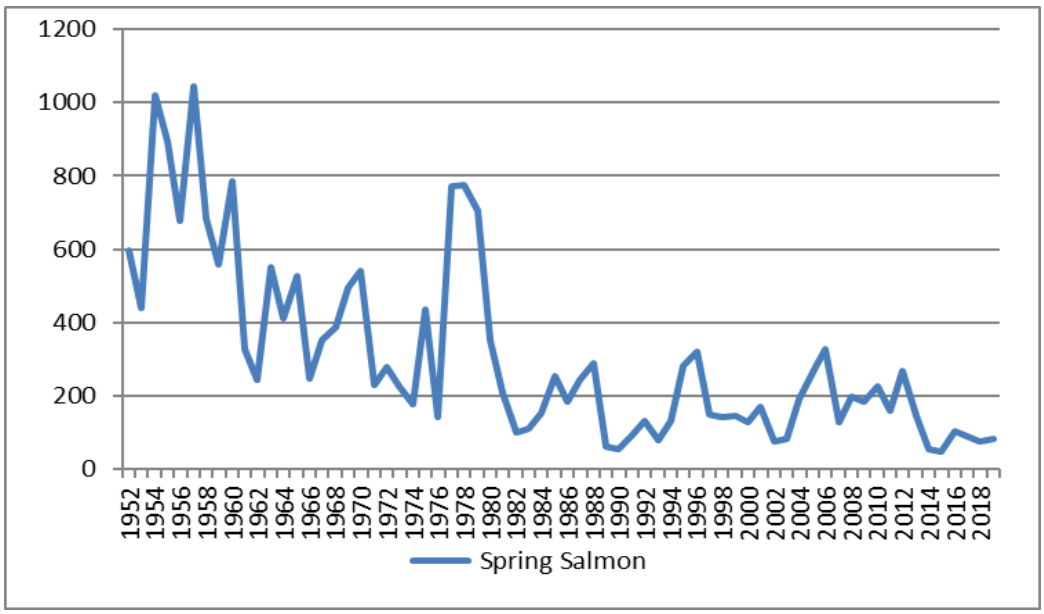
The data above suggests a period of descending catches from 1957 to 1976 which includes the outbreak of Ulcerative Dermal Necrosis (UDN) during the period 1966-67, which had a destructive effect on Deveron fish stocks. From 1976 onwards there was a period of relatively good catches with annual fluctuations until 1989. Four years after the commercial netting operations ceased, catches increased with record high years in 1998, 2004 and 2009 and apart from a low catch in 2003 (due to an extremely dry year) remained relatively good until 2012. Since then catches have dropped significantly. Graph 2b below shows the catch of early

running spring salmon entering the Deveron system has declined, falling to a record low in 2015. A decline of early running spring salmon (February – May) has been common thread throughout most of Scotland over the same time period.

Graph 2a Total rod and line salmon (Multi sea winter salmon and grilse) catch for the Deveron catchment 1952-2019



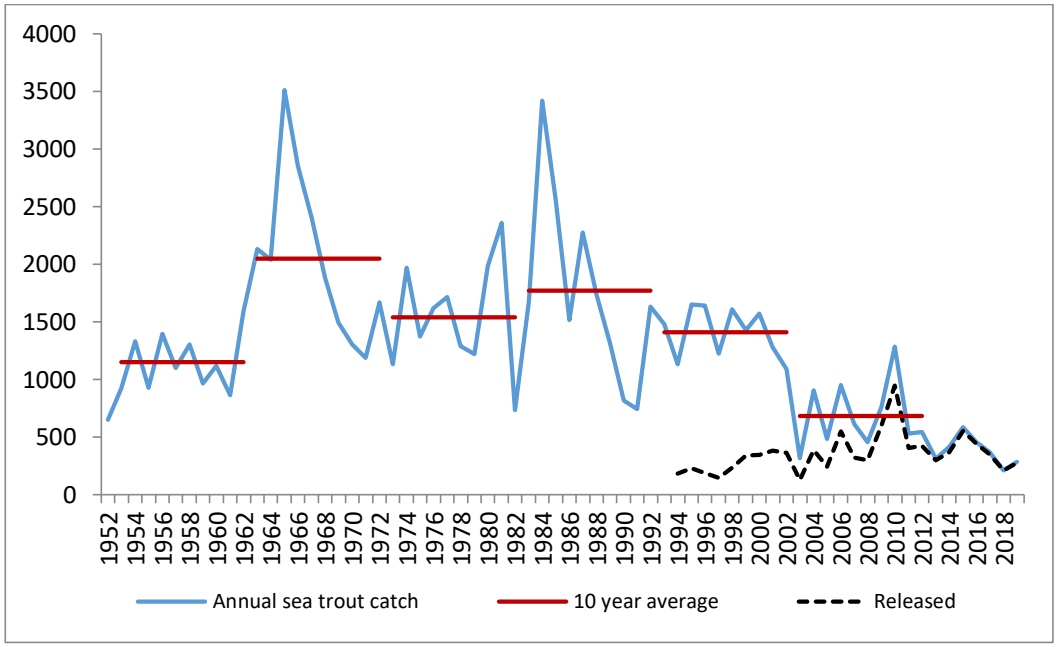
Graph 2b Total rod and line (retained & released) spring salmon (February-May) catch for the Deveron catchment 1952-2017



The information in graph 3 (below) suggests an increase in sea trout catches from 1952 to a peak in 1965 of 3513 fish. This was followed by a period of more moderate catches before peaking again in 1984 and then falling back to a more stable period with annual catches of

around 1400. From 2000 onwards catches fell very rapidly to the second lowest year on record in 2017 and the long term average (2003-2012) has fallen to 684.

Graph 3 Total sea trout rod and line (retained and released) catch for the Deveron catchment 1952-2019



2.3. Aquaculture & commercial trout ponds

The Deveron catchment contains at present one rainbow trout fish farm and 5 commercial trout fisheries.

These are:

- Forgue Fish Farm, Forgue.
- Greenmyres Fishery, Huntly.
- Artloch Fishery, Huntly.
- Delgaty Castle Fishery, Turriff.
- Lochpark Fishery, Drummuir.

Loch Park fishery contains wild brown trout although it was possibly stocked in the past. The remaining four fisheries mentioned above are stocked with farmed rainbow trout. Over the past 10 years some privately owned trout ponds, created by farmers through environmental schemes, have been stocked with rainbow trout, but these are not commercial fisheries and therefore we do not hold any supplementary information on them. There are no coarse fish fisheries within the fisheries district.

2.4. Fish Populations

Table 1: Fish species known to occur in the River Deveron system

Common Name	**Scientific Name**
Atlantic salmon	*Salmo salar*
Trout (Resident / Migratory)	*Salmo trutta*
European eel	*Anguilla anguilla*
River lamprey	*Lampetra fluviatilis*
Brook lamprey	*Lampetra planeri*
Sea lamprey	*Petromyzon marinus*
Three-spined stickleback	*Gasterosteus aculeatus*
Atlantic flounder	**Platichthys flesus*

*Distribution: lower Deveron only.

Table 2 Non-native species known to occur in the River Deveron system

Common Name	**Scientific Name**
Rainbow Trout	*Oncorhynchus mykiss*
Minnow	*Phoxinus phoxinus*

Table 3 Fish species known to occur in the Burn of Boyne

Common Name	**Scientific Name**
Atlantic salmon	*Salmo salar*
Trout (Resident / Migratory)	*Salmo trutta*

Table 4 Fish species known to occur in the Water of Philorth

Common Name	**Scientific Name**
Atlantic salmon	*Salmo salar*
Trout (Resident / Migratory)	*Salmo trutta*

Table 5 Fish species known to occur in the Tore Burn

Common Name	**Scientific Name**
Atlantic salmon	*Salmo salar (occasionally)*
Trout (Resident / Migratory)	*Salmo trutta*

Table 6 Fish species known to occur in the Boyndie

Common Name	**Scientific Name**
Trout (Resident / Migratory)	*Salmo trutta*

Historically the Deveron supported a population of freshwater pearl mussel (*Margaritifera margaritifera*) but it is now considered functionally extinct. The DBIRT are investigating the potential for a project to reintroduce the freshwater pearl mussel to areas of suitable habitat.

2.5. Deveron salmonid stock components

The Deveron system and the coastal rivers have a diverse and complex make up of salmonid stock components and run-timings e.g. spring, summer and autumn. Throughout the catchment there are separate and geographically distinctive stocks of salmon, sea trout and brown trout. These populations need to be preserved to maintain diversity within the river, supporting the best chance of survival in the face of increasing pressures such as climate change. It is this diversity of stock which also gives the Deveron its 9-month long angling season. Understanding the genetic structure of salmon, sea trout and brown trout stocks within rivers is essential for focusing local management and stock assessment of breeding populations. These are the fundamental biological units which underpin recruitment and their character.

2.5.1. Genetics

In 2008 the DBIRT collected 450 juvenile salmon samples from 9 sites across the Deveron that were analysed as part of the Focussing Atlantic Salmon Management on Populations (FASMOP) genetics project (Coulson et al 2012). Using microsatellite markers, the project concluded that genetic diversity at all locations on the Deveron appears high, as observed on other large salmon systems in Scotland. Comparisons of the genetic "fingerprint" among sites in the Deveron catchment show differences of variable magnitude. The largest differences are seen in the Allt Deveron, the upper Isla and the King Edward Burn. Other locations still exhibit significant differences from one another, but the magnitude of these differences is weaker and the relationships between these sites is therefore less well defined.

The results to date suggest that there may be some distinct breeding populations on the Deveron. However, using our current set of genetic markers the boundaries of these potential breeding populations are not easily defined. Following the FASMOP project the DBIRT

commissioned further investigation of the samples using the more powerful SNP (Single Nucleotide Polymorphism) markers. Overall the results suggested a weak level of meta-population genetic structuring in the Deveron using the genetic markers available at the time. At some peripheral sites at the limit of salmon distribution, the sample of juveniles was found to have a large proportion of full siblings which suggests there was a limited number of breeders (Coulson & Miller 2014).

2.5.2. Brown Trout

Brown trout and sea trout are widely distributed throughout the catchment and coastal tributaries but the structuring of breeding populations is not fully known. However, the DBIT Blackwater trout tracking project (Walters 2014) in 2012/2013 revealed how brown trout from the upland Blackwater tributary, use the entire Deveron catchment throughout the year. One female trout was tracked leaving the Blackwater in November after spawning and migrating all the way to the Bridge of Alvah, where she remained through the winter and early summer before returning to the Blackwater to spawn again the following autumn. So, although there may be different sub populations that spawn in distinct tributaries; this project suggests trout have the potential to use the entire main river stem. This work on the Deveron therefore has significant implications for catchment fishery management in highlighting the importance of uninhibited fish passage. Conversely, some trout populations like those stuck above impassable waterfalls will use only a small part of the catchment but are still an important part of the trout diversity that will exist in the Deveron catchment.

3. Priorities for Management Action

3.1. Exploitation

Despite the declining rod and line catch, juvenile surveys suggest adequate numbers of adult salmon may still be spawning to saturate available and suitable habitats. Nonetheless, the RDevDSFB is adopting the precautionary principle, as recommended by the North Atlantic Salmon Conservation Organisation (NASCO), and has reduced exploitation to maximise the numbers of adults surviving to spawn. This conservation initiative has included the purchase of commercial and removal of illegal coastal nets, bans on the use of prawn and shrimp baits by anglers and the promotion of catch and release which has now risen to 89% for salmon and 95% for sea trout. Through the Conservation of Salmon (Scotland) Amendment Regulations 2016 the Scottish Government has introduced a range of measures designed to improve the conservation status of salmon by managing fishing exploitation within Scotland's domestic waters. They are designed to complement, not replace, other management activities being undertaken at local, national and international level in the interests of conservation. The objective of the measures is to ensure harvesting in Scottish domestic waters is sustainable and that fishing does not damage vulnerable stocks or cause damage to the network of Special Areas of Conservation in place across Scotland. The Conservation of Salmon (Scotland) Regulations 2016 outlined for the first time a system whereby the killing of Atlantic salmon in inland waters is managed on an annual basis by categorising the conservation status of their stocks by the Scottish Government.

In general terms the Regulations:

- prohibited the retention of salmon caught in coastal waters
- permitted the killing of salmon within inland waters where stocks were above a defined conservation limit i.e. those rivers accorded category 1 or 2 status for the forthcoming fishing season
- required mandatory catch and release of salmon in areas which fell below their defined conservation limit following the assessment of salmon stocks i.e. those rivers accorded category 3 status for the forthcoming season

The conservation status of each stock is defined by the probability of the stock meeting its conservation limit (egg target) over a 5-year period. Rather than a simple pass or fail, stocks have been allocated to one of the following three grades, each with its own recommended management actions:

Category	Probability of Meeting CL	Advice
1	At least 80%	Exploitation is sustainable therefore no additional management action is currently required. This recognises the effectiveness of existing non-statutory local management interventions.

2	60-80%	Management action is necessary to reduce exploitation; mandatory catch and release will not be required in the first instance, but this will be reviewed annually.
3	Less than 60%	Exploitation is unsustainable therefore management actions required to reduce exploitation for 1 year i.e. mandatory catch and release (all methods).

Through the Conservation of Salmon (Scotland) Amendment Regulations 2016 the Deveron was classified as Category 1 in 2017, Category 2 in 2018, Category 1 for 2019 and Category 2 in 2020. Following the Category 2 assessment for the 2018 season the Deveron DSFB tightened the Conservation Code for the 2018 season by asking all day rods to release all fish throughout the season. This code has been maintained for the 2020 season (Conservation Code for the 2020 Season).

3.1.1. Illegal exploitation

The control of illegal fishing or 'poaching' as it is referred to is under the remit of the RDevDSFB. Coastal patrols are undertaken in conjunction with the Spey Fishery Board bailiffs to look for illegal nets along the coast. The RDevDSFB undertake routine river patrols to check anglers have the appropriate permissions and to check for illegal fishing activities. The River Bailiffs often work in conjunction with Police Scotland.

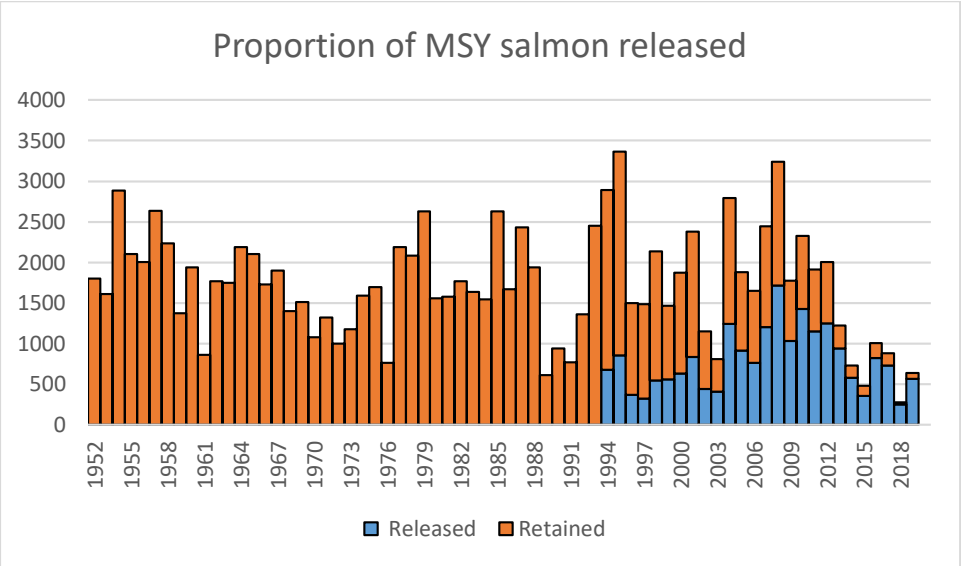
3.1.2. In river estuaries and nets

The Conservation of Salmon (Scotland) Regulations 2016 prohibited the retention of salmon taken in coastal waters which has effectively closed coastal fixed engine nets at present. The in-river cruives salmon fishery was removed in 1898.

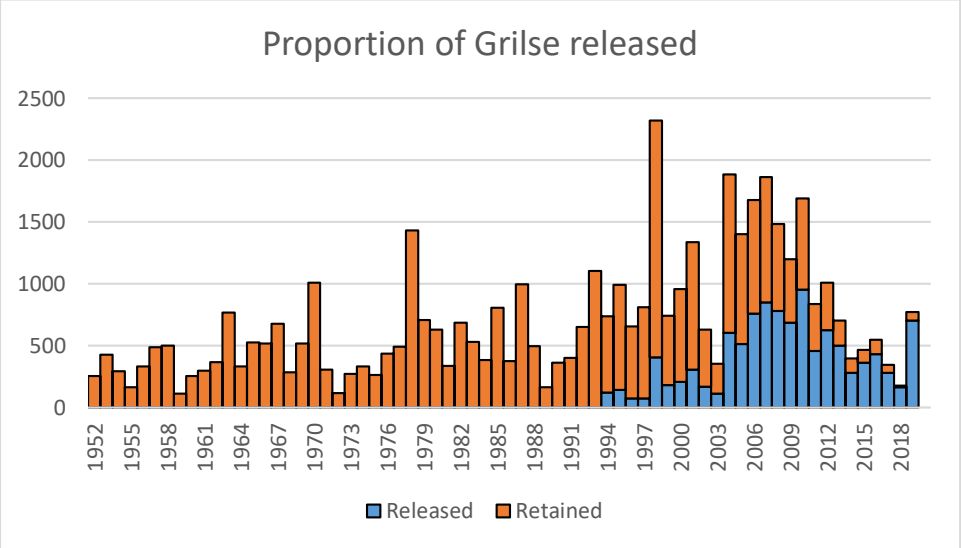
3.1.3. Rod and line exploitation

Throughout the angling season, potential spawning salmon, sea trout and brown trout can be caught and retained. This in turn reduces the number of adults reaching the spawning grounds and could, in poor years result in reduced numbers of eggs and resulting juveniles. The angling season is set annually by the RDevDSFB and is currently from the 11th February to the 31st October inclusive. The RDevDSFB operate a voluntary angling conservation code which is reviewed before the beginning of each new angling season. A copy of the updated voluntary code can be found online. The exploitation of salmon, sea trout and brown trout by rod and line occurs mainly on the Deveron main stem from the town of Banff (estuary) to the conclusion of Huntly fishing's (Huntly). Very limited exploitation occurs on the upper Deveron above Huntly all year. Brown trout fishing is increasingly popular and is practiced on the Deveron and Bogie throughout the brown trout season (15th March – 6th October). Angling occurs on the middle and lower section of the Isla but effort is minimal. Angling is practiced on the Water of Philorth by Fraserburgh Angling Club and also The Burn of Boyne by Portsoy Angling Club.

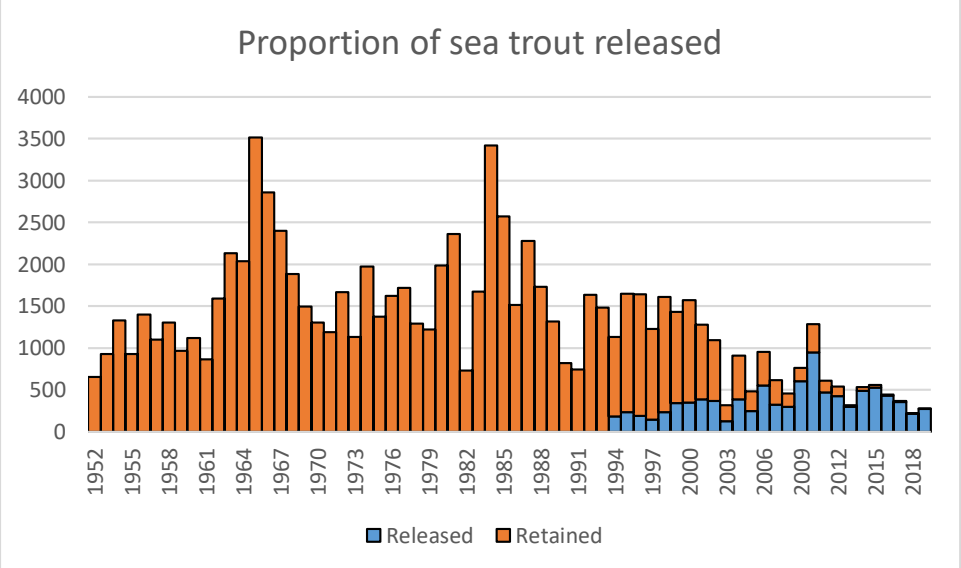
Graph 4 Annual Salmon catch and proportion released for the River Deveron



Graph 5 Annual Grilse catch and proportion released fro the River Deveron



Graph 6 Annual Sea trout catch and proportion released for the River Deveron



It can be seen from Graphs 4&5 that the practice of 'catch and release' has been increasing on the Deveron since 1994 and has been above 90% in in 2018 &2019. In 2012 the Deveron Board adopted a full catch and release policy for sea trout and since 2015, more than 95% of sea trout have been released each year (Graph 6).
It is very important when returning salmon or sea trout (including juveniles and in particular smolts) to the river that the fish are handled appropriately so as to not cause any damage and ensure the fish survive to spawn. DBIRT offers advice on catch and release, as does Fisheries Management Scotland and Marine Scotland Science

3.2. Predation / competition

Predation of salmon and trout stocks is a natural occurrence. Fish species, piscivorous birds and mammals have co-existed in ecological balance over many millennia. Juvenile salmonids may be eaten by other juvenile salmon as well as a various different predators including trout, eel, kingfisher, sawbill ducks, cormorant and mink. Adult salmonids are also preyed upon by species such as cormorant, otter and seals. The predation of early life stages of salmonids may not have a huge effect as salmonid populations naturally compensate through lowered mortality of those that remain (known as density dependant mortality). However, when salmonids reach the parr stage, the smaller populations have reduced ability to compensate for losses. By the smolt stage density dependant mortality is no longer a factor, so the loss of smolts has a direct impact on the potential number of returning adults. During the smolt migration, salmon and sea trout are particularly vulnerable to predation as they move downstream together in large numbers. Predation can have a significant impact upon smolt numbers reaching the sea.

To improve our understanding of predation pressures on smolts the DBIRT has conducted three smolt tracking studies (Lothian et al 2017, Honkanen 2017 and Garret 2018). The overall aim of the work was to measure the survival of smolts from the headwaters to the sea and pinpoint the main locations and causes of mortalities. Ultimately, our objective is to determine what management measures can be deployed to increase the survival of smolts leaving the river. This work was extended by DBIRT'S involvement in the Atlantic Salmon Trusts Moray Firth Tracking Project in 2019 (River Deveron Missing Salmon Project, SCENE 2019 & Moray Firth Missing Salmon Project).

3.2.1. Piscivorous birds

Avian predation has the potential to significantly reduce the number of smolts surviving to the reach the sea, particularly during periods of low water. It is well established the high number of smolts that Goosanders can eat (Armstrong et al 1998) and combined with the high numbers seen on the river in the spring there is a significant potential impact on the number of smolts surviving out of the river.

Recent research has shown that across Scotland smolt survival rates in the river are lower than expected (Dee report, Tweed report). Research conducted by the DBIRT has found that on average only 40% of salmon smolts from the upper Deveron catchment successfully make

it to sea. Tracking of smolts in 2016, 2017 & 2019 showed losses of 0.5-0.77% per km. Even higher losses were observed during the 2018 smolt migration when the river experienced sustained low flows throughout the spring.

The DBIRT is a member of the Moray Firth Sawbill Management group and annually gets a licence from SNH for shooting, as an aid to scaring, a limited number of Goosanders and Cormorants. To secure the licence the DBIRT has to conduct two annual bird counts according to a standardised methodology prescribed by SASA (Science and Advice for Scottish Agriculture). Based on our bi-annual counts, SASA advise SNH on the number of birds that can be shot before SNH ultimately issue a licence that runs from October to May.

3.2.2. Piscivorous fish

Brown trout (*Salmo trutta*) are opportunistic feeders and once of adequate size some will consume other fish as well as invertebrates. Whether any large Deveron trout switch entirely to a specialised piscivorous diet is unclear but it seems likely that most adapt to the seasonal availability of prey they encounter. The tracking project in 2012 revealed that some of the trout that spawn in the Blackwater migrate throughout the Deveron catchment. Their extensive freshwater migration, as distinct from the anadromy of sea trout, is another successful biological strategy, perhaps driven by the seasonal presence of suitable in-river prey and available holding habitat. Salmon and trout have evolved to exist together in the catchment, with some necessary behavioural adjustments. At this stage of our knowledge, there is nothing to suggest that this balance is out of sync. The DBIRT accepts that there are some juvenile salmon losses to trout, but there is no evidence that this requires further management intervention.

3.2.3. Seals

The predation of returning adult salmonids by seals can also be a problem on the lower Deveron and coastal area in terms of reducing the spawning stock available. The RDevDSFB is a member of the Moray Firth Seal Management Plan (Butler 2004) and is annually issued with a licence for a designated marksman to shoot problem seals that have been identified as threatening the fish stocks within the Deveron DSFB area.

3.2.4. Other

American mink (*Neovison vison*) is an invasive non-native species (INNS) and is a voracious predator that can cause serious damage to native bird, fish and mammal populations. See INNS (Section 3.5).

3.3. Fish health

Ensuring that juvenile salmonids leaving the river and returning adults are in good health is of utmost importance to ensure maximum spawning potential. The DBIRT and RDevDSFB pay close attention to fish in the river and monitor for signs of disease or parasites. From 2020 anglers will be asked via the Conservation Policy to report all fish with signs of disease or parasitic loading.

3.3.1. Disease

Although many diseases can impact salmon, one of the most easily observed and frequently recorded is Red Vent Syndrome (RVS). RVS had not been prevalent within the Deveron system up until the summer of 2007 when it turned up in nearly every river in Scotland. During 2007 both grilse (1SW) and Salmon (2SW) caught from the Deveron, showed external signs of RVS. Parasitological investigations carried out by MSS have discovered the presence of nematode worms (*Anisakis* sp. and *Hysterothylacium* sp.) in the region of the vent of all fish examined that were exhibiting signs of RVS. These parasites can occur naturally in wild fish and are considered to be the most likely causal agent of RVS in Atlantic salmon. The impact of the parasites is not fully known but there is no evidence that the condition affects salmon spawning or leads to mortality during their final freshwater stage. There is a risk that eating raw or undercooked infected salmon could result in the parasite affecting humans.

3.3.2. Sea lice

Sea lice (*Lepeophtheirus salmonis* and *Caligus elongatus*) are a naturally occurring parasite that salmonids pick up in the sea. They can, in substantial numbers, cause significant damage to adults and juveniles in the marine environment. Increased and unnatural abundance of sea lice (*Lepeophtheirus salmonis*) is associated with intensive salmonid aquaculture and has been associated with declines in sea trout and wild salmon populations on the west coast of Scotland and in the Northern Isles. Smolts leaving rivers are especially prone to intensive lice infestation. There are currently no salmon farms on the east coast of Scotland, therefore Deveron salmon and sea trout only face naturally occurring levels of lice in our immediate coastal waters. However, migrating salmon may swim through intensively farmed waters elsewhere or mingle at sea with escaped farmed salmon carrying artificially elevated lice infections. The DBIRT asks anglers to report and photograph salmon and sea trout with unusually high levels of lice and campaign for stronger regulation of salmon farming in Scottish Waters.

3.3.3. Other parasites

Gyrodactylus salaris (GS) is a small external parasite that infects the skin, gills and fins of freshwater fish. It can multiply rapidly and cause serious damage. In Norway it has resulted in significant losses of salmonid populations. GS is a listed disease that must be reported under Schedule 1 of the Aquatic Animal Health (Scotland) Regulations 2009. Although the UK does not currently have the disease, it is believed that Scottish Atlantic salmon are very vulnerable should the infection spread here. To try and stop the spread of the parasite the DBIRT has implemented a Biosecurity Plan (see Section 3.5).

3.4. Genetic Introgression

As described in section 2.5.1, the genetic structuring of the salmonid populations within the catchment is crucial to their long term survival. To protect these populations, the DBIRT and RDevDSFB have adopted a precautionary Stocking Policy (see below) and a reporting scheme for escaped farmed fish that have the potential to spawn with wild Deveron stocks.

3.4.1. Stocking

The DBIRT operated a salmonid hatchery with the capacity to rear up to 300,000 ova from 2003-2014. The main aim of the hatchery programme was to stock fishless habitat i.e. above completely/partially impassable obstructions and also areas where native fish stock densities were minimal. Broodstock were always sourced from the same sub catchment as the ultimate stocking location as to maintain the genetic integrity of potential sub-stocks. The RDevDSFB took the decision not to continue stocking salmon into the Deveron from 2015 onwards. This decision was based on the latest recommendations and research from RAFTS/ASFB (and now FMS), The Spey Fishery Board and Dr Kyle Young (Aberystwyth University) (Young 2014) and data from catchment wide juvenile (electrofishing) fish surveys throughout the Deveron. It was concluded that RDevDSFB resources from the restocking programme should be redirected to support existing long-term fish access, habitat restoration and diffuse pollution reduction projects, to assist in protecting and enhancing a healthy wild population of fish. The hatchery has been mothballed to maintain the RDevDSFB's ability to undertake stocking in the future should, for example, a catastrophic event occur.

3.4.2. Escapees

Escapees from stocked inland fisheries or from commercial salmon farms at sea have the potential to breed with wild native fish and weaken the genetic integrity of Deveron salmonid populations. The Deveron is fortunate not to have salmon farms in the nearby coastal area but escapees have been recorded by anglers in the past. In the Conservation Code anglers are asked to retain any farmed salmon and inform the RDevDSFB. Rainbow trout farms within the catchment are monitored to ensure they have provisions in place to minimise the risk of escapees.

3.5. Invasive non-native species

As part of a national campaign to protect against the introduction and spread of *Gyrodactylus salaris* the RDevDSFB and DBIRT has instigated a Biosecurity Plan**:** *"To establish a sustainable framework which will prevent, detect, control and eradicate invasive non-native species within the Deveron fisheries district through appropriate management, data collection, liaison, and education".*

3.5.1. Crayfish

Signal crayfish (*Pacifastacus leniusculus*) have been present in Britain since they were first imported from Sweden during the 1970s. Subsequent escapes from farms and deliberate illegal releases have resulted in the establishment of new feral signal crayfish populations over large areas of England and Wales. Several records exist of signal crayfish introductions to Scotland during the 1980s and there is some anecdotal evidence to suggest that crayfish were translocated to a variety of locations at that time. They were first formally recorded in Scotland during 1995, since when a total of 15 populations have been identified. These extend from the Kirkcudbrightshire Dee in Galloway and the River Clyde in Lanarkshire to the River Nairn near Inverness. Populations have also been recorded in the catchments of some of Scotland's most well-known river systems, such as the Tay, Tweed and North Esk. Signal

Crayfish are not currently in the Deveron fisheries district and everything possible must be done to ensure they are prevented from entering. Signal crayfish can have a significantly adverse impact on native freshwater flora and fauna in running and standing waters. They consume large quantities of plants and invertebrates, and by either predating or displacing reduce numbers of native amphibians and fish. Signal crayfish can also modify aquatic environments by burrowing into the banks or rivers and ponds. In ponds, this behaviour can undermine the littoral zone and result in increased turbidity. In running waters, extensive burrows may destabilize the riparian zone, leading to increased rates of bank erosion, the shallowing of streams and the compaction of salmonid and lamprey spawning grounds. The foraging activity of signal crayfish can also lead to significant remobilisation of fine sediment, causing diurnal fluctuations and overall increases in water turbidity. The species' impact on freshwater pearl mussel is unknown but is likely to be significant. The potential for signal crayfish to act as a vector for transmission of diseases within or between catchments cannot be discounted.

3.5.2. Fish

Rainbow trout (*Oncorhynchus mykiss)* are non-native and compete with native fish populations for food and habitat. The DBIRT closely monitors stocked fisheries to ensure they have adequate provisions in place to stop the escape of non-native fish.

The number of minnows (*Phoxinus phoxinus*) being encountered during annual electro fishing surveys has also increased since 2001. Minnows again create competition with native fish populations for invertebrates and habitat. DBIRT are investigating if there are any management actions that could reduce their spread.

Following introductions into some Russian rivers in the 1960s, Pink Salmon (*Oncorhynchus gorbuscha*), a Pacific Salmon species, have slowly spread west and colonised some northern Norway Rivers. In 2017 unprecedented numbers were recorded in Scottish Rivers including two caught in the River Deveron. Pink salmon spawn in the summer and have a distinct 2 year breeding cycle meaning they are either of odd or even year populations. The Norwegian populations are odd year spawners and as result we anticipate more pink salmon in 2019 and 2021. Although it is possible they could establish breeding populations in Scottish rivers, it is believed that the warmer water temperatures will mean the fry leave the river too early and will not survive. The risks they pose through competition and disease to wild Atlantic salmon is not fully understood but as an INNS, all anglers are asked to kill and report all Pink Salmon caught. Fishery Management Scotland (FMS) have issued a briefing on Pink Salmon.

3.5.3. American mink

The non-native American mink (*Neovison vison)* is first thought to have reached Britain in 1929. It is not known when they first reached the Deveron system. Of particular concern is their impact on water vole (*Arvicola amphibious*) populations that are already threatened and on fish populations. The main threat they pose to fishery performance is the reduction in juvenile production through predation. The Deveron also has one of the largest breeding populations of water voles in Europe (*Xavier Lambin et al, 1996 and subsequent works*), to which mink also pose a threat to. The control of American mink has been undertaken by the

DBIRT in the Deveron catchment since 2006 and over 400 have been captured and humanely dispatched. Through previous SNH funded projects and most recently the HLF and SNH funded SISI (Scottish Invasive Species Initiative), volunteers across the catchment monitor rafts for signs of mink and when detected, live traps are deployed to catch them. More information on the DBIRT website.

3.5.4. Plants

3.5.4.1. Japanese knotweed

The establishment of the invasive-species, Japanese knotweed (*Fallopia japonica*) within the Deveron district is currently a major concern to the RDevDSFB & DBIRT. If allowed to establish further, it poses the threat of shading out native plants by producing a dense canopy of leaves early in the growing season which can accelerate bank erosion. Knotweed also offers a poor habitat for native insects, birds and mammals. Survey and eradication is ongoing through the SISI Project and more information is available on the DBIRT website. Japanese knotweed is currently all female and cannot breed and only spread asexually. However, if it was to hybridise with Giant knotweed or Himalayan knotweed it could potentially begin to breed and the risk of spreading becoming significantly worse.

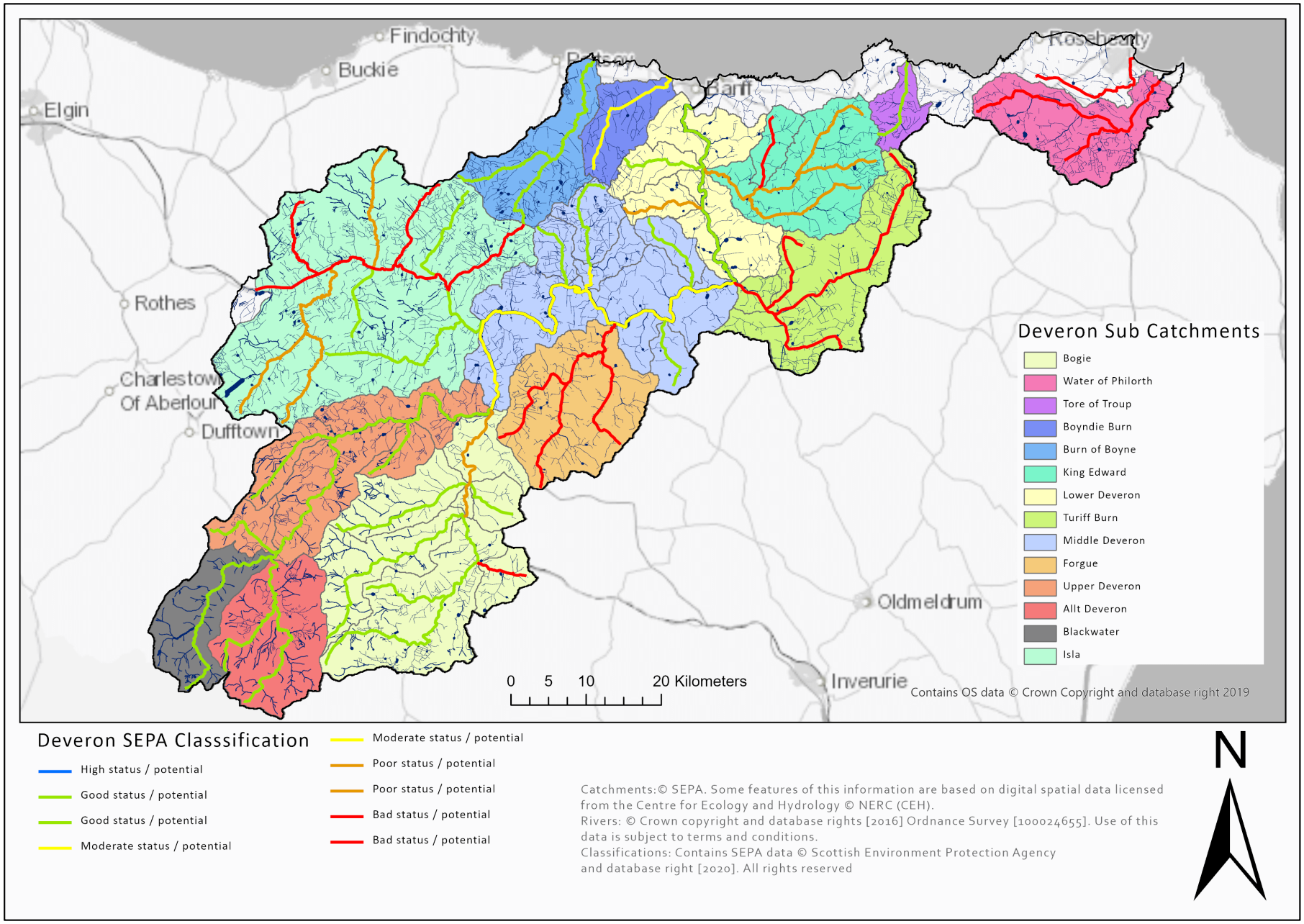
3.5.4.2. Giant hogweed

The non-native invasive species Giant hogweed (*Heracleum mantegazzianum*) is distributed widely throughout the Deveron, Bogie and Isla catchments. Giant hogweed dominates vegetation in marginal habitats and along rivers, thus crowding out native plants and leaving river banks open to erosion. Sap from the plant can also cause serious burns to exposed skin. In 2005 the DBIRT began a control programme on the River Isla for Giant hogweed which proved successful and was then expanded in 2008 to the River Bogie and Deveron main stem. It has been the focus of work every year since through subsequent INNS Projects and many miles have been treated along the Deveron annually. Many landowners now take responsibility to treat it on their own land and the DBIRT will continue to support and encourage landowners to do so. It is now being targeted through the current SISI Project and more information is available on the DBIRT website.

3.5.4.3. Himalayan balsam

Himalayan Balsam (*Impatiens glandulifera*) has become increasingly widely distributed throughout the Deveron catchment, with the most significant increase observed throughout the lower Deveron fishing beats. Himalayan balsam again shades out native grasses reducing diversity and leaving river banks prone to erosion. Its control is also included in the SISI Project and is being targeted with teams of volunteers. More information is available on the DBIRT website.

Map 6. Overall SEPA Classification of the condition of Deveron Waterbodies



3.6. Water Quality

To survive and flourish, fish stocks and especially salmonids require water relatively neutral in pH without excessive acidity, well oxygenated without oxygen depletion from organic matter pollution (effluents) or from eutrophication impacts via nutrient enrichment. They should also have low exposure to emerging organic compounds (pesticides and pharmaceutical) and other new threats such as plastic fragments. Aquatic invertebrates form the base of the aquatic food chain, providing food for salmonids and also require high quality clean water and are very sensitive, even to minor changes in water quality. A number of key river shingle invertebrate species, plus a British endemic stonefly the Northern February red (*Brachyptera putata*), occur in the Deveron catchment, all of which are listed as 'Priority' species in the UK Biodiversity Action Plan. A number of issues have been identified facing these species, such as acidification in headwaters, agricultural pollution, sedimentation, dredging of gravels, deepening of watercourses and water abstraction. It is clear many of these issues are relevant in the river Deveron catchment context. Although some information is available on these species, relatively little is known about their distribution and ecological needs. This information is essential if effective conservation management plans are to be put into operation. More comprehensive baseline surveys are required to assess their rarity and distribution.

Under the Water Framework Directive (WFD), SEPA have characterised water bodies as High, Good, Moderate, Poor or Bad, assummarised on the water classification online hub map tool (Map 6). The classification is based on water quality, physical condition, access for fish migration, water flows and levels and freedom from invasive species.

Most of the Deveron is classified as Good for water quality with only the King Edward, Forgue and Isla being classified as Moderate.

3.6.1. Acidification

Acidification can result from coniferous tree plantations that collect and concentrate atmospheric pollutants which are then washed into the water course. The trees also actively remove calcium and magnesium which are natural buffering agents. Acidic conditions where the pH falls below 5.5 can increase the leaching of aluminium from soils and underlying geology which can be toxic to salmonids. Salmonid eggs are particularly vulnerable to acidic conditions as it can impede the function of the hatching enzyme. As juveniles get older they are more resilient to acidic conditions. Overall this is a declining threat since the reduction of acid sulphate emissions to the atmosphere during the 1990's and the background, previously dominating rainfall acid inputs onto which land use effects were superimposed, have greatly declined.

3.6.2. Point source pollution

Point source pollution is pollution from a single identifiable source. A range of specific activities and sites have the potential to contaminate and pollute specific parts of the

catchment as well as the channel downstream. Point sources of pollution include but are not limited to sewage plants, fuel storage, distilleries and farms (e.g. silage clamps and slurry pits). Ultimately it is SEPA's responsibility as the regulator to ensure that potential point sources of pollution have suitable preventative measures and procedures in place to prevent accidents. However, the DBIRT and RDevDSFB do continually monitor the catchment and will highlight and call to account potential sources of pollution where required. Furthermore, should a pollution event occur the DBIRT will respond and monitor the situation to ensure appropriate measures are taken to mitigate and log impacts and ensure prosecution where necessary. The DBIRT will continue to encourage further processing of domestic sewage tank effluent and ensure that local Councils are installing adequate waste water treatment plants to keep up with increasing housing.

3.6.3. Diffuse pollution

Diffuse pollution is the release of potential pollutants from multiple sources that individually may not have an identifiable effect but cumulatively may have a significant effect on the water environment. Diffuse pollution can come from a wide range of sources; domestic sewage tanks, agriculture, roads and forestry, among others. Diffuse pollution, particularly of fine sediment is a significant issue on the Deveron which has been designated as a Priority Catchment for Diffuse Pollution by SEPA. The SEPA Land Unit have combined modelling and walkover surveys to identify the most at risk areas (Isla, Bogie Turriff and King Edward Burns). Within the priority areas SEPA visits the local farms to inspect, advise and enforce measures to reduce sources of diffuse pollution.

Diffuse pollution often originates as run off from agricultural and forestry land (Map 3). One of the best solutions for surface runoff is the maintenance or reinstatement of the riparian zone alongside the river. As well as providing a physical border to push agricultural practices (e.g. agrochemical application, cultivation from the water edge) the buffer strips are effective against sediment and sediment bound (pesticide, phosphorus) pollution transfers. However, different designs and variable targeting of buffers need to be considered to match high risk areas of sediment transfer and other challenges from subsurface transfers of nitrate, bank stabilisation and habitat improvement. Improved ways of working and managing the land can also reduce the rates of runoff, tackling the issue at source. The DBIRT is working with SEPA and landowners to identify the most at risk areas and ensure the maintenance and / or reinstatement of the buffer strips as required by the General Binding Rules (GBR) issued by SEPA under the Water Framework Directive (WFD).

3.6.4. Changing rainfall patterns

Changing rainfall patterns due to climate change are potentially a long term threat to Deveron fish stocks and the fishery. Climate change in the UK is likely to result in; an increase in summer heat waves, extreme temperatures and drought; increased frequency and intensity of extreme precipitation events and a reduced occurrence of frost and snowfall. As summarised by the SEPA Climate change webpage. Prolonged dry spells reduce the flow in the river and result in increased river temperatures which threaten salmonid populations that rely on cool water. Increased risk of severe flooding threatens instream habitat and juvenile

life stages of salmonids. Less snow will result in less snowmelt which helps to maintain flows during the spring when smolts are leaving the river. The Deveron relies on elevated flows for successful angling and the fishery will be negatively impacted by increased prolonged dry spells and severe floods. In 2018 the prolonged spell of dry hot weather and resulting low river level, led directly to the Deveron's lowest Rod & Line catch on record. Prolonged periods of low flow also potentially inhibit fish movement within the catchment, preventing optimal habitat utilisation and increasing the risk of predation.

To try and mitigate for these changes the DBIRT is looking for opportunities with landowners to implement long-term catchment scale restoration projects that will climate proof the catchment. This could include the following:

- Tree planting in the riparian zone to shade the river and maintain salmonid tolerable water temperatures. Trees also help reduce run off, reducing peak floods and maintaining more prolonged moderate flows.
- Peat restoration projects to increase the retention of water within peatland. Blocking of exiting peat drains (grips) and restoring vegetation helps the peat to retain water, reducing run off and reducing peak flood flow and intensity.

3.6.5. Eutrophication

Although eutrophication (excessive richness of nutrients) has not been formally recorded on the Deveron, there are likely significant inputs of nutrients (Nitrogen and Phosphorous) from the intensive land-use. This would suggest that the Deveron is a river of good natural resilience and is able to mop up excessive inputs. The DBIRT staff remain vigilant in monitoring for signs of excessive algal growth, particularly in flow conditions that could trigger algal blooming. By encouraging the reinstatement of buffer strips and encouraging the responsible application of fertilisers the DBIRT is limiting the excessive introduction of nutrients that could trigger eutrophication.

3.6.6. Oligotrophication

Oligotrophication, the depletion of nutrients, is generally not a problem in the productive Deveron catchment. However, the reduction of carcasses from returning adults may be a factor in reduced nutrients in some parts of the catchment. It can be a by-product of acidification in commercial forestry, best addressed through the provision of native deciduous buffer strips between commercial forestry and the watercourse.

3.7. Water Quantity

3.7.1. Abstraction

Water abstraction for distilleries, agricultural irrigation, trout farms/fisheries and human drinking water is common practice in the area and, cumulatively, has an impact on natural

flow patterns of watercourses. During periods of low summer flows all the abstractions potentially reduce the quality of juvenile fish habitat and limit upstream migrating adults and downstream migrating juveniles. Some abstraction points may also have insufficient screens to prevent smolts / parr passing through, which can cause mortalities, this is currently under investigation by the RDevDSFB. The SEPA RBMP water classification online hub map tool highlights the King Edward Burn, The Turriff Burn and the Crooksmill as being Moderate for water flows and levels while the rest of the catchment is classified as High or Good. The DBIRT commissioned a report in 2014 to investigate the Impacts of water abstraction on juvenile Atlantic salmon (Salmo salar) in the Deveron catchment which highlighted that natural droughts water abstraction contributed to an exceedance of low flow conditions with potential impacts for salmonid upstream migration. Consequently, the results pointed to further factors such as extreme climatic conditions and poor habitat quality, potentially caused by land use in the upper region of the Deveron catchment, which should be further investigated (Weber 2014).
The DBIRT and RDevDSFB are planning an audit of all licensed abstractions in the catchment to enable an assessment of the total abstraction from the catchment and the individual tributaries. This will highlight the area's most at risk and provide the background information required to either campaign for reduced abstraction or oppose new abstractions.

3.7.2. Upland / agriculture land-use and drainage

Certain management of agricultural land, including improper cultivation, compaction and in some cases drainage, particularly on steep valley sides can result in increased runoff, increased peak flows and reduced lag flood times. This results in an increased risk of flash floods and severe erosion which can be directly damaging for juvenile salmonids and their habitat as well as contributing to siltation. The DBIRT is working with landowners and farmers to reinstate buffer strips that slow down runoff and trap silt. The adoption of sympathetic land management practices as described in the Farming &Water Scotland guidance is key.

3.7.3. Forestry drainage

Forestry and associated drainage on steep hill sides can result in increased runoff, increased peak flows and reduced lag flood times. This issues are most likely during establishment of new infrastructure (tracks and compounds), planting and harvesting and this is when mitigation is most important. Conifer afforestation, conversely can also result in reduced yields of water as result of increased transpiration and increased evaporation from the canopy.

3.8. Habitat Thermal

Salmonids need cool clean water to thrive but different stages of their life history have specific temperature tolerance thresholds. The incubation period for salmon and trout is 100 days at 5°C and 50 days at 10°C (otherwise described as 500 degree days). Although trout eggs can survive in temperatures of 0-13°C and salmon 0-16°C, the mortality and deformity increase rapidly in water temperatures above 12°C. Once at the Alevin stage they can survive temperatures up to 22°C. The ability for older trout and salmon to survive extreme

temperatures depends upon the length of time they are exposed, the upper temperature and the acclimation period. The 1000-minute upper lethal temperature is 27°C for brown trout and 29.5°C for Atlantic salmon parr. The seven-day upper lethal temperature is 25°C for trout and 28°C for salmon parr. Although able to survive these high temperatures, in the long term they need cooler water to feed and grow. Brown trout can grow in water from 3.5-19.5°C with maximum growth at 13°C. Atlantic salmon can grow in water temperatures from 6-22.5°C with maximum growth at 15°C. At higher temperatures salmonids are more susceptible to pollutants and pathogens.

Water temperature can also have more subtle impacts on life history and behaviour. Smolt age depends on growth which is partly dependent on the temperature regime. Indeed the timing of smolts reaching the sea can be critical for survival and is likely influenced by temperatures through the winter and spring. Returning adult salmon may be delayed in the estuary by river temperatures in excess of 16°C. There will be virtually no migration at 20-23°C. Conversely their maximum swimming speed may be limited by low temperatures which limit their ability to navigate upstream obstacles when the temperature is below 5°C. More information can be found in this Environment Agency Leaflet.

Water temperature is also crucial to the river supporting a healthy and diverse invertebrate population. As the water warms up it holds less of the dissolved oxygen that they need to survive. This Buglife Report has more information.

3.8.1. Changing temperature patterns

During the prolonged hot dry summer of 2018, the River Deveron main stem was routinely rising above 20°C on a daily basis. With global warming predicted to result in more hot dry summers, this is a likely indication of what the future may hold for the River Deveron. Given the requirements and temperature limitations of salmonids outlined above, temperatures of this level can have a detrimental effect on salmonids and the fishery. In 2013 Marine Scotland Science began Scotland's River Temperature Monitoring Network (SRTMN) by deploying river temperature loggers all over Scotland. The data collected by these loggers has produced a model of temperature through Scotland's river network and how it will behave with climate change.

3.8.2. Loss of shading

Native deciduous trees in the riparian zone provide shading and help to regulate temperature increases from direct sunlight during summer months. Historically, apart from the very upper reaches, the entire Deveron catchment would have been populated by a mixture of native deciduous trees but these have been lost over time as man's use of the landscape has intensified. The upper catchment has been cleared for grazing and the presence of livestock and deer in particular prevents the natural regeneration of native trees. Where buffer strips have been fenced off and livestock excluded, trees will return naturally but a programme of planting would greatly increase the pace of reforestation. The model produced by Marine Scotland Science's SRTMN has produced a tool to help highlight the parts of the catchment most at risk of warming and consequently prioritise tree planting. (Jackson et al 2018).

3.8.3. Over-shading

Coniferous planting too close to the river channels can lead to heavy shading which can reduce native bank side vegetation and reduce in-river productivity. The DBIRT are working with Forestry Commission Scotland (FCS) and other forestry land managers to ensure all new forestry has an adequate buffer beside any waterway as required by the Forestry Commission "Forestry and Water Guidelines". Where existing plantations have been planted within the minimum buffer we are working to have the natural habitat reinstated.

3.8.4. Thermal discharge

There are six distilleries within the main Deveron catchment and all of them use the Deveron or its tributaries for cooling water. Under the Water Framework Directive (WFD) SEPA impose limits on how much the cooling water discharge is allowed to increase the ambient temperature of the receiving waterway. This SEPA Guidance provides a summary. Waters of high ecological status should not be increased more than 2 °C and waters of good ecological status should not be increased more than 3°C. In the summer of 2018 during a prolonged hot dry spell, routine monitoring by the DBIRT revealed that cumulatively the three distilleries in Keith were increasing the temperature of the River Isla by 6°C. Although this was just within the limit allowed, SEPA were notified and limitations were imposed on all 3 distilleries to ensure the legal allowance was not exceeded. From 2019 onwards the DBIRT will include temperature monitoring in its routine monitoring during periods of prolonged hot weather when these discharge temperature thresholds are at risk of being broken.

3.8.5. Hydro modification

The only hydro scheme on the Deveron is Avochie micro hydro at Rothiemay that is regulated by SEPA. There are two small additional small hydro schemes at Aswanley and Invermarkie.

3.9. Instream Habitat

A functioning river system will naturally have a diverse range of habitats that are all crucial for supporting a healthy functioning ecosystem and in particular to supporting salmon and trout populations. Salmonids require a diverse range of habitats from gravel for spawning, to juvenile habitats with cobble and deep pools and cover for returning adults. If any one part of required habitats is missing it can result in a bottleneck and ultimately limit the production and / or carrying capacity of salmonids.

The SEPA RBMP water classification online hub map tool shows that significant portions of the Deveron catchment have been classified as Poor or Bad for Physical Condition. These include the significant tributaries of the King Edward Burn, the Turriff Burn, the Forgue Burn and The Isla. These burns constitute the majority of the middle and lower River Deveron sub-catchments. Under WFD Rules these need to be rectified to Good or Better status by 2027. Given the importance of these catchments to the Deveron salmonid populations it is of priority to DBIRT and the RDevDSFB that scoping is undertaken to identify the source of the

physical degradation, potential solutions and begin developing projects and partnerships to take this restoration forward.

3.9.1. Sedimentation

Sedimentation in the river is a significant threat to salmon and trout. Sediment can smother juvenile salmonid habitats and leave gravel beds unsuitable for spawning as well as reducing biodiversity and productivity.

Agriculture is the most significant source of damaging fine sediment into the river. Intensification of arable farming practices can result in increased soil erosion as result of cropping patterns that leave soils exposed without vegetation cover, often during the wettest months of the year. Grazing and poaching by livestock on the bank can also lead to serious bank erosion and siltation.

Forestry plantations can also lead to changing patterns of run-off, resulting in increased erosion, sediment transport and ultimately sedimentation. Sediment run off is further increased early in the forestry cycle and again during clear felling, potentially damaging juvenile and spawning habitats.

Input of sediment from arable farming can be controlled by leaving uncultivated buffer strips (varying from the mandatory 2 metres wide to larger zones depending on local pressures) alongside the stream and any feeder tributaries. Buffers placement, design and even maintenance (in the case of excessive converging flows eroding the buffer) are important and greater actions may be necessary to managed fine silts and clays that travel more readily, or sites of excessive erosion. Additionally buffers should always be combined with good in-field management or do not sustain long-term actions. The provision of buffers also satisfies the requirement for bankside cover and stabilises the bank generally. Similarly fencing off the riparian zone to keep out livestock prevents damage to the banks bankside vegetation and removes a significant source of sediment and pollutants (nutrients and microbial). The DBIRT is working with landowners to maintain and reinstate buffer strips throughout the catchment.

Sedimentation, apart from in a particularly severe cases, is generally diffuse pollution in that it is a cumulative problem. The River Deveron which has been designated as a Priority Catchment for Diffuse Pollution by SEPA and as such it is included in the farm inspections carried out by SEPA's Land Unit team under the Priority Catchment for Diffuse Pollution. (See Section 3.6.3).

3.9.2. Loss of sediment transfer

In-river barriers can stop the downstream transport of sediment and can result in increased erosion and loss of spawning substrate. This has not been identified as an issue on the Deveron, which is a dynamic river with a plentiful supply of mixed sediment including gravel.

3.9.3. Lack of, or excessive, large woody debris

Large woody debris is a very important habitat for juvenile salmonids but the reduction of trees in the riparian zone has limited the input of trees to sections of the river. Large woody

debris create cover and via changing flow patterns help diversify instream habitat. Conversely, too much instream large woody debris can create log jam and ultimately create a blockage to upstream migration. The DBIRT has a policy to only remove log jams that are potential total blockages to migration. The installation of large woody debris is a valuable tool in small stream restoration projects and can be used to help diversify habitat particularly in canalised sections.

3.9.4. Canalisation & Dredging

Agricultural canalisation and straightening not only directly removes habitat but dredging and over deepening channels reduces habitat diversity and compacts beds reducing fry or parr habitat. Canalised and dredged channels support significantly fewer salmonids than naturally functioning channels. Some channel modifications are allowed under SEPA guidance described in the SEPA Water Environment Controlled Activities Scotland Regulations 2011. A Catchment Licence has been issued by SEPA for the Isla downstream of Keith that permits a consortium of farmers to undertake a wide range of bank and instream dredging on an annual basis. The DBIRT have raised concerns about the scope of these works and the lack of apparent regulation of the works and timings. The DBIRT will continue to campaign for a more refined set of works with clear outcomes and benefits for the farmers that minimise the damage to the Isla catchment.

3.10. Habitat Riparian

3.10.1. Loss of natural riparian vegetation

The loss of natural riparian vegetation and woodland is a characteristic of many upper river catchments in the Moray Firth region. This was largely caused by the clearance of native woodland for grazing in the 19th century and has been maintained by grazing pressure by deer and sheep.

The consequences of this loss of riparian woodland have been;

- A loss of biodiversity within and at the margins of the woodland.
- Increased erosion of river banks leading to siltation and degradation of rivers
- A loss of buffer habitat which filtered and slowed down water flow from surrounding land. This increases pollution and flood risk.
- Increase in summer water temperatures through a of lack of shading.
- Changes in the nutrient cycling due to loss of invertebrates, leaf litter and other beneficial organic matter inputs that reduce resilience provided by in-river cycling of nutrient pollution inputs.
- Fragmentation of habitat and the loss of the natural corridor which connected habitats and species.

Watercourses within the fisheries district that are devoid of livestock fencing have problems with areas of bank collapse, which has in turn increased in stream silt loading, resulting in riverine habitat becoming degraded. Both the Isla and Bogie rivers have soft, alluvial soil banks which are prone to chronic collapse where stock fencing is absent. The Bogie is a naturally

meandering river which, along with increasing incidence of spates, exacerbates the erosion problem.

To date, habitat enhancement works such as livestock restriction and provision of buffer strips have been undertaken mostly by farmers and landowners (under the Countryside premium schemes and the Rural stewardship schemes (RSS) and more recently under the Scottish Rural Development Programme (SRDP). This process has been facilitated by the DBIRT identifying problem areas and collaborating with farmers to include these areas in their funding applications. The DBIRT has also made financial contributions to farmers who have applied to for grants to assist with the application costs. Problematic areas were identified from the 1998 habitat survey and from ad hoc sightings but a more up to date riparian surveys are now required to identify problem areas and target future work and management.

The DBIRT have also carried out bank revetment work on the Aultmore burn (Isla) using the log & Christmas tree technique to protect a 100 metre length of river bank from further erosion. Similar work was undertaken on the River Bogie on a 30 metre stretch. The DBIRT successfully applied to the Heritage Lottery Fund to install 'Willow spilling' on the Isla and Bogie rivers during 2007 to halt two areas of chronic bank collapse. Hard standing cattle watering's were also installed where stock had caused bank collapse. Other catchments that could benefit from riparian fencing and planting have been identified. These include the River Isla (WTT Report 2014), the Crooksmill Burn (CBEC Report 2014) and the King Edward Burn. The DBIRT plans to consult landowners in these catchments to develop collaborative projects and secure funding to take this restorative work forward with mutual benefits for the river and landowners.

3.10.2. Conifer afforestation

The unsympathetic planting of coniferous trees such as Sitka Spruce directly beside some significant spawning tributaries can cause many problems. This has led to the loss of native bankside vegetation, bank collapse, over shading of juvenile habitat and siltation of spawning gravels. Domination of the banks by coniferous plantations can also reduce light penetration and thus primary productivity, reducing fish production. A proportion of the original Clashindarroch Forest (under the ownership of Forestry Enterprise) on the River Bogie system, was planted in this manner.

The DBIRT is working with Forestry Commission Scotland and other forestry landowners to reinstate buffer strips of native species between commercial forestry and the waterway as well as ensuring all new planting follows the Forestry Commissions "Forestry and Water Guidelines".

3.11. Obstacles to Fish Passage

Barriers in the river to fish migration can be caused by road culverts, weirs, bridge aprons or excessive natural large woody debris accumulations. Not only can they stop or delay adults in returning to their spawning streams but they can stop or delay downstream migrating juveniles and smolts and lead to pinch points where they are more vulnerable to predation.

Some barriers although passable under the right conditions can become temperature barriers when water temperature limits the physical ability of the salmon to navigate the barrier. In the Deveron fisheries district, nearly all man made barriers have been removed or eased in the last 15 years. All man made obstructions to migratory fish tend to be historical that were installed before existing regulations. Any new developments will need to include provision for fish passage under WFD Rules and should consult with the RDevDSFB/DBIRT in their design. Each year there are episodic occurrences of fallen trees which can restrict fish access. If these are identified as total obstructions, they are removed by the DBIRT.

3.11.1. Upstream passage

Barriers can stop or delay adults migrating upstream to spawn. Most upstream barriers in the Deveron catchment have been removed or eased however some remaining barriers need further assessment and easement:

- River Isla
    - Mill of Towie Weir
    - Strathmill Weir
    - Glen Keith Weir
    - Disused Old Mill Weir
- King Edward - Old disused weir

The weirs on the Isla are the priority for easement as the electrofishing data clearly shows these are limiting spawning upstream of Keith. The DBIRT is in discussions with SEPA and Pernod Ricard to identify solutions.

3.11.2. Downstream passage

Instream barriers can cause significant delays to the downstream migration of salmonids. Smolts are of particular concern as the timing of their downstream migration, and transition from freshwater to saltwater, is critical in optimising survival rates. Barriers can therefore greatly increase mortality as a result of predation (Gauld et al. 2013) but also through delays that prevent migration at the optimal time. This is taken into account when the DBIRT assess barriers as the parameters that may stop downstream migration are not always the same as those that limit upstream passage.

3.11.3. Dams / weirs / large water bodies

In many river systems hydro dams and impoundments can cause significant problems for smolts trying to migrate out of the system. However, the only Loch in the Deveron system, Loch Park, does not support salmon and is understood to only have brown trout present. Salmon and trout adults cannot migrate into the Loch and the outfall is likely also to be a barrier to any potential sea trout smolts migrating downstream.

3.12. Coastal and marine

3.12.1. Coastal nets

The Conservation of Salmon (Scotland) Regulations 2016 prohibited the retention of salmon in coastal waters which has effectively closed coastal fixed engine nets at present.

3.12.2. Developments

The Deveron is fortunate to not have many developments in the coastal and inshore area that are directly threatening salmon or sea trout. Without a large estuary, the smolts can leave the river and are straight into the sea. There are, however, three large offshore windfarm developments planned for the Moray Firth, the construction and installation phases of which have the potential to impact upon salmonid populations. These are Beatrice which is already under construction, Moray East which will begin construction in 2019 and Moray West that is still under planning.

a) Beatrice Offshore Windfarm Ltd (BOWL) - 86 turbines, 558MW, £2.6 billion. First electricity in 2018 and completed 2019. Cable comes ashore at Portgordon near the Spey and joins at Blackhillock near Keith.

b) Moray Offshore East - 100 turbines, 950mw. Construction begins 2019, first power 2021. Cable land fall at Inverboyndie 3km West of Deveron mouth. Cable route crosses Deveron at Inverichnie and joins substation at New Deer.

c) Moray Offshore West - possible 90 turbines 750MW. Only at early scoping and consultation phase. Cable to come ashore near Sandend and join at Keith (crossing Isla).

These significant construction projects have the potential to negatively affect salmon and trout in various ways. Noise during construction from ships and piling could damage or scare salmon and trout away from normal migration routes or feeding grounds. The noise could also disrupt prey including sandeels. There has also been some concern that Electromagnetic Fields (EMF's) from the seabed cables could affect salmonid navigation systems and disrupt their migration. However, tests done in the laboratory by Marine Scotland Science suggest that the levels of EMF to which the fish will be exposed will have no effect on their behaviour (MSS 2015). Conversely, it has also been proposed that the windfarms will function as artificial reefs and provide additional habitat in the Moray Firth for sea trout and may reduce commercial trawling and dredging. However, these artificial reefs may also attract large predatory fish and mammals which could increase marine predation.

These projects all have a commitment to undertake salmonid monitoring that is approved by the Moray Firth Regional Advisory Group (MFRAG) to satisfy Marine Scotland licensing conditions. The Beatrice windfarm funded a salmonid tracking study in 2016 (Newton et al 2017). The Moray East windfarm has committed significant funds towards the Atlantic Salmon Trust Moray Firth Tracking Project 2019. Both of these projects will help to understand the

migration routes of salmon smolts after they leave the river and better assess potential effects from interactions with windfarms.

3.12.3. Other

The increasing predicament of marine mortality in post-smolts is out-with the scope of this management plan but is arguably the most significant current problem affecting adult production and fishery performance today. There has been a decline in marine survival of salmon throughout much of the North Atlantic (NASCO State of North Atlantic Salmon Report) and monitoring by MSS suggests that the marine survival of smolts leaving the River North Esk has declined from an average of 40% in the 1960s to ~15% in the 1980s, to less than 10% in the 2000s and less than 5% more recently. These figures are representative of international declines in marine survival which translates to a direct effect on the number of returning adults to the River Deveron both to the fishery and spawning population. The main causes for this decline are understood to be changing ocean temperatures and circulation in the North Atlantic disrupting the food web on which the salmon relies. This has contributed to fewer adults returning to the River Deveron, and hence lower rod catches over the last 5 years. Underlying long-term cycles of return timing may also be involved with different patterns being observed in Grilse and Multi Sea Winter Salmon.

4. Development of the fishery and Education and Outreach

The fishery management plan is reliant on having a functioning fishery. The fishery provides an income and puts a value on the salmon and trout that populate the river. The costs of the local administration, protection and improvement of these fisheries are financed by those owners. The District Boards finance their activities by levying a rate, on the owners. The DBIRT has developed a River Deveron Promotional Strategy to promote the river, its wildlife and angling.

The plan will:

1. Publicise the work of the Trust locally through journals, publications and social media.
2. Promote the lifestyle benefits of the river to the local community
3. Develop the next generation's appreciation and understanding of the river and the wildlife it supports and instil a sense of responsibility for safeguarding it in the future.
4. Promote the River Deveron to anglers primarily locally and nationally but also internationally where there is specific improved visitor potential.
5. Inspire the next generation of anglers and ensure the long-term future of the sport and the economic and conservation benefits it brings.

5. Population Monitoring

The DBIRT conducts annual fish population monitoring through electrofishing, smolt monitoring and scale collection.

5.1. Electrofishing

The DBIRT has carried out an annual programme of electrofishing since 2002 to monitor juvenile stock abundance and distribution. This monitoring programme has allowed the DBIRT to manage the fisheries district in a more comprehensive and efficient way by using the electrofishing data to target management actions. The electrofishing programme has been instrumental in gauging the effectiveness of remedial works carried out by the RDevDSFB and DBIRT such as obstruction removal and Habitat restoration. In 2018 and 2019 the DBIRT undertook electrofishing surveys as part of the National Electrofishing Programme for Scotland (NEPS) (Malcolm et al. 2019) that will contribute to the Conservation of Salmon (Scotland) Regulations assessment of the conservation status of salmon stocks.

5.2. Smolt Monitoring

Since 2014 the DBIRT has been monitoring the smolt production from the Allt Deveron and Blackwater catchments using two Rotary Screw Traps as part of the Dorenell windfarm Fishery Management Plan. These floating traps catch a sample of the downstream migrating smolts and using mark capture analysis can be used to estimate the total number of smolts produced

upstream. This monitoring will continue through 2020 and thereafter the smolt traps can be deployed where required to monitor production form different parts of the catchment.

5.3. Scale Collection

The DBIRT has run a scale sampling programme since 2004, collecting scales from adult salmon and trout as well as juveniles. This allows DBIRT to assess the age structure of juvenile salmon and trout within the freshwater environment as well as how long returning adults have spent at sea. The adult salmon data is used to understand the stock structure of the Deveron salmon population and monitor the proportions of spring salmon, grilse and multi sea winter salmon. It is also important for understanding the trout stock and monitoring for the presence of any farmed salmon.

5.4. Invertebrate Monitoring

Invertebrates are a crucial part of a healthy functioning ecosystem and are very sensitive to pollution and poor water quality. Historically the DBIRT has monitored Deveron invertebrate populations but a more strategic invertebrate monitoring strategy should be designed to monitor throughout the catchment on a frequent basis. This could be potentially be delivered by a network of volunteers and ghillies.

5.5. Insufficient data

At present, there remains several subject areas in which further data collection would greatly assist the RDevDSFB and DBIRT fishery management decisions. Those areas are summarised below:

5.5.1. Genetic status of local salmon, sea trout and brown trout stocks.

The FASMOP project and subsequent SNP's analysis suggested overall weak genetic differentiation between Deveron salmon populations. However, this cannot rule out the possibility of locally adapted traits being present within the system. This may be further clarified with the development and application of newer, more targeted, genetic markers. To determine if it is possible to improve assignments and gain better distinction for potential breeding populations, larger sample sizes and/or newer genetic markers will be required and possibly a more complete baseline of potential populations sampled.

A similar project to investigate the structuring of trout populations within the catchment is vital step in achieving targeted management to potentially restore sea trout populations. Although classified differently in Scottish law, anadromous sea trout and resident brown trout are the same species. Currently, it is not clear whether there are specific tributaries or sites within the Deveron catchment that are of greater importance to brown or sea trout. Over the last 20 years the Deveron sea trout rod and line catch has crashed while brown trout within the catchment appear to be preforming well. To protect and restore the sea trout component of the stock would require a better understanding of any structuring within the catchment.

This could potentially be achieved by a genetics project similar to the FASMOP salmon project. However, through the MFTI (Moray Firth Trout Initiative) the DBIRT began developing a survey tool with Napier University that uses stable isotopes to determine if trout fry collected during routine electrofishing surveys are of sea trout or brown trout progeny (Briers et al 2017). Following two years of trials this project has shown the technique has potential but much like the genetic work, requires a thorough sampling programme across the catchment.

5.5.2. Numbers of returning adult salmon and sea trout

At present the DBIRT operates one resistivity fish counter on the upper river Isla. The counter was installed primarily to monitor the number of adults that successfully negotiated a series of problematic obstacles downstream. The counter is also used to gain further information such as length and run-timing of Isla stock. However, further counter technology is required for the rest of the catchment to fully understand and assess the entire Deveron run. The model developed under the Conservation of Salmon (Scotland) Regulations 2016 to assess the conservation status of salmon in each river relies heavily on rod and line catch data. The model estimates the total salmon run from the rod catch and assesses whether that total run is adequate to meet the egg deposition target. Currently the model estimates that the Deveron exploitation (% of total run captured) rate is as high as 20% which is significantly higher than the estimate for neighbouring rivers. To fully understand the run and its relationship with the rod catch, a full river counter is required.

The Trust has conducted extensive research into current fish counting technology and the most suitable options for the river Deveron. There are four types of counter technology available: Resistivity, Optical beam, Video and Hydroacoustic (Sonar).

Resistivity technology requires an existing weir structure to be present to attach the electrode sensor equipment to or a new weir built. There are currently no suitable weirs on the Deveron main stem and to build a new weir would be extremely costly and would have significant associated ongoing liabilities. The installation of new weir structures is also in contravention of the Water Framework Directive and aspirations of uninhibited fish passage on the catchment.

Optical beam counters, which use infrared beams, also require additional structures or fish passes to be present and require low water turbidity, which means the technology is unsuitable for the turbid Deveron main stem.

Video counters function by placing cameras in fish passes or on the riverbed. The DBIRT completed a trial of underwater cameras at Eden during 2015. During the trial, the cameras operated successfully around 80% of the time but the high water turbidity hampered the clarity of the video footage. The cameras could be used to assist another counter technology in terms of fish species ID but not as the only technology deployed.

Hydroacoustic counters (Sonar) use sound wave technology to produce image data. We have completed two trials of the technology on the Deveron main stem at Eden and Montcoffer. The trials have been successful and the sonar could operate in high turbidity conditions. The technology also requires low engineering or structural requirements and produces high

quality data. Unfortunately, the initial cost of the equipment can be high and management of the sonar equipment and post-processing of the data can be very labour intensive. Species validation of the counts (e.g. salmon or sea trout) is also not always possible under high turbidity conditions, so a local model would need to be developed to assist this important part of the data analysis.

5.5.3. Angling effort and Exploitation rates of salmon and sea trout stocks

In 2017 the RDevDSFB asked proprietors to include angling effort along with their catch returns. This is a vital piece of information in understanding how the seasonal catches relate to the actual run in the river. There was an excellent response from proprietors with 75% including effort data with their return. The continued collection of this data is a vital and key component in understanding the Deveron fishery and its fish stocks and also the potential to achieve favourable conservation status. In 2019 Marine Scotland Science has requested that all beats collect angling effort data alongside their annual angling rod catch return.

To assess the pressure of the rod and line fishery on sub-components such as spring or autumn salmon requires a tagging and recapture program to be developed. The DBIRT are developing a project that would capture and tag adult salmon close to the mouth of the Deveron before tracking them upstream. The number of tagged fish later recaptured by anglers would then be monitored to establish an exploitation rate. It would also allow us to quantify the number of salmon that are re-caught following angler catch and release and quantify how this might be influencing annual rod and line catch figures.

6. Appendix 1: Delivery of Objectives

Objectives	Actions to deliver objectives	Lead Partner	Other partners	Funding	Timing
Objective 1: Manage exploitation of fish stocks to maximise the number of salmon, sea trout and brown trout reaching their spawning grounds.	a) Recommend and advise the RDevDSFB on the implementation of their Fisheries Conservation Policy to maximise the number of adults spawning successfully.	DBIRT	RDevDSFB	RDevDSFB	Annually
	a) Install a counter system to allow a more precise estimate of salmon and sea trout adults returning to the Deveron to spawn.	DBIRT	RDevDSFB	AST, Commercial Partners, AST, MSS	2021-2023
	b) Collate and analyse annual salmon, sea trout and trout rod catch data to determine rates of rod effort, catch and abundance.	DBIRT	RDevDSFB	RDevDSFB	Annually
	c) Conduct mark recapture research to estimate the exploitation rate of each stock and quantify effect of catch and release on rod catch data.	DBIRT	RDevDSFB	TBC	2021-2023
	d) Conduct research to better understand structuring of salmon and trout populations within the catchment.	DBIRT	RDevDSFB	TBC	2021-2023
	e) Minimise all illegal exploitation through robust and collaborative policing of the river.	RDevDSFB	DBIRT, Police	RDevDSFB	Continuous
	f) Work with the Spey DSFB to conduct regular coastal patrols for illegal nets.	RDevDSFB	SpeyDSFB, DBIRT	RDevDSFB	Annually
Objective 2: Manage predation at natural levels within the River Deveron District to minimise the losses of	a) Research and quantify the effects of different types of predation on salmonid juveniles and returning adults.	DBIRT	RDevDSFB, AST	RDevDSFB	TBC
	b) Use smolt shepherding to protect smolts and maximise the number reaching the sea.	DBIRT	Fishing Beats,Volunteers	RDevDSFB	Annually
	c) Contribute where possible to AST Likely Suspects Framework	DBIRT	RDevDSFB	AST	2020-2023

juveniles, in particular smolts, and maximise the number of adult salmon, sea trout and brown trout reaching their spawning grounds.	d) Reduce the impact of seal predation through the RDevDSFB partnership in Moray Seal Management Plan.	RDevDSFB	DBIRT, Spey DSFB, MSS	RDevDSFB	Annually
	e) Conduct three river counts of piscivorous birds on the Deveron main stem.	RDevDSFB	DBIRT, Fishing Beats	RDevDSFB	Annually
	f) Map bird count data to highlight potential piscivorous bird predation hot spots.	DBIRT	AST		Annually
	g) Control the impact of piscivorous bird predation through our participation in the Moray Firth Sawbill Management Group and Licence application.	RDevDSFB	DBIRT, Spey DSFB, FMS	RDevDSFB	Annually
	h) Continue to trap and control American mink throughout the catchment	DBIRT	RDevDSFB, SISI	SNH, HLF	Annually
Objective 3: Ensure that fish populations within the Deveron are as healthy and free of disease as possible.	a) Monitor juvenile and adult fish for signs of disease.	DBIRT	RDevDSFB,	NA	Seasonally
	b) Maintain close links with Marine Scotland Science Fish Health Inspectorate and ensure all protocols and training is up to date.	DBIRT	RDevDSFB, MSS	NA	Seasonally
	c) Create a fish disease reporting programme to raise angler awareness of common fish diseases and what to look for.	DBIRT	RDevDSFB,	NA	2021
	d) Update the current Biosecurity Plan and enforce strict biosecurity protocols for visiting anglers to prevent the introduction of diseases, in particular GS.	DBIRT	RDevDSFB, SISI	NA	Seasonally
	e) Monitor local fish farms and local put and take fisheries to minimise the risk of spreading disease.	DBIRT	RDevDSFB	NA	Annually
Objective 4: Maintain the genetic integrity of the Deveron	a) Raise awareness in anglers to ensure that fish of fish farm origin and are correctly identified and killed.	DBIRT	RDevDSFB,	NA	2021
	b) Conduct routine inspection of fish farm to ensure there is adequate protection in place to stop the escape of farmed fish.	DBIRT	RDevDSFB	NA	Annually

fish populations and sub populations.	c) Engage in the planning process to ensure any proposed Moray Firth fish farms are met with a robust and evidence-based response.	DBIRT	RDevDSFB	NA	Only if new farms seek planning
Objective 5: Monitor, control and where possible eradicate Invasive Non-native Species (INNS) that threaten the biodiversity and ecological functionality of the River Deveron and its riparian zone.	a) Update and relaunch the Deveron Biosecurity Plan.	DBIRT	SISI, RDevDSFB	SISI	2021
	b) Control, monitor and remove Giant Hogweed, Japanese Knotweed, Himalayan Balsam and American mink through the Scottish Invasive Species Initiative (SISI).	DBIRT	SISI, RDevDSFB	SISI	Annually
	c) Raise awareness of anglers to identify, report and kill all pink salmon landed.	DBIRT	RDevDSFB	NA	Annually
	d) Develop control measures, where necessary, for other priority INNS known to exist locally.	DBIRT	RDevDSFB, SISI	TBC	2021-2023
Objective 6: Ensure the water quality of the River Deveron and sub catchments is the best possible for fish populations and the wider ecology.	a) Continue the water quality monitoring programme with James Hutton Institute; disseminating results and highlighting issues with SEPA and Scottish Government.	DBIRT	JHI, RDevDSFB	RDevDSFB	Bi-annually
	b) Begin a continuous water monitoring programme using the continuous water monitoring once Dorenell windfarm monitoring is complete.	DBIRT	EDF, JHI, RDevDSFB	RDevDSFB	2021-2023
	c) Conduct a benthic invertebrate survey of the significant tributaries and main stem as an indicator of water quality.	DBIRT	BugLife, RDevDSFB	RDevDSFB	2021-23
	d) Ensure all coniferous plantations have adequate buffer zones and adhere to Forestry Commission guidelines.	DBIRT	Foresty and Land Scotland, RDevDSFB	NA	On going
	e) Work with SEPA to ensure strict regulation of potential sources of point source pollution.	DBIRT	SEPA, RDevDSFB	NA	On going

	f) Work with SEPA Land Use Team to manage and reduce potential sources of diffuse pollution.	DBIRT	SEPA, RDevDSFB	NA	On going
	g) Identify pathways of pollution and areas of the catchment most at risk to help prioritise potential areas and solutions.	DBIRT	Landowners, SEPA, RDevDSFB	NA	On going
	h) Request from SEPA all historic water quality monitoring data to analyse for trends and compare with DBIRT & JHI results.	DBIRT	SEPA, RDevDSFB	NA	2020-21
	i) Investigate the feasibility of re-establishing a viable freshwater pearl mussel (Margaritifera margaritifera) population.	DBIRT	SNH, RDevDSFB	SNH	2021-23
Objective 7: Ensure there is enough water in the river to maintain its ecological function, the fishery and in particular to maximise the spawning potential of wild fish and the subsequent survival of their offspring.	a) Commission an audit of all authorised river abstractions.	DBIRT	SEPA, RDevDSFB	NA	2021-23
	b) Liaise with SEPA to ensure enforcement and consultation on all future abstraction licence applications.	DBIRT	SEPA, RDevDSFB	NA	2021-23
	c) Encourage and implement land management practices to increase the retention of water, Including peat restoration, buffer strips and sensitive forestry planting.	DBIRT	RDevDSFB, Landowners, NFUS	SNH, Scottish Water, SRDP	2021-23
Objective 8: Make the catchment resilient to climatic warming to maintain, where possible, water temperatures that are	a) Monitor water temperatures to understand areas of catchment most at risk.	DBIRT	MSS, EDF, RDevDSFB	TBC	2021-23
	b) Use the MSS water temperature model to identify areas most at risk.	DBIRT	MSS, FMS, RDevDSFB	NA	2021-23
	c) Mitigate for climate change by working with landowners to develop riparian deciduous tree planting projects to provide shade and minimise river warming.	DBIRT	Landowners, FMS, Forestry Scotland, Trees	Forestry Scotland, SNH, SRDP	2021-23

optimal for fish populations.			for Life, RDevDSFB		
	d) Monitor distilleries and work with SEPA to ensure cooling water discharges do not raise temperatures above acceptable levels.	DBIRT	Distilleries, SEPA, RDevDSFB	NA	Annually during hot periods
Objective 9: Protect and restore natural in-stream habitat diversity to maintain ecological diversity and maximise wild fish production.	a) Work with SEPA's RBMP officer to begin scoping restoration projects for catchments classified as being in Poor and Bad physical condition. Specifically, the lower burns (Isla, Forgue, Turriff and the King Edward).	DBIRT	SEPA, RDevDSFB	WEF, SRDP, MOWEL	2021-23
	b) Conduct or commission habitat survey in the lower burns to identify potential solutions within the limitations of existing land use.	DBIRT	RDevDSFB, Consultant, SEPA	RDevDSFB	2021-23
	c) Implement restoration projects to restore instream habitat diversity in the Lower Burns and elsewhere.	DBIRT	Landowners, NFUS, SEPA, RDevDSFB	WEF, SRDP, MOWEL	2021-23
	d) Develop the use of aerial photography to survey and highlight areas of degraded habitat.	DBIRT	RDevDSFB	NA	2020-21
	e) Reduce sedimentation sources from diffuse pollution by working with landowners and SEPA to identify and regulate areas most at risk.	DBIRT	SEPA, RDevDSFB, Landowners	NA	2021-23
	f) Encourage the retention of Large Woody Debris in the rivers.	DBIRT	RDevDSFB, Beat Owners	NA	2021-23
	g) Monitor all in river works and stop any unlicensed works.	DBIRT	SEPA, RDevDSFB	NA	Continuous
	h) Work with SEPA to manage and minimise the impact from works associated with the Isla Catchment Licence.	DBIRT	SEPA, RDevDSFB,	NA	Continuous

			NFUS, Landowners		
Objective 10: Restore and maintain natural riparian vegetation to improve ecological diversity, provide bank side cover for fish and provide a barrier to agricultural land use and contaminated run-off.	a) Identify areas within the catchment where the riparian zone needs restored.	DBIRT	RDevDSFB,	NA	2021-2023
	b) Work with local landowners to restore and maximise buffer strips in the riparian zone where required.	DBIRT	RDevDSFB, NFUS, Landowners	SRDP, WEF	Continuous
Objective 11: Remove or make passable all remaining man-made obstacles to fish passage.	a) Identify and asses any remaining barriers to fish migration upstream (adults) and downstream (smolts).	DBIRT	RDevDSFB, Landowners	NA	2021-23
	b) Work with SEPA to scope and remove barriers.	DBIRT	SEPA, RDevDSFB, Landowners	WEF	2021-23
	c) Specifically work with SEPA and Chivas on the removal of the four barriers on the River Isla in Keith.	DBIRT	SEPA, CHIVAS, RDevDSFB, Landowners	Owners, WEF	2012-23
	d) Maintain good communications with SEPA, local councils and developers to ensure no new impassable structures to fish are installed.	DBIRT	RDevDSFB, SEPA, Moray Council, Aberdeenshire Council.	NA	Ongoing

Objective 12: Protect and promote the restoration, where possible, of the inshore marine habitat for salmon and sea trout.	a) Participate in Scottish Government Salmon Conservation Policy to ensure no coastal nets are reopened in the DBIRT coastal area.	RDevDSFB	Spey DSFB, DBIRT,	RDevDSFB	Annually
	b) Continue to campaign to make it illegal to deploy gill nets for species other than salmon in the coastal zone.	RDevDSFB	DBIRT, FMS, MSS	NA	2021-23
	c) Comment on environmental consultations for developments that may have an impact on salmon and sea trout at sea.	DBIRT	RDevDSFB, FMS	NA	2021-23
	d) Participate with the AST Missing Salmon Project to help identify and reduce threats to salmon and sea trout at sea.	DBIRT	AST, RDevDSFB	AST, TBC	Annually
Objective 13: Conduct routine annual surveys to monitor fish populations, invertebrate populations, water and habitat quality.	a) Conduct annual strategic electrofishing surveys (NEPS or similar) throughout the catchment to monitor the extent and numbers of juvenile salmon and trout as well as other native species including eels and lamprey.	DBIRT	RDevDSFB	NEPS	Annually
	b) Conduct timed electrofishing to monitor juveniles in the main stem Deveron.	DBIRT	RDevDSFB	RDevDSFB	Annually
	c) Conduct routine annual smolt monitoring surveys to measure salmon smolt production from different parts of the catchment and its tributaries.	DBIRT	RDevDSFB	EDF, MSS, RDevDSFB	Annually
	d) Routinely collect adult and juvenile salmonid scales to monitor for changes in the life history.	DBIRT	MSS, RDevDSFB	NEPS RDevDSFB	Annually
	e) Continue monitoring water quality using both JHI sampling and continuous water monitoring equipment.	DBIRT	JHI, EDF, RDevDSFB	RDevDSFB	2021-23
	f) Implement an invertebrate monitoring programme throughout the catchment.	DBIRT	BugLife, RDevDSFB, Ghillies	TBC	2021-23

	g) Design and implement redd monitoring using a series of strategic reference sites throughout the catchment and the main tributaries.	DBIRT	RDevDSFB	TBC	2021-23
Objective 14: Advance the education of the public in relation to the conservation and protection of the area by conducting and commissioning research into the plant, bird, insect and animal life in the area, and help to publish and disseminate the results for the public benefit.	a) Raise awareness of DBIRT's conservation work and to publish research for the public's benefit, to gain support from the local population and to increase membership. (through journals, publications and social media.	DBIRT	RDevDSFB	TBC	2021-23
	b) Promote the lifestyle benefits of the river to the local community to improve local people's appreciation of the river and engender potential support.	DBIRT	RDevDSFB	TBC	2021-23
	c) Hold classes with local primary schools to educate children in the ecosystem of the river and the life cycle of salmon, sea trout and brown trout.	DBIRT	RDevDSFB	TBC	2021-23
Objective 15: Promote the River Deveron as a rod and line fishery and inspire the next generation of anglers.	a) Promote the River Deveron to anglers primarily locally and nationally but also internationally where there is specific improved visitor potential.	DBIRT	RDevDSFB	TBC	2021-23
	b) Encourage young people to try angling through active participation.	DBIRT	RDevDSFB	TBC	2021-23

7. Appendix 2: Key Performance Indicators (*A quantifiable measure used to evaluate the success of an organization, employee, etc. in meeting objectives for performance):*

The delivery of the objectives and their and effectiveness in maximising the numbers of migratory and native fish returning to and breeding in the Deveron Catchment and District will be assessed annually against the following Key Performance Indicators

1. **Number of Returning Adults:**
    a. *Counter* – Number of returning adult salmon and sea trout each year.
    b. Rod catch
        i. Annual catch
        ii. Conservation assessment by Marine Scotland Science (MSS). The Assessment uses a model based on data from 5 counters across Scotland to estimate the total annual Deveron run of adult salmon from the rod catch. Used to categorise river as 1, 2 or 3 according to percentage chance that egg target was met for last 4 years based on MSS model.
        iii. Catch and release rate of greater than 80%

2. **Juvenile production**
    a. In the tributaries
        i. MSS National Electrofishing Programme for Scotland (NEPs) – Funded in 2018 & 2019. Scientifically rigorous method using 30 sites picked at random (10 annual, 20 random). Results compared to a baseline target both at an individual site and on the catchment scale.
    b. In the main stem
        i. Fry Index Surveys – Can't electrofish whole channel so just sample chosen sections as an annual indicator.
    c. Key Index Sites
        i. Electrofish a series of long standing DBIRT sites annually to provide a longer term dataset.
    d. Smolt production
        i. From 2022 the two Rotary Screw Smolt Traps are available to be deployed in the tributaries (of adequate size) or main stem
3. **Water quality**
    a. Deveron DSFB Monitoring
    b. SEPA water monitoring
    c. SEPA Ecology team invertebrate assessment as an indicator of water quality

4. **Smolt survival**
    a. Annual piscivorous bird count results
    b. Annual smolt survival to sea via tagging studies

5. **INNS**
    a. INNS plant assessment via DARFOR scale on a site by site basis.
    b. Annual monitoring of mink presence and capture

8. References.

Armstrong 1998. Fish-eating birds and salmonids in Scotland: Report on fish-eating birds research (1990-97), to the Scottish Office Agriculture, Environment and Fisheries Department Unknown Binding – 1998

Briers, R., Campbell, R., Galt, K., Walters, M., & Holmes, J. (2017). Using stable isotopes to assess the distribution of reproduction by migratory and resident Salmo trutta within river systems: some complicating factors. In Sea Trout Science and Management

Butler, Radford, Riddington, Laughton 2009. Evaluating an ecosystem service provided by Atlantic salmon, sea trout and other fish species in the River Spey, Scotland: The economic impact of recreational rod fisheries. Volume 96, Issues 2–3, March 2009, Pages 259-266

Butler, James. Stuart J. Middlemas Simon A. McKelvey Iain McMyn Ben Leyshon Ian Walker Paul M. Thompson Ian L. Boyd Callan Duck John D. Armstrong Isla M. Graham John M. BaxterButler, (2008) AQUATIC CONSERVATION: MARINE AND FRESHWATER ECOSYSTEMS Aquatic Conserv: Mar. Freshw. Ecosyst. 18: 1025–1038.

CBEC 2014. BURN OF CROOKSMILL RESTORATION FINAL REPORT

Conservation of Salmon (Scotland) Regulations 2016 (https://www.legislation.gov.uk/ssi/2016/115/pdfs/ssi_20160115_en.pdf)

Coulson, Miller 2014. The use of SNPs to resolve population genetic structure of Atlantic salmon within the Deveron: a comparison with microsatellites. RAFTS.

Coulson, Webster, Miller, Armstrong, Cauwelier, Stradmeyer, Gilbey & Verspoor 2012. An Overview of Population Genetic Structuring in the Deveron. Marine Scotland Science Report 03/12

The River Dee, 2019. Smolt Migration Through The River Dee And Harbour.

The Environment Agency 2008. The thermal biology of brown trout and Atlantic salmon ISBN: 978-1-84432-932-8 December 2008 Report Product Code: SCHO0808BOLV-E-P

Garret, Adams & Honkanen 2018. River Deveron Atlantic salmon smolt tracking project 2018. Dissertation submitted as part of the final examination for the degree of MSc Quantitative Methods in Biodiversity, Conservation and Epidemiology, Institute of Biodiversity, Animal Health and Comparative Medicine and Scottish Centre for Ecology and the Natural Environment, University of Glasgow, 2018.

Gauld, R.N.B.Campbell, M.C.Lucas (2013) Reduced flow impacts salmonid smolt emigration in a river with low-head weirs. Science of The Total Environment. Volumes 458–460, 1 August 2013, Pages 435-443

Grimble 1899. The Salmon Rivers of Scotland. 4 volumes, Publisher: Kegan Paul, Trench, Trubner and co

Honkanen 2017. River Deveron Atlantic salmon smolt tracking project 2017Scottish Centre for Ecology and the Natural Environment University of Glasgow & Deveron Bogie & Isla Rivers Trust.

Jackson F. Robert J.FryercDavid M.HannahbColin P.Millara1Iain A.Malcolma (2018). A spatio-temporal statistical model of maximum daily river temperatures to inform the management of Scotland's Atlantic salmon rivers under climate change. Science of The Total Environment. Volume 612, 15 January 2018, Pages 1543-1558

Lothian AJ, Newton M, Barry J, Walters M, Miller RC, Adams CE. Migration pathways, speed and mortality of Atlantic salmon (Salmo salar) smolts in a Scottish river and the near-shore coastal marine environment. Ecol Freshw Fish. 2017;00:1–10. https://doi.org/10.1111/eff.12369

Malcolm, I.A., Millidine, K.J., Jackson, F.L., Glover, R.S. and Fryer, R.J. (2019) Assessing the status of Atlantic salmon (Salmo salar) from juvenile electrofishing data collected under the National Electrofishing Programme for Scotland (NEPS). Scottish Marine and Freshwater Science Vol 10 No 2, 74pp. DOI: 10.7489/12203-1

MSS 2015. Scottish Marine and Freshwater Science Vol 6 No 9: Behavioural Responses of Atlantic Salmon to Mains Frequency Magnetic Fields ISBN: 9781785444791

NASCO 2020 State of North Atlantic Salmon.

Newton, Main & Adams 2017. Atlantic Salmon Salmo Salar smolt movements in the Cromarty and Moray Firths, Scotland. Beatrice Offshore Windfarm Ltd LF000005-REP-1854

Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.
(https://www.legislation.gov.uk/asp/2003/15/contents)

SCENE 2019, River Deveron 'Missing Salmon Project' 2019. Report compiled by the Scottish Centre for Ecology and the Natural Environment, University of Glasgow & Atlantic Salmon Trust

Shearer 1986. The exploitation of Atlantic salmon in Scottish home water fisheries in 1952-83, Freshwater Fisheries Laboratory, Pitlochry (Field Station, Montrose)

The Tweed Foundation, 2020. The Tweed Salmon Smolt Tracking Project.
https://www.arcgis.com/apps/Cascade/index.html?appid=525c5148837d4cea8908b66641af75db

Walters, 2014. Deveron Brown Trout Tracking Pilot http://deveron.org/brown-trout-tracking-pilot/

Weber, Viora. 2014. Impacts of water abstraction on juvenile Atlantic salmon (Salmo salar) in the Deveron catchment. PROJECT REPORT: 2014MSC CONSERVATION AND MANAGEMENT OFPROTECTED AREAS SCHOOL OF LIFE, SPORT AND SOCIAL SCIENCES

WTT 2014 River Isla Walkover Advisory Visit