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Wild Atlantic Salmon

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Prelims

Naturalist Papers

Historical Papers

Colour Plates

THE FORTH NATURALIST AND HISTORIAN

The Forth Naturalist and Historian (FNH) is an informal enterprise of Stirling University and is a Registered Charity (SC 013270 91992). It was set up in 1975 by several University and Central Regional Council staff to provide a focus for activities and publications concerned with the environment, wildlife and history of the Forth Region.

Currently the area the journal covers is comprised of Stirling, Falkirk and Clackmannanshire local authority areas and their immediate hinterland. Today FNH is run by a committee of volunteers who organise and finance the annual 200 page journal as well as an annual all day conference and wildlife and historical forums held across the Region. The committee is supported by a membership of 50 and there is an AGM at the annual conference.

Forty four volumes of the FNH journal have now been published. They provide a valuable successor to The Transactions of the Stirling Field and Archaeological Society which ran from 1878 to1939. The editorial in the first 1976 volume 1 of FNH states: "*The aim in launching the Forth Naturalist and Historian is primarily to increase our knowledge of this neglected part of Scotland.*" This has certainly been accomplished and since its inception nearly 500 articles have been published.

The FNH website (http://www.fnh.stir.ac.uk) carries a complete title word index together with Volumes 1- 40 which are available on line. Hard copies can be found in local and national libraries, museums and archives and some of the last 20 volumes are still available for sale. FNH's popular multi-author publication Central Scotland: Land, Wildlife and People is also archived on the FNH web site.

FNH publications are listed on the internet British Library (BLPC) and by booksellers e.g. Amazon, Bol, Barnes and Noble. Offers of papers/notes for publication and of presentations for conference are ever welcome. Visit the website for instructions to authors.

ATLANTIC SALMON IN THE FORTH RIVER SYSTEM

Environmental Predictor and Climate Victim?

Drew Jamieson and Alison Baker

Drew Jamieson is a Fellow of the Institute of Fisheries Management and Alison Baker is the Director, Forth Rivers Trust.

Figure 1: Fresh from the Sea - a Spring-run salmon in prime condition - about to be released.

The Atlantic salmon, *salmo salar,* is an EU Species of Conservation Concern in its freshwater phase and breeds in much of the Forth river system. (See Figure 2 and Plate A1) In Scotland the wild Atlantic salmon is a fish of many facets. It has been a cultural icon since Pictish times. It is a key indicator species of Scotland's biodiversity. It is the basis of the historic and much-respected recreation of angling which forms the foundation of many rural economies. Wild salmon was traditionally an important food supply, both locally and for export, but declining stocks have closed most commercial netting stations in Scotland. The Atlantic salmon was formerly more prolific in Scotland but obstructions,

pollution, over-fishing, habitat loss and, now, climate change have reduced its abundance. Over recent years, salmon have faced a number of challenges in both the Atlantic and the Pacific oceans - leading to the launch of the "*International Year of the Salmon"* initiative in 2019.

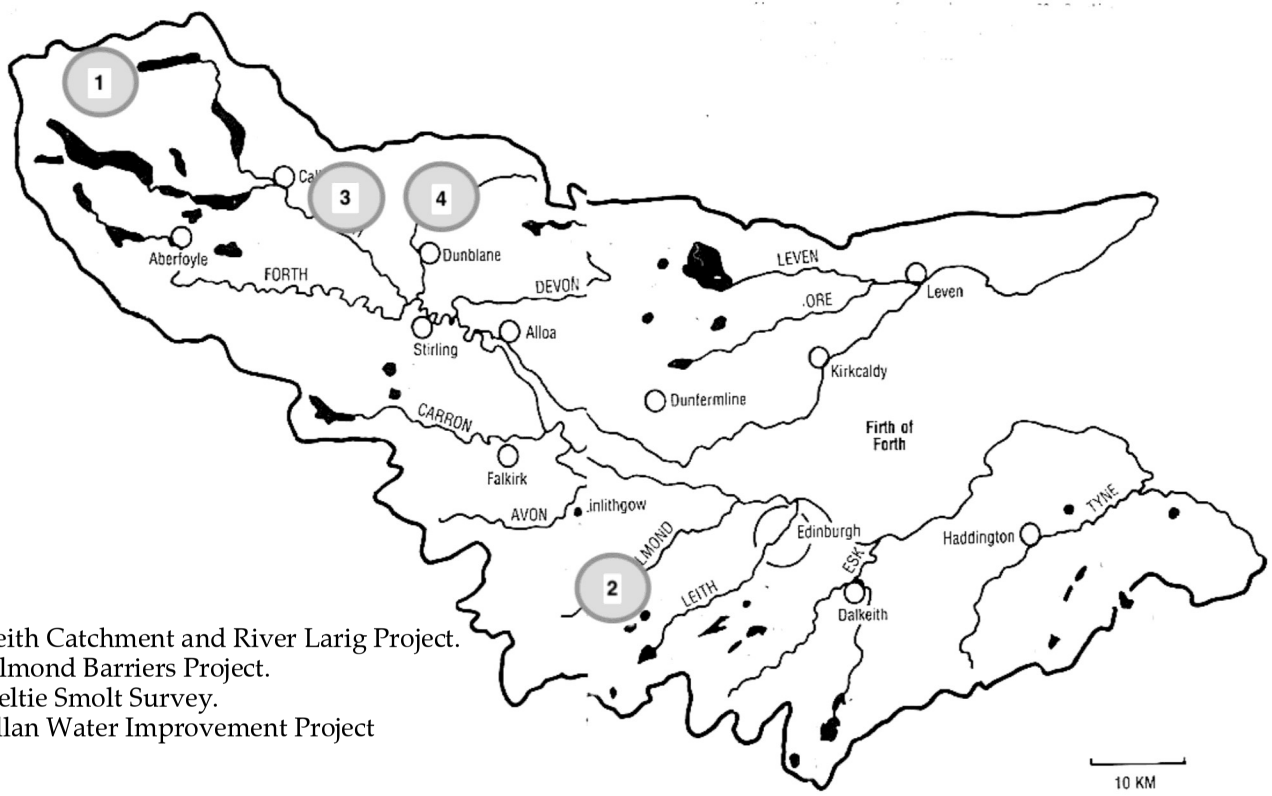
The Atlantic salmon uses different aquatic environments: freshwater, marine and freshwater again, at different stages of its life-cycle. Its success or failure in any or all of these environments has served as a warning of wider problems - the 'canary' effect - and if these problems are not successfully addressed, the Atlantic salmon may disappear from Scotland's rivers - a victim of climate change.

Atlantic Salmon in the River Forth

The River Forth and its tributaries form a major river system leading out to the North Sea. Salmon can be found in many tributaries, predominantly in such local rivers as the Teith, Leny, Forth, Allan and Devon. The smaller rivers in the lower Forth estuary, such as the Tyne, Leven, North and South Esks, Water of Leith, Almond, Carron and Avon, all have some salmon populations but these are seen to be very fragile and strict catch-and-release regulations are in place. The River Teith is also a designated EU Special Area of Conservation (SAC) on account of its populations of lampreys and Atlantic salmon.

Salmon may enter the Forth system at any time of the year but generally between February and October. A Spring run of adult salmon return to freshwater after 2 or more winters feeding at sea. These tend to favour the Forth/ Teith/Leny tributaries and have been subject to greatest decline in recent years. Other runs of salmon arrive during Summer and Autumn, dependent on river levels. These runs are more widespread and can also be found in the Allan and Devon. A Summer run of younger salmon, 'grilse', which have spent only one winter at sea, can also be recognised. Spawning takes place in October and November. The eggs are laid in a nest or 'redd' dug out of the gravel and covered such that a stream of clean water flows over them during incubation. The young salmon - 'alevins' - hatch in the

Figure 2: The Forth River System and Forth Rivers Trust projects mentioned in the text.

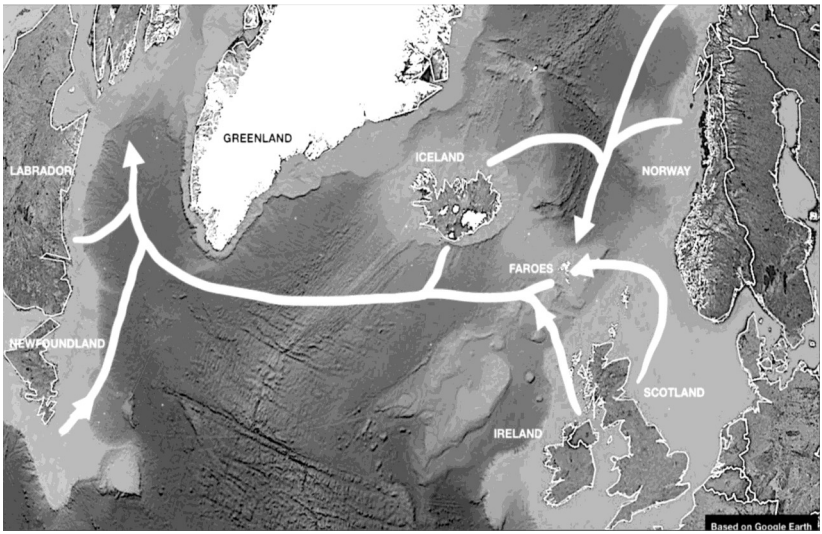


1. Teith Catchment and River Larig Project.
2. Almond Barriers Project.
3. Keltie Smolt Survey.
4. Allan Water Improvement Project

Spring, grow over two/three years as 'fry' and then 'parr' and eventually migrate downstream as 'smolts', in silvery covering, ready to enter salt water in the estuary.

Once at sea the smolts disappear into the North Sea and the North Atlantic, feeding heavily on small fish and crustaceans. Exact migration routes are still unclear but some head north into the Norwegian Sea to feed and return to the Forth after one year at sea as a grilse. Other smolts head for Greenland and may return, after two or more winters at sea, as 'salmon' proper. Changes in sea temperature which affect their food supply affect their size, condition and timing when they enter the rivers. Ongoing multi-national research has been attempting to unravel the mysteries of their marine phase for many years.

Figure 3: Approximate migration routes in the North Atlantic, Jamieson 2021.



Regulation of the Forth Salmon Fishery.

The Forth salmon fishery is regulated by the Forth District Salmon Fishery Board **http://forthdsfb.org** which is empowered to protect and enhance the Forth salmon fishery. It has powers to appoint bailiffs to enforce certain offences in conjunction with Police Scotland and works with other

regulators such as SEPA, NatureScot and Local Authorities to undertake its work. The limits of its jurisdiction is set out, rather prosaically, in the Salmon Fisheries (Scotland) Act 1868: *"1st. That the Limits of the District of the River-Forth shall be—on the North, Fife Ness ; on the South, the Boundary between the Counties of Haddington and of Berwick ; and that the District shall consist of the Portions of the Sea Coast and the Estuary, and the River, contained between the said Points."*

It is the fourth largest DSFB in Scotland and includes all river catchments that discharge into the Forth Estuary and the Firth of Forth and also the Estuary and Firth themselves. The Forth Rivers Trust **https://forthriverstrust.org** is a charitable organisation, one of a network of 25 Rivers and Fisheries Trusts, forming part of Fisheries Management Scotland. Their scientific knowledge and qualified fisheries staff have a major role in research, advice and education on all species of Scotland's freshwater fish. There are now no commercial salmon fisheries in the Forth system but there are active recreational, rod-and-line, fisheries predominantly on the Teith, Leny, Forth, Allan and Devon **https://www.fishforth.org**. Stirling Council manages major publicly-owned waters on the Forth at Stirling and the Teith at Callander.

History of The Forth Salmon Fishery.

Salmon have been harvested from the Forth since man first followed the retreating glaciers northwards. By default, in Scotland, all salmon fishing rights belong to the Crown unless the Crown has given the rights away. Oram (2012) describes the operation of the Forth salmon fishery by the canons of Cambuskenneth. As part of the endowment charter of 1147, King David 1 granted substantial rights to catch salmon, to the canons of the abbey, giving them a controlling interest all the way from Cambuskenneth down to Alloa. There is no doubt the salmon fishings on the River Forth were a valuable resource. Stirling Council's salmon fishings were also a royal gift, this time from Robert II, in 1386. The grant was made to the Burgh and *"our beloved burgesses"* and was re-confirmed by Charles II in 1641. In addition to supplying the local population, salted salmon had been

exported to France and Flanders as early as 1380. Franck (1658), one of Scotland's earliest angling tourists, reported that, at Stirling: *The Firth runs here that washeth and melts the foundations of the city, but relieves the country with her plenty of salmon; where the burgomasters (as in many other parts of Scotland) are compelled to reinforce the ancient statute that commands all masters and others not to force or compel any servant, or an apprentice, to feed upon salmon more than thrice a week."*

One of the early methods of catching salmon was by means of a 'cruive' - a weir constructed across the river with a trap in the middle to catch the fish. Long since prohibited, one of the best historic examples can be seen in the Forth at Craigforth, on Stirling Town Water fishery.

Predictors of Climate Change.

Jamieson (2008) summarised some of the early impacts of the changing climate on Scotland's salmon populations. Laughton (2007) and Mackelvey (2007) had described the impact of increased winter floods on the survival of salmon eggs and young. At the same time, changing currents in the North Sea and the North Atlantic were impacting the marine phase of the salmon's life-cycle and numbers of returning salmon were declining. Shelton (2007) and Todd (2007) had studied the impact of increasing ocean temperatures on salmon migration and feeding. Shelton concluded that: *There is widespread agreement among fishery scientists that large, climatically-driven changes in the distribution and abundance of the crustaceans and young fish upon which salmon and sea trout feed are the primary reason for the current shortfall.*

In 2018, the Meteorological Office, reported the seventh warmest year for the United Kingdom since 1884 and predicted that, by 2050, there would be a 50% chance of having summers as warm as 2018.

Salmon in Crisis?

The numbers of salmon returning to Scotland's coast have declined since the early 1970s, when some 25% of the young salmon leaving the rivers could expect to return to

freshwater. By 2018 that figure had reduced to 5%. Also, by 2018, the rod-catches of salmon in Scotland were the lowest since records began in 1952.

The published *Wild Salmon Strategy* suggests that: *"The estimated numbers of salmon actually managing to spawn has remained steady over this period, before declining from 2010 onwards.* (See Figure 4) *The difference in trends between the two measures is a result of the reduction in the numbers of salmon removed by fisheries. The decline in returns to Scottish rivers was compensated for by a reduction in commercial net fisheries and the adoption of 'catch and release' in many rod-and-line fisheries, resulting in the numbers spawning in rivers remaining relatively constant. However, this buffering capacity has now been fully utilised and post-2011 the continued decline in returning salmon has had an impact on the estimated number of salmon spawning in Scottish rivers. Furthermore, reduced growth at sea has caused a decline in the body size of returning salmon, and therefore egg production per fish, further reducing the total numbers of eggs deposited by the spawners."*

Figure 4: Trends in the estimated numbers of salmon returning to Scottish coastal waters and the numbers spawning in Scotland's rivers 1971 – 2020. Estimated numbers include both fish that spent one (1SW) and >1 (MSW) years at sea. (Source: Wild Salmon Strategy).

Other evidence also pointed to a species in crisis. In April 2019, the Scottish Parliament, debated the *"Long-term Decline in Salmon Stocks"*. On 19 August 2019, Ashley (2019) presented the Scottish Parliament with a Briefing Paper on *"Wild Salmon"*, providing a comprehensive review of the importance, status, threats and opportunities for conserving Scotland's king of fish. Campbell (2021), then Senior Biologist of the Tweed Foundation, was more optimistic. He cited the healthy populations of young salmon in many nursery streams.

The National Electrofishing Programme **https://data.marine.gov.scot/dataset/national-electrofishing-programme-scotland-neps-2019** provides further information on the strength of juvenile fish numbers. Campbell also cited the successes in restoring salmon to previously lost habitats in the Clyde, Gala, Garry and Almond in Scotland. The River Almond Project, in West Lothian, is Scotland's only major catchment-wide, barrier-easement project, dealing with 25% of all the barriers in the Forth. This project has been driven by the Forth Rivers Trust, in partnership with Edinburgh and West Lothian Councils and funded by Scottish Government via Scottish Environment Protection Agency (SEPA) (**https://www.sepa.org.uk/media/594088/211222-final-rbmp3-scotland.pdf**). In 2022, there is only one weir still to be overcome.

Victims of Climate Change?

There is general agreement that the overall abundance of salmon in both the Atlantic and the Pacific is at a low level. Where have all the salmon gone? Some problems are at sea. Some problems are around the coasts. Some are in the freshwater phase of the salmon's life-cycle. Above all is the overarching challenge of climate change. Potter (2011) summarised the situation: *"Over recent decades, there have been marked changes in the patterns of growth and mortality of Atlantic salmon (Salmo salar) during both the freshwater and marine phases of their lifecycle and consequent effects on the structure and status of populations. In some cases, these changes have been due to factors that are within our control and can be alleviated by*

appropriate management action. Taking such action should clearly be given a high priority."

High Level Pressures.

The Scottish Government's Marine Scotland Science (MSS) https://www.gov.scot/collections/marine-scotland-science/ has identified a number of 'high-level pressures' which illustrate the wide research required to find possible solutions to the decline of Scotland's salmon. These include issues of *Exploitation, Predation, Fish Health, Genetic Introgression* and *Invasive Species,* which mainly affect the salmon - as a fish. Other pressures affect the salmon's habitat, the river environment, and include issues of *Water Quality, Water Quantity, Water Temperature, In-stream Habitats* and *Riparian Habitats.*

Managing Exploitation.

In the light of the reducing catches, salmon rivers have been classified in terms of their capacity to meet a target Conservation Level (CL) for spawning and the recruitment of young salmon - Category 1 - 3 in descending order. In the Forth system, the Teith SAC reaches Cat 1 status but because it is part of a 'mixed stock' fishery with the Cat 2 rivers Forth and Allan, all three rivers are classified as Cat 2, where each angler is allowed to retain only one salmon per season. The River Devon and all other parts of the district, including the estuary, only reach Category 3 status and anglers must return all salmon to the water. Additional conservation measures protect the vulnerable Spring salmon and it is recommended that, throughout the fishing season, all female fish and all male fish above 10 lbs weight are also returned to the river.

Challenges for the Forth Salmon.

Salmon in the Forth are affected, to some degree or other, by the same 'high level pressures' as the wider Scottish salmon populations but three particular issues requiring management efforts can be identified in the Forth system:

a) Changes in the nursery streams - affecting young salmon in freshwater;
b) Increasing volatility in river flows - affecting all salmon in the freshwater phase and

c) Loss of young salmon - 'smolts' - migrating from freshwater to the sea.

a) The Changing Nursery Streams:

Increasing Water Temperatures. Salmon is a cold-water species and needs strict temperature conditions to survive and thrive. River temperatures significantly affect the distribution, health, and survival of salmon and these are increasing. They perform best when the temperature is in the mid-teens °C. They struggle when it reaches 20 °C and die quickly at 23 °C. In 2018, 70% of Scottish rivers experienced this threshold and forecasts suggest that, by 2050, these temperatures may happen every other year. The Scotland River Temperature Monitoring Network (SRTMN) **https://www.gov.scot/publications/scotland-river-temperature-monitoring-network-srtmn/** was established in 2013 using temperature data-loggers to map those regions of the rivers which are most vulnerable to temperature change.

In 2019/20, Forth Rivers Trust deployed water temperature monitors to record river temperatures throughout the year. In 2019, the water temperature in the River Larig reached 19 °C and remained above 15 °C for a period in excess of 40 days. In July 2021 temperatures in the River Teith and its tributaries reached 25 °C. The summer of 2021 was recorded as the driest summer since 1869 in parts of Scotland, and the fourth hottest since records began.

Lack of Nutrients. Although juvenile stocks of salmon are abundant in many rivers, in other nursery streams young salmon can suffer from lack of suitable habitat and limited food supply. Mckelvey (2018) drew attention to the loss of nutrients in Highland streams due to the reduced runs of salmon and the consequent reduction in nutrient-rich salmon kelt carcasses, after spawning. The River Larig, at the head of Loch Voil and Loch Doine, west of Balquhidder, is the main spawning and nursery stream of the Teith/Leny system. Forth Rivers Trust was concerned at the low numbers and small size of young fish. Despite good quality gravels for spawning, most fish were small and appeared malnourished. There appeared to be a need to increase the level of nutrients.

b) Increasing Volatility in River Flows.

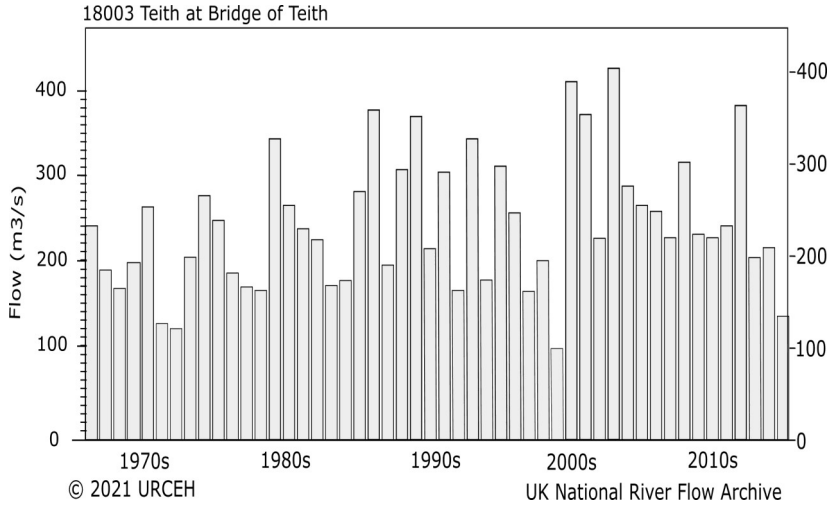
Climate change has already resulted in significant changes in rainfall patterns and river flows in Scotland, with further changes predicted over the coming decades. (See Figure Increasing rainfall intensity, frequency of storms and droughts all affect the stability of salmon rivers and the economic benefits brought by salmon angling. If there are no salmon and no water there are no anglers and no income for those who depend upon the salmon fishing.

Too little water. Although generally considered a wet country, Scotland can be vulnerable to periods of dry weather. Records show that, in 2018, 69% of Scottish rivers experienced thermal-stress conditions although none exceeded the temperature that would be lethal for salmon. As a result of climate change recent predictions suggest that, by 2050, there will be a 50% chance of having summers as warm as 2018.

Although impounding reservoirs have a legal requirement to release an agreed minimum 'compensation flow' all year, the worst low-water conditions in the Teith and Devon should be avoided by compensation flow from Loch Venacher and the Glen Devon reservoirs. However, with the unpredictability of climate change, a more dynamic management of water will be required including the quality, as well as the quantity, of water needed to maintain downstream ecosystems. This will require difficult discussions between Scottish Water, SEPA, FRT and other stakeholders.

Too Much Water. Between 1961 and 2005, increases to river flows of around 30% were recorded in some parts of the country, especially for rivers rising in the west, such as the Teith. Winter river flows, in particular, have seen a substantial increase in some rivers, corresponding with changes in precipitation.

Figure 5: Increasing Volatility - High Water Flows. River Teith at Bridge of Teith - Maximum River Levels 1970s - 2000s. (Source: UK National River Flow Archive).



In 2019 a cloud burst resulted in land slips in both Loch Katrine/Glengyle and Inverlochlarig. This affected the rivers and the sediment it produced spread downstream impacting all parts of the catchment. This event was attributed to climate change and the damage was greater because the land did not have the root structure to hold the soils together. Increased flooding also affects the mobility of spawning gravels in the headwaters and salmon spawning redds are often washed out and destroyed.

In a healthy river system, gravels should move as part of the natural cycle of a river. Natural wood falling within the river normally slows this process down, trapping gravels in place, creating pools and runs. But this was not happening due to the lack of trees and wood within the channel. Forth Rivers Trust noted that gravels in the Larig were moving by a substantial amount after each flood and management effort was required.

c) Loss of Young Salmon Smolts.

One of the most vulnerable stages in the salmon's life-cycle is the journey of the smolt from nursery stream down to the sea.

Figure 6: Salmon smolt - The future of salmon stocks.

Knight (2019) describes the challenges affecting young smolts on their journey to the sea. Research has suggested that, during the early part of the smolts' journey within the river, these young fish sustain high losses. It is known that some of these losses are down to predation from fish-eating birds – such as goosanders, mergansers and cormorants. Seals and dolphins also prey on salmon and salmon smolts in estuary and inshore waters. The Atlantic Salmon Trust **https://atlanticsalmontrust.org** is currently coordinating a large project in the Moray Firth, where smolts from seven rivers are being tracked from the nursery streams until they leave the firth on the first stage of their ocean journey. Preliminary results suggest that only 50% of smolts survive to reach to sea. (See Figure 6)

Management Efforts in the Forth.

Roque (2011) summarised the priorities for mitigating the effects of climate change on salmon: *"Management efforts are now focused on reducing the impacts on salmon at all stages in the life cycle, particularly those in freshwater, these being direct, measurable and recognising the imperative of sustaining healthy freshwater environments. The manager's tools now include preserving and restoring river habitat, minimising and eliminating*

fish passage constraints, eliminating habitat fragmentation, and managing land *use activities."*

Managing and restoring the physical habitat of the river, its bed and its banks can help to address issues of water temperature, nutrient levels and flood damage by creating cooler 'refuges' and increasing the space, shelter and food for young salmon. Trees are one of the most useful tools to achieve this by providing shade during hot weather and nutrients from falling leaves and branches. Trees also absorb carbon dioxide from the air and expel oxygen mitigating climate change.

Habitat Restoration.

Forth Rivers Trust is carrying out a number of initiatives which help to tackle all three issues and has identified some 8 km of the River Larig, where there is a need for management action. (See Plate A2) As part of '*The Teith Catchment Project*', action was agreed with the landowner to boost riparian tree cover, tackle excessive erosion and add large pieces of wood to stabilise gravel and kick-start natural processes for increasing nutrients and cover within the river. Some 8000 trees have now been planted.

Under the '*River Larig Riparian Woodland Project',* Forth Rivers Trust has installed a number of tree trunks into the river-bed and banks to try and recreate this natural process and slow down the flow of gravels. The Trust is also installing 'green' bank protection at a number of key sites. Using tree trunks and root-wads, banks have been lined to create a woody structure to slow down the erosion, increase nutrients and provide cover for fish. (See Plate A3) All of this is helping the River Larig and surrounding habitats adapt to a changing climate, whether through increased rainfall causing more floods or the increased frequency of prolonged dry spells.

Work has been agreed for similar work in 2023 with the adjoining owner at Blaircreich, to restore flood-plain connectivity and block ditches and drains to 'slow the flow' and clean the water. Further bank-stabilisation will protect

the trees until they reach maturity and fencing will connect natural woodland on the Invernenty Burn to trees planted last year. A further project on the Calair Burn is in discussion with the landowners. Loss of good habitat is now acknowledged by Loch Lomond & The Trossachs National Park and will lead to a greater step-change and emphasis to deal with the issues on a landscape scale - **https://www.lochlomond-trossachs.org/park-authority/publications/future-nature/**

Smolt monitoring.

In the Forth catchment, the Forth Rivers Trust is monitoring the smolt migration from the Keltie tributary of the Teith. Recent studies have shown that fitter smolts have a much higher chance of surviving at sea and returning as adults. In 2021, some 187 smolts were caught in the trap, comprising 143 salmon and 44 sea trout. The average weight of salmon was 19.8g and average weight of sea trout smolts was 49.5g. Other parameters were recorded each day such as temperature, water levels and water pH and the data will be interrogated further and over time as the data grows from year to year.

This information allows the Trust to advise on best measures to protect the smolt-stage of salmon whilst they are vulnerable. While predation by other species has a negative impact this can be mitigated by better in-stream protection with woody debris, the removal of weirs and impoundments and to ensure works such as dredging in the estuary do not occur during smolt transit timings. Low water conditions and rising water temperatures also make the smolts more vulnerable.

The Big Picture, Going Forward.

Sheehan (2011) emphasises the broader, ecosystem approach to salmon management: *"The big picture going forward will be that we need to be proactive in ensuring that the salmon's interests are represented in long-term planning and we need to focus on the entire ecosystem……."*.

Protecting the Ecosystem.

The watersheds and the upper tributaries are usually considered to be the 'power-houses' of the salmon system. Not only do they include the common spawning areas and the nursery areas for young fish but they also control the flow of water into rivers and ultimately the opportunities for angling for salmon. Many watersheds have been de-forested, drained and over-grazed for centuries. Recent changes in land use has seen sheep numbers decreasing, woodland, and forestry expanding, peatlands being restored and other natural processes for flood management being implemented.

The Forth system has not been immune from these problems. In the middle of the 19th century, one observer in the River Allan catchment recorded that: *"Two hundred years ago the land in the upper reaches of the Allan was not drained, as it is today. The great spates we now have were consequently unknown then. The river did not rise so rapidly as it does today, and it never fell so low…"*

Now the Forth Rivers Trust is driving the *'Allan Water Improvement Project',* working with landowners in the Allan Water catchment to improve the water environment, 'slow the flow' of water through the catchment to protect communities downstream. The project includes a variety of projects such as peatland restoration, installing leaky dams, tree planting, river restoration, embankment removal, and wetland creation. (See Plates A4 and A5) All of these activities provide natural flood management benefits by storing the water on land for longer so that water is released gradually instead in one large flush. Many of the individual natural flood management projects have minimal effects on flooding on their own but many small interventions might eventually lead to a big benefit not just for the communities downstream but also for the fish and other wildlife using the catchments.

Integrated Catchment Management.

The watersheds and upland catchments which salmon rely upon are subject to a number of different sectoral strategies - for development, forestry, agriculture, flood-risk,

water quality, water-supply - which may not always take account of salmon or salmon fishing interests. Climate change, population growth, economics, and environmental legislation all necessitate a move towards a more integrated, catchment-based approach to the management of land and water. Already there are trends in this direction.

Under its Land Use Strategy, the Scottish Government is promoting to concept of Regional Land Use Partnerships - which might lead to better integrated land use in the watersheds. **https://www.gov.scot/publications/scotlands-third-land-use-strategy-2021-2026-getting-best-land/pages/4/.** SEPA already operates River Basin Management Plans under the original EU Water Framework Directive **https://www.sepa.org.uk/environment/water/river-basin-management-planning/** and a number of individual Catchment Management Plans are in operation. The *Forth & Teith Catchment Management Plan 2021-2027* was launched in August 2021. Where land and water are managed together, at the catchment scale, this can bring about whole catchment improvements and multiple benefits. If the upland catchments can be managed as an integrated ecosystem, perhaps the salmon resource, within the freshwater environment, might be maximised.

A future for the Forth Salmon?

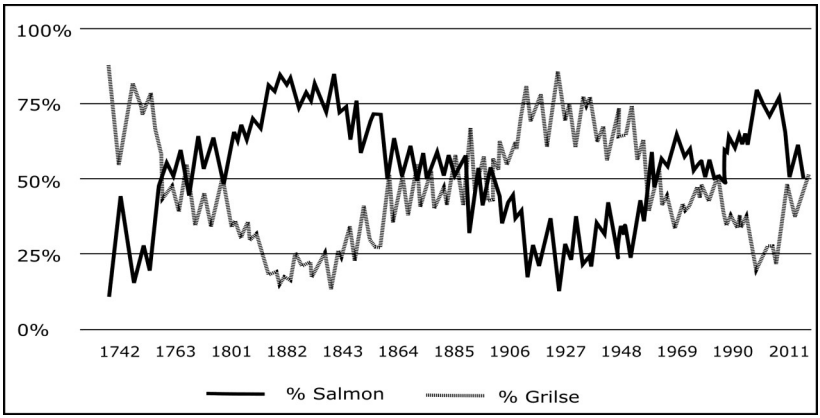
The Atlantic salmon *Salmo salar* has been both a predictor of climate change and one of its victims. There is ample evidence that changes in rainfall patterns and temperature regimes are affecting salmon behaviour and survival. But salmon are adaptable. They have coped with a changing climate since the last ice-sheet started to retreat. Netboy (1968) reviews the historical decline of the salmon on both sides of the Atlantic, including some populations which still survive in warmer climates in Spain, France and Canada. Whether they can cope with the current accelerating rate-of-change of climate remains to be seen.

ICES (2017) **https://www.ices.dk** concluded. *"It is extremely unlikely that Atlantic salmon as a species will become globally extinct within the next 100 years"*, as a result of climate

change. *"However, it is very likely that some populations will suffer significant reductions in abundance."* Localised disappearance is neither as permanent nor quite as devastating as utter extinction. But for communities which lose their salmon, the losses will feel no less final. In Scotland, the Atlantic salmon is a mainstay of some rural economies.

Campbell (2021) is more optimistic. Historical data from Tweed, from 1742, suggest cyclical swings from one-sea winter grilse to multi-sea winter salmon, associated with the North Atlantic Multi-decadal Oscillation. (See Figure 7)The present low rod-catches appear to be related to a cyclical 'ebb' in the combined returns of grilse and salmon. Campbell guesses that, *"As Arctic temperatures increase, we will get "stuck" in a warm period and so "stuck" in a salmon period with consequently lower numbers. Given that we are going into a warmer Arctic phase. Multi-sea winter salmon catches seem to be holding up but we may have to give up on grilse as an important stock component"*. This could have implications for the Forth salmon fishery.

Figure 7: Tweed netting records 1742-2018 (smoothed x 3) fluctuations correlate with temperatures in the Arctic: (Warmer - salmon phase, Colder - grilse phase) (The Tweed Foundation). Towards a "*Wild Salmon Strategy*".



In September 2019, the Scottish Government made a commitment to publish a *"multi-year national wild Atlantic salmon strategy"*. This is now in progress and Scotland's network of River and Fisheries Trusts have a significant contribution to make to its development. Their local knowledge and qualified staff have a major role in both designing and implementing this long-awaited and much-needed commitment to protecting the future of the Atlantic salmon in Scotland - and in the River Forth system.

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Fisheries Management Scotland (FMS) http://fms.scot

Marine Scotland Science (MMS): https://www2.gov.scot/Topics/marine/Salmon-Trout-Coarse

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Scottish Natural Heritage (SNH) https://www.nature.scot

RESTORATION OF MONTANE WOODLAND AND SCRUB ON BEN LAWERS NNR

D. K. Mardon and H. M. Cole.

Introduction

Ben Lawers is one of the ten most important nature conservation sites in the UK (SNH 1998), and is famous for its concentration of rare and scarce montane plants. Different areas have been designated as a Special Area of Conservation (SAC), a Site of Special Scientific Interest (SSSI) and a National Nature Reserve (NNR). This whole area is nine miles long including nine mountains, and is within a National Scenic Area. The NNR is owned by The National Trust for Scotland (NTS), and extends from the head dyke to the ridge-top watershed on both the Ben Lawers and Meall nan Tarmachan ranges..

Several hundred years of intensive sheep and deer grazing on Ben Lawers has restricted woodland and montane scrub plants to cliffs and other inaccessible refuges. A major objective of the NTS has been to return these threatened woodland and scrub habitats to the NNR. The account below describes how a progressive programme of pioneering active restoration carried out over the last four decades has secured significant populations of rare mountain willow scrub. This has been principally achieved by employing fenced herbivore exclusion areas together with both natural and assisted regeneration. In addition this programme has provided sites for the development of associated natural plant communities as well as populations of rare montane invertebrates and birds.

Conservation has been delivered through successive management plans starting in 1981 when the first measurable objectives were adopted. These were initially drawn up in collaboration with the Nature Conservancy Council, followed

by Scottish Natural Heritage and latterly by NatureScot. The crucial objectives, briefly paraphrased, included the maintenance of:

- The existing area of the important plant communities.
- The population sizes of the rare species, (unless a decline is due to natural factors).
- The general biodiversity of the site.

Since then, a programme of survey and monitoring has been undertaken to determine whether these objectives were being achieved.

Establishing a baseline

The Reserve is within an area dominated by both intensive sheep grazing and grazing by deer, the effects of which are all too plain to see (Plates B1 and B2). Cliff ledges and other niches inaccessible to sheep and deer provide the only refuges for montane scrub and other grazing-intolerant tall plants. The extreme contrast between grazed and ungrazed sites applies to cliffs and gully-sides at any altitude but is most conspicuous below the treeline.

Whilst deer numbers can be controlled by culling, reducing sheep grazing is more challenging. The Trust ground on the Ben Lawers range is subject to a number of grazing rights held by the owners of the farms below the head dyke. Although the ground on the Tarmachan range is not burdened with grazing rights, unfenced marches with surrounding estates means that there is still an inevitable drift of animals.

It became clear that two plant communities that were restricted to cliff ledges and were not being maintained in 'favourable conservation status' were montane willow scrub and the tall herb community. Both were classified as important features in the site designations. Worse still, there was evidence that the scrub was in a slow but terminal decline. At every cliff-ledge population, dead plants or parts

of plants were visible below, having fallen from their refuge, but no corresponding recruitment could be found. Many plants were 'alone', isolated on cliffs, even relatively small ones (Frontispiece). Progressive erosion of unstable mountain cliffs, and rock-falls can and do damage shrubs in their path, and winter snows can also be destructive to trees or shrubs in precarious locations.

The conclusions drawn from these preliminary observations, together with the objectives quoted above, indicated that proactive management to avert further decline was necessary. Pilot projects in collaboration with NCC staff began in August 1987, and continue to the present day (2022). A series of exploratory operations enabled us to demonstrate the potential for recovery of both individual species and habitats. Early progress with these projects was assisted by a series of fortuitous funding opportunities.

Trial exclosures

The potential for recovery of these habitats in the absence of grazing was demonstrated by an initial project, funded by the NCC, on Creag an Lochain, at that time part of the Morenish Farms Estate on Meall nan Tarmachan. As part of the NNR, the owner was happy to permit small-scale exclosure fences on her land. This area was remarkable for the diversity of its tall herb flora, with all but the toxic or spiny ones confined to the ledges. There was also a vast population of the nationally scarce Mountain Willow *Salix arbuscula*. This willow species seems to survive the intense grazing as a result of its lateral, predominantly procumbent growth, and an ability to tolerate the destructive browsing of any upright shoots.

Two small areas with a total area of c. 1 ha., at an altitude of 550-600m, close to the natural tree limit, were fenced with a 5 -strand electric fence, one against the cliff and the second separated from it. Anticipating the inevitable threat of snow damage, wires were lowered in winter, although, after a few

years observation, the fence further away from the cliff was left in place over winter. In the plan we predicted rockfall damage "sooner or later"; it happened sooner, 2 weeks after erection, but it was easy to repair very quickly. Other breakages occurred over the 13-year life of these fences. Within 5 years, the fenced areas developed a spectacular growth of a diversity of tall herbs, led by some familiar species: Angelica *Angelica sylvestris,* Hogweed *Heracleum sphondylium*, Meadowsweet *Filipendula vulgaris*, Melancholy Thistle *Cirsium heterophyllum* and Valerian *Valeriana officinalis*. In the first area the willows were heavily browsed as leafless twigs, just as the vestiges of heather are on other parts of the hill, but in the second area some incremental growth was achieved.

The case for active restoration

The potential for natural regeneration was examined. Willows are dioecious, i.e. the plants are either male or female, although some exceptions have been reported (Webb, 2008). Therefore seed production depends on cross-pollination, which is predominately insect mediated (Meikle 1984), although again some exceptions have been reported (Peeters and Totland, 1999). Female willows close to a male plant can produce an abundance of seeds, whereas isolated plants without a male do not. However our data are insufficient to define the correlation between male-female separation and seed production. Juniper are wind pollinated but are also dioecious. Mountain Birch is self-sterile and therefore also needs cross pollination. The viability of the tiny amount of seed we collected was measured and found to be negligible. A survey of the sites considered for restoration projects also showed the numbers of seedlings, sapling trees and young shrubs were insignificant: (single digit) and the potential for natural regeneration was therefore negligible. A programme of propagation and planting would obviously be necessary to support the recovery of shrub and tree species.

This approach of proactive nature conservation was new to the Trust, and with respect to the montane scrub component, was pioneering, a first for the UK (Johnston, J. L. 2000). The term 'restoration' was coined for the process because it was analogous to that routinely applied as the default option for many of the Trust's built properties.

Opposition to restoration was expressed by some. They argued that the vegetation had changed over long periods and, without knowing exactly what was there in the past, there was no clear goal. Unfortunately it was considered impossible to determine the exact distribution and composition of montane scrub communities at any given time in the past even with research into the pollen record. Long ago, Robertson (1799) described extensive changes in vegetation on the Perthshire hills, and Ben Lawers in particular and attributed it to the sheep grazing. Indeed it is generally accepted that montane scrub was once more widespread and has declined as a result of man's activities (e.g. Raven and Walters, 1956; Poore and McVean, 1957; McVean and Ratcliffe, 1962; Ratcliffe, 1977b; Rodwell, 1991), and that the present stands of scrub, and many isolated plants, are likely to be the survivors of such a decline. Clearly the intensive grazing on Ben Lawers NNR has been enough to destroy most of the montane willows exposed to it.

Whereas we may never 'restore' an exact replica of former communities, this can surely not justify passively accepting the status quo, which has been shown to be unsustainable. In order to achieve sustainability, we needed to restore the processes of seed production and establishment of seedlings within the protected area. The former proximate target was easily achieved within 6 years by planting clusters of both male and female plants (See Plate B3). The ultimate target of long term sustainability will require, in addition to the annual seed rain, the coincidence of several environmental factors that influence success. Such events are sporadic and

unpredictable (Mardon 2003). Thus, the projects must be planned as long-term and probably at least a human life-span.

Expanded exclosure projects

Experimental, seasonal stock fencing demonstrated the potential for recovery of some species, but significant practical considerations needed to be overcome to achieve year-round exclusion of herbivores including deer. Difficult terrain, snow lie, rockfalls, the potential for bird-strike and impact on the landscape all posed challenges. The lines for and designs of permanent fencing took these issues into account. In 1989, with funds from Esso UK and NCC an area of c. 5 ha., 700-810m, near the Lairig Innein was deer fenced. This surrounded a gully with a few willows and tall herbs but was seriously damaged by snow and needed significant repairs in spring. A benefit of global warming is that since the early 90s, a reduced accumulation of snow has meant fewer fence repairs. Willows, especially Downy Willow *Salix lapponum* and Dark-leaved Willow *Salix myrsinifolia*, both represented there by minimal numbers (2 and 4 plants respectively) were planted.

This site has a positive feature for restoring willow populations: occasional landslips, creating bare soil niches that are necessary for seedling establishment to succeed. No planting of herbs was planned here, but after 6 years, Globeflower *Trollius europaeus* appeared unaided, and has since multiplied considerably. Other tall herbs flourished, e.g. Lady's-mantle *Alchemilla glabra,* and Marsh Hawks-beard *Crepis paludosa*, and Roseroot *Sedum rosea*.

In 1990, an anonymous American donor provided funds that enabled enclosure of c. 25 ha., around a stretch of the Edramucky Burn. At an altitude of 440-640m, it enclosed the Nature Trail and sections of the main path to Ben Lawers. In addition to the restoration of montane and other willows, and a range of tall herbs, this site is very accessible from the

road and is an excellent opportunity to demonstrate the issues and the potential for restoration. The combination of these attributes added another element to the rationale. The original targets for recovery, willow scrub and tall herbs, in nature, do not always grow alone: in fact they are often entirely mixed together as one community (See Plate B4). Furthermore, in nature, there are few clear boundaries between the classified vegetation units: both montane willows and tall herbs grow both above and below the treeline (when there is one!), i.e. in submontane and montane zones.

The area of the exclosure was mostly or entirely below the treeline, and would in nature include herb-rich birchwood, as inferred from the ledge-bound plants surviving there. Therefore, the native tree species deserve to be conserved here, even though they are not national rarities, and therefore not designated targets for conservation. Designations of species, habitats and sites are designed to prioritise the limited funding available for conservation, but, if interpreted as limits to action, they will lead to an unnatural result. Consequently, the tree species Mountain Birch (*Betula pubescens* ssp. *tortuosa**) and Rowan (*Sorbus aucuparia)* were regarded as part of the community. Rowan, however, is seeded abundantly by natural processes, so only the birch needed to be planted. Later, small numbers of Juniper *Juniperus communis* were planted too.

The early stages of willow planting was strongly supported by a volunteer, Richard Marriott, who grew large numbers of Downy Willow and Dark-leaved Willow in his nursery in Stonehaven, and helped with the planting. Smaller numbers of Mountain Willow and all the herbs were grown in Killin. As soon as possible a tree nursery was established at the Trust's new operational base in downtown Killin. [*This taxon has had several name changes; the name used is as Stace, 1991.]

Vestiges of the vegetation limited to inaccessible ledges gave guidance on which species should be planted and where. In the larger exclosures, planting began with Downy Willow *Salix lapponum*, Dark-leaved Willow *S. myrsinifolia*, and, in smaller numbers, Mountain Willow *S. arbuscula*. Small numbers of three species of tall herb were planted in the Edramucky Burn exclosure to kick-start a process of recovery: Globeflower *Trollius europaeus*, Wood Cranesbill *Geranium sylvaticum*, and Water Avens *Geum rivale*. The completeness of the tall herb community was important for the demonstration function of this site.

Increasing the scale

In 1996 the Trust was able to extend its ownership beyond the Ben Lawers range, with the purchase of the hill ground on the south side of the Meall nan Tarmachan range, part of Morenish Farms Estate. This area did not have externally-owned grazing rights, thus enabling expansion of the restoration project to a much greater area. This included the 2.5 km, complex, east-facing cliff of Creag an Lochain, including our first two experimental exclosures. Referring to it in their 1956 New Naturalist book, *Mountain Flowers*, authors Raven and Walters praised "*the luxuriance and variety of its vegetation*". John Raven wrote "*If only it were possible to surround this cliff and the area below it with a fence that would exclude both deer and sheep, it seems most likely that this same vegetation, including the dwarf willows, would soon invade the slopes below the cliff*". This vision had become possible and it became part of the targets for conservation projects for the next few years.

After preparatory work, including funding applications, the Tarmachan Habitat Restoration and Improvement Project (THRIP) began in 1998, for the period until 2001. However, as the active life of the project would extend well beyond the period for which the grants applied, it was recognised as a very long-term project. The lower, eastern corner of the

ground purchased was a mixed conifer plantation which needed to be removed before native species could be introduced. The extraction problems, and the condition of the trees, were such that a net loss was incurred. The anticipated cost was included in the funding package.

The project comprised three large exclosures built on the Tarmachan range, using electrified fencing. This was effective with sheep and red deer, but roe deer can sometimes get through. The general aim was the re-establishment of native trees, shrubs and tall herbs, by a combination of natural regeneration and planting. Millennium Forest for Scotland (MFS) supported all three exclosures, the Woodland Grant Scheme (WGS) supported the two lower exclosures, and SNH supported the higher, Creag an Lochain exclosure with the willow scrub and tall herb community. In total the exclosures included an altitude range of c. 400- 923 metres. However, there was not a continuum of vegetation due to the inherent practical constraints.

The two lower exclosures were planted predominantly with birch, Eared Willow *Salix aurita*, Grey Willow *Salix cinerea*, Aspen *Populus tremula* with some Alder *Alnus glutinosa* and small numbers of Hazel *Corylus avellana* and Scots pine *Pinus sylvestris* at lower altitudes. The largest exclosure, at higher altitude, incorporated 180ha around Creag an Lochain, much above the tree line. Here, there are numerous cliff ledges with a high diversity of tall herbs. These and montane willow scrub require a very low level of grazing for their status to be enhanced. The dynamic processes of landslip and rockfall around the large complex of cliffs, and also the activities of small mammals, frequently create niches for seedling establishment. This combination of features indicated that Creag an Lochain is an ideal site for enhancing the limited status of both tall herbs and montane willow scrub (See Plate B6).

In addition to the species mentioned, this area has a wide range of plants, including some rare and scarce species, too numerous to list in full, e.g. Net-leaved Willow *Salix reticulata*, Alpine Woodsia *Woodsia alpina*, Alpine Cinquefoil *Potentilla crantzii*, Black Alpine Sedge *Carex atrata*, Alpine Saw -wort *Saussuria alpina*, Wood Vetch *Vicia sylvatica*, and occasional stands of Nettle *Urtica dioica* and Hedge Woundwort *Stachys sylvatica* together, marking the sites of fatal falls of sheep.

The project has elicited criticism, especially of the fencing, from the wild land lobby. Decisions to fence, on the hill, are never taken lightly, and involve great efforts to minimise their impact and visibility. The priority for the Trust, and dictated by the designations, is nature conservation. The objectives defined in the Management Plans, supported by years of survey and monitoring, cannot be achieved without control of sheep and deer, which, at present, requires fencing. The numerous, centuries-old remains of fencing precede the current projects. The wild quality of the designated land was seriously impaired before conservation management was implemented. The cultural landscape was in no sense wild, due to the vegetational changes described above, and the target of the projects would be nearer to a wild condition. The industrial landscape of the hydro-electric scheme erodes wildness more seriously than any fencing, and is surely permanent. Fencing is reversible: the first fences described here were removed 21 years ago.

Outwith these exclosures, the presence of browsers continued with some progressive colonization by 'trespassing' sheep. Deer culling achieved a significant reduction in the population over several years. In 2011 a stock fence was erected joining two of these exclosures excluding sheep from a further 300ha of land. Experimental planting within this area was monitored but the deer damage was too great for establishment of woodland so it was upgraded to a deer fence.

In 2012, Scottish Rural Development Programme (SRDP) funding was obtained for incremental expansion of restoration by creating an additional 75 ha of woodland within this area, concentrated around the burns, effectively joining sub-montane woodland and montane scrub. The grant application for this ambitious project was supported by the demonstrable success in the older exclosures.

It included planting of Downy Willow in more impoverished grassland away from cliff refuges on the south facing slopes of Meall nan Tarmachan and experimental reintroduction of Dwarf Birch *Betula nana*, under licence from NatureScot. The factors affecting establishment, growth and survival of these species are being investigated as part of a PhD project.

A crucial factor in ensuring the success of this enormous, ongoing project was the appointment of a versatile, dedicated and energetic Ranger, eventually to a permanent post: Andrew Warwick. He and the other team members have provided continuity of staffing, a vital ingredient for such long-term projects. Regular maintenance of the fencing is vital to success, as snow damage on the higher sections is inevitable and the generally hostile environmental conditions lead to deterioration of materials. This can occasionally allow access to small numbers of sheep, which need to be herded out. The electric fencing is porous to Roe Deer so culling by staff is required. Latterly, the Trust has been eligible for grant aid via the Agri-environmental Climate Scheme (AECS) for maintaining scrub of high conservation value, the conditions of which formalises the requirement to exclude large herbivores.

Indications of progress achieved, to 2022

The results of this project are thriving ecosystems which are very apparent within the landscape. Over 110 ha of montane scrub and 90 ha treeline woodland have been actively restored and within a much larger area of enclosed ground between 300 to 900 m asl. In addition to meeting

organisational objectives it has contributed to government targets by moving Natura habitats, montane willow scrub and tall herbs, towards favourable condition. Seed produced from shrubs and trees within the exclosures provides material for the expanding project.

An explosion of invertebrates paralleled the developing plant communities. Most obvious were moths and their caterpillars, including some less common species such as the Cousin German *Protolampra sobrina*, and leaf-eating beetles. This was followed by increased bird diversity, including breeding Stonechat *Saxicola rubicola,* Willow warbler *Phylloscopus trochilus,* Redpoll *Acanthis flammea*, Ring Ouzel *Turdus torquatus* and Twite *Linaria flavirostris*. It is predicted that further bird species may follow, e.g. Bluethroat *Luscinia svecica*, Lapland bunting *Calcarius lapponicus*, Brambling *Fringilla montifringilla* (Halley 2011).

New records are frequently being made including additional micro-sites for the Mountain Plume moth *Stenoptilia islandicus*, only recorded from Ben Lawers, and an endemic sawfly *Eura arbusculae*. One of a recent group of visiting Dipterists, an eminent entomologist, said that our restored habitat was the richest he had seen anywhere.

Throughout the duration of this work, Ben Lawers has hosted groups from all over Britain, including of influential policy makers, wishing to learn more about treeline woodland and montane scrub restoration. The restored habitats have been the inspiration for many other subsequent mountain woodland restoration projects, and used for numerous research projects, including by other conservation organisations. Our own monitoring has produced one scientific paper to date (Watts et al. 2019). Experience gained from delivery has contributed significantly to national efforts to conserve Woolly Willow and for the bulk of the *Montane Scrub Action Group's best practice guidance (*now renamed the Mountain Woodlands Action Group).

The Trust's remit also includes access and holistic planning has enabled incorporation of visitor facilities into developing woodland to minimise visual impact on the mountain environment. Two waymarked trails and the main path to Ben Lawers itself pass through restored habitats, so visitors can enjoy both enhanced landscape and biodiversity (See Plate B7).

This project epitomises successful delivery of visionary long-term management. Exponential development in achievable increments informed by monitoring has delivered against objectives. The legacy is improvement to the landscape, habitats and wider biodiversity. The Trust's long-term restoration of mountain woodland and scrub was highly commended in the 2020 Nature of Scotland awards.

The Way Ahead

The exclusion of sheep and deer was necessary to establish communities of trees and shrubs that could supply seed sources. However, zero grazing in the long term produces unnatural vegetation with fewer opportunities for seedling establishment. A regime of grazing that the woodland and scrub could tolerate will need to be introduced. A proposal to experiment with conservation grazing by cattle has been developed with the aim promoting natural regeneration of woodland and scrub whilst also benefitting open ground habitats such as dry heath. This would still require the exclusion of sheep and red deer, but as woodland establishes culling of roe deer becomes progressively more difficult. Monitoring of the impacts of browsing will inform the requirement for this.

Acknowledgements

The conservation work at Ben Lawers has been supported financially by the NCC and SNH throughout their respective time periods. Manual tasks such as fence repairs and planting have been achieved with many volunteers, too numerous to mention. This vast contribution of effort has saved the Trust huge costs.

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UPPER FORTH BIRD REPORT 2021

N. Bielby

This is the 48th bird report for the Upper Forth SOC (Scottish Ornithologists Club) recording area. The area covered by the report comprises the council areas of Falkirk, Clackmannanshire and Stirling but excludes parts of the Clyde drainage basin such as Loch Lomondside and the Endrick Water area (including Fintry and Balfron) all of which are covered by the Clyde bird report. The total area covered is c.222,554 ha. The report consists of a summary of the main bird news from 2021 followed by detailed species accounts.

Chris Pendlebury, the local SOC recorder, can be contacted by e-mail at chris@upperforthbirds.co.uk; by leaving a message on 07798 711134 or by mail to 23 Ochlochy Park, Dunblane FK15 0DU. Records are best provided through the BTO BirdTrack system (61,657 records were entered into BirdTrack for 202 species and 2 sub-species by 192 users for 1,327 places in our area in 2021) or by an Excel spreadsheet that can be sourced from Chris. Details of what type of records are required for each species along with advice on writing descriptions and submitting records can be obtained from the deputy recorder, Neil Bielby at n64b68@gmail.com or by phoning 01786 823830 (please note that records of rare/scarce species entered **only into BirdGuides** cannot be used in this report because of the inability to verify them due to GDPR protocols).

In this report a coded summary of general distribution is included after the species name. The codes used in this report are:

B Breeding status: widespread (present in more than five ten km squares).

b Breeding status: local, scarce (present in fewer than five ten km squares).

W Winter status: widespread or often in groups of more than ten.

w Winter status: local, scarce or usually fewer than ten in a group.

P or p Passage (used for species usually absent in winter). P and p used for widespread and local/scarce respectively, as in winter status above.

S or s Summer visitor (used for species present in summer but which do not normally breed). S and s used for widespread and local/scarce, respectively, as in winter status above.

Irr Irregular: less than annually.

V Vagrant: does not normally occur.

Scarcer and rare species for which a full list of records are provided are highlighted with the use of an asterisk (*). Records of rare species are subject to acceptance by the BBRC, SBRC or the local rarities panel. The latter currently consists of Pete Carroll, Graeme Garner, Mark Lewis, Duncan Orr-Ewing and Chris Pendlebury. A list of local rarities is available from Chris Pendlebury.

Much information and records - especially counts, rates and comparisons - come from the Wetland Bird Survey (WeBS) and Breeding Bird Survey (BBS) surveys carried out on behalf of the British Trust for Ornithology (BTO). In 2021 a total of 70 randomly selected km squares were surveyed for the BBS which, along with four Waterways BBS (WBBS) sites, resulted in 277.2 linear km's being perambulated. A total of 12,247 birds were recorded from 107 species by 40 surveyors with the coverage in each broad habitat type in the Upper Forth area being quite close to that of the actual.

The monthly 'core' WeBS counts (Jan – Mar and Sep - Dec) are split into estuary and inland with the former being co-ordinated by Mike Bell. The estuary counts, which are downstream from Cambus, are split into five sectors in the Upper Forth area in which 96,795 wildfowl (excl. geese) and waders were counted in the 7 months (Jan-Mar & Sep-Dec) by six volunteers. Inland, 115 still sites and 150.5 km's of rivers and canals were counted by 54 volunteers who carried out 613 counts on still sites and perambulated 877.5 km of

river and canal producing 35,183 wildfowl (excl. geese and waders) in the same 7 months. Note: a detailed weather report for 2021 can be found elsewhere in this journal.

HIGHLIGHTS OF THE YEAR

January—A Green-winged Teal at Kinneil and a Taiga Bean Goose at Skinflats Pools made for a good start to the local birding year (2nd). These were followed by the sighting of a juvenile White-tailed Eagle near Lochearnhead (6th). Small groups of Snow Buntings were encountered on Wood Hill and Ben Ever in the Ochils during the 1st week while a group of up to eight Hawfinches (becoming an annual species in the Upper Forth) were in the Holme Hill woods, Dunblane (8th – 24th). Three Bearded Tits were encountered at the mouth of the Grange Burn in Grangemouth (10th). The first Waxwing of the winter was reported from Callander (13th) with a 1stW Iceland Gull seen in the Raploch area of Stirling (18th). Two White-fronted Geese were recorded just to the south of Bonnybridge (23rd). Two more rarities completed January's birding highlights. The first was a Siberian Chiffchaff calling at New Carron, Falkirk (23rd) while a Bittern, flushed by the R. Forth a little way upstream of the M9 at Craigforth, is only the 5th record for the Upper Forth (24th).

February—Two Common Redpolls were in Stirling (7th). Five Guillemots and a Merlin were by Kincardine Br. (13th). A Glaucous Gull was at Kinneil with a wintering flock of c.90 Twite at Higgin's Neuk when a Jack Snipe was flushed on Myreton Hill in the Ochils (14th) to be followed by a Greenland White-fronted Goose at Cambus Village Pool the next day. Hen Harriers were seen over Tullibody Inch (7th), then at Skinflats Pools and in the Buckieburn area (10th). Short-eared Owls were observed on Dumyat, at Kinneil and Skinflat Pools (13th). Guillemots ventured well up the R. Forth with four at Cambus (14th) and singles at Taylorton and Cambuskenneth the previous day. Towards the month end, adult Mediterranean Gulls were recorded at Kinneil and W of Doune (28th).

March — Highlights: A Black-necked Grebe on Flanders Moss was just the 4th record for the Upper Forth (3rd). A Slavonian Grebe was off Blackness when a Marsh Harrier was at Tullibody Inch (27th). A Spoonbill was by the R. Forth at Cambus (31st). Other notable records included: a Greenland White-fronted Goose and a Barnacle Goose on Gartartan Fields, Aberfoyle (5th) with a Green Sandpiper was along the Allan Water at Kinbuck Br. the following day. Goshawks were seen at Br. of Allan (13th), G. Ample (15th) and Ashfield (17th) (See Plate C3). 42 Whooper Swans were at the head of L. Tay (15th) while a flock of 35 Crossbills was above Touch (27th).

April—A Hawfinch was feeding under a bird table in a Falkirk garden (3rd). A redhead Smew was on Devonmouth Pool and the adjacent R. Forth at Cambus (10th – 15th). Four Ring Ouzels flew over Dunblane when one was on Dumyat (10th). Two Little Ringed Plovers were at Cambus Village Pool (12th) with one there (26th). Three White-tailed Eagles were near Killin (14th). A pair of Garganey were in the Blackdevon Wetlands (21st). A 'Blue-headed' Yellow Wagtail (ssp *flava*) at Devonmouth Pool was only the second record for Clackmannanshire (23rd). Two Yellow Wagtails (ssp *flavissima*) were at Skinflats Pools when a Spoonbill was on Longcarse and a Little Ringed Plover was at the head of L. Tay (26th). The month ended with an Iceland Gull at the confluence of the R's Teith & Forth (30th).

May—Highlights: A Bluethroat of the red-spotted form in Menstrie Glen on the 15th May was only the 3rd record for the UF and the first in Clackmannanshire. A Turtle Dove visited a Polmont garden (23rd). Other notable records were: a Mediterranean Gull and a 2cy Iceland Gull at Kinneil (2nd); a 2cy Iceland Gull on the R. Forth at Westleys (2nd & 5th) and a Light-bellied Brent Goose in the Kennet Pans area (12th & 15th).

June—Highlights: A Turtle Dove in Cambuskenneth (3rd)

was only the 7th record for the Upper Forth BR area while a Rose-coloured Starling at Blackness Castle (9th) was similarly just the 6th. Some other notable records were: a Spoonbill in the Tullibody Inch/Bandeath area (3rd); a Marsh Harrier quartering Flanders Moss (17th); a Common Tern well inland at the Killin Marshes (18th) and a Quail calling on Sheriff Muir (29th).

July—An ad summer-plumaged Great Northern Diver was very unusual at the head of L. Tay (4th - 8th) with almost certainly the same bird seen on L. Lubnaig (7th). Two Mediterranean Gulls were at Skinflats Pools (6th) with another seen at Kinneil (11th). At the head of L. Tay, a Black-tailed Godwit on the 8th and a Common Scoter two days later were again unusual. A Hobby was at Ochtertyre (13th) with a Honey Buzzard at Lix Toll, Killin when a Golden Eagle was over G. Lochay (18th). Kinneil produced an Arctic Tern (22nd). A Little Stint and a Sanderling were at Skinflats Pools when a Little Ringed Plover was at Powfoulis TB and a Green Sandpiper was on the Carse of Lecropt (25th). A White-tailed Eagle was reported from the Crianlarich area (29th).

August—Up to four Ruddy Shelducks were reported from Tullibody Inch (1st - 15th) with a pair of Cape Shelducks appearing there (9th & 12th). White-tailed Eagles were seen at Lochearnhead and flying up the M9 at Craigforth, Stirling (18th). A Common Scoter, two Mediterranean Gulls and an Arctic Tern were at Blackness (8th). A summer-plumaged Black-throated Diver was on L. Achray and at the head of L. Tay (21st & 25th) while a Dotterel was on top of Ben Cleuch (22nd). Also on the 22nd, a coordinated count of the estuary produced 3,435 Shelducks, a Green Sandpiper, three Mediterranean Gulls, 452 Sandwich Terns, +244 Common Terns, 12 Arctic Terns, two Black Terns, three Arctic Skuas and a Marsh Harrier. Three Swifts were still present in Dunblane (25th). Kinneil held two Red-throated Divers, six Eiders and a Guillemot (30th). A maximum of four Bearded

Tits were reported from Tullibody Inch.

September—Highlights: A Little Gull was at Kinneil (9th) with an immature Pomarine Skua off there (12th). A Black-throated Diver was on L. Katrine (14th). A Little Owl at Howietoun Ponds is probably the first record for the Upper Forth (13th). A Long-tailed Skua was off Blackness (23rd). A Slavonian Grebe was at Kinneil (25th) with one at Blairdrummond Ponds (28th). Eight Brent Geese were at Blackness with 12 there two days later (26th). There was a good seabird passage with the following high counts. Gannet: 101 Blackness, 84 Kinneil and 19 Powfoulis TB. A large 'wreck' of auks also occurred during the month with some maximum counts of Guillemots being: 137 on the R. Forth between S. Alloa and Dunmore, c.120 at Blackness, 107 on the R. Forth round Longcarse, 89 at Kennet Pans, 18 at Kinneil and 11 on the R. Forth through Stirling. Maximum counts of Razorbills were: c.100 off Blackness, 10 off Kinneil, four at Powfoulis TB, two on the R. Forth at Alloa and one on the R. Forth at Longcarse. There was also a good Arctic Skua passage throughout the month with high counts of 10 at Blackness, 6 at Kinneil and three on the estuary off Skinflats.

Other notable records: Maximum numbers at Blackness were**:** 55 Barnacle Geese (18th), 15 Common Scoters (20th); nine Kittiwakes (23rd) and six Red-throated Divers (28th). A late Reed Warbler was at Skinflats Pools (7th) while two Marsh Harriers were there (29th).

October—The seabird passage/influx continued with a Pomarine Skua at Blackness along with eight Red-throated Divers, c.50 Gannets, six Arctic Skuas, 55 Guillemots and c.30 Razorbills (2nd). These were followed there by a Black-throated Diver, three Red-throated Divers, three Common Scoters, c.40 Guillemots, three Razorbills, three Arctic Skuas and two Rock Pipits (9th) with a further 28 Arctic Skuas (11th). Further up the estuary at Kinneil there were eight Scaups, four Eiders five Arctic Skuas, c.30 Guillemots and seven Razorbills (2nd) with five Red-throated Divers 2 days later.

The Skinflats Pools area produced 26 Whooper Swans and five Shovelers (2nd), a Curlew Sandpiper (4th), 32 Grey Plovers (6th), two Red-throated Divers, 12 Brent Geese and a late Lesser Whitethroat (16th) and 47 Barnacle Geese (17th). Even further up the R. Forth at Longcarse there were four Gannets (1st); 44 Guillemots, two Razorbills and a Bearded Tit (5th); nine Dunlin and three Rock Pipits (9th) and a late Common Sandpiper (10th). C.40 Guillemots were on the R. Forth through Stirling (7th).

Away from the tidal Forth, a Ring-necked Parakeet was reported from Cobleland, Aberfoyle when a Little Egret flew over Dunblane (2nd). Two Gannets were at Ashfield (3rd). Four Redwings at the Bows, Doune were the first of the autumn (4th) with the first Brambling reported from a Carronshore garden (12th). 106 returning Bean Geese were at Slamannan (15th). A Mandarin Duck was at Cultenhove Dam when a Merlin was near Thornhill (23rd).

November—Highlights: a Cetti's Warbler ringed at Kinneil was the 1st record for the Upper Forth when a Siberian Chiffchaff was also ringed there (20th). A Glossy Ibis at Blairdrummond Ponds is a first record for Stirling District and the 4th for the Upper Forth (21st – 26th). Other notable sightings included a Dotterel on Ben Ledi (1st) followed by a Green-winged Teal at Skinflats Pools (4th) with a Spotted Redshank on the Skinflats mud (2nd-11th). A late Swallow was over Tullibody Inch (3rd) while a White-tailed Eagle passed through G. Dochart (7th). A Greenland White-fronted Goose visited L. Coulter (8th). A Hen Harrier quartered the Devon Haugh's near Dollar (13th) with a 1stW Long-tailed Duck at Cambusmore/Gart GP the next day. A Jack Snipe was at Ashfield Pools 16th with 4 at Doune SUDS when a Ring-necked Parakeet was reported from Camelon Cemetery (28th).

December—A Greenland White-fronted Goose turned up at Devonmouth Pool, Cambus (1st). Two White-tailed Eagles were at Inverhaggernie, Strath Fillan (7th) with a Black-throated Diver on L. Earn (12th). A Red-throated Diver and a Guillemot were at Bo'ness when a Merlin was at Brackenlees

and five Twite were by Airth (19th). A Glossy Ibis flew over the M9 east of Plean (24th). A Long-eared Owl was at Glassingall, Kinbuck with a Black Grouse on Sheriffmuir and a Hen Harrier on the Braes of Doune (25th). A Snow Bunting, encountered on King's Seat in the Ochils, provided a fitting end to the year (27th).

SPRING ARRIVALS

March—Chiffchaff, Blairdrummond (1st); Osprey, Buckieburn (14th); Sand Martin, Cambus (16th) and Swallow, Skinflats (27th).

April—Common Sandpiper, Aberfoyle; Wheatear, Myreton Hill & Blackcaps Br. of Allan, Camelon (Falkirk) and Menstrie (1st); House Martin, Br of Allan (2nd); Grasshopper Warbler, Skinflats Pools (10th); Common Whitethroat, Skinflats Pools & Whimbrel, Powfoulis TB (13th); Cuckoo, Harperstone, Sheriffmuir (15th); Redstart, Killin (16th); Tree Pipit, Blairdrummond (19th); Garden Warbler, Skinflats (20th); Wood Warbler, G. Finglas (21st); Sedge Warbler, R. Devon, Glenochil (22nd); Reed Warbler, Cambus (25th) and Swift, Skinflats Pools (27th).

May— Spotted Flycatcher, Killin (13th).

Spring and autumn arrival and departure dates in this report have not usually been recorded systematically so that changes between years should only be seen as indicative and not interpreted as reflecting true phenological variation.

CONTRIBUTORS

This report has been compiled from records submitted by the contributors listed below. Where initials are given, the contributors are listed in species entries of birds that are rare, uncommon or otherwise noteworthy. The editor is grateful to all contributors for submitting their records without which this report could not be written. Apologies to anyone who has been inadvertently missed out.

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SYSTEMATIC LIST

Codes – F, C and S refer to the Falkirk, Clackmannanshire and Stirling Council Areas respectively.

Names and species order: both the common and Latin names, along with the species order, have been in a continuous state of flux over recent years. To maintain some semblance of continuity (in order to make locating a species in the report a little easier) the same order as last year has been retained. As with the species order, there appear to be different sets of common English names by different authorities, but for this report the British Birds 2016 list has been used with the IOC International English names (2012) in brackets.

Abbreviations: ad (adult), aon (apparently occupied nest (s)), aot (apparently occupied territories), Av (avenue), BGMO (Bean Goose Monitoring Officer), b (brood), b/lkm (birds per linear km), br (bridge), BoA (Bridge of Allan), BoD (Braes of Doune), bldgs. (buildings), cy (calendar year), CVP (Cambus Village Pools), CVR (Carron Valley Reservoir), cemy (cemetery), Cott (cottage), CP (country park), Cres (crescent), cy (calendar year), E (east), Est (estuary/estate), f (female), FF (food for young), Fm (farm), FL (fledgling), F & C (Forth & Clyde), gdn (garden), G (glen), GC (golf course), GP (gravel pit), Hosp (hospital), Ho (House), Imm (immature), Incl (including), junc (junction), juv (juvenile), Kinc. (Kincardine), km (kilometre), L. (Loch), m (male), max (maximum), min (minimum), N (north), NB (nest building), NH (new high), nr (near), NW (North-west), NY (nest with young), occ (occasionally), ON (occupied nests), pr (pair), Pl (Place), resr. (reservoir), Rd (road), ssp (sub-species), Sta (Station), St (Street), SuDS (sustainable drainage system), SW (South-west), TB (Tidal Breach), Trek (Trektellen), UF (Upper Forth), v (very), W (winter & West), WNW (West-North-West), yr (year), Y (young) & > (flying).

MUTE SWAN *Cygnus olor* (B, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	333	293	295	229	282	321	421
Estuary	9	6	4	14	53	48	11

F Breeding: Pr + 6Y N Pool, Skinflats 7 May (AB); pr + 8Y Dalderse 17 May (AB); pr + 3Y Larbert Hosp' Ponds 22 May (RD); pr + 7Y Kinneil Ho. Pond 29 May (AIB); pr + 7Y Union Canal, Bantaskine 1 Jun (BP); pr + 9Y Callendar Park Loch 7 Jun (RD); Pr + 5Y Lionthorn 5 Jul (RD) & ad + 5 juv Little Denny Resr. 6 Sep (NB). Site max: 53 Skinflats Pools 14 Nov & 33 Helix Park Pond 28 Sep.

C Breeding: Pr + 3Y Blackdevon Wetlands 19 Jun (CRM) & pr + 4 juv Delph Pond, Tullibody 4 Sep (NB). Site max: 110 R. Devon (Alva - Tullibody Br.) 17 Jan; 51 R. Devon (Tullibody Br. - A907) 27 Dec; 46 Gartmorn Dam 3 Jan & 46 Alva Floods 20 Feb.

S Breeding: 5 pr's with b's of 3,4,6,7 & 7 Airthrey Loch, 8 Jun (MVB); pr + 6y hatched Millhall Pond, Polmaise [NS 811917] (DT); b's of 7 & 6 Y Cambusmore/Gart GP 22 May (NB); pr + 7Y Ochlochy Pond hatched 22 May (CJP); pr + 5Y Howietoun Ponds 29 May (NB); pr + 9Y Cromlix Ho. Loch 19 Jun & pr + 2Y Cromlix Lodge Pond 19 Jun (MVB) & pr + 3 juv Doune Ponds 30 Sep (NB). Site max: 38 Blairdrummond Ponds 11 May; 32 Airthrey Loch 21 Oct; 31 Cambusmore/Gart GP 14 Nov where 2 dead ad & 1 juv frozen into the ice 23 Jan (NB) & 28 Lake of Menteith 2 Dec.

WHOOPER SWAN *Cygnus cygnus* (W)

Spring departure: last 4 L. Iubhair 26 Apr (JPH). A single bird over-summered at Blairdrummond Ponds. Autumn arrival: first, 5 Skinflats Pools & 1 head of L. Tay 25 Sep (AB, JPH).

F Autumn/winter site max: 30 (incl 6 juvs) Skinflats Pools 29 Sep; 28 Howkerse, Skinflats 17 Oct & 9 Darnrigg Moss Pools 10 Nov.

C Winter/spring site max: 22 >WNW Cambus 30 Mar & 16 Gartmorn Dam (29 Mar). Autumn/winter site max: 29 Gartmorn Dam 15 Oct; 23 Tullibody Inch 4 Oct & 27 >W Tullibody Inch 15 Oct.

S Winter/spring site max: c.80 >NW Bandeath 1 Apr; 42 >E L. Tay 15 Mar; 41 over Cocksburn Resr 4 Apr; 30 L. Iubhair 24 Mar & 16 R. Forth, Kippen 13 Mar. Autumn/winter site max: 15 L. Dochart 27 Nov.

BEAN GOOSE *Anser fabalis* (W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	26	2	69	3	5	28	18
Estuary	5	6	0	0	28	10	0

F Regular wintering flock of Taiga race birds in the vicinity of the Slamannan Plateau. Winter/spring: 164 birds located in three separate flocks of 12, 72, 80 on 8 Jan; 170 nr. Slamannan 18 Jan; GPS data indicated that some birds still present near Slamannan 10 Feb & GPS also showed movement of Bean Geese in the Forth 11 Feb flying E out into the North Sea. All arrived Pandrup, Nordjylland, Denmark by 13 Feb (AMac, BGMO). Autumn/winter: First 24 nr. Strathavon Fm 6 Oct (TF). Max: 206 Easter Jawcraig Farm 3 Dec (AMac, BGMO). Other sites: 1 Skinflats Pools 2 Jan (AB, SWo).

More information can be had on the Bean Geese web site including annual reports which can be downloaded. See https://sites.google.com/view/scotlands-bean-geese Also see (beangoose.blogspot.com) for information and pictures.

PINK-FOOTED GOOSE *Anser brachyrhynchus* (W)

With several birds over-summering it is now very difficult to ascertain an accurate last spring departure date but 52 Bandeath 15 May was probably it (DH). Autumn arrival: first 30 Skinflats 16 Sep (DMB). Forth Est WeBS: 1,085 in Jan, 1,371 in Feb, 1,226 in Mar, 87 in Sep, 4,951 in Oct, 45 in Nov & 2,127 in Dec. (Virtually all these birds are in fields above the high-water mark. Although this species is recorded on inland WeBS sites, most flocks spend the day grazing in non-wetland locations making the WeBS counts unrepresentative).

F Winter/spring site max: 2,500+ Skinflats 5 Jan, 2,500+ S. Alloa - Dunmore 7 Apr & 2,000+ Carron Ho 27 Jan. Probable summering record: 1 Larbert Loch 10 Sep. Autumn/winter site max: 4,190 Skinflats 31 Oct & 1,500 Airth W 27 Sep.

C Winter/spring site max: c.7,200 Alloa Inch 9 Apr; c.6,500 Cambus 10 Apr; c.3,400 Menstrie 23 Jan & c.2,710 Tullibody Inch flew NW from roost at dawn 25 Jan (GG).

Summering records: max. Longcarse 6 on 3 Jun & 1 Alva Floods 3 Jun. Autumn/winter site max: c.5,500 Longcarse 8 Oct & c.1,350 >W Cambus 29 Nov.

S Winter/spring site max: c.1,050 BoA 13 Mar; c.800 Crianlarich 15 Apr; 763 Gartartan 5 Mar & 425 >N Strathyre 13 Apr. Autumn/winter site max: c.5,140 >SW Ashfield 23 Oct; c.2,750 Cambusmore/Gart GP 10 Oct; c.2,500 >S Dunblane 24 Oct & c.1,170 Gartartan 3 Nov.

*WHITE-FRONTED GOOSE (Greater) *Anser albifrons* (w)

C One *ssp flavirostris* Menstrie 23 Jan & 17 Feb. Also, Cambus Village Pool 15 Feb (JRC, DH). One *ssp flavirostris* Devonmouth Pool 1 Dec (DH).

S 1st W/spring bird Gartartan Fields 5 Mar (NB); 1 head of L. Tay sandbar 8 May (JPH) & 1 L. Coulter 8 Nov (AMcP).

GREYLAG GOOSE *Anser anser* (b, W)

Icelandic birds normally depart in Apr and return in mid Oct but the exact spring departure and autumn arrival dates of these birds are muddied by the presence of an ever-increasing number of resident feral birds whose winter population probably matches, or even exceeds, the Icelandic one now. Forth Est. WeBS: 526 in Sep, 455 in Oct, 9 in Nov & 2 in Dec. (Virtually all these birds are in fields above the high -water mark. Although this species is recorded on inland WeBS counts, many flocks spend the day grazing in non-wetland locations making the WeBS counts unrepresentative).

F Feral/naturalised birds: 215 Blackness (UF) 2 Sep.

C Winter/spring site max: c.320 Alva Floods 16 Jan & c.300 Devonmouth Pool 27 Feb. Summer (feral/naturalised birds): c.1,500 R. Forth, Cambus 25 Sep; c.1,200 Tullibody Inch 15 Aug & 453 Alloa Inches 3 Oct.

S Breeding: pr + 5Y Kippen Muir Dam 26 Jun (JC). Winter/spring site max: c.300 Blairdrummond Ponds 5 Mar & c.220 Crianlarich 31 Mar. Autumn/winter site max: 373 Lots of Callander 13 Oct; c.300 Blairdrummond Ponds 3 Dec; 271 Cambusmore/Gart GP 11 Sep; 262 R. Forth, Kippen 10 Oct & 188 L. Coulter 8 Nov.

*SNOW GOOSE *Anser caerulescens* (Irr)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	503	713	283	1110	357	850	502
Estuary	70	30	7	602	40	140	100

F A white phase bird was in the Skinflats area from 21 Nov – 19 Dec (JSP, CAM, DOE et al).

CANADA GOOSE *Branta canadensis* (B, W)
Numbers continue to steadily increase. BBS/WBBS: recorded at 0.46 b/lkm (1997-2021 average: 0.13 b/lkm).

F Site max: 265 Larbert Hosp Ponds 10 Sep; 184 Skinflats Pools 17 Sep; 163 Black Loch 30 Jan & 118 St Helen's Loch, Bonnybridge 11 Dec.

C Breeding: ad + small Y Gartmorn Dam 13 May (GG). Site max: 242 Kennetpans 19 Sep; c.150 Longcarse 15 Aug & c.150 Craigrie Pond 15 Sep.

S Breeding: Cambusmore/Gart GP: crèche of 20Y from 5 nests 19 Jun (NB); 4 ad. + 5Y head of L. Tay 22 Jun (JPH) & pr + 2Y W end L. Katrine 26 Jun (JC). Site max: c.310 L. Venachar 9 Nov; 178 Cambusmore/Gart GP 11 Sep; 176 G. Finglas Resr. 23 Oct; 165 N. Third Resr. 22 Oct; 158 head of L. Tay 13 Feb & 148 L. Voil 29 Jan.

BARNACLE GOOSE *Branta leucopsis* (w)
In our area it can be difficult distinguishing between wild migrants and feral resident birds but most records of the groups between Feb –Mar & Sep – Nov will be of wild birds on migration between Svalbard & the Inner Solway Firth.

F Winter/spring site max: 3 Airth 30 Jan & 1 Skinflats 2 Jan. Autumn/winter site max: 47 Skinflats Pools 16 Oct & 18 Airth 1 Nov.

C Winter/spring site max: 4 Menstrie 23 Jan & 2 Alloa Inches 9 Apr. Autumn/winter site max: 44 Tullibody Inch 15 Oct; 35 R. Forth, Alloa 21 Oct & 2 R. Forth, Cambus 12 Oct.

S Winter/spring: 1 Gartartan (NS 5397) 5 Mar. Autumn/ winter site max: 28 >SW Ashfield 23 Oct; 27 Greenyards, Dunblane 20 Oct; 2 head of L. Tay 23 Oct; 2 Blairdrummond Ponds 5 Nov & 1 Doune 13 Dec. One

Balvag Marshes, Balquhidder 3 May, 28 Aug & 1 Nov is probably the resident feral bird.

*BRENT GOOSE (Brant Goose) *Branta bernicla ssp hrota* (Irr)

F Blackness: 8 on 26/27 & 12 on 28 Sep (WT, GG, DOE); 12 Skinflats Pools 16/17 Oct (AB, MVB) & 1 R. Forth (Clackmannanshire Br.) 12 May (RSm).

C One Kennet Pans 15 May (GG).

SHELDUCK (Common) *Tadorna tadorna* (b, W)

Forth Est. WeBS: 460 in Jan, 688 in Feb, 627 in Mar, 3,459 in Aug, 3,526 in Sep, 1,855 in Oct, 807 in Nov & 217 in Dec.

F Breeding Kinneil: b's of 6 & 8 chicks 21 Jun & 6 & 5Y 20 Jul (AB, NB, RD). Kinneil monthly max: c.300 in Jan, 25 in Feb, 166 in Mar, c.150 in Apr, 65 in Jun, 1,002 in Jul, 1,090 in Aug, c.400 in Sep, 1,452 in Oct & c.250 in Dec. Moult flock max counts: 4,690 ad's + 107 juv Kinneil / Skinflats 10 Aug (DMB). Other site max: c.3,100 Skinflats (offshore) 5 Aug, c.300 Bo'ness 30 Oct & c.250 Blackness 9 Oct.

C Breeding - Tullibody Inch: pr + 3Y 29 Jun (NB). Site max. 144 Kennet Pans 15 Feb; 112 Tullibody Inch 11 Aug; 24 Blackdevon Wetlands 13 Jan; 11 Cambus Village Pools 2 Apr; 2 R. Devon, Alva 13 Mar & 1 Gartmorn Dam 9 Jun.

*S One Allan Water, Kinbuck 7 Mar (CJP); 1 Pendreich Pool (NS 7998) 15 Mar; 2 Blackdub Floods 29 Mar (NB) & 3 head of L. Tay 12 May (JPH).

*MANDARIN DUCK *Aix galericulata* (b, w)

It is unknown whether the following records relate to a bird (s) bred in the wild or escapees.

S Male head of L. Tay 23 Jan & 16 Oct (JPH). 2 Crianlarich (one of which was leucitic – completely white) 14 Apr (IMcP) & ♂ Cultenhove Dam 23 Oct (NB).

WIGEON (Eurasian) *Anas penelope* (s, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	543	337	445	18	208	395	545
Estuary	773	1403	641	139	426	917	1066

F Winter/spring site max: 444 Skinflats (WeBS) 15 Feb & 178 R. Forth, Airth 14 Feb. Autumn/winter site max: 297 Skinflats (WeBS) 19 Dec & 137 Kinneil 13 Dec.

C Winter/spring site max: 554 Alloa Inches 11 Feb; c.300 Cambus 24 Mar & 84 Alva Wetlands 10 Jan. Autumn/winter site max: 292 Tullibody Inch 9 Dec.
S Winter/spring site max: 274 Cambusmore/Gart GP 23 Jan & 116 R. Forth (The Frews) 22 Feb. Autumn/winter site max: 136 R. Forth (The Frews) 12 Dec & 111 L. Coulter 28 Dec.

GADWALL *Anas strepera* (s, w)
F Skinflats Pools monthly max: 1 in Mar, 6 in Apr; 3 in May, 11 in Jun, 14 (incl. a ♀ & 7 juv) in Aug, 8 in Sep, 6 in Oct, 6 in Nov & 3 in Dec. 6 S. Broomage 26 Jun & 3 Kinneil 27 May.
C Breeding: ♀ + b4 chicks Blackdevon Wetlands 19 Jun (CRM). Craigrie Pond: 4 on 14 Mar, 2 on 13 Nov & 1 on 11 Dec. Blackdevon Wetlands monthly max: 4 in Apr, 6 in May & 1 in Aug. Other sites: 5 Devonmouth Pool 31 Mar & pr 9 May; 5 Gartmorn Dam 6 Nov; 4 Fire Sta. Pool (NS 898929) 1 Nov & 2 Black Devon Mouth 20 Apr.
*S One Blairdrummond Ponds 26 Jul & 1 L. Watston 3 Oct & 3 Dec (DOE).

GREEN-WINGED TEAL *Anas carolinensis* (v)
These are possibly the 10th & 11th records but the actual number of different birds is unknown due to the strong possibility of returnees.

*F Male Kinneil 2 Jan (VH, SWo) & ♂ Skinflats Pools 4 Nov (CAM, GD).
*C Male Devonmouth Pool 7 Feb (JRC).

TEAL (Eurasian) *Anas crecca* (b, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	1216	1552	869	361	881	1421	1578
Estuary	2246	2971	1757	1585	2479	2892	2162

F Winter/spring site max: 859 Skinflats (WeBS) 15 Feb; 385 Kinneil 28 Mar & 161 R. Carron (Carron Ho. - A905) 13 Feb. Autumn/winter site max: 906 Kinneil 16 Oct; 527 Skinflats (WeBS) 19 Dec & 170 R. Carron (Carron Ho. - A905) 7 Nov.

C R. Forth (Cambus-Alloa) monthly max: 909 Jan, 844 Feb, 701 Mar, 1,135 Apr, 174 Aug, 600 Sep, 1,045 Oct, 1,384 Nov & 1,061 Dec. Other sites. Winter/spring site max: 218 R. Forth (Fallin-Cambus) 15 Feb & 175 Kennet Pans 15 Feb. Autumn/winter site max: c.250 R. Forth at Cambus 14 Nov; 178 R. Forth (Fallin-Cambus) 7 Dec & c.140 Kennet Pans 12 Dec.

S Winter/spring site max: 320 Cambusmore/Gart GP 23 Jan (90% ice); 212 R. Forth (Stirling Br.-A91) 13 Feb; 175 R. Forth (The Frews) 22 Feb; 154 R. Forth (A91-Fallin) 13 Feb; 131 N. Third Resr. 1 Jan; 106 L. Coulter 23 Jan; Autumn/winter site max: 252 N. Third Resr. 24 Nov; 175 R. Forth (The Frews) 12 Dec; 130 Cambusmore/Gart GP 5 Dec; 128 R. Forth (Stirling Br.-A91) 17 Nov & 114 Wester Loch of Daldorn 13 Oct.

MALLARD *Anas platyrhynchos* (B, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	2049	1750	1220	2193	2515	2368	2058
Estuary	329	295	113	228	218	353	208

BBS/WBBS: recorded at 0.88 b/lkm (1997-2019 av: 0.63 b/lkm; range 0.33 (2007) to 0.98 (2006) b/lkm). Unsurprisingly, the highest recording rate was on WBBS at 5.5 b/lkm. The 19th most frequent species on the 2021 BBS/WBBS.

F Breeding: b's at Larbert Ho L. 7 Apr; Bantaskine Park Pond 30 Apr; Dalderse 17 May; Powfoulis TB 9 Jul & Skinflats Pools 16 Jul (DLT, BP, AB). Site max: c.170 Skinflats Pools 5 Aug.

C Breeding: br. at Devonmouth Pool 22 Apr (DH, GG). Site max: 134 R. Devon (Alva - Tullibody Br.) & 109 Gartmorn Dam 23 Sep.

S Breeding: br's at Ashfield 25 Apr; Doune Ponds 30 Apr; Ochlochy Park 25 May; Airthrey L. 8 Jun & W end of L. Tay 10 Jun (CRM, CJP, MVB). Site max: 254 Airthrey L. 21 Oct; c.220 Blairdrummond Ponds 22 Jan; 191 N. Third Resr. 22 Oct & 129 head of L. Tay 29 Sep.

PINTAIL (Northern) *Anas acuta* (W)
Forth Est. max: 189 in Jan, 190 in Feb, 131 in Mar, 14 in Sep, 79 in Oct, 163 in Nov & 146 in Dec.

F Winter/spring site max: 190 Skinflats (WeBS) 15 Feb & c.50 Kinneil 25 Mar. Autumn/winter site max: 218 Skinflats 17 Nov & 80 Kinneil 19 Dec. Other sites: ♂ Larbert Ho. Loch 22 Jan / 9 Oct (DLT, AB) & 4 Blackness 25 Sep (DOE).

*C Pr Alva Floods 18 Feb (RE); ♀ Alloa Inches 9 Apr (DMB); 2 Longcarse 16 Apr (JRC); 2 Cambus 26 Apr (DOE) & 3> Tullibody Inch 25 Aug (DH).

*S Male L. Rusky 22 Jan (NB); 1 Cambusmore/Gart GP 13 Feb (DOE) & 1 Blairdrummond Ponds 16 Sep – 8 Oct (DOE).

*GARGANEY *Anas querquedula* (s)

C Two Blackdevon Wetlands 21 Apr (CAM).

SHOVELER (Northern) *Anas clypeata* (p)

F Skinflats Pools (monthly max.): 1 in Apr, 3 in Aug, 5 in Sep, 5 in Oct, 3 in Nov & 2 in Dec (AB, AE et al). 1 St Helen's Loch, Bonnybridge 6 Sep (NB) & 3 Blackness 20 Sep (DOE).

C 1 - 2 Cambus Village Pools 27 Mar – 25 Apr (CVW, DH et al) & 1 Blackdevon Wetlands 21 Apr (CAM).

POCHARD (Common) *Aythya ferina* (w)
Inland WeBS: 1 in Feb, 2 in Mar, 1 in Oct & 1 in Nov. Numbers have reduced greatly over the past 15 years and the sp's is now quite scarce away from Skinflats Pools. The peak monthly count in 1995 was 230 (Jan).

F Skinflats Pools (monthly max): 2 in Jan, 18 in Feb, 12 in Mar, 1 in Apr, 9 in Jul, 2 in Aug, 1 in Sep, 2 in Oct, 9 in Nov & 8 in Dec (AB, AE et al).

C Gartmorn Dam (monthly max): 2 in Jan, 1 in Mar & 2 in Oct (CAM, GG). 2 Cambus Village Pools 17 Feb (DH, JRC) & 1 Blackdevon Wetlands 9 Nov (CAM).

*S Cambusmore/Gart GP: ♀ 13 Feb, ♂ 21 Feb, 1 on 5 Mar & ♂ 10 Apr (NB, DT). 1 Blairdrummond Ponds sporadically 30 Jun - 3 Oct (DOE). 1 L. Watston 7 Aug (DOE) & ♂ Ochlochy Pond, Dunblane 28 Dec (CJP).

TUFTED DUCK *Aythya fuligula* (B, W)
Inland WeBS: 292 in Jan, 256 in Feb, 370 in Mar, 126 in Sep, 199 in Oct, 355 in Nov & 320 in Dec.

F Breeding: 8 juv Kinneil Curling Pond 15 Jul (AIB). Site max: 76 Skinflats Pools 1 Jan; 33 Helix Ponds 15 Nov & 30 F & C Canal 3 Jan.

C Gartmorn Dam: Breeding: ♀ + 2 juv 20 Jul (GG). Winter/spring max: 83 on 10 Jan. Autumn/winter site max: 74 on 14 Dec. 40 R. Forth, Longcarse 27 Feb.

S Breeding: Ochlochy Pond: ♀ + 6 chicks 19 Jul; 9 chicks (2 being 'rested' by a Mallard) 25 Jul & b8 FL 11 Aug (CJP, MVB). ♀ + 3 chicks Cambusmore/Gart GP 24 Jul (NB). Winter/spring site max: 61 Airthrey Loch 21 Feb; 47 Cambusmore/Gart GP 13 Mar & 38 Blairdrummond Ponds 7 Mar. Autumn/winter site max: 78 Blairdrummond Ponds 12 Oct; 66 Cambusmore/Gart GP 14 Nov & 42 Airthrey Loch 10 Nov.

SCAUP (Greater) *Aythya marila* (s, w)

F Kinneil monthly max: 5 in Jan, 1 in Feb, 15 in Mar, 16 in Apr, 2 in Aug, 4 in Sep, 8 in Oct, 5 in Nov & 11 in Dec. Skinflats N. Pool: 1 -2 sporadically through the year with a max of 4 on 4 Jan. Other estuary site max: 13 Bo'ness 20 Feb; 2 Powfoulis TB 5 Oct & 1 Blackness 9 Oct. Inland: ♀ L. Ellrig 10 Nov (NB).

*C Gartmorn Dam: ♀ on 12 Mar, ♂ on 22 Mar, 2 on 23 Sep, juv 30 Sep & singles on 4 & 15 Oct (GG, JRC, DMB). 1 Kennet Pans (on Forth) 21 Sep (GG).

*S 1stW ♂ L. Iubhair 4 Jan then at head of L. Tay 9 Jan – 15 Feb (JPH).

EIDER (Common) *Somateria mollissima* (s, w)
Forth Est. WeBS: 2 in Sep, 4 in Oct & 4 in Nov.

F Blackness max: 15 in Apr, 2 in Jun, 4 in Aug, 10 in Sep & 4 in Oct. Bo'ness max: 5 in Feb & 8 in Sep. Kinneil max: 2 in Jan, 3 in Apr, 1 in May, 4 in Jun, 7 in Aug, 10 in Sep, 5 in Oct & 2 in Nov. 9 R. Forth (Powfoulis) 27 Jan.

*LONG-TAILED DUCK *Clangula hyemalis* (w)

F Two Blackness Castle 20 Dec (GD).

S F Lake of Menteith 3 Mar (NB) & ♀/imm Cambusmore/Gart GP 14 & 22 Nov (NB, GG).

*COMMON SCOTER *Melanitta nigra* (w)

F Blackness: 15 on 20 Sep, 3 on 9 Oct & ♂ on 9 Aug (DOE, GG). 1 Skinflats Pools 3 Oct (CVW).

S Male head of L. Tay 10 Jul (JPH).

GOLDENEYE (Common) *Bucephala clangula* (W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	277	328	355	0	10	203	363
Estuary	32	134	62	0	2	19	42

F Site max: 66 R. Forth (S. Alloa-Kinc Br.) 14 Feb.

C Winter/spring site max: 84 R. Forth (Longcarse) 12 Feb; 72 R. Forth (Blackdevon Wetlands) 11 Feb; 66 R. Forth (Cambus) 17 Feb; 52 Gartmorn Dam 12 Mar; 46 (3♂) Devonmouth Pool 17 Feb & 43 R. Devon (Tullibody Br. – Cambus Weir) 17 Feb. Autumn/winter site max: 56 Gartmorn Dam 13 Dec.

S Winter/spring site max: 38 (16 ♂) Lake of Menteith 3 Mar; 35 head of L. Tay 16 Mar; 33 Blairdrummond Ponds 5 Feb; 29 L. Venachar 19 Jan; 29 L. Lubnaig 20 Jan & 20 L. Ard 5 Mar. Summer: up to 7 head of L. Tay May – Aug. Autumn/winter site max: 61 (24 ♂) Lake of Menteith 3 Nov; 26 Cambusmore/Gart GP 5 Dec & 20 head of L. Tay 25 Nov.

*SMEW Mergellus *albellus* (Irr)

F 'Redhead' > up the est. off Kinneil Kerse 9 Dec (JRC).

C Single 'Redheads' R. Forth (opp. mouth of R. Devon) 7 Apr & Devonmouth Pool 14/15 Apr (CVW , DH).

RED-BREASTED MERGANSER *Mergus serrator* (b, W)

Forth Est. WeBS: 33 in Jan, 36 in Feb, 46 in Mar, 121 in Aug, 62 in Sep, 42 in Oct, 78 in Nov & 76 in Dec.

F Kinneil monthly max: 15+ in Jan, 1 in Feb, 12 in Mar, 5 in Apr, 5 in May, 10 in Jun, 65 in Jul, 80 in Aug (moult flock), c.50 in Sep, 23 in Oct, c.25 in Nov & 15 in Dec. Other site max: 31 Bo'ness 29 Aug; 21 Skinflats (WeBS) 15 Feb; 11 Blackness 10 Oct; 10 Higgin's Neuk 28 Nov; 6 Powfoulis TB 11 Dec & 5 Skinflats Pools 20 Feb.

C Site max: 8 Kennet Pans 12 Dec; 5 Alloa Inches 15 Mar; 4 R. Forth (Cambus) 17 Mar; 3 Blackdevon Wetlands 13 Jan; 3 R. Forth (Alloa) 21 Oct; 2 Tullibody Inch 12 Jan; 1 R.

Devon (Menstrie) 13 Mar; & ♂ R. Devon (Cambus) 17 Feb.

S Breeding: head of L. Tay: ♀ + 8 ducklings 12 Aug & ♀ + 7 juv 29 Aug (JPH). Killin / head of L. Tay monthly max: 6 in Apr, 7 in May, 4 in Jun, 3 in Jul & 8 in Sep. Other records: ♂ Strathyre (freezing conditions) 6 Jan (DJC); 2 R. Teith (Lecropt) 6 Feb; 2 R. Forth (Teith-Allan conf's) 16 Feb then 6 on 17 Mar; 1 R. Teith (Lecropt) 6 May & 2 head of L. Katrine 26 Jun.

GOOSANDER (Common Merganser) *Mergus merganser* (B,W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	125	202	138	35	57	118	158
Estuary	19	5	30	35	9	12	18

F Site max: 95 Kinneil & 25 Skinflats (WeBS) 22 Aug; 24 Blackness 6 Sep; 19 Bo'ness 23 Sep; 15 Kinneil 18 Sep & 15 Powfoulis TB 18 Sep. ♂ 'caught a good sized Tench (*Tinca tinca*)' F & C Canal (Underwood) 19 Jan (AIB).

C Breeding: ♀ + 6Y R. Devon (Glenochil) 6 Jun (JS) & ♀ + 7 juv Cambus 23 Jun (RSm). Site max: 70 Gartmorn Dam 14 Dec; 30 Alloa Inches 15 Mar; 19 (11 ♂) Delph Pond (Tullibody) 15 Feb; 19 Tullibody Inch 12 Jan & 18 R. Forth (Cambus) 26 Feb.

S Breeding: ♀ (with Y on back) R. Forth (Aberfoyle) 16 May (DT) & ♀ + 15Y head of L. Tay 4 Jun (JPH). Site max: 51 Blairdrummond Ponds 24 Oct; 24 R. Forth (Stirling Br. – A91) 13 Feb; 13 R. Forth (Lecropt) 24 Jan; 13 L. Venachar & 12 Marl Loch (Argaty) 8 Nov.

RED GROUSE (Willow Ptarmigan) *Lagopus lagopus* (B, W)
BBS/WBBS: recorded at 0.09 b/lkm (1997-2018 av: 0.14 b/lkm. Range: 0.03 to 0.37 b/lkm). Only present in heather habitat and then in small numbers at a rate of 0.26 b/lkm.

*F One Upper Gonachan Glen (Campsies) 14 May (NBM).

*CThree Menstrie Moss 22 Mar; 3 The Nebit (Ochils) 26 Apr & 2 Castle Campbell 1 Jun (GG, AE, AC).

S Site max: c.20 Touch Muir 3 Mar; 7 Lochan Breachlaich 30 Jan; 7 BoD windfarm 28 Feb & 7 Earlsburn Resrs. 23 Oct.

Smaller numbers also recorded at L. Mahaick, Cononish (Tyndrum), Buckieburn Resr., Ben Venue, Sheriff Muir, Beinn Leabhainn (NN 5729), Ben Vorlich – Stùc a' Chroin & Meall Buidhe (G. Ogle).

*PTARMIGAN (Rock Ptarmigan) *Lagopus muta* (b, w)

S Four G. Lochay 26 May (LL); 6 Stob Creagach (NN 4523) 1 Jun (GW); 2 Stùc a' Chroin 24 Apr (GW); 1 Beinn Each 11 Feb (CG); ♀ Ben Lui 24 Apr (GG) & 1 G. Kendrum 15 May (CW).

*BLACK GROUSE *Tetrao tetrix* (b, w)

S Seven (6 ♂) Green Hill 1 Sep (VW); 7 L. Mahaick 3 Apr (DOE); 2 Buckieburn Resr's 3 Jan & 9 Mar (AMcP); 2 lekking ♂ Auchessan (G. Dochart) 30 Apr; 2 ♂ Gleann a' Chlachain (Tyndrum) 2 Aug (JPH); 1 Ardeonaig 28 May (DOE); ♂ Sheriff Muir 21 Mar, 27 Aug, 8 Sep, 24 Nov & 25 Dec (JD, NB, PR, MVB, CJP); 1 Ben A'an 29 May (JT) & ♂ top of Finlarig Power Sta. pipeline 3 Apr (JD).

RED-LEGGED PARTRIDGE *Alectoris rufa* (b, w).

Released for shooting it is thought unlikely that the small feral population is self-sustaining.

*F One Upper Kinneil (Bo'ness) 13 Jun (AIB).

*C Four R. Devon (Balquharn) 7 Oct (LW).

S 142 Stonehill (Dunblane) 24 Nov; 26 Kippenross Cotts (Dunblane) 7 Feb; 2 Kilbryde 18 Apr; 2 Torrie & 2 Whirrieston (Thornhill) 24 Jul & 2 Braes of Doune 29 Sep.

GREY PARTRIDGE *Perdix perdix* (b, w)

Has become very scarce during the last 20 years. A small number of releases helps sustain numbers.

F Site max: 11 Higgin's Neuk 28 Nov; 9 Skinflats fields 17 Sep; 1 A 88, S. Bellsdyke 1 Jun & 1 Kinneil 2 Nov.

C Site max: 9 Menstrie 13 Nov; 8 Craigrie Pond (NS 8991) 11 Dec & 8 Blackdevon Wetland 27 Dec.

S Site max: 4 Carse of Lecropt 30 Jul & 1 B 9124 Cowie 30 Apr.

* QUAIL (Common) *Coturnix coturnix* (b)
S Calling ♂ Glentye Hill 29 Jun (CJP).

PHEASANT (Common) *Phasianus colchicus* (B, W)
Large numbers released on shooting estates, otherwise widespread but in small numbers. Released birds occ. visit gdns for food (& sanctuary?). BBS/WBBS: recorded at 0.41 b/lkm (1997-2021 av: 0.51 b/lkm. Range: 0.22 (2016) to 0.8 (2006) b/lkm).
C Breeding: ♀ + b Blackdevon Wetlands 19 Jun (CRM).
S Breeding: ♀ + 2Y Lake of Menteith 1 Sep (NB). Max: 172 Stonehill, Dunblane 19 Jan.

RED-THROATED DIVER (Red-throated Loon) *Gavia stellata* (b, w)
F Blackness monthly max: 3 in Sep & 8 in Oct (DOE et al); Kinneil monthly max: 1 in Apr, 2 in Aug, 1 in Sep & 5 in Oct (CVW, GG, DB); singles Skinflats (Est.) 16 Oct & 17 Dec (AB) & 1 Bo'ness & Higgin's Neuk 19 Dec (DOE).
*S Two at Trossachs' loch 2 Jun (HT) & 1 calling in flight Duke's Pass, Aberfoyle 24 Jul (CJP).

*BLACK-THROATED DIVER (Black-throated Loon) *Gavia arctica* (b)
S L. Iubhair: 2 on 21 & 26 Apr, 2 on 19 May & 1 on 27 May (JPH). Up to 7 head of Loch Tay intermittently from 18 Apr – 30 Aug (JPH, IYM). 1 G. Finglas Resr. 13 Mar (MW); 1 L. Essan (NN 4128) 17 Jun (JPH) & 1 L. Katrine 14 Sep (TM).

*GREAT NORTHERN DIVER (Great Northern Loon) *Gavia immer*
S One head of L. Tay 4 – 13 Jul is the 13th record for the UF (JPH, DOE) with almost certainly the same bird in Ardchullarie Bay (L. Lubnaig) 7 Jul (DJC) .

BLACK-NECKED GREBE *Podiceps nigricollis* (V)
S One Flanders Moss 3 Mar is only the 4th record for the UF (DAP).

*SLAVONIAN GREBE (Horned Grebe) *Podiceps auritus* (w)
F One Forth Est (Carriden) 2 Jan (SM) & 1 (w. plumage) Kinneil 25 Sep (DMB).
S One Blairdrummond Ponds 29 Sep – 9 Oct (DOE, NB).

LITTLE GREBE *Tachybaptus ruficollis* (B, w)
Inland WeBS: 87 in Jan, 57 in Feb, 45 Mar, 98 in Sep, 64 in Oct, 89 in Nov & 89 in Dec.

F Breeding: Pr + 3 chicks Kinneil Ho Curling Pond 3 May (AIB); pr + 1Y Glen Pool (Lionthorn) 5 Jul (RD) & pr + 6 juv Darnrigg Moss Pools 13 Sep (WT). Site max: 25+ N. Pool, Skinflats 10 Aug; 7 L. Ellrig 6 Sep; 6 Kinneil Ho Curling Pond 14 Mar & 6 Little Denny Resr. 10 Nov.

C Breeding: ad + juv Kersiepow Pond 4 Sep (NB). Site max: 9 Gartmorn Dam 14 Dec & 5 R. Devon (Alva-Tullibody Br) 19 Dec.

S Breeding: 2Y L. Drunkie 15 Jun (NB); ad + 1Y Culnagreine Loch (NN 5503) 17 Jun (NB); ad + juv L. Dochart 5 Jul (JPH); pr + 4Y Cromlix Ho. Loch & 1Y Keeper's Pond (Cromlix) 18 Jul (MVB); 1Y Sheriffmuir Woods Pond 27 Jul (MVB); 3Y Cocksburn Resr. 26 Jul (MVB) & 2 ON & 8 juv Cambusmore/Gart GP 15 Aug (NB). Site max: 39 Cambusmore/Gart GP 11 Sep; 14 Blairdrummond Ponds 22 Aug; 8 L. Watston 28 Mar; 10 L. Ard 4 Jan; 9 L. Dochart 4 Jan; 7 head of L. Tay 24 Jan; 6 R. Forth (Stirling Br. – A91) 9 Jan; 6 L. Lubnaig 20 Jan & 6 L's Doine/Voil 22 Nov.

GREAT CRESTED GREBE *Podiceps cristatus* (b, w)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	0	4	23	24	24	16	2
Estuary	7	6	4	64	52	28	4

F Blackness monthly max: 2 in Mar, 3 in Aug, 23 in Sep, 41 in Oct & 17 in Dec. Kinneil (monthly max): 1 in Jan, 1 in Feb, 1 in Mar, 3 in Apr, 1 in Jun, 4 in Jul, 26 in Aug, 35 in Sep, 51 in Oct, 47 in Nov & 7 in Dec. Other site max 2 Bo'ness 20 Feb; 2 Darnrigg Moss Pools 11 Apr; 1 L. Ellrig 17 Mar & 1 Forth Est (Skinflats) 20 Oct.

C Gartmorn Dam monthly max: 2 in Feb, 8 in Mar, 4 in Sep, 5 in Oct & 5 in Nov. 1 R. Forth, Longcarse 19 Sep.

S Breeding: Cambusmore/Gart GP: 2 ON 22 May; b's of 1, 2 & 3 on 9 Jul; 1 ON & 7 juv 15 Aug & 3 juv 11 Sep (NB). Pr + 3 chicks L. Rusky May (VMH). Lake of Menteith monthly max: 8 in Mar, 6 in Apr; 3 in May, 11 in July, 17 (incl. 5 juv) Sep, 21 in Oct, 11 in Nov & 1 in Dec. Other sites max: 14 Cambusmore/Gart GP 24 Apr; 1 – 2

Blairdrummond Ponds 5 Mar – 10 Apr; 2 L. Coulter 27 Mar; 2 CVR 3 May & 1 L. Venachar 30 Mar & 16 Dec.

GANNET (Northern) *Morus bassanus* (p)

F Autumn: First - 12 Blackness 20 Sep & last - 1 juv Kinneil 2 Nov (DOE, DMB). Site max: 84+ imm's >W Kinneil 29 Sep; 68 >W Blackness 27 Sep; 21 Skinflats (Est) 10 Oct; 12 juv >W Bryce Av (Carronshore) 5 Oct; 19 >W Forth Est. (Powfoulis) 26 Sep & 2 Bo'ness 23 Sep.

*C Four Longcarse 1 Oct & singles on 5 & 10 Oct (DOE, CAM). 1 Alloa Inch 3 Oct (GG).

*S Two juv Ashfield 3 Oct (DO) & 2 juv Kirkton Fm (Tyndrum) 11 Oct (JPH).

CORMORANT (Great) *Phalacrocorax carbo* (S, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	45	132	75	100	115	156	103
Estuary	61	35	33	103	39	90	38

F Site max: 39 Skinflats (WeBS) 1 Oct; 24 Blackness 25 Sep; 24 Higgin's Neuk 21 Feb & 15 R. Forth (S. Alloa – Dunmore) 1 Mar.

C Site max: 83 R. Forth (Cambus) 17 Mar; 43 R. Forth (Alloa) 21 Oct; 42 R. Forth (Longcarse) 2 Sep; c.30 Kinneil 9 Oct; 23 Gartmorn Dam 6 Nov & 15 R. Forth (Fallin – Cambus) 15 Mar.

S Site max: 53 (NH) Carron Valley Resr 12 Sep; 40+ R. Forth (Drip Moss) 14 Feb; 40 Lake of Menteith 3 Nov; 23 head of L. Tay 7 Nov; 17 R. Forth (Stirling Br. – A91) 13 Feb & 11 Cambusmore/Gart GP 10 Oct.

*SHAG *Phalacrocorax aristotelis* (Irr)

F 13 Skinflats Est. 26 Sep (DLT).

*BITTERN (Great) *Botaurus stellaris* (V)

S One flushed at close range from R. Forth reed-clump (Craigforth) >E 24 Jan is the 5th record for the UF area (DMB).

LITTLE EGRET *Egretta garzetta* (w, s)

Steadily becoming more frequent.

F One Kinneil 1 Jan & 29 Sep; 1 – 3 Skinflats Pools & saltmarsh 22 Jan – 23 Apr & 5 Nov - 12 Dec; 1 Powfoulis

TB 27 Jan, 27 Feb, 9 Dec, 19 Dec with 2 on 28 Nov; 1 Higgin's Neuk 16 Jan, 21 Feb & 2 on 1 Nov & 1 R. Forth (Dunmore) 7 Apr.

C One Alva floods 10 Jan & 19 Dec; 1 R. Devon (Alva – Tullibody Br.) 11 Jan & 6 Feb; 1 Alloa Inches 12 Jan; 1 mouth of Black Devon 15 Feb; 2 S. Alloa 18 Mar; 1 Blackdevon Wetlands 25 Apr; 1 periodically (mostly in flight) Cambus 22 Feb - 6 May & 28 Oct & 1 Longcarse 27 Feb & 9 May.

S One Craigforth 25 Jan; 1 >N Ochlochy Park (Dunblane) 1 Mar; 1 Allan Water (Kinbuck) 7 Mar then 4 & 28 Dec; 1 R. Teith (Lecropt) 15 Mar; 1 Blackdub Floods 29 Mar; 1 >S Dunblane 2 Oct; 1 >S Allan Water (BoA) 18 Nov & 1 N. L. Lubnaig 22 Dec (DJC).

GREY HERON *Ardea cinerea* (B, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	67	68	46	102	86	86	77
Estuary	39	17	10	64	78	62	27

BBS/WBBS: recorded at 0.11 b/lkm (1997-2011 av: 0.12 b/lkm. Range 0.03 (1997) to 0.23 (2005) b/lkm). The highest recording rate was on farmland at 0.25 b/lkm followed by WBBS at 0.23 b/lkm.

F Breeding: 10 aon's Kinneil Wood (AIB) & 1 aon Dalderse Sewage Works 31 Mar (AB). Site max: 45 Skinflats (WeBS) 14 Nov; 22 Airth shore 31 Jan & 12 Kinneil 12 Sep.

C Breeding: 2 birds carrying twigs into a mature conifer belt on SE corner of the Blackgrange Bond 15 Feb & 'birds heard in nest' there (NS 850939) 14 Apr (DH, GG). Site max: 12 Tullibody Inch 12 Jan.

S Breeding: 11 aon's Nyadd 28 Apr (NB). Site max: 18 (mostly juvs) Cambusmore/Gart GP 15 Aug; 13 Blairdrummond Ponds 5 Feb & 8 head of L. Tay 31 Jul.

*GLOSSY IBIS *Plegadis falcinellus* (V)

S One Blairdrummond Ponds 21 – 26 Nov is the 5th record (4th bird) for the UF (DOE, CAM, IG et al). (See Plate C1)

*SPOONBILL (Eurasian) *Platalea leucordia* (Irr)
C One R. Forth (Haugh of Blackgrange, NS 8492) feeding in shallow water 31 Mar & 1 Longcarse 3 Jun (DH, DOE).
S One Bandeath 3 Jun is the same bird as above (CJP).

RED KITE *Milvus milvus* (b ,W)
Inland WeBS counts: 4 in Jan, 6 in Feb, 2 in Mar, 3 in Sep & 1 in Dec.
*C One Myreton Hill 14 Feb & 20 Mar; 1 Menstrie Glen 5 Mar; 2 Colsnaur Hill 22 Mar; 1 Dollar Glen 10 Jun; 1 Longcarse 4 Sep & 1 Cambus Pools 23 Oct (GG, KH, JRC, JD).
S Breeding: 25 pairs were on territory from which 24+ young fledged (CSRG per DOE). Max of 40 Argaty 19 Oct & 7 Braes of Doune 22 Jun. Regular around BoD, BoA, Callander, Cromlix, Doune, Dunblane, Sheriff Muir & Stirling. Occ. sightings around Aberfoyle, Balquhidder, Edinchip, Flanders Moss, G. Ample, G. Dochart, G. Ogle, Killin, Kippen & Menteith.

*WHITE-TAILED EAGLE *Haliaeetus albicilla* (s, w)
S Juv at a Red Deer (*Cervus elaphus*) 'gralloch' G. Ample 4 Jan; 1 Bracklinn, Callander 15 Apr; 1 Acharn Woods, Killin 29 Apr; 1 Lochearnhead 8 Aug; 1 Craigforth, Stirling 18 Aug; 1 Lime Hill (NS 4696) 19 Aug; 1 L. Dochart 2 Sep; 1 Balquhidder 7 Sep; 2 ad's + 1 juv Kirkton Fm, Tyndrum 15 Sep; 2 Crianlarich 2 Oct; 2 Inverhaggernie, Strath Fillan 11 Oct; 1 L. Iubhair 7 Nov & 2 Inverhaggernie 7 Dec (DJC, DOE, CG, DP, JPH, IYM).

MARSH HARRIER (Western) *Circus aeruginosus* (p, s)
F 16 records of single birds (5 ♀ 3 juv were identified) in the Skinflats Pools area 10 Apr – 29 Sep [2 birds] (SWo, WT, AB et al). Kinneil: 1 on 1 Aug & juv on 5 Aug & 1 Sep (JRC, MVB, DMB). Juv Kinc. Br. 19 Sep MVB).
C Tullibody Inch area: Pr + 3 juv 25 Jul (DH, DR). 50 records, first an imm ♂ 27 Mar & last 3 on ♀ 8 Sep (JRC, CVW). Blackdevon Wetlands: ♀ 31 Mar, 1 on 29 Jun, 1 on 15 Aug & 29 Sep (CRM, DOE, BD). ♀ Devonmouth Pool 5 May (DH).

*HEN HARRIER *Circus cyaneus* (b? w)
F One Skinflats Pools 10 Feb & Threaprig (NS 8374) 17 Nov (AE, MH).

C One ♀Tullibody Inch 20 Jan; ♀/imm Kennet Pans 3 Feb; ♀ R. Forth (Cambus) 9 Feb; 1 Menstrie Glen 5 Mar & 1 Alva Glen 14 Mar (DH, GG, JRC, IYM).

S One ♀ Carleatheran (NS 6891) 2 Jan; ♂ R. Forth (Killin) 17 Jan; 1 The Bows 7 & 18 Feb, 3 on 18 Aug & 1 on 26 Dec; 1 Buckieburn Resr. 10 Feb; ♂ Braeval (Aberfoyle) 21 Feb, 1 Braeleny (Callander) 13 Mar & 7 Apr; ♂ Braes of Doune (windfarm) 14 Mar; 1 Ben Vane 28 Apr; 1 Braes of Doune 22 Jun; ♂ Sheriff Muir 23 Sep; 1 Buckieburn Resr. 25 Sep; ♀/imm Kinnell (Killin) 25 Sep; ♂ Flanders Moss 12 Oct; ♂Buckieburn Resr. 14 Nov & 1 L. Ard Forest (NN 4008) 24 Nov (CRM, RJS, DOE, AMcP, CG, PR, CJP, WA, JPH, JS, PM).

*GOSHAWK (Northern) *Accipiter gentilis* (b, w)

S Breeding: 10 pr's bred but productivity low with broods of only 1 - 2. These are quite widely spread so there are possibly more (DOE per CSRSG). Other records: pr Balquhidder Sta. 30 Jan & pr G. Ample 15 Mar (DJC); 1 Touchadam Muir 31 Jan (JD); ♂ Kippenrait (Dunblane) 16 Feb (CJP); ♂ Mine Wood (BoA) 13 Mar (DMB); 1 Ashfield 17 Mar (CRM); displaying ♂ Cromlix Lodge 23 Mar (MVB); juv ♀ Waltersmuir Wood, Dunblane 7 Oct (MVB); 1 The Bows 24 Oct (DOE) & ad ♂ Kippenross Cotts, Dunblane 14 Dec (MVB).

SPARROWHAWK (Eurasian) *Accipiter nisus* (B, W)

Inland WeBS counts: 3 in Jan, 3 in Feb, 1 in Mar, 3 in Sep, 4 in Oct, 5 in Nov & 5 in Dec. Thinly spread throughout the majority of the recording area. Contributors are encouraged to submit breeding records.

F Max: 4 Skinflats Pools 12 Aug.

C Bird caught a Tree Sparrow in a Cambus gdn 7 Jul (DH).

S Breeding: displaying pr Cromlix 17 Mar (CRM); 2 FL/juv calling Kippenross Cotts. (Dunblane) 8 Aug (MVB). 5 BoA 13 Mar & recorded over central Dunblane 20x 6 Jan – 15 Nov (CRM).

BUZZARD (Common) *Buteo buteo* (B, W)
The most numerous raptor recorded throughout the majority of the recording area. Contributors are encouraged to submit breeding records.
Inland WeBS counts: 45 in Jan, 35 in Feb, 58 in Mar, 34 in Sep, 34 in Oct, 33 in Nov & 24 in Dec.
BBS/WBBS: recorded at 0.3 b/lkm (1997-2021 av: 0.36 b/lkm. Range: 0.24 (2013) to 0.55 (1997) b/lkm). Recorded at between 0.32 b/lkm – 0.48 b/lkm in all habitat categories apart from 'mountain & moorland' where the rate was 0.17 b/lkm and 'urban & suburban' where it was 0.07 b/lkm.
F Max: 5 Camelon cemy 19 Mar & 5 Skinflats Pools 18 Sep.
C Breeding: Nest 'with alarming bird nearby' Ochils Woodland Park 15 Apr (GG) & ad + 2 calling juvs Howietoun Ponds 20 Aug (NB). Max: 6 Birkhill Plantation 1 Mar.
S Site Max: 22 Sheriff Muir 19 Mar; 15 Drumloist Rd 14 May; 6 Braeleny (Callander) 13 Mar; 6 BoA 13 Mar & 2 Apr; 6 Cambusmore/Gart GP 13 Mar; 6 The Bows 21 Mar & 6 Essmitchell, BoD 12 May.

*HONEY BUZZARD (European) *Pernis apivorus* (b)
Breeding: a population in the Trossachs contained 1-4 territories (CMcI et al).
S One Lix Toll 18 Jul (DOE).

GOLDEN EAGLE *Aquila chrysaetos* (b, w)
S. Eleven territories were checked with nine pairs recorded. One territory had only a single bird while the final one was unoccupied. Two successful pairs reared two young (per DOE). Outwith breeding season: 1 Strathyre 29 Jan; 1 Lochan Breaclaich (Killin radio mast) 30 Jan & 17 Nov; 1 L. Iubhair 30 Jan; sub-ad Auchtertyre Glen (NN 3531) 2 Mar; 1>W Killin 7 Mar & 1 over Killin 14 Aug; 1 Ben Our 20 Aug; 1 Cruach Ardrain 27 Aug; 2 Tyndrum 31 Aug; 3 Upper Keltie Water 21 Oct; pr Inverlochlarig 25 Oct; 1 Crianlarich 1 Dec & 2 Inverhaggernie (NN 3726) 3 Dec.

OSPREY (Western) *Pandion haliaetus* (B)
Breeding: 52 nests (DOE per CSRSG). First of the year: one Doune 17 Mar (DOE). Last record: one CVR 12 Sep (JS).
*F One Rashiehill (NS 7781) 19 Aug (AD).

*C One Gartmorn Dam 29 Jul, 26 Aug, 1, 3 & 4 Sep (GG, DOE, TP).
S Present and nesting throughout the district, particularly CVR, Callander, Cringate Muir, Doune, Flanders Moss, Menteith, L Tay / G. Dochart & the Trossachs.

KESTREL (Common) *Falco tinnunculus* (B, W)
Inland WeBS counts: 3 in Jan, 4 in Feb, 4 in Mar, 5 in Sep, 2 in Oct, 4 in Nov & 5 in Dec. (Spread thinly throughout most of the recording area. Contributors are encouraged to submit breeding records. Normally only single birds seen).
F Breeding: Skinflats Pools: pr at nest box 13 Mar, ad feeding 2 v. vocal juv 26 Jun & 5 (incl 3 juv) Skinflats Pools wood 6 Jul (SWo, AB). 2 ad + min 2 juv Christie Dr, Falkirk (NS 8781) 26 Jun.
C Breeding: ♂ leaving nest box with ♀ hunting in nearby council yard, Blackdevon Wetlands 21 Apr (CAM). Max: 4 Blackdevon Wetlands 15 Aug.
S Pr displaying Ashfield 17 Mar (Trek); 6 Sheriffmuir Rd 30 Mar & juv Sheriff Muir 27 Aug.

*HOBBY (Eurasian) *Falco Subbuteo* (v)
S Breeding: there were 3 territories in the recording area (per CMcI). 1 Ochtertyre (NS 7694) 13 Jul (RDG) & 1 BoA 29 Sep (DMB).

*MERLIN *Falco columbarius* (b? w)
F Skinflats area: 1 on 4 / 9 Jan & 21 Feb (CAM, SWo, CVW). 1 Kinc. Br. 21 Feb (MVB) & 1 Powfoulis TB 19 Dec (DOE).
C One Coalsnaughton 24 Dec (DOE).
S One Whirrieston (Thornhill) 6 Feb; 1 Sheriff Muir 19 Mar (DOE) & 1 (chasing Skylark & Redwing) BoD 23 Oct (CRM).

PEREGRINE FALCON *Falco peregrinus* (B, W)
Breeding: 30 territories were checked with 17 occupied by pairs, five where only single birds were seen and eight apparently unoccupied. Ten successful pairs fledged 25+ young (per DOE). Widely, but thinly spread outwith the breeding season, mostly in lowland areas (incl. urban centres) and especially along the tidal R. Forth and estuary.
F Vocal ad carrying prey & mobbed by Carrion Crow over Bryce Av, Carronshore 2 Jan (AB).

S Single birds (ad ♂ imm ♀) were recorded on Dunblane Cathedral from 2 Jan to 16 Feb then from 16 Aug to 31 Dec. Prey incl. Great Spotted Woodpecker, Fieldfare, Redwing, Mistle Thrush, Starling & Goldfinch (CRM et al).

WATER RAIL *Rallus aquaticus* (b, w)
Widespread in suitable habitat. Most records are of birds heard rather than seen.

F Breeding: 3 juv Reid's Pond, Mungal, (NS 877818) 26 Jun (SWo) & 1 Juv Skinflats Pools 20 & 22 Aug (AB, MVB). 4 Skinflats Pools 28 Aug. Also recorded at: Carron Dams & Carronshore.

C Site max: 4 Tullibody Inch 16 Apr / 22 Aug & 4 Cambus Pools 9 Mar. Also recorded at: Blackdevon Wetlands, Gartmorn Dam, R. Devon: upstream of Cambus, Glenochil & Dollar-Tillicoultry. Also Midtown, R. Forth.

S Three L. Iubhair 27 Jul. Also recorded at Blairdrummond Ponds, Cambusmore/Gart GP, Killin Marshes & L. Watston.

MOORHEN (Common) *Gallinula chloropus* (B, W)
Inland WeBS: 118 in Jan, 120 in Feb, 113 in Mar, 103 in Sep, 140 in Oct, 146 in Nov & 141 in Dec.

F Breeding: ad + 2 chicks Larbert Loch 1 May (AB); pr + 2Y Glen Pool (NS 8778) 28 May (RD); 3 ad + 4 juv Kinneil Ho Pond 15 Jul (AIB); pr + 1 chick Bantaskine Park Pond 2 Aug (BP) & juv St Helen's Loch 6 Sep (NB). Other site max: 32 F & C Canal (R. Carron – M80 (13.1 km)) 16 Mar; 17 Kinneil Ho. Pond 13 Dec; 16 Callendar Park Loch 9 Oct; 16 F & C Canal (Lock 16 - R. Carron) 17 Nov; 12 Skinflats Pools 18 Sep & 10 Larbert Hosp. Ponds 6 Jan.

C Breeding: ad + 1Y Cambus Village Pool 6 May (DH) & Juv Delph Pond 4 Sep (NB). Site max: 12 R. Devon (Alva-Tullibody Br) 14 Nov & 10 Gartmorn Dam 20 Sep.

S Breeding: 1 FL & 3 juv Airthrey Loch 26 Jul (MVB) & 2Y Ochlochy Pond 25 Jul (CJP). Site max: 40 Airthrey Loch 10 Nov.

COOT (Common) *Fulica atra* (B, W)
Inland WeBS: 132 in Jan, 146 in Feb, 204 in Mar, 97 in Sep, 197 in Oct, 181 in Nov & 216 in Dec.

F Breeding: 6 ads + 8 juv Kinneil Ho Pond 15 Jul; (AIB). Site

max: 82 Skinflats N Pool 8 Aug; 47 Helix Park Pond 31 Jan; 32 Callendar Park Loch 9 Oct & 25 Kinneil Ho Pond 9 Oct.

C Max: 21 Gartmorn Dam 13 Dec.

S Breeding: Airthrey Loch: 3 ON 1 Apr; 1 ON, 1 N4Y + 13 b's (38 FL – most 6-8 weeks old) 8 Jun; 2 b's of 2 (c.6 weeks old) & 9 juv 26 Jul. (MVB). Pr + 6 chicks Ochlochy Pond 7 May, 3Y 27 Jun but just 1 juv left 25 Jul (CJP). Ad + 2 FL Ashfield Pool 3 Jun (MVB). Site max: 86 Airthrey Loch 10 Nov & 46 Lake of Menteith 3 Mar.

OYSTERCATCHER (Eurasian) *Haematopus ostralegus* (B, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	3	69	252	0	0	3	1
Estuary	456	583	223	500	353	303	199

BBS/WBBS: recorded at 0.33 b/lkm (1997-2021 av: 0.66 b/lkm. Range 0.24 (2016 & 2018) to 1.64 (2003) b/lkm). Recorded in all habitat categories except conifer with the highest rate being on WBBS at 1.09 b/lkm.

F Site max: c.270 Kinneil 5 Aug; 217 Skinflats (offshore) 5 Aug & 125 R. Forth (Alloa – Kinc. Br.) 14 Feb.

C Site max: 54 Tullibody Inch 11 Feb.

S Breeding: pr + 2 chicks Keir roundabout 7 May (CRM); 2 aon Cambusmore/Gart GP 22 May with 1 juv 19 Jun (NB) & pr + 2 FL Barbush B8033 roundabout (Dunblane) 26 May (MVB). Site max: 82 Blairdrummond Ponds 7 Mar. Winter inland: 2 Blairdrummond Ponds 1 Jan & 1 on 23 Jan; 2 Cornton 10 Jan; 1 Lecropt 23 Jan; 1 Craigforth 25 Jan & 3 Airthrey Loch 26 Jan. 1 - 2 Blairdrummond Ponds Nov & Dec & 2 R. Forth (Lecropt) 28 Dec.

*LITTLE RINGED PLOVER *Charadrius dubius* (b)

C Two CVP 12 & 19 Apr with 1 on 26 Apr (DH, GG). Tullibody Inch: 2 on 1 / 2 May, 1 on 10 Jul & ad + juv 29 Aug (DH, DOE, BA, DMB); 2 Alloa Inch 22 May (AD) & 1 Blackdevon Wetlands 19 Jun (CRM).

S Breeding: Pr Cowie Quarry 13 Jun & ON 3 Jul (DMB). Other records: 4 N. Third Resr. 12 Apr then 3 on 14 Apr (DM, CJP); 3 Cambusmore/Gart GP 24 Apr with 2 on 22 May (NB); 1 head of L. Tay 26 Apr – 2 May (JPH); 1 R. Teith (Carse of Lecropt) 2 May (DOE) & 2 Touch Resrs 8 May (JD).

*DOTTEREL *Charadrius morinellus* (Irr)
C Juv Ben Cleugh 22 Aug (WM).
S Juv Ben Ledi 1 Nov (PP).

RINGED PLOVER (Common) *Charadrius hiaticula* (b, W)
Forth Est. WeBS: 3 in Jan, 1 in Mar, 17 in Sep, 24 in Oct & 6 in Nov.
F Site max: 49 Skinflats Pools 20 Aug; 38 Kinneil 13 Dec; 30+ Blackness Castle 11 Oct / 20 Dec & 14 Powfoulis TB 23 Aug.
*C Eight Kennetpans 27 Apr (GG). 1 Longcarse 29 Apr & 4 on 2 Aug (DT) & 2 ad's + juv Tullibody Inch 4 Jul (DMB).
*S Monthly max Cambusmore/Gart GP: 1 on 21 Feb, 2 in Mar, 3 in Apr, 1 in May, 2 in Jun & 1 in Jul. Monthly max head of L. Tay: 2 on 20 Apr, 3 in May, 3 in Jun & 8 in Aug.

GOLDEN PLOVER (European) *Pluvialis apricaria* (B, W)
Forth Est. WeBS: 15 in Sep, 250 in Oct, 428 in Nov & 186 in Dec.
F Monthly max Kinneil: 23 in Jan, c.40 in Mar, 1 in Aug, 98 in Sep, 184 in Oct, c.90 in Nov & c.80 in Dec. Monthly max Skinflats Pools area: 10 in Jan, 23 in Sep, 318 in Oct, 394 in Nov & c.120 in Dec. 18 Blackness 6 Oct.
*C Three Longcarse 2 Oct & 16 Ben Cleuch 23 Oct (DOE, JD).
S Breeding: one displaying Ben Ledi 29 Jun (DMB) & 2 Sgiath Chrom (NN 4730) 30 Jun. Other records: 1 head of L. Tay 10 Feb; 4 Gargunnock Hills 3 Mar; 1 Kirkton Fm (NN 3528) 13 Mar & 11 on 7 Apr; 23 Flanders Moss E 13 Mar; 2 Whirrieston, Thornhill 21 Apr; 1 Ledcharrie, G. Dochart 22 Apr; 4 L. Coulter 27 Sep & c.130 Hilton (NS 5996) 23 Oct.

GREY PLOVER *Pluvialis squatarola* (p/w)
F Monthly max: Skinflats Pools & shore: 5 in Jan, 1 in Aug, 23 in Sep, 47 in Oct, 6 in Nov & 1 in Dec. Singles Powfoulis TB 15 Aug & 9 Dec. Max 2 Blackness 2 Sep – 10 Oct.

LAPWING (Northern) *Vanellus vanellus* (B, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	115	197	153	74	124	63	92
Estuary	5	290	25	1057	1354	1131	687

BBS/WBBS: recorded at 0.1 b/lkm (1997-2021 av: 0.64 b/lkm. Range 0.1 (2019 & 2021) to 1.72 (2000) b/lkm). The highest recording rate was on WBBS at 0.68 b/lkm.

F Kinneil monthly site max: 40 in Jun, 75+ in July, c.370 in Aug, c.500 in Sep, c.270 in Oct & 291+ in Dec. Skinflats Pools area monthly max: 26 in Jan, 5 in Mar, c.40 in Jun, c.120 in Jul, 231 in Aug, c.400 in Sep, 677 (WeBS) in Oct, 524 (WeBS) in Nov & 493 (WeBS) in Dec. Other site max: 262 Powfoulis TB 9 Dec & 207 Blackness 2 Sep.

C Breeding: 'several prs, 1 with 3 Y' Alva Floods 3 Jun (GG). Monthly max Longcarse: c.300 in Aug, c.300 in Sep, 466 in Oct & c.480 in Nov. Other sites: c.250 Devonmouth Pool 11 Aug; 95 R. Forth (Fallin – Cambus) 4 Oct; c.90 R. Devon (NS 8696) 23 Jan & c.90 Ditch 4 Feb.

S Breeding: 1 ON Ashfield 25 Apr (MVB). Site max: c.70 Blairdrummond Ponds 5 Feb.

KNOT (Red) *Calidris canutus* (W, s)

Forth Est. WeBS: 4,128 in Jan, 1,950 in Feb, 236 in Mar, 52 in Sep, 191 in Oct, 343 in Nov & 832 in Dec.

F Kinneil monthly max: 4,128 in Jan, c.1,950 in Feb, c.270 in Mar, 12 in Apr, 22 in Aug, c.50 in Sep, c.188 in Oct, 342 in Nov & 832 in Dec. 'Summering' birds: Kinneil: 1 on 11 May & 4 on 31 Jul. Skinflats Pools area monthly max: c.50 in Jan, 3 in Mar, 2 in Jun, 5 in July (2 in breeding plumage), 4 in Aug, 28 in Sep, c.20 in Oct, c.1,000 in Nov & c.50 in Dec. Other site max: c.180 Bo'ness & 8 Blackness.

*SANDERLING *Calidris alba* (p)

F Four Blackness 12 Aug & 4 Skinflats Pools 5 Sep (DOE).

*LITTLE STINT *Calidris minuta* (p)

F Juv Reid's Ponds, Mungal (NS 8781) 6 Sep (SWo).

C One Longcarse 11 Sep (JRC).

*CURLEW SANDPIPER *Calidris ferruginea* (p)

F Skinflats Pools: max 4 juv from 7 - 10 Sep & 4 on 26 Sep. Juv 4 Oct (SWo, WT, DOE, AB). 1 Kinneil 20 Sep (DOE).

DUNLIN *Calidris alpina* (b? W)
Forth Est WeBS: 4,999 in Jan, 3,881 in Feb, 330 in Mar, 1,468 in Sep, 2,055 in Oct, 2,736 in Nov & 2,158 in Dec.
F Kinneil monthly max: 4,073 in Jan, 2,795 in Feb, 41 in Mar, 15 in Apr, 20 in May, 3 in Jun, 15 in Jul, 52 in Aug, 491 in Sep, c.1,660 in Oct, 2,164 in Nov & c.1,500 in Dec. Skinflats Pools & shore monthly max: 915 in Jan, 976 in Feb, 289 in Mar, 24 in Apr, 50+ in Jul, c.120 in Aug, 976 in Sep, c.380 in Oct, c.2,000 in Nov & 1,323 in Dec. Other sites max: c.50 Blackness 2 Sep.
C Monthly max Longcarse: 1 in Feb, 1 in May, 18 in Aug, 42 in Sep, 23 in Oct & 19 in Dec. 105 Kennet Pans 3 Feb.
*S Monthly max head of L. Tay: 2 in Apr, 18 in May, 2 in Jun & 2 in Jul. (JPH). 3 L. Coulter 27 Sep (AMcP).

*RUFF *Philomachus pugnax* (w, p)
F Skinflats Pools: ♂ Skinflats (offshore) 5 Aug (MVB) & juv ♂ Skinflats Pools 17 / 18 Sep (AB, RD, DOE).
C Longcarse: 6 on 29 Aug, 4 from 4 - 6 Sep, 2 on 10 Sep then 1 on 11 Sep (BA, DMB, JRC, CVM, CAM, GG).

*JACK SNIPE *Lymnocryptes minimus* (w)
F Five Powfoulis TB 21 Jan with 3 on 29 Jan (CRM); 1 Skinflats Pools 4 Jan & 28 Nov (CAM, DOE); 1 by R. Carron (NS 8581) 17 Jan (AE) & 1 Skinflats (flood pool in stubble field) 1 Dec (AB).
C One Myreton Hill ('tiny patch of unfrozen bog') 14 Feb (GG); 1 Kennet Pans 3 Feb & 12 Dec (GG); 1 Blackdevon Wetlands 31 Mar & 30 Nov (CRM, CAM) & 1 Kennet 27 Dec.
S One Allan Water at Netherton 10 Oct (MS); 1 Ashfield Pools 14 Oct (CJP); 2 Doune SuDS 21 Nov with 4 there on 28 Nov (DOE, RDG); 1 L. Watston 3 Dec & 2 Balvalachlan (NN 6306) 29 Dec (DOE).

SNIPE (Common) *Gallinago gallinago* (B, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	63	69	15	27	75	63	114
Estuary	4	11	0	0	11	5	4

BBS: recorded at 0.14 b/lkm (1997-2019 av: 0.1 b/lkm. Range 0.03 (1998) to 0.21 (2018) b/lkm). They were recorded on both mountains & moorland & deciduous, scrub & marsh at 0.22

b/lkm.

F Site max: 18 Larbert Hosp. Ponds 9 Oct & 15 Powfoulis TB 21 Jan.

C Site max: 51 Blackdevon Wetlands 10 Dec; 27 Gartmorn Dam 10 Feb & 14 Longcarse 25 Aug & 1 Oct.

S Breeding: nest predated by Carrion Crow Strathyre 7 Jun (DJC). Site highs: 36 (NH) Howietoun Ponds 30 Oct; 14 Ashfield Pools 14 Oct & 15 L. Coulter 15 Sep.

WOODCOCK (Eurasian) *Scolopax rusticola* (B, W)

Widely, but thinly spread. Resident numbers greatly bolstered by winter visitors. Underreported.

F Singles recorded at Braeface, Carronshore, Drum Wood (High Bonnybridge), Howierigg Moss, Kinneil, Larbert area & Skinflats Pools.

C Max: 16 Dollar 13 Feb; 4 R. Forth (W of Blackgrange) 13 Feb & 2 R. Devon (Alva) 7 Nov. Also: Devonmouth Pool (2) & Cambus Pools.

S Max: 12 Callander 29 Dec & 11 Duncroisk, G. Lochay 13 Feb. Also recorded at Auchtertyre, Strath Fillan, Argaty (3), Balquhidder, BoA, Buchlyvie, Cambusmore/Gart GP (2), Cromlix, Dunblane Cathedral, Doune SuDS, G. Ample, G. Dochart, Killin Marshes, Kippenrait, Dunblane, L. Achray (2), R. Forth, Kippen, R. Teith (Lanrick & Lecropt) & Strathyre.

BLACK-TAILED GODWIT *Limosa limosa* (W, S)

Forth Est. WeBS: 1,137 in Jan, 516 in Feb, 903 in Mar, 1,699 in Aug, 1,253 in Sep, 1,536 in Oct, 178 in Nov & 1,088 in Dec.

F Kinneil monthly max: 1,044 in Jan, 21 in Feb, c.400 in Mar, 539 in Apr, 6 in May, 8 in Jun, 621 in Jul, 1,655 in Aug (WeBS, NH), 1,158 in Sep, 1,142 in Oct, 85 in Nov & 768 in Dec. Other sites max: c.940 Airth shore 31 Jan & 198 Skinflats (WeBS) 19 Dec.

C Site max: 484 Kennet Pans 15 Feb; 13 R. Devon (Menstrie) 4 Aug; present CVP 10 Apr – 28 Jun with max of 10 on 24 Apr; 5 Blackdevon Wetlands 10 Dec; 4 Tullibody Inch 25 Aug & 1>E R. Forth (Cambus) 4 Mar.

*S Head of L. Tay: 94 on 20 Apr, max 3 from 10 – 13 Jul & bird with a broken right leg 29 Jul (JPH). C.70 Whirrieston, Thornhill 21 Apr (DOE) & 4 R. Forth (Drip Moss) 14 Mar (MSh).

BAR-TAILED GODWIT *Limosa lapponica* (W)
Forth Est. WeBS: 227 in Jan, 73 in Feb, 7 in Sep, 12 in Oct, 95 in Nov & 153 in Dec.

F Kinneil monthly max: 204 in Jan, 67 in Feb, 15 in Mar, c.50 in Apr, 20 in May, 6 in Jun, 5 in Jul, 38 in Aug, 17 in Sep, 11 in Oct, 95 in Nov & 147 in Dec. Other site max: c.120 Bo'ness 30 Oct; c.40 Skinflats Pools 11 May & 12 Blackness 3 Sep.

*C 35 Kennet Pans 30 Jan (GG); 2 Longcarse 23 Sep (DOE) & 1 Tullibody Inch 5 Jan (JS).

WHIMBREL *Numenius phaeopus* (p)

F Kinneil monthly max: 1 in Feb, 1 in Jun, 1 in Jul & 1 in Aug. Other sites: 2 Blackness 26 Apr then 1 on 7 May & 13 Aug; 1 Skinflats Pools in Apr, May, Aug & Sep & 1 Powfoulis TB 26 Apr & 12 Aug.

C Longcarse monthly max: 2 in Apr, 2 in May, 3 in Jun & 3 in Sep.

*S Two head of L. Tay 9 May (JPH) & 1 R. Forth, Drip Moss 18 Mar (MSh).

CURLEW (Eurasian) *Numenius arquata* (B, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	24	73	242	3	34	46	208
Estuary	587	1438	920	705	804	787	528

BBS/WBBS: recorded at 0.2 b/lkm (1997-2019 av: 0.56 b/lkm. Range 0.2 (2021) to 0.98 (2003) b/lkm). The highest recording rate was on mountain & moorland at 0.41 b/lkm.

F Kinneil monthly max: 302 in Jan, 220 in Feb, 134 in Mar, 315 in Aug, 186 in Sep, 353 in Oct, 339 in Nov & 198 in Dec. Skinflats monthly max: 221 in Jan, 466 in Feb, 463 in Mar, c.50 in Apr, 368 in Aug, 332 in Sep, 148 in Oct, c.300 in Nov & c.80 in Dec. Other site max: c.540 Powfoulis 21 Jan; c.120 Blackness 10 Oct; 117 R. Forth (S. Alloa – Kinc. Br.) 14 Feb & 92 Higgin's Neuk 21 Feb.

C R. Forth (Cambus-S. Alloa) monthly max: c.350 in Jan, 573 in Feb, 225 in Mar, 85 in Apr, 78 in Jul, 126 in Aug, 37 in Sep, 216 in Oct, 186 in Nov & 56 in Dec. Other site max: c.300 Cambus 1 Feb; 178 Kennet Pans 19 Dec; 176 Haugh Cott Fields 2 Nov; c.100 Park Fm 15 Feb & 78 R. Devon (Menstrie) 4 Aug.

S Site max: 138 Allan Water (Kinbuck) 7 Mar & 82 head of L. Tay 1 Mar.

COMMON SANDPIPER *Actitis hypoleucos* (B)
BBS/WBBS: recorded at 0.09 b/lkm (1997-2021 av: 0.07 b/lkm. Range 0.05 (1999) to 0.12 (2017) b/lkm). First of year: 1 Touch Resrs 5 Apr (JD) with general arrival from 10 Apr. [22-year range: 26 Mar – 21 Apr]. Last of year: 1 Longcarse 10 Oct (DOE).
F Site max: 10 Kinneil 7 Aug; 7 Powfoulis TB 16 Jul & 5 Skinflats Fields 20 Aug.
C Site max: 15 Tullibody Inch 11 Aug.
S Site max: 11 head of L. Tay 5 May; 8+ Cambusmore/Gart GP 5 May & 8 L. Dochart 21 Apr.

*WOOD SANDPIPER *Tringa glareola*
S One head of L. Tay 8 May (JPH).

*GREEN SANDPIPER *Tringa ochropus* (p)
S One Allan Water (above Kinbuck Br.) 20 Jan & 27 Feb (MVB) & 1 R. Teith (Lecropt) 25 Jul (DOE).

*SPOTTED REDSHANK *Tringa erythropus* (p)
F One Skinflats Pools 2 – 11 Nov (CVW, AB, DT, AE).

GREENSHANK *Tringa nebularia* (w, p)
F Kinneil monthly max: 4 in Jan, 3 in Feb, 4 in Mar, 1 in Apr, 1 in Jun, 3 in Jul, 8 in Aug, 10 in Sep, 5 in Oct, 7 in Nov & 4 in Dec. Other sites: single birds Skinflats Pools Jan, Feb, Mar (2), Aug & Sep. 3 Blackness 9 Oct with 1 in Mar, Aug & Sep. Monthly max Powfoulis TB: 3 in Jul, 2 in Aug, 2 in Sep & 1 in Dec. 1 Bo'ness 16 Oct & 1 Higgin's Neuk 19 Dec.
C One Longcarse Apr, Aug (2), Jul, Sep & Oct. 5 >W R. Forth (Cambus) 23 Apr & 2 CVP 13 Apr.
*S Monthly max head of L. Tay: 3 in Apr, 1 in May, 2 in Jun & 1 in Jul. Monthly max L. Dochart: 4 in Apr, 4 in May & 3 in Jun. 4 Crianlarich Meadow 15 Apr (IYM).

REDSHANK (Common) *Tringa totanus* (b, W)
Forth Est. WeBS: 2,075 in Jan, 1,916 in Feb, 1,715 in Mar, 1,724 in Aug, 2,444 in Sep, 2,401 in Oct, 2,281 in Nov & 2,298 in Dec.
F Other sites max: c.250 Bo'ness 30 Oct; 99 Blackness 18 Sep;

65 Powfoulis TB 9 Dec & c.50 Higgin's Neuk 19 Dec.

C Monthly max R. Forth (Cambus - S. Alloa): 18 in Jan, 54 in Feb, 15 in Mar, 31 in Apr, 2 in Jun, 4 in Sep, 15 in Oct, 2 in Nov & 23 in Dec. Other sites max: 118 Kennet Pans 10 Jan & 12 Blackdevon Wetlands 26 Apr.

S Head of L. Tay monthly max: 1 on 28 Feb, 4 in Mar, 36 in Apr, 6 in May, 6 in Jun, 16 in Jul with last 2 on 22 Jul (JPH). 1 N. Third Resr. 8 Mar with 5 on 14 Apr (NB, CJP) & 1 R. Teith (Lecropt) 15 Mar (CAM).

TURNSTONE (Ruddy) *Arenaria interpres* (w)

Forth Est. WeBS: 6 in Jan, 19 in Mar, 4 in Sep, 19 in Oct 10 in Nov & 10 in Dec.

F Site max: 19 Bo'ness 16 Oct; 4 R. Carron mouth 19 Sep; 3 Kinneil 13 Dec; 3 Skinflats Pools 29 Mar / 3 Oct; 1 Blackness 22 May & 11 Oct (MVB, DMB, VH, CVW, AF, GD).

*POMARINE SKUA *Stercorarius pomarinus* (Irr)

F Imm Kinneil 12 Sep (JRC) & 1 Blackness 2 Oct (DOE).

ARCTIC SKUA *Stercorarius parasiticus* (p)

A strong autumn passage.

F Blackness: 1 on 30 Aug; max of 10 in Sep & max of 28 (& last) on 11 Oct (GG, GD et al). Bo'ness: singles on 5 & 23 Sep (GG, DOE). Kinneil: 3 on 22 Aug, a max of 6 in Sep, a max of 5 in Oct with last on 10 Oct (JRC, DB, JRC et al). Skinflats (offshore): singles on 7 & 19 Sep with 3 on 26 Sep & 1 on 2 Oct (SWo, MVB, DLT, CVW). A grounded bird, found in a stubble field at Skinflats, was taken into care but unfortunately died 5 Sep (AB).

*LONG-TAILED SKUA *Stercorarius longicaudus* (Irr)

F One Blackness 23 & 29 Sep (DOE).

* KITTIWAKE (Black-legged) *Rissa tridactyla* (p)

F Blackness: 5 on 2 Sep, 3 on 20 Sep, 9 on 23 Sep & 8 on 25 Sep (DMB, GG, DOE). 1 Kinneil 12 Sep with 2 on 17 Sep (JRC).

BLACK-HEADED GULL *Chroicocephalus ridibundus* (b, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	1548	1319	1139	692	616	701	1401
Estuary	286	501	264	488	311	293	760

BBS/WBBS: recorded at 0.05 b/lkm (1997-2021 av: 0.86 b/lkm. Range: 0.05 (2021) to 3.47 (1997) b/lkm). The highest recording rate was on urban / suburban at 0.34 b/lkm.

F Site max: c.400 Powfoulis TB 29 Jul; c.400 Skinflats Pools 20 Sep & c.300 Kinneil 19 Dec.

C Site max: c.320 Longcarse 30 Dec; c.300 Blackdevon Wetland 1 Aug & 212 Gartmorn Dam 10 Jan.

S Breeding: 5 ON Falcon bldgs. (Airthrey est.) 8 Jun (MVB). Site max: 305 Airthrey Loch 26 Jan.

*LITTLE GULL *Hydrocoloeus minutus* (Irr)

F Ad in non-breeding plumage Kinneil 7 Sep (VH).

*MEDITERRANEAN GULL *Larus melanocephalus* (w)

F Blackness: 2 ad (non-breeding plumage) 9 Aug & 1 on 6 Sep (GG, DOE). Kinneil: 1 on 2 May, 1 (1st S) 21 Jun, ad 11 Jul & 3 on 22 Aug (VH, NB, JRC). Skinflats Pools: 2 (1s/2cy) 6 Jul & 2 juv 7 Aug (SWo, AB). 1 Reid's Pond (NS 8781) 26 Jun (SWo) & 1 Powfoulis TB 15 Aug (DOE).

COMMON GULL (Mew Gull) *Larus canus* (b, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	461	284	1208	641	306	230	200
Estuary	17	404	29	424	43	30	110

BBS/WBBS: recorded at 0.25 b/lkm (1997-2021 av: 1.23 b/lkm. Range: 0.18 (2015) to 3.31 (1998) b/lkm). Like Black-headed Gull, the highest recording rate was in the urban / suburban habitat at 0.27 b/lkm.

F Site max: c.200 Kinneil 15 Aug.

C Site max: c.600 Cambus E 28 Jan.

S Breeding: Cambusmore/Gart GP: min 3 aon 24 Apr, 11 ON 22 May & 14 juv 24 Jul (NB); 3 ON & 2NY Falcon bldgs. (Airthrey est.) 8 Jun (MVB) & 3 ON head of L. Tay 20 May (JPH). Site max: c.530 Ashfield 28 Mar; 507 Blairdrummond Moss 29 Mar; 429 L. Coulter 10 Feb; c.260 Blairdrummond Ponds 5 Mar & 208 Killin 21 Feb.

LESSER BLACK-BACKED GULL *Larus fuscus* (B, P, w)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	10	42	260	507	120	26	33
Estuary	0	8	43	23	91	5	3

BBS/WBBS: recorded at 0.98 b/lkm (1997-2021 av: 0.99 b/lkm. Range: 0.53 (2016) to 1.89 (2009) b/lkm). The highest recording rate was in urban/suburban habitat at 7.84 b/lkm but it was recorded in all six broad habitat categories except conifer. The 17th most numerous species on the 2021 BBS/WBBS.

F Site max: c.70 Kinneil 15 Aug.

C Site max: c.80 Blackdevon Wetlands & c.80 Longcarse 25 Jul Aug. 64 on sandbank in middle of R. Forth at low tide (Cambus) 30 May (DH).

S Pathfoot bldg. (Stirling Uni.): 5 ON 8 Jun & 22 juv on Airthrey Loch 22 Jul (MVB). 1 aon Bruce St (Stirling) 26 May (JD). Site max: c.200 Blairdrummond Ponds 23 Sep & 104 Gartartan Fields (NS 5397) 5 Mar.

HERRING GULL (European) *Larus argentatus* (b, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	177	852	101	144	42	175	514
Estuary	560	524	10	43	97	705	82

BBS/WBBS: recorded at 0.47 b/lkm (1997-2021 av: 0.5 b/lkm. Range: 0.1 (2000) to 4.17 (1999) b/lkm). The highest recording rate was in urban habitat at 5.27 b/lkm. Numbers much reduced in recent years following the closure of open refuse tips and greater recycling of food waste.

F Site max: 615 Grangemouth Docks 22 Aug & 116 Kinneil 23 Apr.

C Site max: c.790 R. Devon, Ditch 24 Jan & c.80 Longcarse 25 Aug.

S. Site max: 158 L. Coulter 28 Dec & 2 head of L. Tay 3 Jun.

ICELAND GULL *Larus glaucoides* (Irr)

S One Carse of Lecropt 3 Apr & 6 May (RDG, DOE).

GREAT BLACK-BACKED GULL *Larus marinus* (S, W)

WeBS totals	Jan	Feb	Mar	Sep	Oct	Nov	Dec
Inland	13	8	8	21	1	11	10
Estuary	20	41	6	47	78	49	77

Recorded in small numbers, especially inland.

F Site max: 68 Kinneil 16 Oct & 9 Helix Pond 31 Jan.

C Site max: 5 Longcarse 9 Aug & 9 Oct; 5 R. Forth (Fallin – Cambus) 15 Mar & 5 Alva floods 6 Nov.

SANDWICH TERN *Sterna sandvicensis* (s, P)

First for year: 3 Kinneil 4 Jul (VH). Last of year 2 Blackness 10 Oct (DOE).

F Site max: c.550 Blackness 13 Sep; 365 Kinneil 22 Aug; c.350 R. Carron mouth 5 Aug; c.140 Skinflats Pools 4 / 19 Sep & c.70 Bo'ness 5 Sep.

*C 94 Kennet Pans (roosting on mud) 30 Aug & 1 heard passing over Gartmorn Dam 20 Jul (GG). Longcarse: 10 on 29 Aug, c.110 on 2 Sep, c.50 on 3 Sep & 4 on 6 Sep (DMB, CAM, DOE).

COMMON TERN *Sterna hirundo* (S)

First of year: 2 Skinflats Pools 7 May (AB). [22-year range: 24 Apr – 18 May]. Last of year: 1 Kinneil & 'present' Skinflats Pools 3 Oct (MDB, CVW).

F Breeding Skinflats Pool (N) tern raft: 2 ON 20 Jun with 2 chicks seen 17 Jul (AB). Site max: 244 Kinneil 22 Aug; c.130 Blackness 12 Aug & c.100 Skinflats Pools 19 Sep. C.250 'commic' terns R. Carron mouth 22 Aug.

*C Longcarse: 1 on 24 Aug, c.20 on 29 Aug & c.50 on 4 Sep (CAM, DMB, JRC, CVW). C.60 Kennet Pans (roosting on R. Forth) 4 Sep (GG).

*ARCTIC TERN *Sterna paradisaea* (p)

F Blackness: 1 on 9 Aug, 2 on 12 Aug, 2 on 16 Aug, 1 on 2 Sep, 1 on 2 Sep & 1 on 27 Sep (GG, DOE, DMB, AF). 12 Kinneil 22 Aug (JRC).

C One Longcarse 4 Sep (JRC, CVW). This appears to be the first record for Clackmannanshire (Ed).

BLACK TERN *Chlidonias niger* (Irr)

F Two Kinneil 22 Aug (JRC).

GUILLEMOT (Common Murre) *Uria aalge* (s, w)
A large 'wreck' occurred in September (with remnants into October) with the cause eventually thought to be starvation due to strong winds in the North Sea making feeding difficult. Forth Est WeBS: 231 in Sep.

F Monthly site max. Blackness: c.120 on 23 Sep & c.60 on 10 Oct. Bo'ness 25 on 23 Sep & 1 on 19 Dec. Kinneil: 88 on 17 Sep & 100+ on 6 Oct. R. Forth (S. Alloa – Dunmore): 137+ on 8 Sep & 3 on 24 Oct. Skinflats Pools (estuary): 72 on 5 Sep & 15 on 10 Oct. 36 R. Forth S. Alloa 3 Oct.

C Monthly site max. 89 R. Forth (Kennet Pans) 7 Sep. R. Forth (Cambus): 4 on 14 Feb; 4 on 6 Sep & 5 on 20 Oct. R. Forth (Longcarse): 2 on 12/13 Feb, 107 on 10 Sep & 44 on 5 Oct. 6 R. Forth (A91-Fallin) 6 Sep with 2 on 11 Oct; 1 Gartmorn Dam 7 Oct & 1 Haugh of Blackgrange 11 Oct.

S Monthly site max. 11 R. Forth (Stirling): on 9 & 13 Sep. Other sites: 1 found on Cornton Rd (Stirling) 10 Feb (CJP); 1 flew over Bruce St (Stirling) 10 Sep; 11 R. Forth (Kildean) 12 Sep; 1 Blairdrummond Ponds 8/9 Oct & 1 Cambusmore/Gart GP 11 Sep with 2 on 10 Oct.

*RAZORBILL *Alca torda* (Irr)
Part of the large 'wreck' detailed above. Forth Est WeBS: 19 in Sep.

F Off Blackness 1 Sep – 10 Oct with max of c.100 on 23 Sep (DOE, GG, AF, DMB); 1 Bo'ness 5 Sep with 7 on 23 Sep (GG, DOE); 1 Kinc. Br. 19 Sep (MVB); Kinneil (est.) 4 Sep – 9 Oct with max of 18 on 17 Sep (DB, DOE, JRC et al); 4 Powfoulis TB 19 Sep (DOE) & 1 R. Forth (S. Alloa) 3 Oct.

C Longcarse: 1 on 23 Sep, 1 on 4 Oct & 2 on 5 Oct (DOE, CAM). Two Blackdevon Wetland 23 Sep (DOE).

S Dead Guillemot / Razorbill M9 Junc. 10 on 30 Oct (CRM).

FERAL PIGEON *Columba livia* (B, W)
BBS/WBBS: recorded at 0.48 b/lkm (1997-2021 av: 0.93 b/lkm. Range: 0.29 (2016) to 2.19 (1997) b/lkm). The highest recording rate was in the urban / suburban habitat at 5.68 b/lkm.

F Max: c.60 Skinflats Pools 10 Sep.

C Max: c.100 Longcarse 9 Oct.

S Max: c.60 Dunblane centre 5 Jan.

STOCK DOVE *Columba oenas* (B, W)
Widely but thinly spread, mostly in farmland areas. Usually in groups of <4. BBS: Recorded at 0.05 b/lkm (1997-2021 av: 0.05 b/lkm.
Range: 0.01 (2003) to 0.12 (2005) b/lkm).
F Site max: 11 Skinflats Pools 27 Mar.
C Site max: 4 Longcarse 1 Oct.
S Site max: 28 Greenyards (Dunblane) 2 Mar; 24 Kippenross Cotts (Dunblane) 21 Jan & 19 Lanrick Est 4 Jan.

WOOD PIGEON (Common) *Columba palumbus* (B, W)
BBS/WBBS: recorded at 3.29 b/lkm (1997-2021 av: 3.49 b/lkm. Range: 2.48 (1997) to 4.78 (2012) b/lkm). The highest recording rate was in urban habitat at 11.55 b/lkm but was recorded in all six, broad habitat categories. The 2nd most numerous species on this year's BBS.
F Max: c.500 Skinflats Farms 10 Jan.
C Max: 105 Longcarse 12 Dec.
S Site max: 2,000+ Greenyards (Dunblane) 21 Nov; 1,163>W BoD 23 Oct; c.400 Hill of Row 30 Jan & 81 head of L. Tay 30 May.

COLLARED DOVE (Eurasian) *Streptopelia decaocto* (B, W)
BBS/WBBS: recorded at 0.12 b/lkm (1997-2021 av: 0.25 b/lkm). Range: 0.12 (2021) to 0.48 (2006) b/lkm). The highest recording rate was in urban habitat at 1.08 b/lkm.
F Max: 10 Blackness 3 Sep.
C Max: 4 Tullibody Inch 12 Jan.
S Max: 19 Cambuskenneth 8 Jan & 10 Doune 24 Dec.

TURTLE DOVE (European) *Streptopelia turtur* (V)
F One Polmont 22 May is the 7th record for the UF (ST).
S One Cambuskenneth 3 Jun is the 8th record for the UF (RM).

CUCKOO (Common) *Cuculus canorus* (B)
BBS/WBBS: recorded at 0.18 b/lkm (1997-2021 av: 0.1 b/lkm. Range: 0.03 (2009) to 0.26 (2018) b/lkm). First spring records: 1 Sheriff Muir 15 Apr (NB). [22-year range 14 to 29 April]. Last record: juv L. Voil 26 Aug (NH). Widespread to the north and west of Stirling, especially in the 'highland glens' and lowland moors and mosses. Much scarcer in Clackmannanshire and Falkirk districts.

*F One Skinflats Pools 27 May (AE, LW); 1 Howierigg Moss (NS 8578) 5 Jun (HT) & a rufous morph ♀ Kinneil 1 Aug (JRC, CAM, JS, CVW).
*C One Myretoun (Menstrie) 17 May (CVW) & 1 Castle Campbell 1 Jun (AC).
S Max: 5 calling ♂♂ Sheriff Muir 17 May & 5 aot Tyndrum 8 Jun (DMB); 4 G. Lochay 26 May & 4 G. Dochart 30 May. Juv eating a large caterpillar head of L. Tay 8 Aug (JPH).

*BARN OWL (Western) *Tyto alba* (b, w)
F One Inchyra (NS 9379) 7 Feb (AIB); 1 Larbert 14 Feb (AE); 1 dead junc. 4 M9 on 13 Jun (SW); 1 Kinneil 7 Sep (MGC) & 1 Skinflats Pools 10 Sep (DOE).
C One A91 (E side of Alva) 28 Jan (DK); 1 The Boll (Alva) 13 Feb, 1 & 11 Apr (LW) & 1 Kennet 20 Sep (DOE).
S Fresh pellets in old bldg Wester Bows (NN 7306) 1 Jan; 1 A91 Manor Powis 23 Jan; 1 Invertrossachs 21 Feb; 1 calling Pier Rd, Killin 18 Mar; 1 Gatehouse, A811 (Kippen) 23 May; 1 G. Ogle 23 May; 2 Torrie 24 Jul; 1 Cromlix 5 Sep; 1 Strathyre (NN 5619) 5 Oct; 1 Easter Lix (Killin) 20 Oct; 1 Old Mill (G. Dochart) 23 Nov; 1 Keir roundabout (M9) 25 Dec & 1 Callander Crags 29 Dec (CRM, CAM, JPH, RJS, GG, DOE, LH, MVB).

TAWNY OWL *Strix aluco* (B, W)
F Breeding: calling Y & ad Larbert Loch Wood 19 Apr (DLT). Recorded from: Carron Ho, Howierigg Moss, Larbert Loch, Skinflats Pools & The Pineapple.
C Recorded from: Birkhill, Cambus ('calling for 1st time in several years', DH), Gartmorn Dam CP, Menstrie & Tullygarth.
S Breeding: Pier Rd Killin: 4 calling birds, 3 Mar & a calling Y 22 May (JPH). NY Side Wood, Sheriffmuir (NN 8203) 17 Apr (MVB). Recorded from: Argaty, Balquhidder, Blairdrummond, Bracklinn, Callander Crags, Crianlarich, Cromlix, Doune, Dykedale Woods (Dunblane), Gargunnock, G. Dochart, Kilbryde, Kippen, Lanrick, Plean CP, Stirling Castle & The Bows.

*LONG-EARED OWL *Asio otus* (b, w)
S Two flushed from roost Carse of Lecropt 10 Feb & 1 Glassingall (NN 8003) 25 Dec (DMB, DOE).

*SHORT-EARED OWL *Asio flammeus* (b, W)

F One Kinneil 1 Jan (VH); 1 'mobbed by gulls' Powfoulis TB 26 May (CRM); 1 Kincardine Br. 19 Sep & 31 Oct with 2 there 19 Dec (MVB, DMB) & 1 Powfoulis TB 19 Dec (DOE).
C One Blackdevon Wetlands 15 May (CRM) & 1 Longcarse 2 Oct (CAM).
S One Dumyat 13 Feb (CJP) & 3 Back Hill, Sheriff Muir 15 Apr (JD).

LITTLE OWL *Athene noctua* (V)

S One at Howietoun Ponds, Old Sauchie 13 Sep is the first verified record for the UF (NB, DMB).

SWIFT (Common) *Apus apus* (B)

Recorded throughout the area but in steadily decreasing numbers. BBS/WBBS: recorded at 0.06 b/lkm (1997-2021 av: 0.37 b/lkm. Range: 0.02 (2018) to 0.98 (2002) b/lkm). The highest recording rate was in the farmland habitat at 0.1 b/lkm. First for year: 1 Skinflats Pools 27 Apr (AB). [22-year range 24 April to 6 May]. Last 4 BoA 28 Aug (DMB).

F Site max: 25 Kinneil 19 Jul.
C Max: 25 Gartmorn Dam 13 May & 24 Cambus 4 Aug.
S Breeding: 79 active nest-sites Dunblane (CRM). Site max: 46 head of L. Tay 19 Aug; 45 Auchmore, Killin 8 Jul; c.40 Dunblane 19 Jul; c.40 Glassingall 24 Jul; c.30 (evening screaming party) BoA 20 Jun; 25 Stroneslaney, Balquhidder 8 Aug & 23 Cocksburn Resr. 8 Jun.

KINGFISHER (Common) *Alcedo atthis* (b, w).

Inland WeBS: 4 in Jan, 1 in Feb, 3 in Mar, 19 in Sep (indication of another good breeding season?), 2 in Oct, 1 in Nov & 3 in Dec. Breeding in small numbers in suitable habitat throughout the area. More widespread outwith the breeding season.

F Max: 3 R. Carron, Carronshore 30 Aug & 3 R. Carron, Larbert 12 Sep.
C Max: 3 R. Devon, (Alva – Tullibody Br.)
S Max: 3 R. Teith, Cambusmore 11 Sep & 3 R. Teith Lecropt 16 Sep.

GREEN WOODPECKER (European) *Picus viridis* (B, W)
F No records.
C Recorded from: Alva, Aitkenhead, Menstrie, Myreton Hill, Woodhill, Alva & Wester Cornhill (NS 9799).
S Recorded from: Airthrey, Argaty, Balquhidder, Blairlogie, Brig O' Turk, Cromlix, Doune, Dunblane GC, G. Lochay, Kilbryde, Killin, Kilmahog / Leny, Kippenrait, Old Sauchie, Sheriffmuir Woods (imm), Strathyre, Wester Lundie & Yellowcraigs Wood (BoA).

GREAT SPOTTED WOODPECKER *Dendrocopos major* (B, W)
Spread thinly throughout the area and year. BBS/WBBS: recorded at 0.08 b/lkm (1997-2021. average 0.07 b/lkm. Range 0.0 (1997) to 0.15 (2012) b/lkm).
F Max: 5+ Larbert Loch & Woods 1 May; 3 Callendar Park 9 Jan & 3 Kinneil Ho 30 Mar.
S Breeding: NY Dykedale S. Wood, Dunblane 24 May; NY Cromlix Lodge 19 Jun; 2 juv Kiltane & juv Pisgah Wood, Dunblane 23 Jun (MVB). Pr & 2+ Y Culnagreine (NN5503) 17 Jun (NB). Max: 4 Argaty 7 Nov; 3 R. Teith, Lecropt 15 Mar; 3 Doon Hill, Aberfoyle 16 May; 3 Plean CP 17 Jun & 3 Cambusmore/Gart GP 24 Jul.

SKYLARK (Eurasian) *Alauda arvensis* (B, W)
BBS/WBBS: recorded at 1.81 b/lkm (1997-2021 av: 1.67 b/lkm. Range: 1.25 (1997) to 2.71 (2000) b/lkm). The highest recording rate was in the mountain & moorland habitat at 3.51 b/lkm where it was the 2nd most numerous species after Meadow Pipit. The 8th most numerous species on this year's BBS/WBBS.
F Breeding: 3 singing ♂♂ Skinflats 27 Feb (AB). Max: min 400 Brackenlees 9 Jan & c.200 Blackness 10 Oct.
C Max: c.260 Longcarse 26 Jan with 105 there 11 Feb.
S Breeding: 9 singing ♂♂ Sheriffmuir rd 15 Apr (NB). Max: min 850 Glenhead, Dunblane 3 Jan with min 750 there 21 Nov; c.200 Carse of Lecropt 17 Jan; c.170 Stonehill, Dunblane 24 Dec; 165 Kippen 1 Jan; c.120 Greenyards, Dunblane 21 Nov & c.110 Lanrick 4 Jan.

SAND MARTIN *Riparia riparia* (B)
BBS/WBBS: recorded at 1.34 b/lkm (1997-2021 av: 0.65 b/

lkm. Range: 0.02 (2003) to 1.34 (2009 & 2021) b/lkm. The wide annual range is largely due to changing colony locations). First for year 1 Cambus Pools 16 Mar (CAM) [22-year range 4 Mar to 30 Apr]. Last 7 Deanston 1 Oct (SWi).

F Site max: c.250 Skinflats Pools 10 Apr.

C Site max: c.1,050 Gartmorn Dam 5 Apr & c.350 (pre-roost flock) Cambus Pools 31 Mar (GG).

S Breeding: 474 aon Cowie Quarry 13 Jun (DMB); 27 aon R. Balvag, Strathyre 3 Jun (DJC); 12 aon Allan Water (Kinbuck-Ashfield) 3 Jun & 11 aon Allan Water, Kinbuck Br. 19 Jun (MVB); Site max: 300+ BoA 2 Apr; c.200 head of L. Tay 2 Apr; c.100 Cambusmore/Gart GP 24 Apr & c.70 Blairdrummond Ponds 1 May.

SWALLOW (Barn) *Hirundo rustica* (B)

BBS/WBBS: recorded at 0.95 b/lkm (1997-2021 av: 2.03 b/lkm. Range: 0.95 (2021) to 3.53 (2009) b/lkm). The highest recording rate was on the farmland habitat at 2.69 b/lkm. The 18th most numerous species on this year's BBS/WBBS. First for year: 1 Skinflats Pools 27 Mar (SWo). [22-year range: 6 Mar – 11 Apr]. Last: 1 Tullibody Inch 3 Nov was very late (GG). More breeding records please.

F Max: c.70 Skinflats Pools 16 Sep.

C Breeding: 5 ON Orchard Fm (DH). Max: c.60 Gartmorn Dam 13 May & 48 Tullibody Inch 7 Sep.

S Breeding: 2 ON 'Witsend', Strathyre 7 Jun (DJC). Max: c.40 N. Third Resr. 26 Jun.

HOUSE MARTIN (Common) *Delichon urbicum* (B)

BBS: recorded at 0.21 b/lkm (1997-2021 average: 0.71 b/lkm. Range: 0.21 (2021) to 1.29 (2003) b/lkm). The highest recording rate was in farmland at 0.62 b/lkm. More breeding records please. First of year: 1 BoA 2 Apr (DMB) [22-year range: 25 Mar – 21 Apr]. Last: 3 Blairdrummond 1 Oct (DOE). More breeding records please.

F Max: c.50 Skinflats 1 Sep.

C Max: c.30 Longcarse 15 Aug.

S Breeding: min 3 aon Stronachlachar café 22 Jun (ZB). Max: c.120 Kinlochard 24 Aug; 100+ Killin 16 Aug; c.40 Stroneslaney, Balquhidder 8 Aug; c.40 Landrick, Dunblane 21 Aug & 37 Callander 11 Aug.

TREE PIPIT *Anthus trivialis* (B)
BBS/WBBS: recorded at 0.25 b/lkm (1997-2021 av: 0.11 b/lkm. Range: 0.0 (2004) to 0.25 (2019 & 2021) b/lkm). The highest recording rate was in deciduous wood / scrub habitat at 0.54 b/lkm but was recorded in all the other broad habitat categories apart from urban / suburban – a reflection of its increasing numbers in recent years. First of year: 1 Blairdrummond 19 Apr (SWi). [22-year range: 2 Apr – 27 Apr]. Last: Skinflats Pools 28 Aug (CVW).
*F Two Darnrigg Moss 21 Jun (RD).
*C One Dollar Glen 8 Jun (KH).
S Breeding: 21 aot Tyndrum 8 Jun, 4 aot Ben Ledi 29 Jun, 1 aot BoA 17 May & 1 aot Sheriff Muir 27 May (DMB). 1 FF Cromlix Lodge 19 Jun (MVB). Max: 8 Whirrieston, Thornhill 24 Jul; 7 Lix Toll 8 Aug & 6 Brig o' Turk 11 May. Widespread to N & W of Stirling, scarcer elsewhere.

MEADOW PIPIT *Anthus pratensis* (B, W)
BBS/WBBS: recorded at 6.25 b/lkm (1997-2021 av: 5.13 b/lkm. Range: 2.71 (1997) to 7.38 (2016) b/lkm). The highest recording rate was in the mountain & moorland habitat at 13.16 b/lkm. The most numerous species on this year's BBS/WBBS.
F Max: c.200 Skinflats Pools 10 Apr & 80+ Powfoulis TB 16 Apr.
C Max: c.70 Longcarse 18 Sep.
S Max: c.160 L. Mahaick 3 Apr; 125 Kippenross Cotts, Dunblane 19 Aug & c.110 Stonehill, Dunblane 2 Sep.

*ROCK PIPIT (Eurasian) *Anthus petrosus* (w)
F Blackness: 1-2 from 3 Oct – 27 Dec (AF, DOE, MSi). Skinflats foreshore: 2 on 21 Feb, 1 on 23 Oct & 1 on 19 / 23 Dec (CVH, AB, DOE). 1 R. Forth, by Dunmore 14 Feb (RDG) & 1 Powfoulis TB 28 Nov (DOE).
C One Longcarse 9 & 11 Dec (DMB, DOE).

*YELLOW WAGTAIL *Motacilla flava* (Irr)
F Two ♂♂ Skinflats Pools 26/27 Apr (CAM, DOE, AB, AE, GG, SWo).
C Male Devonmouth Pool 23 Apr & 1 Longcarse 9 May are only the 2nd & 3rd records for the county (DH, JRC).

GREY WAGTAIL *Motacilla cinerea* (B, w)
Found in small numbers in suitable habitat throughout the area. A partial migrant. Inland WeBS: 6 in Jan, 10 in Feb, 17 in Mar, 32 in Sep, 7 in Oct, 11 in Nov & 4 in Dec.
C Max: 5 R. Devon (Alva – Tullibody Br.) 14 Mar.
S Max: 6 G. Dochart 14 Aug; 6 Auchtertyre, Strath Fillan 12 Sep; 2 pr Allan Water (Dunblane) 23 Mar & 4 L. Coulter 27 Mar.

PIED WAGTAIL *Motacilla alba yarrellii* (B, w)
BBS/WBBS: recorded at 0.23 b/lkm (1997-2021 av: 0.34 b/lkm. Range: 0.17 (2013) to 0.77 (1998) b/lkm). Recorded at the highest rate on farmland at 0.51 b/lkm.
F Max: 20 Higgin's Neuk 6 Apr.
C Max: 41 CVR 28 Aug, c.40 Blackdevon Wetland 3 Sep & 23 Longcarse 4 Oct.
S Max: 122 >S (to roost) Dunblane 25 Aug (CRM); 95 head of L. Tay 5 Mar & c.40 Doune 28 Feb.

WHITE WAGTAIL *Motacilla alba* (p)
F Skinflats Pools area. Spring: first was 1 on 13 Mar with max of 20+ on 27 Apr & last on 4 May. Autumn: first were 2 on 5 Sep with last 13 on 10 Oct. Powfoulis TB: 2 – 6 from 5 Apr – 5 May. 10 Higgin's Neuk 6 Apr & 3 Blackness 20 Sep.
C CVP's: 1 – 4 from 15 – 30 Apr. 5 Haugh of Blackgrange 19 Apr; 1 Alloa Inches 9 Apr; 3 Longcarse 9 May & 1 Alloa Inches 29 Aug with 5 there 10 Sep.
*S Three Cambusmore/Gart GP 24 Apr; 14 head of L. Tay 1 May & 1 Lecropt 13 May (NB, JPH, DOE).

*WAXWING (Bohemian) *Bombycilla garrulus* (w)
C Three Menstrie 15 Jan (JRC).

DIPPER (White-throated) *Cinclus cinclus* (B, W)
Recorded on suitable watercourses throughout the region. Inland WeBS: 42 in Jan, 42 in Feb, 26 in Mar, 28 in Sep, 42 in Oct, 27 in Nov & 35 in Dec.
F Breeding: ad feeding 2 Y R. Carron (Carron) 6 May; I singing Chapel Burn (Carronshore) 25 Oct (AB). Site max: 6 R. Carron (M876-Larbert) 10 Oct.

C R. Devon: Vicar's Br-Tillicoultry WeBS max: 17 in Jan, 13 in Sep, 18 in Oct, 13 in Nov & 15 in Dec. 5 R. Devon (Alva – Tullibody Br.) 17 Jan.

S Breeding: singing bird Allan Water (Dunblane) 31 Dec (CRM). Site max: 5 R. Teith, Lanrick 9 Jan & 5 Allan Water, Dunblane 12 Jun.

WREN (Eurasian) *Troglodytes troglodytes* (B, W)

Widespread and common. BBS/WBBS: recorded at 1.79 b/lkm (1997-2021 av: 1.84 b/lkm. Range: 0.78 (2011) to 2.37 (2000) b/lkm). The recording rate was fairly similar in all habitats except mountain & moorland where it was much lower. The 9th most numerous species on this year's BBS/WBBS.

C Site max: 13 Dollar Glen 18 May & 11 Blackdevon Wetlands 13 Jan.

S Breeding: 9 singing Howietoun Ponds 10 May (NB). Site max: 15 Brig o' Turk 11 May; 14 Gargunnock – Kippen 7 Jun & 13 R. Teith (Lecropt) 15 Mar.

DUNNOCK *Prunella modularis* (B, W)

Widespread and common. BBS/WBBS: recorded at 0.46 b/lkm (1997-2021 av: 0.45 b/lkm. Range: 0.26 b/lkm (2018) to 1.13 b/lkm (2021)). The highest recording rate was in urban habitat at 1.62 b/lkm.

C Max: 5 Gartmorn Dam 9 Mar.

S Max: 7 Howietoun Ponds 12 Apr.

ROBIN (European) *Erithacus rubecula* (B, W)

Widespread and common. BBS/WBBS: recorded at 1.1 b/lkm (1997-2021 av: 1.16 b/lkm. Range: 0.77 (2018) to 1.52 b/lkm (2004)). The highest recording rate was in conifer woodland at 3.47 b/lkm followed by deciduous wood / scrub habitat at 2.55 b/lkm. The 14th most numerous species on this year's BBS/WBBS.

F Max: 15 Candie Ho (NS 9374) 16 Apr.

C Breeding: late newly fledged Y Cambus 5 Sep (DH). Max: 18 Longcarse 3 Jan & 10 Feb.

S Site max: 15 Brig o' Turk 11 May & 14 Blairdrummond Ponds 12 Oct.

*BLUETHROAT *Luscinia svecica* (V)

C A bird of the red-spotted form in Menstrie Glen 15 May (JRC) is the 3rd record for the UF after birds in

Grangemouth May 1980 & Kinneil May 1991 and the 1st for Clackmannanshire.

*BLACK REDSTART *Phoenicurus ochruros* (Irr)

S Male (1stW) Higgin's Neuk 1 & 20 Feb then 21 Mar (AB). This is the 7th record for the UF, the last being a bird at Springkerse (Stirling) Oct 2019.

REDSTART (Common) *Phoenicurus phoenicurus* (B)

Found in low numbers mostly to the N & W of Stirling. First spring record: ♂ Killin Marsh 16 Apr (JPH). [14-year range: 10 Apr – 29 Apr]. Last: 1 Skinflats Pools 19 Sep (DOE).

S Breeding: 3 aot's Tyndrum 8 Jun (DMB) & FY Cauldhame, Kippen 23 Jun (CAM). Max: 7 Killin Marsh 1 May & 7 Kilbryde (Dunblane) 9 May.

WHINCHAT *Saxicola rubetra* (B)

BBS/WBBS: recorded at 0.11 b/lkm (1997-2021 average: 0.09 b/lkm. Range: 0.01 (2007) to 0.22 (1997) b/lkm). Recorded mostly to the N & W of Stirling. First spring record: ♂Lade Trail (Sheriff Muir) 22 Apr (MVB). [22-year range: 15 Apr – 26 May]. Last: 5 Skinflats Pools 19 Sep (DOE).

*F Five Skinflats Pools 19 Sep (DOE).

*C One Alloa Inches 13 May (DMB).

S Breeding: 2 aot Sheriff Muir 17 May & 2 aot Tyndrum 8 Jun (DMB). Max: 12 (ad & juv) Strathyre 17 Aug; 5 Flanders Moss (W) 27 Jun; 5 Flanders Moss (E) 17 Jul & 5 Lade Trail (Sheriff Muir) 10 Aug.

STONECHAT (European) *Saxicola rubicola* (B, W)

BBS/WBBS: recorded at 0.11 b/lkm (1997-2021 average: 0.06 b/lkm. Range: 0.0 (2012) to 0.19 (2008) b/lkm).

F Site max 4 Skinflats Pools 18 Sep & 2 Kinneil 27 Feb.

C Site max: 4 Blackdevon Wetland 13 Jan & 25 Jul. Also present at Cambus Pools & Gartmorn Dam.

S Breeding: 3 aot Sheriff Muir 17 May (DMB); FL Druim Wood (Brig o' Turk) 28 Mar (JT); pr + 3 FL Nether Glastry (Dunblane) 30 May; 1 aot Tyndrum 8 Jun; 'pr 'alarming' Ben Ledi 29 Jun (DMB); pr + 3 FL Lade Trail (Sheriffmuir) 8 Aug (MVB). Site max: 8 (5 ♂)Sheriff Muir 22 Apr; 6 Lade Trail (Sheriffmuir) 5 Oct; 6 Rhynaclach (NN 6001) 24 Jul; 6 L. Mahaick 29 Sep; 5 G. Lochay Power Sta. 1 Jun & 5 Lix Toll 8 Aug.

WHEATEAR (Northern) *Oenanthe oenanthe* (B)
BBS/WBBS: recorded at 0.21 b/lkm (1997-2021 av: 0.18 b/lkm. Range: 0.07 b/lkm (2004) to 0.33 b/lkm (2019)). The highest recorded rate was on mountains and moorlands at 0.4 b/lkm. First spring record: ♂ Myreton Hill 1 Apr (GG). [14-year range: 14 Mar – 8 Apr]. Last: 1 Longcarse 1 Oct (DOE).

F Max: 3 Skinflats Pools 25 Apr. Also recorded at Blackness & Powfoulis.

C Max: 10 Haugh of Blackgrange 10 May were thought to be of the ssp *leucorhoa* (GG). 3 Alva Glen 14 May & 3 Longcarse 11 Sep. Also recorded at Blackdevon Wetland, Gartmorn Dam CP, Kennet Pans & Myreton Hill.

S Breeding: 2 aot Sheriff Muir 17 May (DMB). Max: 6 Harperstone, Sheriffmuir 23 Apr; 5 Lochan Breaclaich 18 Jul; 4 Auchtertyre, Strath Fillan 26 Apr & 4 Longleys, Lecropt 5 May.

*RING OUZEL *Turdus torquatus* (b)

C Male Dumyat 13 Apr (MC).

S Breeding: 4 aot Ben Ledi 29 Jun (DMB). One Ben Lui 12 & 25 Apr (JD, GG); 2 G. Lochay 30 Apr & 26 May (AE, LL); 1 G. Ogle 28 May (DOE) & 4 Ben Vorlich/StÙc a Chroin 4 Jun (GP).

BLACKBIRD (Common) *Turdus merula* (B, W)
Widespread and common. BBS/WBBS: recorded at 1.54 b/lkm (1997-2021 av: 2.05 b/lkm. Range: 1.28 (2016) to 2.72 (1999) b/lkm). The highest recording rate was in urban/suburban areas at 6.28 b/lkm but was recorded in good numbers in the other habitat categories except mountain and moorland where it was scarce. The 11th most numerous species on this year's BBS/WBBS.

F Max: 15 Skinflats Pools & 10 Powfoulis TB 19 Dec. A ♂ with an orange bill, white head, chest & back was at Kinneil 8 Apr (AB).

C Max: 27 Blackdevon Wetland 10 Dec; 17 Jellyholm Fm 5 Jan; 15 Gartmorn Dam 14 Dec; 14 Menstrie Brae 1 Jan & 13 Cambus Pools 12 Jan.

S Max: 14 Sunnylaw/ Drumbrae (BoA) 13 May; 12 Blairdrummond 5 Jan; 12 Howietoun Ponds 18 Jan & 12

Landrick (Dunblane) 24 Dec.

FIELDFARE *Turdus pilaris* (W)
Last spring record: 1 Kinneil 11 May (DT) is within 10-year range of 25 Mar - 14 May. First autumn record: 7 Longcarse 19 Oct (CAM, JS) is within the 10-year range of 3 Sep to 22 Oct.

F Max: c.150 Threaprig (NS 8374) 21 Nov & c.140 Black Loch, Limerigg 22 Feb.
C Max: c.200 Tullibody Inch 12 Jan & 106 Orchard Fm 20 Jan.
S Max: c.250 Drip Moss 16 Jan; c.200 Strathyre 2 Dec; 185 Waterside (NN 7805) 28 Mar & 162 Gallow Hill, Kilbryde 28 Feb.

SONG THRUSH *Turdus philomelos* (B, W)
A partial migrant. BBS/WBBS: recorded at 0.65 b/lkm (1997-2021 av: 0.53 b/lkm. Range: 0.24 (2011) to 0.82 (2000) b/lkm). The highest recording rate was in deciduous wood / scrub at 1.6 b/lkm but found in all six broad habitat categories.

F Max: 8+ Skinflats Pools in mixed flock of Blackbirds & Fieldfares 22 Oct.
C Max: 8 Gartmorn Dam 9 Mar.
S Max: 6 Blairdrummond 20 Mar.

REDWING *Turdus iliacus* (W)
Last spring record: 1 singing Auchtertyre (Strath Fillan) 15 Apr (JPH) is within the previous 10-year range of 7 Mar to 1 May. First autumn record: 5 Auchtertyre (Strath Fillan) 7 Oct (JPH) is within the previous 10-year range of 16 Sep to 12 Oct.

F Max: c.200 Threaprig (NS 8374) 21 Nov & 100+ Old Bellsdyke Rd, Larbert 19 Oct.
C Max: 200+ Cambus Pools 5 Nov.
S Max: c.2,500 Doune 19 Oct; 1,000+ Tyndrum area 24 Oct; c.600 Hill of Row 31 Oct; c.500 Argaty 19 Oct; c.400 Kippen area 20 Oct & c.320 Strathyre 12 Nov.

MISTLE THRUSH *Turdus viscivorus* (B, W)
BBS/WBBS: recorded at 0.12 b/lkm (1997-2021 av: 0.16 b/lkm. Range: 0.06 (2011) to 0.3 (2003 & 2004) b/lkm). Recorded in low numbers in all habitat categories except urban / suburban where none.

S Max: 21 Sheriff Muir 7 Aug & 12 The Bows (NN 7406) 30 Dec.

GRASSHOPPER WARBLER (Common) *Locustella naevia* (B)
Widely but thinly spread throughout the area. First spring record: 1 Skinflats Pools 10 Apr equals the earliest record for the UF (SWo). [22-year range 10 Apr to 27 Apr]. Last 1 Blairdrummond 28 Aug (DOE).
C Max: 7 Blackdevon Wetland 26 Apr & 5 Menstrie 24 Apr.

SEDGE WARBLER *Acrocephalus schoenobaenus* (B)
BBS/WBBS: recorded at 0.11 b/lkm (1997-2021 av: 0.1) Range: 0.03 (2018) to 0.27 (2012) b/lkm). Unsurprisingly, the highest recording rate was on WBBS at 0.95 b/lkm - relatively scarce elsewhere. First spring record: 1 Blackdevon Wetland 22 Apr (CAM, JS) [22-year range 20 Apr - 1 May]. Last: 2 Longcarse 19 Sep (DOE).
F Site max: c.15 Skinflats Pools 6 Jul.
C Breeding: 9 ♂♂ Tullibody Inch 13 May (DMB). Max: 17 Tullibody Inch 5 Sep; 13 Blackdevon Wetland 10 Jul & 11 R. Devon (Alva-Tullibody Br.) 20 Jun.
S Breeding: 11 (min 5 juv) Howietoun Ponds 26 Jun & c.10 Carse of Lecropt (S) 2 May.

CETTI'S WARBLER *Cettia cetti* (V)
F One (caught in a mist net) Kinneil Kerse 13 Nov is the first for the UF and only the 4th record for Scotland (CRG).

*REED WARBLER (Eurasian) *Acrocephalus scirpaceus* (b)
Breeding of the species in the Upper Forth area was first confirmed in 2011. First spring record: 1 Cambus 25 Apr equals the previous earliest date (JRC). [4-year range: 25 Apr – 17 May]. Last Alloa Inches 10 Sep (DMB).
F Breeding: 2 ad + min 2 juv Reid's Pond (Mungal, NS 877818) 26 Jun & min 10 juv Skinflats Pools 6 Jul (SWo). Skinflats Pools from 27 Apr – 7 Sep with max of 16 on 6 Jul (AB, SWo et al). 1 Skinflats Fields 18 May (AE) & 1 Kinneil 27 May & 27 Jun (TR, CRG).
C Breeding: 5 singing Alloa Inches 13 May (DMB). Tullibody Inch from 2 May to 8 Aug with max of 4 on 9 Jul (DOE, JRC, MVB et al). Cambus: 2 on 28 May & 4 on 25 Jun (DH, JRC) & 1 Blackdevon Wetland 25 Jun (JRC).
*S One R. Forth (Lower Taylorton) 5 Jun (GG).

BLACKCAP (Eurasian) *Sylvia atricapilla* (B)
Found throughout the area. BBS/WBBS: recorded at 0.36 b/lkm (1997-2021 av: 0.17 b/lkm. Range: 0.07 (1999) to 0.36 (2021) b/lkm). The highest recording rate was in deciduous wood / scrub at 0.79 b/lkm. Probable first spring record was at Gartmorn Dam 21 Mar (CVW). Probable last summer record: 1 Howietoun Ponds 30 Oct (NB). [It is difficult to separate the few over-wintering birds from E. Europe with genuine summer migrants].

F Winter record: 1 Beech Cres. gdn, S. Broomage 8 Jan (SR). Max: c.20 Skinflats Pools 7 Sep & 5 Larbert Loch 1 May.

C Max: 6 Blackdevon Wetland 25 Apr.

S Winter records: BoA: 2 on 3 Jan & ♂ on 15 Jan (DMB). 1 R. Teith (Lecropt) 17 Jan (CAM); 1 BoA 25 Nov (DMB); ♂ Crianlarich gdn 8 Dec (IYM) & 1 Causewayhead gdn 10 Dec (MU). Max: 13 Blairdrummond 1 May & 7 Gargunnock – Kippen 7 Jun.

GARDEN WARBLER *Sylvia borin* (B)
BBS/WBBS: recorded at 0.14 b/lkm (1997-2019 av: 0.04 b/lkm. Range: 0.0 (1999) to 0.14 (2021) b/lkm). The highest recording rate was on WBBS at 0.59 b/lkm. First spring record: Larbert Hosp. Woods 19 Apr (HT) [22-year range 14 Apr to 5 May]. Last: 2 Skinflats Pools 10 Sep (DOE).

WHITETHROAT (Common) *Sylvia communis* (B)
BBS/WBBS: recorded at 0.14 b/lkm (1997-2021 av: 0.20 b/lkm. Range: 0.11 (2015) to 0.32 (2000) b/lkm). Recorded in all habitat categories except conifer. First spring record: 1 Skinflats Pools 13 Apr (AB) [22-year range 9 Apr to 2 May]. Last: 1 Skinflats Pools 18 Sep (DOE).

F Breeding: 3 ♂♂ Skinflats Pools 23 Apr (AB). Max: 7 Kinneil 27 May.

C Max: 10 Blackdevon Wetland 25 Jul.

S Breeding: 6 ♂♂ Howietoun Ponds 10 May (NB). Max: 7 Howietoun Ponds 12 Jun.

*LESSER WHITETHROAT *Sylvia curruca* (Irr)

F ♀ Kinneil 12 may CRG; 1 Kinneil Kerse 26 Jun (JRC, CVW) & 1 Skinflats Pools 16 Oct (AB).

WOOD WARBLER *Phylloscopus sibilatrix* (B)
Recorded in small numbers in deciduous woodland, mostly to the N & W of the highland line and in the Doune & Dunblane area. First spring record: 1 G. Lochay 25 Apr (JPH) [22-year range: 17 Apr to 24 May]. Last: 1 Auchmore (Killin) 8 Jul (DOE).
S Breeding: FY Brig o Turk 17 Jun (DB). Max: 7 Brig o' Turk 11 May & 6 G. Lochay 26 May. 2 ♂♂ Cocksburn Resr. 30 Apr were probably on passage.

CHIFFCHAFF (Common) *Phylloscopus collybita* (B, w)
BBS/WBBS: recorded at 0.4 b/lkm (1997-2021 av 0.15 b/lkm. Range: 0.01 (1997) to 0.4 (2021) b/lkm). Numbers have increased steadily over the past 20 years and the sp's is now widespread in suitable habitat. First singing record: 1 Broomridge (Stirling) 18 Mar (DT) with the last autumn record 1 Carronshore 19 Oct (AB).
F Max: 7 Bantaskine Park 30 Mar; 7 Kinneil 11 Apr & 7 Candie Ho. 16 Apr.
C Max: 10 Gartmorn Dam CP 29 Mar.
S Max: 12 Gowanhill, Stirling 1 Apr; 8 Blairdrummond 27 Mar & 5 S L. Tay Rd. 15 May. Winter: 1 Ochlochy Park, Dunblane 17 Feb & 1 Dunblane Cathedral 15 Nov (CRM).

SIBERIAN CHIFFCHAFF *Phylloscopus collybita tristis* (V)
F One calling at New Carron 23 Jan (SWo) & 1 (caught in a mist net) Kinneil Kerse 13 Nov (CRG). These are the 1st & 2nd records for the UF.

WILLOW WARBLER *Phylloscopus trochilus* (B)
Widespread. BBS/WBBS: recorded at 2.47 b/lkm (1997-2021 av: 1.76 b/lkm. Range: 1.15 (2007) to 2.84 (1997) b/lkm). The highest recording rate was in deciduous wood / scrub at 5.37 b/lkm. The 5th most numerous species on this year's BBS. First of year 1 Camelon cemy. 1 Apr equals the precious 1st date (SWo). [22-year range 1-18 Apr]. Last: 1 Haugh of Blackgrange 11 Oct (GG).
F Breeding: 9 aot Skinflats 22 Apr (DMB). Max: 14 Skinflats Pools 15 Aug.
C Max: 34 Gartmorn Dam CP 23 Apr.
S Breeding: 35 aot Tyndrum 8 Jun (DMB). Max: 37 Brig o' Turk 11 May & 23 Ballochleam Fm (NS 6592) 5 May.

GOLDCREST *Regulus regulus* (B, W)
BBS/WBBS: recorded at 0.18 b/lkm (2013-2019 av: 0.31 b/lkm. Range: 0.18 (2021) to 0.42 (2014) b/lkm). As usual, the highest recording rate was in the conifer habitat at 1.37 b/lkm.
F Max: 5 Skinflats Pools 13 Mar.
C Max: 6 Alloa Park Woods 13 Jan & 6 Gartmorn Dam CP 14 Dec.
S Max: 13 Lix Toll 8 Aug & 9 Blairdrummond Ponds 22 Nov.

SPOTTED FLYCATCHER *Muscicapa striata* (B)
First spring record: 1 Pier Rd (Killin) 13 May (JPH). [22-year range: 1 to 25 May]. Last: 1 Skinflats Pools 23 Sep (AE). Found in ever decreasing numbers – mostly to the N & W of Stirling.
*F One Strathavon Fm (NS 8674) 21 Jun (RD); 2 Blackness 31 Aug (LL) & 1 Skinflats Pools 19 Sep (DOE).
C No records.
S Breeding: 1 NB Darn Walk, Dunblane GC 28 May (MVB); 1 aot Strathyre 16 Jun (DJC); 1 FF Cromlix Lodge 19 Jun (MVB) & 2 juv Balquhidder Sta. 26 Aug (NH). Max: 8 Ardeonaig (L. Tay) 28 May; 4 G. Lochay 26 May; 4 Killin 28 May; 4 Auchlyne (G. Dochart) 18 Jun & 4 Strathyre Village 8 Aug.

*PIED FLYCATCHER *Ficedula hypoleuca* (b)
First spring record: 'present' Druim Wood, Brig o' Turk 30 Apr (SCW).
S Druim Wood, Brig o' Turk: 3 on 13 May with 1 on 27 & 28 May (GW, IC, JT). G. Lochay: 3 ♂♂ NN 5335 & 2 ♂♂ Tullich 15 May; 2 ♂♂ NN 5335 & a ♂ Tullich 22 May; 2 NN 4736 on 26 May & 1 Low Botaurnie 2 Jun (JPH, CAM, AE).

BEARDED TIT (Bearded Reedling) *Panurus biarmicus* (b)
*F Grangeburn (NS 9583): 3 on 10 Jan, 14 on 14 Nov & 3 on 19 Dec (JRC). Kinneil: pr 27 Jun & ♂ 12 Sep (CRG).
C Breeding: 2 juv Tullibody Inch 8 Aug (JRC). Monthly max Tullibody Inch: 4 in Jan, 2 in Feb, 1 in Mar, 4 in Apr, 3 in May, 6+ in Jun, 4 in Jul, c.10 in Aug, 4 in Sep, 6 in Oct, 2 in Nov & 2 in Dec (JRC, CAM, CVW, DOE, DH, DMB et al). 3 Cambus 10 Apr (JRC) & 1 Blackdevon Wetland 26 Apr (DOE).

LONG-TAILED TIT *Aegithalos caudatus* (B, W)
Family groups of up to 12 visited several gdns. BBS/WBBS: recorded at 0.32 b/lkm (1997-2021 av: 0.14 b/lkm. Range: 0.03 (2009) to 0.38 (1997) b/lkm).

F Max: 15 Carron Glen 3 Nov.
C Max: 24 Cambus 6 Jan; 19 Menstrie E. 6 Sep & 14 Jellyholm 17 Jan.
S Max: 20+ Killin 19 Sep; 19 Doune Ponds 22 Oct & 16 Newton Cres., Dunblane 30 Oct.

BLUE TIT (Eurasian) *Cyanistes caeruleus* (B, W)
BBS/WBBS: recorded at 1.06 b/lkm (1997-2021 av: 1.5 b/lkm. Range: 0.8 (2016) to 2.51 (2005) b/lkm). Recorded in similar numbers in all the broad habitat categories except mountain & moorland and conifer where it was peripheral. Deciduous wood / scrub returned the highest rate at 2.1 b/lkm. The 15th= most numerous species on this year's BBS/WBBS.

F Max: 8 Camelon cemetery 15 & 19 Mar.
C Max: 11 Longcarse 26 Mar.
S Max: flock of 24 Dykedale S. Wood 14 Dec; 16 Cambuskenneth Abbey 16 Jan; 14 R. Teith (Lecropt) 16 Sep & 13 in Ochiltree gdn 12 Sep.

GREAT TIT *Parus major* (B, W)
BBS/WBBS: recorded at 1.06 b/lkm (1997-2021 av: 0.89 b/lkm. Range: 0.41 (2000) to 1.32 (2010) b/lkm). As with Blue Tit, recorded in similar numbers in all the broad habitat categories except mountain & moorland where it was peripheral. Deciduous wood/scrub returned the highest rate at 1.99 b/lkm. The 15th= most numerous species on this year's BBS/WBBS.

F Max: 9 Carron Glen 3 Nov.
C Max: 11 Gartmorn Dam CP 10 Feb.
S Max: 22 Crianlarich 31 Oct; 18 N. Third Resr. 26 Jun; 13 Howietoun Ponds 22 Mar & 13 Argaty 7 Nov.

COAL TIT *Periparus ater* (B, W)
BS/WBBS: recorded at 0.4 b/lkm (1997-2021 av: 0.47 b/lkm. Range: 0.14 (2009) to 1.00 (2002) b/lkm). The highest rate was 1.29 b/lkm in the conifer woodland habitat.

S Max: c.20 Argaty 7 Nov.

NUTHATCH (Eurasian) *Sitta europaea* (B)
After the first record in 1999 breeding was recorded in 2009. Now widespread in steadily increasing numbers and has become a regular visitor to many garden bird feeders.
F Max: family part of 4 Callendar Park 12 Sep (AB).
S Breeding: ON Strathyre 25 May (DJC) & FF in nest box Howietoun Ponds 10 May (NB). Max: 7 Blairdrummond 11 Sep & 5 R. Teith (Lanrick) 10 Dec.

TREECREEPER (Eurasian) *Certhia familiaris* (B, W)
Widespread in small numbers.
F Breeding: ad feeding juv Kinneil Ho Pond 29 May (AIB).
S Max: 6 R. Teith (Lanrick) 10 Dec.

JAY (Eurasian) *Garrulus glandarius* (B, W)
Widespread in small numbers. Secretive in the breeding season.
F Breeding: 3 large juv in nest Callendar Park 26 Jun (SWo). Max: 4 Carronshore 5 Oct.
C Max: 4 Gartmorn Dam CP 31 Oct.
S Max: 7 Blairdrummond 12 Oct & 7 R. Teith (Lanrick) 10 Dec.

MAGPIE (Eurasian) *Pica pica* (B, W)
Widespread in Falkirk and Clackmannan districts plus lowland Stirling. Unusual N of the Highland Line. BBS/WBBS: recorded at 0.53 b/lkm (1997-2021 av 0.49 b/lkm. Range 0.31 (2003) to 0.75 (2010) b/lkm). Notably most numerous in urban/suburban habitats at 3.38 b/lkm.
F Max: 12 Bo'ness 16 Nov; 11 S. Alloa – Dunmore 8 Sep & 10 Skinflats Pools 28 Dec.
C Max: 12 Cambus 1 Jan; 12 Alloa Park Woods 13 Jan & 10 Blackdevon Wetland 19 Apr & 27 Dec.
S Max: 22 Greenyards, Dunblane 25 Feb; 16 Newton Cres., Dunblane 3 Feb & 10 Lecropt 18 Mar.

JACKDAW (Western) *Corvus monedula* (B, W)
BBS/WBBS: recorded at 2.23 b/lkm (1997-2021 av 2.39 b/lkm. Range: 1.56 (2016) to 3.27 (2005) b/lkm). Recorded in all six broad habitat categories but most frequent in urban/suburban areas at 5.81 b/lkm. As in 2019, the 7th most numerous species on 2021 BBS/WBBS.

F Max: 100+ Carron 30 Aug.
C Max: c.160 W Glenochil 5 Nov & c.110 Gartmorn Dam CP 3 Jan.
S Max: c.1000>SE Dunblane 23 Nov; c.250 head of L. Tay 10 Apr; c.200 Hill of Row 30 Jan & 130+ L. Coulter 20 Oct. A bird in Crianlarich on 21 Mar was the first this resident had recorded there (IYM).

ROOK *Corvus frugilegus* (B, W)
BBS/WBBS: recorded at 1.62 b/lkm (1997-2021 av: 3.09 b/lkm. Range: 1.37 (2016) to 6.74 (1999) b/lkm). Most frequent on WBBS at 3.55 b/lkm closely followed by farmland at 3.49 b/lkm. The 10th most numerous species on 2021 BBS/WBBS.
F Max: 84 Haugh's of Airth 21 Feb.
C. Max: 125 Longcarse 12 Aug.
S Breeding: 364 nests Dunblane in Apr is an increase of 17 on 2020 - another NH & 47 nests Kinbuck 25 Apr (MVB). Max: c.1000>SE Dunblane 23 Nov & 183 Kippen carse 17 Jan.

CARRION CROW *Corvus corone* (B, W)
Ubiquitous. BBS/WBBS: recorded at 2.67 b/lkm (1997-2021 av: 3.09 b/lkm. Range 2.0 (2018) to 6.22 (2005) b/lkm). Recorded in all six broad habitat categories but most frequent in the urban/suburban habitat at 6.49 b/lkm. The 4th most numerous species on 2021 BBS/WBBS.
F Max: c.60 Fishers Brae (NS 9878) 21 Feb & 37 Bo'ness 16 Oct.
C Max: 19 Longcarse 19 Oct.
S Max: 53 Callander 9 Aug & c.30 Dunblane (pre-roost) 15 Jul. A bird was seen caching food in Dunblane cemy 3 Jan (CRM).

HOODED CROW *Corvus cornix* (b, w)
Hybrids with Carrion Crow are common in a transition band running E-W across the area to the N of Callander.
S Most pure birds are found in the far north-western part of the area. Max: 14 Inverlochlarig 25 Oct; 4 Ardeonaig 8 Jul & 3 Allt Coire Chaorach (NN 4625) 28 May. Singles A9 Dunblane 1 Jan & Flanders Moss 14 May were outwith the normal range (DO, AE).

RAVEN (Northern) *Corvus corax* (B, W)
Now quite widespread but mostly in small numbers apart from non-breeding groups. BBS/WBBS: recorded at 0.16 b/lkm (1997-2021 av 0.1 b/lkm. Range 0.01 (2000) to 0.23 (2019) b/lkm).

F Recorded from Blackness: (2), Bo'ness, Callander Park, Carron (3), Carronshore (2), Higgin's Neuk (2), Lionthorn, Falkirk, Skinflats Pools (2) & the Slamannan plateau.

C Max: 6 Grodwell Hill (NN 9101) 17 Mar. Also recorded from: Blackdevon Wetland, Birkhill, Castle Campbell, Dollar Glen., Gartmorn Dam CP (2), Longcarse, Myreton Hill, Seamab Hill, Silver Glen., Tullygarth, W End Park, Alloa & Woodhill Wood, Alva.

S Breeding: pr + 4 large Y Stronachlachar 22 Jun (NB). Site max: 94+ Balquhidder Sta (roost) 9 Nov (DJC); 24 The Bows 16 Jan; 20 Drumloist Rd 11 Apr; 14 Argaty 9 Jan; 15 Auchtertyre, Strath Fillan escorted a Sea Eagle 'off the premises' 15 Sep (JPH) & 14 L. Mahaick 11 Jan.

STARLING (Common) *Sturnus vulgaris* (B, W)
BBS/WBBS: recorded at 2.42 b/lkm (1997-2021 av: 4.61 b/lkm. Range: 2.08 (2016) to 10.70 (2000) b/lkm). Notably most frequent in urban/suburban areas 16.69 b/lkm (the highest rate for any sp's in any habitat). The 6th most numerous species on this year's BBS/WBBS – its lowest ever position.

F Site max: c.300 Airth 14 Feb & c.200 Threaprig 17 Nov.

C Site max: 184 Longcarse 24 Aug.

S Site max: c.500 Drip Moss 16 Jan & c.380 Dykedale (Dunblane) 3 Mar.

ROSE-COLOURED STARLING *Pastor roseus* (V) (See Plate C4)

F One Blackness Castle 9 Jun was the 6th record for the UF (RJS).

HOUSE SPARROW *Passer domesticus* (B, W)
BBS/WBBS: recorded at 1.45 b/lkm (1997-2021 av: 1.67 b/lkm. Range: 1.20 b/lkm (2016) to 2.93 (2010) b/lkm). Most abundant in urban/suburban areas at 14.86 b/lkm. The 12th most numerous species on this year's BBS/WBBS.

F Site max: 125 Skinflats Fields 5 Aug & c.30 Powfoulis TB 3 Sep.

C Site max: 55 Longcarse 12 Aug.
S Site max: c.70 Carse of Lecropt 15 Aug & c.50 E. Flanders Moss 17 Jul.

TREE SPARROW (Eurasian) *Passer montanus* (B, W)
BBS/WBBS: recorded at 0.1 b/lkm (1997-2021average: 0.1 b/lkm. Range: 0.00 (2002) to 0.28 (2010) b/lkm).
F Breeding: 15 Jun 34 Campbell Christie Dr., Mungal, Falkirk 27 Jun (SWo). Max: c. 40 R. Forth (Airth) 31 Jan & 25 Powfoulis TB 5 Oct.
C Breeding: ad feeding juv (2nd clutch) Forth St, Cambus 10 Aug (DH). Max: c.30 Forth St, Cambus 14 Feb / 1 Dec & 23 Longcarse 26 Mar.
S Breeding: 4 aon Howietoun Ponds 29 May. Max: c.60 Lecropt 15 Aug; c.50 Craigarn Hall (NS 7598) 3 Jan; 42 Greenyards, Dunblane 3 Dec & 35 Glenhead, Dunblane 25 Jan.

CHAFFINCH (Common) *Fringilla coelebs* (B, W)
BBS/WBBS: recorded at 3.01 b/lkm (1997-2021 av: 3.74 b/lkm. Range: 2.73 (2019) to 5.15 (1998) b/lkm). Recorded in all six broad habitat categories but most frequent in conifer woodland at 6.77 b/lkm followed by deciduous wood/scrub at 5.78 b/lkm. The 3rd most numerous species on this year's BBS/WBBS.
F Max: c.100 Airth shore 31 Jan.
C Max: c.50 R. Devon (Glenochil) 11 Jan.
S Site max: c.450 Greenyards (Dunblane) 3 Dec; c.350 Hill of Row 16 Jan; c.200 Blairdrummond 17 Jan & c.130 Craigarn Hall 18 Feb.

BRAMBLING *Fringilla montifringilla* (w)
Last spring record: 1 Falkirk (8680) 18 Apr (WT). First autumn record: 1 Dykedale Woods, Dunblane 9 Oct (MVB).
*F One Falkirk (NS 8680) 18 Apr; 1 Kirkton Pl. (Carronshore) 12 Oct; 1 Skinflats Pools 14 Oct & 1 Bryce Av. (Carronshore) 28 Oct (WT, AE, MVB, AB).
*C One W. Glenochil 5 Mar; 2 Cambus Pools 5 Nov & 1 Blackdevon Wetlands 30 Nov (JS, CAM, JD).
S Site max: c.20 Greenyards (Dunblane) 25 Mar; c.20 Hill of Row 16 Jan; c.10 Crianlarich 31 Oct & 10 Kirkton Fm, Tyndrum 2 Nov.

GREENFINCH (European) *Carduelis chloris* (B, W)
Still widely but now thinly spread. Numbers on BBS in Scotland fell by 69 % between 2007 – 2017, largely due to the parasite *Trichomonosis gallinae*. However, numbers have recently shown a limited recovery. BBS: recorded at 0.14 b/lkm (1997-2021 av: 0.42 b/lkm. Range: 0.03 (2017) to 1.07 (2005) b/lkm). Recorded at the highest rate on farmland at 0.37 b/lkm closely followed by 0.34 b/lkm in urban/suburban areas.

F Max: 10 Blackness 30 Aug.
C Max: c.20 Orchard Fm. (NS 8693) 12 Jul.
S Breeding: pr + 3Y Strathyre 11 Jun (DJC). Site max: c.380 feeding on Noble Fir (*Abies procera*) cones Dykedale Woods, Dunblane 9 Oct (MVB); c.140 Landrick, Dunblane 8 Dec & c. 80 Stonehill, Dunblane 24 Nov.

GOLDFINCH *Carduelis carduelis* (B, W)
BBS/WBBS: recorded at 0.81 b/lkm. (1997-2021 av: 0.47 b/lkm. Range: 0.12 (1998) to 1.00 (2010) b/lkm). The highest recording rate was in urban/suburban areas at 2.91 b/lkm. The 20th most numerous species on the 2021 BBS/WBBS.

F Site max: c.80 Powfoulis TB 22 Aug; c.80 Skinflats saltmarsh 29 Aug; c.80 Kinneil 7 Sep & c.70 Grangemouth Docks 19 Sep.
C Site max: 79 Blackdevon Wetlands 10 Dec & 21 Cambus 4 Aug.
S Site max: 155 Lade Trail, Sheriff Muir 2 Aug; c.60 Dykedale Woods, Dunblane 25 Aug; 56 Newton Cres., Dunblane 18 Dec; 55 Stonehill, Dunblane 2 Sep & c.50 Hutchison, Kinbuck 2 Sep.

SISKIN (Eurasian) *Spinus spinus* (B, W)
BBS/WBBS: recorded at 0.28 b/lkm (1997-2021 av: 0.32 b/lkm. Range: 0.1 (2000) to 0.75 (1997) b/lkm). Largely found in conifer habitat (0.81 b/lkm) & deciduous wood/scrub (0.75 b/lkm).

F Max: 42 Carron 22 Dec.
C. Max: 45 Kennetpans 19 Dec.
S Breeding: ad feeding Y Ochiltree gdn (Dunblane) 26 Jun (NB). Site max: 75 Dykedale S Wood 8 Dec; 72 Stroneslaney, Balquhidder 24 Nov; c. 50 Eas Gobhain, Callander 13 Oct / 8 Nov & c.50 BoA 24 Dec.

LINNET (Common) *Linaria cannabina* (B, W)
BBS/WBBS: recorded at 0.26 b/lkm (1997-2021 av: 0.25 b/lkm. Range: 0.05 (2005) to 0.83 (2006) b/lkm). Essentially a farmland bird where it was recorded at 0.53 b/lkm.
F Site max: c.200 Bellsdyke Fm 24 Jul; c.200 Skinflats Pools 14 Nov; c.100 Bo'ness 8 Jan; 100+ Skinflats Fm's 10 Jan; c.70 Kinneil 12 Sep & c.60 Airth shore 31 Jan.
C Max: c.40 Longcarse 5 Sep & 34 Menstrie (NS 8696) 5 Dec.
S Max: c.70 Hillside of Row 1 Feb & c.40 Doune 30 Jan.

TWITE *Linaria flavirostris* (b, W)
F Site max: c.90 Dunmore – Airth 14 Jan; c.70 Skinflats 17 Nov; c.60 Airth shore 31 Jan & c.40 Higgin's Neuk area 21 Feb.
*C One Tullibody Inch 11 Feb & c.30 Longcarse 7 Feb (CJP).
*S Breeding season: 4 G. Lochay 26 May (LL). 4 Kirkton (NN 3528) 27 May & 3 there 21 Jun (JPH). Max: 3 Doune 30 Jan (DOE) & 1 Carse of Lecropt 23 Jan (DMB).

LESSER REDPOLL *Acanthis cabaret* (b, W)
BBS/WBBS: recorded at 0.37 b/lkm (1997-2021 av: 0.12 b/lkm. Range: 0.01 (2008) to 0.37 (2021) b/lkm). The highest recording rate was in the deciduous / scrub habitat at 0.68 b/lkm.
F Max: c.40 Callendar Park 9 Jan & 26 Skinflats Pools 17 Mar.
C Max: 26 Longcarse 17 Mar.
S Site max: c.50 Springkerse (Stirling) 7 Feb; c.45 Whiteston Wood, Dunblane 28 Sep; c.40 Sheriffmuir Wood 26 Dec & 25 Airthrey 9 Jan.

*COMMON REDPOLL *Acanthis flammea* (Irr)
F Two Kinneil 24 Apr (CRG).
S Two Ochlochy Park, Dunblane 27 Jan & 2 Springkerse (Stirling) 7 Feb (CJP, GC).

COMMON CROSSBILL (Red) *Loxia curvirostra* (b, W)
BBS/WBBS: recorded at 0.01 b/lkm (1997-2021 av: 0.07 b/lkm. Range: 0.00 (2010) to 0.56 (2012) b/lkm). Only recorded in the deciduous/scrub habitat at 0.03 b/lkm.
*F Six Glen Rd, Torwood 16 Jul (SPM) & 4 Skinflats Pools 1 Feb (AE).
*C Two R. Devon (Tillicoultry) 7 Dec (CAM).

S Max: 35 Touch Hills 26 Mar; c.10 CVR 8 Dec & 8 Lix Toll 8 Aug. Recorded in small numbers at several other sites.

BULLFINCH (Eurasian) *Pyrrhula pyrrhula* (B, W)
Recorded in low numbers. BBS/WBBS: recorded at 0.07 b/lkm (1997 2021 av: 0.06 b/lkm. Range: 0.01 (2003) to 0.12 (1998) b/lkm).

F Max: 10 Braeface, Banknock 29 Jan & 8+ Larbert Hosp. Loch 27 Dec.
C Max: 9 Cambus Pools 15 Feb.
S Site max: 20 Whiteston Wood, Dunblane 2 Sep; c.20 Coille Coire Chuilc, Tyndrum 19 Nov; 17 Cauldhame (NN 8201) 19 Jan; 13 L. Mahaick 20 Feb & 12 Hill of Row 19 Sep.

*HAWFINCH *Coccothraustes coccothraustes* (V) (See Plate C2)
F One Falkirk gdn 3 Apr (WT).
S One to 8 from 7 - 31 Jan Holmehill, Dunblane (CS, CJP, MVB et al.). Ochlochy Park, Dunblane: 3 on 16 Jan then 1 on 18 & 27 Jan (CJP).

*SNOW BUNTING *Plectrophenax nivalis* (w)
C Ten Andrew Gannel Hill 17 Mar (CW) & 2 Menstrie Glen 5 Mar (JRC).
S Ten Beinn Dearg (NN 5803) 31 Jan; 7 Lochan an Eireannaich 24 Jan (CG); 6 Edra, L. Katrine 2 Jan (DOE); 4 Earlsburn Resr. N 2 Jan (CRM); 1 Dunchroisk, G. Lochay 31 Jan; 2 Meall na Samnha, G. Lochay 27 Feb (JPH) & 1 Dumyat 13 Feb (CJP).

YELLOWHAMMER *Emberiza citrinella* (B, W)
BBS/WBBS: recorded at 0.46 b/lkm (1997-2021 av: 0.45 b/lkm. Range: 0.08 (2003) to 0.74 (2010) b/lkm). As would be expected, most frequent on farmland at 1.67 b/lkm.

F Site max: c.50 Brackenlees 9 Jan & 40+ Skinflats 15 Jan.
C Site max: c.150 Cambus 7 Jan & c.150 Longcarse 14 / 23 Jan.
S Site max: 109 Easter Row 5 Dec; 101 Carse of Lecropt 23 Jan; 84 Greenyards, Dunblane 21 Nov & c.50 Hill of Row 30 Jan.

REED BUNTING (Common) *Emberiza schoeniclus* (B, W)
BBS/WBBS: recorded at 0.17 b/lkm (2004-2021 av: 0.23 b/lkm. Range: 0.10 (2005) to 0.45 (2006) b/lkm). As usual, most frequent on WBBS at 0.45 b/lkm.

F Site max: 25 Airth shore 31 Jan & c.20 R. Carron (Skinflats) 19 Dec.
C Site max: c.90 Longcarse 6 Jan & 25 Park Fm / Black Devon 15 Feb.
S Site max: c.80 Glenhead (NN 7500) 3 Jan & 74 Carse of Lecropt 24 Jan.

HYBRIDS

CANADA GOOSE x GREYLAG GOOSE
C One Gartmorn Dam 3 Feb & 19 Mar. 1 Cambus 1 Oct.
S Two Balvag Marshes 1 Nov & 1 Balquhidder 20 Dec.

SCAUP x TUFTED DUCK
F Male Kinneil 5 Apr (DB).

ESCAPES

RUDDY SHELDUCK *Tadorna ferruginea* (Irr)
This sp's is listed as Cat B on the Scottish List & is therefore not known to have bred in the wild since at least 1949.
*C Two to four Tullibody Inch 1 – 15 Aug (CJP, DH et al) & 4 there 8 Sep (CVW).

SOUTH AFRICAN SHELDUCK *Tadorna cana*
C Two Tullibody Inch 9 & 12 Aug (GG, DOE, CRM).

RING-NECKED PARAKEET (Rose-ringed Parakeet) *Psittacula krameri*
C One W. End Park, Alloa 28 Aug & 27 Sep (IR, CAM).

DUNBLANE WEATHER REPORT

Neil Bielby and John Holland

The weather station is my suburban back garden in Ochiltree, Dunblane. This is situated 50 m to the east of the Dunblane Hydro ridge, 100 m a.s.l., in a shallow, sheltered valley. (G.R. NN 78990143).

I have been recording the weather since 1995 and all averages etc. refer to the last 26 years. (Note: because there is much variation from year to year in Britain in the parameters used to define climate, climatological averages are usually taken over periods of 30 years for temperature and 35 years for rainfall. Therefore, all averages in this report should be viewed with some caution). I am indebted to Dr. John P. Holland for providing Met Office and additional weather records from Kirkton Farm, Strathfillan (NN 359283; 170 m a.s.l.) and Killin. Weather recording began in 1991 at Kirkton Farm and means etc. for this site date from that year. Killin means date from 2000. The data from Kirkton allows for some interesting meteorological comparisons between the far north-west and central areas of our region.

Daily rainfall (> 0.2mm), maximum and minimum temperatures, barometric pressure, cloud cover, wind direction and speed (Beaufort scale) are recorded. All except the maximum daily temperature are recorded at 09.00 hours. A brief description of the day's weather is also noted along with exceptional and unusual weather phenomena across the UK. Unless indicated otherwise, daily (24 hour) rainfall amounts are measured from 09.00 hours on the date mentioned until 09.00 hours the following morning.

(LTA = long-term average which, unless stated otherwise, is for the 1995 - 2021 period at this station).

Summary

The mean temperature for 2021 of 8.61°C was 0.1°C above the 1995 – 2021 average while precipitation of 1,109.6 mm (43.68 inches) was 75.4 mm (7%) below the average. The month with the most precipitation was October (181.4 mm) while April was again the driest with only 15.8 mm (see plates). The warmest month was July (mean temp. 17.59°C) and the coldest January (mean temp. -0.18°C). The highest recorded temperature was 28.6°C (21st July) and the lowest -9.4°C (11th & 24th February). There were 77 air-frosts (average 70) and six ground frosts (average four) while snow lay on the ground at 09.00 hours on 38 occasions (average 21). Temperatures of over 25.0°C were recorded on 13 days (11 in July (including 8 consecutive days from the 19th – 26th) and 2 in August). There were 190 (52%) 'rain days' (average 208) with the highest 24-hour total being 44.0 mm (measured at 09.00 hours on the 5th of February). The mean barometric pressure was 1013.5 mb (average 1011.5 mb) with a high of 1041 mb (18th December) and a low of 967 mb (11th March). It was calm at 09.00 hours on 181 (51%) of recorded mornings although only on 82 occasions (23%) did it remain calm throughout daylight hours. Turning to the seasons: Winter (December 2020 – February 2021) was colder and wetter with the mean temperature being 0.7°C below and the 378.6 mm of precipitation being 35% above the LTA. Spring (March – May) was colder (-0.84°C) but with precipitation almost exactly the same as the LTA. Summer (June – August) was warmer (+0.75°C) and quite a bit drier with only 72% of the average rainfall. Finally, Autumn (September – November) was markedly warmer than the average (+1.24°C) (see plate) but notably wetter with the rainfall total of 342.9 mm being 35% above the LTA.

January's mean temperature of -0.18°C (LTA 2.27°C) made it the 2nd coldest at this station after -0.8°C in January 2010. The minimum temperature was -8.7°C (-10.5°C Kirkton, 9th) and the maximum 8.9°C (9.0°C Kirkton, 11th). There were 24 night-frosts (average 14) while the temperature stayed below freezing on 4 days. The garden pond remained frozen throughout the month. Total precipitation of 110.6 mm was

94% of the average with c.50% of this being snow which lay on the ground at 09.00 hours on 28 days (average eight days) - the previous high being 16 days in 2010. The mean barometric pressure of 1009 mb was the same as the LTA with a high of 1032 mb (4th) and a low of 970 mb (21st). The Scottish mean temperature of 0.5°C was 2.1°C below the LTA (1981 – 2010) making it the coldest January since 2010. The daytime high was 10.9°C (Drummond Castle, Perthshire 11th) with a night low of -13.0°C (Dawyck, Peeblesshire 9th and Braemar 31st). Overall precipitation was 91% of the average with sunshine 31% above average making it Scotland's 4th sunniest January in a series from 1919. Other UK monthly extremes were: a maximum temperature of 14.2°C Pershore College, Hereford (28th); 132.8 mm of rain Honister Pass, Cumbria (20th) and wind gusts of 69 mph S. Uist & Marham, Norfolk (21st).

The wintery cold spell and lying snow persisted until the 10th with the minimum temperature during this period being -8.7°C (9th, -10.5°C Kirkton) while it remained below freezing during the 6th and 8th. The stationary high-pressure system (1032mb, 4th) meant that it was mostly calm. Light rain and sleet during the 4th froze on landing forming treacherous black ice. The 10th and 11th were milder with a max. temp of 8.9°C (11th). Night frosts returned on the 12th with the temperature remaining below freezing the following day. Fine snow, which started to fall during the afternoon of the 13th, became heavier during the night so that by 09.00 hours the next day its depth was 11 cm. This was as deep as at any low level elsewhere in Scotland and caused the A9 round Dunblane to be closed for a while. Milder weather from the 16th (5.9°C) started a thaw but snow continued to lay at this station until the end of the month. 2.5 cm of fresh snow during the early hours of the 21st saw a return to colder conditions with night frosts (-5.9°C, 24th) and cloudless, calm days. The cold weather continued until the month end with a mixture of damp and sunny days along with occasional light night snow.

February was slightly colder but much wetter than the norm. The mean temperature of 2.97°C was 0.09°C below the

average with a daytime high of 10.9°C (20th & 21st) and a night low of -9.4°C (11th). The daytime temperature didn't rise above freezing on five occasions reaching only -1.7°C on the 11th while there were 12 air-frosts (average 10). Precipitation of 177.9 mm was 51% above the average with measurable amounts on 20 days (average 17). The highest 24-hour total of 44.4 mm (in the 24 hours ending at 09.00 hours on the 5th) was the 2nd highest at this station (after 58.0 mm on 04/08/2020). Snow lay on the ground at 09.00 hours on nine occasions (average six). The mean barometric pressure of 1011 mb was 2 mb above the average with a high of 1040 mb (27th) and a low of 985 mb (18th). The mean temperature across Scotland of 2.5°C was 0.2°C below the LTA (1981 – 2010) with rainfall 16% and sunshine 5% above their LTA's. The maximum temperature at Altnaharra, Sutherland on the 9th was only -5.5°C. Other UK monthly extremes were: a maximum temperature of 18.4°C Santon Downham, Suffolk (24th); 125.8 mm of rain Honister Pass, Cumbria (24th) and wind gusts of 83 mph S. Uist (14th).

The cold spell, with occasionally strong easterly winds, persisted until the 12th. Increasingly heavy rain from noon on the 4th had produced 44.4 mm by 09.00 hours the following morning (71.0 mm Tyndrum). This rain, along with slightly milder weather on the 5th, removed the last of the snow in the garden. However, a centimetre of new snow in the early hours of the 9th was followed by frequent showers throughout the next day to provide a depth of 14.5 cm (5¾ inches) by 09.00 hours on the 10th. (38 cm Aboyne, Aberdeenshire). High pressure (1033 mb, 12th) produced calm, cloudless conditions which, allayed to a light northerly airflow, provided ideal conditions for overnight temperatures to plunge to -9.5°C (11th, -18.0°C Strathallan School, -23.0°C Braemar – the lowest UK temperature since 1995), the lowest of the winter so far. Daytime temperatures remained below freezing from the 8th to the 11th and again on the 13th. The wintery weather, which had dominated the year so far, was ended by a succession of Atlantic low-pressure systems which brought the usual milder but wet and windy conditions. From the 15th, daytime temperatures were a little above the norm for mid-February reaching a high of 10.9°C

(10.8°C Kirkton, 20th). The persistent, often strong, south-westerly winds gusted up to 40 mph at times. The 23rd was a particularly wet and windy day with rain from 04.00 hours producing 19.0 mm which was accompanied by southerly gusts of up to 43 mph. A high-pressure system building over the country from the 25th peaked at 1040 mb on the 27th. As usual, this brought quieter conditions being either calm or with only light breezes from the 26th.

March was milder and drier than the norm. The mean temperature of 6.23°C was 1.42°C above the average with the mean minimum and maximum temperatures being 1.27 °C and 1.26°C above their averages respectively. The maximum temperature was 18.5°C (18th) with the minimum temperature being -3.2°C (6th). There were five air-frosts (average 11) and one ground frost. Rainfall of 68.8 mm was 82% of the average with measurable amounts on 15 days (average 16). The highest 24-hour total was 15.6 mm (9th). No snow fell during the month. The mean barometric pressure of 1017 mb was 5 mb above the average with a high of 1035 mb (5th) and a low of 976 mb (11th). The mean temperature across Scotland of 5.3°C was 1.8°C above the 1961 – 1990 LTA with rainfall 9% above this average while sunshine was 99% of it. A maximum temperature of 19.3°C was recorded at Grangemouth (18th) and a low of -8.5° Braemar (3rd). Other UK monthly extremes were: a maximum temperature of 24.5° C Kew Gardens, London (30th); 177.2 mm of rain Seathwaite, Cumbria (29th) and a wind gust of 99 mph The Needles, Isle of Wight (13th).

With high pressure (1035 mb, 5th) continuing to dominate until the 8th, the weather remained settled with hardly any rain, a light north-easterly airflow and mostly sunny days. However, from the 8th to the 12th, a succession of deep Atlantic low-pressure systems (967 mb, 11th) provided a complete contrast with a mixture of heavy rain and showers accompanied by south-westerly, then westerly winds gusting up to 36 mph. The 13th was mostly sunny although the easing westerly wind saw temperatures remain below the norm for mid-March. As a high-pressure system developed over the UK (1034 mb, 17th) daytime temperatures rose to a year high

of 18.5°C on the 18th (19.3°C Grangemouth). From the 16th – 21st Central Scotland basked in almost unbroken sunshine thus enjoying the best weather in the UK. The clear skies also resulted in a ground frost (19th) and a frost of – 1.3°C (21st). There was no rain from the 16th to the 23rd. This early taste of spring ended on the 24th with the fresh to strong south-westerly winds, gusting up to 36 mph, bringing showers. These winds, along with bands of rain, persisted until the month end and, although amounts were moderate at this station, on the 28th, 85.8 mm fell at Kirkton Farm compared to just 9.2 mm in Dunblane, thus providing a stark reminder of the west to east rainfall gradient in the reporting area.

April was colder and much drier than the norm with the mean temperature of 5.60°C being 2.16°C below the average making this the coldest April at this station. The mean minimum temperature o -0.36°C was 3.55°C below the average; 1.75°C below the previous April mean low of 1.36°C in 2013. The maximum temperature was 19.2°C (23rd) with the minimum temperature being -6.3°C (12th). There were 15 air-frosts (average five) and four ground frosts - both of these setting new highs. Rainfall of 15.8 mm was only 22% of the average making this the 2nd ever driest month at this station after 14.9 mm in April 2020. There were measurable amounts on 10 days (average 14). The highest 24-hour total was 4.0 mm (27th). There was a light covering of snow at 09.00 hours on the 5th. The mean barometric pressure of 1024 mb was 11 mb above the average with a high of 1036 mb (3rd) and a low of 1011 mb (8th & 27th).

The mean temperature across Scotland of 4.6°C was 1.5°C below the LTA (1981 – 2010) while it enjoyed the sunniest ever April in a series dating from 1919 with 211.5 hours, thus eclipsing 2020's record of 204.6 hours. The UK had the highest number of air frosts in 60 years with an average of 13 which resulted in the lowest average minimum temperature since 1922 and the third lowest since records began in 1884. Averaged across the UK, April was also colder than March for the first time since 2012 while it was the 4th driest in a series from 1862. Some UK monthly extremes were: a maximum temperature of 21.4°C Treknow, Cornwall (1st); a

minimum temperature of -9.4°C Tulloch Br., Inverness-shire (12th); 28.8 mm of rain St Athan, S. Glamorgan (27th); a wind gust of 75 mph on Fair Isle (5th) while a snow depth of 12 cm was recorded at L. Glascarnoch (7th).

The first three days of the month were sunny and calm courtesy of high pressure over the country (1036 mb 3rd). Daytime temperatures peaked at 16.5°C (3rd) but the clear skies resulted in night frosts (-3.2°C, -5.9°C Kinbrace, Sutherland, 2nd). A predominately northerly airstream from the 5th produced cold, dry but often sunny days. There were nightly frosts with a low of -5.9°C (-7.5°C Kirkton, -9.4°C Tulloch Br.,12th) while daytime temperatures struggled to reach 10.0°C in the sometimes bitterly cold and strong northerly winds. It was particularly windy on the 8th with gusts of 46 mph as the air-stream turned south-westerly for the day. There was a fine covering of snow at 07.00 hours on the 5th. A building high-pressure system over the country from the 9th (1036 mb, 15th) produced nine consecutive days of virtually unbroken sunshine and calm weather. However, although daytime temperatures reached 15.5°C (15th), the clear skies resulted in nightly frosts, several of which were quite sharp (-6.3°C, 12th) which caused damage to tender garden plants. Apart from a little light rain on the mornings of the 18th and 20th, it continued dry and mostly calm as another high-pressure system (1033 mb, 25th) built. It was virtually cloudless from the 21st – 23rd with temperatures reaching a maximum of 19.2°C (17.9°C Kirkton, 20.0°C Bowhill, Selkirkshire, 23rd). A low-pressure system (1011 mb, 27th) moving down across Scotland from the NW, brought more unsettled weather along with spells of mostly light rain. The 27th was windy with the cold NE 5 gusting up to 34 mph. This north-easterly airflow kept temperatures below the seasonal norm with a maximum of 11.8°C (30th).

May was colder and wetter than the norm. The mean temperature of 9.34°C was 1.67°C below the average which makes it the 2nd coldest May at this station after 8.27°C in 1996. The maximum temperature was 23.6°C (30th) and the lowest -1.6°C (7th) and there were 4 air-frosts. Rainfall of 102.8 mm was 41% above the average with measurable amounts on 16 days – the same as the average. The highest 24-hour total

was 32.4 mm (3rd). The mean barometric pressure of 1008 mb was 5 mb below the average with a high of 1029 mb (30th) and a low of 990 mb (9th). The mean temperature for Scotland was 1.2 °C below the LTA (1981 – 2010) with more frosts than average. Scotland had 130% of average rainfall, with more than double the average in some eastern parts but below the average in the west. Sunshine totals were 80% of average with it being dullest (relative to normal) on the eastern side. Across the UK, it was the 4th wettest May in a series dating from 1862, with rainfall 71% above the average. The UK mean temperature of 9.1°C was 1.3°C below the 1981 – 2010 LTA. Some UK monthly extremes were: a maximum temperature of 25.1°C Kinlochewe, Ross & Cromarty (31st); a minimum temperature of -6.1°C St Harmon, Powys (2nd); 103 mm of rain Mickleden, Cumbria (21st); a wind gust of 93 mph The Needles, Isle of Wight (3rd) while a snow depth of 1 cm was recorded at Achiltibuie, Ross & Cromarty (5th).

An Atlantic low (990 mb), laden with moisture, deposited 32.4 mm of rain between 10.00 hours on the 3rd to 03.00 hours the next day - an amount double that received during the whole of April! It was also windy with the raw E 3-4 gusting to 30 mph. As it passed east across Scotland a northerly airstream replaced it which brought unseasonably cold conditions. There were several night frosts (-1.8°C, 7th) while the daytime maximum reached only 8.9°C (8th). With the jet-stream to the south of the UK the resulting, largely north-easterly airstream, meant that temperatures remained below the norm for May until the 26th. Several low-pressure systems during this period produced showery conditions although rainfall amounts were reasonably low in the main. In fact, a run of seven consecutive dry days was ended on the 20th when an Atlantic low-pressure system (990 mb) brought autumnal like weather to the UK. 17.0 mm of rain fell in 28 hours from 11.00 hours on the 20th with the raw north-easterly winds gusting up to 31 mph. Threave (Kirkcudbrightshire) recorded 57.2 mm (20th). Further rain during the 23rd, 24th & 25th produced a further 25.0 mm. The unusually cold spring finally ended as high pressure (1029 mb, 30th) brought a warm (24.2°C, 22.6°C Kirkton, 30th), dry end to the month.

June was warmer and much drier than average with the mean temperature of 15.07°C being 0.94°C above the LTA. The maximum day temperature was 24.8°C (29th) while the minimum night temperature was 3.6°C (22nd). Rainfall of 40.9 mm was 51% of the average with measurable amounts on only 8 days (average 15). The highest 24-hour total was 12.0 mm (13th). The mean barometric pressure of 1018 mb was 4 mb above the average with a high of 1025 mb (6th) and a low of 1008 mb (16th). Scotland's mean temperature was 1.2°C above the LTA (1981 – 2010) with rainfall 56% below and sunshine 12% above average respectively. Some UK monthly extremes were: a maximum temperature of 29.7°C Teddington, London (31st); a minimum temperature of -2.4°C Altnaharra, Sutherland (22nd); 74.0 mm of rain Princetown, Devon (28th) and a wind gust of 54 mph L. Glascarnoch (10th).

The north-easterly breeze and accompanying early haar continued for the first 3 days. However, this had usually burnt off by 11.00 hours to give sunny and warm afternoons (24.2°C, 1st; 25.6°C Prestwick, Ayrshire, 2nd). The airflow changed to a light southerly direction from the 4th with the daytime maximum temperatures falling a little (19.0°C, 4th). It remained mostly dry though with only 0.1 mm of rain during the evening of the 5th. Mostly patchy light rain during the 9th (3.5 mm) provided the first measurable amount in 14 days. Temperatures peaked at 22.2°C (7th) during this period which coincided with a barometric high of 1025 mb (6th). Slightly fresher and breezy weather followed the rain. The 13th was sunny and warm with a maximum temperature of 23.7°C but more unsettled, cooler weather followed with 12.0 mm & 9.1 mm of rain during the early hours of the 14th and 16th respectively. The 14th was a windy day with the south-westerly gusting up to 36 mph around noon. The 17th and 18th were mostly sunny and warm (19.9°C, 17th) however, the following 2 days were showery. There was no particular pattern to the weather over the next 7 days with the 21st and 22nd being sunny and reasonably warm although the temperature fell to an unseasonal low of 3.6°C during the early hours of the 22nd. Rain from noon to midnight on the 24th produced 11.6 mm (32.9 mm Nunraw Abbey, E. Lothian) which was welcomed by dry gardens. Subsequent north-

easterly winds depressed temperatures which only reached a maximum of 15.8°C (9.6°C Aviemore) on the 25th. The final five days of the month were dry and mostly sunny with temperatures peaking at 24.8°C (25.0°C Kirkton, 29th).

July was warmer than normal with the mean temperature of 17.59°C being 1.71°C above the average. The maximum day temperature was 26.6°C (20th) while the minimum night temperature was 8.2°C (1st). Rainfall of 82.8 mm was 86% of the average with measurable amounts on 13 days (average 16). The highest 24-hour total was 38.4 mm (27th). The mean barometric pressure of 1014 mb was one mb above the average with a high of 1028 mb (17th) and a low of 996 mb (6th). The mean temperature for Scotland of 15.1°C was 1.8°C above the LTA (1981 – 2010) making it the 3rd warmest July in a series dating back to 1884. Additionally, rainfall was only 67% of average with sunshine 25% above average. Some UK monthly extremes were: a maximum temperature of 32.2°C Heathrow (20th); a minimum temperature of -0.1°C Braemar (2nd); 87.9 mm of rain Bethersden, Kent (26th) and a wind gust of 77 mph The Needles, Isle of Wight (30th).

The first two days of the month were dry and warm with the temperature reaching 24.1°C (1st). With the morning blanket cloud (haar) taking longer to burn off than during the latter days of June it wasn't quite as sunny. Falling low pressure heralded a change to more unsettled conditions with the first rain for 8 days (11.7 mm) falling during the evening of the 3rd and early hours of the 4th. A further 22.2 mm of rain fell over the next 3 days before a high-pressure system (1020 mb, 8th) brought drier and warmer conditions as temperatures reached 23.3°C (7th). It continued warm with small amounts of rain until the 14th when a building high pressure system (1028 mb, 17th) brought dry and sometimes hot conditions (28.6°C, 21st; 27.3°C Kirkton & 29.6°C Forrest Lodge, Kirkcudbrightshire, 22nd) but only reaching 12.3°C at Baltasound, Shetland (20th). The night of the 20th / 21st was mild with the temperature at Grangemouth falling no lower than 16.7°C. Although a few days were totally cloudless, the normal pattern was for early overcast east coast haar to clear anytime between 10.30 and 14.00 hours with temperatures then rising quickly in the afternoons to peak around 17.00

hours. This heatwave lasted until the evening of the 27th when an electric storm, accompanied by torrential rain, deposited 38.4 mm between 19.00 hours and midnight (57.9 mm Cawdor Castle, Nairnshire). This was the 9th highest daily total at this station ending a run of 13 days without rain. Both sunshine and temperatures were slightly reduced in the final 4 days of the month.

August was slightly cooler but quite a bit drier than the norm. The mean temperature of 14.63°C was 0.45° below the average with a daytime high of 26.3°C (25th) and a night low of 5.6°C (12th). Rainfall of 72.6 mm was 76% of the average with measurable amounts on 11 days (average 17). The highest 24-hour total was 11.5 mm (11th). The mean barometric pressure of 1015 mb was three mb above the average with a high of 1035 mb (31st) and a low of 990 mb (7th). The mean temperature for Scotland of 13.7°C was 0.3°C above the 1981 – 2010 averages. However, Glasgow enjoyed its 4th hottest August in a series dating back to 1884. Rainfall was only 71% of the average with the 127.4 hours sunshine being close to normal. Some UK monthly extremes were: a maximum temperature of 27.2°C Heathrow (25th); a minimum temperature of 0.3°C Braemar (31st); 74.2 mm of rain Spadeadam, Cumbria (9th) and a wind gust of 59 mph The Needles, Isle of Wight (9th).

The first four days of the month were dry, warm and mostly sunny but a low-pressure system (990 mb, 7th) drifting up from England brought unsettled weather. There was rain every day, mostly in the afternoon / evenings with short thunderstorms on the 6th and 7th which caused some localized flooding in both Edinburgh and Glasgow. The unsettled conditions with daily rain of varying amounts, occasionally in the form of thundery downpours, continued until the 14th. On the 9th these caused more flooding in the Central Belt with some ScotRail services being diverted or delayed. The next 5 days were dry with good sunny spells but a slow moving, meandering Atlantic front, produced 22.0 mm of rain from the evening of the 20th to noon on the 22nd. Subsequently, a large 'blocking' high-pressure system developed over the UK (1035 mb, 30th) resulting in dry weather until the month end. It was also mostly sunny and sometimes very warm (26.3°C,

25th). The 27.2°C recorded at Kirkton that same day was the highest temperature in the UK for the month as it enjoyed an official, localized 'mini-heatwave' with temperatures of more than 25°C on three consecutive days. However, this fine spell was often tempered by overnight haar drifting in from the east coast, which sometimes took up until mid-afternoon before the sun finally dispersed it**.**

September was warmer but wetter, than average with the mean temperature of 14.05°C (1.77°C above the average) being the highest recorded at this station after 13.98°C in 2016. The mean day high of 18.03°C and the mean night low of 10.06°C were 1.9°C and 1.64°C above their respective averages. The maximum daytime temperature of 26.7°C (8th) was the highest for September here after 24.5°C in 2005. The lowest night temperature was 3.5°C (29th). Rainfall of 111.2 mm was 31% above the average with measurable amounts on 17 days (average 16) and a 24 hour high of 23.9 mm (26th). The mean barometric pressure was 1015 mb (average 1014) with a high of 1036 mb (1st) and a low of 997 mb (27th). The mean September temperature for Scotland of 13.0°C was 2.1° C above the average making it the second warmest in figures dating back to 1884 (see fig ?). The mean rainfall of 105.1 mm was just 78% of the average while the 90.5 hours of sunshine was 86% of the average. Some UK monthly extremes were: a maximum temperature of 30.8°C Hartpury, Gloucestershire (7th); a minimum temperature of -1.4°C Aboyne (30th); 76.6 mm of rain at White Barrow, Devon (29th) and a wind gust of 74 mph The Needles, Isle of Wight (27th**).**

The fine, dry spell continued into this month with the 1st, after a night low of 6.1°C (3.9°C Tyndrum), being a warm day (23.9°C) of unbroken sunshine as the high-pressure system peaked at 1036 mb. However, the 3rd and 4th were much cooler as the regular overnight haar failed to clear resulting in a maximum temperature of only 14.1°C on the 3rd. Light rain during the evening of the 5th ended a run of 14 consecutive dry days. The night of the 6th / 7th was very mild with a minimum of only 17.2°C at Grangemouth. A plume of humid southerly air on the 8th produced the highest September temperature in Scotland for 115 years. The 29.1°C at Floors Castle, Borders (27.6°C Dunblane, 26.2°C Kirkton,)

only being bettered by 32.2°C at Gordon Castle, Moray in 1906. A shallow low-pressure system (1006 mb, 9th) produced scattered electrical storms throughout the UK although none at this station – just 12.4 mm of rain fell here during that day. Rising pressure (1020 mb, 13th) produced reasonably settled conditions although 14.0 mm of rain fell during the night and morning of the 13th / 14th followed by a further 9.4 mm on the 19th. The following 6 days were mostly dry, increasingly warm (19.6°C, 26th), but breezy with the south-westerly winds gusting up to 34 mph (22nd, 69 mph Fair Isle, 23rd). More autumnal conditions ensued from the 27th with spells of heavy rain producing 59.9 mm during the last 4 days of the month with 37.4 mm falling at Kirkton on the 26th alone.

October was milder but wetter than usual with the mean temperature of 9.52°C being 0.94°C above the average. The maximum daytime temperature was 16.2°C (7th) with a minimum night low of 0.1°C (15th). The minimum temperature during the night of the (7th / 8th) was a mild 14.2°C. There was only one air and one ground frost. Rainfall of 181.4 mm was 39.7% above the average with measurable amounts on 26 days (average 21). The highest 24-hour total was 29.9 mm (29th). The mean barometric pressure was 1008 mb (average 1010) with a high of 1029 mb (11th) and a low of 980 mb (3rd). The mean temperature for Scotland of 9.2°C was 1.3°C above the LTA (1981 – 2010) with a maximum temperature of 21.2°C at Kinloss, Morayshire (8th) and a low of -3.1°C at Aboyne, Aberdeenshire (23rd). Rainfall was 25% above average with the south being especially wet. It was a dull month with only 74% of the average sunshine. Some UK monthly extremes were: a maximum temperature of 22.9°C at Thornes Park, W. Yorks (8th); a minimum temperature of -3.6° C at Redesdale Camp, Northumberland (16th); 222.6 mm of rain at Honister Pass, Cumbria (28th) and a wind gust of 75 mph The Needles, Isle of Wight (31st).

The unsettled, autumnal weather continued for the first five days of the month courtesy of a complex low-pressure system over the North of Scotland. A ridge of high pressure on the 6th produced a clear, cold night (1.6°C) resulting in iced car windscreens by dawn followed by a sunny calm day. A meandering band of moist, humid, tropical air, running

SW to NE across the country, then deposited 33.4 mm of rain during the next 3 days - despite the barometer rising to 1025 mb (9th). The temperature during the night of the 7th / 8th fell to only 14.6°C (15.9°C Edinburgh) rising just 0.9°C during the day to 15.5°C (21.2°C Kinloss, Morayshire). With high pressure (1029 mb, 11th) remaining over the UK calm, if mostly overcast conditions, ensued until the 14th which was a windy day (WSW 4, gusting 37 mph). This was followed by the first air-frost of the autumn (-0.1°C, -1.1°C Kirkton,) and a virtually cloudless day on the 15th. Heavy rain during the evening and night of the 16th / 17th produced 17.8 mm by 09.00 hours the next morning. A deep mid-Atlantic low pulled up warm, moist air from the tropics during the 18th / 19th raising the daily temperature to a high of 15.1°C (16.4°C Kirkton, 19th) following a peak of 15.6°C during the previous night. The jet stream then moved to the south of UK thus drawing colder air from the north resulting in a ground frost on the morning of the 21st and a maximum daytime temperature of only 9.7°C. The reward was two sunny and dry days. It was also windy at times gusting up to SW 31 mph (20th). The final week of October was wet and windy with successive Atlantic lows (987 mb, 30th) and frontal systems delivering 81.5 mm of rain making it the 6th wettest week at this station. 18.8 mm fell between 16.00 hours and 20.00 hours on the 27th (89.8 mm Eskdalemuir, Dumfries & Galloway) with a further 29.9 mm from midnight to 16.30 hours on the 29th. South-westerly winds predominated during this period gusting up to 37 mph (26th).

November was milder and drier than the norm with the mean temperature of 5.65°C being 0.98°C above the average. The maximum daytime temperature was 12.6°C (19th) with a minimum night low of -3.1°C (29th). The minimum temperature during the night of the (29th / 30th) was a mild 11.0°C. There were 6 air-frosts (average 8). Rainfall of 57.3 mm was only 51% of the average with measurable amounts on 14 days (average 20). The highest 24-hour total was 21.1 mm (30th). The mean barometric pressure was 1014 mb (LTA 1008) with a high of 1033 mb (22nd) and a low of 976 mb (1st). The mean temperature for Scotland of 6.3°C was 1.3°C above the LTA with a maximum temperature of 16.8°C at Dyce,

Aberdeenshire (19th) where the temperature had fallen to only 14.0°C the preceding night, all courtesy of a Foehn effect. The minimum temperature recorded was -7.0°C at L. Glascarnoch, Ross & Cromarty (29th). Rainfall was 16% below average with only the north-west corner being wetter - receiving double the norm. Sunshine was 91% of the average. Some UK monthly extremes were: a maximum temperature of 17.6°C at Nantwich, Cheshire (9th); a minimum temperature of -8.7°C at Shap, Cumbria (29th); 67.2 mm of rain at Achfary, Sutherland (20th); a snow-depth of 18 cm at Middleton, Derbyshire (27th) and a wind gust of 98 mph at Brizlee Wood, Northumberland (26th).

The first five days of the month were settled and dry with good spells of sunshine. Thanks to the jet-stream being to the north of the UK, the mild conditions continued until the 21st with maximum daytime temperatures of 12.8°C (9th) and 12.6°C (19th). With a dominant south-westerly airstream it was often damp, although rainfall totals were mostly low, with 10.5mm from 16.00 hours on the 11th to midnight the following day the only notable amount. Being mild, it was quite pleasant on those days when the increasingly low winter sun appeared. It was occasionally windy, with the aforementioned south-westerlies gusting up to 36 mph on both the 7th and the 18th. The weather then became colder with a frost of -2.2°C (22nd) causing the first thin skin of ice of the winter on the garden pond. It was largely dry, sunny and calm however until the night of the 26th / 27th when the first named storm of the winter 'Arwen' brought gale force northerly winds to the whole of the UK. The East coast from Fraserburgh to Scarborough was the most badly affected causing the Met Office to issue its first 'Red Alert' warning in 3 years. Three people were killed by falling trees across the UK, including one in Aberdeenshire, with many areas suffering power cuts as a maximum wind speed of 98 mph (56 mph at this station) was recorded at Brizlee Wood, Northumberland. The maximum wind gust recorded in Scotland was 78 mph at Inverbervie, Kincardineshire. As would be expected, ferry and train services were severely disrupted while many roads were blocked by fallen trees. Roofs were blown off buildings and high-sided lorries

toppled. C.100,000 homes in Scotland, almost all in the east, from Fraserburgh to Berwick, were without power on Saturday morning (27th). C.30,000 were still not reconnected by the end of the month with the last finally having their power restored on the 5th of December. In contrast to the Arctic blast of the weekend, the night of the 29th / 30th was unusually mild with a minimum temperature of 10.9°C. Although November had been relatively dry, heavy rain in the evening of the 30th produced 21.2 mm, which equated to 38% of the month's total rainfall.

Like the previous month, **December** was milder and drier than the norm with the mean temperature of 2.9°C being 0.6° C above the average. The maximum daytime temperature was 11.2°C (30th) with a minimum night low of -3.9°C (6th). There were 13 air-frosts (average 14). Rainfall of 87.5 mm was 75% of the LTA with measurable amounts on 21 days (average 20). The highest 24-hour total was 12.4 mm (29th). The mean barometric pressure was 1008 mb (average 1009) with a high of 1041 mb (17th) and a low of 974 mb (8th). The mean temperature for Scotland overall of 3.4°C was 0.6°C above the 1991-2020 average with a maximum temperature of 16.1°C at Kinlochewe, Ross & Cromarty (31st) and a low of -10.2°C at Braemar, Aberdeenshire (22nd). Rainfall (136.8 mm) and sunshine (26 hours) were both 79% of the average with the north being the brighter half. The highest 24-hour precipitation total was 52.8 mm at Achnagart, Ross & Cromarty (14th) while gusts of up to 78 mph were recorded at Lerwick, Shetland (13th). Some UK monthly extremes were: a maximum temperature of 16.5°C at Bala, Gwynedd (31st); a minimum temperature of -10.2°C at Braemar, Aberdeenshire (22nd); 97.2 mm of rain fell at Honister Pass, Cumbria (31st); a snow-depth of 9 cm at Copley, Durham (26th) and a wind gust of 86 mph at Aberdaron, Gwynedd (7th).

The first six days were a mixture of overnight frosts (-3.9° C, 5.7°C Kirkton, 6th), sunny days and spells of rain. The 7th saw 'Barra', the second named storm of the winter, sweep through with its easterly gales gusting to 36 mph in Dunblane. The southern half of England, Wales and Northern Ireland were affected most with the usual fallen trees and flooding causing transport links to be disrupted.

The previous pattern then resumed until the 12th when the weather turned milder, damper and windier. The south-westerly winds gusted up to 47 mph during the night of the 12th / 13th when the temperature rose to 12.0°C. It became calm from the 16th as a 'mega' high pressure system built over the UK (1041 mb, 17th). The 17th was cloudless and calm with just a few mist patches - a perfect winter's day. Inevitably however, high pressure at this time of year brings fog. This blanketed the area during the next 2 days to be followed by 2 days of damp, dreich and raw conditions before the weakening high pressure system enabled an Atlantic front to pass through Scotland. This produced 19.5 mm of rain from 14.00 hours on the 22nd to midnight the next day. The subsequent north-easterly airflow brought dry weather and some sunshine at last for Xmas Day and the wind, gusting up to 24 mph, provided rare mid-winter drying conditions. A mild south-westerly airstream from the 29th saw temperatures rise to an unusually mild 11.2°C (30th). This was inevitably accompanied by rain with 26.7 mm falling during the final 3 days of the year.

Kirkton Farm (Met Office Automatic Weather Station), near Tyndrum, Perthshire

Summary

The total rainfall recorded at the Met Office automatic weather station at Kirkton in 2021 was 1872 mm (73.7 inches). This was 725.7 mm less than the thirty-year 1991-2020 average (2597.7 mm) and 1247.4 mm less than the 2020 rainfall total. 2021 was the third driest year since 1991. The wettest month was March when a total of 307 mm (12.1 inches) of rainfall was recorded. The rainfall was only above average in February and March. The driest month was April with 40 mm of rainfall (only 28% of the 30-year average). This was the driest April recorded at the farm. The highest rainfall over a calendar week (Monday to Sunday) was 174.4 mm between the 22nd March and the 28th March (week 13). There were four calendar weeks when the total rainfall exceeded 100 mm. The highest rainfall in a single day (09:00 GMT to 09:00 GMT) was 85.8 mm on the 28th March. There were only two days in 2021 when more than 50 mm of rainfall was

recorded and a further 12 days when there was more than 25 mm of rainfall recorded. The highest rainfall in a single half-day 12-hour period (09:00 GMT to 21:00 GMT) was 50.6 mm on the 28th March. The total number of rain days was 244 (66.8 %). There was no rainfall recorded over a 14-day period from the 13th July to the 26th July, and no rainfall recorded over a 13-day period between the 23rd August and the 4th September. There were 52 days during the summer when no precipitation was recorded.

The lowest temperature recorded during 2021 was on the 9th January when the temperature fell to -10.5°C. There was only one day in 2021 when the temperature failed to rise above freezing (8th February; -0.2°C). An air frost was recorded on a total of 84 days. There were no air frosts recorded in July, August or September. As well as being dry, April was also cold with the lowest recorded April temperature of -7.5°C (on the 12th April), and the lowest recorded mean minimum temperature of -1.4°C. This is the first time the mean minimum temperature for April has been below zero. There were also 19 days of frost in April (the average is eight). The highest temperature in 2021 was recorded on the 22nd July (27.3°C). July and August were the warmest months with mean temperatures of 16.71°C and 14.83°C respectively; and mean maximum temperatures of 21.73°C and 20.12°C respectively. July 2021 was the warmest month on record, and the summer of 2021 (June, July and August) was also the warmest on record with a mean temperature of 14.94°C and a mean maximum temperature of 20.0°C. Temperatures of 25°C or above were recorded on 11 days, while temperatures above 20°C (but less than 25° C) were recorded on a further 40 days. This is the first year where there have been more than 50 days with maximum temperatures above 20°C (the average is only 25 days). The maximum temperature of 26.2°C recorded on the 8th September was the highest September temperature recorded at the farm. On the 31st December a maximum temperature of 12.1°C was recorded; this is the highest temperature ever recorded on the last day of the year. Sustained gale force winds were recorded at the farm on the 26th/27th November (Storm Arwen) which resulted in some tree damage.

Table 1. Temperature and precipitation 2021. Climatological Stations Dunblane / Kirkton.

	Temp mean minima	Temp mean maxima	Number of air frosts	Total precipitation (mm). Means for Dunblane: 1995-2021 Means for Kirkton: 1991-2020	Greatest 24-hour total (mm)	Number of days of measurable precipitation
January	-2.2 / -2.4 (0.1)	1.9 / 3.8 (4.4)	24 / 20 (14)	110.6 / 151.0 (119.1 / 351.5)	41.1 / 28.2	19 / 19 (20)
February	0.3 / 0.8 (0.3)	5.0 / 5.5 (5.9)	9 / 10 (13)	177.9 /276.2 (102.3 / 256.4)	44.4 / 71.0	20 / 22 (17)
March	2.6 / 1.9 (1.4)	9.8 / 9.4 (8.6)	5 / 8 (11)	68.8 / 307.0 (77.3 / 227.5)	16.4 / 85.8	15 / 22 (16)
April	-0.4 / -1.4 / (3.2)	13.6 / 11.2 (12.3)	15 / 19 (5)	15.8 / 40.0 (57.4 / 141.8)	4.0 / 19.2	4 / 15 (14)
May	4.3 / 3.1 (5.8)	14.4 / 13.5 (16.2)	4 / 7 (2)	102.8 / 126.8 (67.3 / 134.8)	32.4 / 40.0	16 / 21 (16)
June	9.1 / 8.4 (9.1)	20.3 / 18.1 (19.1)	0 / 1 (0)	40.9 / 55.8 (73.5 / 122.8)	12.0 / 25.2	8 / 14 (15)
July	12.4 / 11.7 (10.9)	22.7 / 21.7 (20.9)	0 / 0 (0)	82.8 / 67.8 (88.3 / 131.4)	38.4 / 28.8	13 / 12 (16)
August	10.7 / 9.5 (10.5)	18.6 / 20.1 (19.7)	0 / 0 (0)	72.6 / 128.2 (90.9 / 158.9)	11.5 / 20.4	11 / 14 (17)
September	10.1 / 9.4 (8.4)	18.0 / 17.4 (16.1)	0 / 0 (0)	111.2 / 119.4 (85.1 / 200.5)	23.9 / 37.4	17 / 25 (16)
October	6.9 / 6.5 (5.4)	12.1 / 12.3 (11.8)	1 / 2 (3)	181.4 / 268.3 (125.8 / 269.4)	21.9 / 22.5	26 / 29 (21)
November	3.1 / 3.0 (2.1)	8.2 / 9.7 (7.3)	6 / 6 (8)	57.3 / 180.0 (108.9 / 275.0)	21.1 / 31.6	14 / 25 (20)
December	1.0 / 0.8 (0.2)	4.8 / 6.2 (4.4)	13 / 11 (14)	87.5 / 151.5 (113.2 / 327.8)	13.8 / 24.2	21 / 26 (20)
Year	4.9 / 4.3 (4.8)	12.3 / 12.5 (12.2)	77 / 84 (70)	1109.6 / 1872.0 (1109.7 / 2597.7)	38.4 / 85.8	190 / 244 (208)

The single climatological LTA in ( ) relate to Dunblane. Where either two 2021 values or climatological means are given, the first relates to Dunblane and the second to Kirkton. Temperatures are in degrees Celsius.

Thanks to the Met Office for supplying the data from the automatic weather station at Kirkton.

John Holland (SRUC Hill & Mountain Research Centre, Kirkton & Auchtertyre Farms)

Killin

The total rainfall recorded in Killin in 2021 was 1584.5 mm (62.4 inches); this was 275.3 mm less than the 2002-2021 twenty-year average (1859.8 mm). April was the driest month with only 26.5 mm of rain, while February was the wettest month with 292 mm. During 2021 Killin received 85% of the rainfall recorded at Kirkton (i.e. some 287.5 mm less). Storm Arwen on the 26th/27th of November caused extensive damage to trees and powerlines in the Killin area, resulting in a power-outage of more than 48 hours.

STIRLING IN THE AGE OF THE GREAT DISRUPTION

Religion, Law, Money and Politics in a Scottish Parish

Kenneth B. Scott

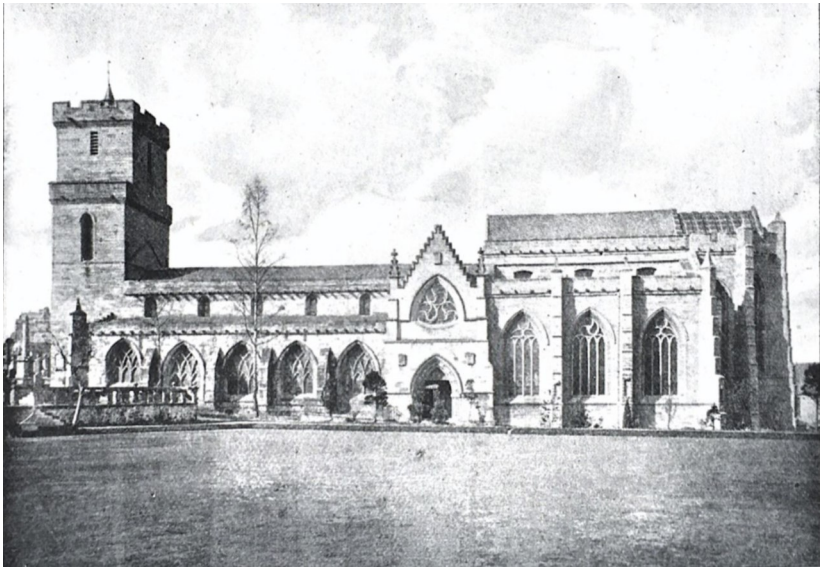
On 18 May 1843, 121 ministers and 73 elders walked out of the General Assembly of the Church of Scotland, the national church by law established, being held at St Andrew's Church in George Street, Edinburgh, and walked down the hill to the Tanfield Hall at Canonmills. There they held the first meeting of the Free Church of Scotland General Assembly. Eventually, 474 of about 1,200 ministers 'came out' of the Established Church for the Free Church. The Great Disruption, as it came to be called, was one of the most important events in Victorian Britain, with far-reaching implications not only for religion, but also for education, law, politics, social welfare and the relationship between Church and State.

The causes of the Disruption were long-standing and complex. They involved divisions between those who supported patronage, the right of 'heritors' such as landowners and town councils, to impose a minister on a parish over the head of the congregation; between the Evangelicals, who emphasised personal salvation, and the Moderates, who were more willing to accept the culture of the times; and between those who recognised that the State had a right to intervene in the affairs of the Established Church, and those who invoked the 'spiritual independence' of the Church from the State.

How the Disruption worked out varied from parish to parish, and in this article the focus is on events in the Parish of Stirling. The church situation in Stirling was complicated. The parish had already been at the centre of the Original Secession led by the Rev. Ebenezer Erskine in the eighteenth century (Scott 1983), and two of the largest congregations were within the United Secession Church, and therefore untouched by the events of 1843. The medieval Parish Church of Stirling, below the Castle, was divided into two

congregations, or 'charges' - West and East - with three ministers, the minister of the third 'charge' officiating alternately in the other two Churches. Between them the two congregations could accommodate about 2,300 parishioners. The upkeep of the building and payment of the ministers' stipends lay in the hands of the heritors of the parish, primarily the Town Council (Scott 2020).

Figure 1. The Parish Church of Stirling - West Church to the left, East Church to the right.



This account of the Disruption in Stirling is based substantially on an article written in 1893 by local historian and newspaper publisher, W.B. Cook. Cook was the founder - editor of Stirling's third weekly newspaper, the *Stirling Sentinel.* From around 1888 Cook produced a series of articles called *The Stirling Antiquary*, which was subsequently published in book form in several volumes (Cook 1893). Although written half-a century after the Disruption, it is clear that Cook had access not only to public sources, such as the newspaper reports of the time, but also to a number of private documents and correspondence, which provided intimate background information about events from the mid-1830s onwards.

The 'Ten Years' Crisis'

For several years issues of patronage and spiritual independence were fought out in church and civil courts during the 'Ten Years' Crisis'. As one modern historian of the Scottish churches summarised the situation: "The combination of the hardening of evangelical attitudes, the unwillingness of Parliament to change its policy towards the Scottish church, the increasingly bitter and personal war of words between the different factions of the church, all meant that some sort of crisis was inevitable" *(*Muirhead, 2015*).*

While a series of major civil law cases arose over patronage in various parts of the country in the ten years prior to 1843, Stirling was focused on its own ongoing church disputes. When the West Church, the first 'charge', became vacant in 1835, the Town Council had a majority in favour of political reform and generally supported the idea of complete independence of church and state, known as Voluntary-ism. Consequently, the West Church vacancy provided an opportunity to suppress one of the three Established charges and thereby save the cost of a stipend. When the Council met in October 1835 a deputation appeared from the East Church asking for their church to be promoted to first charge, with the Rev. George Cupples as their minister. This move would have increased the status of the congregation, and greatly improved Mr. Cupples' stipend. For some reason, however, the Council, refused to discuss this request until after the November elections.

The municipal election of 1835 accordingly turned upon the 'Church Question'. The Council majority assumed that the East Church was in favour of the suppression of one of the other two charges, or at least of a reduction in stipend. The contest therefore assumed the character of a struggle between the friends of the Establishment and its opponents. In the election for the eight vacancies on the Council, the result was a complete victory for the Establishment/West Church party, with a number of leading Voluntaries being defeated at the polls. In addition, Mr Cupples was rejected by the West Church congregation and the vacancy was filled by the Rev Julius Wood from Newton-on-Ayr.

These defeats for their opponents seemed to encourage the supporters of the Establishment to proceed with the work of Church Extension, which was then being strongly promoted at national level by the Rev Dr. Thomas Chalmers. Locally, a proposal was circulated for a third church in the lower part of the town, an idea that had been long in the making, given that the Parish Church was situated at the top of the town, and its position was becoming a disincentive to attendance by the growing population further down the hill. Trustees were appointed for the new church and a committee was formed to procure donations and subscriptions. The cause was also strongly promoted by the Rev Dr Alexander Beith, a Gaelic-speaking minister who had served successfully in Oban, Glasgow, Argyll and Glenelg, before succeeding to the first charge in 1839. (see plate D) Dr. Beith, a successful and popular preacher, was not greatly enamoured of the ministerial arrangements in the Parish of Stirling, and quickly took steps for the erection of a third church to accommodate the third minister.

In May 1840 the Presbytery of Stirling resolved on an arrangement for 'uncollegiating' the three charges and dividing the parish into four districts, the fourth being assigned to the minister of the Spittal Square Church, which had previously been an Original Burgher church situated behind the High School of Stirling. This branch of an earlier secession had re-joined the Church of Scotland in 1839. Each district consisted of between 480 and 500 parishioners, and was to have its own elders and kirk session, reporting every half-year to a General Kirk Session, which met monthly for the management of the poor.

The new North Church was to be built in Murray Place. Dr Beith was insistent that the new Church would be a parish church with the same rights and privileges as the West and East Churches. After some negotiation with the Town Council an agreement was signed by the North Church managers, agreeing to pursue through the church courts the uncollegiating of the ministerial charges, and the transfer of one of the present ministers to the new congregation. The financial limit for building the *new* church was set at £2,600, and the Town Council could demand the return of the

building, free of debt, at the end of thirty years.

The site originally secured for the North Church belonged to the Bank of Scotland. *One* substantial donation came at the cost of providing an infant school alongside the church. As a result a new site had to be purchased at Spring Gardens, and with additional expense required in building, the costs rose to £4,000. A considerable number of subscriptions were raised for the building fund, but amounted to only £1,816, mostly from people who were *not* members of the North Church, a matter which would later cause some controversy. However, on 29 May 1842 the North Church was opened for worship. Dr Beith was elected as minister, and before the close of the year nearly all its seats had been rented out. These local issues played out against a background of conflict and manoeuvering related to the national divisions within the Church of Scotland, but provided an *important* context for the coming crisis. As Drummond and Bulloch (1973) argued: *all that now remained for the Evangelicals was to prepare for the day of parting and to muster the* maximum *support possible . . . From now onwards preparations for the coming division of the Church began to be made at [local] level.'*

1843 - Disruption Year

The situation in Stirling during the six months preceding the Disruption tended to increase the popular excitement – stirred up by Dr Beith, according to Cook (1893) – *over* the controversy regarding patronage. On this question the managers of the North Church were equally divided, but the anti-Establishment faction, who were against the existing patronage system, had the minister on their side, and the voting power. Dr.Beith had already indicated his position when, during the agitation on the subject of spiritual independence was reaching a crisis in the Church of Scotland, he was one of the seven ministers deposed in 1842 for preaching at the induction of an unwanted minister at Marnoch in the Presbytery of Strathbogie, Aberdeenshire, against the prohibition of both the Court of Session and the General Assembly.

On 18 May 1843 the great schism within the Church of Scotland occurred, and all the Stirling ministers joined the seceders. Public feeling ran high, but the break-up of society and domestic discord that was caused by the Disruption, and the bitter animosity which existed for years towards the old Church and its members were also amongst the results. As Drummond and Bulloch (1974) stated: 'Denominational rivalry became an accepted feature of daily life in every Scottish parish'. Foremost in this rivalry, and of particular interest to Cook as a newspaperman, was the significant part played by the local press in Stirling. During the political agitation at the time of the Reform Act of 1832, the *Stirling Journal* had advocated the cause of Reform, but gradually became more conservative and increasingly became the organ of the Tory party.

The *Stirling Observer* appeared in 1836 as a pro-Liberal paper. The first meeting of the Free Presbytery of Stirling was held in the Court- Room in Broad Street, 'most considerately and kindly granted for the purpose by our Liberal Town Council', commented the *Observer*. At the meeting, Presbytery referred to the fact that the *Stirling Observer* had supported the Free Church in an able manner. It soon came to represent the adherents of the Free Church in this part of the country. Some argued that the *Observer* was in a very bad shape, and would have collapsed had it not been supported by the Free Church party. Indeed, the Establishment-supporting *Journal* went as far as stating that it was entirely controlled by that party, and that the hand of Dr Beith could be traced in several of its leading articles.

When the majority of congregations in Stirling pledged to quit the Establishment along with their ministers, Dr Beith was able to carry a resolution that the managers of the new North Free Church should apply to the Town Council for possession of the church until the expiry of the 30 years originally granted to them as an Established Church. Although the Established Church party was in a minority in the Council, the matter was shown to be not within the power of the Town Council, and the proposal was withdrawn.

The events of 18 May made no difference to the Stirling Churches on the following Sunday, the pulpits being supplied as usual. On 28 May there was no service in the North Church as no minister appeared; Mr Cupples preached in the East Church, and an afternoon service was held in the Court House; Rev. Alexander Leitch, minister of the third charge, occupied the West Church pulpit both forenoon and afternoon, but announced that on the next Sunday services would be held in the Guildhall; Dr Beith preached to large crowds in the Corn Exchange, a situation that continued for some eight years. On the first Sunday in June, according to the Free Church-supporting *Observer*, the attendances at the East Church were 109 (a.m.) and 83 (p.m.); and in the West 210 (a.m.) and 226 (p.m.). The paper commented that: "this was the first turn out of these congregations which before the 18th of last month produced an average attendance of from 2000 to 2400 assembling in their Churches."

In the Free Churches things were very different. Mr Leitch's congregation in the Guildhall amounted to between 400 and 500, which was all the place could hold, either sitting or standing. Mr Cupples' congregation in the Court House was uncomfortably crowded, and the Corn Exchange was as crowded as it had been the previous Sabbath for Dr. Beith's service. Clearly, the early skirmishes appeared to favour the new denomination.

The North Church Saga

Meanwhile, the arguments over the North Church continued unabated. A meeting of pro-Establishment seatholders on 31 May 1843 resolved that it was highly necessary that the pulpit should be regularly supplied during the vacancy. The seceding managers strongly objected to this as they were determined to keep the church shut until they secured it for Dr. Beith's Free Church congregation. This was the beginning of what Cook (1893) described as "a most extraordinary and exciting struggle" between the seceding managers, backed by the Town Council, and their Establishment colleagues, backed by the Presbytery of Stirling. The Presbytery at its meeting in June appointed

supply for the vacant pulpits, but the seceding managers of the North Church submitted a petition arguing that it was *ultra vires* for the Presbytery to make such an appointment in respect of their church, as it was not connected to the Establishment. The Presbytery ignored the seceding managers' petition, appointed the minister of Alva to preach in the North Church on the following Sunday, and demanded the keys of the church. The Rev. Dr. Beith and the managers, however, had no intention of submitting to the Presbytery, and planned to lock out the minister appointed to preach.

Figure 2. Stirling North Church of Scotland - opened for worship in 1842 as the "third charge"

The pro-Establishment *Observer* reported as follows: "Between the time of the Presbytery meeting and the Sabbath, those who are friendly to the Kirk had got possession of the keys, without, it would seem, the consent of the majority of the managers. When this fact became known to the majority of the managers, a meeting was called late on Saturday night, at which it was resolved, seeing the keys had been obtained, that workmen should enter the house in another way and barricade the doors on the inside, which was accordingly done, but lest even this should not be found sufficient to prevent intrusion, a watch was placed on the outside all night.

"When the hour for public worship arrived, the watch was still there, and the clergyman found that, although he was in possession of the keys, the doors would not open. At this moment a good many people were collected, more for the purpose of seeing what was going on, than with, as it appeared, the intention of forming a congregation. The minister was allowed to depart in a peaceable manner."

The pro-Free Church *Journal* on the other hand, reported: "It is no stretch of charity to say that the late hour of the meeting was adopted because it precluded the minority from resorting to such means as might be deemed legal or advisable for securing the authority of the Presbytery. We wish this was all we had to say of the spirit evinced by the non-intrusionists; but we are sorry to add that their hostility has shown itself in a still more unseemly manner . . . to prevent worship as intended by the Presbytery, tradesmen were set to work to barricade and nail up the doors till the indecent hour of twelve o'clock at least. It may be proper to state that Mr Brown of Alva appeared at the church at the usual time for worship in the forenoon. On finding that entrance could not be effected, he directed the church officer to make the requisite proclamation of marriages at the Church door, and thereupon withdrew."

At a meeting of Presbytery on the following Tuesday, the Rev. Mr. Brown reported what had taken place and laid the keys of the North Church on the table. A deputation from the congregation of the Established Church appeared before the Presbytery, asking regular supply for the pulpit, and, over the protests of the seceding managers, resolved to submit to the advice of the General Assembly's Law Committee.

The Town Council and the Parish Churches

Meanwhile. the Disruption afforded too good an opportunity to revive the question of the suppression of the second or third charges, or both, of the Established Parish Church, and the Town Council, which was said to be mainly composed of anti- Establishment members, seized the opportunity. At the Council meeting on 13 June, a series of

resolutions was moved that the Council had received no official intimation of the uncollegiating of the three charges by any competent authority, and that, as the three incumbents had withdrawn from the Establishment, to present to the three ministerial charges would be a misapplication of the funds of the town. It was therefore proposed that a minister paid from the funds of the parish be presented to *either* the East or West, and that inquiry be made as to the best means of legally suppressing the second and third charges. The Establishment had only a handful of supporters in the Council, and, as Cook (1893) described it, they weakly agreed to this resolution.

The *Journal* reported on the seceding ministers' attempts to seduce members away from the Church of Scotland. "Every day of the week, Sabbath not excepted, an organised system of proselytising was kept up, the ministers of the Establishment being held up as incapable of preaching the Gospel, as men placed beyond the pale of saving grace whose prayers can never reach the throne 'of mercy'."

The Disruption, according to Cook (1893), may have been for a high cause as its supporters claimed, "but unquestionably, in its local aspect, it was the cause of much evil-speaking on the part of the seceders, ministers as well as laymen". However, it was not long before the Established Church gave evidence of recovery from the staggering blow imposed by the Disruption. On Sunday 25 June the *Observer* stated there was only a skeleton congregation at the East and West Churches – a "miserable turnout". The *Journal*, on the other hand, maintained that in the afternoon the West Church was crowded. *The Observer* acknowledged that the attendance at the first sacrament of Communion was 350, while the skeleton, a month after the Disruption, had expanded to 380, providing the best evidence that an Establishment rection had begun.

Meanwhile, the Town Council began a series of strategic moves which, firmly opposed by the Presbytery and the local supporters of the Establishment, ended in failure and disgrace. Under the power of an interdict of the Court of Session against the seceding managers taking illegal

possession of the North Church, that place of worship was re-opened on Sunday, 6 August as part of the Establishment. On the following Tuesday the defeated and disappointed minister of the Free North, the Rev. Dr Beith, met with his congregation and decided that a completely new church would have to be built behind the site of the Baptist Chapel.

Motivated by Free Church hostility to the Establishment, the Town Council refused to give the East Church the choice of a minister. The Council voted to present the Rev. Dr. Wilson of Irvine as minister and this was agreed to by a Council, most of whose members had left the Establishment on account of patronage, and who knew that the presentation was opposed by the congregation. The call was signed by only 14 members of the congregation, but was sustained by the Presbytery of Irvine. The matter was referred to the Synod of Perth and Stirling and hence to the General Assembly, which decided by a small majority in favour of Dr Wilson, and remitted to Presbytery to proceed to his induction. Dr Wilson was accordingly inducted on 22 August 1844.

As a result, the Town Council found that it was bound by law to appoint ministers to all three charges at the same time. It determined to perform this duty, in what Cook (1893) described as "as disagreeable a manner as possible to the remaining members of the Establishment". In the case of the West Church, a petition was presented to the Council by no fewer than 211 members of the congregation, praying the Council to present the Rev. William Findlay to the second charge. The Council Treasurer, a Free Churchman, spoke against giving the people their choice, and later moved that the Rev. Robert Watson, Chaplain of the Castle, whom he had met over dinner and was an excellent man, should be presented to the West Church. By a majority of 13 to 5, they decided in favour of Mr Watson, a move which raised much sarcasm in the town as to how dining with members of the Town Council could lead to an ecclesiastical appointment.

The unfairness of the majority of the Town Council towards the Established Church congregations was so transparent that it raised opposition from an unexpected

source. The Seven Incorporated Trades stepped in and demanded a vote in the presentation of ministers to the second and third charges. Although the right of the Incorporated Trades had not been exercised since 1818, it was argued that it continued to exist. After much legal argument in both Council and Presbytery, and after an interdict had been sought unsuccessfully by the Trades in the Court of Session, the matter was departed from and Mr Watson's settlement in the West Church was proceeded with on 19 September 1844.

The North Church Again

The faithful few left in the North Church of Scotland, having waived their claim to the services of the first minister, and been denied those of the second minister by the Free Church patrons, were left without a settled pastorate for some time. At its meeting on 20 November 1843 the Council voted to delay an appointment by 11 votes to 9, a move suspected of being another attempt to inflict a severe blow to the Establishment. In the days immediately following, leading members of the Council, however, came to the opinion that the safest way of preventing the Presbytery taking the presentation of a minister to the third charge out of the Council's hands was to issue a presentation themselves. A petition in favour of Mr Findlay, signed by 106 members of the North Church, was raised in a day. That evening the Council offered unopposed the presentation to Mr Findlay, and it was transmitted to the Moderator of Stirling Presbytery that night. The *Journal* noted critically: "They have not only filled the very charge which eight days before they had resolved to suppress, but they have appointed the very man whom they formerly rejected."

When the Presbytery met in December to sustain the presentation to Mr Findlay, further protests were raised by the Free Church members of the Town Council and of the North Church managers, right up until the induction of Mr Findlay on 18 January 1844. The Presbytery ignored the protests, sustained the call signed by members of the congregation, and proceeded with Mr Findlay's induction.

The troubles of the North Church did not end there, however. The ministers of the first and second charges considered that the minister of the third charge should assist them in the East and West Churches, on the grounds that the North Church was merely a preaching station. At a meeting of Presbytery on 31 December 1843, a petition signed by 15 persons supporting Dr Wilson's and Mr Watson's views was presented. However, another petition signed by 605 members in the different Established Churches praying that no alteration be made in the ecclesiastical arrangements of the town and parish was also laid on the table. In an intemperate debate, it was suggested that the whole thing was a Free Church plot, in which the two ministers were either victims or the aiders and abettors of the conspirators. The ministers' motion was defeated by 8 votes to 2, with one abstention. Appeal was made to Synod, but nothing came of it, and the North Church's status as a full charge was upheld.

Conclusions and Reflections

Cook's views (1893) on the Disruption in Stirling changed significantly over the course of his account. At first, he presents a fairly factual and even-handed narrative of events, but as the story proceeds, he becomes more supportive of the Establishment and highly disillusioned with the Free Church party. In particular, he was very critical of the way in which the seceders went about their business, and their high-handed, and indeed malicious, attitudes towards their former clerical colleagues. Whether or not this was a reflection of the turbulent nature of the history of Christianity in Stirling, (Bebbington 2000), it is hard to say.

This was encouraged by the support afforded to the Free Church by the majority of the Town Council who for most of this period were anti-Establishment. In relation to their dealings with the West and East Churches, "if they had been allowed to suppress [these] charges, it would have committed an irredeemable injustice and inflicted irreparable loss on the community", states Cook (1893). In respect of their treatment of the North Church, the irony was that the majority of the Council were great advocates of "spiritual independence", the outward and visible sign of which was

freedom to choose a minister. Time and again the Council acted in ignorance of the correct legal and ecclesiastical procedures, and found itself, not only criticised, but also disgraced over its actions. The standing of Stirling Town Council as heritors in relation to the churches certainly fell into disrepute, and probably contributed to the eventual decline of support for patronage locally.

As far as Cook (1893) was concerned, the *eminence grise* behind the whole tenor of church relations during the time of the Disruption was the Rev. Dr. Alexander Beith, originally minister of the West Church, then minister of the new North Church, and finally minister of the North Free Church. Beith's hand was identified as manipulating both local politicians and the local press, even, it was claimed, writing editorials anonymously for pro-Free Church *Stirling Observer*. In the longer term, however, Cook (1893) could hardly contain his satisfaction that, after the dust had settled, "the North Parish Church, served by a succession of able ministers, is the most prosperous of all, having a larger membership than the Free North itself, and doing, it may be claimed, just as much good."

Cook (1893) was particularly critical of Beith over the financial arrangements involved in the building of the original North Church. When the financial bond elapsed after thirty years, Dr. Beith, as one of the managers of the North Church who had advanced money in 1839, claimed interest at the rate of 5 per cent per annum. The sum for his share amounted to £300. Cook (1893) thundered: "*the rev. gentleman got his own money back, and in view of his attempts in 1843 and 1844 to wreck the congregation and render the Church useless for the purposes of the bond, this was more than he deserved or had any right to expect*." Dr Beith's situation seems to have been much more favourable than the many examples across the country of ministers who 'came out' suffering considerable financial and material hardship as a result. Dr Beith retired from an active ministry in Stirling in 1876, and moved to Edinburgh, where he died in 1891. However, he is buried beneath an obelisk in the Valley Cemetery in Stirling behind the Church of the Holy Rude, his original charge.

On a wider canvas, the context of the Disruption in Stirling was very much about local church issues, which largely overrode the national ones. The situation of the Parish Church and its ministerial arrangements had been live in Stirling since the early 1830s. The situation of having three ministers for two charges was becoming more awkward and burdensome, and the need to cater for the population in the lower part of the parish, given the geographical positioning of the West and East Churches, was becoming more urgent. There were divisions amongst the Stirling ministers, but it had little to do with being Evangelical or Moderate, and more to do with personality clashes. All were Evangelical and so the Disruption appealed to them on those grounds. In this Age of Reform in all kinds of areas of public life, the main cause of disruption stemmed from the attempts by the patrons, the Town Council, to bring about ecclesiastical change by suppressing charges and reducing the cost of paying stipends and maintaining church buildings, which put the Council at odds with the Established Church. The Disruption simply became an expression of a national conflict at a local level.

If the history of the Disruption had finished at this point in time, then the fate of the Church of Scotland would have appeared pretty dark indeed. This view is supported by the returns of the Census of Religion carried out in 1851, although such statistics need to be read with caution. Nonetheless, within eight years of the Disruption, the Church of Scotland still had more congregations throughout the country than did the Free Church – 1,183 to 889; total attendances at all services on census day showed a slight majority for the Establishment – 566,400 to 555,700; but the Free Churches were more fully occupied than those of the Church of Scotland, at morning, afternoon and evening services – approximately 37% to 25%. In Stirling, the gap was wider. There were two Church of Scotland churches (the Parish and the North) and two Free Churches (Free North and Free South), but attendances at the latter (2,826) outstripped the former (1,938) by over 900 persons. Again, the Free Churches were considerably fuller than the Establishment ones at both morning and afternoon services –

about 81% to 43%.

However, with the passage of time the picture became much brighter for the Church of Scotland. Cook (1893) argued: *"The flourishing condition of the Establishment in Stirling today [June 1893] is the best answer to the sneers and slanders of [the Free Church] supporters, and it is pleasing to think that the ill-feeling they created has now almost entirely disappeared."* Recent opinion on the recovery of the national Church of Scotland after the Disruption tends to support this view (Brown, 2019). Nonetheless, Cook's overriding conclusion on all these matters is fairly pessimistic: "after *the lapse of half-a-century, it is clear that the Disruption, as far as Stirling is concerned, was a deplorable mistake*."

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The Stirling Journal

The Stirling Observer

THE FIRST FORTH BRIDGE

Built by the Alloa Railway Company, 1895.

Edward Stewart and Murray Dickie

The late Edward Stewart was chairperson of the Clackmannanshire Field Studies Society for many years and had a life-long interest in the river Forth. He encouraged me to take an interest in the story of the South Alloa Bridge and we had undertaken a great deal of research. Sadly, Eddie died before the research was completed. This article and its illustrations rely heavily on his work and the photographic collection of the late Dr Ken Mackay.

The Background:

The river Forth has long been a means of East to West water-borne communication and, at the same time, a barrier to North to South land communication. It flows across a wide, level plain (Carse) from Flanders Moss in the West to Grangemouth and Kincardine in the East. This level plain was created when the relative level of land was about 40 metres lower at the end of the last glacial period, some 10,000 years ago . **(1)** Today the River Forth winds its way eastwards across the Carse, opening out into the upper Estuary at Alloa.

Land crossings:

The river Forth presented a serious obstacle to North - South travel. Indeed, until the early 19th century, the Forth Estuary and the river Forth, together with the large area of mosses West of Stirling, almost divided Scotland into two parts. There are ancient and more recent historical records of a number of fords crossing the rivers Forth and Teith at Frew, Old Keir **(2)** the Town Ford (**3**), the Abbey and Sow fords at Cambuskenneth **(4)** and Trosk. **(5)** There are also two points at Stirling (Stirling Old Bridge and Kildean) where the river is fordable when it is running low and the tide is out. Many of these fords were still in operation in 1861 and are marked on the Ordnance Survey maps (OS First Edition Six Inch maps

1860—1863). There are also records of ferries linking the North and South banks of the river: Kincardine was linked to Higgin's Neuk, Alloa to South Alloa, Fallin to Haugh Farm, Cambuskkenneth Abbey to Boroughmeadow and Stirling Shore to Cambuskenneth. These are shown as still in operation in the mid-19th century. **(6)** and **(7)**

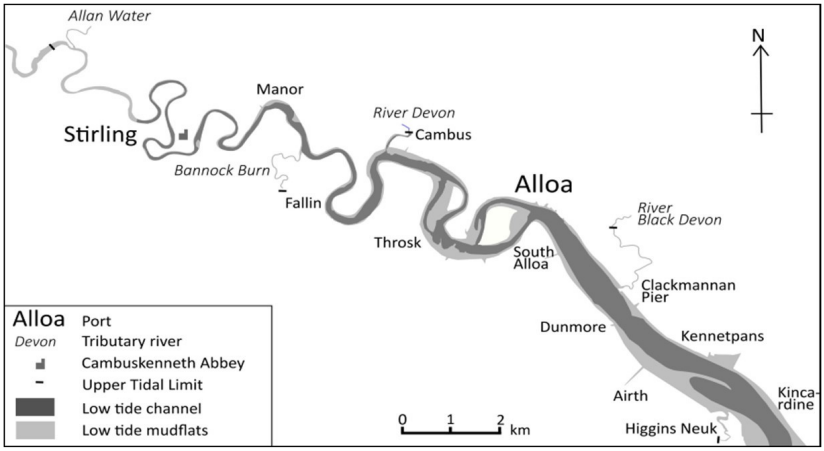
However, from the 14th century until the end of the 19th century if you wished to cross the lower reaches of the river Forth by means of a bridge, Stirling was your only option. The first site for a bridge lay immediately North East of the town of Stirling where the whinstone sills underlying the Castle and the Wallace Monument form a bottleneck in the valley, reducing the width of the Carse to 1.3 kilometres. creating the upper tidal limit of the river. This narrow gap at Stirling provided the opportunity to create a reliable bridging point and a succession of wooden bridges were built across the river sometime in the 13th to 14th centuries, the most famous of which featured in the Battle of Stirling Bridge in 1297. **(8)** The stone piers of an early bridge have been surveyed just upstream of Stirling Old Bridge [NS 79729 94615]. **(9)**

On several occasions a bridge across the river here was replaced by a ferry. Eventually, a medieval stone-arched bridge was built in the 15th or early 16th century, cementing Stirling's strategic position as the lowest bridging point across the Forth. In 1745 the southern arch was blown up to prevent the Jacobite army entering Stirling and was replaced in 1749. **(10)** The strategic potential of the bridging point at Stirling, combined with the defensive potential of the site of nearby Castle Rock, has been recognised throughout history.

Development of Maritime Trade: Despite the barrier to North and South communication, the tidal reaches of the river enabled reasonably easy East to West communication. Outcrops of lava at the Wallace Monument and Stirling Castle hill created a narrow stretch of land. The lava outcrop also created the small elevated site of Craigforth. A bed of harder sedimentary rock crosses the line of the river Forth near Craigforth. The change in level of the river here has accommodated two weirs in the past: one for salmon fishing

(11) and one supplying water to two mills (Craigforth Mills and Kildean Mill) on the South bank. **(12)** The change in level of the river marked the upper tidal limit of the river although the stone bridge at Stirling came to define the upper limit of navigation. Below this point the level of the river fluctuates by some five metres (17 feet) between high and low tides. **(13)**

Figure 1 The Tidal River Forth and Upper Estuary.



Early plans of the river by John Adair show that it was considerably wider than at present, with extensive inter-tidal mud banks on both sides. [**14)** During the 17th, 18th and 19th centuries the local estates built a series of embankments along the edge of the river Forth and its tributaries from Kincardine to Stirling and Stirling to Grangemouth. Some of the earliest embankments are shown on Roy's Survey of Scotland, 1747-1755. **(15)** These embankments still protect thousands of acres of farm land from flooding and substantially narrow the channel of the river Forth (See Plate F1).

Because of the very level nature of the Carse, every small river or stream entering the Forth has an inter-tidal section or 'Pow' which provided a safe harbour for small ships. In the late 17th century each Pow was closely associated with the site of a keep or country mansion. [**16)** With extremely poor roads, ships provided the easiest and cheapest way of moving goods, particularly heavy goods such as coal,

limestone and grain, and there were many small harbours and piers on both sides of the river from Kincardine/Higgins Neuk to Stirling.

The physical nature of the river Forth below and above Alloa is quite different. There is a fairly straight, wide channel from Kincardine to Alloa and a twisting, narrow river above Alloa, known as the "windings" of the Forth. Although the direct distance from Alloa harbour to Stirling harbour is only 5 miles (8 km), the distance by the "windings" is 24 miles (38 km). **(17)** The boundary between river and estuary is complicated, containing two small islands; Tullibody Inch and Alloa Inch, and several complex channels. **(18)**

While getting small sailing ships to Alloa harbour and docking there was relatively easy, the changing flow in the multiple river channels around the islands of Alloa Inch and Tullibody Inch made navigation difficult and, the further up the windings ships travelled, the more difficult was the task of sailing and docking. Ships would use the incoming tide to travel upstream and dock and the outgoing high tide to float off and travel downstream.

During the 18th and 19th centuries Alloa became the largest port on the upper river, aided by the status of a Customs Port in 1710, **(19)** the creation of a dry dock between 1788-1793 with funds remitted from the East Indes **(20)** and a wet dock in between 1860 and 1863. **(21)** In contrast, shipping at the Shore in Stirling remained at a much lower level. However, the Burgh of Stirling saw its harbour and the goods and passenger traffic as an important asset and one worth protecting, particularly in supporting its function as a market town, serving the agriculture in its hinterland.

First Plans for a bridge.

The first record of interest in constructing a bridge across the river Forth at Alloa noted that "*A number of public spirited gentlemen of Alloa*" were actively considering the possibility of a bridge across the river Forth, as an alternative to the crossing at Stirling. In the first years of the 19th Century they

commissioned a survey by the celebrated engineer Rennie of a crossing at the site of the ferry at Craigward. When the findings were presented, the case was sound but the costs proved too much to finance and the plans were deposited in Alloa Tower. **(22)** There is a second reference to this event in 1845 which dated the survey more closely to 1807 and indicated that Rennie preferred the Rhind route. **(23)**

By the early 19th century more settled political circumstances saw the development of the economic importance of the crossing at Stirling. The slow development of better road conditions with the creation of Turnpike Trusts and the construction of the Robert Stevenson designed road bridge in 1829-32 **(24)** enhanced Stirling's position as the lowest crossing point on the river Forth.

The introduction of railways, with their potential to move heavy goods and passengers quickly and cheaply, revolutionised transport and Stirling's position as the lowest bridging point on the river Forth was quickly utilised. There is a pair of parallel railway bridges crossing the Forth at Stirling. The Scottish Central Railway was set up in 1845 to connect the Edinburgh to Glasgow railway at Castlecary with a line to Stirling and then onwards to Perth. The upstream Stirling bridge was constructed in 1846 as a wooden bridge on stone piers. In 1865 the Scottish Central Railway amalgamated with the Caledonian Railway and in 1868 the upstream bridge was rebuilt its present form. **(25)**

In the early stages of railway building, companies were in competition and sometimes poor relations developed between them. The Stirling to Dunfermline Railway was designed to get access to the mineral deposits on the line of route, but also as a tactical measure to keep the Caledonian Railway out of Fife. The Stirling to Dunfermline Railway Company planned to build the line and then lease it to the Edinburgh and Glasgow Railway Company. The Edinburgh and Glasgow Railway attempted to purchase the Scottish Central Railway, failed to do so and relations became strained between them.

Although the Central Railway was willing to share its bridge and track over the river with the Stirling and Dunfermline Railway, the directors of the Edinburgh and Glasgow Railway would not agree to share resources and forced the Stirling to Dunfermline Railway to build a separate bridge **(26)** and station in Stirling in 1848. The line finally opened in 1852 with a branch to Alloa docks. **(27)**

With the construction of these three road and rail bridges between 1831 and 1848, Stirling had monopolised the road and rail traffic crossing the river Forth. However, Alloa now had a major rail link to Stirling, and onwards to Glasgow, Edinburgh and Perth. There was always a desire to have direct crossing from Alloa across the river Forth. The oar-powered ferry was replaced with a steam-powered boat about 1815. **(28)** This ferry was so successful that it was quickly added to by a new ferry built at Dumbarton. The ferry carried many carts with beer southwards while bringing peat and grain northwards to the breweries and distilleries. By 1823 the ferry had been replaces by a new roll-on-roll-off ferry taking only four minutes to cross the river. The ferry was 70 feet (21 meters) long and 30 feet (nine metres) wide and could carry 80 cattle or 400 sheep.

Second Plans for a Bridge:

In 1845 there was great excitement in Alloa when the Directors of the Edinburgh and Glasgow Railway Company announced that they had purchased the Alloa Ferry and made arrangements for working the Stirling, Alloa and Dunfermline line. **(29)** They also announced that they were undertaking surveys with a view to a branch from the Glasgow and Edinburg line at Croy by way of Denny to Alloa, so as to give direct railway communication between Fife and Glasgow. At last, Alloa looked like it could become the lowest bridging point on the river.

The decision to bridge at the Ferry would mean that the bridge would need to span over 250 metres of water at low tide. Further upriver at the junction with the Poppletrees Burn the Forth was only just over 100 meters wide at low tide. **(30)** At the same time (1845), the Scottish Central Railway announced their intention to construct a branch line

from the main line near Larbert to South Alloa. **(31)** This cut across the plans of the Edinburgh and Glasgow railway to create a link across the river.

The South Alloa Bridge appeared to be part of an ambitious plan by the Edinburgh and Glasgow Railway to get a railway up the Devon Valley, into Fife and on to Dundee. Unfortunately the Devon Valley railway initially only reached Tillicoultry in 1851, as the route beyond this section encountered many difficulties. The line was eventually completed in 1871, by the North British Railway, but the single line could never compete with the double line route from Stirling to Perth. When in 1849, the Edinburgh & Glasgow Railway had failed to acquire the Scottish Central Railway, they refused to honour the lease the Stirling to Dunfermline line. They eventually took over the lease and bought the line in 1858. **(32)**

All of this uncertainty and discord meant that the viability of a crossing at Alloa began to be questioned. In 1850 the Scottish Central Railway constructed a branch to South Alloa from their main line to Stirling. They built a small passenger station at South Alloa and took over the ferry. Passengers were conveyed to South Alloa on the branch line, ferried cross the river and travelled onwards by train to Stirling. **(33)** The railway company also sought to accommodate local farmers, offering them a discounted rate on the ferry. **(34)** In 1852, however, it was reported that the railway line from Alloa to Stirling was finally opened.

At the same time, the Board of the Stirling and Dunfermline railway questioned the cost of the proposed South Alloa Bridge. It was indicated that the contract for the bridge and the formation of a line into the station would be £7,000. It was agreed that the Board would contact the Directors of the Edinburgh and Glasgow Company, giving them the opportunity to reconsider their determination regarding this bridge. Following this, the Edinburgh and Glasgow Railway decided not to proceed and the fate of this proposed South Alloa Bridge was sealed. **(35)**

At the half yearly meeting of the Scottish Central Railway in 1852 the shareholders were informed that the Alloa Ferry had been greatly used previous to the opening of the Stirling and Dunfermline Railway and that it was let to a contractor at a rent of £700 per annum. The Company had retained the right to purchase back the steam-boats and lease. Since the opening of the Stirling and Dunfermline Railway, most of the traffic travelled by this railway to Stirling and it was suggested that the ferry lease be bought back. Following this decision, the steam ferries were removed and the Alloa ferry ceased to operate. **(36)** Not only was the possibility of a bridge taken way, the ferry was also removed.

The Ferry Connection Re-established.

In 1853 the Alloa ferry was resurrected, and the lessee, James Falshaw, Civil Engineer, introduced a new boat onto the crossing. **(37)** It would appear that this ferry was not powered by steam as, in 1859, it was reported that "*Notwithstanding the large blocks of Ice which, since last Saturday morning having been floating down the river, the passage at the Alloa Ferry, between the north and south sides, has not been interrupted, though difficulty has been occasionally experienced in feathering the oars through the water*." **(38)**

The Burgh of Stirling was still developing its harbour. In 1859 they were advertising a contract for the construction of a new Quay. **(39)** In the meantime, the Scottish Central Railway's branch line to South Alloa was doing well. "*Already the goods traffic betwixt South Alloa and the Greenhill junction, is very considerable —the receipts of the station yielding about £300 a-month.*" **(40)** By 1860, two shipping piers had been built and a set of coke ovens constructed. **(41)**

Between 1861 and 1865 an number of local businessmen leased out the Alloa Ferry and attempted to improve the service. **(42)** and **(43)** By 1865, the ferry was running two connecting boats to link with trains leaving the South Alloa Station. **(44)** but the owner, the Earl of Mar, was seeking a way of making the ferry pay. **(45)** It continued to run and its connections by way of the South Alloa station of the Caledonian Railway were advertised to and from Carlisle,

Edinburgh, Glasgow and Perth. **(46)**

Third Plans for a Bridge:

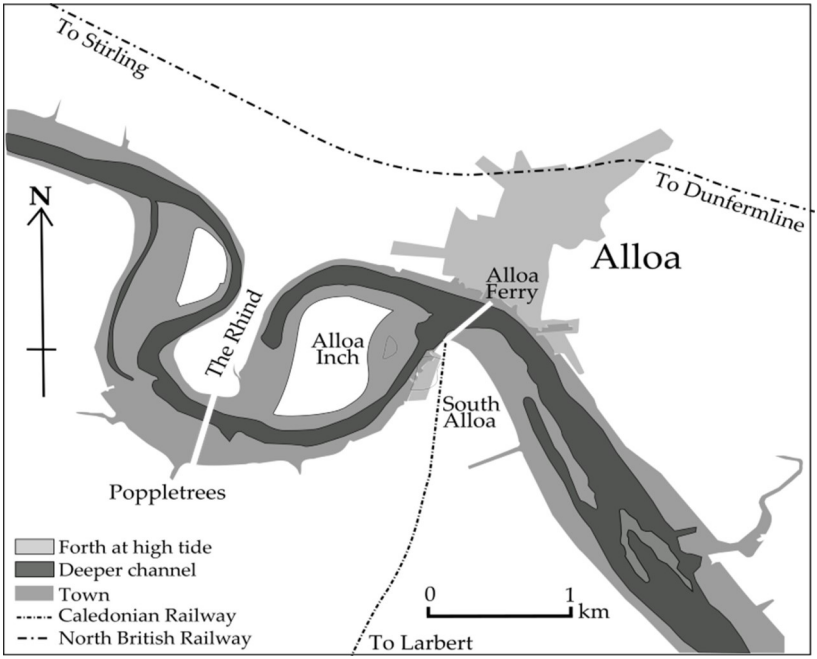
However, in 1866, events were about to take a dramatic turn. The North British Railway Company applied to Parliament to construct a railway across the river Forth at Alloa. It was noted that the capital would need to be raised by the public. "*The capital, we learn, will be £50,000 or £60,000, and though this is a pretty large sum, is not thought that there should be much difficulty in raising it, if the people of this district are only satisfied that the work will be carried through, and that there is a good prospect of obtaining fair return for the capital.*". **(47)** There were indications that the endeavour was not without its critics. The residents of the town of Dunfermline were against it as they thought it would adversely affect their chances of getting a bridge across the river Forth at Queensferry, proposed to be built by the North British Railway Company. **(48)** The Forth Navigation Commissioners, now responsible for Navigation of the Forth up to Stirling, also objected, on the grounds that the bridge would severely restrict navigation. **(49)**

The North British Railway company put forward a bill to Parliament in 1868, which included a plan to build a bridge at Alloa. This bill was rejected by Parliament. (50). The case then took another turn when the Caledonian Railway Company applied to construct and manage the route to provide a link between their railway lines on both sides of the river. Despite objections from the North British Company, this was finally agreed, with the Caledonian Company providing £40,000 of the £60,000 funding which would be required. (50)

Finally, nearly 80 years after the bridge was first proposed, it was going to be built. The sum of £20,000 still had to be raised by public subscription. This was undertaken by the Alloa Railway Company—"*The total estimate for land and works is and the capital of the Company has been fixed at 2,000 shares of £10 each, with borrowing powers to the extent of £20,000. agreements entered into between the promoters and the Caledonian Railway Company, and now confirmed by the Alloa Railway*

Company under seal.". (51) In 1880, the Caledonian Railway Company agree to subscribe £40,000. **(52)**

Figure 2. The Sites at the Ferry and Poppletrees/Rhind.



Based on the OS, 1860, First Edition Map, Clackmannanshire Sheet, CXXXIX.7, NLS.

Two sites had been considered; at the Alloa Ferry or between the Rhind and the Poppletrees Burn. The site at the Ferry was largely taken up by the deeper channel of the river, with little land exposed by the tide. This would have required the bridge to have deep foundations, extending well below the low water mark.

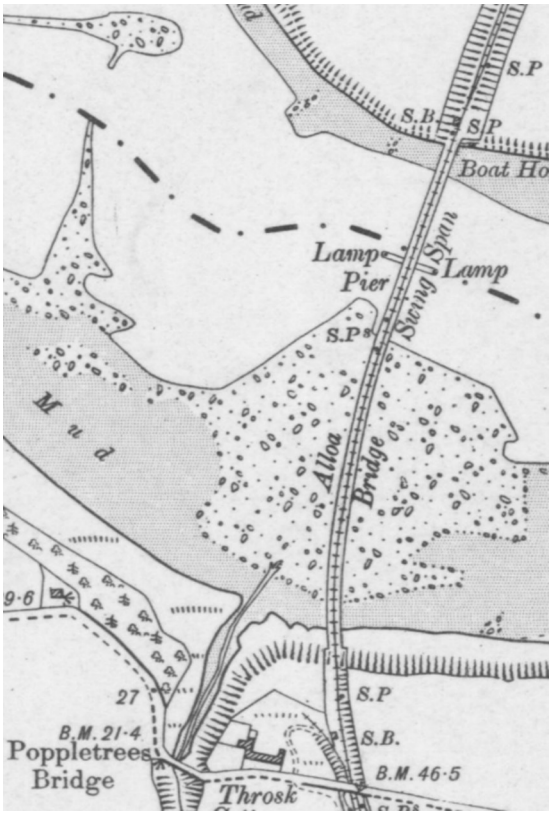
The site at the Rhind/Poppletrees crossing had the advantage of a narrower channel and a broad expanse of shallow water, with a large area of the bed of the river composed of grits, gravels and rocks, exposed on the southern bank of the river at low tide. This meant that building a bridge would be much easier here.

Figure 3. The Rhind/Poppletrees crossing at low tide.

Beyond a narrow edge of mud, much of the southern bed of the river here is composed of firm grit, gravel and medium sized rocks and is exposed at low tide, with the shipping channel being tight to the North shore.

Figure 4. The piers at the Rhind/Poppletrees crossing.

Figure 5. The Bridge Completed. (See also Plate F2)



The location at the Rhind/ Poppletrees crossing enabled most of the piers of the bridge to be built on land exposed at low tide. Only two piers on each side of the central opening were well below water at low tide. This made the construction of the majority of the piers much easier.

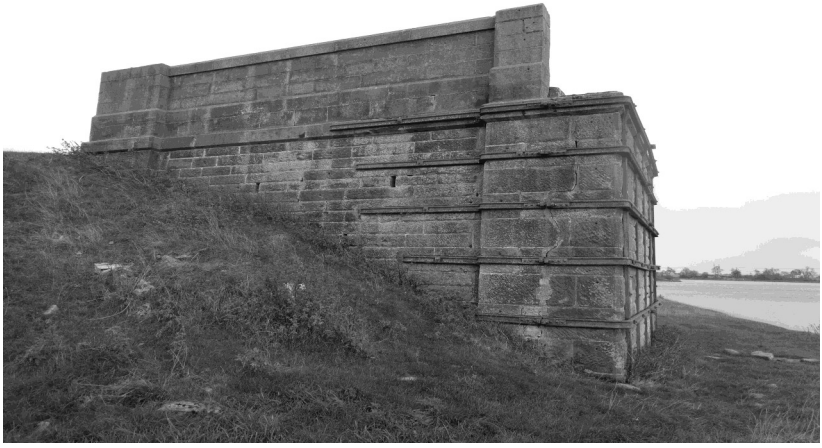
OS, 1896, Six inch Map, Stirlingshire Sheet XVIII.NW. Reproduced with the permission of the National Library of Scotland

The start of work on the bridge was recorded with great detail in the Aberdeen Evening Express on Wednesday 5th April 1882 . **(53)** "*The foundation stone of this bridge was laid this afternoon, near to the Dunmore Moss, South Alloa, at one o'clock. A luncheon afterwards took place. The Right Hon. Lord Balfour of Burleigh performed the ceremony. The bridge is designed to spring from massive stone abutments, built of rubble 6ft* (1.83 metres) *at the base on the south and 7ft* (2.13 metres) *at the base on the north side, with a face-work of hammered dress courses.*"

Work started on the South abutment., which was connected to the South Alloa Junction railway. Today the area around the abutment has been colonised by young trees, but the stonework is still intact. It is connected southwards by a deep cutting (See Plate F3), linking to the line joining with the South Alloa Junction Railway.

Figure 6, The South Abutment.

Figure 7. The North abutment.



Photograph courtesy of Robert Dingwall

Figure 8. Remains of the piers forming the curved bridge

Between these two strong abutments: *"The bridge will consist of seventeen spans, two of 100 ft. (30.48 metres), two of 80 ft. (24.38 metres), and thirteen of 68ft. (20.73 metres), The bridge would be carried across the river on a curved bridge supported on twenty, double, stone-built piers. Sixteen pairs of piers would be built on the South side on the southern side of the river channel and four on the northern side. The piers would support seventeen spans, two of 100 ft., two of 80 ft. and thirteen of 68ft."*

The method of sinking the foundations for the stone piers was detailed:- *"Cast-iron cylinders will be sunk for the foundation of the piers, and brought up to low-water mark, when the excavation will be filled in with concrete and the columns continued in ashlar. The largest cylinders are to be 8ft. (2.44 metres), and the smallest 6ft. (1.83 metres) in diameter, while the stone work above low water will diminish respectively to 5 ft 6 in. (1.68 metres) and 4ft. (1.22 metres) in diameter."* **(54)**

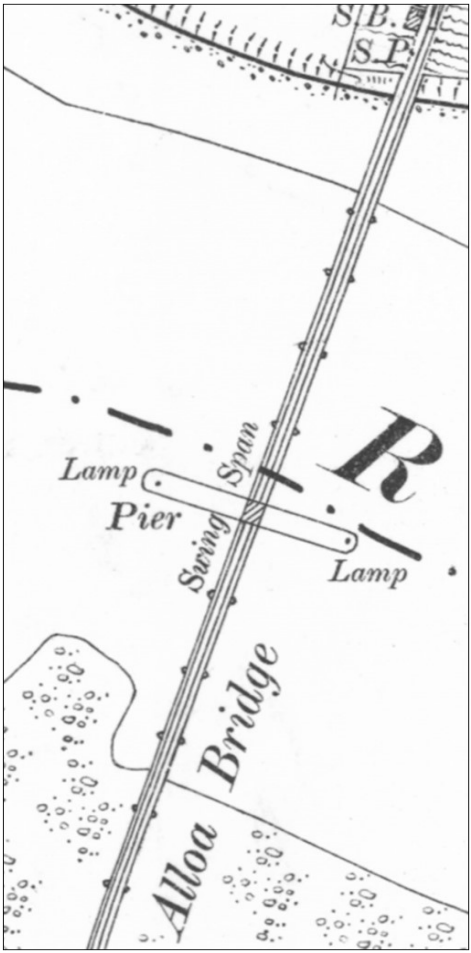
Figure 9. The central swing span.

Photograph from the collection of the late Dr K . Mackay.

The bridge, constructed for one line of rails, will be 17 feet 2 inches (5.2 metres) *in breadth outside, and 14 feet (*4.3 metres) *inside the girders. In the bridge there will two opening spans swinging on a massive central pier, composed of six cylindrical columns. This remarkable gateway is in the fairway of the channel of the river, only navigable to any but the very smallest craft at high water, and as the spans are 24 feet (7.32* metres*) clear.* (55) *The swing bridge, to be wrought by hand lever, is not likely to be very often unlocked. Two spans of 69 ft* (21.03 metres) *each are to be opened free by the use of the swing bridge, and on either side are first 100 feet and next 80 feet spans, there- being only these two on the north and thirteen on the south side of the swing bridge. The piers will surmounted by cast-iron caps, and the bridge protected and strengthened by strong malleable iron girders proportioned to the length of the spans; thus the swing-bridge girder will be 12 feet 6 inches* (3.81 metres), *100 feet spans 9 ft* (2.74 metres) *and the 80 feet spans 68 ft spans 7 feet (2.13 metres) in height. Large rubble stones are to be deposited in the river round the cylinders of the swivel pier."* **(56)**

The two 100 feet (30.48 metres) spans on either side of the opening span reduced the number of piers which needed to be built in the deeper section of the shipping channel to four, two on either side of the central pier. The remaining piers were built in shallow water and could be placed only 68 feet (20.73 metres) apart.

Figure 10. The central pier.

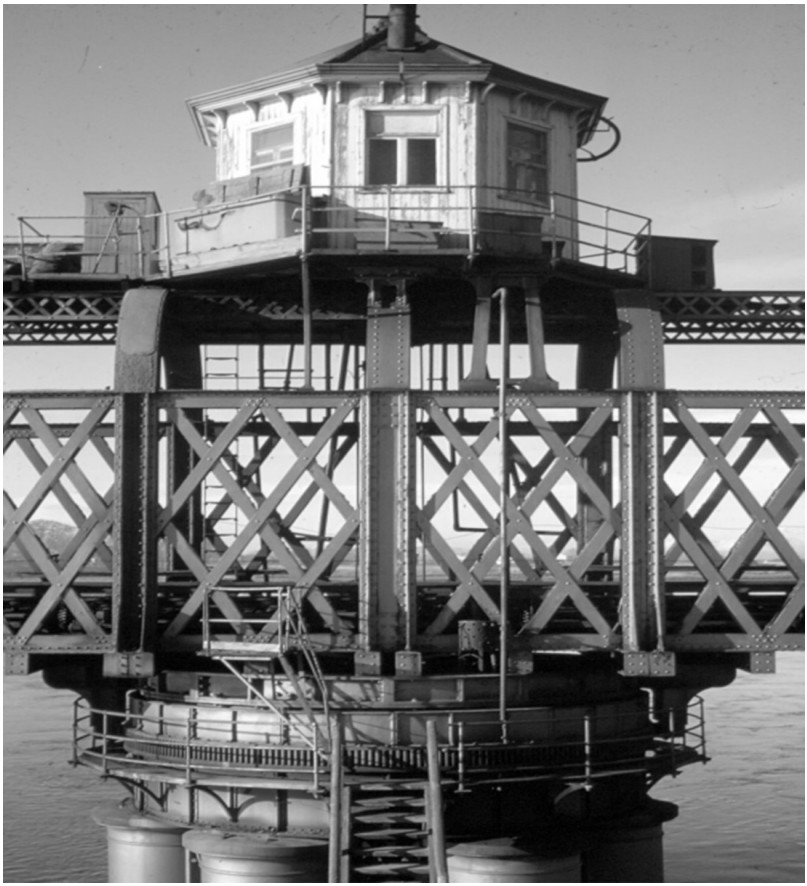


There was a great deal of detail given about the lengths to which the builders were going to ensure quality, both in terms of the material used and the methods of building. To keep the line of the channel as open as possible during construction:- *"The swing span is to be erected in the line of the channel at right angles to the bridge, so not to impede the navigation during its erection, and will be constructed so that it may turned completely round, and close equally well at either end. Timber fenders are to erected for protecting the swing spans when it is lying open, piles being driven 20 feet* ,(6.1 metres) *into the bed the river. "***(57)**

OS, 1896, Twenty five inch Map, Stirlingshire Sheet XVIII.6. Reproduced with the permission of the National Library of Scotland

It interesting that the description given by Aberdeen Evening Express proved to be extremely accurate, except for the proposal to open the central span by hand.

Figure 11. The central opening.



Photograph from the collection of the late Dr K . Mackay.

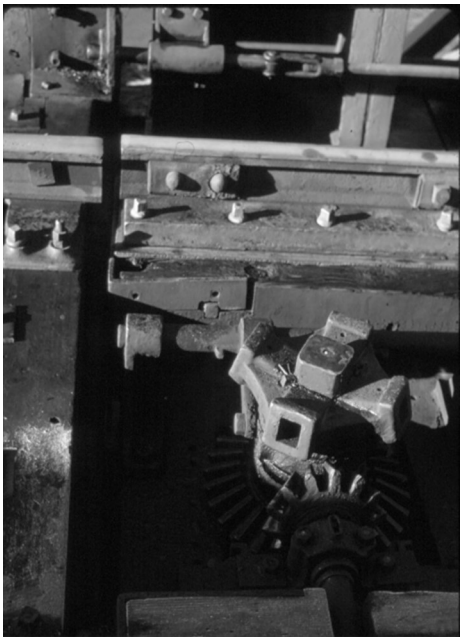
Instead the bridge was operated by a small steam engine sited in a cabin above the span. The engine drove a vertical shaft which engaged with a geared ring fixed to the piers. This was connected by a worm drive to a shaft engaging with a ring gear fixed to the central pier. The opening span was balanced on a set of bearings on top of the central piers.

Figure 12. Drive wheel.

Photograph from the collection of the late Dr K . Mackay

The gear wheels at the base of the vertical shaft driven by the steam engine were small and had very few teeth (16 in number). They meshed with the ring gear attached to the central piers, which was very much larger and had a great deal of teeth (approximately 256 in number). The 1:16 gearing of the shafts was enough to easily and slowly rotate the central span so that the bridge could open and close.

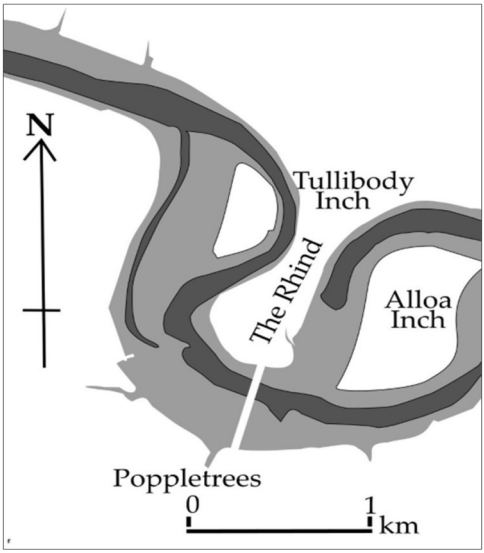
Figure 13. Locking Mechanism.



It was extremely important that the bridge was locked when it was in the closed position so that the rails joined up with those on the bridge. It was equally important that it locked in the open position in line with the pier in the river. This pier protected the central span when the bridge was opened. The locking mechanism had a manual backup (Seen here with connectors for a wooden shaft able to turn the lock.)

The opening of the swing span would reduce the channel of the river quite dramatically, from some 500 feet at low tide to less than 64 feet on each side of the central pier when the bridge was completed. At the time of its construction the river channel was in a different position than it is today. Modern aerial photographs show that the channel on the East side of Tullibody Inch has silted up. **(58)** The OS maps of 1898, show that this eastern route was the main shipping channel at the time. **(59)**

Figure 13. Old shipping channel.



The current coming down this eastern channel would tend to throw vessels coming downstream to the South, making it more difficult to enter the opening span. In addition, vessels coming downstream would not be able to see the central span until they rounded the end of Tullibody Inch.

Local Alloa organisations were keen to help with the opening of the bridge and a deputation from the Alloa Masonic Lodge assisted Lord Balfour of Burleigh in laying the foundation stone. The party travelled across to the South side by the Alloa Ferry and joined a train at the South Alloa station. The train then travelled to the Moss Junction, picked up coaches from Glasgow, and proceeded over the new line to the southern abutment. Dinner was served in a spacious marquee erected for the occasion but "*Unhappily, certain pieces of valuable silver plate, brought specially for the dinner, were stolen from the train on the return journey to Glasgow*". **(60)**

We have details of the construction of the piers due to an unfortunate accident at the site of pier number 15 (numbered from the South side of the river) which was reported in the Edinburgh Evening News. **(61)** A wooden service bridge had been erected alongside the site of the stone-built piers. This bridge was used by a service engine pulling trucks to transport the heavy metal cylinders used to excavate the space to enable the concrete foundations to be cast. A crane was built on top of the wooden staging to lift the cylinders and rings into place.

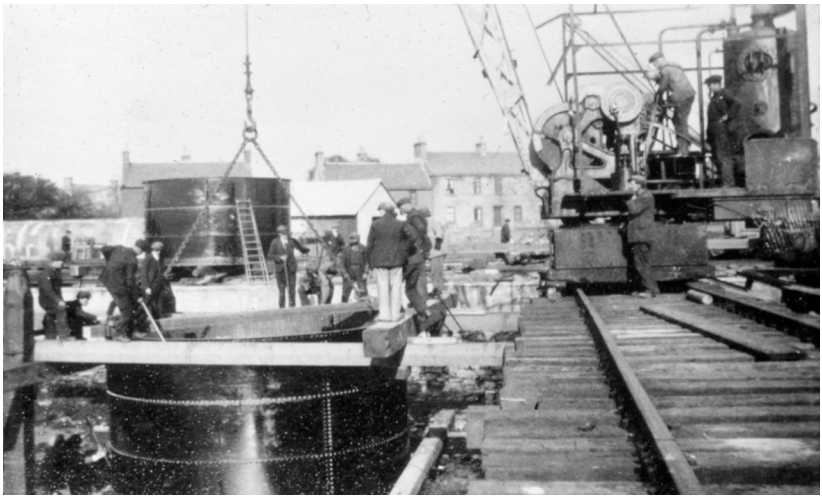
Figure 14. Building a service bridge to create the foundations.

Photograph from the collection of the late Dr K . Mackay

Unfortunately, the photograph did not have a note of its location but it was almost certainly not taken at Alloa. Once the cylinders were in place on top of each other, heavy ring weights, weighing two or three tons each, were laid on top to drive them down until a firm foundation was reached. There are wooden remains of piers on the Throsk side of the riverbed. (See Plate F4)

Once the rings were in place the material inside was excavated and the space filled with concrete up to the level of the low water mark. This provided a firm foundation for the construction of the stone piers.

Figure 15. Lowering the cylinders and weights.



Photograph from the collection of the late Dr K . Mackay.

Unfortunately, this photograph also did not have a note of its source or location, but from the details in the background it was unlikely to have been taken at Alloa. The details however, are exactly as noted in the newspaper report of the accident. In the foreground, a heavy ring weight is being placed by the crane on top of the cylinder.

While it was being lowered into place, one of the ring weights suddenly fell over onto the wooden staging, breaking down some 50 feet (15 metres) of it. (See Plate F5) The service engine and the two trucks were thrown into the river. Four men fell off the staging, three into the river. Two men were rescued by the safety boat, but the third was washed downriver and drowned. The crane operator jumped on to the staging, but was caught under a falling metal "kettle" and was severely crushed. **(62)**

The bridge was completed under the direction of the Glasgow Engineers, Crouch and Hogg, and contractors, Watt and Wilson. **(63)** It was finally opened on Thursday 1st October, 1885, with trains being run by the North British Railway company. **(64)** (See plate F2)

Within a few years the Queensferry rail bridge opened to traffic. **(65)**. Undoubtedly, together with the delay of the construction of the Devon Valley line, this had a serious consequence for the level of traffic across the South Alloa bridge. The line was a double railway line, except for the crossing over the bridge, which was reduced to a single line, controlled by signal boxes at Throsk (See plate F6) and the North side of the bridge. The original line crossed the river and headed East, ending at South Alloa Station. [NS 8809692573], which eventually became the Caledonian Railway Goods Yard, now part of Alloa Glass Works. As relations between the Caledonian Railway and North British Railway improved, a spur was taken off at Longcarse Junction [NS 87034 92748] to connect with the main Stirling to Dunfermline line at the Grange Crossing [NS 8775793086]. **(66)** The route of the line is still mostly visible, especially at Longcarse Junction and the Grange Crossing.

Despite assurances as to the safety of the navigation, there were a number of accidents which led to the temporary closure of the bridge. These were summarised on a report to the Forth Navigation Commissioners in 1920, drawn up by D & C Stevenson, Civil Engineers, Edinburgh. **(67)** The report indicates that *"The deepest water lies to the North of the northern opening spans of the bridge and the position of the opening spans of the bridge was no doubt chosen with a view to securing deep water as far as is possible, but the opening spans were kept rather to the south of the deepest water, evidently to make allowance for the flood tide, on coming between Alloa Inch and the Rhind* **(See Plate F 5)**, *to force vessels over to the southern shore when they are approaching the bridge. This tendency has been the cause of many of the accidents through many vessels fouling the piers of the bridge. We understand that there have been over twenty-five accidents to shipping on account of the bridge since its construction was begun in 1880."* In 1899 the bridge was struck by the sailing vessel Stephanie, from Hamburg with a cargo of salt. Having unloaded some salt at Stirling she was sailing back down the river when, driven by a strong tide, the vessel collided with the Alloa Bridge. The topmast was carried away and several plates were stove in. **(68)**

On the 11th October, 1904, the schooner Stirling, being

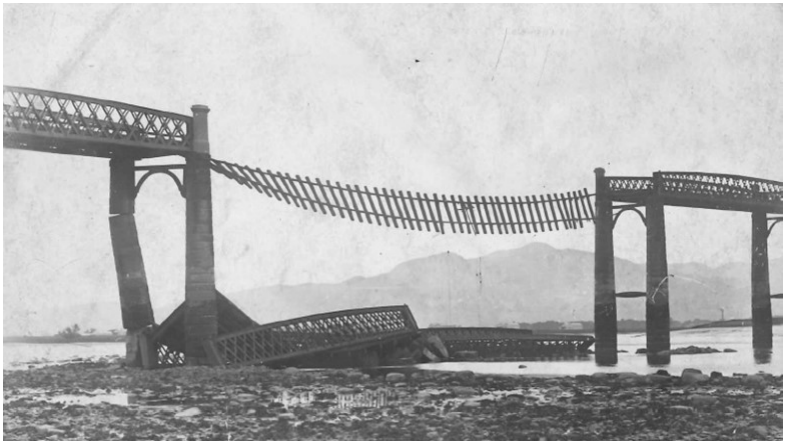
towed upriver to Stirling by a steam-powered tug, collided with the southern pier supporting one of the spans of the bridge adjacent to the opening span. The pier was seriously damaged resulting in the span of the bridge collapsing into the river. Traffic was rerouted by Stirling **(69)** and the bridge was not reponed until June 1905 **(70)** The screw steamer James Tennant collided with the bridge early on the morning of 7th January, 1904. The Railway Company stated in court that it was a calm morning, and although there was haze, there was no strong flow of tide or current, and all the lights on the bridge were burning brightly.

Figure 16. Damage caused by collision with a steamer in 1904.

The steamship company stated that the vessel was kept too far to starboard, and although before entering the opening her course was directed to port, it was too late to enable her to clear the south landing pier. They indicated that the vessel had been caught by a severe current which caused the vessel to strike one of the piers adjacent to the opening span. The Judge, Lord Johnston, gave decree for £90, and found the Railway Company entitled to expenses, holding that "*the accident occurred through faulty navigation, and that there was nothing so exceptional in the circumstances of the morning in question not to be capable of being overcome by careful navigation*." (71)

By far the most serious accident occurred in the early hours of Sunday morning the 14th of August 1920 involving the partial destruction of the Alloa Bridge, It was reported that "*about one o'clock, a surrendered German destroyer, which had been moored at South Alloa, preparatory to breaking up, broke loose from her moorings. The tide was then flowing and, drifting with the current, the heavy vessel struck the bridge. the point of impact was almost in the centre, between the swing span and the southern approach at the Throsk end. With the weight of the vessel the impact was considerable. One of the stone piers was destroyed and two spans of girders collapsed into the river bed. The bridge carries the railway line between Glasgow, Alloa, Dollar and Kinross." (72)*

Figure 17. Damage caused by destroyer in 1920.



Photograph courtesy of Clackmannanshire Archive & Local History Service.

This report was repeated in a number of publications, including the Falkirk Herald, which reported that the Provost of Stirling had said in a meeting of the Council that, as the bridge had always been a great obstruction to river traffic to Stirling the ramming of it was the "*only good thing that he knew a German destroyer do*". This false claim is still repeated in a number of modern sources, which clearly took their information from the early reports.

In reality, the vessel was one of a pair of Royal Navy Torpedo Boat Destroyers, HMS Vigilant and HMS Mallard. The Caledonian Railway Company pursued an action for damages against the South Alloa Shipbreaking Company and R.B Reith, the sole shareholder of the Company, for £18,000 damages relating to the repair of the bridge. The Ship breaking Company had leased a pier from the Caledonian Railway Company at South Alloa and the two ex-navy vessels were delivered there, to be broken up. Vigilant was tied up to the quay and the Mallard was roped to its side.

The shipbreaking company claimed that the jetty was not sufficiently strong and the Railway Company insisted that the ships had not been properly moored. The judge ruled in favour of the Railway Company, judging that the Mallard had not been sufficiently well moored and attended to. He also noted that the Mallard had not had her anchor in working order. He found in favour of the Railway Company, awarding damages and costs. (73) The repairs meant that the bridge was closed between 1920 and 1921, with trains being diverted via Stirling. (74) In undertaking major repairs to the bridge, three of the sets of stone piers were replaced with metal columns and all piers were strengthened with metal lattices. At the same time the North abutment was strengthened with old railway lines.

Figure 18. Remains of metal and stone piers.

This set of stone piers still has its original metal top connection, which is shown in pre-1920 photographs. When the piers were strengthened, four metal collars connected with cross bracing have been added to the stone pillars. The two sets of piers in the background have been replaced with ones made of metal.

Figure 19. Replacement metal piers.

Three sets of stone piers were replaced with metal ones Unlike the original piers, these replacements were cylindrical. The strengthening cross sections were bolted on to the metal casings. The bridge reopened in 1921.

Figure 20. The bridge opening.

Photograph courtesy of Clackmannanshire Archive & Local History Service.

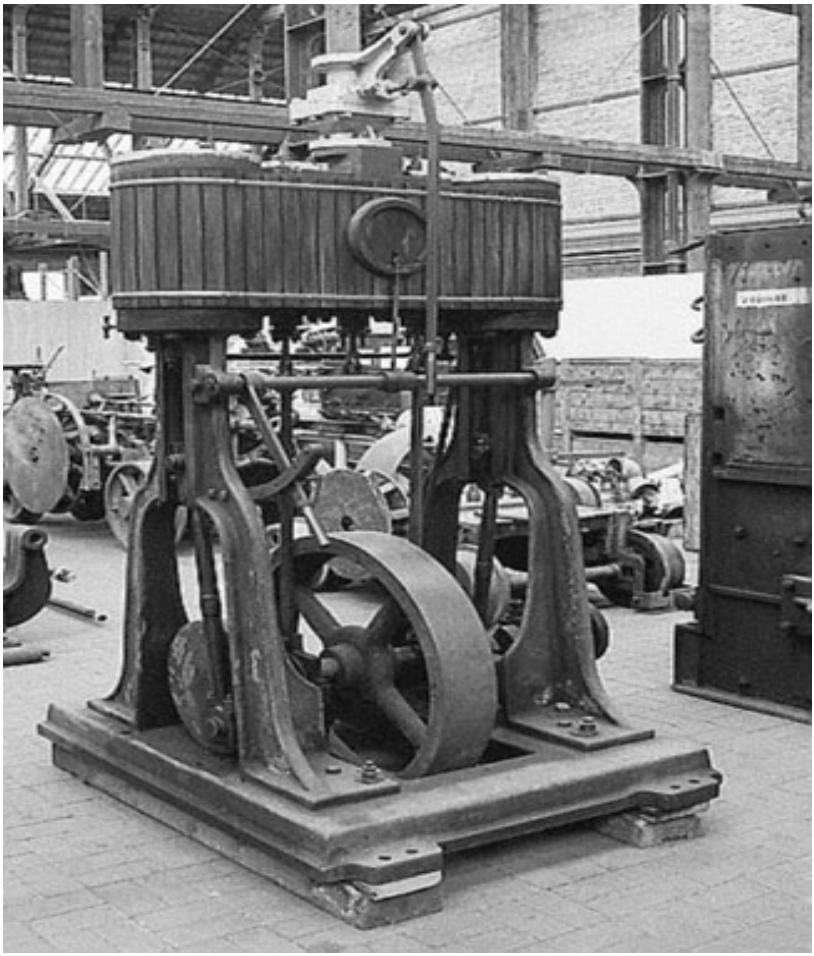
The bridge continued to provide freight and passenger services to Alloa through the first half of the twentieth century. The North British Railway constructed a loop to connect the bridge to the mainline station at Alloa and by 1899 the old Alloa (South) station became the Central Railway's goods station. **(75)**

In 1936, the construction of the road bridge across the Forth at Kincardine offered easy road access across the river **(76)** and spelled the end for the Alloa Ferry. The last vessel, Hope, was laid up in 1937 and sold to inverness where it operated on the Kessock ferry until 1947. **(77)** By the mid-1960's the industrial base of Alloa was beginning to decline. The distilleries, breweries, textile mills and their supporting industries were slowly disappearing and railway traffic declined. The passenger trains across the bridge were replace by a railbus which continued to run until 1968. The photographs below was taken on the last occasion the railbus ran from Alloa.

Figure 21. Last Railbus to travel over the bridge.

The boiler and steam engine which powered the bridge mechanism were located in the cabin. Coal continued to be delivered to the cabin by train until 1970 when the bridge was fixed in the open position. **(78)** The lines and spans of the bridge were finally removed in 1972 and the two-cylinder steam engine, made in 1886 by the Caledonian Railway at their St Rollox Works, is now on display at the Scottish Maritime Museum in Irvine. **(79)**

Figure 22. Steam Engine.



Conclusion.

The landowners and residents of Alloa had desired a means of crossing the river Forth and a ferry boat had provided this from the medieval period. From the early nineteenth century, they sought a crossing by bridge. Given that Stirling by this time had a new road bridge and was about to become a major railway crossing, it is hard not to see the construction of the Alloa Bridge as a vanity project for the people of Alloa. Opened in 1885 and in use for some 60 years, it only shortened the route via Stirling by a few kilometres and was soon eclipsed by the construction of the Forth Rail Bridge at Queensferry, which gave access to Fife and Dundee.

Having travelled several times by boat through the piers of the bridge at the turn of the tide, the narrow width of the central opening span certainly presented a challenge. Each time I travelled, captains opted for the larger span immediately to the South as a safer option. The reservations expressed as to the safety of the bridge opening were not without foundation.

Today, the two abutments and the remains of the piers are mouldering away under the effects of time and tides. Access to the remains from the South Side is difficult, due to the existence of a band of tidal mud between the shore and the gravel bank on which the piers are constructed. Access is much easier on the North side, from the Arnsbrae Roundabout on the A907, West of Alloa [NS 8729 6934]. Head South following "The Pavilions" and cross the railway line. Follow "The Pavilions" right then first right onto the farm road. Follow the road for 600 metres until is crosses the old railway line. Follow the course of the line South for 1.4 kilometres until you reach the North abutment.

Acknowledgements.

Thanks are due to the late Edward Stewart for his years of dedicated research and encouragement The research also drew on the work and photographic collections of the late Dr. Ken Mackay. Photographs were kindly supplied by Clackmannanshire Archive & Local History Service, the Scottish Maritime Museum and Robert Dingwall. Much of the research was based on the on-line collections of the British Newspaper Archive and the National Library of Scotland.

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REPORT ON THE FORTH NATURALIST AND HISTORIAN CONFERENCE, 2021

The Forth: Its Waters and Coast, 2021, Susan Mills

The general theme of the conference, which took place entirely online for the first time in our history and in the aftermath of the Covid-19 pandemic, was chosen to compliment the postponed VisitScotland's Year of Coasts and Waters and focussed, naturally enough, on a range of subjects relating to the Forth estuary, its tributaries and the landscapes around it. Murray Dickie, then Chair of FNH, welcomed everyone to the conference and hoped that they would enjoy the online format and the presentations, which promised to be very interesting. The following summaries are given in the order in which they were presented and were written, unless otherwise stated, by Susan Mills.

Forth-ERA: A Regional Recovery Platform

Professor Andrew Tyler is Scotland Hydro Nation Chair in the Department of Biological and Environmental Sciences, University of Stirling. His role is to provide leadership to forge collaborative relationships across the Scottish water sector to deliver sustainable water management in Scotland, including going beyond net zero. He is also the academic Director for Scotland's new International Environment Centre (SIEC).

The problems of the climate crisis can only be solved by bringing together the environmental research sector; government; the policy and regulatory community; industry and communities, because only by collaboration can a sustainable, workable, adaptable and implementable solution be found to mitigate the effects of climate change and reduce our carbon footprint. The environment must be brought to the heart of decision making in order to drive forward new sustainable green industry and economy.

Such ideas were tested with SEPA, Scottish Enterprise and others; their positive responses led to the inclusion of the SIEC in the Stirling and Clackmannanshire City Region Deal application, which was successful and is providing c£22m to drive this platform forward over the next ten years. The SIEC is an opportunity to take a different approach and transform innovation to deliver sustainable, inclusive growth.

The Covid-19 pandemic made it evident that what was needed was a *platform* for action, change and green recovery, rather than a new building, bringing together partnerships, data and intelligence in a 'one stop shop'. Forth-ERA will be Scotland's first regional recovery platform, a digital 'twin' to support a living laboratory to help changes, behaviour and opportunities. It aims to be of multi-sector relevance, with a wide range of applications and users.

Water is at the heart of this ambitious programme. The effects of climate change are all felt through water, but water is also the medium for driving forward green recovery, providing opportunities for energy, for a circular economy and reducing waste. Managing water more effectively can have carbon sequestration benefits and deliver net zero, with the added advantage of promoting biodiversity.

A better understanding of the environment is vital, however, alongside a less compartmentalised, biased way of working. Forth-ERA will break down 'silos' by considering the entire water continuum. World-leading satellite technology has been developed at Stirling and is being used to measure water quality and changes across the world. Satellites are also used to study water quantity and soils and may perhaps start to predict flooding events. Satellites record daily or every few days, whereas sensors can give high temporal resolution information, so existing sensors will be used in the data-sharing network. This will exploit satellite technology, spatial data, existing and new sensor technology to measure variables, validate satellite data and develop a predictive capability.

Forth-ERA sensors have AI capability, to work on forecasting the effects of action or inaction in response to the climate challenge. This will generate a huge amount of data which must then be converted into knowledge; a data visualisation company called 3deo is helping to transform it into formats more readily interpretable by a wide range of stakeholders. This will drive forward innovation within industry, changing behaviour and reducing its exploitation of the environment. It will, hopefully, also provide the basic intelligence for better, more informed decision making, driving efficiencies and increasing resilience to climate change challenges.

The SIEC was launched on 11th November, following two years of discussions with a range of stakeholder organisations to develop this capability in partnership. An example of the technology being used is the use of earth observation to look at water quality. This

was being done on a global scale already, but now an enormous amount of weekly satellite data is being processed for c1000 water bodies across the UK. An information portal has been developed to look at the changes in water quality, to understand whether it is increasing or deteriorating. This is now being applied specifically to Forth-ERA. It is possible to focus on one water body and compare data with previous years, to see how it has changed and to locate the problems. This far exceeds anything previously possible, because it is at a much higher resolution and taken from more data points, giving greater spatial perspective.

A 'demonstrator' has been built in the Forth around the Leven catchment area: a range of data will be gathered to look at water quality and quantity and augmented with other high resolution data. Some twenty-nine statutory and other organisations have been involved in the last year during the development of these technologies and a new 5G Centre will be established soon in Alloa.

The Scottish Hydro Nation Chair comes with a £3.5m investment, to help drive innovation in delivering on net zero for the Scottish water sector and beyond; it will also be used to lever in more investment. Forth-ERA is a partner with a quango of all UK utilities helping to deliver on net zero and with the UN Environment Program, the World Water Quality Alliance. It is also part of an intergovernmental panel that promotes earth observation to resolve environmental challenges and is leading on the European node for the GEO Aquawatch. Proof of Concept is also a new development, focussing on greener towns and air quality in urban areas; protecting and enhancing biodiversity and wildlife monitoring and improving communities.

A series of satellites will be launched in 2023 to look at thermal properties of earth surfaces at an unprecedented spatial resolution of 3m up to twenty times a day. This will give new insights into a range of constant environmental processes and feed into models of carbon sequestration. These new technologies are being built into the programme which Forth-ERA will lead, its mission being to bring the best of Scotland together to meet the challenges and deliver a net zero across the Scottish water sector. There are opportunities to drive real change and be a global leader; Scotland will be a genuine hydro nation.

The Loch Katrine Water Supply.

Jim Martin has worked for Scottish Water and its predecessors for about 35 years. He was a Water Network Team Leader for 16

years and is now Operations Team Leader in Water Treatment, managing a team of twenty operators. He explained that, until the early 19th century, Glasgow's water supply came from the River Clyde which washed its southern boundary, via its tributary streams and from many public and private wells, among the earliest recorded being St Ninian's Well in St Tenew Street (the Trongate) in 1433, and the Deanside Well (1530) off Rottenrow in Balmanno Street. St Mungo's Spout (1556) was near the Gallowgate, while St Kentigern's Well (1572) was perhaps the same well using the saint's proper name.

Many of Glasgow's buildings evince the great wealth still being generated by the early 20th century, though many industries were faltering by then and the social problems, particularly urban squalor, were mounting. There was already an awareness by 1820s/30s of the difficulties in coping with the very rapid population growth. Once elegant and spacious squares were now becoming built up and mansions designed to accommodate a single family were now being divided up to house a dozen or more families.

By the 1840s some of Glasgow's housing conditions were regarded as among the worst in Europe. Overcrowding and a highly mobile population made it vulnerable to epidemics; typhus fever and typhoid struck with depressing and often fatal regularity in foul housing 'backlands' and dingy lodging houses. Cholera also swept through the city in lethal waves in 1832 and 1848, killing thousands of people, with the worst hit areas being those with the poorest water supply. The 1848 outbreak led directly to the relocation of the University of Glasgow from the polluted High Street to the leafy suburbs of Gilmorehill; it also provided the impetus for a clean water supply from Loch Katrine. Cholera is a water-borne disease, caught by eating or drinking food or water tainted with the excreta of a cholera victim. It can spread much further and more rapidly than typhus and relapsing fever, particularly where the water supply is poor and there is no proper sewage disposal system.

Loch Katrine (its name derives from the Gaelic 'Cateran', meaning a Highland robber) is just under ten miles long and over a mile wide. It is located on the southern edge of the Highlands, with easy access from the Central Belt. The Loch Katrine Water Works were designed originally on a scale sufficient to supply Glasgow with 50 million gallons of water a day and the storage provided in the lochs that fed Loch Katrine was sufficient to ensure a constant

supply. Prior to this, Loch Katrine flowed into Loch Achray then to Loch Venachar, the River Teith and finally into the River Forth, so to engineer the scheme Loch Katrine's water level had to be raised and the flow into the adjoining loch restricted. Loch Arklet and Glen Finglas are each directly connected to Loch Katrine, so all of the water taken from these catchment areas for use in Glasgow and its environs flows into Loch Katrine before being discharged into the two aqueducts at Royal Cottage and delivered to the two reservoirs at Milngavie (Mugdock and Craigmaddie).

The first and second aqueducts bring water from the draw-off works at Royal Cottage to Mugdock and Craigmaddie Reservoirs by gravity. The first aqueduct was constructed from 1855 to 1859 and has mainly large lengths of 'cut and cover' sections where it followed the ground contour to avoid tunnelling. The 42km (26 miles) long works included 22 bridges, some 60–80 feet in height, and was completed in only three years by employing vast numbers of men who worked on a large number of simultaneously worked faces. Its complex infrastructure was explained. Eighty tunnels were built along the route, excavated and blasted through soil and hard rock by an army of approximately 3,000 "navvies" (Navigators), who were predominantly from England. A new aqueduct was begun in 1885 and completed in 1896, its construction via mainly tunnel.

The old aqueduct supplies 45 million gallons a day to Balmore Water Treatment Works (WTW) and has a transfer time of 10 to 12 hours. The new aqueduct supplies Milngavie Water Treatment Works with 80 million gallons a day. The Loch Katrine aqueduct supplies both water treatment works. The water passing through the old WTW at Milngavie to supply Glasgow received very basic treatment, passing through straining wells, PH correction and disinfection with chlorine gas. The absence of filtration gave little protection against Cryptosporidium. A new WTW was commissioned at Milngavie in 2007 and this now supplies the majority of Glasgow's water supply, c310,000 properties, giving the people of Glasgow a fully treated water supply. Balmore WTW, meanwhile, was commissioned in 2000 and is the biggest WTW in Scotland, supplying from the east side of Glasgow to the outskirts of Edinburgh, c350,000 properties.

The River Teith Special Area of Conservation.

Paul Roberts is Operations Manager for NatureScot (formerly Scottish Natural Heritage), leading and supporting a team of staff to deliver the organisation's priorities across protected areas, wildlife management, development planning, placemaking & partnership projects in Stirling, Falkirk and Loch Lomond & Trossachs National Park, as well as supporting the Area Manager. leading on development and wildlife management.

The waters of the River Forth and its catchment have both UK and internationally important populations of fish, birds and aquatic mammals. Along its length there are many nature conservation areas that provide these species with statutory protection. For example, the Firth of Forth Special Protection Area (SPA) covers the endangered and migratory birds in a number of large areas of the Forth Estuary stretching from Cambus to Musselburgh. The River Teith SAC includes many of the rivers and burns in the Teith catchment, extending from the railway bridges over the Forth in Stirling upstream to Lochs Venachar and Achray and then further north up the rivers Leny and Balvaig to include Lochs Lubnaig, Voil and Doine. Many feeder burns are also included such as the Ardoch, Annet and Calair burns and the Keltie and Black waters.

SACs and SPAs were originally EU designations resulting from the EU Habitats (SACs) (1992) and Birds Directives (SPAs) (1979), the cornerstones of EU nature conservation legislation. They were known collectively as Natura sites. 27,000 of these were spread across the EU, with 243 located in Scotland. Since the UK left the EU the European legislation has been transposed into Scottish Law and SACs and SPAs (renamed European Sites) have continued to be designated under domestic legislation.

In Scotland European Sites are administered by a new independent scrutiny body, Environmental Standards Scotland. This has been set up to ensure environmental laws and standards are adhered to, replacing the European Union's scrutiny and enforcement role. This non-ministerial office is tasked with assessing how legislation is implemented and ensuring that government and public bodies are compliant. The River Teith was designated because of its strong populations of River, Brook and Sea Lampreys. These are primitive parasitic fish (Maitland, 2003) whose hosts include Atlantic Salmon which is a fourth qualifying interest. Conserving these fish has a wider impact and other endangered species that share their habitat have also been protected, such as the Arctic Charr (Maitland, 2009) and Pearl

Mussels. The speaker emphasised that this protection does not stop at the boundary of the SAC and negative influences on the qualifying interests originating outside the SAC are included. The responsibility for enforcing this powerful legislation resides with Competent Authorities, ie those who give permission for activities that might affect the SAC. The planning authorities of Stirling Council and the Loch Lomond and Trossachs National Park, as well as Scottish Forestry, would be obvious examples. They take advice from NatureScot and SEPA and will usually require favourable Environmental Impact Assessments before giving planning consent. Both NatureScot and SEPA also provide management advice to land owners and carry out periodic site condition monitoring to ensure that our European sites remain in peak condition.

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Maitland, P.S. 2009 The status of Arctic Charr in the Forth Catchment Forth Naturalist and Historian 32, 51-65.

(Roy Sexton)

The Allan Water Improvement Project ,

Alison Baker joined Forth Rivers Trust (FRT) in 2013. She has over twenty years of project management experience and worked previously as Programme Coordinator on the Trust's Forth Invasive Non-Native Species Programme. She became Director of the Trust in 2015, at the same time as it took over this project. The FRT, an environmental charity, was formed in 2008 to look after the whole of the Forth catchment area. It began with just two members of staff which grew quickly to the current twenty, due largely to a wish for environmental solutions to water and river issues. Its work is evidence-based delivery of projects by a mainly scientific staff, who deliver ecologically sustainable solutions on the ground using grants rather than core funding.

The Allan Water Improvement Project (AWIP) was initiated due to flooding in Bridge of Allan and Blackford, with the aim of finding natural flood management solutions. The talk concentrated on the Upper Allan catchment, where there are both the best options and room to implement them. The main funder is the Scottish Government and possible solutions arise from discussions between FRT, landowners and other stakeholders.

Two specific sites where work is now in progress has followed these discussions. The first was the Upper Knaik, a tributary of the Allan Water, where c.850 dams have been put across drainage ditches in the moorland above and rough pasture around Tigh na Blair (NN 771166) to slow water coming off the hills and to aid peatland restoration. The second was the Allan Water between Blackford and Greenloaning, where its original 'wriggly' course had been canalized during the construction of the Perth to Stirling railway in the second half of the 19th century.

While the flood bank protecting the railway will remain, work is in progress to reconnect the river with its flood plain to the north in four places, primarily at the SSSI of Shelforkie Moss. This will include the creation of pools and wader scrapes as well as peatland restoration. Work is also underway to install 'leaky' dams on the Danny Burn above Blackford to alleviate flooding in the village and the creation of wader breeding areas in the Loig area between Greenloaning and Kinbuck.

Looking ahead, the FRT has several other schemes in the pipeline, including solutions to the barriers of fish passage and the easing of flooding in Callander, Stirling and the Devon Valley. (Neil Bielby)

Salt, Trees and Peat in the Middle Ages.

Professor Richard Oram joined the University of Stirling in 2002 and is Professor of Medieval and Environmental History. He is a former Director of the Centre for Environmental History and Policy and in 2008 was appointed a member of the Historic Environment Advisory Council for Scotland.

In the late 10th to early 11th centuries new settlements began and existing ones expanded into wooded districts north of the Forth between the marshy carseland and Ochils escarpment, especially along the old raised beach. Gart- (= a clearing or cultivated area) place-names occurring through the central zone (McNiven, 2007) record the efforts of peasant farmers to open up broadleaved woodland, exploiting the easily tillable forest soils and creating new arable land through assarts.

This happened against the backdrop of climate change. Annual temperatures rose from the mid 10th century until the Medieval Climate Anomaly (MCA); annual temperatures were higher than the mean, though still lower than present day averages; conditions were generally milder, drier and better, though with occasional severe weather episodes. This encouraged agricultural and

population expansion. The MCA began to break down catastrophically from the mid 1250s, the eruption of the Samalas Volcano in Indonesia in 1257 being the final tipping point. Huge amounts of particulate entered the atmosphere, cooling it more rapidly; this precipitated a great disruption episode known as the Wolf Minimum (1280-1350) - a period of low-level sunspot activity coinciding with cooler, wetter stormier conditions.

The Dantean Anomaly occurred in the 1310s-1320s and coincided with the great European famine and cattle plague. The Sporer (needs an umlaut over the o) Minimum from c1460-1550 was another period of low sunspot activity, when temperatures plunged, with intensely cold winters and cold, unproductive summers; it is no accident that the era saw some of the greatest levels of political unrest.

By the early 12th century the royal Forest of Clackmannan, a substantial oak woodland, still remained between Clackmannan and Dollar, but the Crown began to make grants of access to monastic institutions, giving them licences to take as much timber as they wanted for building purposes, as well as brushwood. David I (1124- 53) granted access in the 1140s for timber and fuel-wood to St Andrews Cathedral Priory, the monks of the Island of May and the canons of Holyrood Abbey. He also issued instructions to his local officials not to obstruct these tree-felling operations, but there was a conflict between the role of men like Gilleserf of Clackmannan, charged with protecting and preserving the forest and its green cover for the deer which the king wanted to hunt, and this large-scale granting of unlimited access and felling rights.

Fuel-wood, mainly from scrub but also gleaned after felling, was in great demand for domestic and industrial fires. The best oak had already gone by the later 12th century, so grants were made of boscas - primarily alder, willow, hazel and birch - or managed coppice, which produced large quantities of material for withies/ wattling, fencing and basketry. Some fuel-wood was gathered for domestic use by the monasteries, but it was mainly for the salt-pans on the Carse, which may have begun as early as the third quarter of the 11th century.

Salt production had been established on the south coast of Fife by the late 11th century, but the main production centres were upstream on the carselands on both sides of the Forth and mainly east of Stirling. David I granted the Abbot of Dunfermline a salt pan c1139 and in 1140-53 he granted pans to Newbattle Abbey; Holyrood Abbey; Kelso Abbey; Cambuskenneth Abbey and

Jedburgh Abbey. These grants were from around Manor to Kincardine on the north bank and as far as what is now Grangemouth on the south bank. A new cluster began there from the 1140s on the salt marsh and estuary mud flats, especially in the vicinity of Airth; these areas were ideal for recovering salt through the sleeching process. Sleeching was done by rinsing through muds and silts from the salt marsh; the resultant thick brine sludge was removed, rinsed in pits, a thick saline was boiled and salt was produced. The raised peat moss west of Airth supplied fuel for this process.

The main monastic saltpan owners in the Forth area c1200 were the abbeys of Arbroath, Cambuskenneth, Coupar Angus, Dunfermline, Holyrood, Jedburgh, Kelso, Melrose, Newbattle and St Andrews; nearly twenty recorded sites owned pre-1200 were in areas appropriate for sleeching. Fuel was essential for salt production operations. The earliest 12th century grants gave access to supplies of fuel-wood, mainly from the Forest of Clackmannan and scrub along the Hillfoots. Such grants had ended before 1200 and all later grants around Stirling were awarded for peat-cutting rights in the raised peat bogs on land flanking the Forth estuary.

Malcolm IV (1153-65) confirmed and expanded his grandfather David I's grants of saltpans to the monks of Newbattle and Cambuskenneth. Holyrood and Newbattle Abbeys directed drainage of the 'blankelands' of the Carse of Callendar from the 1140s, creating arable in the district where they had been given sleeching sites by the king. The end of the MCA and descent into the Wolf Minimum affected rainfall and storminess and this low-lying ground became prone later to inundation in storm surges, flood spates and very high tides, first recorded in 1267. Holyrood Abbey had abandoned its interests there by 1533, granting away the land because parts of it were submerged every day.

A supply crisis for Biscay salt, meanwhile, helped to keep Scottish salt prices buoyant, despite deteriorating weather conditions and fuel shortages; even old saltpans around Stirling found willing exploiters like John Menteith, who in 1366 took the feu of Arbroath Abbey's pan for an annual rent of 6s 8d. Salt from the Biscay region was manufactured by solar evaporation and favoured for its large crystals over the smaller ones made by boiling sea water in pans; the latter was better, however, for use in brine. The Wolf Minimum was unfavourable for solar evaporation and for peat-fired salt pans, as drying peat in large quantities was difficult in poor weather conditions. The Spörer Minimum was worse;

during that period peat-fired salt panning declined and there was a rapid growth in coal-fired, direct sea-water boiling salt production.

West coast and Highland chiefs began to tighten their grip on sea fishing, gaining great wealth and power by controlling the herring trade; by the later 15th century contracts with mainly Edinburgh-based merchants and foreign dealers were common, while the Crown was also deriving a substantial 'custom' from this international trade. Small salt crystals were good for preserving fish and new coal-fired saltpans were established in the outer Firth of Forth by the early 1400s. Charters and feus record the presence of rock-cut pools at Cockenzie and Wemyss; iron patellae, pans, boiling houses and girnals. Much of the salt was delivered to the Edinburgh merchants, who also had the capital to invest in the development of these new commercial centres. The salt industry of the Inner Forth no longer benefitted and began to decline.

McNiven, Peter, 2007, 'The *Gart*-names of Clackmannanshire', *JSNS* 1, 61-76.

Clackmannan Harbours.

Murray Dickie is a founder member of the Clackmannanshire Field Studies Society (CFSS) and the Forth Naturalist and Historian and continues to promote an interest in the local environment. He led an Inner Forth Landscape (IFLI) project researching the development and decline of the historic estates of Clackmannan and Alloa, c1690 – 1900. The evolution and eventual decline of the Clackmannan harbours was a key piece of research during that project. He is Journal Editor of the Forth Naturalist and Historian.

The Clackmannan estate lay on the north shore of the River Forth, bounded in the east by the River Black Devon. Clackmannan Tower, the ancestral home of the Bruce family, sits on the western end of King's Seat Hill, a glacial ridge (drumlin), with Clackmannan lying to the east. An extensive area of carse land, the former sea bed created some 10,000 years ago after the end of the ice age, lies to the south. Rivers and streams like the Black Devon entering the Forth below the tidal limit at Stirling cross the carse lands in tidal loops (Pows). As the tidal range in the Inner Forth is about 5m (17ft), these small Pows offered a safe haven for the shallow draft sailing vessels commonly used until the mid-18th century. Each medieval estate in the area was associated with a Pow, as shown by John Adair's A Mapp of Clakmanan Shire, c.1681.

Clackmannan Harbour was developed at the northern end of the main tidal section of the Black Devon, the area upstream being too narrow to allow vessels to access it. A small settlement, Powside, was built on a slightly raised, artificial island connected to the foot of King's Seat Hill by a raised causeway. Up to the mid-18th century the Forth was much wider and less straight than it is today and was edged with a wide area of salt marsh. The Clackmannan estate was underlain by rich coal seams, five of which outcropped close to Powside. Like many of the inner Forth estates, Clackmannan exported coal across the North Sea and around coastal Britain from the mid-16th century.

In its tidal section the Black Devon is underlain by glutinous estuarine and alluvial muds and in three places the bed of the river has been covered with layers of water-worn pebbles. Two of these are composed of stones of local origin and were almost certainly fords. At Powside the stones are not local, being almost exclusively micaceous schists, possibly brought as ballast from the Baltic. The water-worn schists are planar in form and create a substantial surface on top of the mud. Sailing ships in the mid-18th century were small, carrying some 40 tons of cargo; they would have come upriver to Powside on the incoming tide. The stone layer would have provided a safe area for them to sit when the tide went out. Once unloaded and reloaded with coal, they would have floated seaward on the next outgoing high tide.

At some point the harbour at Powside was rebuilt, with a substantial sandstone embankment on the eastern side and a flagstone floor in the river. By the mid-17th century, John Erskine, 2nd Earl of Mar, constructed a small embankment on the neighbouring farm of Ferryton to keep his land protected from high tides. In 1772, the Zetland family, by then owners of the Clackmannan estate, were anxious to reclaim their land next to the Forth and began to construct an embankment down the eastern edge of the Black Devon. At the same time the size of sailing vessels was increasing and a wooden wagon way was built along the top of the embankment to reach two timber piers much closer to the junction with the Forth.

In 1832 the embankment was built further towards the Forth and carried eastwards, enclosing more of the Carse. The wagon way was extended again, with two additional timber piers being built, and the course of the Black Devon straightened to place these piers almost on the edge of the Forth. By 1861, the 1st Edition Ordnance Survey 25-inch map shows that the embankment had been rebuilt at the edge of the Forth and a large timber shipping

harbour constructed (Clackmannan Pier). The harbour had four piers extended from a timber decked area, backed by an extensive built-up area of land. Coal was loaded into ships by means of a harbour crane and coal chutes.

The harbours in Clackmannan Pow enabled a healthy coal trade to be built up in the late 19th century. Towards the end of the period most of the trade was within the Inner Forth, but with cargoes travelling up and down the coast of Britain and across the North Sea. By this time vessels built of riveted iron plates were replacing wooden ships; when the tide went out these vessels were left sitting on the mud. Flexible wooden vessels coped well with this, but older iron vessels suffered distortion and, in 1890, three iron-hulled vessels which had taken on coal at Clackmannan foundered at sea. A Board of Trade enquiry in Dundee concluded that it was not safe to load older iron-hulled vessels at Clackmannan Pier and the trade ceased almost at once. Vessels were redirected to Alloa, where there was a large wet dock, allowing vessels to sit in water regardless of the state of the tide.

Despite its sudden closure, the various harbours at Clackmannan, connected to the rest of the estate by a lengthy network of wagon ways, supported the coal mining for nearly five hundred years. Coal was the principal trade, but the harbour also exported salt and manufactured tiles and imported grain and agricultural lime. For a short period (1835-58) it supplied limestone to the Devon Iron Works and exported cast iron and cast-iron goods. Although abandoned for more than a century, substantial remains of the harbours, waggonways, embankments and Powside can still be seen. (Murray Dickie)

Wildfowl of the Upper Forth.

Neil Bielby has been the Wetland Bird Survey (WeBS) Inland Local Organiser for what was Central Region since July 1994 and the British Trust for Ornithology's (BTO) Regional Representative for their 'Central Scotland' Region since April 1995. He has also been the Secretary and Treasurer of the Scottish Ornithologists' Club (SOC) Central Scotland Branch since 2011 and 2005 respectively. He is Treasurer of the Forth Naturalist and Historian. His talk covered the twenty-five years of the Wetland Bird Survey (WeBS) counts on inland water bodies 1995/6 – 2018/9 in the Upper Forth bird recording area. These were initiated in 1947 by the International Wildfowling Inquiry Committee and taken over by the Wildfowl and Wetlands Trust (WWT) at Slimbridge in 1954.

The current project, covering all water species from divers to kingfisher, has been run by WWT since 1993 and then by the British Trust for Ornithology (BTO) since 2004. It is funded by BTO, RSPB and JNCC. Counts are done monthly on a designated date from September to March. The Upper Forth does not include the estuary but does take in inland water features, linear water features (rivers, canals) but excludes Loch Earn, which is mostly in Perth and Kinross. The tidal rivers include the Forth, Devon - counted as far as Cambus - and Carron to the A905 at Glensburgh are also counted, but below these points the Forth and Carron are included in the estuary counts. Divers, grebes, cormorants, herons, swans, ducks, sawbills, rails, gallinules and coots are all included, but Pink -footed, Greylag and Canada geese are excluded as these cannot be monitored satisfactorily by daytime counts. The total number of 'wildfowl' counted was 949, 522 from 1995 to 2019 but the total is now over one million,

Covid restrictions notwithstanding. 71% were counted on still water sites (13,634 individual counts) and 29% on linear water sites (17,175 kms walked). Approximately 50 counters participate each winter, totalling 172 over the 25-year period. A typical winter was described using 2018/99 data. 114 still sites, 115.2 km of river and 25.8 km of canal had at least one visit; 56 counters completed 695 individual counts of still water sites, while 879.2 km of linear waterways were counted; this resulted in an accurate total of 42,000 'wildfowl' being recorded with 30,028 (71.5%) found at still sites and 11,972 on linear waters. Several illustrations demonstrated a steady decline in bird numbers, for example in 2009, when between 10th December and 11th January the temperature never rose above zero. The top three still water sites are: Cambusmore/Gart gravel pit, Callander (av. 281 birds per month); Lake of Menteith (av. 301 bpm); Gartmorn Dam (av. 727 bpm).

The monthly count at Cambusmore has fluctuated, especially as extraction continued. Wigeon and teal in particular benefitted from the seasonally, partially flooded Gart fields until they were excavated. Counts of significant species: Little Grebe (max. count 42 Sept. 2012) These like small, well-vegetated ponds for breeding. Wigeon (max. count 460 Dec. 2000) Teal (max. count 349 Oct. 2001) Tufted duck (max. count 68 Sept. 2016) This is also a moulting site. Lake of Menteith counts have only declined slightly over the period, although more noticeably in severe winters, when it has been frozen over. Great crested grebe (max. count 47 Sept. 2015) even recently stay into midwinter, perhaps a sign of global warming. Tufted duck (max. count 201 Dec. 2004) The numbers are

probably related to food availability. Goldeneye (max. count 248 Dec. 2004) Coot (max. count 313 Dec. 1998) are now 'short-stopping' on the continent.

Gartmorn Dam was the first site counted for wildfowl in Central Region, by Tom Paterson in 1962. Numbers have fallen dramatically since 1995/6, when 1,302 birds/visit/month was the average; in 2018/19 the total was 464. The highest monthly average was 1,878 in 1989/9, with an individual count of 2,784 in January 1994. The fall to 206 in 2020/21 is the lowest ever, so Gartmorn has relinquished its position as the top site. Mute swan (max. count 164 Nov. 2018) Wigeon (max. count 1,150 Dec. 1995, with the highest ever count 1260 Jan. 1994) Tufted duck (max. count 422 Oct. 2012, with the highest ever count 807 Feb. 1972) Coot (max. count 810 Dec. 1996, but these were only included in counts since the mid-1990s) Mallard numbers too have decreased from a high of 1,531 in Dec. 1978 to a max. of 130 Nov. 2018.

Rivers and canals provide almost 30% of birds counted. Bird numbers tend to increase on rivers going downstream, especially when the river becomes tidal. Canal counts are more evenly distributed. These linear waterways provide 62% of Herons, 57% of Goosanders and 46% of Teal. Pochard have had a catastrophic decline over the 25 years, the result of a combination of 'short-stopping' and also because they build nests among blackheaded gull nesting colonies for protection. There are now fewer of these colonies in the European countries which provide most of the UK birds, including Norway, Germany and Latvia. Nutrients washing off farmland also cause algae and plants to proliferate, thus preventing diving duck from foraging. On a positive note, however, little grebe are doing well. (Marilyn Scott)

The Forth Bridges World Heritage Site

Dr Miles Oglethorpe moved to the Scottish Government heritage agency Historic Scotland in 2007. He led the team responsible for preparing the successful World Heritage nomination for the Forth Bridge and is now Head of Industrial Heritage at Historic Environment Scotland and President of the International Committee for the Preservation of Industrial Heritage (TICCIH).

There are few better ambassadors for engineering and railway heritage than the Forth Bridge, built from 1882-1890. Its iconic power and extraordinary cultural resonance is demonstrated by the fact that it has appeared on a range of items almost since it was

completed: bank notes; Meccano magazine; souvenirs; body art; company logos, whisky bottles and most recently on a panel of the Great Tapestry of Scotland. "Forth Bridgery" also includes Scottish Seafood Week, a laundry service, coffee, hearing aids and even a refuse collection lorry. It has been projected onto buildings in mainstream cultural events and a huge scale model of it once sat atop the Norwood Cinema in Glasgow, built in 1936, though it was removed in 1958. One of its most famous appearances was in an Irn Bru advertising campaign, though the famous fizzy drink is unlikely to actually contain any iron. Its iconic status was demonstrated by a very recent visit to the bridge by US Secretary of the Interior, Deb Haaland, during the COP 26 summit in Glasgow; President Biden also took a detour to see the wonder after leaving the summit and prior to boarding Air Force One. The bridge has huge symbolic power and has also been used in news items as a backdrop for clean-up campaigns, as well as being deployed to great effect in public protests.

A site cannot be nominated for World Heritage status without the support of its owners. Network Rail was not keen at first, but have since become one of the biggest supporters and a very important partner. In the late 1990s a huge restoration project began, finally completed in 2011 for £140m, the cost reflecting the fact that the bridge had to remain operational throughout. It now looks better than ever and the quality of the work won many awards. It had been on the World Heritage UK tentative list in 1999, but this expired in 2011, so it had to compete to get onto the new, much shorter list, with only 13 sites selected out of 38 applicants. Three local authorities, Network Rail, Transport Scotland, Historic Scotland, VisitScotland, Forth Estuary Transport Authority, Forth Replacement Crossing and local community councils all came together in a partnership, without which the nomination would have been impossible.

Comparative analysis is important to prove significance and the TICCIH Thematic Study of Bridges supported the highest level of protection for it. Proving its importance was vital and the role of its builder, Sir William Arrol & Co., an important and iconic Glasgow engineer whose company engineered structures from mild steel all over the world – they were building Tower Bridge and the second Tay Bridge at the same time as the Forth Bridge – was a key ingredient. It was vital to show that there are not many similar sites; the Quebec Bridge is the only similar one, but not as important as it and, on closer analysis, different from the Forth Bridge, to which nothing comes close, so demonstrating universal

value was not a problem. It was also crucial to identify clear reasons and benefits for the nomination, so the work of economist James Rebanks was extremely helpful. The internet and social media were also used successfully to support the nomination.

The nomination document was finally ready, approved and submitted in the nick of time. The support of the Scottish Government was essential for the nomination and it was also vital to work closely with ICOMOS, which carries out the evaluations for UNESCO. The bridge was finally inscribed at the 39th meeting of UNESCO World Heritage Meeting, in Bonn on 5th July 2015. That was the moment when the work when really started. The bridge is an operational piece of infrastructure and requires a permanent commitment to its upkeep and preservation. It must be well maintained, as it carries 200 trains per day.

The Forth Bridge Management Plan was the most valuable part of the World Heritage process; buffer zones are considered important for protection, but the bridge is too big and visible to have one so, controversially, a decision was made not to have one and to rely on existing statutory designations in its immediate environment to provide more protection, in effect a buffer-less buffer zone. It is worth noting that the new Queensferry Crossing would have been impossible if a buffer zone had been created; it has, in fact, added great value to the area as a visitor destination. There is an excellent archive for the bridge, including iconic and powerful photographs taken during its construction held in the National Archives and previously unseen material in the archives of Network Rail.

The bridges are now being promoted together - three bridges spanning three centuries, with publications showing them all and with a shared strategic plan. The Forth Bridge Experience has been created to try to promote sustainable tourism, relieve pressure on hotspots and create a visitor centre to promote access to a bridge walk. The partnerships formed at the nomination stage continue after inscription, so The Forth Bridges Forum partners still work together.

The Forth Bridge is an ambassador for science and engineering; strong links with education and young people are important. It is now possible to fly through the bridge digitally, using the latest 3D Digital Documentation Technologies, which are constantly changing, becoming quicker, more powerful and accessible. New technologies are being developed by industry for historic industry, so everyone will be able to 'visit' virtually all parts of the bridge.

Scottish Government funding is conditional on the bridge being used to promote education, so there are Go Forth education packages, including interactive games and web resources. There is still further work to be done on the overall project. The Forth Bridge, meanwhile, is still doing exactly what it was designed and built to do and there is no reason to think that it will not still be doing it a century from now.

Plate A1. Atlantic Salmon in the Forth River System: Project Map.

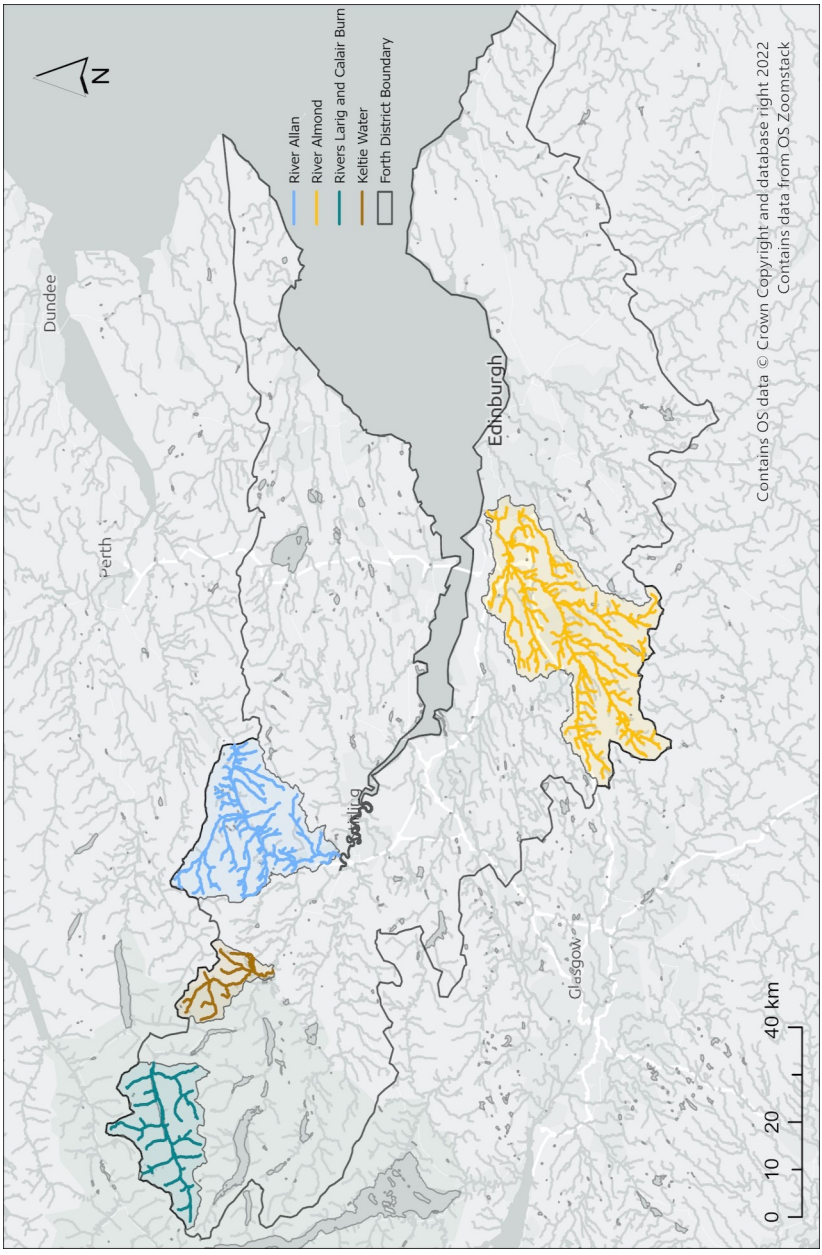


Plate A2. Larig project tree planting.

Plate A3. Large woody structure.

Plate A4. River Allan project bank stabilization.

Plate A5. River Allan project bank stabilization, after.

Plate B1. *Salix lapponum* on typical cliff site.

Plate B2. Tree line wood on cliff, Craig an Lochain.

Plate B3. Cliff edge habitat with *Silene dioica* and *Anthyllis vulneraria.*

Plate B4. Restored Downy willow scrub at Edramucky Burn.

Plate B5. Immature Downy Willows with tall herbs at Edramucky Burn.

Plate B6. Creag an Lochain.

Plate B7. Developing woodland at Edramucky Burn.

Plate B8. The extent of the project.

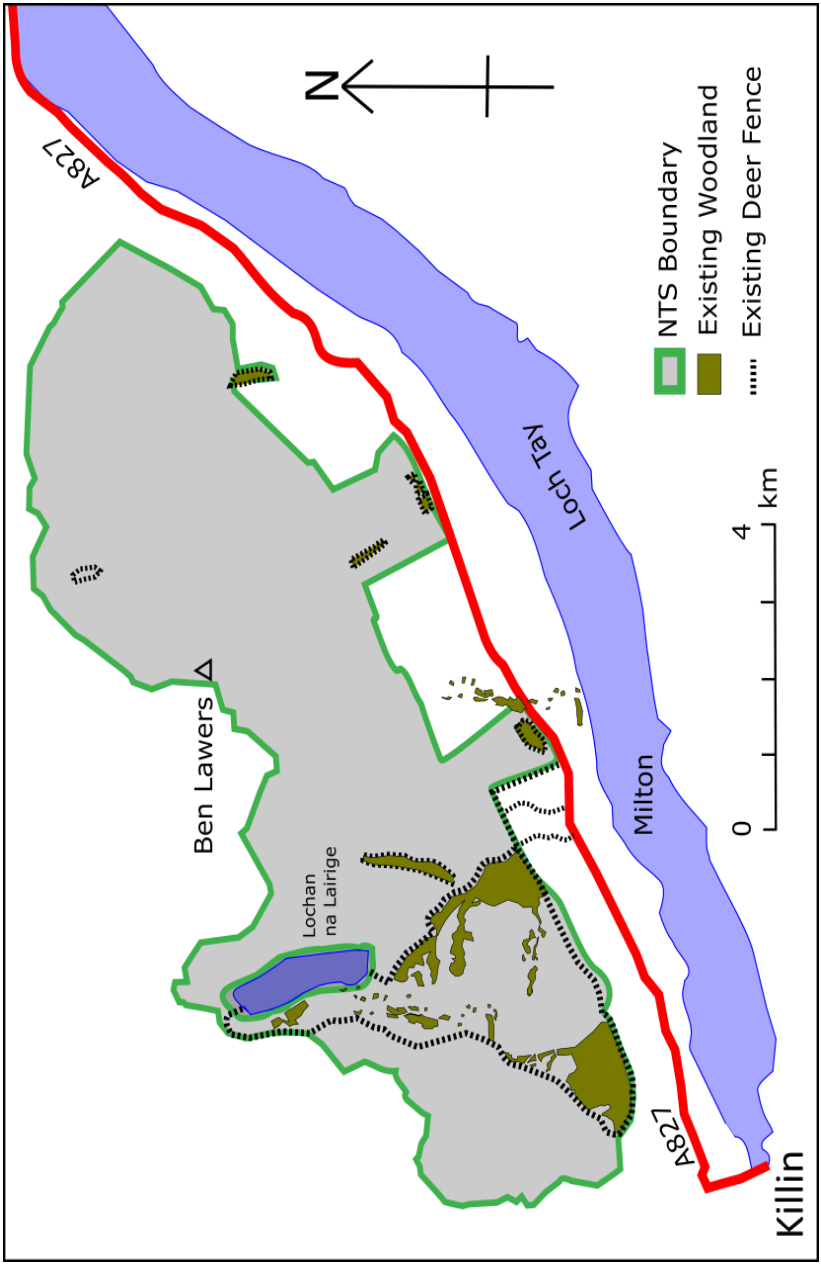


Plate C1. Glossy Ibis, M. Cook.

Plate C2. Hawfinch, Annon.

Plate C3. Whooper Swans, R.J.N. Stewart.

Plate C4. Rose-coloured Starling, R.J.N. Stewart.

Plate D1. Dunblane and Kirkton, Precipitation Totals.

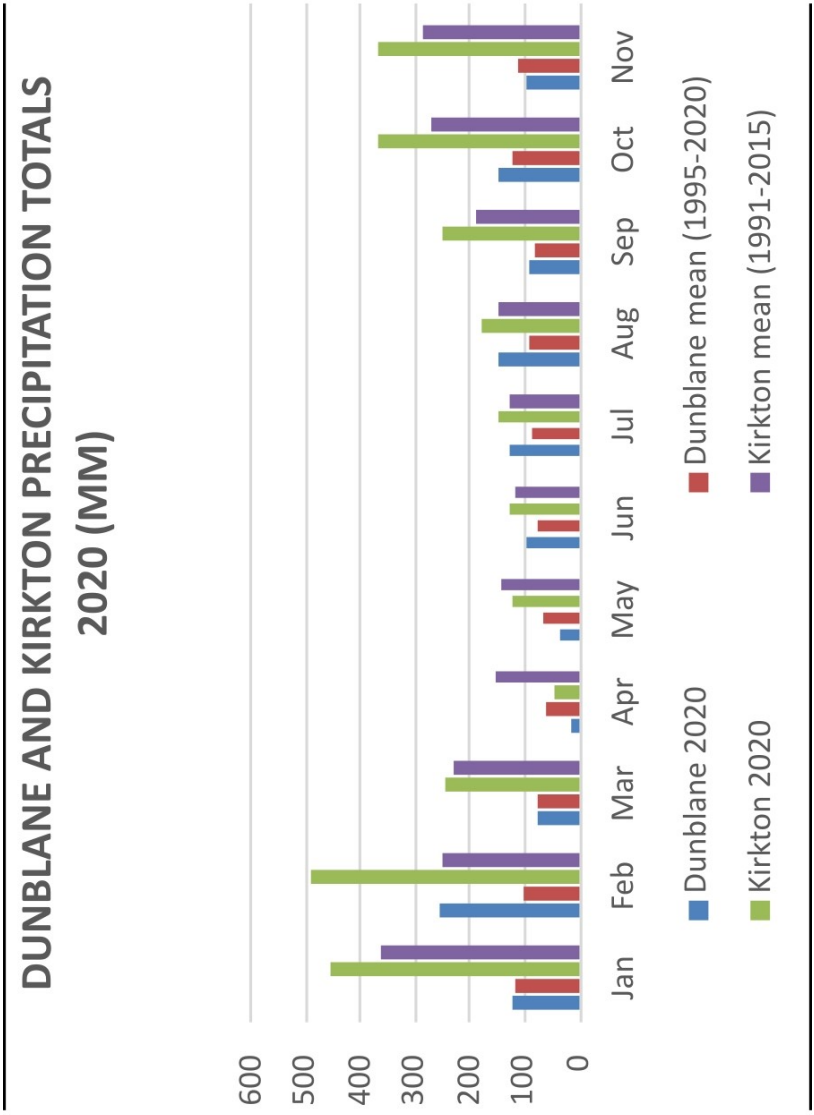


Plate D2. Dunblane and Kirkton, Sunshine Duration.

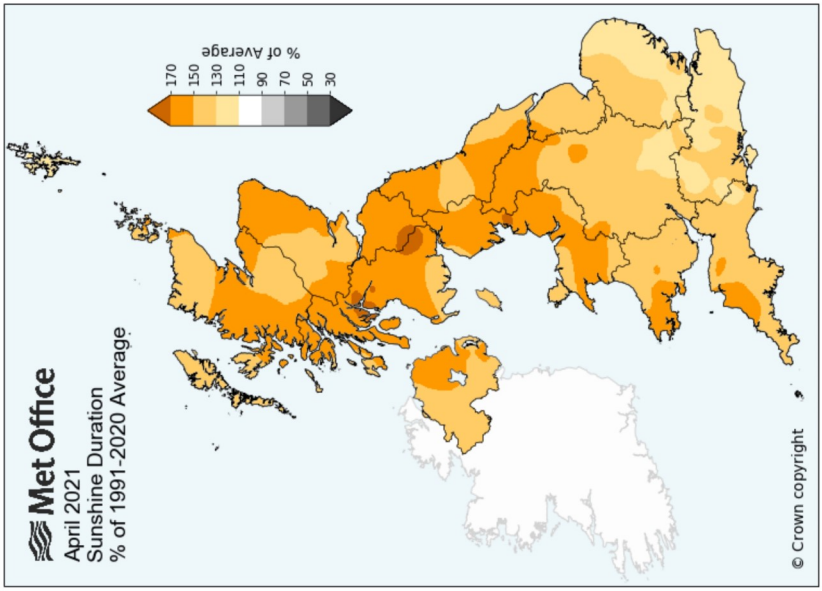


Plate D3. Dunblane and Kirkton,Annual Mean Temperature.

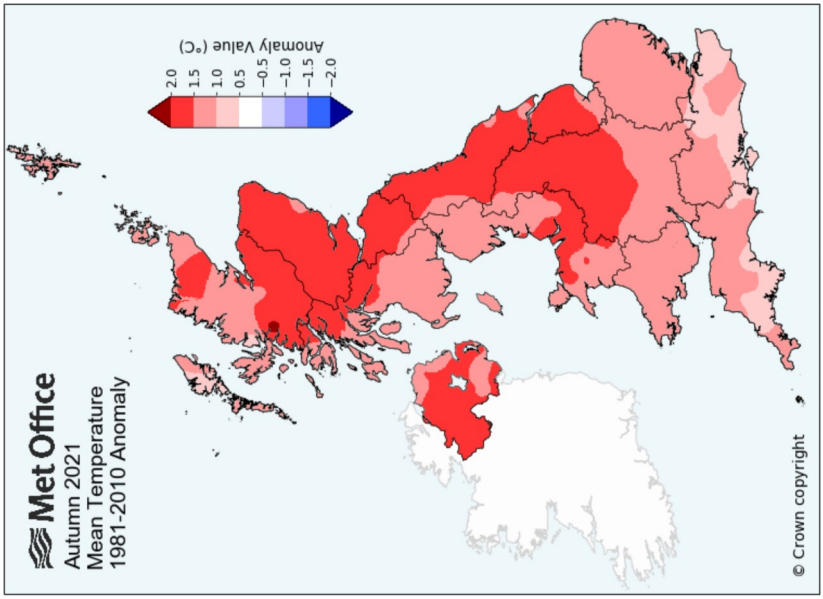
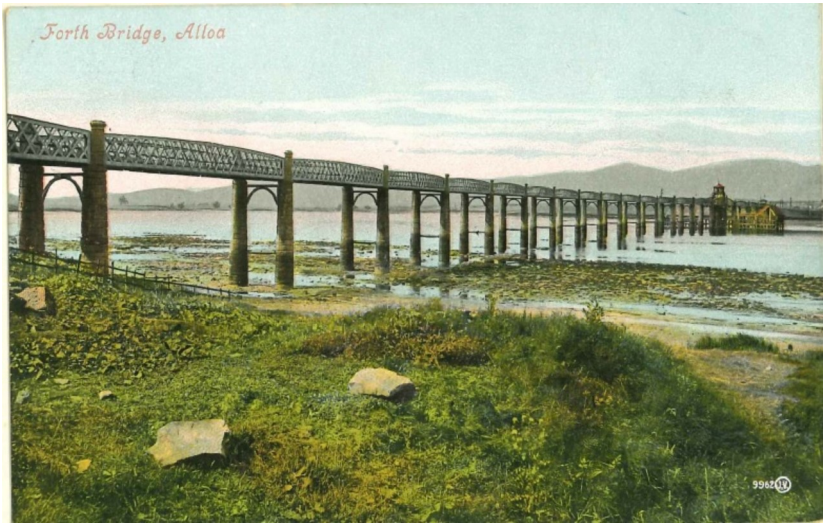


Plate E. Reverend Alexander Beith's Grave, Valley Cemetery, Stirling.

Plate F1. River Forth Embankment on the Rhind.

Photograph courtesy of Robert Dingwall

Plate F2. South Alloa Bridge, pre 1920.



Photograph courtesy of Clackmannanshire
Archive & Local History Service.

Plate F3. Cutting leading from the South side of the bridge.

Plate F4. Wooden Piers at the Southern End of the Bridge.

Plate F5. The Northern Opening Span at High Tide, the site of crane accident

Plate F6. Signal box at the Throsk end of the bridge.

Photograph from the collection of Dr. Ken Mackay.

the Forth Naturalist and Historian

South Alloa Bridge

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