

Cruachan Power Station Biodiversity Survey 2022



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Produced by David Fotheringham, Blue Leaf Nature,
for Cruachan Power Station, December 2022



The arctic-alpine plant Roseroot *Sedum rosea* is one of the characteristic species of upland rock faces and ledges at Cruachan Dam

1.0 EXECUTIVE SUMMARY

Welcome to the 12th Biodiversity Survey Report prepared by Blue Leaf Nature on behalf of Cruachan Power Station.

Cruachan is a pumped storage power station with a capacity of 440MW situated at Loch Awe, Argyll, at grid reference NN0791226753. Its turbine hall is located 1km underground, generating water supplied from Cruachan Reservoir to the north of the site.

The station is set in a celebrated landscape close to one of the finest examples of an old oak woodland in Scotland and framed by the impressive massif of the Ben Cruachan horseshoe. Blue Leaf first carried out surveys for Cruachan in 2009, initially for ScottishPower. We are delighted to continue our work for Drax, who obtained the site in 2018.

In 2022, Blue Leaf's surveyor visited Cruachan on seven days to carry out a Breeding Bird Survey (BBS), conduct a small mammal survey and moth-trapping sessions, and continue to monitor insects and other species.

1.1 BREEDING BIRD SURVEY

■ A total of 54 species of birds were recorded at Cruachan Power Station during the Blue Leaf survey in 2022. All of these are common and widespread species associated with woodland, upland and waterside habitats.

■ Ten Red List species – those of highest conservation concern in the document BoCC5 – were recorded along with 19 Amber List species of medium conservation concern and 25 Green List birds – those that are deemed to have a favourable conservation status.

■ 25 (46%) species of birds were Confirmed (C) as having nested on or adjacent to Drax's landholdings. A further 13 (24%) species Probably Nested (PR) and eight (15%) species were considered to have Possibly Nested (PO). Although the Confirmed figure of 46% isn't exceptional, the season was notable for the high populations of species such as Meadow Pipit (19AOT) and Pied Wagtail (8AOT), which were present in record numbers. A total of 12 Red and Amber List species were confirmed as breeding.

■ The report discusses new research that identifies a key risk for insectivorous upland birds, whose breeding success may be impacted by a crash in availability of a food species.



Pyrausta cingulata was found for a second year at Cruachan

Studies found the mass of craneflies (*Tipulidae*) emerging from peatland soils had declined by 95% in recent years.

1.2 MAMMAL REPORT

■ Six species of mammal were recorded or reported in 2022, including records for a second consecutive year of Red Squirrel *Sciurus vulgaris* and European Otter *Lutra lutra* at the Loch Awe area.

■ Three humane BioEcoSS tube traps were operational on two dates at the reservoir access road resulting in a two species of rodents being caught – Field Vole *Microtus agrestis* and Wood Mouse *Apodemus sylvaticus*.

1.3 INVERTEBRATE SURVEY

■ A total of 115 species of insects were recorded during fieldwork at Cruachan in 2022. These include 46 species of moth; 31 true-flies; 12 bees and wasps; 11 beetles; 10 butterflies and five dragonflies. This compares to 153 species in 2021, 179 in 2018 and 160 in 2017.

■ The beetle highlight of the year was the first Cruachan record of Violet Oil-beetle *Meloe violaceus* (pictured on the cover) at the reservoir access road. This Nationally Scarce species was one of 11 Coleopterans found during fieldwork at the power station landholdings in the 2022 survey.

■ A total of 156 moths of 46 species was recorded at Cruachan in 2022. Most were identified at two overnight

moth trapping sessions organised in summer but others, including the Nationally Scarce *Pyrausta cingulata*, were encountered during fieldwork.

■ Four new species of moths were recorded: Brindled Green *Dryobotodes eremita*, Burnished Brass *Diachrysis chrysis*, Bright-line Brown-eye *Lacanobia oleracea* and Dotted Clay *Xestia baja*. This increases to 186 the total number of moth species seen by Blue Leaf at the station.

■ The report discusses the revised *Red List of British Butterflies*, released by the Butterfly Conservation, which assigns new extinction-risk values for several species found at Cruachan. Six species are now on the Red List, while one species is deemed no longer threatened. Ten butterfly species were recorded during fieldwork in 2022.

■ Numbers and diversity of true-flies remained low on site visits but a total of 31 Diptera species, representing seven genera of true-flies, were found in 2022. Three new species were discovered for Cruachan – two hoverflies *Paragus haemorrhous* and the Nationally Scarce *Megasyrphus erraticus* plus the Muscid fly *Mesembrina meridiana*.

■ Twelve species of bee and wasp were seen in 2022. No new species were found although Chocolate Mining Bee *Andrena scotica* was recorded for the second time. We examine the new Red List of UK Sawflies (Part 1) and how it affects species found in the Blue Leaf survey at Argyll.

■ Six insect species were found that have not previously been recorded in Cruachan's hectad NN02 – three macro-moths and three species of true-fly. Since the survey started at Cruachan in 2009, a total of 294 species, apparently new to NN02, have been recorded by Blue Leaf. The two new hoverflies have not previously been reported from Argyll.

1.4 ADDED VALUE

■ Blue Leaf has revised the site lists of all species' groups found at Cruachan to produce an up-to-date spreadsheet checklist. This has resulted in some minor revisions to totals.

■ We supported Drax's press office by supplying images to help publicise, in an online article, the value of biodiversity that are found on the station's land.

■ This report summarises the proposed new Scottish Biodiversity Strategy. *Scottish Biodiversity Strategy to 2045: Tackling the Nature Emergency in Scotland* was released for consultation in December 2022.

Chequered Skipper
was recorded again at
the reservoir access
road after the first
sighting in 2021



2.0 INTRODUCTION

Welcome to the 12th Cruachan Power Station biodiversity survey report by Blue Leaf Nature.

This detailed account is based on seven fieldwork visits carried out in 2022 that aimed to develop station management's understanding of the fauna and flora at the station's landholdings at Cruachan, near Lochawe, Argyll.

Blue Leaf carried out its first survey for Cruachan in 2009 and has since delivered a series of reports that describe the breeding birds, mammals, invertebrates and other species that are present on its landholdings and areas that may be affected by station operations.

We have also produced detailed reports discussing Cruachan and the Global Reporting Initiative, Invasive Non-native Species at the site and a habitat survey.

The broad objectives during the year were to:

- Continue the Breeding Bird Survey (BBS), plotting changes since 2009 and confirming, if possible, additional bird species as having bred.

- Monitor invertebrate species to improve the site's knowledge of several under-recorded families. In particular, to examine in greater detail the moth diversity at the site, by carrying out trapping with artificial lights.

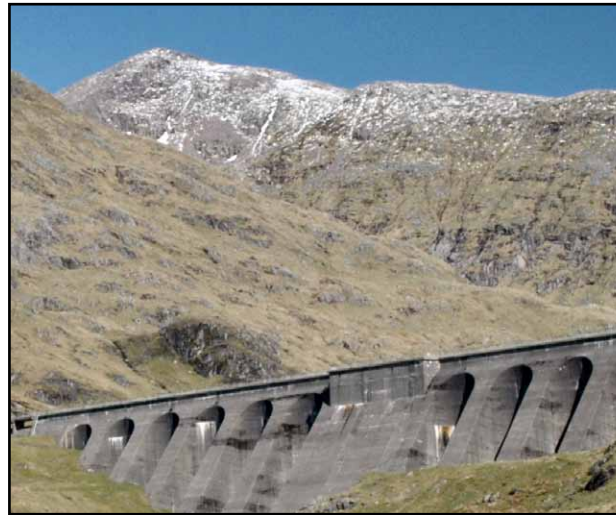
Cruachan Power Station is located at NN080267 to the west of the village of Lochawe. Its boundary encloses a wide range of habitats – from the reservoir on the slopes of Ben Cruachan to the office gardens by the banks of Loch Awe.

The report examines the ecological context of the survey at Cruachan, the main focus areas for fieldwork and the best-practice survey methodologies that were used.

The findings of this year's effort are presented in the report's systematic list along with a discussion of the latest conservation status of the species that were recorded.

The various surveys help to form an inventory of species and provide a baseline against which changes in species' occurrence and population can be measured going forward.

Such fundamental information will be particularly important in the context of any future development at Cruachan Power Station. Finally, the significance, in a local and national context, of each species recorded in 2022 is also explored.



Ben Cruachan, at 1126m, is the highest peak in Argyll & Bute

3.0 BIODIVERSITY POLICY

3.1 DESIGNATED SITES

The United Kingdom supports a wide variety of species and habitats that are deemed important in a local, national and international context.

The key policy tool for conserving special areas and important wildlife is the designation and management of protected sites – areas of land, inland water and the sea that have special legal protection. Such protection to prevent damaging activities is enshrined in international treaties as well as European and UK legislation.

Cruachan Power Station is on or adjacent to the Coille Leitire Site of Special Scientific Interest (SSSI), designated in 1986, which is a native broadleaved woodland on the north edge of Loch Awe.

SSSI designations protect wildlife and land features of outstanding quality and are notified in Scotland by NatureScot (formerly Scottish Natural Heritage) under the Nature Conservation (Scotland) Act 2004. Under SSSI legislation, landowners and operators must inform NatureScot and gain consent for any proposed operation that may affect

the notified features of the protected sites.

The woodland is also a component in the wider Loch Etive Woods Special Area of Conservation (SAC) designated site and the power station is adjacent to the Loch Etive and Glen Fyne Special Protection Area (SPA), designated in 2010 for Golden Eagle *Aquila chrysaetos*.

SACs are designated to protect rare or vulnerable habitats and species that are listed in the 1992 EU Habitats Directive. SACs are designated in Scotland under the Conservation (Natural Habitats) Regulations 1994 (as amended).

Special Protection Areas aim to protect one or more rare, threatened or vulnerable bird species listed in Annex I of the Birds Directive, or certain regularly occurring migratory species. Although the UK has left the EU, the Scottish Parliament has passed legislation to ensure that Scotland's nature will remain protected to the same standard as before.

3.1.1 COILLE LEITIRE SSSI

The Coille Leitire woodland SSSI extends over 101 hectares and is notified for its Atlantic oak woodland features and its resident population of European Otter *Lutra lutra*.

The mixed deciduous woodland has a rich field layer of tall herbs and woodland grasses and is dissected by numerous burns, some with spectacular gorges, that support rich assemblages of ferns and stoneworts that require shade and high humidity to thrive.

The site supports a strong woodland bird community and its invertebrate fauna includes the Scottish Biodiversity List (SBL) butterflies Pearl-bordered Fritillary *Boloria euphrosyne* and Small Pearl-bordered Fritillary *Boloria selene*.

In its most recent assessment, in July 2000, the SSSI's condition was described as "Favourable Maintained" although it faced negative pressures from the spread of invasive Rhododendron and grazing by deer. Blue Leaf notes a great deal of new case work for the SSSI in 2022.

Cruachan's Site Offices, Visitor Centre and Contractors Compound are within 20m of the Coille Leitire's southern boundary, which starts on the north side of the Glasgow to Oban railway line.

Within the SSSI are two water sources serving the station. A small pool, measuring approximately 4m x 3m, at NN07962686 provides water for the Contractors

Compound. A rough stone-built dam about a metre high contains the water that is piped to the compound.

The second source at NN08142671, which serves the Site Offices and Visitor Centre, is a much more permanent structure. It consists of a concrete water trap, 6m x 4m, that intercepts a stream that tumbles in a mini waterfall into a pool approximately 4m x 3m and 2m deep.

Meanwhile, the north edge of the Coille Leitire SSSI is adjacent to the Cruachan Reservoir Access Road for about 1.5km of its length and the woodland heavily influences the range of birds, mammals and other species present.

The management statement for Coille Leitire recommends removal of invasive Rhododendrons to the north of the site, to prevent their spread into the SSSI. It also highlights the beneficial impact of the management of powerline wayleaves associated with Cruachan for creating suitable conditions for invertebrates, such as the Small Pearl-bordered Fritillary.

3.1.2 LOCH ETIVE WOODS SAC

The Coille Leitire SSSI is a component in a wider protected area designation, the Loch Etive Woods Special Area of Conservation (SAC).

The SAC consists of nine distinct ancient woodlands covering 2,639 hectare in North Argyll and Highland.

Loch Etive Woods is considered one of the finest old Sessile Oak *Quercus petraea* woodlands in the UK. Its qualifying features include its old Sessile woodlands, such as found at Coille Leitire and nearby Glen Nant, and its Tilio-Acerion forests that occurs in the deeply-incised rocky gorges and ravines, including canopy species such as Common Ash *Fraxinus excelsior*.

3.1.3 GLEN ETIVE AND GLEN FYNE SPA

Meanwhile, the Glen Etive and Glen Fyne Special Protection Area (SPA), designated in 2010 for Golden Eagle, includes the entire Ben Cruachan range and area to the south, enclosing Cruachan Reservoir.

On its west side, the SPA extends down to the main road at the Pass of Brander. The SPA boundary follows the 150m contour east from the reservoir site. The SPA extends over 81,104ha, divided into two distinct sections: Glen Etive to the north and Glen Fyne to the south.

Meadow Pipit enjoyed a successful breeding season in 2022 with a record 19 territories at upland Cruachan



3.2 PRIORITY HABITATS AND SPECIES

The allocation of resources and prioritisation of biodiversity action in the UK has been guided by the development of the UK Biodiversity Action Plan (UK BAP), which was developed by the UK Government to meet its commitments under the Convention of Biological Diversity, signed at the Rio Earth Summit in 1992.

Since December 2012, responsibility for implementing biodiversity improvement has been passed to the devolved authorities, including the Scottish Government.

The Scottish Biodiversity Strategy (SBS) was first published in 2004 as Scotland's response to its obligations under the Convention of Biological Diversity and the UK BAP.

The strategy, which is currently being reviewed (see panel right), highlights those animals, plants and habitats that are considered to be of principal importance for biodiversity conservation in Scotland – for instance those that are rare in a Scottish context or undergoing a decline in population.

The SBS has cascaded down to local government – a local biodiversity action plan is administered by Argyll and Bute Biodiversity Partnership, a coalition of more than 30 organisations including Argyll and Bute Council.

The current version of the plan operated between 2016 and 2021 and is due to be updated.

The Plan has adopted an ecosystems approach to the protection of habitats and species – three of the ecosystems are relevant to Cruachan Power Station: Freshwater and Wetland, Woodland and Upland.

Using this approach and working with partners and landowners, the Plan seeks to improve habitat quality and extend habitat connectivity to help the species present.

3.3 ROLE OF THE JNCC/RED DATA LISTS

The Joint Nature Conservation Committee (JNCC) is the statutory adviser to the UK Government on UK and international nature conservation.

The work of the JNCC contributes to maintaining and enriching biological diversity, conserving landscapes and habitats and sustaining natural systems.

JNCC is also involved in surveillance that provides status information for terrestrial and freshwater species, some marine species and terrestrial habitats. Reports on the

UK populations for many creatures and plants have been compiled as part of the JNCC Species Status Assessment Project.

These include the Population Status of Birds in the UK (Gregory *et al* 2002) that placed birds in one of three lists – Red, Amber or Green.

Red List species are those of the highest conservation concern usually due to a long-term or rapid population decline or contraction in their breeding range. Amber List species are those of medium conservation concern while Green List species enjoy favourable conservation status.

The lists of birds of conservation concern were reviewed in December 2021 in the document *Birds of Conservation Concern 5* (BoCC5, Stanbury *et al* 2021) and the systematic list in this year's report includes tables showing the latest conservation status for the bird species recorded at Cruachan Power Station.

Similar JNCC status reports exist for vascular plants, mammals, dragonflies, freshwater fish, other branches of invertebrates, fungi, lichens and mosses, liverworts and stoneworts etc – and these follow a similar selection criterion to that of birds. The following species summaries include reference, where applicable, to those that appear on the various Red Data Lists.

3.4 WILDLIFE AND COUNTRYSIDE ACT 1981

The Wildlife and Countryside Act 1981 and its amendments is the principal mechanism for the legislative protection of birds, animals and plants in Great Britain.

Part 1 of the Act legislates for the protection of birds, animals and plants. For instance it prohibits the intentional killing, injuring or taking of any wild bird and taking or destroying eggs. Species listed on Schedule 1 enjoy even greater protection and it is an offence to disturb these birds at the nest.

There are other schedules that offer similar protections for wild animals, mammals and plants. Schedule 9 of the Act deals with invasive animals and plants.

At Cruachan Power Station and its assets, Part 1 of the Act is of importance in relation to the presence of protected species that may breed on the station land or may be affected by station operations.

3.5 SCOTTISH BIODIVERSITY STRATEGY

The Scottish Government has published its new draft strategy document for biodiversity, setting out its long-term programme to address the twin crises of climate change and biodiversity loss by 2045.

Scottish Biodiversity Strategy to 2045: Tackling the Nature Emergency in Scotland was released for consultation in December 2022. It sets out plans to deliver landscape-scale, transformative change to meet the Scottish Government's statutory targets.

Priority actions will focus on accelerating nature restoration, expanding and improving protected areas and helping vulnerable species to recover. The tranche of measures is based on the principle of tackling the nature and climate emergencies together.

It is the first full rework of the strategy since the original was published in 2004 and its authors hope it will come into effect, after consultation, within a year.

The new strategy would introduce statutory targets for the restoration of nature and seek to deliver transformational changes to protect and restore terrestrial, freshwater and marine biodiversity in Scotland, backed by qualitative evidence and supported by a £65million investment fund.

Key proposals would include the creation of local projects to improve ecological connectivity and the extension of the area protected for nature to at least 30% of Scotland's land area by 2030 (up from 16%).

There would be a focus on sustainable agriculture, fishing and forestry, and peatland restoration and tree planting as nature-based solutions to climate change.

The strategy would also result in a revision of the Scottish Biodiversity List – the species and habitats that are deemed priorities for conservation.

As a high level document, there is little to concern Drax and Cruachan management although Target 15 would require business to assess and report on their impacts on biodiversity. Blue Leaf will continue to report back as the strategy is implemented.

4.0 METHODOLOGY

4.1 PROCEDURE

The visits to Cruachan Power Station followed a procedure that was established in 2009, when Blue Leaf was first commissioned to undertake biodiversity work.

Station boundaries and areas of operation were identified, health, safety and environmental considerations were established – particularly lone working in a potentially hazardous environment – and procedures were set out for site visits and reporting. Regular meetings were held with Health, Safety and Environmental Advisor Roddy Davies, at which survey procedures were reviewed.

4.2 BREEDING BIRD SURVEY

A Breeding Bird Survey (BBS) forms the main element of the biodiversity species survey carried out by Blue Leaf at Cruachan in 2022. The BBS is based on the methodology devised jointly by the British Trust for Ornithology (BTO), Royal Society for the Protection of Birds (RSPB) and JNCC.

The methodology requires three visits to be made to a site in the breeding season, from March to July, to gather evidence of birds' breeding status.

Two transects have been plotted and have now been in use since the first survey in 2009. One transect runs along the western edge of Cruachan Reservoir while the other runs from the dam wall, at 340m above sea level, south to 276m.

A third transect was established in 2017 to improve the surveillance of woodland and grassland birds at the reservoir access road, and this was continued in 2022.

The 1km route runs west along the roadway from the site of the former entrance gate. Birds observed on all three transects are recorded along with notes about behaviour indicative of breeding taking place.

The limited landholdings at the Station Offices/Visitor Centre and elsewhere at the reservoir road make it more practical to plot birds seen or heard on to a base map.

Other areas, outwith the key study sites, such as the 'Penthouse Pond' and elsewhere along the dam access road, were visited several times over the survey period to assess the species present. Cruachan Substation has not been included in the Breeding Bird Survey since 2014.

4.2.1 DETERMINATION OF BREEDING STATUS

The behaviour, sex, age and location of individual birds recorded allow conclusions to be reached about their breeding status, based on three categories devised by the European Ornithological Atlas Committee (EOAC) 1979.

The categories are: Confirmed (C), Probable Breeder (PR) and Possible Breeder (PO) – although it is also possible that a bird may be merely present in a habitat and not breeding. Breeding evidence in this report follows EOAC guidelines.

Examples of confirmed breeding could include an adult bird carrying a faecal sac or food for nestlings; adults carrying out distraction displays or showing anxiety near a possible nest site; a nest with eggs or young; or fledged juveniles that have recently left their nest.

Breeding can be considered probable if a territory has been established for a period of longer than two weeks; if a pair of birds is seen in suitable habitat; if courtship is observed; or if adults are seen with nesting material. Possible breeding can be assumed if a bird is found in suitable habitat on a single visit.

4.3 INVERTEBRATE SURVEYS

A range of methodologies was employed to survey invertebrates at Cruachan. These follow guidance in the Natural England report NERR005 'Surveying terrestrial and freshwater invertebrates for conservation evaluation' (Drake, C.M et al 2007).

The principal aim of the Blue Leaf survey was to produce an indicative list of species that are present at Cruachan so that their conservation value could be assessed.

Sunny, south-facing and sheltered sites, with a range of vegetation types and structures, were prime areas for searches. Such sites include the Visitor Centre meadow, the north embankment of the contractors compound, the north side of the Reservoir Road and the Penthouse Pond.

Flowering plants, sunny leaf surfaces, tall stalks and stems, fenceposts and tree trunks and open areas, were all visually searched, for instance, for flies and aculeates. Objects, such as rocks, were lifted to look for beetles.

Blue Leaf has scaled down its efforts to record some of the more complex species of insect. Usually, specimens of difficult tribes that could not be identified in the field are

collected and retained for laboratory investigation. Only eight specimens were collected in 2022 with a resulting time-saving, both in the field and in microscopy work.

However, a new species for the survey and for Argyll was obtained as a result of even this limited microscopy effort – the obscure hoverfly *Paragus haemorrhous*.

Blue Leaf carried out moth trapping on two nights at Cruachan Visitor Centre and Cruachan Reservoir using a range of artificial light traps.

The traps were positioned in suitable habitat before dark and the bright light attracted moths to a collecting box, where they roosted before being examined by the surveyor the following morning, then released unharmed.

Best practice, as described in the Moth Recorders Handbook (Randle 2013), was followed in delivering the sessions and handling the catch. The handbook establishes standard procedures for trapping and the care of the catch.

4.4 SURVEY LIMITATIONS

Visits were planned, often at short notice, to take advantage of optimum weather conditions for undertaking wildlife surveys. However, it is not possible to record every bird, butterfly or plant etc. on a site during seven visits and it is likely that some species could have been overlooked.

The weather in 2022 was notable for its above average temperatures from April to July, although it was often unsettled and rainfall was above average. The implications for wildlife at Cruachan are examined in a weather summary on page 13.

TABLE 1: FIELDWORK DATES AT CRUACHAN 2021

DATE	TIME	WEATHER CONDITIONS
18 May	0800-1500	0-16C, brisk SSW wind, mostly cloudy but dry
2 Jun	0730-1600	12-16C, variable light wind, cloudy but sunny spells
30 Jun	1530-0000	13-17C, light west wind, improving after cloudy start
1 July	0000-1430	13-16C, light westerly wind, early rain, mostly cloudy
20 July	1400-0000	13-16C, light west wind, mostly cloudy
21 July	0000-1620	14-17C, light WNW wind, mostly cloudy
14 Sep	0900-1630	13-16C, light NW wind, part cloud but periods of sun



5.0 THE SURVEY SITES

5.1 CRUACHAN RESERVOIR

Cruachan Reservoir, at an altitude of 340m above sea level, is a man-made waterbody constructed for the storage and supply of water to Cruachan Power Station, a pumped storage plant that produces around 10% of its generated output from conventional hydro operations.

The reservoir occupies an area of approximately 44ha and is bounded on three sides by the Cruachan horseshoe, which rises to a height of 1126m at Ben Cruachan, the highest peak in Argyll. At its southwestern edge, a 316m-long buttress dam contains the water of the reservoir.

Land around the edges of the reservoir is unenclosed open hill ground, grazed by sheep. The habitat is largely semi-improved acid grassland with pockets of unimproved grassland and marsh supporting the typically vegetative communities that exist in acidic podzols and peat.

The characteristic plants around the reservoir include various grasses and sedges, and mosses of the genus *Sphagnum*. Typical wildflowers include Tormentil *Potentilla erecta*, Common Lousewort *Pedicularis auriculata*, Heath Spotted-orchid *Dactylorhiza maculata*, Creeping Thistle *Cirsium arvensis* and Marsh Thistle *Cirsium palustre*, with small numbers of other species such as Common Dog-violet *Viola riviniana*. In general, however, the habitat at Cruachan Reservoir lacks botanical interest, likely as a result of overgrazing by sheep.

A steep area of road embankment in the southeast corner of the reservoir contains a richer diversity of plant species, including Arctic-alpine saxifrages. Another characteristic of the reservoir's surrounds is large numbers of granite boulders that provide habitat for mountain-breeding birds, although these occur in low densities.

Survey method: A 1.5km transect has been established from NN08262942 at 415m above sea level to NN07812813 at 400m above sea level. This route (mapped in previous reports), along the western edge of the reservoir, is walked and birds seen or heard plotted on a BBS record sheet. Casual monitoring of other wildlife takes place and, in 2021, moth trapping took place on a single night near the reservoir and at the access road to the southeast of the dam.

The 316-metre long buttress dam at Cruachan Reservoir is the obvious landmark in the upland areas of the survey site

5.2 SOUTH OF THE DAM WALL

The Allt Cruachan burn and an access road to the west side of the dam structure dissect the large bowl-shaped area south of the dam wall.

The area is dominated by semi-improved acid grassland, similar to the National Vegetation Classification (NVC) U4 community – with Sharp-flowered Rush *Juncus acutiflorus* rush mire – similar to NVC M23a – in wetter areas at the south and east of the site, and small areas of tertiary habitats including flush and Bracken *Pteridium aquilinum*.

Species present are similar to those listed above but include wet grassland species such as the carnivorous plants Round-leaved Sundew *Drosera rotundifolia* and Common Butterwort *Pinguicula vulgaris*, plus Common Cotton-grass *Eriophorum angustifolium*, Bog Myrtle *Myrica gale* and Devil's-bit Scabious *Succisa pratensis*.

The area has a limited range of breeding birds but the Allt and its wetlands host a varied invertebrate assemblage and was the site of the only Cruachan record of Beautiful Demoiselle *Calopteryx virgo*. The river has also hosted amphibians, including Palmate Newt *Lissotriton helveticus*.

Survey method: A 1km transect has been established from NN07922792 at 340m above sea level to NN08092736 at 276m above sea level, just above the tree line. This route is walked and birds seen or heard are plotted on a record sheet. Casual monitoring of other wildlife takes place on the transect walk.

5.3 THE PENTHOUSE POND

The Penthouse Pond is the name given by Blue Leaf to identify a small permanent pool at NN0797227658, approximately 0.7km south of Cruachan Reservoir.

Despite measuring just 20m x 7m, the waterbody is an oasis of freshwater life in an area generally lacking in other pond features. Around 1.5m deep at its south end, the pool becomes increasingly shallow then grades out into marsh and wet grassland at its north and west edges.

As an eutrophic standing water, it has high levels of nutrients and supports healthy populations of invertebrates.

The presence of various water snails and beetles, and a small colony of Palmate Newt *Lissotriton helveticus* is an indicator of excellent water quality. The Pond is also the key



Looking northeast towards Cruachan Reservoir and its buttress dam with the west side access road in the foreground

site for damselflies and dragonflies in the survey area, hosting up to eight breeding species.

There is limited marginal vegetation, possibly due to grazing, but this includes various sedges, Common Cottongrass *Eriophorum angustifolium*, Soft Rush *Juncus effusus* and Purple Moor-grass *Molinia caerulea*.

5.4 THE RESERVOIR ROAD

The Reservoir Access Road extends for approximately 5km and permits vehicles to access Cruachan Reservoir from Lochawe Village (NN11262660). The single-track metalled road starts at 50m above sea level but climbs to 350m beside the reservoir dam wall.

For much of its length, the road runs parallel to the Coille Leitire SSSI. The mixed deciduous woodland is particularly close to the road at the eastern, lower end – where a new transect route was established in 2017.

Drax own both the road and its immediate margins and maintenance has been carried out in recent years both to cut back where vegetation is encroaching the roadway and to realign areas of embankment to prevent rock falls.

The Reservoir Access Road was highlighted as an area of High Biodiversity Value in Blue Leaf's report *Biodiversity at Cruachan and the GRI Index* (Fotheringham 2010), mainly for its interesting rockface plant community.

These are found on the steepest parts of the road embankment in the west part of its route and include Arctic-alpine plants such as Yellow Saxifrage *Saxifraga aizoides*, Starry Saxifrage *Micranthes stellaris* and Alpine Lady's-mantle *Alchemilla alpina*.

Elsewhere along its length, the road margins contain a range of nectar plants, such as Bird's-foot Trefoil *Lotus corniculatus* and White Clover *Trifolium repens* that have proven important for feeding insects.

Since 2015, eroded areas of road embankment have been examined for nesting solitary bees and wasps. Key survey areas include:

■ **NN1202656:** The vegetated road margins north of Loch Awe village. **Key species:** *Salix* saplings, *Juncus* wet meadow, Marsh Thistle, Devil's-bit Scabious. Solitary wasps and bees, Common Lizard *Zootoca vivipara*, Pearl-bordered Fritillary, Small Pearl-bordered Fritillary.



The reservoir access road runs adjacent to Coille Leitire SSSI for part of its length, such as this wooded gorge at NN10552105

■ **NN10802646:** The vegetated road margins near a river gorge. **Key species:** *Salix* saplings, *Juncus* wet meadow, bracken, Tormentil, White Clover. Pollinating insects, including Blaeberry Bumblebee *Bombus monticola*.

■ **NN09492649** and **NN08452698:** Eroded road embankments. **Key species:** Tormentil, Wild Thyme *Thymus serpyllim*, Bird's-foot Trefoil. Pearl-bordered Fritillary. Ground beetles. Pollinating insects.

■ **NN08182807:** Exposed rockface near Cruachan Reservoir. **Key species:** Yellow Saxifrage, Starry Saxifrage, Tormentil, Alpine Lady's-mantle, Rose-root *Rhodiola rosea*. Yellow-ringed Carpet *Entephria flavicinctata*, Grey Mountain Carpet *Entephria caesiata*, Red Carpet *Xanthorhoe decoloraria*. Pollinating insects.

In 2022, Violet Oil Beetle *Meloe violaceus* was found for the first time at the access road near the shepherd's cottage at NN1057326380 while a breeding aggregation of the Common Furrow Bee *Lasioglossum calceatum* was located nearby on an open road embankment.

Survey method: The BBS transect established in 2017 starts from the site of the former entrance gate (NN11262659) and continues west for 1km to (NN10552638) near the shepherd's cottage. Spot checks of other parts of the road are also carried out.

5.5 SITE OFFICES AND VISITOR CENTRE

Located on the northwest shore of Loch Awe, Cruachan's Site Offices and Visitor Centre landholdings occupy an area of approx 32 hectares.

The grounds contain the station offices and workshops, storage areas, the Visitor Centre, hardstanding for car parking and areas of gardens. The gardens are laid out with native and naturalised species of shrubs and trees.

Native species include Common Ash *Fraxinus excelsior*, Common Hawthorn *Crataegus monogyna*, Downy Birch *Betula pubescens*, Common Rowan *Sorbus aucuparia* and some mature Sessile Oak *Quercus petraea* trees.

A number of naturalised species are also present including Sycamore *Acer pseudoplatanus*, Eucalyptus *Eucalyptus globulus* and non-native conifers plus shrubs such as Rhododendron *Rhododendron ponticum* and the buddleia species *Buddleja davidii* and *Buddleja globulosa*.



Cruachan tailrace at Loch Awe and the visitor centre building: the site hosts invertebrates and a breeding bird assemblage

The car parks are bordered by perennial lawn but the less-intensively managed road embankment north of the Visitor Centre building, and other parts of the site, have been set aside as a 'wild garden' or mini wildflower meadow as part of the former Cruachan Biodiversity Action Plan.

The banks of the loch are overgrown with Common Gorse *Ulex europaeus*, providing cover and foraging for wildlife. To the north of the tailrace, trees include Ash, Sycamore and Downy Birch, backed by more dense scrub, mostly blackberry, with emerging saplings and tall herbs, notably Rosebay Willow-Herb *Chamerion angustifolium*.

The station gardens and the contractors' compound on the opposite side of the A85 trunk road host mainly a woodland breeding bird assemblage while water birds are often seen on Loch Awe. The site has held breeding Pine

Marten *Martes martes* in past years while Red Squirrel *Sciurus vulgaris* may have nested in 2021 and 2022.

The area is also well-watched for insect species and a number of "first" records for Argyll Mainland have been recorded at the Site Office, Visitor Centre and Contractors Compound grounds. Blue Leaf has carried out moth trapping at the Visitor Centre, Site Offices and contractors' compound on the north side of the A85 since 2017 – and this was continued in 2022.

Survey Methods: The 400m length of the compound is walked and birds seen or heard are logged on a base map along with casual monitoring of other wildlife. In addition, species observed on Loch Awe are recorded, as are birds seen or heard on the north side of the A85 that could conceivably hold territory at the station grounds.

6.0 WEATHER IN 2022

The weather in 2022 was characterised by warmth, with temperatures above average in each month of the survey season. Nationally, only a prolonged spell of freezing weather in December prevented 2022 from becoming the warmest year on record for the UK.

Recent survey years have been severely impacted by unseasonably cold conditions in spring and early summer. Such late springs can have profound impacts on nesting birds and the emergence of invertebrates.

However, with warmer-than-seasonal conditions from March 2022 onwards, it laid the foundations for one of the most successful bird breeding seasons at Cruachan. This is discussed in full on page 21.

A new report by NatureScot (2022) has highlighted the critical role in temperature on the success of breeding birds.

NatureScot uses a sample of 66 bird species (the all-species index) as a reporting tool to produce the official

6.1 WEATHER SUMMARY

March began unsettled before turning drier and milder in the last two weeks, with sunshine and night frosts. The provisional mean temperature for the month was 0.9°C above the long-term average, with particularly mild day times and only half the expected rainfall. Sunshine was above normal in West Scotland, with a figure of 164% of average making it provisionally the sunniest March since 1919.

The first half of April was unsettled and cold before high pressure brought less rain and milder temperatures. The monthly mean temperature was 0.2°C above the long-term average with rain, sunshine and temperatures about average.

May was rather unsettled, with rainfall in West Scotland 133% above normal and Cruachan experiencing only 71% of the usual hours of sunshine. However, monthly mean temperature, again, was 1.1°C above the long-term average with night-time minimums averaging up to 2.5°C above normal in Argyll and Bute.

June was more settled with above average temperatures and sunshine. The monthly mean temperature was 0.8°C

statistics for breeding birds in Scotland. In NatureScot's report on breeding birds (1994-2021) it highlights the strong correlation between breeding success and mean annual temperatures for woodland, farmland and urban indicator species, all of which show a long-term index increase.

However, upland birds – the index for which has declined by 14% – does not show any link with warmer temperatures. Instead, the critical correlation for failed breeding and upland birds was increased level of summer rainfall.

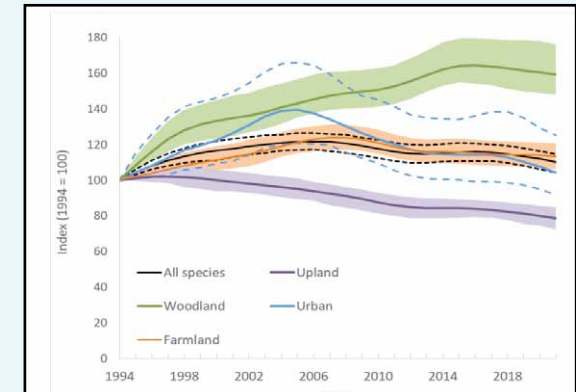
The report noted that summer rainfall is the only seasonal weather factor to have changed significantly in Scotland between 1993 and 2020, with June-August rainfall rising from an average of 237mm (1993-1997) to an average 363mm (2016-2020). NatureScot conclude: "The link between increasing summer rainfall and upland bird declines supports the hypothesis that climate change is driving some of the long-term changes in upland bird populations."

above average, with the west being warmer than usual and more sunny. However, rainfall was above average in Argyll and Bute from mid month onwards.

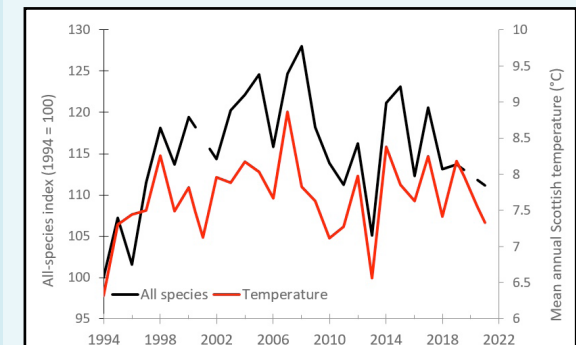
July started mostly cool and unsettled, followed by a drier and warmer period including some record UK temperatures mid-month that resulted in a collapse of insect numbers. Monthly mean temperatures were 0.9°C above average but rainfall was slightly above average in Northwest Scotland but the area only saw 92% of unusual sunshine.

August was often dry and warm but punctuated by a series of unsettled windy spells including thunderstorms. Monthly mean temperatures were 0.7°C above average in Argyll and sunnier than usual with about average amounts of rain. The warmth continued into the autumn which was 1.3°C above average in Scotland although wetter than usual.

Elsewhere in this report, we discuss new official statistics relating to butterflies, hoverflies and bee populations that highlight a trend towards long-term declines, with links to climate change. Also see panel on page 39.



Graph 1 Dashed lines (all species trend) and shaded areas (for other habitat-specific trends) illustrate 95% confidence intervals. The all-species (smoothed) index rose steadily to the mid-2000s then declined to fluctuate between 10% and 17% above the 1994 index. It had been declining since 2016 and it is currently 10% higher than in 1994. Note, habitat indices all show gains except for Upland. Source NatureScot (2022)



Graph 2 The all-species bird index (black lines) and mean annual Scottish temperature from June (red line) in the previous year to May in the stated year (°C, right-hand axis) from 1994 – 2021 (Met office et al., 2018). Source NatureScot (2022)

7.0 BIRDS

A total of 54 species of birds were recorded at the Cruachan Power Station during the Blue Leaf survey in 2022. All of these are common and widespread species associated with woodland, upland and waterside habitats.

Of the 54 species recorded, 25 (46%) were Confirmed (C) as having nested on or adjacent to Drax's landholdings at Cruachan. A further 13 (24%) species Probably Nested (PR) at the sites and eight (15%) species were considered to have Possibly Nested (PO). The remaining eight (15%) species were not thought to be breeding species at Cruachan in 2022 – they were observed outwith the nesting season or flying over the survey areas.

Ten of the species recorded are Red List species – those of highest conservation concern in the document BoCC5. In addition, 19 Amber List species of medium conservation concern were seen during fieldwork along with 25 Green List birds – those that are deemed to have a favourable conservation status. A total of 12 Red and Amber List species were confirmed as breeding at Cruachan in 2022.

7.1 RED LIST

European Herring Gull *Larus argentatus* NB

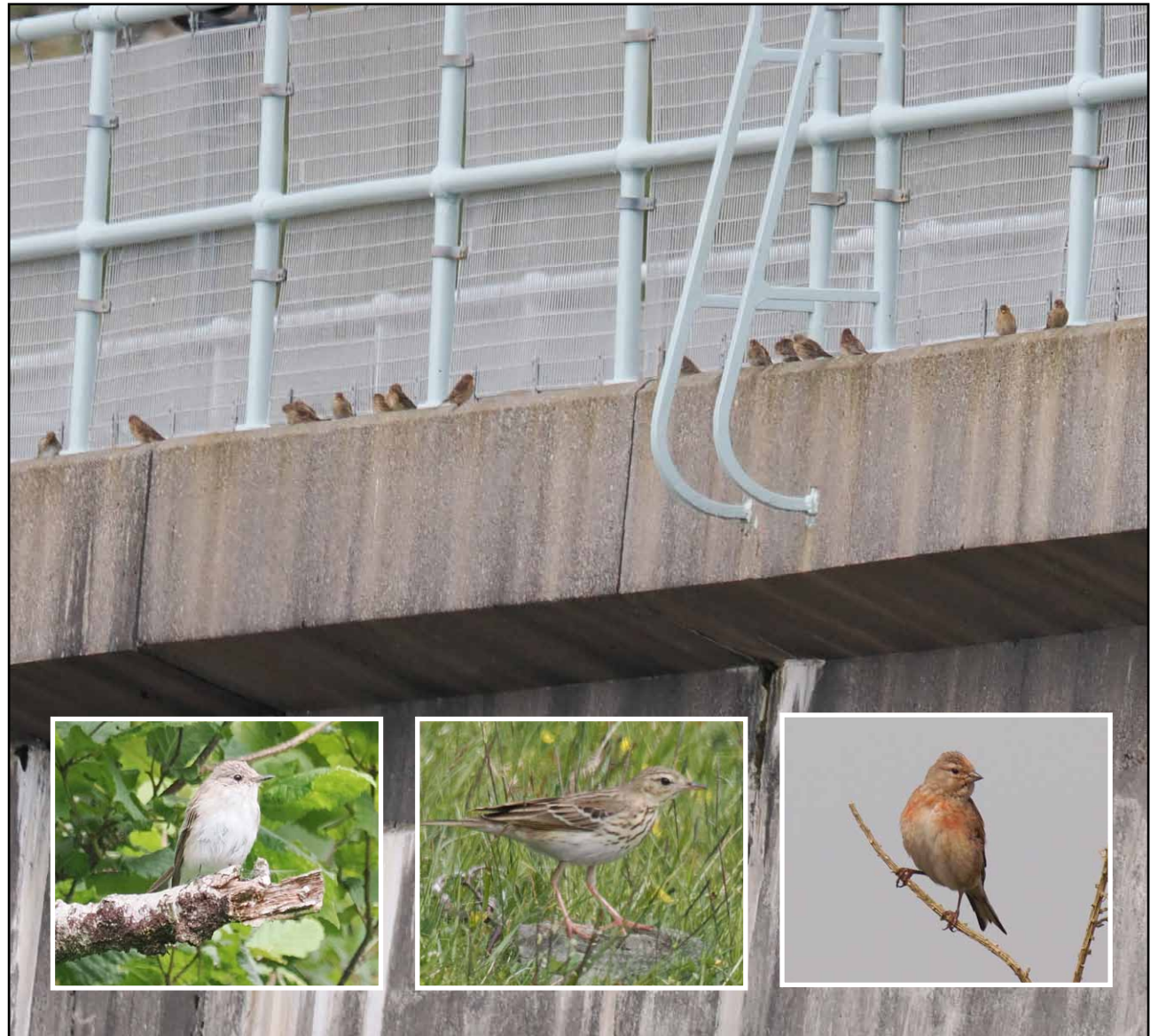
As usual, a small number summered at Loch Awe, often congregating at the tailrace or fish farm with other gull species. The peak count was on 30/6, when two adults and a sub-adult (second calendar-year) were present. The second-year bird was present from 18/5 to 21/7, with adults at the tailrace on 18/5 and 14/9.

Common Cuckoo *Cuculus canorus* PO

Station staff report that birds had returned to Cruachan from 21/4. There was a flurry of activity in May but adults seem to have departed by June. On 18/5, three calling males were heard or seen – singles at the reservoir access road transect, the Coille Leitire at the site offices and on the south side of Loch Awe.

Wood Warbler *Phylloscopus sibilatrix* PR

Just 2AOT is a fairly typical number for recent years but all records were more than 50m from transects and there was no evidence of successful breeding. One was singing from



Some of the dozens of Twite at the dam in September and (above from left) Spotted Flycatcher, Tree Pipit and Common Linnet

deep within the Coille Leitire opposite the visitor centre with a second territory near Lochawe village, with both territories occupied in May and June. There were no subsequent sightings.

Mistle Thrush *Turdus viscivorus* PR

Breeding was considered probable this year, with 2AOT encountered on the BBS transects. Unusually, a male was signing near the Loch Awe tailrace on 18/5 while a permanent territory was established at the reservoir road transect, near Lochawe village, with a singing male present on 18/5 and 2/6. One was near Lochawe village on 14/9.

Spotted Flycatcher *Muscicapa striata* C

Breeding was confirmed for a second consecutive year and 3AOT were recorded – up from 1AOT in 2021. A pair was seen frequently near the contractors' compound entrance in May and June, with 1AOT at the reservoir access road transect and another to the east of the access road, north of Lochawe village, a short distance along the pylon access road. The pair in oaks beside the reservoir road was feeding three juveniles out of the nest on 1/7, while adults and two juveniles were nearby on 21/7, about 200m along the pylon service road.

House Sparrow *Passer domesticus* PO

The first survey sighting since 2017 was of a chirping male perched on the wire-and-post fence beside the reservoir road, near Lochawe village, on 2/6. Post-breeding, four were near the former site of the reservoir road gate on 1/7.

Tree Pipit *Anthus trivialis* C

At least 4AOT were found at Cruachan, the most since 2016, and breeding was confirmed at two locations at the reservoir access road, on 2/6, when adults were seen carrying food. In May and June, two singing males were recorded on the reservoir road transect from Lochawe village, with single territories in the upland, west-end section of the access road. A single was heard calling in flight over Loch Awe from the visitor centre on 1/7.

Common Linnet *Linaria cannabina* PO

The first sighting at Cruachan since 2009 was a singing male at the reservoir road transect, north of Lochawe village. While only present on 18/5, this was felt to be an

TABLE 2: RED LIST BIRDS AT CRUACHAN POWER STATION 2022, SCOTTISH BIODIVERSITY LIST STATUS AND BREEDING STATUS

RED LIST SPECIES	SBL LIST	BREEDING STATUS
European Herring Gull	YES	NB
Common Cuckoo	YES	PO
Wood Warbler	YES	PR
Mistle Thrush		PR
Spotted Flycatcher	YES	C
House Sparrow	YES	PO
Tree Pipit	YES	C
Common Linnet	YES	PO
Twite	YES	C
Lesser Redpoll	YES	PR

interesting record of a territorial male in suitable habitat – a gorse strewn area of scrub and pasture south of the roadway. The only previous record was of two feeding on dandelion seeds at the visitor centre road embankment.

Lesser Redpoll *Acanthis cabaret* PR

More abundant than usual, there was a maximum of 3AOT at the reservoir road transect north of Lochawe village. Birds were engaged in song and display flight from 18/5 although the count reduced to 2AOT on 2/6. There were regular sightings of birds in flight, however, with a maximum group of seven near the 'Titanic' on 14/9.

Twite *Linaria flavirostris* C

One of the highlights of the survey year was an enormous flock of Twite at Cruachan Dam on 14/9. At least 58 were perched on the dam wall and its buttresses, where they were collecting seeds – perhaps airborne seeds such as thistles and Rose-bay Willow-herb – retained on the structure. The flock contained a mixture of adults and many juveniles, suggesting a successful breeding season. Earlier, 3AOT were recorded nearby on the BBS transects (2AOT at the access road junction and 1AOT at the west side of the reservoir) while family parties were recorded at the dam and the steep, rocky embankments at the narrow section of the reservoir access road (both on 30/6).

7.2 AMBER LIST

Common Mallard *Anas platyrhynchos* NB

None was seen in the breeding season, however, a pair was present on Loch Awe on 1/7, with four eclipse males or females close in to the visitor centre on 21/7.

Red-breasted Merganser *Mergus serrator* PO

This species is becoming more regular at Cruachan and has now been seen in three of the survey years since 2017. In the current survey, a pair was seen on Loch Awe on 2/6, looking west from the visitor centre towards the Pass of Brander. Breeding has not yet occurred but a pair in the breeding season suggests that nesting was possible.

Eurasian Oystercatcher *Haematopus ostralegus* PR

There was considerable activity at Loch Awe during the summer, suggesting breeding may have occurred for the first time in the survey. One flew east up the loch towards the Pass of Brander on 18/5, a prequel to a pair that were present on 30/6 and 21/7 on the south bank of the loch east of the fish farm. No young were seen but breeding is considered probable.

Common Sandpiper *Actitis hypoleucos* C

A nest was likely located in the loch embankment close to the visitor centre, with the male in song nearby on 18/5 and an adult flushed accidentally from a possible nest site. Adults were still present on 30/6 with two calling from the visitor centre gardens at night on 20/7.

Common Snipe *Gallinago gallinago* PO

A male was calling from the marshy area south of the Cruachan Reservoir's dam wall on 30/6, starting from dusk and continuing well into the night. That's now four consecutive years this Amber-listed wader has held territory at the dam.

Great Black-backed Gull *Larus marinus* NB

An adult was present at the fish farm on 30/6, associating loosely with the smaller gulls.

Lesser Black-backed Gull *Larus fuscus* NB

Two adults were present at Loch Awe on 30/6, with a single present at the visitor centre car park and tailrace on 21/7.

Tawny Owl *Strix aluco* NB

Night-time activity was recorded on 20/7, while the surveyor was moth trapping at the visitor centre. At least two adults were present, one calling from the Coille Leitire and another calling back from woodland on the south side of Loch Awe.

Song Thrush *Turdus philomelos* C

A total of 4AOT was noted in the BBS, a fairly typical figure for recent years. Breeding was confirmed at the site office gardens, with two juveniles present on 30/6. In addition, 2AOT were located at the reservoir road transect, with 2AOT at the site offices/visitor centre.

Northern Wheatear *Oenanthe oenanthe* C

The total of 5AOT in the survey area in May and June represents a modest improvement on the record low (4AOT) found in the 2021 survey. Just 2AOT were recorded on the west side transect at Cruachan Reservoir (first tunnel access and at the north end of the road) – about half the usual population. A further 3AOT were found on the transect that runs south of the dam, including territories at the dam sluice, dam gorge and hillside. A pair with two juveniles were at the east side dam car park on 30/6, the only evidence of successful breeding.

Common Redstart *Phoenicurus phoenicurus* PO

Scarce in 2022, there was a single record of a singing male from the Common Hazel *Corylus avellana* copse on the north side of the reservoir access road, near Lochawe village, on 2/6.

European Dipper *Cinclus cinclus* PR

Breeding was suspected at the tailrace on 18/5, with two birds present and flying into a hidden spot above the tailrace screens. Adults were also seen commuting between the tailrace and the Loch Awe shore at the visitor centre. Although there were no further records in 2022, this species nests early in the year and young would be leaving the nest by the end of May.

Willow Warbler *Phylloscopus trochilus* C

The BBS total of 16AOT is the most in the survey since 2017, when 18AOT were counted at the Cruachan sites. The key site was the reservoir access road transect, which follows 1.5km of the route west from Lochawe village:

TABLE 3: AMBER LIST BIRDS AT CRUACHAN IN 2022, SCOTTISH BIODIVERSITY LIST STATUS AND BREEDING STATUS

AMBER LIST SPECIES	SBL	BREEDING STATUS
Common Mallard		NB
Red-breasted Merganser		PO
Eurasian Oystercatcher		PR
Common Sandpiper		C
Common Snipe		PO
Great Black-backed Gull		NB
Lesser Black-backed Gull		NB
Tawny Owl		NB
Song Thrush	YES	C
Northern Wheatear		C
Common Redstart		PO
European Dipper		PR
Willow Warbler		C
Grey Wagtail		C
Meadow Pipit		C
European Bullfinch	YES	C
Dunnock	YES	C
Common Wood Pigeon		PR
Winter Wren		C

11AOT were counted on 18/5 (9AOT on 2/6), with several family groups present from 30/6. Elsewhere, 3AOT were at the site office/visitor centre transect with a further three territories further west on the access road. Post-breeding counts included four lemon-yellow coloured juveniles feeding among Sessile Oaks at the site offices (1/7) – which probably fledged locally – plus eight in willows and Bracken at the reservoir road later in the month (21/7).

Grey Wagtail *Motacilla cinerea* C

Breeding was confirmed at Loch Awe with adults carrying food on 30/6, possibly to a nest on the roof of the site offices. On 18/5, two territories were found on the transects: one on the loch bank at the site offices and another at Cruachan Reservoir, at the inflow into the loch at the north of the reservoir. A male was at the visitor centre beach on 30/6 and a female was on the tailrace on 21/7.

Meadow Pipit *Anthus pratensis* C

An estimated 19AOT were noted in May and June, the highest population since surveys began in 2009 (17AOT in 2017). There was enormous activity at upland Cruachan, with numbers peaking in June after a fairly slow start – for instance 5AOT were found in the Cruachan Reservoir west side transect on 18/5, increasing to 10AOT by 2/6. Other peak counts included 4AOT on the transect south of the reservoir, 2AOT at the access road junction, 2AOT at the reservoir road with a single territory at the Penthouse Pond. Adults were seen carrying food from 2/6, with many young out of the nest by 30/6 at upland Cruachan. Adults were still seen carrying food on 1/7, at the reservoir road transect, suggesting birds had successfully managed second broods. Post-breeding, small flocks were encountered on 14/9, with eight near Lochawe village and seven near the reservoir.

European Bullfinch *Pyrrhula pyrrhula* C

A pair nested in a Sessile Oak at the visitor centre and were seen carrying food on 2/6 to a probable nest site. A second pair AOT was found at the reservoir road transect the same day but not relocated. These are the first survey sightings since 2017 and the first confirmed nesting since 2016.

Dunnock *Prunella modularis* C

The site office and visitor centre gardens supported 3AOT from May to July – 1AOT each at the loch embankment at the two sites and another at the site office entrance. Unusually, an adult visited the tailrace screens on 18/5 to apparently gather trapped insects. Juveniles were out of the nest at the visitor centre on 30/6 and being fed by adults.

Common Wood Pigeon *Columba palumbus* PR

Nesting was considered possible in the Coille Leitire opposite the site offices, with a male singing on 18/5 and



30/6. Two were also seen flying between trees in the area on 18/5. This common species was first recorded at Cruachan in 2015 but has become more frequent, being seen in four surveys since then.

Winter Wren *Troglodytes hiernalis* C

There were few records and the local population appears to be low. Just 7AOT were logged on the BBS, involving 3AOT at the reservoir road transect, 2AOT at the visitor centre, 1AOT at the contractors' compound and 1AOT at the mid-section of the dam road. Juveniles were at the visitor centre loch embankment on 30/6, the only evidence of successful nesting.

7.3 GREEN LIST

Great Cormorant *Phalacrocorax carbo* NB

There were sightings on two dates at Loch Awe, with a single present on 30/6 then four on 14/9 – possibly suggesting a movement inland from the coast for winter.

Grey Heron *Ardea cinerea* NB

Just two were seen and, unlike in previous years, no roost developed on the bank of Loch Awe opposite the visitor centre. An adult was at the shingle beach at the visitor centre on 18/5 and, on 21/7, one was perched on the oil bund at the tailrace.

Canada Goose *Branta canadensis* C

All sightings were in midsummer of a group comprising adults and a small number of young. On 30/6, at least 30 basked on the Loch Awe bank near the fish farm, increasing to 67 on 1/7, when the birds formed a raft on the loch off the site offices.

Common Buzzard *Buteo buteo* PR

Sightings were rather infrequent but a pair, seen circling over the west side of Cruachan Reservoir on 18/5 and 2/6, was engaged in typical territorial behaviour (although outwith the survey area). The only other sighting was of a single at the east end of the reservoir access road on 14/9.

Ring-necked Pheasant *Phasianus colchicus* PO

There were records on two dates at the reservoir access road transect near Lochawe village, with a male present on



Lesser Black-backed Gull at the tailrace and (above from left) male Northern Wheatear, juvenile Willow Warbler and Winter Wren

Cruachan Power Station Biodiversity Survey 2022

18/5 and one heard on 30/6. This species has only occurred in two years since 2012: it was formerly regular at Cruachan Substation.

Barn Swallow *Hirundo rustica* NB

Two adults were flying into the tailrace screens on 18/5, raising hopes that breeding might occur for the first time since 2019. However, there were no other sightings at the location and the only other records were four together over the reservoir access road on 2/6, with one near the shepherd's cottage on 21/7.

Great-spotted Woodpecker *Dendrocopos major* C

Breeding was confirmed on 30/6, when a juvenile visited the visitor centre bird feeders, but sightings were otherwise scarce. A male was drumming near the location of the former entrance gate to the reservoir road on 18/5 and 2/6 and one flew into spruce trees near the 'Titanic' on 21/7.

Pied Wagtail *Motacilla cinerea* C

Possibly eight territories were recorded, the highest population since the survey began, and this translated to many juveniles from 30/6 onwards. Pairs AOT were found at Loch Awe tailrace, the east side of Cruachan Reservoir, the east car park at the dam, the 275kW bridge over Allt Cruachan and at four locations along the reservoir access road. On 30/6, three sets of juveniles were out of the nest at the east dam car park, the visitor centre and the narrow part of the reservoir access road (five juveniles present). Another possibly new brood of fledged young was at the Penthouse on 1/7. A good breeding season for this species.

European Robin *Erithacus rubecula* C

A juvenile was out the nest on the early date of 18/5, at the entrance to the contractors compound. It was likely the start of a long and productive breeding season for this species, although overall the number of territories was down. A total of 6AOT were recorded (8AOT in 2021) with three at the reservoir road transect near Lochawe village, 2AOT at the site office/visitor centre transect and 1AOT in the mid-section of the reservoir road. Juveniles were seen in woodland near the site of the former access road gate on 2/6 and 30/6 and at the site office gardens on 1/7, suggesting multiple broods were successful.

TABLE 4: GREEN LIST BIRDS AT THE CRUACHAN POWER STATION 2022, SCOTTISH BIODIVERSITY LIST STATUS AND BREEDING STATUS

GREEN LIST SPECIES	SBL	BREEDING STATUS
Great Cormorant		NB
Grey Heron		NB
Canada Goose		C
Common Buzzard		PR
Ring-necked Pheasant		PO
Barn Swallow		NB
Great-spotted Woodpecker		C
Pied Wagtail		C
European Robin		C
European Stonechat		C
Common Blackbird		C
Eurasian Blackcap		C

European Stonechat *Saxicola rubicola* C

The only pair was located at the lower east end of the reservoir access road. A pair was present from 2/6, frequenting stands of Bracken either side of the road. It wasn't until 14/9 that they appeared with at least three juveniles, apparently recently fledged.

Common Blackbird *Turdus merula* C

A female with food was recorded at the reservoir access road transect on 18/5, suggesting young in the nest nearby. Breeding was also confirmed at the contractors' compound when two juveniles were present on 2/6. A total of 3AOT were counted, with 2AOT at the reservoir road and one at the Coille Leitire, opposite the site offices, in May and June.

Eurasian Blackcap *Sylvia atricapilla* C

Two singing males were present at site office/visitor centre transect, including one singing from lochside vegetation near the Cruachan tunnel and another within the Coille Leitire opposite the visitor centre. On 30/6, adults with food were

GREEN LIST SPECIES	SBL	BREEDING STATUS
Garden Warbler		PO
Goldcrest		PR
Eurasian Nuthatch		PR
Eurasian Treecreeper		C
Long-tailed Tit		PR
Blue Tit		C
Coal Tit		C
Great Tit		C
Common Raven		PO
Hooded Crow	YES	C
Common Chaffinch		C
Eurasian Goldfinch	YES	C
Eurasian Siskin		PR

issuing contact calls close to the benches at the site offices, suggesting young birds were nearby.

Garden Warbler *Sylvia borin* PO

With just one record, it was a poor year for this warbler – a singing male on 18/5 at the Coille Leitire woodland opposite the site offices.

Goldcrest *Regulus regulus* PR

A pair was present in firs at the site office gardens from May to July. This diminutive species has been found at the site offices in all but one survey year, but there has not yet been evidence of successful breeding. A single visited the bird feeding station at the security office cabin on 1/7.

Eurasian Nuthatch *Sitta europaea* PR

At least 2AOT were located in May and June, at the east end of the reservoir access road and at the site offices and visitor centre. There were frequent sightings during the survey but breeding was not confirmed. One was at the



Great Tit proclaims its territory at the site offices and (inset) Eurasian Nuthatch continues to become established at Cruachan

visitor centre gardens on 30/6 with it or another visiting at the security cabin feeders the following day. Two were seen together at the reservoir access road on 1/7 and 21/7.

Eurasian Treecreeper *Certhia familiaris* C

The first confirmed breeding for the survey away from Cruachan Substation took place at the reservoir access road on 30/6, when juveniles were seen out of the nest following around their parents. Elsewhere, Roddy Davies reports a pair at the site office on 17/5. Two were part of a roving tit flock at the lower reservoir road on 14/9. The only previous confirmed breeding record was at the substation from 2010 to 2012.

Long-tailed Tit *Aegithalos caudatus* PR

Just one pair was recorded in the BBS at the reservoir road transect on 2/6 and the birds were not seen again during fieldwork visits. This species is vulnerable during cold winter conditions.

Blue Tit *Cyanistes caeruleus* C

A pair using the camera nestbox at the site offices successfully fledged five or six young in 2022. Nest building began from mid-April with juveniles leaving the nest in the first week of June. Other fledged young out of the nest were recorded at the tailrace (30/6), east end of dam access road (30/6), site offices (1/7) and near the new access road gate (1/7). Just 3AOT were recorded on the BBS transects, however, including 2AOT at the site offices and visitor centre. A flock of eight was near Lochawe village on 21/7.

Coal Tit *Periparus ater* PR

Breeding was probable at the site offices with a pair holding territory near the tunnel in May and June and frequently visiting the bird feeders at the security cabin. Unusually, on 18/5, an adult picked at insects at the tailrace screens. Four were part of a tit flock on the reservoir road near Lochawe village on 21/7.

Great Tit *Parus major* C

Broods of young were found near the location of the former reservoir access road gate (30/6), site office gardens (1/7), and the quarry at the access road (21/7). The BBS found

3AOT beside Loch Awe and a nest was located in a rothole in the large Sessile Oak at the site office road entrance.

Common Raven *Corvus corax* PO

Infrequent in this year's survey, there were sightings on just two dates: two flying up the east side of Cruachan Reservoir (18/5) and one south over Loch Awe on 30/6.

Hooded Crow *Corvus cornix* C

A pair nested at the contractors' compound with an adult AON (apparently on nest) on 18/5 and another pair at the reservoir road transect on 2/6. There were regular records of birds in flight with several at Cruachan Reservoir (18/5), five on the banks of Loch Awe (30/6), four at the reservoir (30/6) and birds south over Loch Awe on 21/7 and 14/9.

Common Chaffinch *Fringilla coelebs* C

At least 12AOT were recorded on the Breeding Bird Survey transects in May and June. The woodland at the east end of the reservoir access road was the key site, holding at least 7AOT, while 4AOT were at the site offices/visitor centre and 1AOT was in the gorge beneath the bridge at the reservoir road. Juveniles were at the site office gardens on 1/7 and up to five visited the feeders at the security cabin and visitor centre, while a post-breeding flock of nine developed at the reservoir road near Lochawe on 21/7.



Eurasian Goldfinch *Carduelis carduelis* C

Most records were from the site offices and visitor centre gardens that supported at least 3AOT during spring and early summer. Fledged juveniles were seen on 30/6 at the visitor centre bird feeding station. Two males were still exhibiting territorial behaviour on 21/7, possibly indicating repeat nesting attempts well into the summer. A group of four visited thistles at the access road on 14/9.

Eurasian Siskin *Spinus spinus* PR

The BBS located 2AOT – one each at the reservoir road and site office/visitor centre transects. Territorial activity was noted on 18/5 and 2/6, typically a singing male engaged in display flights. There were few other records and breeding was not confirmed.



Female Common Chaffinch near the nest – 12 territories were found at Cruachan in BBS 2022 – and (inset) Eurasian Goldfinch

7.4 DISCUSSION

A total of 54 species of birds were recorded in 2022 – the third highest count since survey work began and well above the 13-year median of 50.5.

Graph 3 (right) illustrates that the 2022 total has only been surpassed by the figure in 2010 when Cruachan Substation – with its different range of habitats – was included in fieldwork and in the 2016 survey, when an exceptional 57 species were seen.

No new species were added to the Cruachan List for a third consecutive year. As we stated in the 2021 report, it may be that the accumulation curve of species over time has flattened out and there may be few, if any, further new additions to the site list. The site list continues to stand at a total of 79 species – same as at the end of the 2018 survey.

Despite this, it was a remarkable year for breeding success at Cruachan for many species, aided by the often warm and often bright weather conditions.

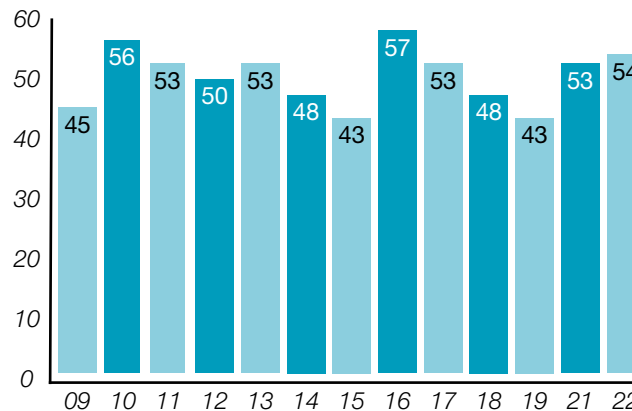
Although the Confirmed breeding figure of 46% isn't exceptional – it has been surpassed in four survey years – the season was notable for the size of populations for several species.

Upland birds were particularly successful with Meadow Pipit (19AOT) and Pied Wagtail (8AOT) present in their greatest numbers since reports began. It was a successful season also for Twite, with a post-breeding flock at the dam numbering 58 birds, including many juveniles, and 3AOT located during the BBS.

Elsewhere, Spotted Flycatcher (3AOT) was the most abundant since 2014 and Tree Pipit (4AOT) occurred in most numbers since 2016. Common Treecreeper was confirmed as nesting for the first time at the power station area (previous records have all been from Cruachan Substation) and Eurasian Bullfinch successfully bred for the first time since 2016.

Wood Pigeon was suspected of nesting for the first time with a territorial pair located at the site office/visitor centre transect. European Dipper was present for a second consecutive year at the visitor centre, and probably nested at the Loch Awe tailrace screens, raising hopes it could be a regular feature in future reports.

GRAPH 3: NUMBERS OF BIRD SPECIES RECORDED IN EACH YEAR OF THE CRUACHAN SURVEY 2009-2019 AND 2021-2022



In addition, Common Linnet appeared as a Possible breeding species at Cruachan for the first time. The Red Data species has undergone a long-term population decline in the UK and it is described in the Argyll Bird Report as “a sparsely distributed partial migrant” that nests mainly on offshore islands and the Kintyre Peninsula.

The only previous sighting at Cruachan was from 2009, the first survey year, when two birds were collecting seeds on the main road verge at the visitor centre in August.

In total 13 (24%) species Probably Nested (PR) at the Drax landholdings and eight (15%) species were considered to have Possibly Nested (PO).

It wasn't all positive news, however, with Barn Swallow failing to nest – breeding is now intermittent at the site offices – and low populations of some insectivorous species such as Winter Wren, European Robin and Long-tailed Tit, possibly as a result of food scarcity due to the warmer weather conditions. And while some upland species thrived in 2022, Northern Wheatear failed to show a bounce back from the record low totals in 2021.

The remaining eight (15%) species were not thought to be breeding species at Cruachan in 2022 – they were observed outwith the nesting season or flying over the survey areas.

7.5 UPLAND BIRDS AND CLIMATE CHANGE

New research has highlighted the increasing threat to upland birds as a result of changes in the availability of a key insect food.

Research by the universities of Aberystwyth, Newcastle and Manchester has highlighted that the mass of craneflies (*Tipulidae*) emerging from peatland soils has crashed by 95% in recent years.

It is thought higher late summer temperatures dry out the peaty soils, killing the cranefly larvae.

Adult craneflies and their larvae provide a crucial food source for a wide range of upland birds found at Cruachan, such as Ring Ouzel *Turdus torquatus*, Northern Wheatear, Meadow Pipit and Pied Wagtail.

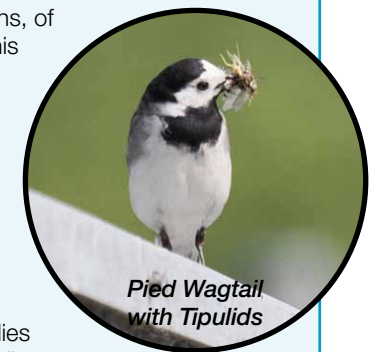
The lack of availability of their food could mean breeding failures and reduced productivity even if nests are successful.

Dr James Pearce Higgins, of RSPB Scotland, said: “This is the most worrying development that I have found in my scientific career to date.

“However, by understanding these processes, we now have the chance to respond. If we can maintain good quality habitats for craneflies we can help the birds too.”

Research is continuing into how the positive impact of climate change – warmer seasons that may lead to improved adult winter survival and summer breeding productivity – will be balanced out by predicted significant increases in rainfall.

However, the dietary composition of upland birds, and particularly their reliance of Tipulids, is therefore an indicator of climate change sensitivity.



8.0 REPTILES & AMPHIBIANS

Common Lizard *Zootoca vivipara* (Lacertidae)

There were several records and breeding was confirmed on 1/7, when a small black juvenile was unfortunately found dead on the reservoir road, north of Lochawe. Three adults were disturbed from vegetation nearby on 2/6 and, on 14/9, an adult was seen scurrying over the road near the rocky embankment at its west end, south of the dam.



Common Frog were found at two upland sites in 2022

Common Frog *Rana temporaria* (Ranidae)

Two adults were found within the Sharp-flowered Rush *Juncus acutiflorus* mire beside the Allt Cruachan, south of Cruachan Dam, on 2/6. Later in the survey, about a dozen froglets were in wet grassland close to the Penthouse Pond on 30/6.

Palmate Newt *Lissotriton helveticus* (Lissotriton)

At least six were present at the Penthouse Pond on 2/6, cruising near the surface in the warm weather conditions. Two were seen here on 30/6, with another nearby at the Allt Cruachan in a pool near the 275kW bridge. A typical set of records.

9.0 MAMMALS

Six species of mammal were recorded or reported in 2022, including two rodents that were caught in a small mammal trapping programme at the reservoir access.

Three humane BioEcoSS tube traps were set out at three locations in May – two at the lower east end of the reservoir (NN1111726528 and NN1101126481), north of Lochawe village and one in the mid-section of the road, close to the new gate, at NN0956126489).

These were supplied with straw bedding material, baited with seeds and nuts, then activated on two occasions – overnight on 30/6 and 20/7, when the surveyor was managing moth traps at Cruachan. The 2017 Cruachan report contains full details of methodology, ethical and health and safety considerations and survey limitations.

Traps operated on six occasions over two dates, resulting in two species of rodents being caught – Field Vole *Microtus agrestis* (on 30/6) and Wood Mouse *Apodemus sylvaticus* (on 20/7), both in traps at the east end of the access road.

Other mammal highlights included records for a second consecutive year of Red Squirrel *Sciurus vulgaris* and European Otter *Lutra lutra* at the Loch Awe area.

9.1 SYSTEMATIC LIST

Field Vole *Microtus agrestis* (Cricetidae)

A mature male was caught in a tube trap at the east end of the reservoir access road on 30/6. The only previous record was an individual caught near Cruachan Reservoir in 2018.

Wood Mouse *Apodemus sylvaticus* (Muridae)

A female was trapped at the east end of the reservoir access road on 20/7 and there were also field records nearby on 18/5 and 30/6. On both dates an unsexed individual was found under a piece of corrugated iron near the pylon close to the reservoir road. The only previous record for the survey was caught at the contractors' compound in 2017.

Pine Marten *Martes martes* (Mustelidae)

Numbers of sightings at the visitor centre appear to be much reduced on previous years but centre staff reported infrequent sightings at the bird feeding table.



This Wood Mouse was found twice under a corrugated sheet

Red Squirrel *Sciurus vulgaris* (Sciuridae)

Station staff continue to report regular sightings of Red Squirrel at the site offices. The surveyor recorded an adult on 18/5, in oaks at the contractors' compound entrance.

European Otter *Lutra lutra* (Mustelidae)

For a second survey, there was a sighting at Loch Awe close to the site offices. On 18/5, an adult was seen swimming east close-in to the site office loch embankment.

Red Deer *Cervus elaphus* (Cervidae)

There were sightings on two dates at upland Cruachan. On 18/5, a male in velvet crossed the reservoir access road west of the shepherd's cottage then gracefully leaped the wire and post fence. Then, on 30/6, a female was in fields adjacent to the reservoir road.



10.0 INVERTEBRATES

10.1 COLEOPTERA (BEETLES)

One of the highlights of the 2022 survey was the discovery of the first Violet Oil-beetle *Meloe violaceus* for Cruachan Power Station at the reservoir access road.

This large (30mm) and impressive beetle is suffering a drastic decline in both population and range in the UK and is a priority for conservation action.

A large female was watched and photographed on 30/6, crawling a considerable distance on the steep and open embankment on the north side of the road at NN1057326380, near the shepherd's cottage.

Oil-beetles are considered to be important indicators of environmental quality due to their extraordinary life-cycle that is intricately linked to the presence of nesting solitary bees. After hatching, oil-beetle larvae, known as triungulins, make their way onto a flower head where they lie in wait for a solitary bee.

Using hooks on their feet, they attach themselves on to the back of a visiting solitary bee female and when the bee returns to its underground nest, the triungulin disembarks and continues its development underground, eating through the bee's stores of pollen and nectar. The following year, it emerges as an adult, ready to start the life-cycle all over again.

The specific bee hosts used in Scotland are largely unknown but may include solitary bee species in the genera *Andrena* and *Lasioglossum* – both of which are known to nest in places at the reservoir road embankment.

Such specialised life-cycles make oil beetles particularly vulnerable to environmental change. Declines in the quality and quantity of solitary bee habitat have contributed towards declines in solitary bees and, along with them, oil beetles.

Violet Oil-beetles are considered a priority for conservation in the UK. It is a UK Biodiversity Action Plan and Scottish Biodiversity List species and has a conservation status of Nationally Scarce, meaning it occurs in fewer than 100 UK

The impressive Violet Oil Beetle that was found looking for bee nests at the reservoir access road in June and, inset, Dor Beetle

hectads. The species is known from Cruachan's hectad NN02 from a single record near Cladich, on the banks of Loch Awe south of the station, from June 2010. It is not uncommon in the wider Argyll area, however, with a total of 43 NBN Atlas records, particularly in the south of the region and on offshore islands.

Violet Oil-beetles are associated with wildflower-rich habitats such as unimproved grasslands and woodland edges where Lesser Celandine *Ficaria verna* and dandelion *Taraxacum*, the adult's preferred food plants, occur.

A total of 11 beetle species were recorded in the 2022 survey. They were no other new species recorded for the Cruachan list but notable sightings included the third site records of both the Black Snail Beetle *Phosphuga atrata* and the click beetle *Adrastus pallens*.

10.1.1 SYSTEMATIC LIST

Green Tiger Beetle *Cicindela campestris* (Carabidae)

Two were recorded at a new site along the reservoir access road on 2/6. They were patrolling the steep, open road embankment at the west end of the road at NN087267.

Violet Ground Beetle *Carabus violaceus* (Carabidae)

After the first record for the site in 2021, this impressive ground-beetle was re-recorded on 2/6 at the visitor centre gardens.

Black Snail Beetle *Phosphuga atrata* (Silphidae)

One was found on 18/5 struggling in a puddle at the east end of the reservoir access road near Lochawe village. It was rescued and placed into cover. This carrion beetle was last recorded at Cruachan in 2018 when it was known by its previously accepted scientific name *Silpha atrata*.

***Ctenicera cuprea* (Elateridae)**

There was a modest emergence of this click beetle on 18/5 when at least eight were found on grassland and Bracken at the east end of the reservoir access road north of Lochawe.

***Athous haemorrhoidalis* (Elateridae)**

A regular species at Cruachan, recorded in six previous years, one was found (18/5) on Grey Willow *Salix cinerea* at the east end of the reservoir access road.



Green Tiger Beetle



A click beetle *Ctenicera cuprea*



Third site record of *Adrastus pallens*



Black Snail Beetle in a puddle



Big emergence of Garden Chafer



The leaf beetle *Lochmaea caprea*

***Adrastus pallens* (Elateridae)**

This is a scarce Scottish species but has now been found at Cruachan in three consecutive survey years. The latest individual was swept from oak at the east end of the reservoir road on 2/6.

Garden Chafer *Phyllopertha horticola* (Scarabaeidae)

There was a significant emergence on 2/6 with records throughout the survey area. At the reservoir access road, 19 were at the west end (NN087267) with 16 at the lower, east end north of Lochawe village. Two were seen at Cruachan Reservoir, with eight in the visitor centre/site office gardens. A regular species, recorded in eight previous surveys.

***Rhagonycha fulva* (Cantharidae)**

The only record was a single that turned up in the visitor centre MV trap on 20/7. There was no visit to the site

during the soldier beetle's peak emergence in August but this species has been found in nine previous years.

Violet Oil Beetle *Meloe violaceus* (Meloidae)

A highlight of the year was the discovery of this large, impressive beetle at Cruachan. A female was found on 30/6, crawling across an open road embankment at NN1057326380, looking for solitary bee nest holes.

Dor Beetle *Geotrupes stercorarius* (Geotrupidae)

One was seen on 2/6, in the mid-section of the reservoir access road (NN0942726468) – the first record since 2018.

Willow Leaf Beetle *Lochmaea caprea* (Chrysomellidae)

Individuals were found on two dates, on Grey Willow at the east end of the reservoir access road. Two were present on 2/6 with a single on 14/9.



*Teneral male Black Darter found resting on Bog Asphodel *Narthecium ossifragum* on the margins of the Penthouse Pond*

10.2 ODONATA (DAMSELFLIES AND DRAGONFLIES)

Five species of damselflies and dragonflies were recorded – the same number as in 2021 and the same composition of regularly-recorded species.

The Penthouse Pond continues to be the key breeding site in the survey hosting four of the species. Populations of all species continue to be low, however, with no large counts despite the warmer spring and summer.

10.2.1 SYSTEMATIC LIST

Large Red Damselfly

***Pyrrhosoma nymphula* (Coenagrionidae)**

The upland population near Cruachan Reservoir continues to be low. Only four were found at the Penthouse Pond (NN0796727670) on 2/6, with one on 30/6. Unusually, however, one was perched on vegetation at the tailrace, also on 30/6 – only the third time one has been found close to Loch Awe.

Emerald Damselfly *Lestes sponsa* (Lestidae)

Two early-emerging males were found at the Penthouse Pond on 30/6, with a male and a female the following day. There was no fieldwork carried out at the site in August when more may have been present.

Black Darter *Sympetrum danae* (Libellulidae)

Two teneral males were found in rushes close to the Penthouse Pond on 30/6 but there was no check at the site during the peak flight period in August.

Golden-ringed Dragonfly

***Cordulegaster boltonii* (Cordulegastridae)**

An improved set of records this year compared with 2021 with two males holding territory at the dam access road (east end and near the new access gate) on both 30/6 and 1/7 plus a single at the Penthouse Pond, also on 1/7.

Common Hawker *Aeshna juncea* (Aeshnidae)

Three were recorded on 1/7 – two at sites along the reservoir access road and one at the visitor centre. Then, on the final day of fieldwork, a male was seen cruising over its territory at the east end of the reservoir access road on the late date of 14/9.

10.3 LEPIDOPTERA (MOTHS)

Blue Leaf managed only two trapping sessions at Cruachan in 2012, resulting in a total of 101 moths of 37 species being recorded. The sessions were held at Cruachan Reservoir area on 20/6 and at the site offices/visitor centre on 20/7.

The methodology is fully discussed in the 2017 Cruachan Biodiversity Report. However, as a summary, two types of moth light trap were again deployed. A mains-powered Robinson MV Trap, that requires a power supply, was used at the visitor centre while three battery-powered actinic light traps were used at remote locations, such as the reservoir.

Trapping sessions were arranged for nights that promised the best conditions – warm, humid, overcast conditions with little wind. In practice, the weather on both trapping sessions did not match the forecasts, with overnight rain and cool conditions on 30/6 and rain arriving by morning on 20/7.

In addition, on 20/7, the security lights at the visitor centre remained operational all night and this may have affected the quantity of moths entrapped.

Research recently published by Butterfly Conservation, based on two academic studies, has found that artificial light can have profound impacts on the lifecycles of moths and their caterpillars.

The studies found that artificial light can disrupt pheromone production in moths, making it harder for them to find mates, and reduce feeding in caterpillars and adult moths, including Common Marbled Carpet *Dysstroma truncata* which is a regular species at the station traps.

Experiments to artificially illuminate woodland edges with LED lighting resulted in a 14% decrease in total moth abundance over a period of several years.

Also on 20/7, an actinic light, located at the tunnel entrance, failed during the night resulting in a nil catch.

All this contributed to a rather disappointing set of records, particularly in June when only 14 moths of nine species were caught in three actinic traps at Cruachan Reservoir area.

TABLE 5: TRAPPING SESSIONS AT CRUACHAN 2022

DATE	LOCATION	OVERNIGHT WEATHER CONDITIONS
30/6-1/7	Reservoir area	Mostly cloudy, some rain. 11°C. Light SE wind
20/7-21/7	Visitor Centre	Mostly cloudy, 16°C. Light NE wind. Rain 0500



A moth trap location at upland Cruachan: An 8W Heath trap on the margins of the access road to the east side of the reservoir

The July event resulted in 85 moths being trapped, the vast majority in the Robinson MV Trap.

In addition, a further nine species of moths were found during fieldwork. Notably, these included a second Cruachan record of the “Nationally Scarce” micro-moth *Pyrausta cingulata*, which is associated with areas of Wild Thyme.

Only four species recorded are “new” to the site list (13% of the total catch): Brindled Green *Dryobotodes eremita*, Bright-line Brown-eye *Lacanobia oleracea*, Burnished Brass *Diachrysia chrysitis* and Dotted Clay *Xestia baja*.

None of these species are of conservation concern although Brindled Green is described by the Scottish Macro-moth List as “widespread but local and infrequent”.

A potential fifth new species was recorded: a micro moth from the genus *Depressaria*, possibly the Parsnip Moth *Depressaria radiella* – however, an accurate identification would require a specimen to be retained for dissection.

The Cruachan moth list was reviewed early in 2022 to identify the definitive number of species recorded at the site. The addition of the four new species in 2022 increases the total number of moth species recorded by Blue Leaf at the station to 186, plus three others that could only be identified to a species’ complex.

Cruachan Power Station is located in VC98 (Main Argyll). Main Argyll VC98’s macro-moth list stood at 410 species at the end of 2022 (Hill 2022).

10.3.1 NOTES ON THE SYSTEMATIC LIST

A total of 156 moths of 46 species were recorded in the light trap survey or otherwise found in 2022. This is the lowest total since formal trapping sessions began in 2017, although trapping only took place on two nights in 2022.

The systematic list groups the moths recorded in 2022 by family and follows the order of the British checklist (Bradley 2000). Species new to the Cruachan survey are indicated by an asterisk in front of the name.

The initial figure is the checklist number, followed by the common name used by Bradley (2000) and the scientific name for each species. Where relevant, comments on the Argyll (VC98) status of moths are included, based on the a checklist by VC recorder David Hill (Hill 2022). However, most of the species recorded are common and widespread.



From left, the micro-moth *Micropterix calthella* crammed into buttercup and macro-moths Riband Wave and Common Carpet

10.3.2 SYSTEMATIC LIST

5 *Micropterix calthella*

Several were seen on two dates, typically feeding in numbers at buttercups. On 18/5, dozens were at the reservoir access road BBS transect, with eight on 2/6.

18 Map-winged Swift *Korscheltellus fuscinebulosa*

A single was trapped at the MV light at the Visitor Centre on 20/7. This is a regular in the moth traps, found in four years since 2016.

1272 *Pammene aurana*

One was at Common Hogweed flowers at the contractors’ compound on 21/7, the first survey sighting since 2013.

1314 Pearl-banded Grass Veneer *Catoptria margaritella*

Two appeared in the MV moth trap at the visitor centre on 20/7. All Cruachan records have occurred since light trapping began in 2016.

1367 *Pyrausta cingulata*

The second sighting for the survey, and the first record since 2014, came on 2/6, when at least two of this Nationally Scarce micro-moth were found flying by day at the west end of the reservoir access road, close to the rocky road embankment at NN087267.

672 *Depressaria cf radiella*

Three were caught on 14/9 in the visitor centre MV trap. Although it was not possible to identify the individuals to species’ level, they were likely Parsnip Moth *Depressaria radiella*, which would be a new species for the survey. As its common name suggests, its larvae feed on Wild Parsnip *Pastinaca sativa* but also on hogweed *Heracleum*.

1640 Drinker *Euthrix potatoria*

A regular in the traps in past surveys but just one was seen in 2022 – one at the visitor centre MV trap on 20/7.

1713 Riband Wave *Idaea aversta*

The first records since 2017 involved four, on 20/7, that gathered in the MV trap at the visitor centre.

1722 Flame Carpet *Xanthorhoe designata*

Recorded for the fifth year at Cruachan, a single second-generation individual was attracted to the MV light at the visitor centre on 20/7.

1738 Common Carpet *Epirrhoe alternata*

Two were disturbed from vegetation at the reservoir access road on 2/6: at the lower east end and at the rocky embankments south of Cruachan Dam.

1758 Barred Straw *Eulithis pyraliata*

A Cruachan regular, with records in four of the last five surveys, one was retained in the MV trap at the visitor centre on 20/7.

1764 Common Marbled Carpet *Chloroclysta truncata*

An adult of the sub-form *truncate*, with a brown patch on its forewings, was found on 14/9 roosting at the north wall of the visitor centre. This species is often abundant in the moth trapping sessions and is common in VC98.

1776 Green Carpet *Colostygia pectinataria*

This species turned up in moth traps on two dates – on 20/6, at an actinic trap at Cruachan Dam and, on 20/7, at the MV light at the visitor centre.

1858 V-Pug *Chloroclystis v-ata*

The second record for Cruachan was at the MV trap at the visitor centre on 20/7 – the first sighting since 2018. This is a widespread but local species in VC98.

1870 Chimney Sweeper *Odezia atrata*

One was disturbed from grasses beside the reservoir access road on 2/6 – only the second record for the survey. The only previous sighting was at Cruachan Substation in 2012 but this is a common Argyll species.

1887 Clouded Border *Lomaspilis marginata*

Another regular species, found in eight survey years, two were present at the visitor centre MV trap on 20/7.

1902 Brown Silver-line *Petrophora chlorosata*

This is a very common species at Cruachan, recorded in every survey year apart from 2017. It was abundant on 2/6, with multiple records at various sites along the reservoir access road, resulting in a day count of 22.

1909 Speckled Yellow *Pseudopanthera macularia*

This beautiful yellow-and-brown butterfly-like moth was an exciting find at the west end of the reservoir access road on 2/6. The only previous sighting was at Cruachan Substation in the initial year of the survey (2009). It is a woodland-edge species whose larvae feed mainly on Wood Sage *Teucrium scorodonia*. Hill (2022) describes this as a local species in Argyll VC98.



Common Marbled Carpet



V-Pug



Clouded Border



Common White Wave



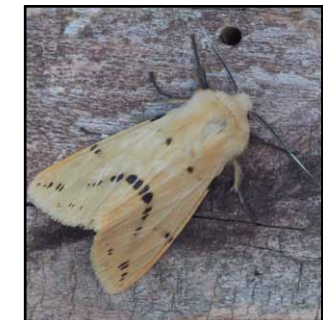
Light Emerald



Pebble Prominent



Large Yellow Underwing



Buff Ermine

1931 Peppered Moth

The only sighting was a one that came to the MV trap at the visitor centre (20/7). This is a reliable species at Cruachan, with only one blank year since trapping began in 2017.

1955 Common White Wave *Cabera pusaria*

A regular species that has only missed one year since moth trapping began at Cruachan in 2017. In 2022, one was captured at the visitor centre MV trap on 20/7.

1961 Light Emerald *Campaea margaritaria*

After a gap in 2021, this attractive species was re-recorded on 20/7, when two were at the visitor centre MV trap.

1981 Poplar Hawkmoth *Laothoe populi*

Singles were seen at both trapping sessions, with one to an

actinic light at the east side of the reservoir approach road (30/6) and another in the visitor centre MV trap on 20/7.

2060 White Ermine *Spilosoma lubricipeda*

This Amber-listed species was seen at Cruachan for the first time since 2018, with two males trapped at actinic lights at Cruachan Reservoir and the east side access road.

2061 Buff Ermine *Spilosoma lutea*

Recorded for the third consecutive survey, on 30/6 a single was at an actinic trap near Cruachan Reservoir. This Amber-listed species is regular at the Drax site.

2003 Pebble Prominent *Notodonta ziczac*

This attractive moth has now been recorded in three consecutive trapping seasons – but just a single was



Grey Arches (main pic) and (from top) Lesser Broad-bordered Yellow Underwing, Bright-line Brown-eye and Small Square-spot

present at the visitor centre MV trap on 20/7.

2107 Large Yellow Underwing *Noctua pronuba*

A very common and familiar species that has been found in every trapping season and can be abundant in the traps. However, just two were seen in 2022, both on 20/7 at the visitor centre MV trap.

2111 Lesser Broad-bordered Yellow Underwing *Noctua janthe*

After the first Cruachan sighting in 2021, this species was re-recorded on 20/7 when a single was present in the MV trap at the visitor centre.

2118 True Lover's Knot *Lycophotia porphyrea*

Recorded on both trapping sessions – but not the dozens seen in 2021. Singles were present at an actinic trap at Cruachan Reservoir on 30/6 and the visitor centre MV trap on 20/7.

2123 Small Square-spot *Diarsia rubi*

Trapped for the second consecutive year, one was at the MV trap at the visitor centre on 20/7.

2128 Double Square-spot *Xestia triangulum*

One of the more abundant species at the visitor centre MV trap, a total of 12 were recorded with a single nearby at an actinic trap in the centre gardens.

*** 2130 Dotted Clay *Xestia baja***

A new species for the survey, one turned up in the visitor centre MV trap on 20/7. This is a common species of heathland and woodland whose larvae hibernate overwinter and emerge to feed on plants including Bog Myrtle *Myrica gale*, a common shrub at Cruachan.

2150 Grey Arches

One was found roosting on a fence post by day at the east end of the reservoir access road (30/6). More followed, with two in the MV trap at the visitor centre on 20/7. Recorded in the 2017 and 2018 trapping seasons.

2160 Bright-line Brown-eye *Lacanobia oleracea

A new species for the Cruachan list, on 20/7, two were attracted to the MV light at the visitor centre. This is a common and widespread species, occurring in a wide range

of habitats, whose larvae feed on a range of woody and herbaceous plants including species such as Common Nettle *Urtica dioica* and willowherbs *Epilobium*.

2225 Minor Shoulder-knot *Brachylochia viminalis*

The first sighting of this Amber-list species since 2017 involved three that turned up in the MV trap at the visitor centre on 20/7.

2248 Brindled Green *Dryobotodes eremita

This is a local species in Argyll VC98 but it was added to the Cruachan list on 20/7, when one turned up in the visitor centre MV trap. The larvae feed on the buds and leaves of oak trees, a key species at the Coille Leitire SSSI.

2250 Dark Brocade *Mniotype adusta*

Recorded for the third consecutive survey, three were in the Robinson trap at the visitor centre on 20/7.

2302 Brown Rustic *Rusina ferruginea*

One was present in the visitor centre MV trap on 20/7. The only blank year since trapping sessions began was in 2018.

2321 Dark Arches *Apamea monoglypha*

This was the most common species in this year's trapping sessions with 20 recorded over the traps on both summer sessions. The peak was in July with 15 at the visitor centre MV trap on 20/7 (one at an actinic at the visitor centre gardens the same night). On 30/6, four were caught at two actinic lights at Cruachan Reservoir area.

2326 Clouded-bordered Brindle *Apamea crenata*

Singles appeared in four traps over the two trapping nights: at actinic traps at the reservoir and east side dam approach road on 30/6, and the visitor centre MV and centre gardens actinic trap on 20/7. Recorded in all four trapping seasons.

2330 Dusky Brocade *Apamea remissa*

This Amber-list moth is a regularly-occurring species at Cruachan and, in 2022, one was caught at an actinic trap at Cruachan Reservoir on 30/6.

2368 The Crescent *Helotopha leucostigma*

The second record for the survey of this Amber-listed species was a single in the MV trap at the visitor centre on 20/7. It was last recorded in 2017.



Minor Shoulder-knot (main pic) and (left from top) Silver-Y, The Crescent, Straw Dot

2434 Burnished Brass *Diachrysis chrysitis

This long-predicted species finally occurred at the station on 20/7, when one was attracted to the MV lamp at the visitor centre. This stunning moth, with areas of metallic colouring on its forewings, is common and widespread in the UK, inhabiting open areas where Common Nettle, its larval foodplant, occurs.

2441 Silver Y *Autographa gamma*

This migrant species was recorded for only the second time at Cruachan, when one came to an actinic trap at Cruachan Reservoir. The only previous record was in 2015.

2442 Beautiful Golden Y *Autographa pulchrina*

Four were recorded at the visitor centre MV trap on 20/7 after records in 2015 and 2017.

2443 Plain Golden Y *Autographa jota*

One appeared along with the more abundant Beautiful Golden Y at the visitor centre MV trap on 20/7. This remains a local and scarce species in VC98

2474 Straw Dot *Rivula sericealis*

One was at the visitor centre MV trap on 20/7. It has been recorded in three survey years since 2017 and, nationally, is expanding its range and population most rapidly.



Grayling is now the most threatened butterfly species, classified as Endangered. It has only been recorded at Cruachan in 2015

10.4 LEPIDOPTERA (BUTTERFLIES)

10.4.1 REVIEW OF BRITAIN'S RED-LIST BUTTERFLIES

The extinction-risk status of Britain's butterflies was reassessed in 2022, resulting in significant changes for species on the Cruachan list. The revised Red List of Britain's Butterflies (Fox and Dennis 2022), published in May, considers the vulnerability to extinction of 63 species that currently or formerly breed in Great Britain.

The authors have considered the latest information on populations and trends for species and compared these against the extinction-risk criteria applied by the International Union for the Conservation of Nature (IUCN).

As a result, 28 species are now considered to be threatened (45% of the total) with an additional five species on the Red List compared with the previous review in 2010.

The range of Scottish species is impoverished compared with those found in southern England, with only 37 species north of the border and 27 known from Argyll and Bute.

The effects of climate change are helping some species, such as White-letter Hairstreak *Satyrium w-album*, to colonise into Scotland from the south although changing weather is also thought to be having a negative impact on some resident species, especially upland butterflies.

The Cruachan list at the end of 2022 stands at 20 species, of which six (30%) are included on the new Red List. Under the 2010 criteria, five Cruachan species were considered threatened, meanwhile the review has resulted in the status of all seven species involved being revised. While there are a

TABLE 6: CHANGES TO RED DATA LIST SPECIES IN 2022

SPECIES	2022 RED LIST	2010 RED LIST
Grayling	ENDANGERED	VULNERABLE
Pearl-bordered Fritillary	VULNERABLE	ENDANGERED
Small Pearl-bordered Fritillary	VULNERABLE	NEAR THREAT
Scotch Argus	VULNERABLE	LEAST CONCERN
Small Heath	VULNERABLE	NEAR THREAT
Dark Green Fritillary	NEAR THREAT	LEAST CONCERN
Chequered Skipper	LEAST CONCERN	ENDANGERED

few conservation “good news” stories, the extinction risk of five species has become more acute in the 12-year period.

One of the headline stories from the review was the improved risk-value of Chequered Skipper *Carterocephalus palaemon*. This species was found at Cruachan for the first time in 2021, when we reported it was considered Endangered in the 2010 Red List, and it was subsequently re-found at the reservoir access road in the 2022 survey.

Although its conservation status remains Nationally Scarce, it drops out of the revised Red List completely and is now categorised as Least Concern.

Targeted survey work has identified that Chequered Skipper is much more widespread in Argyll and Highland than previously thought. It is now known to be present in an area of 832km² (to the end of 2019) and increasing in population in West Scotland – now its only native area in Britain, although it is being reintroduced to England.

As a result, the species is not now considered to have a “severely fragmented” range and does not meet the criteria for threatened status.

Grayling *Hipparchia Semele* is now the most threatened species that occurs at Cruachan following the revised Red List. It has been seen in a single year (2015), at Buddleia at the Loch Awe tailrace, but remains fairly widespread in Argyll, especially at coastal sites.

Grayling qualified as Vulnerable in 2010 but has now been uplisted to Endangered due to a 42% abundance decline and 52% distribution decline over the past 10 years.

Four species found at Cruachan are listed as Vulnerable in the 2022 Red List: Pearl-bordered Fritillary *Boloria euphrosyne*, Small Pearl-bordered Fritillary *Boloria selene*, Scotch Argus *Erebia aethiops* and Small Heath *Coenonympha pamphilus*.

Of these, only the extinction risk of Pearl-bordered Fritillary has shown an improvement, thought to be as a result of targeted conservation measures. While it continues to show a decline in distribution (a 33% decrease from 2010 to 2019), it no longer reaches the threshold of Endangered (its category in the 2010 assessment).

Pearl-bordered Fritillary is recorded regularly at Cruachan (in 12 out of the 14 survey years) but usually in small



Small Pearl-bordered Fritillary's extinction risk has deteriorated from Near Threatened to Vulnerable in the new revised Red List



Pearl-bordered Fritillary – Vulnerable



Scotch Argus – Vulnerable



Small Heath – Vulnerable



Dark Green Fritillary – Near Threatened

numbers – the exception was in the first year of the survey (2009) when an impressive 40 individuals were counted on 1/6, below the deer fence at Coille Leitire SSSI. Typically, total day counts have not exceeded five, mostly along the reservoir access road, but the species has ventured to the power station grounds in 2010 and 2011.

Scotch Argus is another regularly-recorded butterfly at Cruachan, with sightings in 10 out of the 14 survey years although, as a late summer-flying species, it may be missed when no fieldwork is carried out in August.

It can occur in large numbers at the reservoir access road and upland Cruachan (day counts of 50 in 2011 and 17 in 2016) and has occasionally been seen at the visitor centre (2012, 2014 and 2016).

The revised Red List reflects a significant change in its risk assessment. Scotch Argus was classified as Least Concern in 2010 but has now been upgraded to Vulnerable due to a 44% abundance decline and 33% distribution decline over the past 10 years.

Small Pearl-bordered Fritillary and Small Heath were both classified as Near Threatened in the 2010 assessment but their extinction risk has deteriorated to Vulnerable in the latest review.

The “Small Pearl” is the least common of the fritillaries occurring at Cruachan with sightings in only five survey years and day counts never exceeding more than four individuals (four in 2010, three in 2016). It has been recorded from the

lower section of the reservoir access, Cruachan Substation and at the site office/visitor centre area in 2017 and 2019.

Small Pearl-bordered Fritillary remains widely distributed in West Scotland but, nationally, has suffered a 37% distribution decline over the past 10 years.

Small Heath has also experienced a 37% distribution decline in the period and now exceeds the criteria for Vulnerable, although it remains a common species in Argyll and Scotland. The species has been recorded in 10 survey years but is frequently absent during wet, cold conditions in late spring and early summer. Peak counts included 16 in 2009, eight in 2010 and 11 in 2021 – but all records have been from upland sites and the reservoir road.

Dark Green Fritillary appears on the Red List for the first time after previously being classed as Least Concern in the 2010 review. It has been recorded at Cruachan in 10 survey years. An influx of at least 80 individuals in June 2010 was an exception – in most other years it has been found in single figures (but 13 in 2015).

While most are seen visiting thistles at the reservoir road and around Cruachan Reservoir, it has ventured to the visitor centre (2011, 2016 and 2019), and the contractors’ compound (2012 and 2018). Nationally, it has suffered a 27% distribution decline (2010 to 2019).

The revised Red List also raises an alarm about the continued decline in the abundance of Small Tortoiseshell *Aglais urticae*. This common and familiar garden butterfly

has been seen in just over half the survey years at Cruachan but usually in very low numbers (maximum of six in 2014).

With a national decrease in abundance of 29.6%, Small Tortoiseshell meets the threshold for Near Threatened and is just a fraction away from the Vulnerable category (30%). It remains, for now, Least Concern on the Red List as this is a mobile species and the British population is supplemented by immigrants from Continental Europe. All the other species recorded at Cruachan are also on the Least Concern table.

In a typical survey year, around 10 species are recorded at Cruachan Power Station and its landholdings. The key factor is weather and in years blighted by cold, wet conditions, totals can be very low – for instance, just five species in 2013 and seven in 2017.

Of the 20 recorded species, three have only been seen in a single year (Grayling, Ringlet *Aphantopus hyperantus* and Small Copper *Lycaena phlaeas*) while Chequered Skipper has been found only in 2021 and 2022.

Green Hairstreak *Callophrys rubi* has only ever been recorded at Cruachan Substation near Stronmilchan and was last seen in 2012. The site was always considered marginal to its requirements but the colony did not reappear after a very cold spring in 2013 and its Blaeberry *Vaccinium myrtillus* larval habitat was largely removed during the redevelopment of the substation in 2015.

A few others species can be considered irregular at Cruachan. Painted Lady *Vanessa cardui*, which has been

Cruachan Power Station Biodiversity Survey 2022

reported in three survey years, is an irruptive migrant from the Continent. It only reaches Mid Argyll in summers during a mass invasion event but it can then be numerous (10+ in 2009 and five in 2019).

Meadow Brown *Maniola jurtina* (in four survey years), Speckled Wood *Pararge aegeria* (four) and Large White *Pieris brassicae* (five) are the other less regular butterflies, leaving a core of 11 species that could be relied on to occur if the weather on survey visits, coinciding with their flight times, is optimum.

Green-veined White *Pieris napi* and Peacock *Aglais io* are the only species to have been recorded in every survey year while Orange-tip *Anthocharis cardamines* has only been absent in a single year (2015). Green-veined White can be seen anywhere in the survey area but key sites include the bowl in front of Cruachan Reservoir and areas of thistle and knapweed-rich grassland at the reservoir road and the visitor centre. It appears to be declining, however, with recent years returning just single-figure day counts compared with 27 (2009), 13 (2011) and 18 (2016).

In contrast, Peacock is increasing with the three highest day counts all occurring in the past three years: 16 in 2019, 11 in 2021 and eight in 2022. The large flowering Buddleias at the Loch Awe tailrace are a key attraction for this species along with other autumn-flying butterflies.

Orange-tip is one of the earliest butterflies to emerge in spring and its numbers depend on seasonal temperature. The peak count was six in 2011 (four in 2012) but numbers since have been much diminished with just singles in each of the past four years. It is found only at lowland areas such as the visitor centre gardens and the lower, east end of the reservoir road.

Red Admiral *Vanessa Atalanta* is another *Nymphalid* butterfly that, like Peacock, is occasionally seen at the tailrace Buddleias, with records in seven survey years. It is never numerous, however, with a peak count of just three (in 2014).

Finally, Common Blue *Polyommatus icarus* is regularly encountered at the reservoir access road, with sightings in 10 survey years. It often associates with south and west facing road embankments where Bird's-foot Trefoil *Lotus corniculatus*, its larval plant, can be abundant – but it is

TABLE 7: SPECIES OF BUTTERFLIES RECORDED AT CRUACHAN (2009-2022, EXCEPT 2020) AND YEARS OF OCCURRENCE

SPECIES	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022
Grayling													
Pearl-bordered Fritillary													
Small Pearl-bordered Fritillary													
Scotch Argus													
Small Heath													
Dark Green Fritillary													
Small Tortoiseshell													
Chequered Skipper													
Green-veined White													
Large White													
Orange-tip													
Green Hairstreak													
Common Blue													
Small Copper													
Red Admiral													
Painted Lady													
Peacock													
Speckled Wood													
Ringlet													
Meadow Brown													

never numerous (maximum day count of five in 2010). It has also been found at the visitor centre gardens (2012).

The 20 species found at Cruachan Power Station is considered a comprehensive total for the site – although a handful of other species could yet be added to the survey list. Blue Leaf has still to record Comma *Polyommata c-album* at the station landholdings, although it was reported from near the visitor centre in August 2007. This was one of the first Argyll records of this species, which is expanding its range rapidly in Scotland.

Purple Hairstreak *Favonius quercus* occurs in the

neighbouring NN03 hectad at Bonawe (2013). This striking butterfly is associated with veteran oaks, such as those found at Coille Leitire SSSI and the site office gardens, so it has the potential to occur.

Finally, the migrant Clouded Yellow *Colias croceus* has also been recorded from NN02, south of the site offices at Almondbank, beside Loch Awe, in August 1997.

This golden-yellow butterfly is highly irruptive and can visit Britain in huge numbers – on such years, another NN02 record would be possible, perhaps on the Buddleias near the visitor centre.

10.4.2 BUTTERFLIES RECORDED IN 2022

A total of 10 butterfly species were recorded during fieldwork at Cruachan in 2022, below the 13-year mean figure of 10.3.

Notable records included the presence of Chequered Skipper for the second consecutive year and records of three species included on the revised Red List: Small Heath, Pearl-bordered Fritillary and Scotch Argus.

However, there were no large counts of any individuals despite warm, sunny weather conditions on some visits that would have been advantageous for adult butterflies.

This was in line with survey work by Butterfly Conservation volunteers in 2022 that found populations of many species were at the lowest level for 13 years. Worryingly, it is feared that the effects of the above average temperatures in the summer may have a longer-term impact on populations due to mortality of species in their larval stages.

While adults and caterpillars can cope with heat, the lack of rain can cause desiccation of their larval food plants causing starvation. Studies into the effects of the 1976 drought have found it took until 1984 for butterfly populations to recover.

Butterfly populations are a biodiversity indicator used by the UK Government to track its delivery of measures towards the various biodiversity strategies implemented both nationally and by devolved government.

The new DEFRA update 'Butterflies in the UK: Habitat specialists and species of the wider countryside 1976-2021', published in October 2022, identifies a "statistically significant" long-term reduction in the relative abundance of habitat specialists – a decline of up to 60%.

Butterflies of the wider countryside, which includes many of those species recorded at Cruachan, have experienced a long-term decline of 38% in the same period.

10.4.2.1 SYSTEMATIC LIST

Chequered Skipper ***Carterocephalus palaemon* (Hesperiidae)**

For a second consecutive year, at least one was present at the east section of the reservoir access road. Found on 2/6, a male held territory among Common Bracken *Pteridium*



Three butterflies seen in 2022: female Common Blue (above) and (below from left) Red Admiral and Peacock at Buddleia



aquillinum beside the road near the pylon service road junction (NN1112326532), north of Lochawe village, and made repeated flights to intercept other passing butterflies such as Orange-tip. The individual ranged over a considerable area and it is possible that more than one Chequered Skipper may have been present, raising hopes that the site is now being permanently colonised.

Orange-tip *Anthocharis cardamines* (Pieridae)

There were sightings on two dates early in the season. A male was nectaring at dandelion at the east end of the reservoir road on 18/5 (a male and female here on 2/6), with a male in the Visitor Centre gardens, also on 2/6.

Green-veined White *Pieris napi* (Pieridae)

Few were recorded and it is now seven years since the last double-figure day count in the Cruachan survey (18 in 2015). There were sightings on three dates, all at the east end of the reservoir access road with one on 18/5, two on 2/6 and one on 14/9.

Common Blue *Polyommatus icarus* (Lycaenidae)

The only record was a female on 30/6, at the reservoir access road close to the shepherd's cottage, where it was sunning on Bracken.

Small Heath *Coenonympha pamphilus* (Nymphalidae)

Two were recorded at the reservoir road transect on 2/6, the only sightings in this year's fieldwork.

Pearl-bordered Fritillary ***Boloria euphrosyne* (Nymphalidae)**

There were sightings at two places at the reservoir access road on 2/6: one at the narrow part of the road (NN087267) and one or two at the east end north of Lochawe village, where adults were nectaring at Common Bluebell *Hyacinthoides non-scripta* and dandelion.

Peacock *Aglais io* (Nymphalidae)

There was a single sighting in spring, one at the reservoir access road on 18/5, but many more were seen at the end of the survey. On 14/9, four nectared at Devil's-bit Scabious *Succisa pratensis* at the east end of the reservoir road, with three at *Buddleia globosa* at the Loch Awe tailrace and a single on Common Knapweed at the visitor centre gardens.

Red Admiral *Vanessa atalanta* (Nymphalidae)

The first Cruachan sighting since 2017 was a single at the flowering *Buddleia globosa* at the Loch Awe tailrace.

Small Tortoiseshell *Aglais urticae* (Nymphalidae)

One joined the other *Nymphalidae* butterflies at the *Buddleia globosa* at the Loch Awe tailrace on 14/9.

Scotch Argus *Erebia aethiops* (Nymphalidae)

This new Vulnerable-listed species was found on 14/9, at the end of its flight season, when two tattered individuals visited Devil's-bit Scabious beside the reservoir access road north of Lochawe village.

10.5 DIPTERA (TRUE-FLIES)

A total of 31 species, representing seven genera of true-flies, were found at Cruachan in 2022. While an improvement on the 26 species found in 2021, numbers and diversity remained low, with only three new species discovered for the site – the hoverflies *Megasyrphus erraticus* and *Paragus haemorrhous* and the Muscid fly *Mesembrina meridiana*.

10.5.1 SYRPHIDAE (HOVERFLIES)

It was another challenging year for hoverfly recording at Cruachan with generally low numbers and a lack of diversity.

The total of 21 species in 2022 is a modest improvement on the record low count of 13 species in 2021 but still rates among the worst seasons since 2010.

The early-year visits on 18/5 and 2/6 (with just four and three species respectively) were particularly disappointing and it wasn't until late summer that the situation improved.

There may be mitigating factors and the surveyor is forming an opinion that the increased effort to trap moths at Cruachan may not be conducive to recording hoverflies.

Typically, on moth trap nights, the surveyor arrives late afternoon or early evening – when peak hoverfly activity is over for the day. Early mornings are then spent processing the often-considerable catch of moths, again keeping the surveyor out of the field when Syrphids may be most active.

In addition, no fieldwork was carried out in August – a month when flowering plants such as Common Hogweed *Heracleum sphondylium* may attract a diverse range of flies.

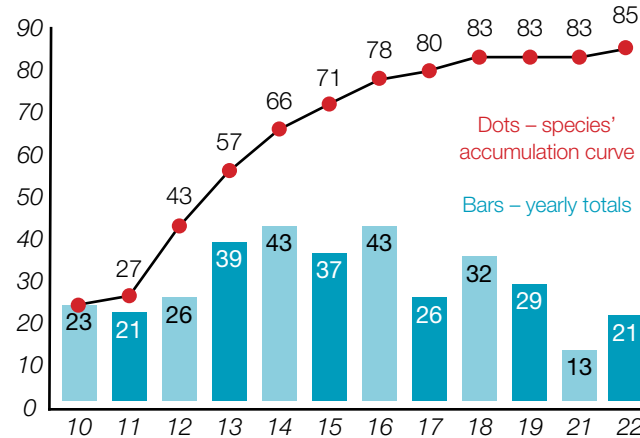
Nevertheless, two new species – *Megasyrphus erraticus* and what is almost certainly *Paragus haemorrhous* – were added to the site list in 2022, the first additions since 2018.

This increases to 85 the total number of distinct hoverfly species recorded at Cruachan since 2009 plus a further two Syrphids that could only be identified to a species' pairing and one species that could only be identified to its family.

The 12-year mean figure for 2010-2022 stands at 29.4 although the graph of yearly totals (Graph 4, right) is rather chaotic, highlighting how responsive this species is to both weather conditions and recorder effort.

In cold or wet spells of weather, adult hoverflies may be

GRAPH 4: NUMBERS OF HOVERFLY SPECIES RECORDED IN THE SURVEY (2009-2019 AND 2021-2022) AND ACCUMULATION CURVE



unable to fly, feed or breed while high temperatures can desiccate cold-blooded insects, and especially their larvae, and have a profound effect on the availability of their nectar resources.

In recent years, we have also raised concerns at the impact of cumulative adverse weather events – such as cold “late” springs, summer drought and floods – on mortality of hoverflies in their larval stage.

The surveys in 2013-2016 inclusive appear to be the golden period for hoverfly recording at Cruachan and, at the time, considerable effort was spent in collecting specimens of invertebrates that are impossible to identify in the field to be identified later in the Blue Leaf laboratory.

However, since around 2017, less effort has been spent on recording hoverflies at the request of station management who wanted more time devoted to the bird survey. In 2022, only two specimens were collected.

The new species recorded for Cruachan is the large and impressive *Megasyrphus erraticus*. This is a Nationally

Scarce species that, while numbers each year can be erratic, is suffering a significant long-term decline.

Its larvae feed on aphids associated with conifer tree species, although aphids on willow *Salix* could be the larval food at Cruachan. It is primarily a northern and western species in the UK but it has only been recorded in 78 hectads since 1990.

In addition, a female of the *Paragus* complex was collected, the first time this family of so-called pygmy hoverflies has occurred at Cruachan. Females cannot be identified, however, *Paragus haemorrhous* is the only species known to occur in Scotland.

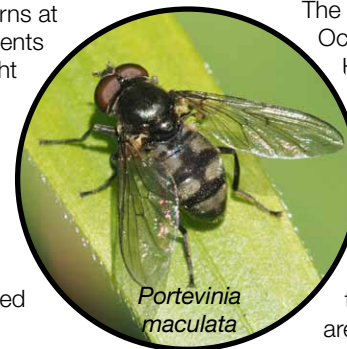
This is a tiny black hoverfly, with a wing length of 5mm, that likes warm, sunny, sparsely-vegetated areas. It can exploit a variety of grassland types, including heathland, where adults visit a range of low-growing flowers.

Other notable records during the year included only the second records of the migratory hoverfly *Eupeodes corollae* (after one in 2018) and the third records of the bumblebee mimic *Volucella bombylans* (first since 2014) and *Cheilosia antiqua* (2014). Otherwise, numbers of all species were low even when conditions seemed optimum.

The year witnessed the publication, in October, of the first European Red List for Hoverflies, a collaborative effort involving the IUCN, the European Commission plus international *Syrphidae* experts and conservation groups.

Although no species recorded at Cruachan Power Station is affected by the new Red List designations, the project has highlighted that almost a third (32%) of the 890 European hoverfly species assessed are at risk of extinction.

Woodland species, whose larvae feed on bulbs and roots – or those that feed on living plants – are particularly vulnerable. For instance, the report highlights the danger of habitat fragmentation to *Portevinia maculata*, a specialist hoverfly that uses Ramsons *Allium ursinum* as its larval host and which could potentially occur at Cruachan.





The bumblebee mimic *Volucella bombylans* (main picture) was found for the first time since 2014 and (from top) *Episyrrhus balteatus*, *Eupeodes corollae* and female *Syrphus ribesii*



10.5.1.1 SYSTEMATIC LIST

Melanostoma scalare

This was the only species recorded on three survey dates. There was a spring record (18/5) of two on dandelion at the contractors' compound but the others were towards the end of the survey, with a male at the site office gardens on 21/7 and four at Devil's-bit Scabious at the reservoir access road on 14/9.

Melanostoma mellinum

Two were among a throng of hoverflies visiting Devil's-bit Scabious at the reservoir access road on 14/9.

Platycheirus albimanus

A single was at the reservoir access road on 3/6 and 30/6 with another at the same site on 14/9. A poor performance for this very common and abundant species.

Episyrrhus balteatus

There was no large-scale summer emergence and numbers were very low. Two were at the reservoir access road on 18/5, visiting yellow composites, with another at the visitor centre gardens on 30/6.

Megasyrphus erraticus

A new species for the survey, a female stood out at the reservoir access road on 14/9 by its large size. Like many other species, it was visiting the enormous nectar source provided by Devil's-bit Scabious.

Epistrophe grossularae

A male fed at the remaining Common Hogweed *Heracleum sphondylium* flowers at the contractors' compound on 14/9.

Syrphus ribesii

Two females visiting Devil's-bit Scabious, on 14/9, were netted and inspected under a hand lens to confirm their identity as this common hoverfly.

Eupeodes corollae

Two males were present at the reservoir access road on 30/6, one of the few species seen on the date. First records since 2018.

Meliscaeva cinctella

A typical autumn sighting, a male was at Devil's-bit Scabious at the east end of the reservoir access road on 14/9.

Eristalis pertinax

The most abundant species in this year's survey although most sightings were confined to an autumn peak. Two were at blackberry blossom on 30/6, at the east end of the reservoir access road, then 14/9 brought a day-count of 23. These included 16, mostly at Devil's-bit Scabious at the reservoir road plus four at the visitor centre gardens and three at the contractors' compound on Common Knapweed.

Eristalis tenax

Four were counted on Common Hogweed and Devil's-bit Scabious at the contractors' compound on 14/9. It is interesting that none was observed elsewhere at the survey areas on the date and it may hint at a local emergence.

Eristalius intricaria

A pair was recorded on 18/5 at the reservoir access road, with the male hovering above the female in its distinctive display flight.

Eristalis arbustorum

One was present on 14/9 among the dozens of other Eristalines visiting Devil's-bit Scabious at the east end of the reservoir road.

Cheilosia antiqua

A male was collected on 18/5 at the contractors' compound and later identified under the microscope. This species associated with Common Primrose *Primula vulgaris* and was last found at Cruachan in the 2012 and 2014 surveys.

Cheilosia pagana

A female, with its large orange antennae, was found on buttercup *Ranunculus* at the reservoir access road on 30/6.

Paragus cf haemorrhous

A female was collected on 2/6 from Tormentil beside the mid section of the reservoir access road, near the new access gate, and later examined under the microscope. Although females cannot be identified from other members of its tribe, *haemorrhous* is the only species found in Scotland.

Sericomyia silentis

All records were from the lower, east end of the reservoir access road. One was seen on 30/6, associating with blackberry blossom. Then, on 14/9, a total of 10 were recorded at Devil's-bit Scabious.



Eristalis intricaria



Eristalis tenax



Cheilosia antiqua



Sericomyia silentis



Volucella pellucens



Xylota jakutorum

Volucella pellucens

The first survey records since 2016 involved four at the east end of the reservoir access road on 30/6, all nectaring at blackberry blossom at the road side.

Volucella bombylans

This impressive bumblebee mimic was found for the first time since 2014 when a male was seen resting on grasses at the east end of the reservoir access road (30/6).

Xylota segnisi

This common species is frequently seen in the survey at lowland sites. In 2022, five were seen at the reservoir access road on 30/6 with two on oak at the visitor centre wildflower meadow on 14/9.

Xylota jakutorum

This formerly Nationally Scarce species was one of the few hoverflies recorded on 2/6, an adult feeding at buttercup beside the reservoir access road.

10.5.2 DIPTERA (ALL OTHER SPECIES)

***Bibio pomonae* (Bibionidae)**

A female was recorded on 30/6, clinging to grasses at the lower east end of the reservoir access road – the fourth consecutive year this Bibionid has been recorded.

***Sciara hemerobioides* (Sciariidae)**

The first record since 2016 involved two on 21/7, seen on Common Hogweed at the contractors' compound.

***Tipula lateralis* (Tipulidae)**

The second site record, after one in 2018, was found on 18/5 – a single perched on the wall of the visitor centre. This is a wetland species, found near running water where its semi-aquatic larvae feed on decaying plants in stream beds.

***Tipula oleracea* (Tipulidae)**

A common spring species, there were multiple records on 30/6 involving four at the east end of the reservoir access road, two at the visitor centre gardens and one at the contractors' compound.

***Tipula paludosa* (Tipulidae)**

The only sighting, on 14/9, was of a single in rushy vegetation near the quarry beside the reservoir access road.

***Neomyia cornicna* (Muscidae)**

The second Cruachan sighting came on 18/5, when two were at buttercups at the site offices and contractors' compound. The previous record was in 2017.

***Noon Fly Mesembrina meridiana* (Muscidae)**

A new species for the survey, the boldly-marked black-and-orange fly was at the contractors' compound on 14/9. While a common and widespread Muscid, its larvae are reared in cow dung so it could be considered an unexpected species for the site.

***Yellow Dung-fly Scathophaga stercoraria* (Scathophagidae)**

Low numbers were recorded on most survey visits. Peak counts involved four at willow catkins beside the reservoir road on 18/5, five at Common Hogweed at the visitor centre and contractors' compound on 1/7 and three at the contractors' compound on 14/9.

***Gymnocheta viridis* (Tachinidae)**

Two of these shiny green Tachinids were perched on birch trees at the reservoir access road on 18/5, with a single at the contractors' compound the same day – the first site records since 2018.

***Dexiosoma caninum* (Tachinidae)**

This woodland Tachinid has now been found in five out of the last six survey years, with five counted on oak at the contractors' compound (21/7).

10.5.3 POLLINATORS IN TROUBLE: TWO NEW REPORTS

Recent Cruachan Power Station biodiversity reports have highlighted declines in the abundance and diversity of pollinating insects recorded by the Blue Leaf surveyor.

Two new reports have highlighted that the reduction in occupancy of bees and wasps is happening on a national scale and puts the local decline into greater context.

In December 2022, the JNCC published its update on a suite of biodiversity indicators, including pollinating insects (Indicator D1c), on behalf of the UK Government.

This indicator tracks changes in pollinator distribution in the UK based on the occurrence of 154 species of bee and 235 species of hoverfly. It measures changes in the number of 1km grid squares across the UK in which the species are recorded annually – the 'occupancy index'.

There has been an overall decline in the pollinator index since 1987. By 2019, the indicator had reduced by 21% compared to its value in 1980 while the change between 2014 and 2019 was a decrease of 6%.

Almost half (48%) of the monitored species are declining, with a third (33%) suffering a strong decline, while 27% are increasing in their occupancy.

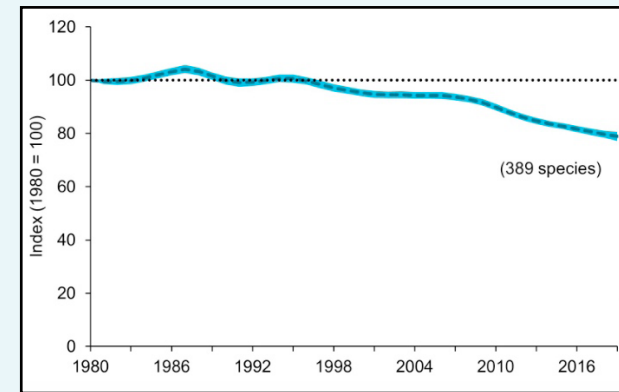
This is concerning because as individual species become less widespread, and communities become less diverse, it has implications for pollination, as more diverse communities are, in broad terms, more effective in pollinating a wider range of crops and wild flowers.

The wild bee index, which includes 154 species, continues to fluctuate but, in 2019, it was estimated to be 2% higher than in 1980.

The hoverfly index of 235 species hit its peak in 1987 (108% compared to its 1980 value) then underwent a progressive decline. It is now 33% lower than in 1980.

Most hoverflies have declined in both the long and short term: down 47% (1980 to 2019) and 54% (2014 to 2019) and only 13% have increased in the long term. It is not clear why hoverflies show a different trend to bees, although differences in the life cycle mean they respond differently to weather events and habitat change. Loss of

GRAPH 5: TRENDS IN DISTRIBUTION OF UK POLLINATORS 1980 TO 2019 (SOURCE: UK BIODIVERSITY INDICATORS, JNCC 2022)



foraging habitat is considered a major driver of change in pollinator distribution while pesticide use has been shown to have an effect on insect behaviour and survival. Weather effects, particularly wet periods in the spring and summer, are also likely to have had an impact.

The report's authors recommend further research to help better policy makers' understanding of the relative importance of these potential drivers of change.

Meanwhile, a new study by Buglife, the invertebrate conservation charity, has identified a 64% decline between 2004 and 2022 in the numbers of insects sampled by volunteer citizen scientists.

The The Bugs Matter Survey, also released in December 2022, which looked at the number of insects strikes on vehicle journeys, showed the decline was not as marked in Scotland – a reduction of 40% in the period.

Andrew Whitehouse, Head of Operations at Buglife, said: "For the second year running, our survey has shown potentially catastrophic declines in the abundance of flying insects. Urgent action is required to address the loss of the diversity and abundance of insect life."

10.6 HYMENOPTERA (ANTS, WASPS AND BEES)

Twelve species of bee and wasp were recorded in the 2022 survey, a marked reduction from 18 species in 2021 but similar to the total in 2018. No new species were recorded although Chocolate Mining Bee *Andrena scotica* was found at Cruachan for the second time.

10.6.1 SYSTEMATIC LIST

Red Wasp *Vespula rufa* (Vespidae)

A female was recorded “girdling” – chewing up wood with which to construct its nest – on a wooden fencepost at the reservoir access road on 2/6. This is the first confirmed breeding of Red Wasp, which has been recorded in four survey years since 2015.

Common Wasp *Vespula vulgaris* (Vespidae)

Uncommon in this year’s survey, one was recorded in spring at the visitor centre (18/5) then four late individuals were at Buddleia at the visitor centre on 14/9.

Chocolate Mining Bee *Andrena scotica* (Andrenidae)

Two females were recorded at a flowering shrub at the site offices on 18/5, the second record for the survey after this first sighting in 2021.

Early Mining Bee *Andrena haemorrhoa* (Andrenidae)

A female was found nectaring on dandelion at the east end of the reservoir access road. This is regular early-spring mining bee, recorded in six previous surveys.

Common Furrow Bee

***Lasioglossum calceatum* (Halictidae)**

This species has been now been recorded in six consecutive years at the reservoir access road and nesting was confirmed on 30/6 at the road embankment (NN1057326380), near the shepherd’s cottage, with females visiting at least five nesting holes. Two adults were collected nearby the same day to confirm identification.

Marsham’s Nomad Bee *Nomada marshamella* (Apidae)

This cuckoo-bee species has become more regular in recent years and two females were found on 2/6, inspecting the sloping sides of the road embankment, at the east end of the reservoir access road, for solitary bee nests to exploit.



Red Wasp



Marsham’s Nomad Bee



Lasioglossum cf. calceatum on buttercup at the reservoir road and (below from left) *Andrena scotica* and *Bombus pratorum*



Western Honey-bee *Apis mellifera* (Apidae)

All records were confined to June at the lower section of the reservoir access road. On 2/6, two queens were recorded at Red Raspberry *Rubus idaeus* blossom then, on 30/6, three workers were seen, mainly nectaring at dandelion.

White-tailed Bumblebee agg *Bombus lucorum* agg

Individuals of this species’ complex were regularly seen in the survey but in rather low numbers. The first four queens were nectaring at willow *Salix* catkins at the reservoir access road on 18/5, with another queen seen here on 2/6. Workers had emerged by 2/6, with three visiting yellow composites at the reservoir road. The final record was of two at Devil’s-bit Scabious on 14/9, at the contractors’ compound.

Common Carder Bee *Bombus pascuorum* (Bombidae)

The most abundant bumblebee in this year’s survey, there were records from May until a peak in mid-September. The first seven were recorded on 18/5, visiting willow catkins and Common Lousewort *Pedicularis sylvatica* at the east end of the reservoir road with another queen at the contractors’ compound. More were seen on 2/6, with five at the dam road at Bird’s-foot Trefoil *Lotus corniculatus* and Red Raspberry. Six workers were seen on 30/6, at yellow composites at the reservoir road where there were 14 on 14/9 (at Devil’s-bit Scabious) with four the same day at the contractors’ compound.

Early Bumblebee *Bombus pratorum* (Bombidae)

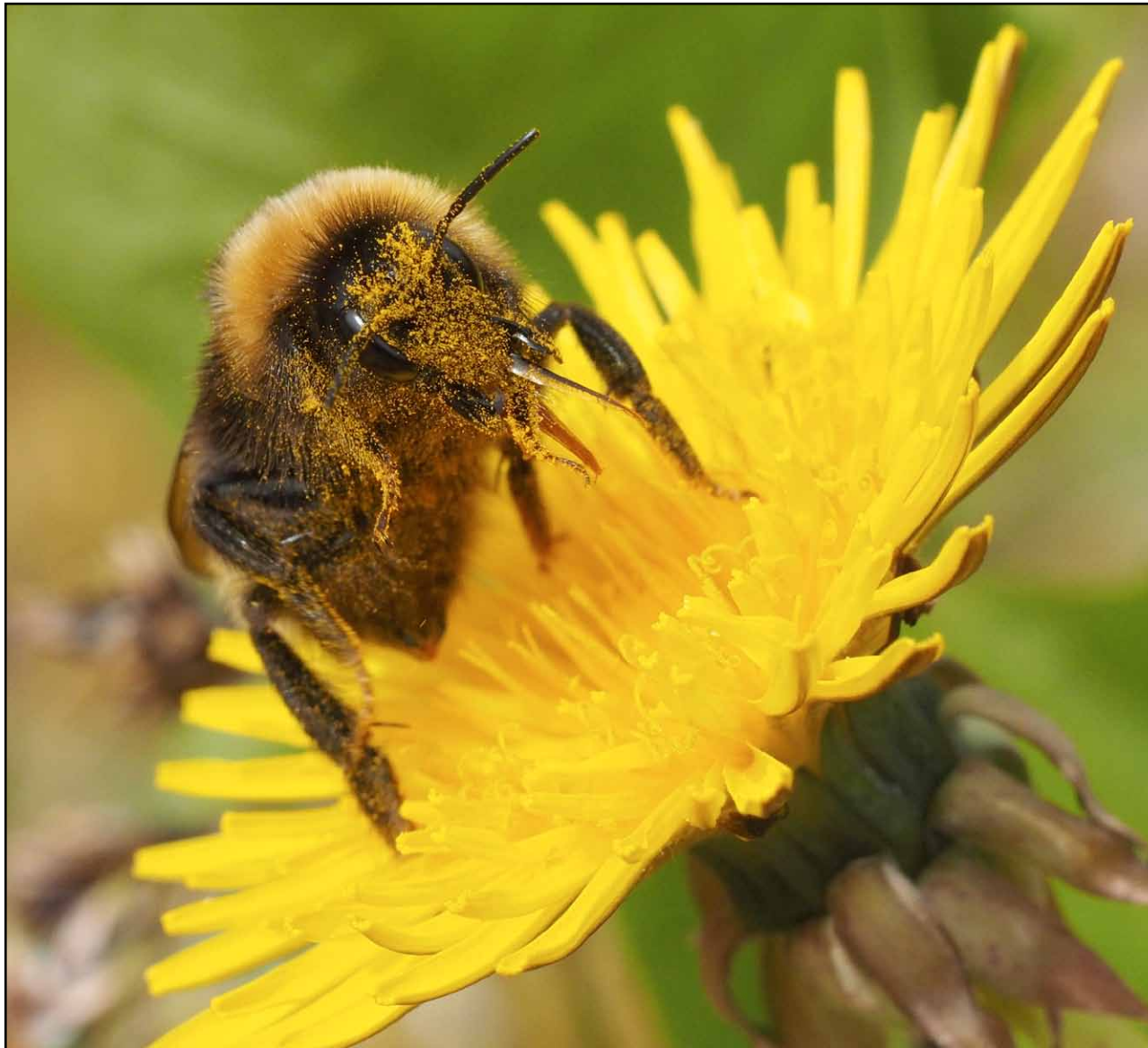
Four were found on 2/6, visiting Red Raspberry along with other bumblebees on the margins of the reservoir access road. There were no late summer records.

Small Garden Bumblebee *Bombus hortorum* (Bombidae)

There was a single record on 30/6, of a queen visiting blackberry blossom on the road verge at the entrance to the contractors’ compound.

Forest Cuckoo Bumblebee *Bombus sylvestris* (Bombidae)

The first sighting since 2017 was a single on 2/6, visiting dandelion at the visitor centre gardens. This is the fourth record for the power station.



The face of this Forest Cuckoo Bumblebee is covered in pollen after visiting dandelion flowers at the reservoir access road

10.6.2 SAWFLY RED LIST

During the year, a new report examined the national threat status of more than 110 species of British sawflies. The *Review of the Status of the Sawflies of Great Britain Part 1* (Musgrove 2022) examined the latest data and trends of families other than the *Tenthredinidae* and compare these to IUCN criteria.

Although none of the various sawfly species recorded so far at Cruachan appear on the new Red List, the report gives a clearer picture of their national status for the first time.

Two of the larger Cimbicid sawflies found in 2021 have been assessed. The Scabious Sawfly *Abia candens*, found as a larva at the reservoir access road, was downgraded in the review – from Near Threatened to Least Concern.

While it continues to have a local distribution, mainly in western areas, it has been found in 68 hectads since 1990 and no longer meets IUCN extinction-risk criteria.

The second species in 2021, considered likely to be *Trichiosoma lucorum*, was recorded as an adult at the reservoir access road.

T.lucorum is one of four *Trichiosoma* species now considered Data Deficient in the review, on the basis of taxonomic uncertainty surrounding the family – specifically anomalies in the various keys used to identify retained specimens to species level.

A further two species recorded at Cruachan are listed as Least Concern in the review: the Blotch-winged Honeysuckle Sawfly *Abia fasciata* (recorded at the contractors' compound in 2015) and the Greater Horntail *Urocerus gigas* (seen at the reservoir access road in 2014).



11.0 ASSESSING THE VALUE OF THE RECORDS

Blue Leaf has examined available biodiversity record databases in an attempt to put into a local and regional context, the species found at Cruachan Power Station during the 2022 survey.

Argyll's freshwater and upland areas have long been recognised as important landscapes and special habitats while the region is the last stronghold for its Atlantic Rainforest with its special biodiversity interest.

The region has a small cohort of professional and non-vocational biodiversity recorders, many of whom will submit records to recording schemes to improve the scientific knowledge of species in the area and further afield.

Many other records have been generated by condition assessment of the region's SSSIs, such as Coille Leitire woodland SSSI near the power station and reservoir.

There is a number of ways to access this information but the main routes used by Blue Leaf have been the NBN Atlas database, atlases of species' occurrence and datasets held by recording schemes.

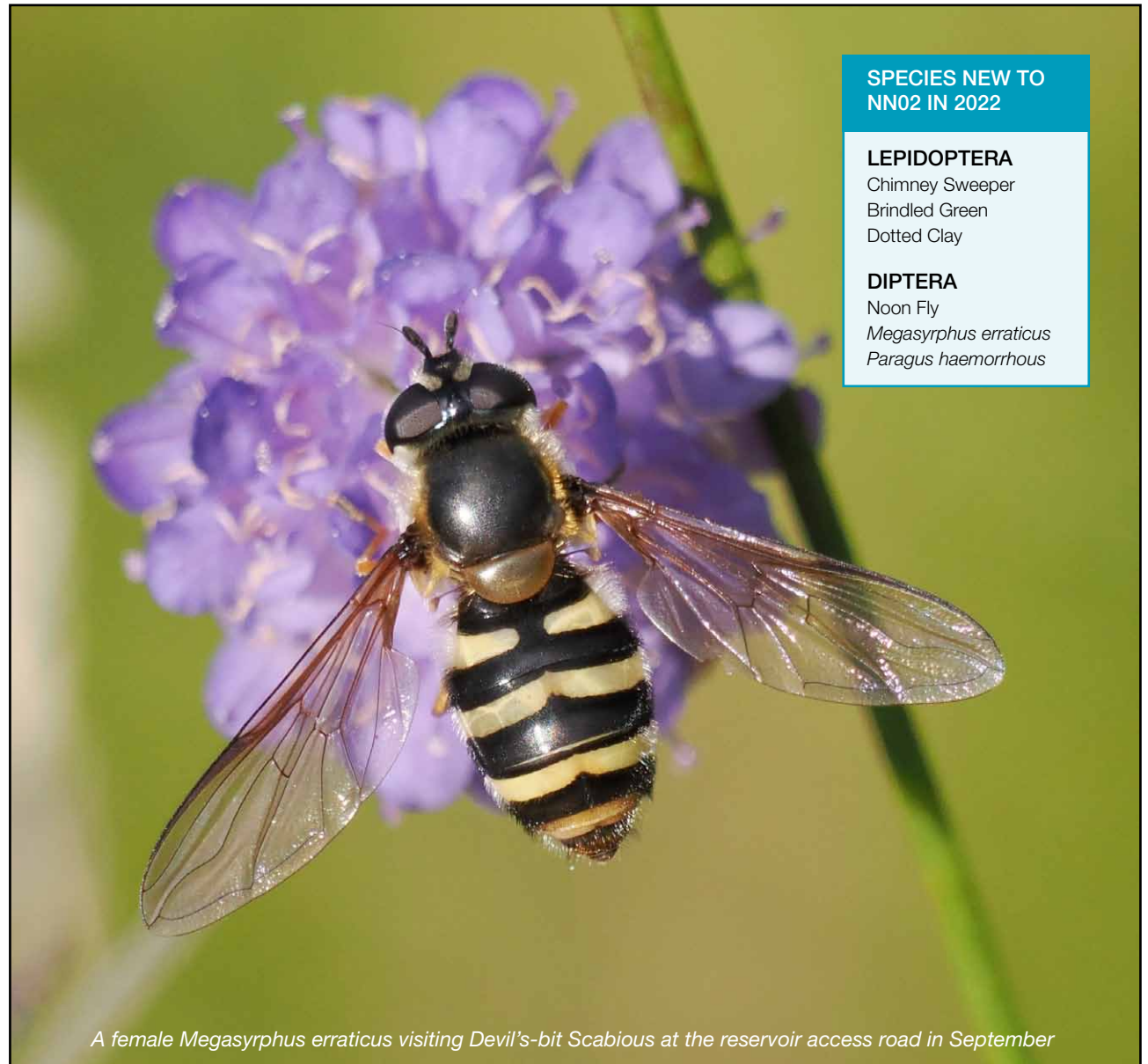
11.1 NATIONAL BIODIVERSITY NETWORK

Records obtained during fieldwork in 2022 were compared with available information on past sightings in the Cruachan area using the resources of the National Biodiversity Network (NBN) and other publicly-accessible datasets.

NBN is a charity established to provide a more joined-up approach to biological recording in the UK. The NBN is a partnership of UK conservation and wildlife groups, Government and central authorities, environmental agencies, biological record centres and many voluntary groups, such as bird clubs and natural history societies.

The NBN collates all available data on UK species and enters individual records on to a national database, the NBN Atlas, to produce maps of national occurrence for birds, mammals, insects, plants etc.

Almost 209 million individual records had been processed in this way by December 2022, making the NBN Atlas a valuable tool for researchers. The standard of recording varies dramatically, however, across the taxonomic



families. Birds, mammals and vascular plants tend to be well recorded while information for other taxa, including many invertebrate families, is deficient.

There are far fewer recorders studying true-flies, solitary wasps, beetles and bugs, than there is for people counting birds or watching butterflies. There is also a lack of accessible reference material for many invertebrate groups – all of which combines to put off casual observer from trying to tackle ‘difficult’ families.

The NBN Atlas dataset is only as good as the quality of data being inputted and it can take a considerable period for the online maps to be updated, especially for the more obscure species’ groups. The absence of a record is therefore not confirmation that a species is not present or has not been recorded at a particular site.

11.2 CRUACHAN AND THE NBN

Cruachan Power Station is located in the 100km square denoted by the prefix ‘NN’ which is subdivided into a hundred units measuring 10km² (a hectad).

The Site Offices, Visitor Centre, Cruachan Reservoir and much of the Reservoir Access Road are located in the 10km square NN02. Cruachan’s landholding is located at the north of the hectad. As the data is displayed on a hectad basis, the NBN Atlas’ records may not necessarily relate to Cruachan Power Station but do indicate a presence (or lack of it) in the general area.

A species search using NBN Atlas identified that a total of 2456 species have been recorded within a 5km radius of the station’s Site Offices – 913 animals, 1087 plants and 452 species of fungi. Of the animals, 126 species are birds, with 21 mammals and 650 types of insects. Many of these records have been contributed to recording societies as a result of past survey work at Cruachan Power Station.

11.3 COMPARISON WITH NNO2 DATASET

A total of eight species, were recorded by Blue Leaf Nature for the first time at Cruachan Power Station in 2022. These involved one beetle, four moths and three true-flies.

In addition, two species of macro-moth, Chimney Sweeper and Speckled Yellow, were recorded for the first



Mesembrina meridiana, a new species for hectad NN02

time at the reservoir access road but which had previously only been recorded at Cruachan Substation, which is located in the neighbouring hectad (NN12) to the east.

These species were examined against the NBN Atlas database and other sources to determine their past occurrences locally (in NN02) and their status nationally.

As a result, six species have apparently not previously been recorded in the hectad. These include three macro-moths and three species of true-fly. Since the survey started at Cruachan in 2009, a total of 294 species, apparently new to NN02, have been recorded by Blue Leaf.

11.3.1 COLEOPTERA (BEETLES)

There is a single previous record of Violet Oil Beetle from NN02 near Cladich, on the banks of Loch Awe south of the station, from June 2010. It is not uncommon in the wider Argyll area, however, with a total of 43 NBN Atlas records, particularly in the south of the region and on offshore islands.

11.3.2 DIPTERA (TRUE FLIES)

The Noon Fly *Mesembrina meridiana* is a common and widespread Muscid fly but the Cruachan record in 2022 is

apparently the first sighting for NN02. A large and distinctive species, it has been recorded in six Argyll Mainland hectads including NN03, the neighbouring square to the north, where there have been nine sightings beside the River Awe, east of Taynuilt, often individuals perched on tree trunks.

However, there is currently no formal recording scheme for Muscid flies therefore its coverage in the NBN Atlas will not be comprehensive. Most of the 28 Argyll records included in the Atlas have been supplied by the local recording centre, Argyll Biological Records Database, and there is no reason to suspect it is not common throughout Argyll.

The hoverfly *Megasyrphus erraticus*, on the other hand, appears to be a genuine rarity. According to NBN, it has been found in only six hectads in Scotland – although this picture is out of date as the Hoverfly Recording Scheme has not submitted its data to the NBN for many years.

The *Atlas of Hoverflies of Great Britain* (Ball and Morris 2011), although now 11 years old, is perhaps a more useful guide to this species’ status. It highlights 36 Scottish hectads with records of *Megasyrphus*, mostly in Speyside, Invernesshire and Aberdeenshire. There are apparently no records for the west coast, including Argyll or its islands.

Although it can be identified in the field, *Megasyrphus* requires an element of taxonomic knowledge as it is easily confused with the much more common hoverflies of the *Syrphus* genus, all of which also occur at Cruachan.

Megasyrphus is highlighted as “Nationally Scarce” in the Red List for UK *Syrphidae* and, while its national frequency of occurrence can vary annually, the Hoverfly Recording Scheme state it has experienced a significant downward

TABLE 8: SPECIES OF TRUE-FLIES AT CRUACHAN NEW FOR NN02 AND LEVELS OF OCCURRENCE AT NATIONAL LEVEL

DIPTERA SPECIES NEW TO NN02	ATLAS RECORDS FOR ARGYLL MAINLAND	SCOTTISH STATUS AND RECORDS
Noon Fly	Six Argyll OHs, nearest at River Awe (2020)	431 Scottish records. Common + widespread
<i>Megasyrphus erraticus</i>	Nil Argyll OHs, nearest Pitlochry (2019)	36 Scottish OHs (2011) Nationally Scarce
<i>Paragus haemorrhous</i>	Nil Argyll OHs, nearest River Tummell (2019)	45 Scottish OHs (2011) most from Highland

trend in sightings in the space of the past 35 years.

Paragus haemorrhous is considered to be a common species – but easily overlooked due to its small size and inconspicuous habits. There is a concentration of Scottish records from Invernesshire and Speyside, where there a number of active Diptera recorders, but no known previous records from Argyll.

Interestingly, the closest records to Cruachan of both hoverflies were from Pitlochry area in 2019 – both was found by experts from the Dipterists Forum while taking part in a summer fieldwork meeting. It would seem logical that a lack of taxonomic expertise, particularly in more remote areas of Scotland, may limit the number of records generated.

11.3.3 MOTHS

There are previous NN02 records for Burnished Brass (three records, most recent Struan House 2019) and Bright-line Brown-eye (one record, also Struan House 2019). Both are described as common in VC98 (Hill 2022),

Dotted Clay is also a common Argyll species but the Cruachan record appears, surprisingly, to be the first for NN02. It has, however, been found in three adjacent hectads to NN02 with close sightings near Kilchurn Castle (2016) and Glen Nant (1973).

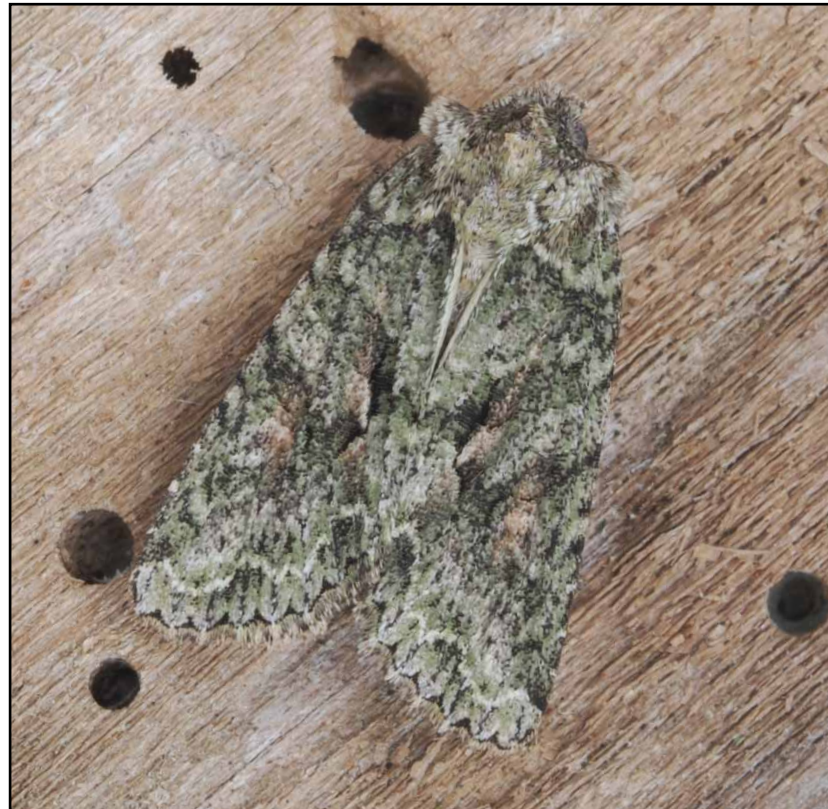
Brindled Green seems to be a fairly local moth, found in only six Argyll hectads, with its distribution likely constrained by its need for high-quality oakwood habitat, such as that found at Coille Leitire SSSI woodland.

Certainly, it can be locally abundant – with 60 records from sites on the banks of Loch Creran (NM94) between 1980 and 2021. The nearest sighting to Cruachan, however, was a single record at NM93, south of Connel, in 1978.

The Cruachan record of Brindled Green (on 20/7) is one of the earliest ever Scottish sightings of this species. This is a single generation macro-moth that usually emerges in mid August and peaks in numbers in September.

The Rothamsted permanent moth trap at Loch Lomond has found Brindled Green to be common but its earliest emergence (between 1968 and 2005) was 13/8 (Knowler 2008) – almost a month later than the Cruachan individual.

Chimney Sweeper is a common and widespread species found in 23 hectads in Argyll Mainland – however, there have



Three moth species apparently new to NN02 Brindled Green (main image), Chimney Sweeper (top) and Dotted Clay (above)

been no previous reports from NN02. The nearest sighting was from the hamlet of Stronmilchan (NN03) in 2010 and it was recorded nearby by Blue Leaf at Cruachan Substation in 2012 (a record not captured by NBN).

Speckled Yellow is less common locally, found in 11 Argyll hectads, but there is a NN02 sighting from the Coille Leitire woodland, north of the power station, in May 2014.

Both these moths are found in similar grassland habitat, are easily identified and fly by day – therefore, there can be a high degree of confidence that their status at local and national level is well reported.

TABLE 9: SPECIES OF MACRO-MOTHS AT CRUACHAN NEW FOR NN02 AND LEVELS OF OCCURRENCE AT NATIONAL LEVEL

MOTH SPECIES NEW TO NN02	ATLAS RECORDS FOR ARGYLL MAINLAND	SCOTTISH STATUS AND RECORDS
Chimney Sweeper	23 Argyll OHs, nearest at Stronmilchan (2012)	1936 Scottish records. Common + widespread
Brindled Green	Six Argyll OHs, nearest near Connel (1978)	577 Scottish records. Local but widespread
Dotted Clay	21 Argyll OHs, nearest nr Kilchurn Cstle (2016)	9877 Scottish records. Common + widespread

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***On the cover:** The Nationally Scarce Violet Oil-beetle was recorded for the first time at Cruachan in 2022. Top right, male European Stonechat. Bottom right, Wood Mouse*