

Cruachan Power Station Biodiversity Survey 2021



TABLE OF CONTENTS

1.0 Executive Summary	3
2.0 Introduction	5
3.0 Biodiversity Policy	5
Nature Designated Sites	5
Priority Habitats & Species	6
Role of the JNCC/Red Lists	6
Wildlife & Countryside Act	6
4.0 Methodology	7
5.0 The Survey Sites	9
Cruachan Reservoir	9
South of the Dam Wall	10
Penthouse Pond	10
Reservoir Access Road	11
Site Offices & Visitor Centre	11
6.0 Weather in 2021	12
7.0 Breeding Bird Survey	13
Birds of Conservation Concern 5	13
IUCN Regional/European List	16
Systematic List	17
Discussion	24
8.0 Reptiles and Amphibians	25
9.0 Mammals	26
10.0 Invertebrates	27
Odonata	27
Hemiptera/Coleoptera	30
Lepidoptera (Moths)	32
Lepidoptera (Butterflies)	43
Diptera	47
Hymenoptera	51
11.0 Assessing the value of records	55
Species new to NN02	56
Comparison with national datasets	57

Produced by David Fotheringham, Blue Leaf Nature,
for Drax Generation Enterprise Ltd, December 2021



Looking west towards the peak of Ben Lui from the reservoir access road, with the Coille Leitire and Loch Awe in the foreground

1.0 EXECUTIVE SUMMARY

Welcome to the 11th Biodiversity Survey Report prepared for 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 2021, Blue Leaf's surveyor visited Cruachan on nine days to carry out a Breeding Bird Survey (BBS), conduct a series of moth-trapping sessions on four nights and continue to monitor insects and other species.

1.1 BREEDING BIRD SURVEY

■ A total of 53 species of birds were recorded at Cruachan in 2021. All of these are common and widespread in Argyll and Scotland, associated with woodland, upland and waterside habitats.

■ Of the 53 species recorded, 26 (49%) were Confirmed (C) as having nested. A further 10 (19%) species Probably Nested (PR) and nine (17%) were considered to have Possibly Nested (PO). The remaining eight (15%) species were not thought to be breeding in 2021 – they were seen outwith the nesting season or flying over the survey areas.

■ Nine of the species recorded are on the Red List of birds of highest conservation concern in the UK. In addition, 18 Amber List species of medium conservation concern were recorded along with 26 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 having bred in the 2021 survey. In addition, the Green-listed Common Raven was confirmed as having nested for the first time at Cruachan while Red-breasted Merganser was elevated to Possible Breeding.



Chequered Skipper was found for the first time at Cruachan

■ It was a mixed nesting season for many species with record low numbers of Northern Wheatear and Winter Wren and low breeding productivity of Blue Tit and Meadow Pipit. In contrast, the Red-listed Twite enjoyed an exceptional season in upland Cruachan.

■ The 2021 report discusses the implications of *Birds of Conservation Concern 5*, the *Regional IUCN Red List* assessment and the *European Red List* review and how they affect the conservation status of Cruachan's birds.

1.2 MAMMAL REPORT

■ It proved an exciting year for sightings of large mammals with the addition of Eurasian Badger to the Cruachan site list while Red Squirrel and Red Fox were both seen using the station's landholdings for the first time. Six species of mammal were recorded in 2021, with European Otter and Pine Marten also present at the station.

■ The 2021 report discusses a new biometric survey project that identified "high concern" over species such as Weasel, Bank Vole, Field Vole and Common Shrew, all of which have been recorded at Cruachan Power Station.

1.3 INVERTEBRATE SURVEY

■ A total of 150 species of insects were recorded during fieldwork at Cruachan in 2021. These include 78 species

of macro-moth; 26 true-flies; 16 sawflies, bees and wasps; 12 beetles; 11 butterflies; five dragonflies; and two types of bug. This compares to 179 species recorded in 2018, 160 in 2017 and 145 in 2016.

■ The report discusses *The State of Dragonflies 2021*, released by the British Dragonfly Society, which describes the 50-year population trends of many *Odonata* species in Britain and Ireland. It highlights that five of the six species that have shown the greatest decreases in national occupancy are species that occur at Cruachan.

■ Four moth-trapping sessions were held that resulted in 271 moths of 78 species being identified. These included 22 species (28%), that were recorded for the first time at the station's landholdings. This increases to 179 the total number of different moth species for Cruachan.

■ The report discusses *The State of Britain's Larger Moths* (Butterfly Conservation 2021). The new report highlights the continuing decline of Britain's moth fauna, with four times as many moth species decreasing in abundance as those increasing their population. Among those struggling are a number of montane species found at Cruachan.

■ A total of 23 moths that are included on the Red and Amber Data Lists have now been recorded at Cruachan with the addition of one Red List moth – Dark-barred Twin-spot Carpet – and five Amber List moths in 2021.

■ Butterfly Conservation's UK Conservation Strategy for 2025 is discussed along with the charity's plans for the creation of a High Priority Landscape for butterflies and moths in Argyll, including Cruachan area, and its priorities for conservation of species found at the power station.

■ Eleven butterfly species were recorded in 2021 including two new for the survey: an Endangered species, Chequered Skipper, and the common and widespread Small Copper.

■ A total of 26 species of true-flies were recorded along with 16 species of sawflies, wasps and bees – but it proved a disappointing year with low numbers of insects present.

■ Nine insect species recorded are apparently new to Cruachan's 10km² hectad NN02. These include one beetle, three macro-moths, three crane-flies, a sawfly and a mining bee. Since the survey started at Cruachan in 2009, a total of 288 species, apparently new to NN02, have been recorded by Blue Leaf at the power station's landholdings.



Masses of Yellow Saxifrage, a rocky outcrop specialist, on road margins at Cruachan Reservoir

2.0 INTRODUCTION

Welcome to the 11th Cruachan Power Station biodiversity survey report by Blue Leaf Nature.

This detailed account is based on nine fieldwork visits carried out in 2021 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.

Blue Leaf returned to Cruachan in 2021 after a two-year absence. 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 2021 is also explored.



The Coille Leitire SSSI is home to several important species such as the SBL-listed butterfly Small Pearl-bordered Fritillary

3.0 ECOLOGICAL CONTEXT

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 are selected 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*.

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 1m 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.

The SSSI's management statement also highlights the beneficial impact of the powerline wayleaves associated with Cruachan, adding: "The electricity company periodically removes encroaching scrub from wayleaves. This practice is not detrimental but [creates] ideal 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 LOCH ETIVE AND GLEN FYNE SPA

Meanwhile, the Loch 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.

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 List (SBL) strategy was first published in 2004 as Scotland's response to its obligations under the Convention of Biological Diversity and the UK BAP. The strategy, last updated in 2009, 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 SBL 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.



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. A meeting was held in June 2021 with 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 2021. 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 2021.

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 three 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.

4.2.2 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

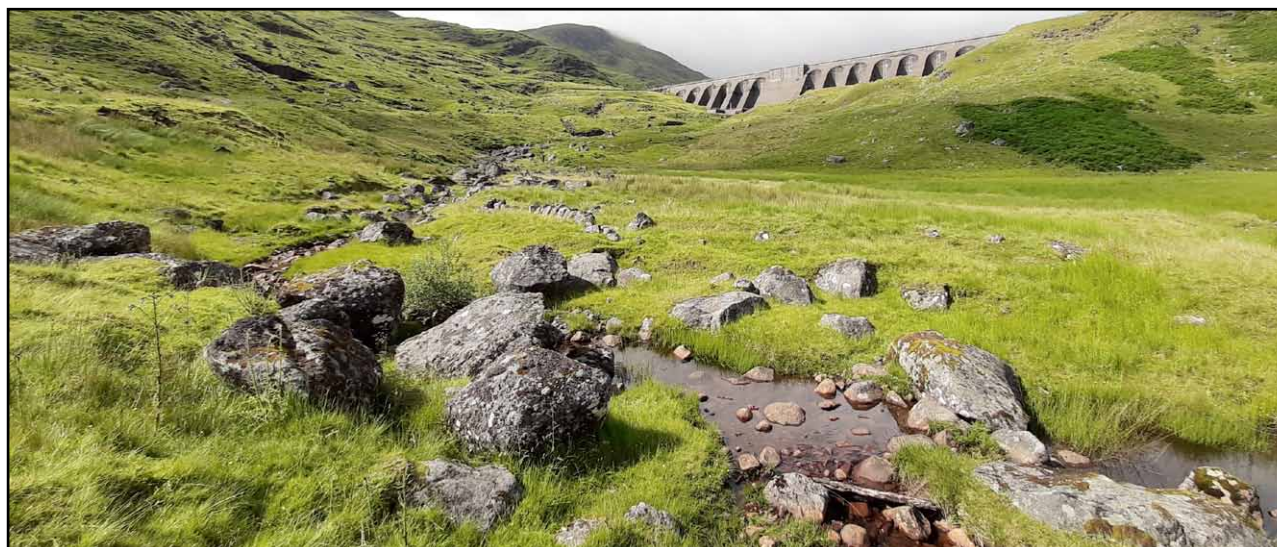
A range of methodologies was employed to survey invertebrates at Cruachan. These follow guidance in the Natural England report NERR005 'Surveying terrestrial and freshwater invertebrates for conservation evaluation' (Drake, C.M et al 2007).

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



The "Cruachan Bowl", south of the dam, is bisected by the Allt Cruachan burn, with areas of acid grassland and mire vegetation

collected and retained for laboratory investigation. Only 12 specimens were collected in 2021 with a resulting time-saving, both in the field and in microscopy work.

Blue Leaf carried out moth trapping on four nights at Cruachan Visitor Centre, Cruachan Reservoir and the

reservoir access road, 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.

TABLE 1: FIELDWORK DATES AT CRUACHAN 2021

DATE	TIME	WEATHER CONDITIONS
17 May	1600-0000	11°C, light SE wind, overcast, after rain in morning
18 May	0000-1130	10°C, light S wind, mostly cloud, occasional showers
31 May	0830-1600	9-17°C, light SE wind, mostly cloudy after bright start
17 Jun	1500-0000	16°C, light WSW wind, fair and sunny spells
18 Jun	0000-1430	6-15°C, light W wind, bright start, cloudy from noon
13 Jul	1400-0000	17°C, still but WSW wind afternoon, mostly cloudy
14 Jul	0000-1630	12-17°C, light W wind, foggy start then mostly cloud
23 Aug	1800-0000	18°C, variable winds, foggy start clearing from 1100
24 Aug	0000-1530	13-19°C, largely still, partly cloud then fair from 1000

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 six visits and it is likely that some species could have been overlooked.

The weather in 2021 was remarkable for its dry April, wet May and unsettled spring and summer that would have had an effect on the species present during fieldwork visits. The implications for wildlife at Cruachan are examined in a weather summary on page 13.



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.

This area was not adequately surveyed in between May and late July 2021, as an extensive area of land was being used by a film crew, and their apparatus, involved in the production of a new television series. The area is dominated by semi-improved acid grassland, with Sharp-flowered Rush *Juncus acutiflorus* rush mire 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 a small colony of



The Penthouse Pond, south of Cruachan Reservoir, provides conditions for eight species of dragonfly and a colony of newts

Palmate Newt *Lissotriton helveticus* is an indicator of excellent water quality. The Pond is also the key 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.

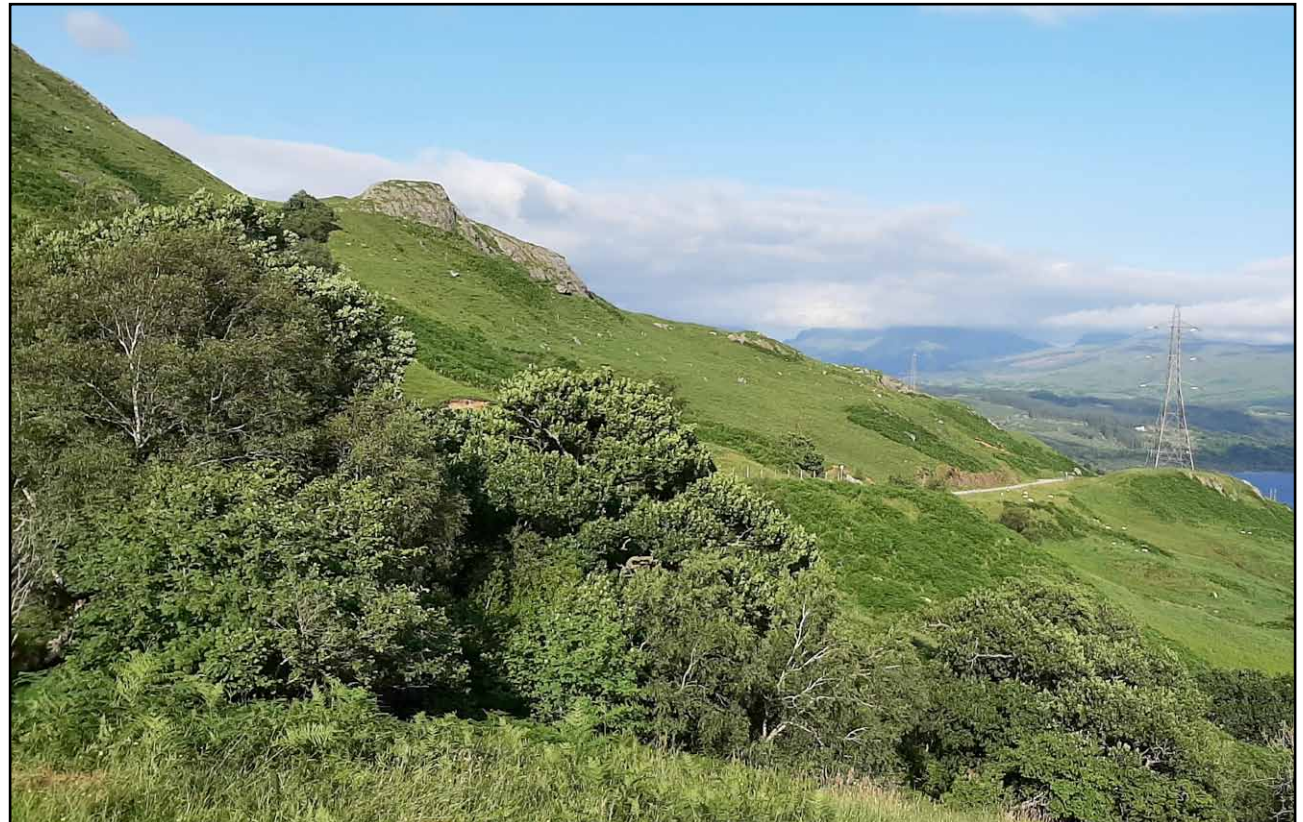
Drax own both the road and its immediate margins and maintenance has been carried out in recent years both to cut back where vegetation is encroaching the roadway and to realign areas of embankment to prevent rock falls.

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 *Saxifraga stellaris* and Alpine Lady's-mantle *Alchemilla alpina*. Elsewhere along its length, the road margins contain a range of nectar plants 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.

■ **NN10802646:** The vegetated road margins near a river



The reservoir access road extends for almost 5km from Lochawe village to Cruachan Dam, passing through a range of habitats

gorge. **Key species:** *Salix* saplings, *Juncus* wet meadow, bracken, Tormentil, White Clover *Trifolium repens*. Pollinating insects, including Blaeberry Bumblebee *Bombus monticola*.

■ **NN09492649** and **NN08452698:** Eroded road embankments. **Key species:** Tormentil, Wild Thyme *Thymus serpyllim*, Bird's-foot Trefoil *Lotus corniculatus*. Pearl-bordered Fritillary. 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 2021, Blue Leaf carried out moth surveys for the first time at the dam road as it was not possible to carry out night-time trapping at the dam, due to security issues so close to the film set.

Survey method: The new BBS transect 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.

5.6 FILM CREWS AT CRUACHAN

Unusually, Blue Leaf's fieldwork in the early part of 2021 took place against the backdrop of Cruachan Reservoir area being used as a film set for a lavish new television series.

On the first visit, in mid May, the production teams were only starting to move on to the site but, by the time filming had ceased in July, hundreds of people – crew, actors and extras – had been at the upland area and filming took place at night, with the Cruachan Bowl illuminated by bright spotlights.

Security was heightened and the Blue Leaf surveyor was deterred from carrying out work at usual areas of interest, such as the Allt Cruachan and Penthouse Pond, and conducting early-year moth trapping at the dam and approach roads.

There may have been some disturbance to species as a result of all this activity.

Northern Wheatear *Oenanthe oenanthe* occurred at its lowest population levels ever at Cruachan Reservoir in 2021 and Common Snipe *Gallinago gallinago* only started territorial behaviour once the site had been vacated.

How much the filming affected species cannot be quantified – poor weather in May and early June complicates the picture, and several species away from the dam appear to have had poor breeding success. In addition, some species, such as Twite, appear to have had a productive season.

In the aftermath of the filming, it was clear there was some local disturbance to vegetation communities, particularly close to Allt Cruachan and the Penthouse. Although these communities are botanically poor, of greater concern was the method of remediation that was employed to restore the affected sites – high-nutrient material, apparently a animal dung mix, was introduced to soils that, at Cruachan, are low-nutrient and acidic. We would expect to see a flush of rank vegetation and weeds emerging as a result.



One of the remediated areas following filming in 2021

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*.

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



Cruachan tailrace and looking west along banks of Loch Awe

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 hosts mainly a woodland breeding bird assemblage and 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.

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, such as

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 2021. A trail camera was installed close to the loch edge at NN0769826838 and this operated between May and July, providing 24-hour surveillance of the area.

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 2021

The year was notable for extended spells of unsettled weather that made planning survey work difficult and impacted on the species present.

Most notably one of the driest, sunniest Aprils on record was followed by an exceptionally dull, wet and cold May that effectively halted spring in its tracks.

April was cool, with the mean temperature 1.5°C below the long-term average and a run of particularly cold, frosty nights. However, it was very dry – the sixth driest since 1862 – and sunshine totals were 160% of average, making it the sunniest April since 1919.

In contrast, May was unsettled, cold and often windy. The mean temperature for the month was 1.2°C below the long-term average, with more frosts than usual. Scotland had 130% of average rainfall, and sunshine totals were 80% of average.

While BirdTrack reported an early arrival of most summer migrants in Scotland in April, the cool weather impacted on the start of the breeding season.

Insectivorous species such as Tree Pipit, Northern Wheatear, Willow Warbler and Barn Swallow all showed significantly reduced reporting rates in Argyll in May, compared with the historical average, and this continued into June with numbers of sightings being depressed.

This suggests the nesting season was suffering difficulties and there was evidence on the ground at Cruachan. A pair of Blue Tit using the monitored nestbox at the Site Offices delayed egg-laying until June but suffered egg failures and mortality of chicks in the nest, likely as a result of food shortages, resulting in only three juveniles fledged.

Meanwhile, the number of territories of species such as Winter Wren and Northern Wheatear were the lowest since records began at Cruachan.

The cold and wet weather in May likely had a profound impact on insects too, delaying emergence and causing mortality of insects in their early stages, with a knock-on effect up the food chain by reducing the availability of larvae for breeding birds. Past Cruachan reports have drawn

a correlation between wet and cold weather in spring and a negative impact on insect species later in the summer.

It is now thought that the cause of declines may be more complex and relate to the cumulative effects of adverse weather events, such as drought in summer followed by mild winters and wet springs that may impact on larval survival.

It is now accepted that the abundance of a given species is likely to be related to the productivity of the last generation of the previous year.

Numbers of insects recorded in the survey were very low in May and June. None of the butterfly species recorded at Cruachan were abundant, reflecting national survey work that declared that butterfly populations in 2021 were at their lowest level for 12 years.

The June moth-trapping session at the Visitor Centre/Site Offices was hugely disappointing, with only 22 moths trapped, while spring and early summer were notable for the almost total absence of hoverflies – just two species on 31/5 and one species on the June visit (18/6).

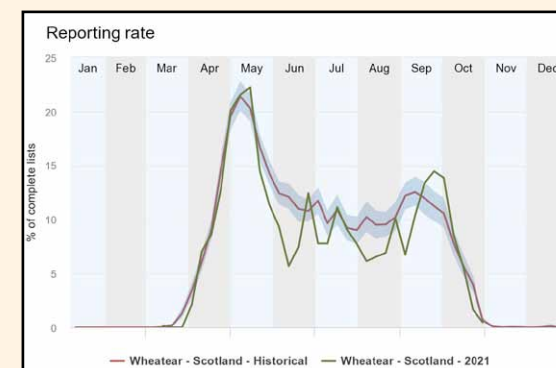
June saw variable temperatures and weather was largely unsettled until the second half of the month, which was drier. This improving picture continued into July, which was the third warmest since 1884, with maximum temperatures 2-3°C above average across western parts of Scotland.

Birds may have made belated efforts to raise new or second broods. Common Snipe was still holding territory at Cruachan Reservoir on 13/7, when the first Meadow Pipit and Northern Wheatear fledglings had finally emerged near the dam. At the Loch Awe sites, Spotted Flycatcher was feeding juveniles in July and there was a late brood of European Robin in August, which saw a return to more seasonal conditions.

The provisional mean temperature for August was 0.6°C above the long-term average and the west coast was drier and sunnier than normal. The most productive moth-trapping sessions of the year took place in July and August, while the improved conditions saw a late surge of dragonflies at the site, an improving diversity of hoverflies and the highest counts all year of most species of bumblebee.



Graph 1 highlights the impact of the drought in 2020 (orange line), with a trough in August/September that indicates a crash in hoverfly numbers reported to the Hoverfly Recording Scheme, followed by the cold and wet May 2021 (blue bars) showing a similar severe reduction in sightings as a result of the weather.



Graph 2 illustrates Northern Wheatear sightings in Scotland reported to the BTO's BirdTrack app – while birds returned in the summer around normal times, the reporting rate in May and June was significantly reduced. It was a similar picture for other species.

7.0 BIRDS

7.1 BIRDS OF CONSERVATION CONCERN REVIEW

The status of British birds of conservation concern underwent a major review in 2021, resulting in significant changes to the composition of the Red, Amber and Green Data Lists.

Birds of Conservation Concern 5 (BoCC5), published in December 2021, assessed 245 species in light of the latest information about trends in range, population and threats. As a result, several species have been reassigned within the lists to reflect their greater or reduced conservation concern.

The Red List now increases to 70 species (from 36 at the outset of the review process in 1996 and 67 in the previous 2015 assessment). The number of Amber List species increases to 103 species (96 in BoCC4), while there are nine fewer on the Green List (now 72), as species are elevated to higher conservation risk categories.

The review affects how species seen at Cruachan Power Station are assigned to the new lists. In this section, we explore the implications of BoCC5, which identifies more than half (51%) of the 79 species recorded at the station since 2009 as being birds of conservation concern.

After the new review, the number of Red List species recorded at Cruachan remains at 17, the same as following the 2015 study (BoCC4). However, there have been changes within the list with two species dropping to the Amber List as a result of an improving conservation outlook while European Greenfinch and House Martin are added to the Red List.

European Greenfinch has been recorded at Cruachan in three survey years since 2009 and breeding was confirmed in 2011, among lochside vegetation at the Site Offices. A pair held territory at the dam access road in 2013, when nesting was thought possible, and a single male was at the tailrace in 2017, the most recent survey sighting.

The conservation concern over European Greenfinch was one of the main headlines to emerge from BoCC5 – a common and familiar garden bird whose decline has been so dramatic, that it has jumped straight to the Red List from the Green List.

Its Scottish population collapsed by 68% in the period 2008-2018, closely mirroring the UK figure, with its decline linked with the emergence and spread of *Trichomonosis*, a

TABLE 2: SPECIES OF CONSERVATION CONCERN AT CRUACHAN, OLD AND NEW STATUS AND POPULATION TRENDS

SPECIES	NEW	OLD	10-YR TREND	50-YR TREND
Herring Gull				
Common Cuckoo			+13%	-53%
Eurasian Skylark			-7%	-56%
Wood Warbler			-22%	
Common Starling			-24%	-82%
Ring Ouzel			+37%	
Mistle Thrush			-15%	-57%
Spotted Flycatcher			-11%	-88%
Whinchat			-14%	
House Sparrow			+8%	-65%
Tree Pipit			+6%	-74%
House Martin			-21%	-53%
Common Linnet			+6%	-56%
Lesser Redpoll			+21%	-87%
Common Greenfinch			-68%	-64%
Twite				
Yellowhammer			-11%	-60%
Greylag Goose			+14%	
Common Mallard			-7%	+86%
Black-throated Diver			+16%	
Osprey			+34%	

parasite-born disease that causes high mortality to its hosts.

The disease is spread through contaminated food and water and poor hygiene at garden bird feeding stations may be a factor in the epidemic's spread, particularly among European Greenfinch, which are highly gregarious and social at feeding sites, but other species, including Common

SPECIES	NEW	OLD	10-YR TREND	50-YR TREND
Oystercatcher			-11%	
Common Sandpiper			-9%	-51%
Common Snipe			-9%	
Red-breasted Merganser				
Great Black-backed Gull				
Lesser Black-backed Gull				
Razorbill				
Tawny Owl			-8%	
Common Kestrel			-26%	-48%
Eurasian Sparrowhawk			-19%	+52%
Song Thrush			+2%	-49%
Northern Wheatear			-35%	-13%
Common Redstart			+8%	+24%
European Dipper			-6%	-23%
Willow Warbler			-3%	-43%
Common Whitethroat			+1%	-13%
Grey Wagtail			-18%	-43%
Meadow Pipit			+8%	-37%
European Bullfinch			+21%	-38%
Dunnock			-4%	-33%
Wood Pigeon			-2%	+121%
Winter Wren			+11%	+65%

Chaffinch and Dunnock, are also vulnerable.

A single pair of House Martin nested successfully at Cruachan's Site Offices in 2018 and 2021, building their cup-shaped nest on the structure of the building, but, prior to this, it had been recorded infrequently, usually hunting over Loch Awe or the substation. House Martin was on the



European Greenfinch numbers have fallen by 68% in a 10-year period. It is now on the Red List, along with House Martin (inset)

Green List at the outset of the review in 1996 but slipped on to the Amber List in 2002 and has remained there until BoCC5, when its new Red-listing reflects its 'Near Threatened' assessment in the IUCN Regional Red List.

Its population has fallen by 57% (1969-2018) and, while the reasons are not fully understood, it may be related to climate and land-use changes. The report also highlights the destruction of their nests by home owners – House Martin will re-use their nests from the previous season and they should be left intact over the winter.



Two species found at Cruachan drop out of the Red List. BoCC5 cautions that the movement of Song Thrush to the Amber List is due to a slight variation in trends rather than significant improvements in its fortunes – its reduction in population of 49.9% is just a fraction outside the 50% Red List threshold.

Meanwhile, Grey Wagtail – only promoted to the Red List in 2015 – is now reassigned to the Amber List.

The number of Amber List birds recorded at Cruachan increases to 26 species, following the BoCC5 review.

The 18 Cruachan species previously listed as Amber in BoCC4 (2015) are unchanged in the new update but they are joined by the two dropping from the Red List and a further six species promoted from the Green List as a result of their worsening conservation outlook.

Northern Wheatear and Common Whitethroat are back on the Amber List for the first time since 2009 due to a fall in their nesting population. Both long-distance summer visitors from sub-Saharan Africa, it is thought the two species may be experiencing difficulties on their migration routes.

Common Whitethroat has only been recorded in two survey years (2014 and 2015) while Northern Wheatear is a familiar upland bird at Cruachan but whose breeding population is subject to often marked fluctuations.

Eurasian Sparrowhawk and Red-breasted Merganser are Amber-listed for the first time along with two other very familiar woodland species, Wood Pigeon and Winter Wren, that have been added to the Amber List due to significance of the UK population in holding more than 20% of the European population, and not due to population declines.

Population trends shown in Table 4 are taken from *The*

Cruachan Power Station Biodiversity Survey 2021

State of the UK's Birds 2020 (RSPB 2020) and show the 10-year trend (2008 to 2018) and 50-year trend (1978-2018) although some information is not available, particularly for species that are uncommon and not often recorded during formal surveys – for instance Twite which is an upland breeding species that occurs in low densities.

Several Red and Amber species show an increase in the past 10 years although in many cases from very low historic populations – for instance, Tree Pipit increased by 6% in the 10 years to 2018 but this follows a 50-year decline of 74%.

7.1.2 IUCN REGIONAL RED LIST

The status of British birds was also assessed in BoCC5 against the extinction risk criteria set out by the International Union for the Conservation of Nature (IUCN).

The IUCN Red Data List is the world's most widely-accepted system for measuring the global conservation risk of species. Regional List assessments examine species against the IUCN guidelines at national level, where conservation policy and action are implemented.

The second IUCN Regional Red List assessment, also published in December 2021, indicates that 46% of 235 regularly-occurring species have populations that are threatened with extinction from Great Britain.

These include 21 species that qualified as 'Critically Endangered', 43 that are 'Endangered', 58 that are 'Vulnerable' and 33 species that are listed as 'Near Threatened' in Britain – a number of which have been recorded at Cruachan Power Station and its landholdings.

The criterion for qualification in the various categories is complicated and BoCC5 does not give individual species' accounts. As the IUCN Regional Red List process focuses on extinction risk, assessments tend to identify species with extremely low numbers, restricted ranges and/or rapid recent declines and there may be little correlation with those on the BoCC5 lists. For instance, 49 Red- and Amber-listed species are assessed as being of IUCN Least Concern.

However, for the record, we have listed all those species that are threatened and have been recorded at Cruachan.

A total of 27 species found at Cruachan appear on the IUCN Regional Red List assessment, including six species highlighted as Endangered. A total of 79 species have been recorded at the power station site, therefore more than a

TABLE 3: SPECIES QUALIFYING FOR THE IUCN REGIONAL RED LISTS AND GB EXTINCTION THREAT STATUS

ENDANGERED
Great Black-backed Gull
Herring Gull
Northern Wheatear
Common Chaffinch
European Greenfinch
Twite
VULNERABLE
Red-breasted Merganser
Common Mallard
Black-throated Diver
Grey Heron
Eurasian Oystercatcher
Common Snipe
Eurasian Sparrowhawk
Common Kestrel
Barn Swallow
Wood Warbler
Common Starling
NEAR THREATENED
Red-throated Diver
Common Sandpiper
Tawny Owl
Osprey
House Martin
Mistle Thrush
Ring Ouzel
Spotted Flycatcher
Whinchat
Grey Wagtail



Great Black-backed Gull



House Sparrow



Eurasian Skylark

third (34%) are now on the IUCN Regional threat list in respect of the vulnerability of the populations in Britain.

While BoCC focuses on the current and past status, IUCN examines current and likely future trends so may provide an early warning of trouble ahead. For instance, Common Chaffinch and Barn Swallow qualify as Endangered and Vulnerable respectively against IUCN criteria, due to their population declines over a 10-year period, and may be elevated from the Green List in future conservation reviews.

7.2 IUCN EUROPEAN RED LIST

The 2016 Cruachan report discussed the document the *European Red List of Birds* (ERLB 2015) that examined the extinction risk of birds occurring in the Western Palearctic.

The *European Red List of Birds* was reviewed in August 2021, highlighting that 13% of 544 species in Europe are threatened (Birdlife International 2021). Although there has been no change in this headline figure over the six-year period, in total 84 species have changed their Red List status since the 2015 review.

There is some good news as three birds occurring at Cruachan – Herring Gull, Razorbill and Meadow Pipit – all of which qualified as Near Threatened in 2015, have been downgraded to Least Concern. European Oystercatcher and Red-breasted Merganser have shown no change and remain listed as Vulnerable and Near Threatened respectively in the new European Red List.

However, Common Snipe now qualifies as Vulnerable to extinction across Europe. This wader, which may nest near Cruachan Reservoir, has suffered a 36% global decline – particularly in its strongholds in Russia – as a result of habitat loss and degradation of its breeding grounds.

TABLE 4: SPECIES ON THE IUCN EUROPEAN RED LISTS

SPECIES	2021	2015
Common Snipe	VUL	LC
Oystercatcher	VUL	VUL
Red-breasted Merganser	NT	NT
Herring Gull	LC	NT
Razorbill	LC	NT
Meadow Pipit	LC	NT



The Red-listed Spotted Flycatcher made a return to Cruachan in 2021 and a pair raised young at the Contractors Compound

7.3 BIRDS IN 2021 SUMMARY

A total of 53 species of birds were recorded at the Cruachan Power Station during the Blue Leaf survey in 2021. All of these are common and widespread species associated with woodland, upland and waterside habitats.

Of the 53 species recorded, 26 (49%) were Confirmed (C) as having nested on or adjacent to Drax's landholdings at Cruachan. A further 10 (19%) species Probably Nested (PR) and nine (17%) were considered to have Possibly Nested (PO). The remaining eight (15%) species were not thought to be breeding in 2021 – they were seen outwith the nesting season or flying over the survey areas.

Nine of the species recorded are Red List species – those of highest conservation concern in the document BoCC5. In addition, 18 Amber List species of medium conservation concern were recorded during fieldwork along with 26 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 having bred at the Cruachan Power Station in the 2021 survey.

7.3.1 RED LIST

European Herring Gull *Larus argentatus* NB

Three adults overwintered at Loch Awe, seen on 17-18/6 and 14/7, often loafing at the fish farm but occasionally individuals perched at Cruachan tailrace. Unusually, a juvenile was present at the loch on 23/8, likely dispersed from breeding sites on the Argyll coast.

Common Cuckoo *Cuculus canorus* NB

Birds were heard on 18/5 and 18/6 but the surveyor felt, overall, that the species was scarcer than usual in 2021. Most records were obtained at the dam access road, where two were present on 18/6, but one was calling north of the Site Offices on 18/5.

House Martin *Hirundo rustica* C

For a second year, a pair nested at Cruachan Site Offices, with adults feeding young on 14/7 in a nest built above the reception office window. The outcome of the nest is not known but 30 birds, including juveniles, were feeding over Cruachan tailrace on 23/8.

Tree Pipit *Anthus trivialis* C

Two territories were recorded on the dam access road transect north of Lochawe village. 1AOT was present on 18/5, increasing to 2AOT by 18/6. On the latter date, an adult was seen carrying food, suggesting a nest with young nearby. Finally, two birds were heard in flight on 24/8 at upland Cruachan, likely returning migrants heading south.

Mistle Thrush *Turdus viscivorus* PO

There were sightings on two dates but nesting was not proven. One flew south over Loch Awe from the Site Offices on 18/5 (sightings here are unusual) then on 24/8, three fed among the slopes of Beinn a Bhuidh, at the east side approach road to Cruachan dam.

Wood Warbler *Phylloscopus sibilatrix* PR

Singing males were present in May and June, with 3AOT at the dam access road transect north of Lochawe and 1AOT north of the Contractors Compound. None was seen or heard after June, however, and breeding may have been abandoned or failed at the first brood.

Spotted Flycatcher *Muscicapa striata* C

This declining species made a welcome return to Cruachan, with a pair feeding two fledged juveniles high in the tree canopy at the Contractors Compound on 14/7. None had been seen at the site in May or June so it is possible the breeding territory was, for instance, on the north side of the railway line.

Twite *Linaria flavirostris* C

Twite had a productive nesting season at upland Cruachan, with decent-sized family parties present from mid-June. Just one territory was located in BBS work, beside the dam access road on 31/5, about 1km south of the dam – but, by 18/6, family parties were conspicuous. On 18/6, adults and three young were beside the dam road, close to where the territory had been recorded, then a flock of nine comprising adults and several juveniles were at the Allt Cruachan road bridge near the Penthouse on 13/7. The following day, four were found at the east side approach road to the dam then, finally, on 24/8, upwards of 15 birds were present close to the Penthouse Pond. Although there may be some overlap, this likely represents the best breeding season on record.

TABLE 5: RED DATA LIST BIRDS AT THE CRUACHAN POWER STATION, SBL STATUS AND BREEDING STATUS

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

Lesser Redpoll *Acanthis cabaret* PR

All records were from the dam access road, where there were regular sightings of flyover individuals but just one male holding territory in May and June. Maximum counts were four in flight near 'The Titanic' on 18/6 and five south over Loch Awe on 24/8.

7.3.2 AMBER LIST

Red-breasted Merganser *Mergus serrator* PO

The trail camera overlooking Loch Awe recorded a female ashore on the shingle bank at Cruachan Visitor Centre on 16/6. This is only the third record for the survey after two in September 2016 and a pair in June 2017.

Common Mallard *Anas platyrhynchos* PR

There were several sightings caught on a trail camera beside Loch Awe at Cruachan Visitor Centre: these included a pair on 30/5, a male on 31/5, a pair on 1/6 and three males on 6/6. Finally, a pair was near Cruachan tailrace on 14/7.

Eurasian Sparrowhawk *Accipiter nisus* PO

There were two sightings during the survey, more than usual. A female dashed through the Hazel copse north of the dam access road on 17/6, then it or another female flew over the access road north of Lochawe village, pursued by Hooded Crows.

Eurasian Oystercatcher *Haematopus ostralegus* NB

Two presumed failed breeding birds were together on the shores of Loch Awe on 14/7. None had been recorded earlier in the season.

Common Snipe *Gallinago gallinago* PO

A male was heard calling and engaged in its "drumming" display date south of Cruachan Dam on the very late date of 13/7. Such sightings are infrequent, with past records in 2017 and 2018, but always in May. It may be that breeding attempts were delayed due to disturbance associated with the presence of the film crews' encampment.

Common Sandpiper *Actitis hypoleucos* PR

Single birds were recorded on the Loch Awe trail camera, located overlooking the shingle bank at Cruachan Visitor Centre, on several dates in late June. However, there were no other sightings and nesting was not proven. Singles were also on the south side of the loch on 18/5, the first of the year, and on 18/6.

Great Black-backed Gull *Larus marinus* NB

Birds were present throughout the summer at Loch Awe, often associating with the fish farm. Single adults were seen on 18/5, 17/6 and 14/7, with two adults early in the morning of 18/6.

Tawny Owl *Strix aluco* NB

A single was heard hooting from the Coille Leitire on 13/7, while the surveyor was engaged in moth trapping overnight at Cruachan Visitor Centre.

Common Wood Pigeon *Columba palumbus* PO

There were records on two dates. On 18/5, three flew west over the dam access road on the St Colms Road transect, then a single was recorded in flight on 17/6 at Cruachan Visitor Centre.

Grey Wagtail *Motacilla cinerea* C

At least two nesting attempts were confirmed at Cruachan in 2021. An adult female with food was present at the Visitor Centre on 18/5, then flying towards the Allt gorge, at the Contractors Compound, where a pair was present on 31/5. On 17/6, a male was hawking insects at the Cruachan tailrace and, on 24/8, a female and two juveniles were seen



New additions to the Amber List, from left, Grey Wagtail, Song Thrush and Common Wood Pigeon and, below, European Dipper



TABLE 6: AMBER DATA LIST BIRDS AT CRUACHAN POWER, STATION, SBL STATUS AND BREEDING STATUS

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

at the same site – a late date suggesting a second brood had been successful.

Meadow Pipit *Anthus pratensis* C

This was the most common breeding species in the survey, with a total of 13AOT recorded in the BBS. 2AOT were found at low level, on the transect north of Lochawe, but all other records were from upland Cruachan – 6AOT on the west side reservoir transect, 3AOT on the high part of the dam road and single AOTs at the east side dam approach road, at the Penthouse Pond, the Allt Cruachan bridge and

Cruachan Power Station Biodiversity Survey 2021

the area south of the dam wall. A few juveniles were out of the nest by 13/7, but not in large numbers – the largest family party involved nine on the east side of Cruachan Reservoir on 14/7. By 24/8, there were still a few small groups around the dam, including a single flock of 15 birds.

Common Redstart *Phoenicurus phoenicurus* C

Breeding was confirmed in the small gorge north of the dam access road's new entrance gate. A pair was first noted on 17/6, with the male singing and alarm calling at the presence of the surveyor. On 13/7, both adults were witnessed carrying food, often perching on the barbed wire field boundary and commuting to the gorge on the south side of the road. A second singing male was found on the access road transect north of Lochawe on 17/6.

Northern Wheatear *Oenanthe oenanthe* C

Just 4AOT were recorded at upland Cruachan, the lowest total since the start of survey work in 2009. Most were located on the west side reservoir transect, where 3AOT were noted on 17/5 and 18/6. On the latter date, an adult and two fledged young were seen near the dam. A single pair was found at the dam access road, at NN0828227235 on 18/6, with a single apparently independent juvenile nearby on 13/7. The last female was seen on the east side approach road to the dam on 24/8. None was recorded at the Cruachan 'Bowl' during the year but, with low numbers elsewhere, disturbance may not be the only factor in the reduced Cruachan population.

Song Thrush *Turdus philomelos* C

A total of 4AOT were recorded in the BBS survey, involving 2AOT at the Site Offices/Visitor Centre transect and singles AOT at the Contractors Compound and dam access road north of Lochawe Village. A newly-fledged juvenile was found dead on the A85 near the Site Offices on 18/6 and, the same day, a pair was gathering food on the Visitor Centre lawns.

Willow Warbler *Phylloscopus trochilus* C

This was the third most common breeding species at Cruachan in 2021, with a total of 11AOT recorded on the transect walks. The key site was the east side of the dam access road, from Lochawe, where 9AOT were found in the



Amber-listed bird species recorded in the 2021 survey (from left) Meadow Pipit, Common Redstart and Willow Warbler

early morning of 18/5. Interestingly, only 4AOT were recorded on an transect walk the previous evening. Elsewhere, only 1AOT was found at the Site Offices, a singing male within the Coille Leitire, with 1AOT further west up the dam road. Juveniles were widespread in July, forming small flocks within the bracken stands near upland Cruachan, including a group of 12 on 14/7.

Winter Wren *Troglodytes hiernalis* C

Numbers were low in 2021, with just 7AOT recorded on the BBS transects, including 4AOT beside Loch Awe and 3AOT at the dam access road. Juveniles were present out the nest in the loch embankment at the Site Offices on 18/6. Unusually, a pair bred at upland Cruachan, in the gorge near the Allt Cruachan vehicle bridge, with adults feeding young on 17/6.

European Dipper *Cinclus cinclus* PR

At least one adult summered on the shore of Loch Awe, first recorded on 6/6 by the trail camera on the shingle shore at the Visitor Centre. On 17/6, the surveyor witnessed the bird at Cruachan tailrace and at the shingle shore, often contact calling, suggesting breeding may have taken place. One bird was still present on 24/8, flying round the tailrace. This notable run of sightings represents only the second year this species has been present at Cruachan, after one was seen near the Contractors Compound in 2011.

Dunnock *Prunella modularis* C

Just 4AOT were recorded but breeding was confirmed at the Visitor Centre where two fledglings were found in lochside vegetation on 18/6. A singing male was at the Site Offices and 2AOT were found at the dam access road transect in May and June.

7.3.3 GREEN LIST

Great Cormorant *Phalacrocorax carbo* NB

An adult was at the Loch Awe fish farm on 23/8 and likely the same was fishing on the loch near Cruachan Visitor Centre the following day.

Grey Heron *Ardea cinerea* NB

Singles were seen on four dates but no late summer roost developed at Loch Awe opposite Cruachan Visitor Centre. One flew over the dam access road on 18/5, with a run of singles seen from the station offices on 18/5, 18/6, 14/7 and 23/8, sometimes perched on the fish farm infrastructure.

Canada Goose *Branta canadensis* PR

Breeding was successful at Loch Awe, with several pairs by its banks on 18/5, then a post-breeding creche of 28 adults and 16 juveniles opposite Cruachan site offices on 17/6. Numbers peaked on 14/7 when a total of 59 were on the loch. None was present in August, presumably having joined a moulting flock in the south of the country.



Juvenile Northern Wheatear at the reservoir – only four territories were recorded in 2021. Inset, Great-spotted Woodpecker

Common Buzzard *Buteo buteo* PO

Sightings were rather scarce during fieldwork and there was no indication that nesting took place in the survey area. Singles flew low over the dam access road on 17/5 and 24/8 with, unusually, none seen at upland Cruachan.

Peregrine *Falco peregrinus* PO

A female flew west, low over Loch Awe, on 17/6, carrying a fresh kill. This is only the second record of Peregrine for the survey after one was seen near the dam in 2013.

Great-spotted Woodpecker *Dendrocopos major* C

A pair nested in a hole in a Silver Birch beside the dam access road, just north of Lochawe Village. First found on 18/6, the pair was feeding noisy large young in the nest on 13/7. Two were seen nearby on 24/8. At

Cruachan Site Offices, a female visited the feeding station at the security guard's cabin on several dates, likely gathering food for young nearby.

Barn Swallow *Hirundo rustica* NB

Again, there were no nesting attempts at Cruachan and sightings were rather scarce. The first of the year (31/5) were two flying over the dam access road north of Lochawe village. Birds were seen regularly in spring and summer at the farm building beside the dam road, where nesting likely took place. Finally, four were in flight over Cruachan tailrace on 23/8, part of a mixed flock of migrating hirundines.

Sand Martin *Riparia riparia* C

Small numbers were seen hunting over Loch Awe, with the first of the year involving three on 18/5. A month later (18/6), adults were visiting at least two presumed nests in drainage holes in the road embankment west of the Visitor Centre. Ten birds joined the mixed hirundine flock hawking over Cruachan tailrace on 23/8.

Eurasian Nuthatch *Sitta europaea* PR

This species is continuing to expand its range in Scotland and likely 2AOT were recorded at Cruachan in 2021, including the first sightings at Cruachan Site Offices. At least 1AOT was seen regularly in May and June at the dam

Cruachan Power Station Biodiversity Survey 2021

access road near Lochawe village and nesting was confirmed in oak trees on the east side of the road (although not on Drax land). An adult visited peanut feeders at the security guard's cabin on 18/6 with another calling on the opposite side of the road at the Contractors Compound on 14/7. Finally, one was in gorge woodland near the new location for the dam road entrance gate on 24/8.

Pied Wagtail *Motacilla cinerea* C

A pair likely nested on the Site Office roof, where adults were making repeated visits to a location high above the entrance door on 18/5. An adult carrying food was captured on the trail camera on the banks of Loch Awe at the Visitor Centre on 31/5. Subsequently, three juveniles were being fed by adults at Cruachan tailrace on 17/6. Elsewhere, single territories were found at the narrow section of the dam access road (31/5), at the west side access to the dam (18/6) and near the Allt Cruachan bridge near the Penthouse Pond (also 18/6). Several juveniles were present in upland Cruachan on 24/8.

European Robin *Erithacus rubecula* C

Juveniles were seen out of the nest at the dam access road and Visitor Centre (both 18/6) and a late fledgling at Cruachan tailrace (23/8). A total of 8AOT were recorded during the formal BBS fieldwork, involving 4AOT at the dam access road transect north of Lochawe, 3AOT at the Site Office/Visitor Centre and 1AOT at the Contractors Compound.

European Stonechat *Saxicola rubicola* C

Two pairs were found at Cruachan this year, both of which successfully fledged young. One pair was feeding four newly-fledged juveniles on 17/6, among a stand of bracken, two kilometres west of Lochawe Village, beside the dam access road. On 13/7, a male and three juveniles were perched on the deer fence close to the Penthouse Pond.

Common Blackbird *Turdus merula* C

Just 2AOT were recorded on the BBS transects although nesting was confirmed near the Visitor Centre. Singing males were noted in May and June at the dam access road north of Lochawe village and at the Visitor Centre, where two juveniles were present on 18/6, being fed by adults in the

TABLE 7: GREEN DATA LIST BIRDS AT THE CRUACHAN POWER STATION, SBL STATUS AND BREEDING STATUS

GREEN LIST SPECIES	SBL	BREEDING STATUS
Great Cormorant		NB
Grey Heron		NB
Canada Goose		PR
Common Buzzard		PO
Peregrine		PO
Great-spotted Woodpecker		C
Barn Swallow		NB
Sand Martin		C
Eurasian Nuthatch		PR
Sand Martin		C
Barn Swallow		NB
Eurasian Nuthatch		PR
Pied Wagtail		C
European Robin		C

GREEN LIST SPECIES	SBL	BREEDING STATUS
European Stonechat		C
Common Blackbird		C
Garden Warbler		C
Eurasian Blackcap		PR
Common Chiffchaff		PO
Goldcrest		PO
Great Tit		C
Coal Tit		C
Blue Tit		C
Eurasian Treecreeper		PR
Common Raven		C
Hooded Crow	YES	C
Common Chaffinch		C
Eurasian Goldfinch		PR
Eurasian Siskin	YES	PR



Three of the breeding Green List species at Cruachan, from left, juvenile Pied Wagtails at the tailrace, European Robin, Great Tit



Garden Warbler was confirmed as having nested at the dam access road in 2021 and, inset, European Blackcap likely nested

vegetated margins of the centre car park. Three birds fed on Rowan berries south of Cruachan Dam on 24/8.

Garden Warbler *Sylvia borin* C

Nesting was confirmed on 18/6 at the dam access road transect north of Lochawe village, when an adult was seen carrying food into a willow thicket beside the boundary fence. A singing male was present further up the road the same day. In addition, 1AOT was at the east side of the Site Offices from May to July, and breeding almost certainly took place.

Eurasian Blackcap *Sylvia atricapilla* PR

At least 4AOT were recorded, split equally between the transects beside Loch Awe and the east section of dam access road north of Lochawe. The first records were on 18/5 with a male lingering on 14/7 at the Site Offices.

**Common Chiffchaff
Phylloscious collybita PO**

One was in song north of the Site Offices on 18/5 but on no other dates. Chiffchaff has never been recorded before at the Loch Awe sites so this individual may have involved a passage migrant.

Goldcrest *Regulus regulus* PO

Britain's smallest bird is closely associated with conifer woodland and the only territory was at the Site Offices, where a singing male was recorded in May and June in the tall firs close to the tunnel entrance.

Great Tit *Parus major* C

The BBS transect survey resulted in 5AOT being recorded – most (4AOT) along the dam access road north of Loch Awe, with 1AOT at the Contractors Compound. In addition, a family party including three juveniles were seen on 17/6, in the stream gorge near the shepherd's cottage on the dam access road.

Coal Tit *Periparus ater* C

Five juveniles were queueing up to use the peanut feeders at the Site Office security cabin on 18/6. 1AOT had been recorded in the survey in the tall firs nearby in May and it

Cruachan Power Station Biodiversity Survey 2021

seems likely this pair had been successful. Elsewhere, a single singing male was found at the dam access road transect from Lochawe village.

Blue Tit *Cyanistes caeruleus* C

A pair in the camera nestbox at Cruachan Power Station fledged three young in July but the low productivity rate suggests it was a difficult breeding season for insectivorous birds, likely due to the cold and wet conditions in May. The female laid seven eggs in June – possibly a second brood, given that the breeding season was advanced. Five young hatched out but only three survived to fledge on 14/7, suggesting issues with food availability. A total of 5AOT were logged on the BBS transects, with 3AOT at the Site Offices/ Visitor Centre and 2AOT at the dam access road transect. Three juveniles and an adult were using the peanut feeders at the Site Office security cabin on 18/6.

Eurasian Treecreeper *Certhia familiaris* PR

Just one territory was identified in the BBS, a singing male near the former site of the access gate at the dam road in May and June.

Common Raven *Corvus corax* C

Regularly recorded at upland Cruachan, the peak count was six on the rocky pillar beside the track along the west side of Cruachan Reservoir on 18/5 – a post-breeding count that likely represents a family party. Otherwise, singles or pairs were recorded on most dates. On 13/7, one was flushed from a sheep carcass near the Penthouse Pond and two flew west over Loch Awe on 18/6.

Hooded Crow *Corvus cornix* C

Hooded Crow was recorded frequently on every visit but mostly as singles in flight. Breeding was confirmed, however, on 18/6 when two adults and two juveniles were among boulders on the west side approach road to Cruachan Dam. A single territory was located on the BBS transects – at the dam road near Lochawe. Later in the season, five flew south over Loch Awe on 14/7 and one was perched on Cruachan tailrace on 23/8. Singles were regularly captured on the trail camera at the Visitor Centre in June, drinking at Loch Awe.

Common Chaffinch *Fringilla coelebs* C

A total of 12AOT were recorded in the BBS, making this the



Blue Tit apparently suffered a difficult nesting season in 2021

second most common breeding species during the survey. During transect counts in May and June, 7AOT were recorded at the dam access road north of Lochawe, with 3AOT at the Site Offices/Visitor Centre, 1AOT at the Contractors Compound and 1AOT north of the new dam road barrier. The feeding station at the Site Offices attracted 12, including juveniles, on 14/7, suggesting breeding took place locally.

Eurasian Goldfinch *Carduelis carduelis* PR

Few were found in the BBS but there was evidence of breeding success locally in late August. A singing male was present on three dates in spring at the dam access road transect. Later in the year, two were on the deer fence near the rocky, narrow part of the dam access road (13/7). Eight flew over the Visitor Centre and nine were on thistles in the mid part of the dam road (both 23/8).

Eurasian Siskin *Spinus spinus* PR

Displaying males were conspicuous in May and June with 2AOT recorded on both the Loch Awe and dam access road transects. An adult visited the feeding station at the Site Offices on 13/7 and a post-breeding flock of 12 flew over upper part of the dam road on 18/6.

7.3 DISCUSSION

A total of 53 species of birds were recorded in 2021 – the third-equal highest count since survey work began and well above the 12-year median of 50.4.

Graph 3 (below) illustrates that the 2021 total equals the count from three other years and is only surpassed by the figure in 2010, when Cruachan Substation – with its different range of habitats was included in fieldwork – and the 2016 survey when an exceptional 57 species were seen.

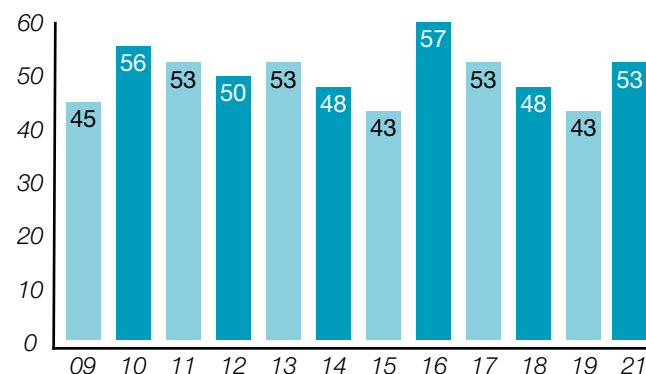
As in the abandoned survey in 2019, no new species were added to the Cruachan List in the current reporting period. It may be that the accumulation curve of species over time has flattened out and there may be few, if any, further new additions to the site list. The site list continues to stand at a total of 79 species – same as at the end of the 2018 survey.

Nevertheless, the 2021 list of birds at the power station was notable for the inclusion of two species that had only been recorded in one previous survey year.

European Dipper was last recorded in 2011, when one flew to the Allt Cruachan near the Contractors Compound. Excitingly, at least one bird or a pair likely summered at Cruachan, with sightings from June to August.

Breeding was considered probable under the EOAC guidelines, however, European Dipper breed early on in the year – clutches of eggs can be laid in April – and the bird(s) recorded at Cruachan may have been failed breeders away from their natal area. Dippers are Amber-listed due to both a

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



population and range decline since 1981 and there may be only 14,000 breeding pairs in the UK (BTO 2021).

Peregrine was also recorded for the second survey year after one was seen at Cruachan Reservoir in 2013. The sighting of a female carrying a prey item suggests breeding possibly took place locally, although the bird was likely on its way to a nest in more suitable habitat at Pass of Brander.

The falcon's UK population is at a record high after a crash in numbers in the 1960s linked to the widespread use of pesticides. A nationwide survey in 2014 estimated there may be 1769 breeding pairs in the UK, up 22% from the previous survey carried out in 2002, as the falcon expands its range into new sites, mostly in England and Wales.

The survey also noted an increasing trend towards Peregrine nesting on man-made structures such as buildings and electricity pylons. However, the 2014 project noted a decrease of the falcon in the Scottish uplands, likely due to limited prey availability and continuing illegal persecution.

The Systematic List highlights that, in many cases, it was a difficult year for breeding birds at Cruachan. Nevertheless, with 47% of species being confirmed as nesting in 2021, it was above the long-term average of 45.4.

Common Raven was elevated to Confirmed breeding for the first time, with a family party seen at a suitable nesting site in May. It had been listed as Probable Breeder in the 2018 survey but as Non-breeder in all other years.

Spotted Flycatcher nested for the first time since 2015, with a pair feeding juveniles at the Contractors Compound; the new Red-list species House Martin nested for at least a second year at the Site Offices; while Common Redstart was confirmed as having bred at the dam access road for only the third year in the survey.

European Nuthatch also edged closer to becoming a breeding bird at the power station. This species was only recorded at the site for the first time in 2018 but nesting was confirmed in 2021, although outwith the Drax landholding near the dam access road north of Lochawe, while adults visiting the feeding station at the Site Offices may suggest breeding took place locally.

The new Amber-list species Red-breasted Merganser was also elevated to Possible breeding status for the first time



Peregrine (stock shot) was recorded for the second time and (below left) European Nuthatch and Red-breasted Merganser



due to the presence of a female on the Loch Awe shore at the Visitor Centre in June.

It was a mixed year for other species, however, with Northern Wheatear at a low ebb at upland Cruachan. Only four pairs were recorded during fieldwork and it will be interesting to see if they bounce back in 2022 without the presence of film crews on their nesting grounds. Species such as Blue Tit, Winter Wren and Meadow Pipit also seemed to have low breeding productivity, likely linked with the cold and wet weather in early spring.

In contrast, Twite appeared to have an exceptional season at upland Cruachan. A further 10 (19%) species Probably Nested at the sites and nine (17%) were considered to have Possibly Nested.

8.0 REPTILES & AMPHIBIANS

Common Lizard *Zootoca vivipara* (Lacertidae)

The surveyor felt that encounters with lizards were less common at Cruachan in 2021, possibly due to cloudy and cool conditions on several visits that will have discouraged the reptiles from basking. Lizards are sensitive to vibration so the increased traffic on the access road may also have deterred them from using their usual roadside roosts. On 31/5, two were disturbed from beneath oak trees, near the Titanic, on the dam access road. Then, on 17/6, one was basking among dead Bracken fronds in the mid section of the reservoir road.



Common Lizard basking at the dam road's mid section

Palmate Newt *Lissotriton helveticus* (Lissotriton)

None was recorded at the Penthouse Pond on the early visit on 18/5 but, with air temperatures around 8°C, it is likely individuals would still have been largely inactive. There were no further checks until 13/7 when several adults, mostly males, were seen in deeper water on the north side of the pond. One was also found dead, possibly predated, at the Allt Cruachan near the road bridge access to the west side of Cruachan Reservoir.

9.0 MAMMALS

A study published in November 2021 has highlighted for the first time that several species of small mammals are undergoing long-term range and population declines.

Authors of *Using biological records to infer long-term occupancy trends of mammals in the UK* state there is now “high concern” over species such as Weasel *Mustela nivalis*, Bank Vole *Myodes glareolus*, Field Vole *Microtus agrestis* and Common Shrew *Sorex araneus*, all of which have been recorded at Cruachan Power Station.

Researchers from the Mammal Society, the University of Sussex and the UK Centre for Ecology & Hydrology estimated the long-term change in the distribution of 37 UK land mammals, based on advanced statistical analysis of records from the past five decades.

They found that 18 mammals, including many species of bats, were increasing in their distribution and a further 12 species showed no change over the period. However, they highlighted long-term reductions in the distribution of five out of seven species of small mammals they had analysed.

The rapid decline for Weasel, seen near Cruachan tailrace in 2017, would qualify the species as ‘Vulnerable’ to extinction in the UK under IUCN Red List criteria.

The authors of the paper estimated the proportion of sites where weasels were found fell from 50 per cent to less than 20 per cent between 1970 and 2016.

Bank Vole and Field Vole, which were trapped in Blue Leaf’s small mammal surveys in 2017 and 2018, and Common Shrew, which was found dead at the dam access road in 2009, have also experienced long-term declines at a slightly lower rate, along with Stoat *Mustela erminea* and Water Shrew *Neomys fodiens*.

Voles and shrews are among the main prey items of Weasel and Stoat and small mammals are critical to ecosystems as they are prey to a wide range of other predatory animals such as birds of prey and owls.

Study co-author Dr Colin Harrower said: “Declines in occupancy are concerning because the smaller the geographical area that a species occupies, the greater the threat to its continued survival. The fact that these declines are occurring in common species, such as Weasel and



Mammal species recorded at Cruachan during 2021 included (from left) Red Deer, European Otter at tailrace and Red Squirrel

Common Shrew, and over several decades, suggests the threats to small mammals are widespread and persistent.”

A report in 2018, led by the Mammal Society, said loss of habitat through development and agricultural practices, use of pesticides and road deaths are all putting pressure on small mammal species.

8.1 SYSTEMATIC LIST

It proved an exciting year for sightings of large mammals with the addition of Eurasian Badger to the Cruachan site list, while Red Squirrel and Red Fox were both seen using the station’s landholdings for the first time. Six species of mammal were recorded in 2021, with European Otter and Pine Marten also present at the station.

Red Deer *Cervus elaphus* (Cervidae)

Five young bucks were seen (17/5) above the old quarry, close to the west end of the dam access road.

Red Squirrel *Sciurus vulgaris* (Sciuridae)

A highlight of the year was the first potential breeding at Cruachan, with a pair present in trees at the Site Office. There were regular sightings by station staff over the summer, in fir trees close to the tunnel entrance and venturing as far as the tailrace. Several observers felt they may have had a dray locally. The surveyor saw an adult on 18/5, close to the A85 opposite the Site Office building. The

only previous survey sighting was from the dam access road at Loch Awe in June 2013.

European Otter *Lutra lutra* (Mustelidae)

Otters were occasionally recorded at Loch Awe by station staff. One was captured by a trail camera, swimming in the loch on 30/5. On 17/6, the surveyor observed an adult female and a well-grown kit in the tailrace. The female climbed on to a ledge on the tailrace screens to eat a fish while the juvenile called in the water nearby.

Eurasian Badger *Meles meles* (Mustelidae)

Badger is an exciting, and unexpected, addition to the Cruachan list – one was captured on film by security staff at the Contractors Compound at 2330 on 14/5.

Pine Marten *Martes martes* (Mustelidae)

Pine Marten has been resident at the station in recent years and continued to be recorded in 2021, but sightings were fewer – possibly as the bird feeding station had been discontinued while the Visitor Centre was closed. The Mustelids were either absent or less conspicuous as they went about the site.

Red Fox *Vulpes vulpes* (Canidae)

Security staff also recorded Red Fox at the station site, with two raiding the skips at the Site Office on 17/5. Fox has been recorded in past surveys but never on station grounds.



Four-spotted Chaser is one species found at Cruachan that is doing well as a result of new wetland habitat creation

10.0 INSECTS

10.1 ODONATA (DRAGONFLIES AND DAMSELFLIES)

An important new report published in 2021 has highlighted the vulnerability of many species of dragonflies and damselflies found at Cruachan Power Station.

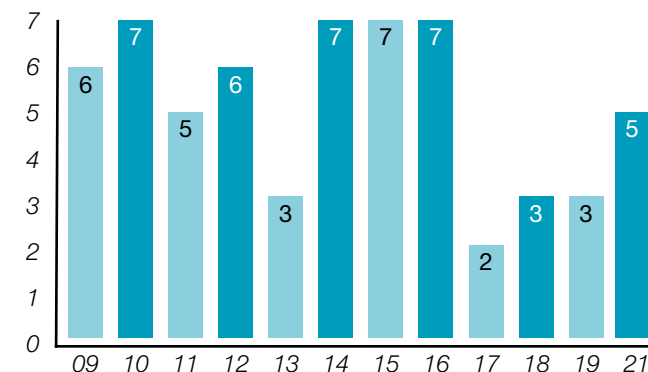
The 'State of Dragonflies 2021', released by the British Dragonfly Society, describes the 50-year population trends of many Odonata species in Britain and Ireland.

More than 1.4 million records submitted by volunteer recorders in the period from 1970 to 2019 were used to calculate annual occupancy trends for species and identify the changes that have occurred over time.

There are 46 resident or regularly-occurring migrant species in Britain and Ireland plus a further 10 species that occur as rare vagrants. Climate change, in the form of increased temperatures, is having a profound effect on the fauna – resulting in new species colonising Britain at the greatest rate ever and contributing to an increase in species richness as some populations move north.

A sample of 19 resident species indicates that 41% have increased in occupancy while only 11% have shown a significant population decline. The Scottish list remains impoverished compared with the range of species found in southern England, with only 23 resident species north of the border plus six that can be classified as vagrants – although

GRAPH 4: NUMBERS OF ODONATA SPECIES RECORDED IN EACH YEAR OF THE CRUACHAN SURVEY 2009-2019 AND 2021



Cruachan Power Station Biodiversity Survey 2021

new species are colonising from the south. At Cruachan, a total of nine Odonata species have been recorded in the Blue Leaf survey since 2009. However, the number of species recorded can vary dramatically from year to year, linked to weather conditions, with cold and dull weather conditions depressing populations (as seen from 2017-2019 when just two or three species were recorded, Table X).

Two species have only been recorded in a single year – Beautiful Demoiselle (Allt Cruachan, 2014) and Blue-tailed Damselfly (Penthouse Pond, 2015) – but there appears to be a core of five or six species that can be relied on to occur if weather conditions are clement.

The Penthouse Pond (NN0796727670) is the key site for species but other Odonata sightings have occurred at Loch Awe and the Allt Cruachan burn, while some, including Golden-ringed Dragonfly and Common Hawker, can range well away from water bodies.

However, the new report *State of Dragonflies 2021* (Taylor *et al* 2021) indicates five of the six species that have shown the greatest decreases in national occupancy are species that occur at Cruachan.

TABLE 9: ODONATA SPECIES THAT HAVE SUFFERED GREATEST DECREASES IN NATIONAL OCCUPANCY

SPECIES	NATIONAL DECLINE	SCOTTISH DECLINE
Blue-tailed Damselfly	- 0.018	+ 0.112
Golden-ringed Dragonfly	- 0.036	- 0.022
Common Hawker	- 0.076	+ 0.267
Black Darter	- 0.123	- 0.186
Emerald Damselfly	- 0.138	- 0.046

Common Hawker and Black Darter, and to a lesser degree Emerald Damselfly, are all linked by being species of moorland or heathland pools and bogs that are mainly filled by rainwater.

Emerald Damselfly has shown the greatest decline in occupancy across Britain and Ireland, although the rate is less pronounced in Scotland and its overall range is unchanged. The species mainly inhabits ponds and bogs, favouring small, shallow waterbodies. Some of these may be temporary and subject to drying out in late summer,

TABLE 8: SPECIES OF ODONATA RECORDED AT CRUACHAN (2009-2021) AND YEARS OF OCCURRENCE

SPECIES	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021
Large Red Damselfly												
Blue-tailed Damselfly												
Common Blue Damselfly												
Emerald Damselfly												
Beautiful Demoiselle												
Four-spotted Chaser												
Golden-ringed Dragonfly												
Common Hawker												
Black Darter												



Species that suffered significant decreases in occupancy, from left, Emerald Damselfly, Black Darter and Blue-tailed Damselfly

although this is not the case at the Penthouse Pond, where this species is seen almost annually (maximum counts of 20 in 2010 and 2011, but single figures in recent years).

The species is adapted to drought, having a late emergence and eggs that over-winter safely inside plant material. However, it is possible that climate change may be causing some of these temporary waters to dry out earlier each year than the species can tolerate.

Black Darter and Common Hawker are species that are typical species of acidic bogs, pools and lakes in moorland or heathland. Both dragonflies have a mainly northern and

western distribution in Britain and, in Scotland, have shown small declines since the early 2000s.

Black Darter has been recorded at the Penthouse Pond in half of the survey years (maximum of four in 2015 and 2016) while Common Hawker has bred at the pond and also in pools in the dam tailrace, but adults can be found ranging anywhere, including at the Loch Awe sites.

The main causes of decline for both species are thought to be climate and habitat changes, especially those affecting upland areas such as afforestation, acidification and desiccation of blanket bog. This is also likely to contribute

to a decline in Golden-ringed Dragonfly, although this large dragonfly is seen in most years at Cruachan, using Allt Cruachan and the small burns adjacent to the dam access road but also ranging to Cruachan Reservoir and, once, at the Visitor Centre (2013).

Blue-tailed Damselfly is one of our most pollution tolerant species, often being the only damselfly to be found in poor quality waters. It has shown a modest increase in Scotland but a statistically significant reduction in England, possibly linked with the increasing use of neonicotinoid pesticides.

Insect conservation charity Buglife reported that 88% of river water samples taken in Britain in 2017 were contaminated by neonicotinoids.

The report authors state: “Although changes are small, that such a ubiquitous damselfly without exacting habitat requirements can be affected serves to highlight some of the threats currently being posed to the environment.”

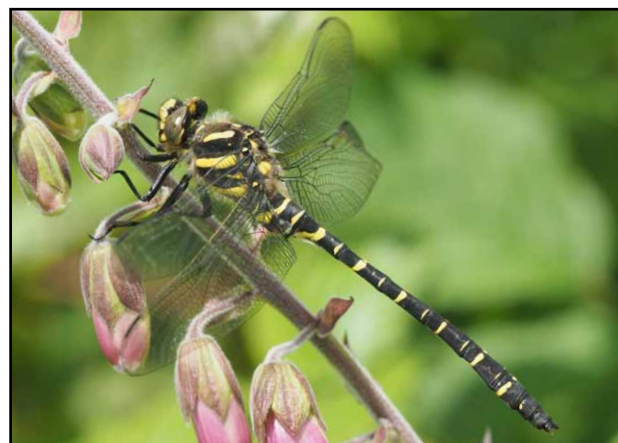
However, more species appear to be benefitting from the impact of climate change. Warmer summers are known to increase the survival rates of both dragonflies and their insect prey, while warmer water temperatures benefit larval development. Among those species that are doing well are several recorded at Cruachan.

TABLE 10: Odonata SPECIES THAT HAVE SUFFERED GREATEST INCREASES IN NATIONAL OCCUPANCY

SPECIES	NATIONAL INCREASE	SCOTTISH INCREASE
Four-spotted Chaser	+ 0.172	+ 0.042
Beautiful Demoiselle	+ 0.091	+ 0.049
Common Blue Damselfly	+ 0.030	+ 0.052
Large Red Damselfly	+ 0.039	- 0.001

Four-spotted Chaser can make use of a wide range of still and slow-flowing waters and is widespread throughout Britain and Ireland. It is a species that can rapidly colonise new sites (Smallshire & Swash, 2018), so has probably benefitted from an increase in suitable wetland habitats.

However, sightings at Cruachan have been intermittent in recent years, with the last record dating back to 2016 (maximum count of seven in 2010). Large Red Damselfly is the only species that has been found in every year of the



Species recorded in 2021, Golden-ringed Dragonfly (above), Large Red Damselfly (below left) and Common Hawker



survey and can occur in large numbers, including 40 at the Penthouse Pond (2014), 20 at Allt Cruachan (2012) and 26+ at the dam access road north of Lochawe – although these pale in comparison to the highest ever count, an impressive 150 at Cruachan Substation in 2009.

Common Blue Damselfly was recorded regularly at Cruachan Substation in the early years of the survey but there have been occasional sightings at Loch Awe (2010), the dam access road near Lochawe (2011), Contractors Compound (2014) and Penthouse Pond (2016).

A 10th species of Odonata at the power station remains an enigma. There have been occasional sightings of an ‘Emerald’-type dragonfly species – at Cruachan Substation (June 2011) and the Visitor Centre (June 2016). There are

three species of emerald dragonflies in Scotland, all rather scarce. Northern Emerald *Somatochlora arctica* and Brilliant Emerald *Somatochlora metallica* both occur in the wider Loch Awe area so could potentially occur at Cruachan.

10.1.1 SYSTEMATIC LIST IN 2021

Five species were recorded at the power station in 2021, slightly below the 11-year mean for the survey (5.5).

Most records were obtained from late summer, with the knock-on effects of the cold, wet May being pronounced, especially the low numbers of Large Red Damselfly that were seen at the sites – although the Penthouse Pond was not accessed in May/June due to the heightened security due to the presence of the film crew.

Large Red Damselfly *Pyrhosoma nymphula* (Coenagrionidae)

Only two were seen in late May (31/5), both associating with the Allt Cruachan. One was at the Contractors Compound with the other near the road bridge south of the dam.

Emerald Damselfly *Lestes sponsa* (Lestidae)

The colony at the Penthouse Pond remains viable, with three males and a female present among its Soft Rush margins on 24/8, with a female about 100m north of the site in a channel near the west side dam approach road.

Black Darter *Sympetrum danae* (Libellulidae)

The Penthouse Pond continues to hold small numbers, with a single female around its margins on 13/7, and two mature males present on 24/8.

Golden-ringed Dragonfly *Cordulegaster boltonii* (Cordulegastridae)

Few were recorded, with only two territorial males noted in the survey. Both were recorded on 13/7, in the upland area of the site – with one cruising over the approach road to the reservoir and another further east at NN0974326459.

Common Hawker *Aeshna juncea* (Aeshnidae)

Six were present at or near the Penthouse Pond on 24/8, including three cruising males, a female ovipositing at the shallow north end and a pair in copulation south of the site near the deer fence. A typical set of records, although none was seen elsewhere at Cruachan this year.

10.2 HEMIPTERA (TRUE BUGS)

Spiked Shieldbug *Picromerus bidens* (Pentatomidae)

A pair of these large predatory shieldbugs was found in copulation (24/8) on a Devil's-bit Scabious flower on the verge of the dam access road north of Lochawe – the first site record since 2014. The sighting was particularly interesting as the male was presenting to its mate a “trophy” – a larva of the rare sawfly *Abia candens* (see account and photograph on page 51).

Green Leafhopper *Cicadella viridis* (Cicadellidae)

Several of these brightly-coloured leafhoppers were swept from damp grassland beside the dam access road north of Lochawe on 24/8.

10.3 COLEOPTERA (BEETLES)

Green Tiger Beetle *Cicindela campestris* (Carabidae)

This spectacular species is now being recorded annually at Cruachan. Two of the metallic green beetles were at the dam access road, west of Lochawe village on 31/5, with two at the same location on 17/6.

Violet Ground Beetle *Carabus violaceus* (Carabidae)

A new species for the survey, this spectacular large Carabid was recorded on 24/8 as it ran across the dam access road near the shepherd's cottage.

Athous haemorrhoidalis (Elateridae)

A common click beetle, singles were seen on 31/5 at the Contractors Compound with another nearby on Ramsons *Allium ursinum* flowers at the Falls of Cruachan gorge.

Ctenicera cuprea (Elateridae)

It was a good year for sightings but all records were obtained in May. Unusually, one was found in the east side car park at Cruachan Reservoir on 17/5 – the highest altitude ever found at the station. All other sightings were from the dam access road on 31/5, when a total of 12 were found at three locations, including seven on the BBS transect route and five among the vegetated road margins higher up the access road north of the power station.



Some of the regularly-found beetles in the Cruachan survey, from left: Green Tiger Beetle, *Ctenicera cuprea* and Orchid Beetle

Shore Sexton Beetle *Necrodes littoralis* (Silphidae)

The second Cruachan record of this burying beetle was obtained on 14/7 when one was at an actinic moth trap on the dam access road southeast of Cruachan Reservoir.

Seven-spot Ladybird *Coccinella septempunctata* (Coccinellidae)

This common and familiar species is irregularly recorded in the survey, with sightings in only four previous years. In 2021, a pair was found in copulation at the dam access road north of Lochawe on 24/8, with another feasting on aphids on Common Knapweed at the Visitor Centre wildflower meadow the same day.

Cream-spot Ladybird *Calvia quatuordecimguttata* (Coccinellidae)

One was found on the rocky road embankment south of Cruachan Reservoir on 17/6. This common species has only previously been recorded in 2017.

Common Red Soldier Beetle *Rhagonycha fulva* (Cantharidae)

Good numbers were present on 14/7, with nine at the

Contractors Compound and three at the Visitor Centre wildflower meadow, nectaring at Common Hogweed at both sites. Unusually, two were also found at altitude near the reservoir the same day, exploiting the profusion of flowering Yellow Saxifrage.

Garden Chafer *Phyllopertha horticola* (Scarabaeidae)

There was no large emergence of this chafer in 2021 and the only record involved two on 17/6, which were crawling on the dam access road embankment north of Lochawe.

Brown Chafer Beetle *Serica brunnea* (Scarabaeidae)

This species was first recorded at Cruachan in 2017 and had not been seen since until 14/7, when one appeared in an actinic moth trap located at the east side approach road to Cruachan Reservoir.

Orchid Beetle *Dascillus cervinus* (Dascillidae)

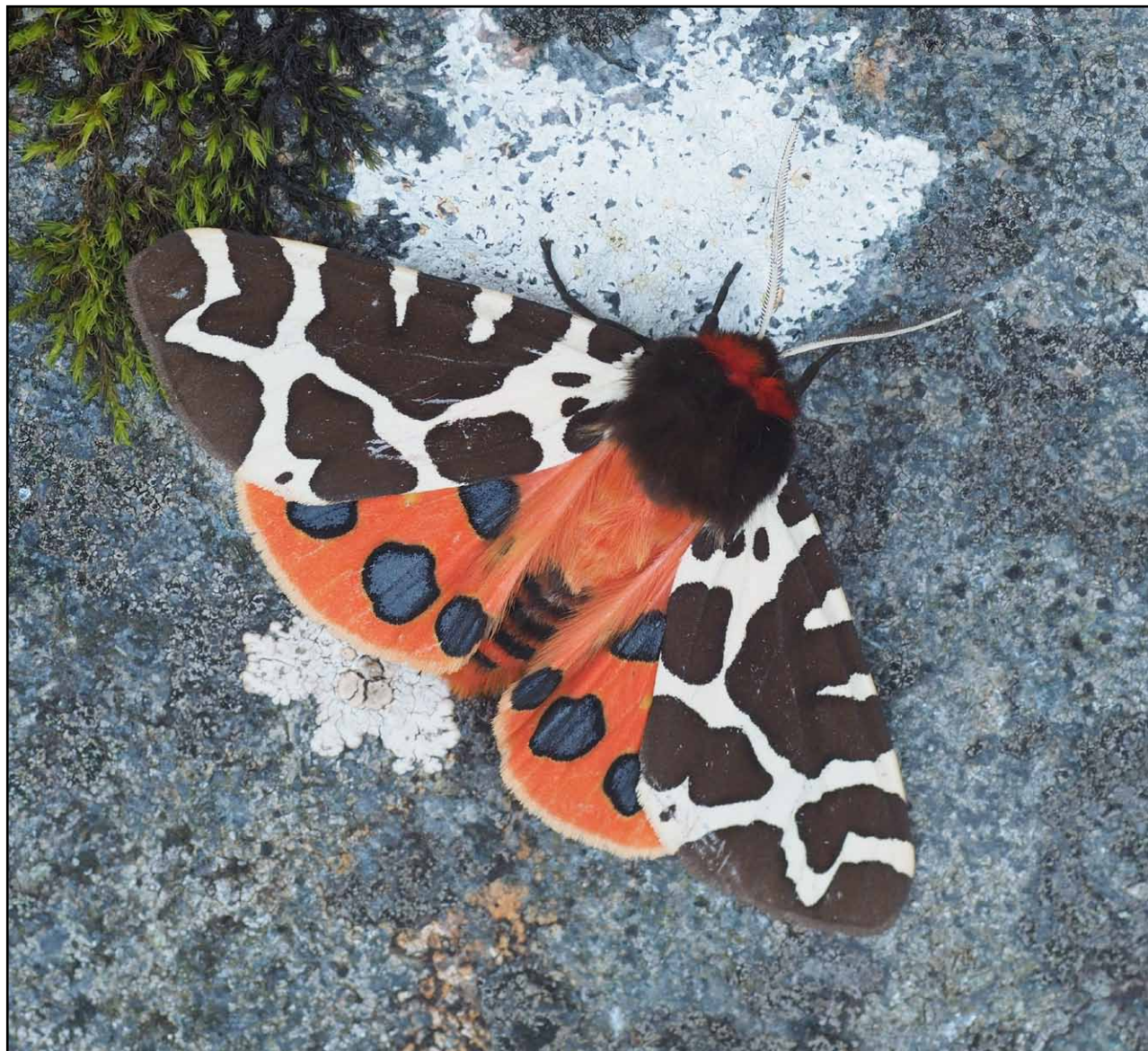
This is a regularly recorded beetle at Cruachan, but the only sighting in 2021 involved a single on 17/6, visiting lady's-mantle beside the dam access road north of Lochawe.

Willow Leaf Beetle *Lochmaea caprea* (Chrysomellidae)

Another familiar species at the power station, five were found on Grey Willow (17/6) at the east end of the dam access road.



Cream-spot Ladybird



Garden Tiger was recorded at Cruachan for the first time in 2021 – this colourful species is declining and is now Amber listed

10.4 LEPIDOPTERA (INTRODUCTION)

The habitats at Cruachan Power Station and its surrounding area have been identified as a High Priority Landscape for butterflies and moths.

Butterfly Conservation's UK Conservation Strategy for 2025, which was published in 2019, is adopting a new five-stage approach to identifying and delivering conservation action, recognising that most species of butterflies and moths are in rapid decline.

Species have been assigned new threat risk values and priorities for conservation, while 19 areas have been designated in Scotland for their value in supporting Lepidopteran assemblages and vulnerable populations.

In total, 10 butterflies and 91 moths, including micro-moths for the first time, have been reassessed as part of the new strategy. Five of these species – four butterflies and one moth – occurring at Cruachan have been identified as priorities for active conservation efforts.

■ **Conservation Priority A**
Urgent action across UK range
Chequered Skipper
Pearl-bordered Fritillary

■ **Conservation Priority B**
Action necessary across UK range:
Grayling
Small Pearl-bordered Fritillary
Yellow-ringed Carpet

The charity will assess the status of these species through surveys and monitoring; identify reasons for threats or decline; and implement management solutions that, if successful, can be rolled out at landscape level.

The Argyll Coast is one of seven High Priority landscapes designated in Scotland. A further 11 Priority landscapes includes Breadalbane Hills to the east.

The Argyll Coast is highlight as it supports 47 priority species (six butterflies and 41 moths) most of which currently have no mechanism for conservation delivery. The boundary extends north to Glasdrum and south to Knapdale but includes significant areas inland, including the north of Loch Awe at the Coille Leitire SSSI/SPA.

10.5 LEPIDOPTERA (MOTHS)

10.5.1 STATE OF BRITAIN'S LARGER MOTHS 2021

The new edition of the *State of Britain's Larger Moths* (Butterfly Conservation 2021) has highlighted a continuing trend of population decline for most species.

The report summarises current knowledge of the fortunes of around 900 species of Britain's larger moths, based on millions of records gathered through research by the Rothamsted Insect Survey and the National Moths Recording Scheme.

The results found four times as many moth species have decreased in abundance than increased.

Long-term abundance trends were calculated for 427 species of which 41% (175 species) decreased and only 10% (42 species) increased, while the remaining 49% (210 species) did not show statistically significant change.

Despite these population declines, more species are increasing in their distribution likely as a result of climate change. Long-term trends indicate 32% (165 species) had decreased in distribution while 37% (187 species) had increased, while a further 159 species did not show any significant trend.

The report states: "This highlights the complexity of biodiversity change over recent decades. While larger moth abundance in Britain has decreased significantly, raising grave concerns for the species themselves and for knock-on impacts on other wildlife, a substantial proportion of moths are bucking that trend, becoming more widespread and, in some cases, also increasing in numbers."

The charity admits that the knowledge gaps are "hugely significant" and require further research to understand and help improve the fortunes of both habitat specialist moths and those that occur as wider countryside species.

Climate change is one of the key drivers that have been identified for causing change. Warmer climate is causing many moth species to emerge earlier in the year compared with the 1970s and some are having larger and more regular additional generations. However, climate change is resulting in declines in those species with a single annual brood.

New species have colonised the UK and moths with northern range margins in Britain have spread northwards



From left, Clouded Buff, Gold Swift and Grey Mountain Carpet are among the key species that have decreasing distributions



From left, Spruce Carpet, Red-green Carpet and Green Carpet are among the top species that have increased in abundance

still at an increasing rate since the 1960s. A study of 487 larger moth species indicates the mean range margin change was a northward shift of 5.1km per year over the period 1995–2016. In all, 346 species (71% of the total) had statistically significant rates of northward expansion.

Moths that breed in woodland and open grasslands increased in distribution, by an average of 12% and 8% respectively (1970–2016).

However, species that breed on moorland decreased significantly in distribution, by an average of 13%. There is also growing evidence of negative impacts, particularly on moths that are adapted to cooler conditions in northern, western and upland Britain. Species associated with cool, damp climates appear to be undergoing a long-term decline.

Examples found at Cruachan include Grey Mountain Carpet *Entephria caesiata* (81% decrease in distribution

1970–2016), Glaucous Shears *Papestra biren* (38% decrease 1970–2016) and Autumn Green Carpet *Chloroclysta miata* (38% decrease 1970–2016).

Many upland and montane species appear also to be shifting to higher altitude. While the causes are not known with complete certainty, these distribution declines are in keeping with expected responses to climate change.

Two species from Cruachan appear in a list of the top-30 species with the highest rates of decrease in abundance over a 10-year period (2009–2018). Both Red Carpet and Dark-barred Twin-spot Carpet were recorded in 2021.

SPECIES	ABUNDANCE TREND
Red Carpet	-38
Dark-barred Twin-spot Carpet	-40

Four species from Cruachan appear in a list of the top-30 species with the greatest decrease in distribution over the 10-year period (2009-2018).

Gold Swift *Phymatopus hecta* has only been recorded from Cruachan Substation (NN01) in the survey but this indicates a presence in Loch Awe area.

SPECIES	RANGE REDUCTION
Clouded Buff	-30
Angle-barred Pug	-29
Gold Swift	-29
Grey Mountain Carpet	-28

Eight species from Cruachan appear in a list of the top-30 species that have had the greatest increase in abundance over a 10-year period 2009-2018. These include species such as Double-striped Pug that are now having more than one breeding generation at the power station.

SPECIES	ABUNDANCE TREND
Spruce Carpet	+92
Straw Dot	+64
Red-green Carpet	+45
Broad-bordered Yellow Underwing	+43
Green Carpet	+31
Double-striped Pug	+31
Vapourer	+27
Coronet	+24

Finally, four species from Cruachan appear in a list of the top-30 species with the highest rates of increase in distribution over a 10-year period 2009-2018.

SPECIES	INCREASE IN DISTRIBUTION
Red-green Carpet	+49
Spruce Carpet	+45
Pinion-streaked Snout	+42
Straw Dot	+27



Species of Conservation Concern: clockwise from top, Red Carpet is one the top species that is decreasing in abundance; White Ermine and Latticed Heath have been identified for urgent research to identify causes of decline



10.5.2 BUTTERFLY CONSERVATION'S STRATEGY FOR 2025

Butterfly Conservation's new Conservation Strategy 2021-2025 has identified 71 wider countryside moths in need of urgent research to identify drivers of their decline.

These include 22 species found at Cruachan:

- Autumnal Rustic
- Broom Moth
- Buff Ermine
- Centre-barred Sallow
- Cinnabar
- Crescent
- Dark-barred Twin-spot Carpet
- Dark Brocade
- Ear Moth
- Garden Tiger
- Grey Dagger
- Grey Mountain Carpet
- Heath Rustic
- Knot Grass
- Latticed Heath
- Powdered Quaker
- Red Carpet
- Rosy Rustic
- Sallow
- Shaded Broad-bar
- Small Phoenix
- White Ermine

Results of monitoring and future research will help inform the preparation of a revised Red List of British larger moths.

Cruachan Power Station Biodiversity Survey 2021

10.5.3 MOTH TRAPPING SURVEY 2021

Blue Leaf resumed moth trapping surveys at Cruachan Power Station in 2021, with up to four light traps deployed on four nights, to help produce an indicative list of the species present at the station.

In May, the habitats along the dam access road were targeted for the first time while we continued to monitor montane species at Cruachan Reservoir, with a trapping session held in July. Two further sessions were based at Cruachan Visitor Centre, in June and August.

The methodology is fully discussed in the 2017 Cruachan Biodiversity Report. However, as a summary, three types of moth light trap were deployed – a mains-powered Robinson Trap and up to two 12V battery-powered Skinner actinic light traps and two battery-powered Heath traps.

Actinic light traps use fluorescent tubes that emit light with a high ultraviolet content. As they can be run off 12V motorcycle batteries, without a need to be connected to a mains power supply, they are portable and can be placed remotely in any habitat.

Meanwhile, a mains-powered Robinson Trap was located in the car park west of the Visitor Centre. This trap uses a large, very bright 125W Mercury Vapour (MV) bulb that emits ultraviolet light.

These traps require a 240V power supply and, lacking a portable generator, have to be powered by mains electricity. This nearest accessible building with a power supply was the Visitor Centre and Blue Leaf is grateful to security staff at Cruachan for enabling access to the supply.

Trapping sessions were arranged for nights that promised the best conditions – warm, humid, overcast conditions with little wind. Despite this, some nights were more successful than others (Graph 5) and often weather conditions proved

TABLE 15: TRAPPING SESSIONS AT CRUACHAN 2021

DATE	LOCATION	OVERNIGHT WEATHER CONDITIONS
17-18 May	Access Road	Drizzle, overcast, 10°C, light SW wind
17-18 June	Visitor Centre	Dry, partly cloudy, 8°C, mod west wind
13-14 July	Reservoir	Dry, variable cloud, 13°C, light west wind
23-24 Aug	Visitor Centre	Dry, 30% cloud, 14°C, still and foggy



Pebble Hook-tip (main pic), new for Cruachan, and above (from left) Common Lutestring, Shaded Broad-bar, Common Carpet



less than optimum – in May, for instance, overnight rain and low cloud may have reduced the effectiveness of the trapping session. Although 62 moths were captured, two-thirds (41) of these was a single species, the Brown Silver-line, a common Geometrid associated with Bracken.

Meanwhile, the June session at the Visitor Centre/Site Offices was hugely disappointing, with only 32 moths trapped – although, in this case, an actinic trap located near the tunnel entrance failed during the night, resulting in no moths being retained.

The highest catch was overnight on 14-15/7 when 89 moths were attracted to two Heath and one Skinner actinic lights at Cruachan Reservoir and its environs, then 78 were caught in the August session at the Visitor Centre – both nights were mild with little wind.

In each session, the contents of the traps were emptied soon after first light, the catch was examined, identified and photographed, then moths were released into long grass.

A small number of species from difficult-to-identify groups were, however, retained for further investigation. Best practice, as described in the Moth Recorders Handbook (Randle 2013), was followed in delivering the 2021 moth trapping survey.

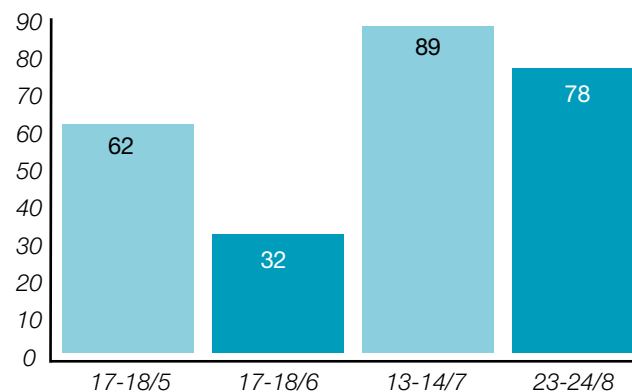
10.5.4 NOTES ON THE SYSTEMATIC LIST

A total of 271 moths of 78 species were recorded in the light trap survey or otherwise found at Cruachan in 2021. This is fewer than the 341 moths of 82 species recorded in 2018 but more than the 185 moths of 78 species that occurred in the 2017 trapping sessions.

The following systematic list groups the moths recorded in 2021 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 given is the checklist number, then the common name used by Bradley (2000) and the scientific name for each species. Where relevant, comments on the Scottish status of moths are included in the text, based on the most recent version of the *Scottish Macro-moth List* (Butterfly Conservation 2020). However, most of the species recorded are common and widespread.

GRAPH 5: NUMBERS OF MOTH SPECIES RECORDED IN 2021 TRAPPING SESSIONS AT CRUACHAN POWER STATION



10.5.6 SYSTEMATIC LIST OF SPECIES

18 Map-winged Swift *Korscheltellus fusconebulosa*

Two were trapped on 14/7, at an actinic light located at the east side approach road to Cruachan Reservoir.

** 1632 Pale Eggar *Trichiura crataegi*

One was caught in the Visitor Centre MV trap on 24/8 – the first record for the survey. This is a moth of heathland and woodland edge that flies in late summer and early autumn. Its caterpillars feed on shrubs such as Common Blackthorn and Blueberry.

1640 Drinker *Euthrix potatoria*

Two of these large moths were attracted to an actinic trap placed at the foot of Cruachan Dam on 14/7.

** 1648 Pebble Hook-tip *Drepana falcataria*

This is a widespread but local species in Scotland. Two were in the Visitor Centre MV trap on 24/8 – the first records for Cruachan. The larvae of this species feed on birch trees and its population is thought to be stable in Scotland.

1657 Common Lutestring *Ochropacha duplaris*

Two were retained on 14/7, in an actinic trap at upland Cruachan, on the east side approach road to Cruachan Reservoir.

** 1715 Plain Wave *Idaea straminata*

One was caught in the actinic traps near Cruachan Reservoir on 14/7, a new species for the site. This species is increasing its UK range and is widespread in Scotland but most records are from the Highlands. It occupies a range of habitats, including woodland and heathland, and its larvae feed on dandelion and knotgrass *Polygonum spp.*

1722 Flame Carpet *Xanthorhoe designata*

Likely two generations were recorded of this small, well-marked carpet species – one at an actinic trap at the Visitor Centre (18/6) then five appeared, two months later, at the Visitor Centre MV trap (24/8).

** 1723 Red Carpet *Xanthorhoe decoloraria*

The first records for the survey came on 14/7, when two were attracted to an actinic Heath trap at the east side of Cruachan Reservoir. This Amber-list species is associated with rocky moorland, where its larvae feed on lady's-mantle *Alchemilla spp* and other low plants – however, the Scottish Macro-moth List highlights that although it is still considered common in Scotland, there has been a major decline in numbers at lower-altitude recording sites.

** 1725 Dark-barred Twin-spot Carpet *Xanthorhoe ferrugata*

This moth is highlighted as Red-listed and it is Endangered in the IUCN Regional Red List, although its population may be stable in Scotland (Levertson 2020). One attracted to the Visitor Centre MV light was the first capture for the Cruachan survey. Its caterpillar feeds on low herbaceous plants, including docks and bedstraws, in woodland and scrub.

** 1732 Shaded Broad-bar *Scotopteryx chenopodiata*

One was caught in a Heath trap at the mid-section of the dam access road on 18/5, the first record of this Amber-listed species for the survey. This is a grassland species whose larvae feeds on clovers and vetches. The Scottish Macro-moth List suggests Shaded Broad-bar, which also flies during the day, is not common in the west of Scotland.

1738 Common Carpet *Epirrhoe alternata*

Four were at the Visitor Centre MV trap, one at an actinic light near the tunnel entrance and another was disturbed during day at the east side of the dam access road (all 24/8).

**** 1742 Yellow Shell *Camptogramma bilineata***

One was seen flying by day on 14/7, beside the dam access road near the old quarry. This brightly-coloured moth is a new species for the survey. This is a common species of damp grassland whose larvae feed on a range of low-growing plants.

1743 Yellow-ringed Carpet *Entephria flavicinctata*

Yellow-ringed Carpet is the only Butterfly Conservation 'Priority B' moth recorded to date during survey work at Cruachan, after several were caught near Cruachan Reservoir in 2018. It was re-recorded at the location in 14/7, when one was at an actinic light at the east side dam approach road. The Scottish Macro-moth List suggests there has been a decline in its numbers since 1980.

1750 Water Carpet *Lampropteryx suffumata*

This species was recorded for the first time in 2018 and re-found on 18/5, when five were in an actinic trap located at the mid-section of the dam access road.

1752 Purple Bar *Cosmorhoe ocellata*

Trapping in upland Cruachan on 14/7 resulted in three of these attractive moths being caught at an actinic light at the east side dam approach road.

1758 Barred Straw *Eulithis pyraliata*

Just one was recorded, caught in an actinic trap at the east side approach road to Cruachan Reservoir on 14/7.

1759 Small Phoenix *Ecliptopera silaceata*

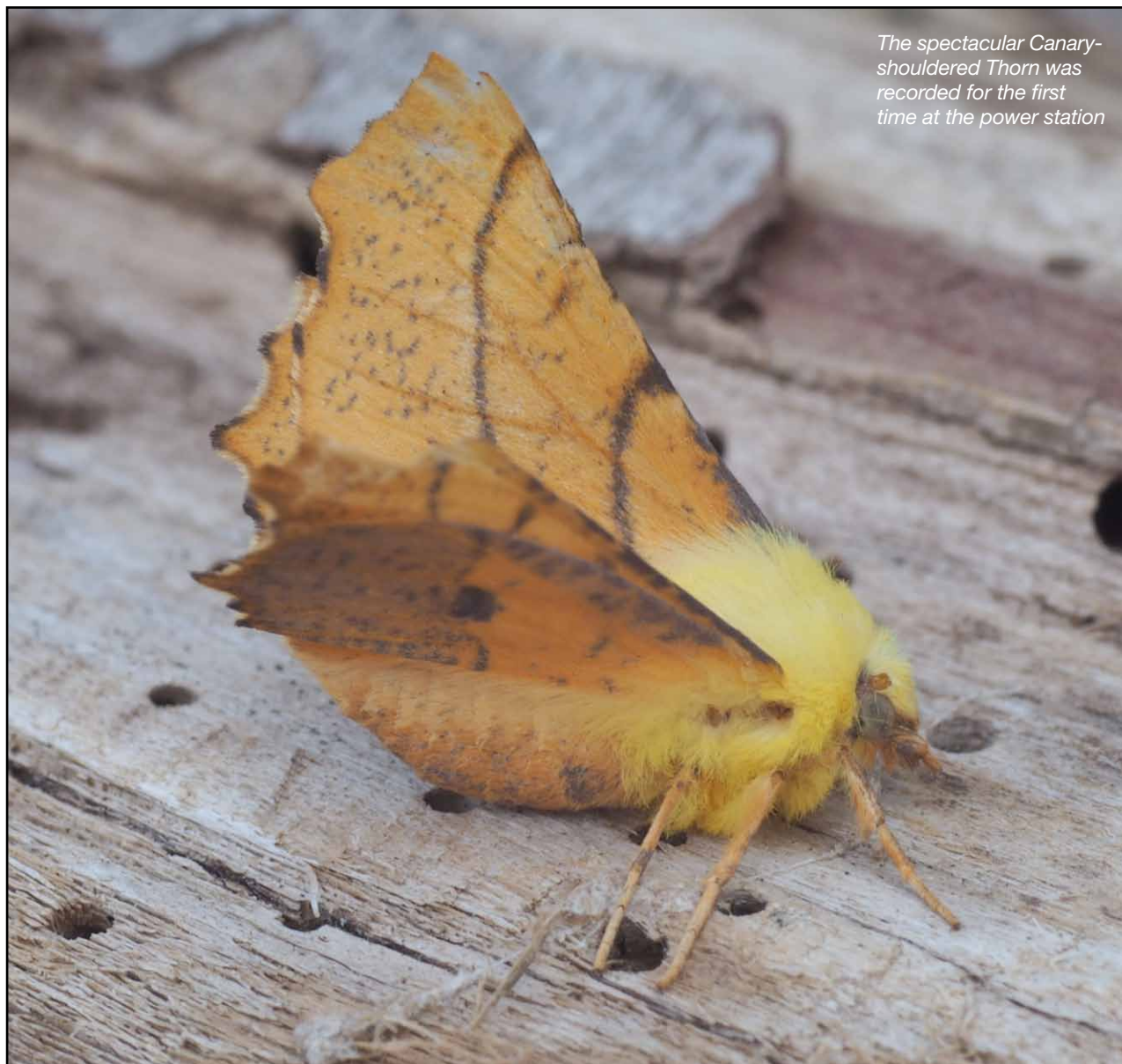
There was just a single record of this Amber Data list species – one at the Visitor Centre MV trap on 18/6.

1762 Dark Marbled Carpet *Chloroclysta citrate*

All records were obtained on 24/8, when four were caught at the Visitor Centre MV trap while a single was at an actinic trap at the children's play area.

1764 Common Marbled Carpet *Chloroclysta truncata*

This was the most numerous of the marbled carpet-type species in this year's survey, with three first-generation individuals caught at the Visitor Centre on 18/6. Then, on 24/8, a total of 10 were caught at the same site, including nine in the Visitor Centre MV trap.



The spectacular Canary-shouldered Thorn was recorded for the first time at the power station



Purple Bar



Barred Straw



Foxglove Pug



Treble-bar



Brown Silver-line



Early Thorn



Engrailed



Clouded Silver

1776 Green Carpet *Colostygia pectinataria*

As usual, this species was abundant, with a single, very late individual still present at the Visitor Centre MV light on 24/8. All others were caught near Cruachan Reservoir on 14/7, with a total of 13 recorded, including seven in an actinic trap at the foot of the dam wall (west side).

1777 July Highflyer *Hydriomena furcata*

A total of 13 were trapped on 24/8 at the Visitor Centre, including nine at the MV trap and four in an actinic placed in the children's play park. This is a very common woodland species but this was towards the end of its flight time.

1817 Foxglove Pug *Eupithecia pulchetta*

Two were caught in Skinner actinic trap placed below the west side of the dam on 14/7.

1862 Double-striped Pug *Gymnoscelis rufifasciata*

A second-generation individual was caught at the Visitor Centre MV trap on 24/8. This species was caught in spring during the 2018 survey.

1867 Treble-bar *Aplocera plagiata*

One was at an actinic trap at the east side dam approach road on 14/7, three days later than one in the 2018 survey.

1887 Clouded Border *Lomaspilis marginata*

A regularly encountered species at Cruachan, two were in the Visitor Centre MV trap on 18/6 with a single at an actinic (14/7) at the east side dam approach road.

1902 Brown Silver-line *Petrophora chlorosata*

This species is associated with Bracken and proved to be

the most common moth during the mid-May trapping session. A total of 41 were caught in the three actinic lights, including 36 in one Heath trap located at the upper section of the dam access road.

** 1904 Scorched Wing *Plagodis dolabraria*

This is a local species in Scotland but is expanding its range north. The first record for Cruachan was attracted to the Visitor Centre MV trap on 18/6. This is a woodland species whose larvae feed on oak and other deciduous trees.

** 1913 Canary-shouldered Thorn *Ennomos alniaria*

A spectacular new species for the Cruachan list, one was caught in the Visitor Centre MV trap on 24/8. This is another woodland moth whose larvae feed on the leaves of a range of deciduous trees but it is common in Scotland with a stable population.

1917 Early Thorn *Selenia dentaria*

Three were caught in two actinic traps located at the dam access road on 18/5.

1920 Scalloped Hazel *Odontopera bidentata*

An actinic trap near the tunnel entrance at the Site Offices failed on the 18/6 trapping session but, the following morning, one Scalloped Hazel was found roosting nearby on the emergency generator

1941 Mottled Beauty *Alcis repandata*

Three were recorded on two dates. One was at the Visitor Centre MV trap on 18/6, with singles in actinic traps at the west side of Cruachan Dam and the east side dam approach road (14/7).

1947 Engrailed *Ectropis bistortata*

This spring-flying species was recorded at the mid-section of the dam approach road on 18/5, when two were caught in an actinic trap.

1952 Common Heath *Ematurga atomaria atomaria*

This is a common day-flying moorland species and one was seen during fieldwork on 31/5, at the east end of the dam access road.

** 1958 Clouded Silver *Lomographa temerata*

A new species for the survey, one was caught in an actinic



Poplar Hawkmoth was common in June



Pale Prominent was new for the survey



Marbled Brown is a local species in Scotland



Coxcomb Prominent is a regular sighting

trap placed at the Contractors Compound on 18/6, while another was netted by the surveyor nearby as it buzzed the LED security lights. This is a woodland species, whose early stages depend on scrub species such as Hawthorn, and it is expanding its range northwards in Scotland.

1981 Poplar Hawkmoth *Laothoe populi*

A familiar species in past moth-trapping surveys, five were recorded on 18/6 at the Visitor Centre. Four were at the Visitor Centre MV trap with a single in an actinic in the grounds of the Visitor Centre.

1991 Elephant Hawkmoth *Deilephila elpenor*

The second sighting for the survey, after one at the Visitor Centre in 2017, turned up in an actinic trap at the west side of Cruachan Dam on 14/7.

1994 Buff-tip *Phalera bucephala*

There was a single record of one caught on 18/6, at the Visitor Centre MV trap.

2003 Pebble Prominent *Notodonta ziczac*

A late individual, towards the end of its flight period (24/8), turned up in an actinic trap located in the children's play park at the Visitor Centre.

2008 Coxcomb Prominent *Ptilodon capucina*

This prominent has been found in all three years of the

trapping survey – but just one was seen in 2021, a single at the Visitor Centre MV trap on 18/6.

**** 2011 Pale Prominent *Pterostoma palpina***

The Scottish Macro-moth List notes that this relatively-recent arrival in Scotland is now widespread and is continuing to increase its range. This is a new species for the Cruachan site list and adults were recorded on two dates, at the start and end of the survey. One was in an actinic trap at the mid-section of the dam access road (18/5) with another in the Visitor Centre MV trap (24/8).

2014 Marbled Brown *Drymonia dodonaea*

This is a local species in Scotland but more common in the west of the country. Two were caught at the Visitor Centre on 18/6.

**** 2057 Garden Tiger *Arctia caja***

A colourful addition to the Cruachan list, three were caught at upland Cruachan on 14/7 – including two in an actinic trap at the east side of Cruachan Dam and a single in the east side dam approach road. This is an Amber-listed species, due to UK-wide population declines, but it remains common in Scotland and its population is stable.

2061 Buff Ermine *Spilosoma lutea*

Two of this Amber List species were recorded at the Visitor Centre traps on 18/6.

**** 2069 Cinnabar *Tyria jacobaeae***

This smart black-and-red moth was disturbed from grassland beside the east section of the dam access road on 31/5 – a new species for the survey. This is an Amber-list species but its distribution is complex in Scotland. The Scottish Macro-Moths List notes that while Cinnabar is increasing its range in the west, where it is largely coastal, it is declining in the east of the country.

2102 Flame Shoulder *Ochropleura plecta*

There was a single record of this small Noctuid – one that was attracted to actinic light on 14/7, at the east side approach road to Cruachan Reservoir.

2107 Large Yellow Underwing *Noctua pronuba*

This large species was present on the two late summer trapping sessions. On 14/7, three were caught in traps near Cruachan Reservoir then, on 24/8, it was common with eight recorded, including seven in Visitor Centre MV trap.

**** 2111 Lesser Broad-bordered Yellow Underwing *Noctua janthe***

This is a common and widespread Scottish species but six at the Visitor Centre MV trap on 24/8, represent the first sightings for the survey. This is another large moth, with a wing span of 40mm, and is abundant in woodlands, gardens and open countryside.



Lesser Broad-bordered Yellow Underwing (main image), a new species for the survey, and (from top) Buff Ermine, True Lover's Knot and The Shears

2019 Lesser Yellow Underwing *Noctua comes*

Singles were recorded on two dates – one in an actinic trap at the east side approach to Cruachan Reservoir (14/7) and another at the Visitor Centre MV trap (24/8).

2118 True Lover's Knot *Lycophotia porphyrea*

This small, well-marked moorland Noctuid was the most abundant species in this year's survey. Large numbers appeared in the actinic traps at upland Cruachan, including 22 in a trap at the base of Cruachan Dam and 14 at the east side approach road to the reservoir.

**** 2121 Barred Chestnut *Diarsia dahlia***

This northern species was recorded for the first time on 24/8, when two appeared in the Visitor Centre MV trap. It is widespread in Scotland where it inhabits woodland and moorland where its larval footplant, Blaeberry *Vaccinium myrtillus* is present.

2123 Small Square-spot *Diarsia rubi*

Two were caught at the MV trap located at the Visitor Centre on 24/8.

2128 Double Square-spot *Xestia triangulum*

Three appeared in an actinic trap placed at the west-side base of Cruachan Dam on 14/7.

**** 2147 The Shears *Hada plebeja***

A new species for the survey, one was trapped in the Visitor Centre MV trap on 18/6. The Scottish Macro-moth List states that although still common, this species may be declining. The Shears occurs on a wide range of habitats, including moorland, where its larvae feed on a range of flowering plants, including dandelion.

2158 Pale-shouldered Brocade

A familiar species in the trapping survey in past years, a single was caught in 2021 in a trap in the mid-section of the dam access road (18/5).

**** 2162 Glaucous Shears *Papestra biren***

One in an actinic trap on 18/5, at the mid-section of the dam access road, was a new species for the Cruachan list. This is a moorland species with a northern range in the UK whose larvae feed on Common Heather and Bog Myrtle.

2168 Broom Moth *Melanchra pisi*

There was just a single record of one attracted to a Heath trap at the east side approach road to Cruachan Reservoir on 14/7.

** 2173 *Lychnis Hadena bicurris*

Another new moth for the survey, one turned up in the Visitor Centre MV trap on 18/6. This is a common species with a stable population in Scotland, inhabiting a range of habitats including woodland and moorland where its caterpillars feed on campions.

2176 Antler Moth *Cerapteryx graminis*

Antler Moth has been recorded in previous years both at light traps and also found by day, nectaring on thistles. In 2021, two were found at a Skinner trap at the west side of Cruachan Dam on 14/7.

2186 Powdered Quaker *Orthosia gracilis*

The mid-May trapping session at the mid-section of the dam access road resulted in a suite of early spring-flying species being caught. These included two Powdered Quaker, which were caught in an actinic trap on 18/5.

2188 Clouded Drab *Orthosia incerta*

Another early-year species, three were in actinic traps at the mid-section of the dam access road on 18/5.

2190 Hebrew Character *Orthosia gothica*

Three were trapped in the actinic traps at the mid-section of the dam access road on 18/5.



Brightly-coloured autumn flying moths, from left, Pink-barred Sallow and Sallow. Right, the Dun-bar, a new moth for Cruachan



From left, the *Lychnis* was a new species for the moth-trapping survey at Cruachan, plus Antler Moth and Clouded Drab

2198 Smoky Wainscot *Mythimna impura*

Two were attracted to the actinic traps near Cruachan Reservoir on 14/7, with singles at the west side of the dam and at the east side approach road trap.

** 2199 Common Wainscot *Mythimna pallens*

Eight individuals trapped at the west side of Cruachan Dam on 14/7, represent a new species for the survey. Care was taken to separate these from the previous similar species, which occurs in the same grassy habitats. A common and widespread Scottish species.

2250 Dark Brocade *Mniotype adusta*

Two of this Amber-listed species were trapped beside the mid-section of the dam access road on 18/5 – a similar sighting to those in the 2018 survey.

2273 Pink-barred Sallow *Xanthia togata*

The first of the classic autumn-flying species on the systematic list, three were caught at the Site Offices/Visitor Centre on 24/8. Two were at an actinic light near the tunnel entrance with a single in the Visitor Centre MV trap.

2274 Sallow *Xanthia ictertia*

One of these bright-yellow autumnal moths was attracted to the MV light at the Visitor Centre on 24/8.

** 2299 Mouse Moth *Amphipyra tragopoginis*

This Amber Data species was recorded for the first time at Cruachan when a single appeared in the Visitor Centre MV trap on 24/8. The Scottish Macro-moth List highlights this rather drab species as declining in Scotland and relatively scarce in the west. Its larvae feed on a wide range of herbaceous and woody plants.

2302 Brown Rustic *Rusina ferruginea*

Two were attracted to the Visitor Centre actinic trap on 18/6.

2305 Small Angle Shades *Euplexia lucipara*

Recorded in every year of the moth trapping survey, this continued with three at the Visitor Centre on 18/6, including two at the MV trap.

** 2318 Dun-bar *Cosmia trapezina*

One turned up in the Visitor Centre MV trap on 24/8 – the first record for Cruachan. This is a common species everywhere in Scotland except for the northwest. Its larvae feed on the leaves of several deciduous trees.



Frosted Orange (main image) is named after its beautiful markings. This was a new species for Cruachan. Inset, Plain Golden Y

2321 Dark Arches *Apamea monoglypha*

This large moth was trapped at the Visitor Centre on 24/8 towards the end of their flight season. Two were found in the MV trap with a single in an actinic trap near the entrance gate to the site.

2326 Clouded-bordered Brindle *Apamea crenata*

Two were recorded on 18/6 at the Visitor Centre – singles in each of the MV trap and an actinic light placed in the children's play park.

2330 Dusky Brocade *Apamea remissa*

An actinic trap at the west side of Cruachan Dam attracted a single on 14/7, the first survey record since 2017.

2361 Rosy Rustic *Hydraecia micacea*

Three were recorded at the Visitor Centre on 24/8, including two in the MV trap and a single at actinic light near the entrance gate.

**** 2364 Frosted Orange *Gortyna flavago***

This species is undergoing a range expansion in Scotland and is starting to appear in the west for the first time. Two trapped at the Visitor Centre MV trap on 24/8 were the first records for the Cruachan survey and likely represent the first inland records for Argyll. This is a woodland and open-ground species whose larvae feed on thistles.

2425 Nut-tree Tussock *Colocasia coryli*

On 18/5, two of these spring-flying moths were caught in actinic traps in the mid-section of the reservoir access road.

2443 Plain Golden Y *Autographa jota*

The only record involved one that was caught at the Visitor Centre MV trap on 24/8. This is the first survey record since 2017.

2474 Straw Dot *Rivula sericealis*

A small grassland species, one turned up in a Skinner trap located near the base of Cruachan Dam on 14/7. This species is one identified in The State of Britain's Larger Moths as having greatly expanded its range in recent years.

Cruachan Power Station Biodiversity Survey 2021

10.5.7 DISCUSSION

Moth trapping surveys are continuing to discover new species at Cruachan Power Station. In 2021, 78 species of macro-moth were recorded of which 22 (28%), a notable proportion, were found for the first time at the station's landholdings.

The addition of 22 species in 2021 increases to 179 the total number of different moth species recorded by Blue Leaf at the station. Most of these have been recorded in the years in which moth trapping, using light traps, has been carried out – 2017, 2018 and 2021. This highlights the range and extent of quality habitats found at the station and, in 2021, we explored new areas with a trapping session organised at the mid-section of the dam access road on 17-18/5.

Although carried out in drizzly, cool conditions, this trap night resulted in three new additions to the Cruachan list – Shaded Broad-bar, Pale Prominent and Glaucous Shears – and highlighted the potential of the area, close to the Coille Leitire SSSI, for future effort.

Later in the month, another new species was discovered (30/5), although outwith the moth trapping survey. The Amber-listed Cinnabar was found flying by day beside the east section of dam access road, north of Lochawe village.

The June session at the Visitor Centre was disappointing but despite the very low total of 32 moths, four of these were first sightings for the power station – Lychnis, Clouded Silver, The Shears and the spectacular Scorched Wing.

Plain Wave, Red Carpet, Garden Tiger and Common Wainscot were trapped near the reservoir in June while Yellow Shell was found in the morning, flying by day beside the dam access road – all new for the site. Another highlight was the rediscovery of the montane species Yellow-ringed Carpet, which is known from only two other sites in Argyll.

Finally, nine new varieties of moths were encountered in the final session, in August, which connected with a range of summer species and the first of the autumn fliers.

These were: Pale Eggar, Pebble Hook-tip, Dark-barred Twin-spot Carpet, Canary-shouldered Thorn, Lesser Broad-bordered Yellow Underwing, Barred Chestnut, Dun-bar, Mouse Moth and Frosted Orange.

Moth recording in Great Britain is organised on the basis



Red List species recorded at Cruachan in 2021, from left, Dark-barred Twin-spot Carpet, Garden Tiger and Cinnabar Moth

of Watsonian Vice-Counties (VC) which are fixed biological recording areas of roughly equal size that do not necessarily relate to local authority area. Cruachan is located in VC98 (Main Argyll). Main Argyll VC98's macro-moth list stood at 401 species at the end of 2016, the most recent figure, with moth trappers providing over 78,000 records to the National Moth Recording Scheme (NMRS).

The Argyll list is increasing every year, with at least three new regional species found in 2021 as more species expand their range north. For instance, the Pale Prominent, which was recorded at Cruachan for the first time in both May and August, has pushed into Scotland dramatically since 2012 and is still spreading – however, nationally, its population has declined by 40% between 1967 and 2018.

Plain Wave has been recorded only 11 times in the VC, all of which have been from Glen Etive and Appin areas.

Frosted Orange has only been known from Argyll since 2015 but 10 of the 16 sightings have been since 2018.

10.5.8 RED DATA LIST MOTHS AT CRUACHAN

Six new species of macro-moths that are included on the Red and Amber Data Lists were recorded at Cruachan for the first time in 2021.

One species, Dark-barred Twin-spot Carpet, is on the Red List following a population decline of -92% over a 35-year

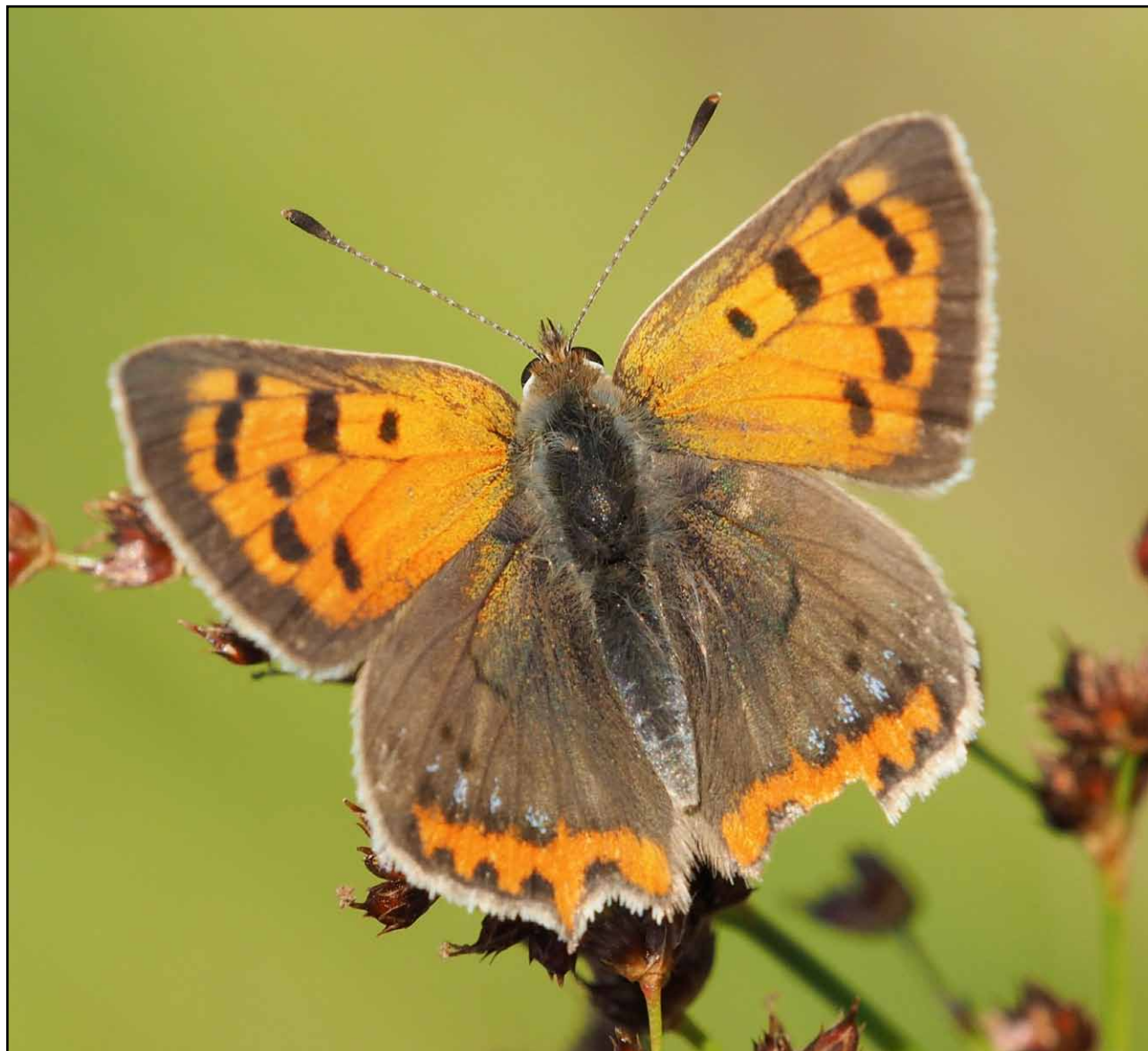
monitoring period (-83% in a 25-year period). It also qualifies as Endangered based on IUCN criteria, as it has experienced a decline of greater than 50% in a 10-year period of monitoring.

Meanwhile, Red Carpet, Shaded Broad-bar, Garden Tiger, Cinnabar and Mouse Moth are all on the Amber List of species of medium conservation concern and highlighted as Vulnerable by IUCN, having suffered declines of greater than 30% in a 10-year timescale.

These species increase to 23 the total number of Red and Amber Data List moths that have been recorded at the station landholdings.

TABLE 16: RED/ AMBER DATA LIST SPECIES AT CRUACHAN 2021

SPECIES	RED LIST	IUCN	DECLINE
Red Carpet	AMB	VULNERABLE	-69
Dark-barred Twin-spot Carpet	RED	ENDANGERED	-83
Shaded Broad-bar	AMB	VULNERABLE	-61
Garden Tiger	AMB	VULNERABLE	-80
Cinnabar	AMB	VULNERABLE	-71
Mouse Moth	AMB	VULNERABLE	-61



Small Copper was found at Cruachan for the first time in 2021, a single that was flying beside the dam access road in August

10.6 LEPIDOPTERA (BUTTERFLIES)

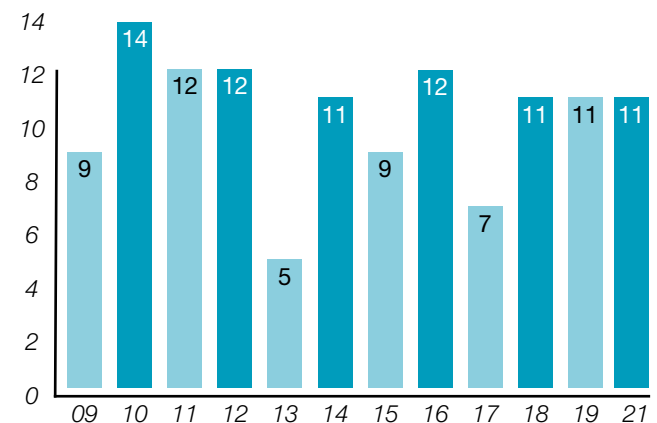
Notably, two new species of butterfly were recorded at Cruachan in 2021, bringing the checklist for the site to 20 species. Small Copper was a long predicted species since the start of fieldwork in 2009 but the second new species, Chequered Skipper, was a major surprise given its very restricted Scottish population.

Small Copper is a frequently-recorded species in Argyll although its distribution is mostly coastal or following the route of sea lochs and river systems. There are only two previous NN02 records – from Taynuilt (1980) and Glen Nant (2015) – so the Cruachan sighting represents a modest expansion to the west.

Chequered Skipper is listed as an Endangered species in the Red List of British Butterflies (2011) due to its fragmented population and limited distribution. It is a Conservation Priority A butterfly for Butterfly Conservation and it is also a Scottish Biodiversity Plan (SBL) priority species that has been targeted for surveys and conservation action. It is known from NN02, however, with records from Glen Nant and Bridge of Awe since 2012.

Nine other butterfly species were recorded during this year's fieldwork – the total of 11 species is slightly above the mean annual total over the previous 11 years of

GRAPH 6: NUMBERS OF BUTTERFLY SPECIES RECORDED IN EACH YEAR OF THE CRUACHAN SURVEY 2009-2019 AND 2021



survey work (10.3). Nevertheless, it was felt that populations remain sparse with few species abundant and, generally, low-figure counts of even the most common species.

This is in line with the results of survey work by Butterfly Conservation volunteers in 2021 that found that populations were at the lowest level for 12 years, likely as a result of this year's unusual weather conditions.

At Cruachan, many species, such as Orange-tip and Green-veined White, were active in March and April during the warm start to spring.

However, cool and wet conditions in May prevented butterflies from feeding and breeding, with a consequent impact for second generations. Species such as Peacock (lowest number in 12 years) and Small Tortoiseshell (third lowest in 12 years) continue to demonstrate long-term population declines of even our most familiar species.

10.6.1 BUTTERFLY CONSERVATION STRATEGY

Butterfly Conservation's Conservation Strategy 2021-2025 has identified four species of butterflies that occur at Cruachan as priorities for conservation:

Priority A – Urgent action across UK range

- Chequered Skipper
- Pearl-bordered Fritillary

Priority B – Action necessary across UK range

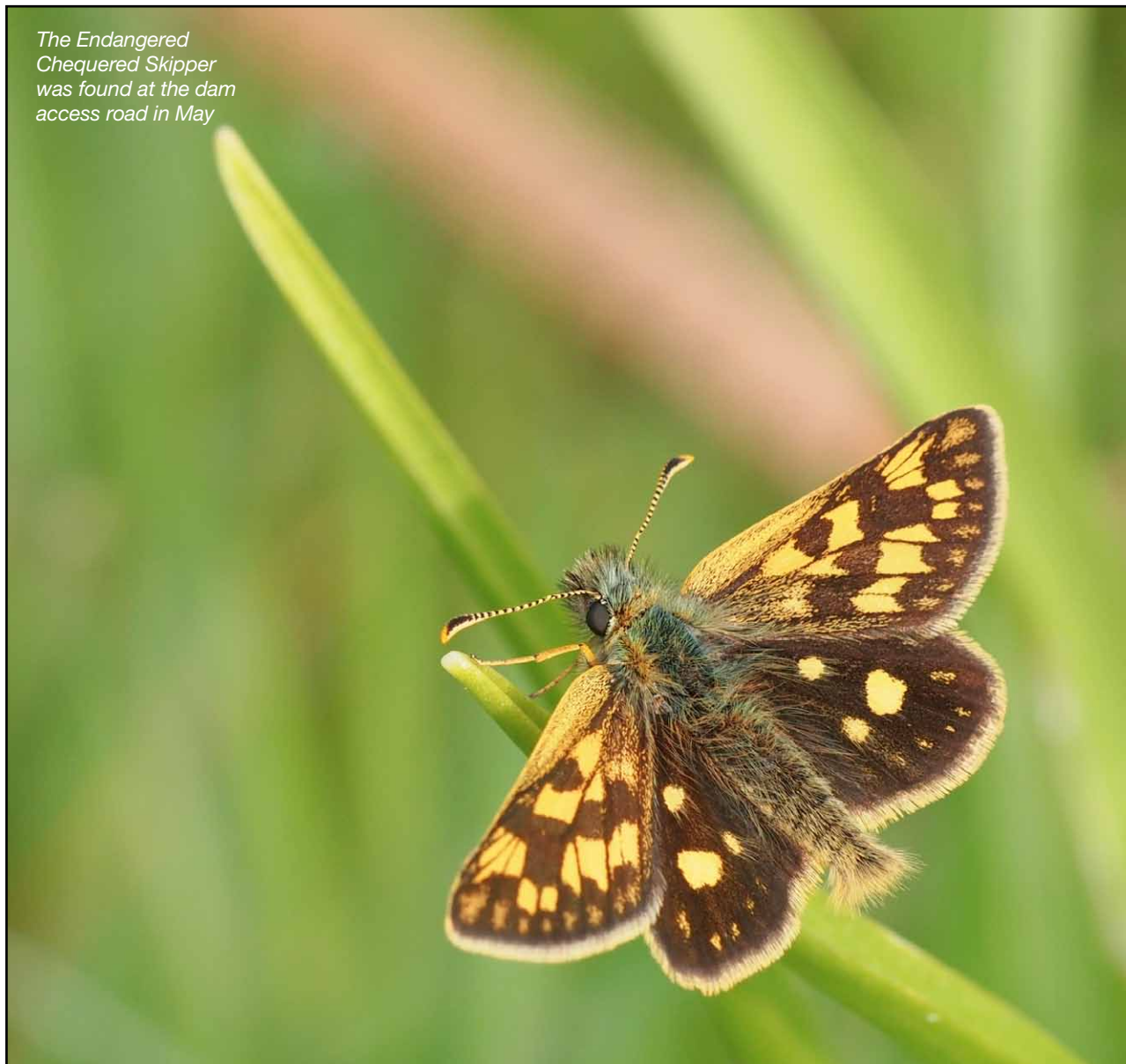
- Grayling
- Small Pearl-bordered Fritillary

Meanwhile, three further species of butterfly found in the wider countryside, including Cruachan, have been identified by Butterfly Conservation as priorities for research to determine the underlying drivers of decline.

- Small Heath (High)
- Small Tortoiseshell (High)
- Small Copper (Medium)

With the exception of Small Tortoiseshell and Small Copper, all these species are also priorities for conservation on the Scottish Biodiversity List.

*The Endangered
Chequered Skipper
was found at the dam
access road in May*



10.6.2 CHEQUERED SKIPPER AT CRUACHAN

The sighting of Chequered Skipper at Loch Awe could never have been predicted when experts were preparing the Red List of British Butterflies in 2011.

At the time of the landmark report, the species was only known from a small number of colonies in Lochaber and North Argyll. However, survey work from 2012 to 2014 has provided researchers with a better understanding of the species and it has been found to be more widespread.

Chequered Skipper was an abundant and widespread species in the English Midlands in the 20th Century and remained common until the 1950s when it underwent a rapid population decline and eventually became extinct at its last site in 1976.

In Scotland, the species was unknown until it was first found in the Lochaber area in 1939 and remained poorly recorded for the next 40 years. Survey work up to 2011 established its general distribution to be restricted within a 45-kilometre radius of Fort William.

Computer modelling undertaken by the Joint Nature Conservation Committee assessed the Chequered Skipper's requirements in terms of habitat, vegetation, topography, aspect, climate, amount of cloud and rainfall. As a result, it was predicted that the species was under-recorded in Scotland by 20% at a 10km resolution and by as much as 80% at a 1km resolution.

In response, a project in 2012-14 encouraged volunteers to search for the butterfly in the top 100 1km squares predicted by the modelling to have the most suitable habitat but where the butterfly had not been recorded. Over the three years Chequered Skipper was recorded in 104 new 1km squares, including 32 in the top 100 plus 72 additional new squares. This increases the known range of the butterfly at a 1km resolution by almost 42%.

The majority of new 1km squares are infilling within the butterfly's known range but the species has expanded along the Ardnamurchan peninsula and to the south and west of Loch Etive. There have been three records in NN02, all since 2012, at Glen Nant (2012 and 2015) and Bridge of Awe (2014). More recently, an accepted sighting from a remote location near Leacann Forest (NM90) in 2017 extends the species' range 30km further to the south of Cruachan. The



Chequered Skipper habitat beside the dam access road, north of Lochawe

habitat along the east end of the dam access road looks suitable for a population of Chequered Skipper to become established.

In Scotland, the Chequered Skipper is primarily a species of woodland edge and scrub, particularly oak (*Quercus*) or birch (*Betula*). It occurs in areas of non-grazed or lightly grazed grassland, scrub and marsh around open broad-leaved woodland.

The butterfly requires areas of lush Purple Moor-grass *Molinia caerulea* (its larval food plant) and Bog Myrtle, similar to National Vegetation Classification habitat M25, which is abundant on the margins of the dam access road and beneath the overhead line at NN111265.

The area also has suitable nectar plants for refuelling adults such as Common Bluebell, Bugle and Marsh Thistle.

The species' original biodiversity action plan (1996), produced by Butterfly Conservation, highlights the value of wayleaves beneath overhead lines for this species.

It states: "Many colonies now only survive under power-lines; Chequered Skipper and other butterflies benefit from the seven to 10-year cyclical clearance of scrub beneath the wayleaves."

"The Chequered Skipper colonises these areas quickly and they reach optimum suitability several years after cutting, when scrub development provides shelter at ground. About one-third of known colonies (although many are small) breed to some extent within such wayleaves."

Attempts are ongoing since 2018 to reintroduce the species to its former sites in Northamptonshire, England, using adults sourced from the Continent.



Four of the common and widespread butterflies found at the station in 2021, from left, Green-veined White, Peacock, the SBL 'Watching Brief' species Small Heath and Scotch Argus

10.6.3 SYSTEMATIC LIST

Chequered Skipper

***Carterocephalus palaemon* (Hesperiidae)**

One of the highlights of the year was the discovery of this High Priority species at Cruachan for the first time. A fresh adult was found on 31/5, feeding at Common Bluebell near the overhead line wayleave close to the dam access road north of Lochawe (NN1115026597). Despite searches on the next visit, on 17/6, the species was not relocated. This species is listed for priority action on the SBL and A&B LBAP and is a Conservation Priority A species for Butterfly Conservation.

Orange-tip *Anthocharis cardamines* (Pieridae)

The only record was a male visiting dandelion at the Contractors Compound on 31/5.

Green-veined White *Pieris napi* (Pieridae)

This is normally the most common species at the power station landholdings but sightings proved scarce in the current season and confined to spring. Two were at the dam access road north of Lochawe village on 31/5, with two near Cruachan Reservoir the same day, with one at the Visitor Centre gardens on 17/6.

Small Copper *Lycaena phlaeas* (Lycaenidae)

The second new species for the Cruachan survey was a

single Small Copper that was found (24/8) on Common Sorrel beside the dam access road, near the old quarry at NN1083326458. This is a common species in Argyll, although its distribution is mostly coastal, and, nationally, its population has declined by a third in the past decade.

Common Blue *Polyommatus Icarus* (Lycaenidae)

A single male was recorded visiting yellow composites, such as trefoils, at NN0846826916 where the dam access road weaves through rocky embankments.

Pearl-bordered Fritillary

***Boloria euphrosyne* (Nymphalidae)**

This High Priority species was recorded, on 31/5, when one was seen in flight and halting at Common Bluebell beside the dam access road, near the former site of the entrance gate. This species is listed for priority action on the SBL and A&B LBAP and is a Conservation Priority A species for Butterfly Conservation.

Dark Green Fritillary *Speyeria aglaja* (Nymphalidae)

A few of these large fritillaries were seen at upland Cruachan on 13/7, often visiting Spear Thistle and Common Knapweed. Singles were found at the Penthouse Pond and at two locations along the dam access road.

Peacock *Aglais io* (Nymphalidae)

None was recorded until the August site visit (23/8), when six were feeding at Buddleia at Cruachan tailrace and five were counted at the east end of the dam access road, where it was visiting Devil's-bit Scabious.

Small Tortoiseshell *Aglais urticae* (Nymphalidae)

One was flying with Peacocks over Devil's-bit Scabious rich grassland beside the dam access road on 24/8. This common and familiar species is now a High priority for research into its population decline.

Small Heath *Coenonympha pamphilus* (Nymphalidae)

A total of 11 at the dam access road, on the route of the BBS transect, on 17/6 is one of the largest single day counts recorded at Cruachan. Earlier, the first of the year were seen on 31/5, with three at the dam access road and one near the Penthouse Pond. Small Heath is a 'Watching Brief' species in the SBL.

Scotch Argus *Erebia aethiops* (Nymphalidae)

The late August fieldwork visit was towards the end of this species' flight time but five were at the dam access road north of Lochawe with two at the Penthouse Pond (all 24/8). Many of the individuals were looking battered and worn so late in their season.



Pedicia rivosa, with its distinctively-patterned wings, was recorded for the first time at Cruachan Reservoir

10.7 DIPTERA (TRUE-FLIES)

A total of 26 species of true-flies were recorded in the 2021 survey, with representatives of eight orders. The largest family was the hover-flies (*Syrphidae*) but it proved a disappointing year with low numbers of species present.

10.7.1 TIPULIDAE – CRANE-FLIES

Crane-flies are familiar to most people as the “daddy long-legs” that invade their homes through open windows at night. However, there are around 300 species in the UK that occupy a wide range of ecological habitats and are often excellent indicators of habitat quality.

Seven species were found at Cruachan in 2021, five of which are new species for the survey and three have not previously been reported from Cruachan’s 10km² (NN02).

One species *Epiphragma ocellare* can be considered scarce with only one previous Argyll record. The others are, however, common and widespread nationally, but this genus is, like many invertebrates, poorly recorded.

Pedicia rivosa

This very large crane fly with heavily-patterned wings was recorded for the first time at Cruachan on 14/7, when a female turned up in an actinic moth trap at Cruachan Dam. This is an easily-recognised species, with two previous NN02 records from Glen Nant (2015 and 2017).

Tipula fulvipennis

A female was found in Soft Rush mire habitat close to the “accident blackspot” sign at the dam access road on 24/8 – another new crane fly for the survey. This is a common damp grassland species, more common in the west, and there are previous NN02 records from Glen Nant (1976 and 2019).

Tipula oleracea

Three were located in damp grassland at the dam access road north of Lochawe on 18/6. This is a common grassland species (19 OTs in Argyll) that can be particularly abundant in autumn. There are past NN02 records, including one from Cruachan Reservoir in 2014, and Glen Nant.

Tipula paludosa

This is a common autumnal species of crane-fly and two were recorded on 24/8, one flushed from damp grassland

beside the reservoir access road and another on the wall of the Visitor Centre building. It is well recorded in Argyll with records from NN02 in the past from the Visitor Centre, as part of Blue Leaf's survey in 2014, and Glen Nant (2012).

Tipula scripta

A female was attracted to the MV moth trap at the Visitor Centre on 24/8. A widespread species in the UK, ubiquitous in habitat, but rather scarce in the west of Scotland, with just six occupied hectads (nearest at Kinlochlaich 2019) in Argyll Mainland.

Tipula confusa

A female was collected from the wall of the Visitor Centre on the morning after a moth trapping session on 24/8. This is a common species of lowland woodland with a widespread distribution in the UK, with eight occupied hectads in Argyll (nearest Ledaig 2020) but none previously in NN02.

Epiphragma ocellare

One was attracted to MV light during the moth trapping session at the Visitor Centre on 24/8. This is an uncommon crane fly and there is only one previous Argyll record – at Glasdrum National Nature Reserve in 1976.

10.7.2 BOMBIDAE – BEE-FLIES

There is only one Scottish representative of this family, which are parasitoids of bumblebees.

Dark-edged Bee-fly *Bombylius major*

Three of these bee mimics, a true sign of spring, were found on 31/5 at the dam access road embankments north of Lochawe, visiting dandelion.

10.7.3 BIBIONIDAE – BIBIONID FLIES

Bibionids are often conspicuous, swarming small-to-medium sized insects – well known to anglers, who base many of their fishing flies on the family. There are 20 recorded species in the UK, of which one was found in this year's survey.

Bibio pomonae

This red-thighed Bibionid has been a regular feature of the Cruachan surveys and, this year, five were attracted to the MV moth trap at Cruachan Visitor Centre on 24/8.



Some of the common, widespread flies recorded in 2021, from left, *Sicus ferrugineus*, *Tipula oleracea* and Dark-edged Bee-fly

10.7.4 SYRPHIDAE – HOVERFLIES

It was a very disappointing year for hoverfly sightings with just 13 species found over the six days of fieldwork. This mirrored the picture nationally, with many observers commenting on the lack of both abundance and diversity of species on their local patches.

The most recent publication of the *State of Pollinating Insects* (JNCC 2021), one of the UK's Biodiversity Indicators,

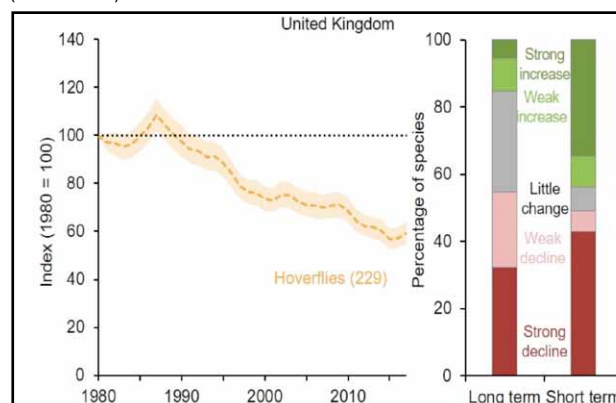
highlights a trend of long-term reduction in the populations of many species of hoverfly.

The index shows a gradual decline between 1987 and 2000. In 2000, the composite index was approximately 74% of the value in 1980. The trend was relatively stable up until 2009, before declining again, ending 41% lower than the value in 1980.

A greater proportion of hoverflies have declined than increased in occupancy over both the long and short term. In the period 1980 to 2017, 55% of 229 monitored species have decreased and only 15% increased. In the same period, populations of wild bees have also declined, but less sharply, and the report states: "It is not clear why hoverflies show a different trend to bees, although differences in the life cycle will mean they respond differently to weather events and habitat change."

The year-total of 13 species is the lowest ever recorded in the Cruachan survey – and by some margin. The next three lowest totals are 21 (2011), 24 (2010) and 26 (2017) that compare to the best year for species' diversity, which was 44 in 2014. For the first time, no new hoverflies were added in 2021 to the Cruachan site list – which remains at 83 species – although a small number of specimens are still to be processed. The cold, wet and dull conditions in May

GRAPH 7: TREND MAP FROM STATE OF POLLINATING INSECTS (JNCC 2021) SHOWING THE LONG-TERM DECLINE IN HOVERFLIES





Syrphus ribesii lays its eggs on a Common Hogweed flower head that is infested with aphids and, from top, *Episyrphus balteatus*, *Leucozona lucorum* and *Meliscaeva cinctella* were all seen in 2021



undoubtedly contributed to a dearth of spring records.

Although there has been a reduced effort in recording hoverflies in recent surveys, it was remarkable that only two species were found casually on the 31/5 visit and only one species was seen in June, despite clement conditions during fieldwork on 18-19/6. Diversity improved in July, with the presence of important flowering nectar plants such as Common Hogweed and Common Knapweed resulting in 11 species being recorded, while nine types of hoverfly were present in August, with Devil's-bit Scabious generating most of the flower-visit records.

New information from the Hoverfly Recording Scheme indicates that a total of 91 species have been recorded in NN02, the 10km² in which Cruachan is contained.

It is clear that records supplied by Blue Leaf on behalf of the power station have contributed greatly to this total, which is three times higher than the mean total (35) of the eight surrounding hectads.

10.7.4.1 SYSTEMATIC LIST

Melonastoma mellinum

A female was nectaring at Yellow Saxifrage near Cruachan Reservoir's east side car park on 13/7.

Episyrphus balteatus

The most regularly encountered hoverfly in 2021, with sightings on three dates. The first was at the dam access road north of Lochawe village on 18/6 but it was the only species recorded on the June visit. On 14/7, two were at the Contractors Compound then, on 24/8, two were at the dam access road with a female at the Visitor Centre wildflower garden, where it was egg laying among aphids that had congregated on Common Knapweed stems.

Syrphus vitripennis

A female was captured and identified under a hand lens on 13/7, as it refuelled on Yellow Saxifrage near Cruachan Reservoir's east side car park.

Syrphus ribesii

There were a couple of summer sightings, with two females on bramble at the Site Office entrance on 13/7, with a single egg-laying among aphids at the Visitor Centre on 24/8.



Eristalis tenax nectaring at Devil's-bit Scabious in August



Sericomyia silentis



Eristalis pertinax



Rhagio scolopaceus



Cynomya mortuorum

Meliscaeva cinctella

A male was attracted to Buddleia at Cruachan tailrace on 23/8, a typical late-year sighting.

Leucozonia glauca

There was the usual rash of sightings in high summer of this species visiting Common Hogweed. A total of 10 were recorded on the umbellifer at the Contractors Compound on 14/7, with two at the Visitors Centre the same day.

Leucozonia lucorum

There were records on the first and last dates of the survey. On 31/5, one was visiting Ramsons flowers in the Allt Cruachan gorge at Contractors Compound then a female was egg laying among aphids at the Visitor Centre (24/8).

Eristalis tenax

Two of this large Eristaline were recorded on 24/8, nectaring among the profuse Devil's-bit Scabious stands at the dam access road north of Lochawe.

Eristalis pertinax

Numbers peaked on 24/8 when 11 were counted visiting Devil's-bit Scabious beside the dam access road. Earlier, on 14/7, a single was nectaring on bramble flowers at the Contractors Compound with two on Common Knapweed the same day at the Visitor Centre wildflower area.

Eristalis intricaria

Singles were recorded on 14/7 at the Visitor Centre gardens and on 24/8 at the east side of the dam access road.

Chrysogaster solstitialis

The only sightings were two on Common Hogweed at the Contractors Compound on 14/7.

Sericomyia silentis

The peak count involved six seen in the vegetated margins of the dam access road on 24/8. On 13/7, one visited Yellow Saxifrage near Cruachan Reservoir with two at the Visitor Centre wildflower area the same day.

Xylota segnis

The first was at Ramsons at the Falls of Cruachan gorge on 31/5. Five were at the Loch Awe sites on 14/7, with two at the dam access road on 24/8.

10.7.5 CONOPIDAE – CONE-HEADED FLIES

Conopids are a family of small to medium-sized parasitic flies that are often wasp-like and elongate with long antennae and often brown-marked wings. There are 24 UK species, two of which have been found at Cruachan.

Sicus ferrugineus

This is the most common and widespread of the UK's Conopid flies and has been regularly recorded at Cruachan since 2010, when it was the first record for Argyll. A female was at the Visitor Centre on 14/7, a day when the wildflower meadow was alive with bumblebees. This species is an endoparasite of worker bumblebees, pouncing on them in flight and injecting an egg into its abdomen that develops into a larva.

10.7.6 CALLIPHORIDAE – BLOW-FLIES

There were few sightings of bluebottles *Calliphora* and greenbottles *Lucilia* at Cruachan during the year and none was taken as specimens. One species, identifiable in the field, was recorded at the power station.

Cynomya mortuorum

This large blueish-green carrion fly was found at Common Hogweed at the Contractors Compound on 14/7.

10.7.7 RHAGIONIDAE – SNIPE-FLIES

This is a group of distinctive long-legged and slender-bodied flies that are often associated with wet habitats such as riparian grassland and damp woodland. One species was recorded at Cruachan in 2021.

Downlooker Snipefly *Rhagio scolopaceus*

Two were seen perched on fenceposts in the lower section of dam access road on 18/6.

10.7.8 SCATHOPHAGIDAE – DUNG-FLIES

Around 55 species of dung-fly occur in the UK – although only a handful rear their larvae in faecal matter.

Yellow Dung Fly *Scathophaga stercoraria*

Small numbers were recorded on several visits. Two were at the Site Offices on 31/5 with more recorded on 14/7 at Common Hogweed at the Contractors Compound.



A pair of *Picromerus bidens* shieldbugs at the dam access road – the presumed male has a 'trophy' for its partner, the larvae of the rare UK sawfly *Abia candens*

10.8 HYMENOPTERA

10.8.1 SYMPHATA – SAWFLIES

There are more than 1000 species of *Symphata* in the UK: many are colourful and well-marked but members of individual tribes are often so similar, identification to specific species requires microscopic analysis. Several unidentified species were seen, one individual was identified to its genus only and another's identity was confirmed due to presence of its distinctive larva.

***Trichiosoma* sp (*Cimbicidae*)**

A large Cimbid sawfly was recorded in flight and visiting Goat Willow catkins on 31/5, in a wooded gorge at NN10774 26481, beside the dam access road west of Lochawe village. It could not be caught for identification but the surveyor considered it was likely *Trichiosoma lucorum*, whose larvae feed on willows and birches – both common tree species in the area.

Scabious Sawfly *Abia candens* (*Cimbicidae*)

A second Cimbid sawfly was found on 24/8, although this time it was in its larval stage. The grey, yellow and black larvae of *Abia candens* was on its host plant Devil's-bit Scabious but it unfortunately had fallen prey to a *Picromerus bidens* shieldbug.

10.8.2 VESPIDAE – SOCIAL WASPS

Two species were recorded of this familiar group of large yellow-and-black patterned wasps. Both have been recorded regularly in the Cruachan survey.

Red Wasp *Vespula rufa* (*Vespidae*)

A worker was recorded nectaring at flowering Yellow Saxifrage at Cruachan Reservoir (13/7) – this species has regularly been recorded using this plant on subalpine ledges in past surveys.

Common Wasp *Vespula vulgaris* (*Vespidae*)

Relatively scarce, a queen was recorded on 31/5 at the Site Offices, with another on 17/6 near Cruachan Reservoir. An active nest was found at the lower part of the dam access road on 13/7, where a single male was still present, on blackberry, on 24/8.

10.8.3 CRABRONIDAE – DIGGER-WASPS

These are commonly known as digger-wasps as they create nesting burrows in wood or soft soils, such as sand or ash. Adults provision their nesting chambers with small insects as food for their larvae. One species were re-recorded at Cruachan for the first time in seven years.

Field Digger Wasp *Argogorytes mystaceus*

One was seen visiting Common Lady's-mantle *Alchemilla vulgaris* in the Visitor Centre wildflower meadow on 17/6, the third sighting for the survey after records in 2012 and 2014. This ground-nesting wasp was likely hunting for the larvae of froghoppers (*Homoptera*) with which to provision larders for its young.

10.8.4 ANDRENIDAE – MINING-BEES

Two species of *Andrena* bee were seen at Cruachan in 2021 – one of which was identified in the field and the other taken as a specimen. *Andrenidae* is a family of solitary, ground-nesting bees with around 70 species in the UK. The eroded embankments beside the reservoir access road is prime habitat and likely to produce a further range of species.

Chocolate Mining Bee *Andrena scotica*

Two were seen beside the dam access road on 31/5 and nesting may have taken place, as one was seen entering an old vole hole in the road embankment.

Andrena sp

A small *Andrena* bee was swept from beneath oak trees on 31/5, at the dam access road near the 'Titanic'. The identity of this species will be determined by microscopy and we will then report back to the client.

10.8.5 HALICTIDAE – FURROW-BEES

This family includes some of the most common and widespread species of solitary bee in the UK. They may form large nesting aggregations in soil, where they excavate cells for their larvae. Two species have been recorded in past surveys at Cruachan and specimens were taken in 2021.

Lasioglossum sp

Two specimens were collected from Tormentil beside the dam access road on 31/5 and 17/6. These have been



From left, the parasitic bee *Nomada marshamella*, Buff-tailed Bumblebee and one of the white-tailed bumblebee complex

retained for microscopy and we will report back our findings to the client at a future date.

Sphecodes sp

A very small *Sphecodes* specimen was collected on 31/5 from the embankment beside the dam access road, north of Lochawe village. We will report on the identity of this specimen at a future date.

10.8.6 APIDAE – FLOWER-BEES AND BUMBLEBEES

Apidae is a very diverse family that includes the familiar honey-bee and bumblebees plus the rather obscure kleptoparasitic *Nomad* bees.

Of interest, a new species of bumblebee, the Tree Bumblebee *Bombus hypnorum*, was recorded for the Cruachan survey on the 2019 visits and re-recorded in the current survey.

The first Scottish sighting was as recently as 2013, but it has spread rapidly and is now common and widespread over much of the country. Meanwhile, Buff-tailed Bumblebee *Bombus terrestris* was recorded for only the second time at the power station, after one in 2009.

Nomada marshamella

Good numbers were seen in late May, despite the poor weather in the early part of the month. On 31/5, a total of

four were recorded on exposed road embankments in the east section of the dam access road then, on 17/6, one was still present in the area.

Common Carder Bee *Bombus pascuorum*

Recorded from May until August, but with a notable late summer peak. On 24/8, 28 were nectaring at Devil's-bit Scabious in the vegetated verges of the dam access road north of Lochawe village, with 12 at the Visitor Centre gardens on Common Knapweed and eight at the Contractors Compound. Until then, all sightings involved single figure, for instance: One on Goat Willow catkins (18/5), six on Tormentil, Bird's-foot Trefoil and Marsh Thistle (18/6) – both at the dam road – and four on blackberry flowers at the Site Office entrance on 14/7.

Buff-tailed Bumblebee *Bombus terrestris*

A queen was found at Common Knapweed at the Visitor Centre wildflower meadow on 24/8, representing only the second sighting at Cruachan since 2009.

white-tailed bumblebee *Bombus lucorum* sp

There were sightings from June to August, with most present in mid-summer when it was the most common species seen at Cruachan. Early on (17/6), three queens were visiting Tormentil at the dam access road but it was more abundant and widespread on 13/7 – four on Wild Thyme at Cruachan



Tree Bumblebee visiting
Devil's-bit Scabious at the
reservoir access road

Dam, six on Yellow Saxifrage at the east side approach road to the reservoir, four at the Site Office entrance on blackberry blossom and 12 at the Visitor Centre wildflower meadow on blackberry, Creeping Thistle and Common Knapweed.

Fair numbers were still present on 23/8, including four on Buddleia at Cruachan Tailrace and at least four on Devil's-bit Scabious at the dam access road. The 'white-tailed' complex consists of three different species that cannot be reliably identified in the field.

Tree Bumblebee *Bombus hypnorum*

This recent Scottish colonist was recorded in the abandoned 2019 survey, when a queen was seen at Viburnum at the Visitor Centre gardens (10/6). It was re-recorded in the current period with all records on 24/8 when it was widespread at the survey sites. Two queens visited the flowering *Buddleia globulosa* at Cruachan tailrace and singles were on Devil's-bit Scabious at the dam access road and Common Knapweed at the Contractors Compound.

Small Garden Bumblebee *Bombus hortorum*

Rather scarce in this year's survey, one visited Wild Thyme (13/7) on the rocky dam road embankment south of Cruachan Dam, then one was at the Visitor Centre wildflower meadow on 24/8, nectaring at Common Knapweed and Creeping Thistle.

Early Bumble-bee *Bombus pratorum*

All sightings involved workers, with two on Tormentil at the dam access road on 17/6 and four on blackberry blossom at the Site Office entrance on 14/7.



Two of the familiar bumblebees species found at Cruachan (from left), Common Carder-bee and the Early Bumblebee

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 2021 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 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 (for birds) and datasets held by recording schemes.

11.1 NATIONAL BIODIVERSITY NETWORK

Records obtained during fieldwork in 2021 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 204 million individual records had been processed in this way by December 2021, making the NBN Atlas a valuable tool for researchers. The standard of recording varies dramatically, however, across the taxonomic



Plain Wave has not been recorded before in NN02 and has a restricted range in Argyll, occurring in only two other hectads



New crane-fly species for hectad NN02, from left, the rare Scottish species *Epiphragma ocellare*, *Tipula confusa* and *Tipula scripta*. And right, the Chocolate Mining Bee *Andrena scotica*

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 2446 species have been recorded within a 5km radius of the station’s Site Offices – 906 animals, 1085 plants and 451 species of fungi. Of the animals, 128 species are birds, with 21 mammals and 646 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 34 species, including Eurasian Badger and 22 species of moth, were recorded by Blue Leaf Nature for the first time at Cruachan Power Station in 2021.

These species were examined against the NBN Atlas database and other sources to determine if they had occurred previously in hectad NN02.

Eurasian Badger has almost comprehensive coverage across Argyll’s hectads and has been recorded in NN02 on seven occasions, although most are from Taychreggan area and none has been reported before from Coille Leitire.

Most of the 22 ‘new’ macro-moths found at Cruachan in 2021 are previously known from NN02 – based on information supplied by the county moth recorder David Hill. Only three species are first records for the hectad.

Chequered Skipper and Small Copper have both been recorded in NN02 with three and two previous records respectively, all to the west of Cruachan.

Two species of crane-fly have also been recorded before locally, *Pedicia rivosa* and *Tipula fulvipennis*. Meanwhile, Tree Bumblebee has been recorded before at Cruachan by Blue Leaf in the abandoned survey in 2019.

This leaves nine invertebrate species found in 2021 that are apparently new to the hectad.

These include one beetle, three macro-moths, three crane-flies, a sawfly and a mining bee.

Since the survey started at Cruachan in 2009, a total of 288 species, apparently new to NN02, have been recorded by Blue Leaf.

The contribution to the list in 2021 was low in comparison with recent years but this may be attributed to the unsettled weather for much of the survey period and the fact few insect specimens were taken during fieldwork.

SPECIES NEW TO CRUACHAN NN02

COLEOPTERA

Violet Ground Beetle

LEPIDOPTERA

Plain Wave Red Carpet
Shaded Broad-bar

DIPTERA

Epiphragma ocellare
Tipula scripta
Tipula confusa

HYMENOPTERA

Scabious Sawfly
Andrena scotica

11.4 COMPARISON WITH NATIONAL DATASETS

Despite its limitations for many groups of invertebrates, the NBN Atlas is the best tool available to explore the records obtained at Cruachan in a national and UK context.

Blue Leaf searched its database for the nine species found during 2021 that have been determined as being 'new' to NN02, to establish the extent of their presence in Argyll, Scotland and the UK in general.

It would appear that none of the nine species are unknown from Argyll Mainland (VC98), although some are scarce and others rare in a national context.

This is the first time that survey work has not turned up a new species for the Vice-county and it compares to six new Argyll Mainland species in 2019 and seven in 2017. A total of 74 new species for Argyll Mainland have been recorded by the Blue leaf survey at Cruachan since 2009.

11.4.1 COLEOPTERA – BEETLES

One new species of beetle for NN02 was recorded – the Violet Ground Beetle at the lower section of the dam access road in August.

This is a widespread species in Scotland, with a presence in more than a thousand Scottish hectads, and it can be abundant in woodlands, moorland and other undisturbed habitats. It is found in seven hectads in Argyll Mainland, with a total of 53 records spanning the period 1973-2020.

Most of these sightings are from coastal areas and along the shore of sea lochs such as Loch Etive, with a cluster inland near the Arrochar Alps.

Large swathes of inland are apparently unoccupied, or the beetle has not been reported, and there have been no past sightings, from NN02 with the nearest sighting at Ben Lui National Nature Reserve in 1986.

TABLE 17: SPECIES OF COLEOPTERA FOUND AT CRUACHAN, NEW FOR NN02 AND LEVELS OF OCCURRENCE AT NATIONAL LEVEL

BEETLE SPECIES NEW TO NN02	ATLAS RECORDS FOR ARGYLL MAINLAND	SCOTTISH STATUS AND RECORDS
Violet Ground Beetle	Seven Argyll OHs, nearest Ben Lui (1986)	1177 Scottish records. Common, widespread



Violet Ground Beetle is a new species for NN02 but a database search shows there are 53 past records from Argyll

11.4.2 LEPIDOPTERA – MOTHS

Plain Wave, Red Carpet and Shaded Broad-bar have all been confirmed as new additions to the NN02 list by the VC98 moth recorder David Hill.

Of these species, Plain Wave appears to have the most restricted range in the Vice-county with only two other occupied hectads where there have been a total of 14 individual records. The nearest venue is at Dalbuie in 2019 but all the past reports are focused on the area around Loch Etive and Loch Creran, therefore the Cruachan sighting is the first inland for VC98.

This species is undergoing a rapid increase in population nationally – *The State of the UK's Larger Moths* report in 2013 suggested its numbers had increased by 634% in the 40 years to 2007).

The Highland branch of Butterfly Conservation state that it is “a local species that is rarely seen in numbers” in the region in high-quality woodland habitats with a Blaeberry underlayer, such as found in the Great Glen and Speyside.

In contrast, Red Carpet is Amber-listed as a species of conservation concern. The upland species has decreased by 92% in abundance and been lost in 62% of its range in the past 50 years.

There are only five records of Red Carpet from three VC98 hectads, all at higher altitudes between 2006 and 2017. A series of records have come from two consecutive hectads in Glen Coe area while the nearest record to Cruachan is from Ben Lui (NN92) in 2006.

Shaded Broad-bar is another Amber List species and is uncommon in the west of Scotland. The Cruachan

TABLE 18: 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
Plain Wave	Two Argyll OHs, nearest at Dalbuie (2018)	330 Scottish records. Most north of C/Belt
Red Carpet	Three Argyll OHs, nearest Ben Lui (2006)	3296 Scottish records. Common + widespread
Shaded Broad-bar	Six Argyll OHs, nearest Ledaig (2013)	2603 Scottish records. Common + widespread

sighting was at the very start of its flight season and its early emergence may have been in response to sunny conditions in April. There have been eight previous Argyll Mainland records from six scattered hectads along the coast from Loch Melfort to Loch Creran. Again, the Cruachan sighting is the first for NN02 and first inland in VC98 – the closest sighting to the power station is at Ledaig (NM93) in 2013.

11.4.3 DIPTERA – TRUE-FLIES

The crane-fly *Epiphragma ocellare* is a rare species in Argyll and Scotland in general. There is just a single past record from one other occupied hectad in VC98. It was found in 1976 during site condition monitoring at Glasdrum National Nature Reserve (NM94) by Alan Stubbs, the pre-eminent expert in UK crane-flies.

It is likely that this woodland species is genuinely scarce as it is very distinctive in appearance, due to the circles pattern on its wings that makes it possible to identify in the field. NBN highlights only 35 past records in Scotland.

The other two species of crane-fly that are apparently new to NN02 are much more common and widespread nationally. *Tipula scripta* has been recorded eight times from four Argyll hectads, mostly from Bute area with two records from the coastal fringe north of Oban. The six Bute sightings are historical, dating back to 1899 and 1900.

There are 14 records of *Tipula confusa* from six hectads in the region, again including some historical records from Bute. Elsewhere, it has been found near Eredine on Loch Awe (NM91, 1973) and in three hectads near Loch Etive.

TABLE 19: 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
Plain Wave	Two Argyll OHs, nearest at Dalbuie (2018)	330 Scottish records. Most north of C/Belt
Red Carpet	Three Argyll OHs, nearest Ben Lui (2006)	3296 Scottish records. Common + widespread
Shaded Broad-bar	Six Argyll OHs, nearest Ledaig (2013)	2603 Scottish records. Common + widespread

11.4.4 HYMENOPTERA – BEES, WASPS AND ANTS

There are only 20 past records of Scabious Sawfly *Abia candens* in Scotland but the Cruachan Power Station sighting in 2021 fits into a defined pattern of occurrence in Argyll, where it is known from six hectads.

There are six individual records on the NBN database, one in each hectad. There is a cluster of four records in four separate hectads around Loch Melfort in the past 10 years plus sightings to the east in Glen Fyne (2011) and Glen Croe (2010). The Cruachan sighting sits slightly north but approximately in the middle of both known past clusters and the timeframe of the records suggests the sawfly may be increasing in occurrence.

International *Symphata* Andrew Liston (per comms) says he expects to receive no more than one record a year of this species from Scotland. Many of the past Argyll sightings, like at Cruachan, have involved the sawfly's distinctive larvae with few of the difficult-to-identify adult stage.

The Chocolate Mining Bee is much more common, with a total of 18 individual records from five Argyll hectads. The nearest to Cruachan was at Inverawe (NN03) in 2019 – where there has been a series of records – but this is a common and widespread species in Scotland.

Finally, a Tree Bumblebee found at Cruachan Site Offices on June 10 2019, during the abandoned Blue Leaf survey, was the first record for NN02. This is a relatively recent colonist to Scotland and it was recorded for the first time in Argyll at Drimfern, north of Inverary, in April 2018.

There was just one other Argyll record that year but it spread rapidly, with nine sightings in 2019 and 28 reports in 2020. It is now widespread in the region and was encountered again at Cruachan in August 2021.

TABLE 20: SPECIES OF HYMENOPTERANS AT CRUACHAN NEW FOR NN02 AND LEVELS OF OCCURRENCE AT NATIONAL LEVEL

HYMENOPTERANS NEW TO NN02	ATLAS RECORDS FOR ARGYLL MAINLAND	SCOTTISH STATUS AND RECORDS
Scabious Sawfly	6 Argyll OHs, nearest Loch Tralaig (2017)	20 Scottish records. Most Argyll & Highland
Chocolate Mining Bee	5 Argyll OHs, nearest Inverwere (2019)	464 Scottish records. Common + widespread



Blue Leaf
Nature

telephone 01475 540791 / 07939 827620

35 Seath Avenue, Langbank, Renfrewshire PA14 6PD
eastendswift@icloud.com

***On the cover:** The Endangered butterfly Chequered Skipper was recorded for the first time at Cruachan in 2021. Top left, Common Chiffchaff. Bottom left, Tree Bumblebee*