The Glasgow Naturalist (online 2012) Volume 25, Part 4. Xx-xx

The moth assemblage of Flanders Moss, Stirlingshire

John T. Knowler

3 Balfleurs Street, Milngavie, Glasgow, G62 8HW

E-Mail: john.knowler@ntlworld.com

ABSTRACT
Moth records derived from an extensive programme of trapping between 2004 and 2010 have been combined with older data-sets in an assessment of the moth assemblage of Flanders Moss. Of the 282 moths species recorded, 45 are considered rare, scarce or local in Great Britain. Other species are present that have dramatically declined in their UK-wide abundance.

INTRODUCTION
The peat dome that forms the raised bog of Flanders Moss was once part of one of the largest complex of raised bogs and other wetland habitats found in the UK. Dotted along the former post ice age estuary of the Carse of Stirling they were subject to clearance and drainage and today Flanders Moss is only 60% of its original size while some other raised bogs on the Carse were completely cleared. Nevertheless, Flanders Moss, lying between Thornhill to the north and Kippen to the south, remains the biggest raised bog in the UK and one of the most important in western Europe. Lowland raised bogs tend to have a richer fauna and flora than upland blanket bogs and that of Flanders Moss is of national importance; hence it has been designated an site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC) and National Nature Reserve (NNR). This paper presents a compilation of the moth assemblage of the Moss that is based on an extensive programme of recording from 2004 to 2010 but also includes older data-sets.

METHODS
Moth traps were run in various parts of the Flanders Moss NNR between 2004 and 2010. A Robinson 125w MV trap and one or two Heath actinic traps were operated by Scottish Natural Heritage (SNH) staff members, Leigh Marshall and David Pickett. The author assisted with the identification of the catch. Key trapping locations were chosen to include the open moss of the raised bog, habitats dominated by bog myrtle (*Myrica gale*) and the fringing birch wood.

The data derived from moth trapping has been combined with the data-sets of Bland (1988 and 2003); Christie (1986), MacLaurin (1974), Morris (1991), Palmer (1986) and a Scottish Entomologists weekend in 1989. Most, perhaps all, of these came from day-time observations and were thus dominated by day-flying moths and species that were identified from their larvae or evidence of larval feeding such as leaf-mines. Other day-time observation records from visitors to the NNR and Scottish Wildlife Trust (SWT) reserves are included where these have been submitted to and validated by the author in his capacity as vice county moth recorder.

RESULTS
Table 1 lists 282 moth species recorded on Flanders Moss up to October 2010. The "code" column gives the UK checklist number (Bradley, 2000). The "records" column lists the number of times that each species has been recorded. It is not possible to list the number of individuals that have been recorded as not all recorders have collected this data. The status column indicates the UK national status of each macro moth species as defined by the Joint Nature Conservation Committee. The categories are as follows:

Red Data Book species (RDB) - species known from 15 or less 10km squares in the UK.
Proposed RDB (pRDB) – proposed for inclusion in the next Red Data Book listing because current information indicates that the species meets the criteria.
Nationally Scarce A (Na) - species recorded from 16-30 10km squares since January 1980.
Nationally Scarce B (Nb) - species recorded from 30-100 10km squares since January 1980.
Local - species recorded from 100-300 10km squares since January 1980.
Common - species recorded from over 300 10km squares since January 1980
Uncommon on introduced food-plant.
Immigrant.
Rare immigrant.
Import.

Of the moth families collectively known as micros, the Pyralidae have also been given UK national status rankings but, of the remaining micro moth families, only those species worthy of Nationally Scarce or Red Data Book status have been categorised.

A list of butterflies and moths from Flanders Moss, published by MacLaurin (1974), included nine larger moth species not otherwise recorded on the Moss and not included in Table 1. They are ghost moth (*Hepialus*

humuli), shaded broad-bar (*Scotopteryx chenopodiata*), yellow shell (*Camptogramma bilineata*), grey mountain carpet (*Entephria caesiata*), juniper carpet (*Thera juniperata*), small yellow wave (*Hydrelia flammeolaria*), tawny-barred angle (*Macaria liturata*), dotted border (*Agriopis marginaria*) and Scotch annulet (*Gnophos obfuscatus*). Dotted border flies at a time of the year when there has been little investigation of the moth fauna of the Moss and its presence would not be unexpected. The larvae of tawny-barred angle feeds on various conifers and the moth was recorded when there were more conifers on the Moss. However, other species on this list, including the nationally scarce, scotch annulet, would not be expected on Flanders Moss. Similarly, juniper carpet is unlikely as its foodplant, common juniper (*Juniperus communis*), has never been recorded on the Moss. It appears possible that MacLaurin may have included a wider spectrum of habitats in his paper than are considered a part of Flanders Moss in this assessment (no precise locations, observational methods or dates are given in the paper). It therefore appears safest to exclude these nine species from the Flanders Moss data-base.

Common rustic (*Mesapamea secalis*) and lesser common rustic (*Mesapamea didyma*) were only recognised as separate species in 1983 and can only be separated by examination of their genitalia. This has not been done on specimens from the Moss so the records are aggregated as (*Mesapamea secalis agg*). Elsewhere in west central Scotland the two species occur in roughly equal numbers.

The ear moths (*Amphipoea*) comprise another genus that can only be unambiguously identified by examination of their genitalia. In August and early September, large numbers of *Amphipoea* come to light traps on the Moss. All of those that have been dissected have proved to be large ear (*A. lucens*); the remainder have been recorded as *Amphipoea oculea agg*. Based on records from elsewhere in the area, almost all of these will be large ear but low numbers of Crinan ear (*A. crinanensis*) might be expected.

DISCUSSION

Of the 282 moths species recorded on Flanders Moss, 45 have received a UK national status of pRDB, Nationally Scarce or Local.

MOTHS CLASSED AS pRDB

One pRDB moth occurs on Flanders Moss

***Lampronia fuscatella* -** This scarce micro-moth occurs in widely scattered localities throughout the UK and its provisional Red Data Book status of 3 indicates that it is vulnerable. It occurs only in regenerating birch woodland on raised peat and is characteristic of ancient birch woodland with a continual history of regeneration. The larvae form galls in the twigs of downy birch (*Betula pubescens*), usually at a node of twigs that are 3 – 13 mm in diameter and 1.0 to 1.5 m from the ground on trees less than 10 years old. The larva within the gall is fully grown in May when it makes a hole to the exterior which it caps with silk and frass. It then pupates in the gall and emerges in June. Records from Flanders Moss indicate that the species is heavily parasitized.

MOTHS CLASSED AS NATIONALLY SCARCE A (Na)

Two Na moths occur on Flanders Moss

Rannoch brindled beauty *(Lycia lapponaria)* - The Rannoch brindled beauty is a moth of boggy acid moorland and in the UK its distribution is centred on the central highlands; particularly Rannoch and upper Speyside. Flanders Moss is the most southerly known site for the species and is well separated from other known locations. Although it has been found to feed on a range of moorland plants including heathers (*Calluna vulgaris* and *Erica* sp.), bilberry (*Vaccinium oxycoccus*) and eared sallow (*Salix aurita*), the occurrence of the species is strongly associated with its main foodplant, bog myrtle (*Myrica gale*). The moth is most easily found as an adult during late March and April by daylight searching of fence posts, old tree stumps and the trunks of trees growing close to bog myrtle. Both sexes rest on these sites and females lay eggs into crevices in them (personal observations of the author) as well as in the dead corollas of cross-leaved heath (*Erica tetralix*) (South,1908). Using this search method, males and females can be found on all those areas of the moss where bog myrtle grows including western fragments between the A81 and B8034 (Offerance Moss) that are outside the nature reserve. Limited data gained by searching the same areas every year indicate a fairly stable population of the moth but more organised observation over many more years would be necessary to confirm this.

Great brocade (*Eurois occulta*) - Throughout most of the UK the great brocade occurs uncommonly and irregularly as an immigrant from northern Europe. These immigrant moths are predominantly mid-grey in colouration. However, there is also a scarce resident form of the moth in the central and western highlands of Scotland that is blackish, variably marbled with grey. Occasional records from Flanders Moss appeared to be of this form and in March 2007 the author swept larvae from the catkins of bog myrtle proving that the species breeds on the moss. Subsequently, a single Robinson trap placed near the same area of bog myrtle on 22nd July 2010 caught five adults, all of which appeared to be freshly emerged. Bretherton *et al* (1983) state that resident populations are found close to growths of bog myrtle; especially where these are bordered by trees. This exactly fits the location in which larvae were found on Flanders Moss and where five adults were subsequently caught in a single overnight trap. There seems every reason to assume that there is a resident population on Flanders Moss

MOTHS CLASSED AS NATIONALLY SCARCE B (Nb)

Nine species of moth recorded on the Moss have Nb status.

***Atemelia torquatella* -** A northern species in the micro moth family Yponomeutidae. The larvae forms blotch leaf-mines in regenerating birch.

Biselachista serricornis – A leaf-mining species in the micro-moth family Elachistidae. It has a scattered distribution that includes central Scotland and it inhabits boggy areas and damp shady woods where the foodplant wood sedge (*Carex sylvatica*) grows. On Flanders Moss this is largely at the fringes.

Bryotropha boreella – A rare and local member of the micro-moth family Gelechiidae that is found on heather (*Calluna vulgaris*). The single record for this species on the Moss is hard to assess and requires confirmation.

Bryotropha galbanella - A local member of the micro-moth family Gelechiidae that is found in forested areas and feeds on mosses.

Prolita sexpunctella - A local member of the micro-moth family Gelechiidae that is found on heaths, moors and mosses and is often seen flying over burnt patches of regenerating heather. The larvae feeds within the spun leaves of heather

Argent and sable (*Rheumaptera hastata*) - In central Scotland, the argent and sable is best known from Flanders Moss where it occurs in most areas of what is now a fragmented habitat; including Offerance Moss. It is also regularly recorded from Glen Finglas, was known historically in the area of Loch Venachar and probably awaits discovery in other areas where bog myrtle is abundant. There is considerable confusion over the various forms of this moth. Most sources state that the southern form *hastata* occurs up to the southern uplands of Scotland and feeds on young birch while the smaller, more intricately marked northern form *nigrescens* feeds on bog myrtle. The moths on Flanders Moss most resemble the form *hastata* despite the fact that their larvae are found mainly on bog myrtle on which they form characteristic domed tents comprising the terminal leaves of young shoots. Most commonly they are on dense, tall plants (0.8 – 1.2m) where bog myrtle is the dominant vegetation often close to birches. There is just one record of a larva feeding on birch on Flanders Moss. The argent and sable has UK Biodiversity Action Plan (BAP) status and is a UK priority species with published action plans (Department of the Environment, Transport and Regions 1999, Kinnear and Kirkland, 2000).

Manchester Treble-bar (*Carsia sororiata*) - Manchester treble-bar is a moth of wet moorland, mosses and bogs. It is confined to northern England and Scotland where it is widespread but scarce. On Flanders Moss it is common and, during July and August, is readily disturbed from ground vegetation during the day. It is also recorded in light traps. The species is much less common elsewhere in central Scotland with widespread but only occasional records. The larvae feed on bilberry, crowberry (*Empetrum nigrum*) and cranberry (*Empetrum oxycoccus)* and it seems likely that the moth will continue to flourish as long as its open boggy habitat is preserved.

Silvery arches (*Polia trimaculosa*) - Although recorded from heaths and mosses throughout the UK, the main centres of distribution of silvery arches are the river valleys of the Spey, Rannoch, Dee and Clyde. There are only five records from Flanders Moss but four of these were in a single trap near bog myrtle and birches on 18th June 2010. The main larval foodplants are bog myrtle, birches and sallow and the western parts of the NNR would appear to offer excellent habitat for this species. Although it comes to light traps in small numbers it is more strongly attracted to sugar. The author is unaware of any sugaring on the moss but it may prove rewarding.

Marsh oblique-barred (*Hypenodes humidalis*) - Because it is small and easily confused with a micro-moth, the marsh oblique-barred is often overlooked. Its habitat requirements are bogs, boggy moorland, swamps, water meadows and marshes and its known foodplants include cross-leaved heath and sphagnum mosses. Christie (1986) recorded it as occurring in 'a very extensive and very numerous colony on the Moss'. However, it was only recorded once more before 2010 when on 11th August, ten were found in a single overnight trap. It appears likely that the moth remains much more common than the few records suggests.

MOTHS CLASSED AS LOCAL

Thirty three moth species classed as local have been recorded on Flanders Moss. Although they are all listed below, not all can be regarded as important members of the Flanders Moss moth assemblage; the species accounts indicate those that are.

Gold swift (Hepialus hecta) – There are few records of gold swift from Flanders Moss and it is most likely to be encountered around its fringes where the larval foodplant bracken (*Pteridium aquilinum*) grows. It cannot therefore be regarded as a key member of the moth assemblage.

Map-winged swift (*Hepialus fusconebulosa*) – Although nationally local, this species is the most common member of the genus in west central Scotland and its presence on Flanders Moss is unremarkable. Like the above species it is likely to be commonest around its fringe where the main larval food plant, bracken, grows.

Pearl-band grass veneer (*Catoptria margaritella*) – This species can be abundant on Flanders Moss and is a part of the resident moth assemblage. Although classed as local, it can be common on boggy moorland throughout Scotland.

Orange underwing (*Archiearis parthenias*) - The orange underwing is not an easy moth to see in central Scotland. It flies in sunshine in late March and April around the tops of birches growing on moorland and other open environments. Less often it can be seen feeding on sallow catkins and is sometimes found on the ground basking or drinking from puddles. It is never common and persistence is required to see it well. The mature birches around the edge of Flanders Moss are productive places to look for it.

Smoky wave (*Scopula ternata*) - Although smoky wave is found on moorland and lightly wooded heath throughout central Scotland it is particularly abundant on Flanders Moss. During June and July large numbers

can be disturbed when walking across the more open parts of the Moss. The larvae feed on heather and bilberry.

Plain wave (*Idaea straminata*) – The habitat preferences of this uncommon species are open woodland and scrubby heaths. Despite the fact that it does not appear ideal for the species, a high percentage of the historical and recent records from central Scotland come from Flanders Moss. Care must be taken with the identification of the species as it is easily confused with the very common riband wave (*Idea adversata*).

Ling pug (*Eupithecia absinthiata f. goossensiata*) – ling pug is a local, heather-feeding form of wormwood pug (*Eupithecia absinthiata*) which is a common polyphagic species. Separation of the two forms is somewhat subjective but, surprisingly, there appear to be no records of wormwood pug from Flanders Moss and there are just two records of ling pug.

Shaded pug (*Eupithecia subumbrata*) – A single example of this species in a light trap run on the moss on 18th June 2010 was the first record from central Scotland since 1987 and the first known record from either Flanders Moss or vice county 87. The normal habitat of the species is rough grassland and it is most common in southern England on chalk downs and in the Brecks. However, it is found locally in parts of western Scotland (Riley and Prior, 2003) and three specimens in the collection of the late Iain Christie were caught at Conic Hill in 1981 and near Gartocharn in 1987. Thus, the species is not unknown in the area and it is highly desirable to try to discover if it is a resident member of the moth assemblage of Flanders Moss.

Lunar thorn (*Selenia lunularia*) – Although never very common, in central Scotland this species occurs in woodland, parks and gardens as well more open habitats like Flanders Moss. It is not therefore one of the more important members of the moth assemblage of the site. The larvae feed on the leaves of a range of broad-leaved trees which on the Moss will be mainly birch.

Grey scalloped bar (*Dyscia fagaria*) – This local species of moors, bogs and mosses should be regarded as an important member of the Flanders Moss moth assemblage. All but three of the known records from central Scotland come from the site. The larvae feed on heathers and the moth appears to prefer the short swards that are typical of many open areas of the Moss. Grey scalloped bar is a UK species of conservation concern and is the subject of a south-west Scotland regional action plan (Kinnear and Kirkland, 2000).

Grass wave (*Perconia strigillaria*) – Although grass wave has been recorded from several moorland sites in the Loch Lomond basin, it is only common on raised bogs and mosses. Like the above species, it is an important member of the Flanders Moss moth assemblage.

Small elephant hawk moth (*Deilephila porcellus*) – This species has been recorded in increased numbers in central Scotland over the last 10 years and Flanders Moss is one of many habitats in which it has been observed. It is not considered a key member of the moth assemblage of the site.

Dark tussock (*Dicallomera fascelina*) – Dark tussock is regularly recorded on Flanders Moss as adults and larvae and the species is a part of the resident and breeding moth assemblage. However, it is also found on moorland throughout Scotland as heather is the main larval foodplant.

Round-winged muslin (*Thumatha senex*) - A single example of this species in a light trap run on the moss on 18th June 2010 was the first record from central Scotland since 1991. Nevertheless, this is a moth of wet moorland, bogs and flushes and it appears highly likely that there is a resident if small population on the Moss. It is clearly desirable to confirm whether this is the case.

Red-necked footman (*Atolmis rubricollis*) - During the first decade of the 21st century, this species has spread spectacularly northwards through central Scotland and beyond (Knowler, 2010). Particularly high numbers are found in association with sitka spruce (*Picea sitchensis*) and it is likely that all records on Flanders Moss are of moths that have come from neighbouring spruce plantations. The species is likely to continue to be recorded on the Moss but it is not considered a key member of its moth assemblage.

Four-dotted footman (Cybosia mesomella) – Although the four-dotted footman is widely distributed on heaths, moorland and bogs, it is particularly common on Flanders Moss. It is frequently disturbed from ground vegetation during the day and overnight catches of up to 66 have been recorded in single light traps. The larva feeds on lichens (*Cladonia sp*.) growing on heathers and these are abundant throughout open areas of the Moss.

Wood tiger (*Parasemia plantaginis*) – Like the above species, wood tiger is widespread but local on moorland and bogs. There is healthy population on Flanders Moss. Although larvae have been observed on various herbaceous plants, heathers are the main foodplants and this is assumed to be the case on the Moss. As long as open areas of the moss do not become overgrown the population of this species is likely to be secure.

Clouded buff (*Diacrisia sannio*) – Like the above two species, clouded buff is strongly associated with moorland and bogs and there is a particularly strong population on the Moss. During the flight season, multiple adults are likely to be disturbed from the vegetation during a walk over the moss and up to 20 have been recorded in and around a single overnight light trap. The larvae feed on heathers and other herbaceous moorland plants.

Neglected rustic (*Xestia castanea*) – The neglected rustic is found on moorland, raised bogs and in woodland with heather in the understory. The colour form with buff, pink-edged forewings is regularly recorded on Flanders Moss. Larvae feed on heather, bell heather (*Erica cinerea*) and cross-leaved heath. UK-wide this species decreased by 82% between 1968 and 2002 (Fox *et al*., 2006)

Heath rustic (*Xestia agathina*) – The heath rustic is a local moth of acid heaths, moorland and bogs but is

particularly common on Flanders Moss. Thus, 77 were recorded in a single trap on 6th September, 2007. The larvae feed on heather. UK-wide this species decreased by 84% between 1968 and 2002 (Fox *et al.,* 2006)

Beautiful brocade (*Lacanobia contigua*) – The beautiful brocade is an uncommon moth of lightly wooded moorland and a high percentage of records from central Scotland come from Flanders Moss. The larvae feed on birches, oaks and other woody species so the species is presumably dependent on areas of birch on the Moss.

Glaucous shears (*Papestra biren*) – Although classed as nationally local, glaucous shears occurs on moorland throughout Scotland and is an expected part of the Flanders Moss moth assemblage.

Golden-rod brindle (*Lithomoia solidaginis*) – Despite occurring widely on the moorlands of Scotland, golden-rod brindle is an uncommon moth. Most recent records from central Scotland are from Flanders Moss. The larvae have been recorded from heathers, bilberry, bog myrtle and other moorland plants.

Red sword-grass (*Xylena vetusta*) – The main habitat of this uncommon species is moorland and rough upland grassland and it would be expected to be an integral part of the moth assemblage of Flanders Moss. However, it also occurs in damp woodland and marshes and is regularly recorded in light traps in parkland and gardens near suitable habitat. Any specimen should be carefully examined to exclude the very similar and nationally scarce sword-grass (*Xylena exsoleta*) which is unrecorded on the Moss but could occur.

Suspected (*Parastichtis suspecta*) – Throughout much of Scotland, suspected is a widespread but uncommon moth of fens, car and moorland with birch scrub. It is an integral component of the Flanders Moss moth assemblage. The larvae feed on the terminal shoots of scrub birch.

Light knot-grass (*Acronicta menyanthidis*) – An uncommon moth of the damper parts of moors and bogs, light knot-grass is typical part of the moth assemblage of Flanders Moss. As well as coming to light traps, it is often found resting on fence posts. The larvae feed on woody moorland plants including bog myrtle, heathers and bilberry.

Old lady (*Mormo maura*) – The old lady is an uncommon moth of riverbanks, marshes, gardens and hedgerows and the single record from Flanders Moss was at its edge. Thus, the species should not be regarded as a typical member of the moth assemblage of the Moss

Large ear (*Amphipoea lucens*) – Although nationally local, the large ear is the commonest member of the genus throughout central Scotland. Single overnight trap catches of over 50 *Amphipoea sp*. have been recorded on Flanders Moss and all of those unambiguously identified by examination of the genitalia have proved to be this species.

Haworth's minor (*Celaena haworthii*) – As a moth of bogs and boggy moorland, Haworth's minor is an integral part of the moth assemblage of Flanders Moss. Its larvae feed on common cotton grass (*Eriophorum angustifolium*). UK-wide this species decreased by 89% between 1968 and 2002 (Fox *et al*., 2006)

Crescent (*Celaena leucostigma*) – Although not as tied to boggy moorland as the previous species, the crescent is nevertheless an integral part of the moth assemblage of Flanders Moss. In this habitat its larvae probably feed on purple moor-grass (*Molinia caerulea*). UK-wide this species decreased by 82% between 1968 and 2002 (Fox *et al*., 2006).

Lempke's gold spot (*Plusia putnami gracilis*) – The common species, gold spot (*Plusia festucae*), and the more local Lempke's gold spot both occur on the moss and their separation can be challenging. Lempke's gold spot is a more northern species and is not uncommon in damp habitats throughout central Scotland.

Scarce silver Y (*Syngrapha interrogationis*) – Although there is only one record of this uncommon moorland species from Flanders Moss it appears likely that it is a scarce breeding resident and therefore an integral part of the moth assemblage. Its larvae feed on heather and bilberry.

Pinion-streaked snout (*Schrankia costaestrigalis*) – A single specimen in a light trap on 22nd July 2010 appears to be the only record of this species from Flanders Moss. This is surprising as it is a moth of damp habitats including raised bogs. However, the lack of earlier records may reflect the ease with which this micro-like species can be over-looked.

MOTHS OF FLANDERS MOSS THAT HAVE DRAMATICALLY DECLINED IN THEIR UK ABUNDANCE

Fox *et al*. (2006) analysed thirty five years of data from the UK-wide network of Rothamsted light traps during the period 1968 to 2002. They examined the data for 337 species of common larger moths and showed that two thirds (226 species) had declined in abundance and 75 species had decreased by over 70% over the thirty five years. 14 of these are found on Flanders Moss and they are listed in table 2 in order of their percentage change in UK abundance. International Union for Conservation of Nature (IUCN) categories are based on rate of decline.

ACKNOWLEDGEMENTS

I should like to thank David Pickett for his help and enthusiasm in compiling the Flanders Moss data-set and for his valuable comments on early versions of the manuscript.

Code	Taxon	Vernacular	Records	First Recorded	Last Recorded	UK Status
3	*Micropterix aureatella*		2	1991	2005	
14	*Hepialus humuli*	Ghost Moth	1	2004	2004	Common
16	*Hepialus hecta*	Gold Swift	4	1973	1991	Local
17	*Hepialus lupulinus*	Common Swift	1	2004	2004	Common
18	*Hepialus fusconebulosa*	Map-winged Swift	9	1973	2010	Local
34	*Ectoedemia occultella*		3	1989	1989	
66	*Stigmella sorbi*		3	1989	1989	
103	*Stigmella nylandriella*		3	1989	1989	
112	*Stigmella luteella*		4	1989	1989	
116	*Stigmella lapponica*		4	1989	1989	
117	*Stigmella confusella*		3	1989	1989	
129	*Incurvaria pectinea*		2	1988	1989	
138	*Lampronia fuscatella*		3	1988	2006	pRDB3
140	*Nematopogon swammerdamella*		2	2005	2005	
141	*Nematopogon schwarziellus*		1	1988	1988	
157	*Heliozela hammoniella*		4	1989	1989	
186	*Psyche casta*		3	1988	1989	
216	*Nemapogon cloacella*	Cork Moth	1	1986	1986	
228	*Monopis weaverella*		2	1986	1988	
276	*Bucculatrix demaryella*		1	1988	1988	
300	*Parornix loganella*		1	1991	1991	
301	*Parornix betulae*		3	1986	1989	
305	*Parornix scoticella*		1	1988	1988	
324	*Phyllonorycter sorbi*		3	1989	1989	
332	*Phyllonorycter corylifoliella f. betulae*		2	1989	1989	
338	*Phyllonorycter cavella*		2	1989	1989	
347	*Phyllonorycter anderidae*		3	1989	1991	
353	*Phyllonorycter ulmifoliella*		3	1988	1989	
385	*Anthophila fabriciana*		1	2005	2005	
391	*Glyphipterix simpliciella*	Cocksfoot Moth	1	2005	2005	
395	*Glyphipterix haworthana*		2	1988	1989	
410	*Argyresthia brockeella*		1	1988	1988	
411	*Argyresthia goedartella*		2	1986	1986	
415	*Argyresthia retinella*		2	1986	1986	
418	*Argyresthia conjugella*	Apple Fruit Moth	1	1988	1988	
437	*Swammerdamia caesiella*		3	1988	1989	
442	*Cedestis gysseleniella*		1	1986	1986	
443	*Cedestis subfasciella*		1	1986	1986	
444	*Ocnerostoma piniariella*		1	1986	1986	
448	*Atemelia torquatella*		2	1989	1989	Nb
452	*Ypsolopha nemorella*		1	1983	1983	
460	*Ypsolopha parenthesella*		3	1986	1988	
464	*Plutella xylostella*	Diamond-back Moth	3	1986	1989	Migrant
493	*Coleophora serratella*		7	1983	2006	
496	*Coleophora milvipennis*		3	1988	1989	
504	*Coleophora lusciniaepennella*		3	1988	2005	
504	*Coleophora viminetella*		2	1983	1986	
541	*Coleophora pyrrhulipennella*		3	1988	1989	
608	*Elachista rufocinerea*		1	1991	1991	
621	*Elachista subalbidella*		1	1988	1988	
626	*Biselachista serricornis*		1	1988	1988	Nb
630	*Biselachista albidella*		1	1986	1986	
654	*Pleurota bicostella*		5	1983	1991	
663	*Diurnea fagella*		1	2007	2007	

770	*Carpatolechia proximella*		3	1986	1988	
773	*Pseudotelphusa paripunctella*		2	1986	1989	
780	*Bryotropha similis*		1	1991	1991	
783	*Bryotropha boreella*		1	1991	1991	Nb
784	*Bryotropha galbanella*		5	1986	1991	Nb
794	*Prolita sexpunctella*		1	1988	1988	Nb
797	*Neofaculta ericetella*		7	1986	2005	
954	*Eupoecilia angustana*		4	1986	1991	
968	*Cochylis nana*		1	1986	1986	
970	*Pandemis cerasana*	Barred Fruit-tree Tortrix	3	1986	1988	
972	*Pandemis heparana*	Dark Fruit-tree Tortrix	2	1986	1986	
986	*Syndemis musculana*		1	1988	1988	
988	*Aphelia viburnana*	Bilberry Tortrix	2	1986	1986	
989	*Aphelia paleana*	Timothy Tortrix	1	2005	2005	
1007	*Capua vulgana*		1	1988	1988	
1008	*Philedone gerningana*		2	1991	2005	
1015	*Eulia ministrana*		2	1986	1988	
1021	*Cnephasia interjectana*		1	1986	1986	
1026	*Exapate congelatella*		1	1986	1986	
1055	*Acleris hyemana*		1	1986	1986	
1057	*Acleris rufana*		1	1986	1986	
1073	*Olethreutes schulziana*		4	1991	2005	
1076	*Celypha lacunana*		2	1986	1986	
1087	*Orthotaenia undulana*		4	1983	1988	
1092	*Apotomis turbidana*		3	1986	1988	
1093	*Apotomis betuletana*		2	1986	1986	
1095	*Apotomis sororculana*		2	1986	1986	
1117	*Ancylis unguicella*		2	1988	2006	
1126	*Ancylis badiana*		1	2005	2005	
1128	*Ancylis myrtillana*		1	1991	1991	
1133	*Epinotia bilunana*		1	1988	1988	
1134	*Epinotia ramella*		4	1986	2003	
1137	*Epinotia tetraquetrana*		4	1983	1988	
1151	*Epinotia stroemiana*		2	1986	1986	
1151	*Epinotia trigonella*		2	1989	2006	
1155	*Epinotia brunnichana*		2	1986	1991	
1156	*Epinotia solandriana*		3	1986	1989	
1159	*Rhopobota naevana*	Holly Tortrix	2	1986	1986	
1184	*Epiblema scutulana*		1	2006	2006	
1201	*Eucosma cana*		1	1986	1986	
1294	*Crambus pascuella*		3	1986	2005	Common
1301	*Crambus lathoniellus*		4	1986	2006	Common
1304	*Agriphila straminella*		2	1986	1986	Common
1305	*Agriphila tristella*		2	1986	2005	Common
1314	*Catoptria margaritella*	Pearl-band Grass Veneer	7	1986	2005	Local
1334	*Scoparia ambigualis*		8	1986	2006	Common
1338	*Dipleurina lacustrata*		1	1986	1986	Common
1340	*Eudonia truncicolella*		2	1986	1986	Common
1345	*Elophila nymphaeata*	Brown China-mark	5	2004	2010	Common
1350	*Nymphula stagnata*	Beautiful China-mark	3	2006	2010	Common
1356	*Evergestis forficalis*	Garden Pebble	1	2004	2004	Common
1388	*Udea lutealis*		3	1989	2007	Common
1395	*Udea ferrugalis*	Rusty-dot Pearl	2	1989	1989	Migrant
1405	*Pleuroptya ruralis*	Mother of Pearl	4	2004	2005	Common
1632	*Trichiura crataegi*	Pale Eggar	1	1991	1991	Common
1637	*Lasiocampa quercus f. callunae*	Northern Eggar	7	1973	2010	Common

1638	*Macrothylacia rubi*	Fox Moth	16	1973	2010	Common
1640	*Euthrix potatoria*	Drinker	21	1973	2010	Common
1643	*Saturnia pavonia*	Emperor Moth	7	1973	2010	Common
1645	*Falcaria lacertinaria*	Scalloped Hook-tip	12	1973	2010	Common
1648	*Drepana falcataria*	Pebble Hook-tip	8	1973	2010	Common
1657	*Ochropacha duplaris*	Common Lutestring	7	1986	2010	Common
1659	*Achlya flavicornis*	Yellow Horned	4	1973	2010	Common
1661	*Archiearis parthenias*	Orange Underwing	2	1974	2007	Local
1666	*Geometra papilionaria*	Large Emerald	5	1988	2010	Common
1677	*Cyclophora albipunctata*	Birch Mocha	2	1973	2010	Local
1694	*Scopula ternata*	Smoky Wave	7	1973	2010	Local
1702	*Idaea biselata*	Small Fan-footed Wave	3	1986	2006	Common
1713	*Idaea aversata*	Riband Wave	6	1986	2007	Common
1715	*Idaea straminata*	Plain Wave	6	1986	2010	Local
1722	*Xanthorhoe designata*	Flame Carpet	2	2010	2010	Common
1723	*Xanthorhoe decoloraria*	Red Carpet	2	2004	2004	Common
1724	*Xanthorhoe spadicearia*	Red Twin-spot Carpet	1	2005	2005	Common
1725	*Xanthorhoe ferrugata*	Dark-barred Twin-spot Carpet	1	2010	2010	Common
1727	*Xanthorhoe montanata*	Silver-ground Carpet	8	1973	2010	Common
1737	*Epirrhoe tristata*	Small Argent & Sable	7	1973	1998	Common
1738	*Epirrhoe alternata*	Common Carpet	11	1973	2010	Common
1752	*Cosmorhoe ocellata*	Purple Bar	2	1973	2007	Common
1755	*Eulithis testata*	Chevron	15	1973	2010	Common
1756	*Eulithis populata*	Northern Spinach	2	1973	2010	Common
1758	*Eulithis pyraliata*	Barred Straw	2	2004	2006	Common
1760	*Chloroclysta siterata*	Red-green Carpet	1	2010	2010	Common
1762	*Chloroclysta citrata*	Dark Marbled Carpet	3	1973	2004	Common
1764	*Chloroclysta truncata*	Common Marbled Carpet	4	1973	2010	Common
1768	*Thera obeliscata*	Grey Pine Carpet	7	1973	2010	Common
1769	*Thera britannica*	Spruce Carpet	4	2006	2010	Common
1773	*Electrophaes corylata*	Broken-barred Carpet	4	1973	2010	Common
1775	*Colostygia multistrigaria*	Mottled Grey	2	1973	2005	Common
1776	*Colostygia pectinataria*	Green Carpet	6	1973	2010	Common
1777	*Hydriomena furcata*	July Highflyer	5	1973	2005	Common
1787	*Rheumaptera hastata*	Argent & Sable	18	1973	2010	Nb
1803	*Perizoma alchemillata*	Small Rivulet	2	1981	2004	Common
1809	*Perizoma didymata*	Twin-spot Carpet	4	1973	2005	Common
1831	*Eupithecia absinthiata f. goossensiata*	Ling Pug	3	1986	1991	Local
1837	*Eupithecia subfuscata*	Grey Pug	2	1986	2005	Common
1840	*Eupithecia subumbrata*	Shaded Pug	1	2010	2010	Local
1846	*Eupithecia nanata*	Narrow-winged Pug	9	1973	2007	Common
1857	*Eupithecia tantillaria*	Dwarf Pug	1	2010	2010	Common
1862	*Gymnoscelis rufifasciata*	Double-striped Pug	3	1973	2010	Common
1866	*Carsia sororiata*	Manchester Treble-bar	22	1973	2010	Nb
1887	*Lomaspilis marginata*	Clouded Border	5	1973	2010	Common
1902	*Petrophora chlorosata*	Brown Silver-line	6	1974	2005	Common
1904	*Plagodis dolabraria*	Scorched Wing	1	2010	2010	Local
1906	*Opisthograptis luteolata*	Brimstone Moth	6	1973	2010	Common
1913	*Ennomos alniaria*	Canary-shouldered Thorn	13	1973	2007	Common
1917	*Selenia dentaria*	Early Thorn	2	1973	2004	Common
1918	*Selenia lunularia*	Lunar Thorn	2	2005	2010	Local
1919	*Selenia tetralunaria*	Purple Thorn	1	2004	2004	Common
1920	*Odontopera bidentata*	Scalloped Hazel	5	1973	2007	Common
1921	*Crocallis elinguaria*	Scalloped Oak	2	2004	2007	Common
1926	*Phigalia pilosaria*	Pale Brindled Beauty	2	1973	2005	Common

1929	*Lycia lapponaria*	Rannoch Brindled Beauty	22	1973	2010	Na
1931	*Biston betularia*	Peppered Moth	8	1973	2010	Common
1935	*Erannis defoliaria*	Mottled Umber	2	1973	1988	Common
1941	*Alcis repandata*	Mottled Beauty	1	1973	1973	Common
1947	*Ectropis bistortata*	Engrailed	3	2009	2010	Common
1951	*Aethalura punctulata*	Grey Birch	2	1991	2010	Common
1952	*Ematurga atomaria*	Common Heath	13	1973	2010	Common
1954	*Bupalus piniaria*	Bordered White	8	1973	2010	Common
1955	*Cabera pusaria*	Common White Wave	13	1973	2010	Common
1956	*Cabera exanthemata*	Common Wave	1	1973	1973	Common
1961	*Campaea margaritata*	Light Emerald	5	1986	2007	Common
1962	*Hylaea fasciaria*	Barred Red	3	1986	2010	Common
1969	*Dyscia fagaria*	Grey Scalloped Bar	6	1973	2007	Local
1970	*Perconia strigillaria*	Grass Wave	23	1973	2010	Local
1981	*Laothoe populi*	Poplar Hawk-moth	4	1973	2005	Common
1991	*Deilephila elpenor*	Elephant Hawk-moth	6	2004	2010	Common
1992	*Deilephila porcellus*	Small Elephant Hawk-moth	4	2004	2010	Local
1994	*Phalera bucephala*	Buff-tip	7	1973	2010	Common
1995	*Cerura vinula*	Puss Moth	2	1973	2007	Common
1997	*Furcula furcula*	Sallow Kitten	1	1973	1973	Common
2000	*Notodonta dromedarius*	Iron Prominent	18	1973	2010	Common
2003	*Notodonta ziczac*	Pebble Prominent	2	2005	2010	Common
2006	*Pheosia gnoma*	Lesser Swallow Prominent	19	1973	2010	Common
2008	*Ptilodon capucina*	Coxcomb Prominent	8	1973	2010	Common
2011	*Pterostoma palpina*	Pale Prominent	4	2004	2010	Common
2026	*Orgyia antiqua*	Vapourer	4	1973	2005	Common
2027	*Dicallomera fascelina*	Dark Tussock	10	1973	2005	Local
2035	*Thumatha senex*	Round-winged Muslin	2	1970	1991	Local
2039	*Atolmis rubricollis*	Red-necked Footman	3	2005	2006	Local
2040	*Cybosia mesomella*	Four-dotted Footman	15	1973	2010	Local
2056	*Parasemia plantaginis*	Wood Tiger	5	1973	2007	Local
2057	*Arctia caja*	Garden Tiger	3	2004	2010	Common
2059	*Diacrisia sannio*	Clouded Buff	10	1974	2010	Local
2060	*Spilosoma lubricipeda*	White Ermine	10	1973	2010	Common
2064	*Phragmatobia fuliginosa*	Ruby Tiger	5	1973	2010	Common
2089	*Agrotis exclamationis*	Heart and Dart	1	2004	2004	Common
2098	*Axylia putris*	Flame	1	2004	2004	Common
2102	*Ochropleura plecta*	Flame Shoulder	6	1973	2010	Common
2107	*Noctua pronuba*	Large Yellow Underwing	22	1974	2010	Common
2109	*Noctua comes*	Lesser Yellow Underwing	3	2005	2007	Common
2110	*Noctua fimbriata*	Broad-bordered Yellow Underwing	1	2007	2007	Common
2111	*Noctua janthe*	Lesser Broad-bordered Yellow Underwing	3	2005	2007	Common
2117	*Eugnorisma glareosa*	Autumnal Rustic	6	2004	2007	Common
2118	*Lycophotia porphyrea*	True Lover's Knot	19	1973	2010	Common
2120	*Diarsia mendica*	Ingrailed Clay	15	1973	2010	Common
2123	*Diarsia rubi*	Small Square-spot	3	2010	2010	Common
2128	*Xestia triangulum*	Double Square-spot	1	2004	2004	Common
2130	*Xestia baja*	Dotted Clay	9	2005	2010	Common
2132	*Xestia castanea*	Neglected Rustic	6	2005	2007	Local
2133	*Xestia sexstrigata*	Six-striped Rustic	2	2005	2006	Common
2134	*Xestia xanthographa*	Square-spot Rustic	5	2004	2007	Common
2135	*Xestia agathina*	Heath Rustic	5	2005	2007	Local
2137	*Eurois occulta*	Great Brocade	3	2006	2010	Na
2142	*Anarta myrtilli*	Beautiful Yellow Underwing	11	1973	2005	Common

2147	*Hada nana*	Shears	1	2004	2004	Common
2149	*Polia trimaculosa*	Silvery Arches	2	2004	2010	Nb
2156	*Lacanobia contigua*	Beautiful Brocade	3	2004	2010	Local
2158	*Lacanobia thalassina*	Pale-shouldered Brocade	6	2004	2010	Common
2160	*Lacanobia oleracea*	Bright-line Brown-eye	4	2006	2007	Common
2162	*Papestra biren*	Glaucous Shears	4	2004	2010	Local
2163	*Melanchra pisi*	Broom Moth	10	1973	2010	Common
2176	*Cerapteryx graminis*	Antler Moth	11	1973	2010	Common
2179	*Panolis flammea*	Pine Beauty	2	2005	2010	Common
2186	*Orthosia gracilis*	Powdered Quaker	1	2010	2010	Common
2187	*Orthosia cerasi*	Common Quaker	3	2005	2010	Common
2188	*Orthosia incerta*	Clouded Drab	3	2005	2010	Common
2190	*Orthosia gothica*	Hebrew Character	5	2004	2010	Common
2198	*Mythimna impura*	Smoky Wainscot	13	1973	2010	Common
2199	*Mythimna pallens*	Common Wainscot	2	1973	2006	Common
2225	*Brachylomia viminalis*	Minor Shoulder-knot	1	2005	2005	Common
2232	*Aporophyla nigra*	Black Rustic	1	2005	2005	Common
2233	*Lithomoia solidaginis*	Golden-rod Brindle	4	1973	2007	Local
2241	*Xylena vetusta*	Red Sword-grass	2	1973	2010	Local
2250	*Blepharita adusta*	Dark Brocade	3	2004	2007	Common
2258	*Conistra vaccinii*	Chestnut	1	2005	2005	Common
2266	*Agrochola litura*	Brown-spot Pinion	2	2006	2006	Common
2268	*Parastichtis suspecta*	Suspected	2	2005	2006	Local
2273	*Xanthia togata*	Pink-barred Sallow	3	2005	2007	Common
2274	*Xanthia icteritia*	Sallow	4	2004	2007	Common
2280	*Acronicta leporina*	Miller	6	1986	2010	Common
2286	*Acronicta menyanthidis*	Light Knot Grass	12	1973	2010	Local
2300	*Mormo maura*	Old Lady	1	2005	2005	Local
2302	*Rusina ferruginea*	Brown Rustic	6	2004	2010	Common
2305	*Euplexia lucipara*	Small Angle Shades	1	2005	2005	Common
2306	*Phlogophora meticulosa*	Angle Shades	2	2004	2006	Common
2321	*Apamea monoglypha*	Dark Arches	16	2004	2010	Common
2326	*Apamea crenata*	Clouded-bordered Brindle	12	2004	2010	Common
2330	*Apamea remissa*	Dusky Brocade	1	2007	2007	Common
2334	*Apamea sordens*	Rustic Shoulder-knot	1	2004	2004	Common
2340	*Oligia fasciuncula*	Middle-barred Minor	6	1973	2010	Common
2343x	*Mesapamea secalis agg.*	Common Rustic agg.	13	1973	2010	
2345	*Photedes minima*	Small Dotted Buff	1	2004	2004	Common
2350	*Chortodes pygmina*	Small Wainscot	9	1973	2007	Common
2357	*Amphipoea lucens*	Large Ear	4	2005	2010	Local
2360x	*Amphipoea oculea agg.*	Ear Moth agg.	15	1973	2010	
2361	*Hydraecia micacea*	Rosy Rustic	5	1973	2006	Common
2364	*Gortyna flavago*	Frosted Orange	2	2005	2007	Common
2367	*Celaena haworthii*	Haworth's Minor	6	1973	2007	Local
2368	*Celaena leucostigma*	Crescent	3	2005	2010	Local
2369	*Nonagria typhae*	Bulrush Wainscot	1	2006	2006	Common
2422	*Pseudoips prasinana*	Green Silver-lines	1	2004	2004	Common
2425	*Colocasia coryli*	Nut-tree Tussock	8	1986	2010	Common
2434	*Diachrysia chrysitis*	Burnished Brass	1	2005	2005	Common
2439	*Plusia festucae*	Gold Spot	3	2004	2006	Common
2440	*Plusia putnami*	Lempke's Gold Spot	4	1998	2007	Local
2441	*Autographa gamma*	Silver Y	2	1989	2006	Migrant
2443	*Autographa jota*	Plain Golden Y	2	2005	2006	Common
2444	*Autographa bractea*	Gold Spangle	2	2005	2007	Common
2447	*Syngrapha interrogationis*	Scarce Silver Y	1	2006	2006	Local
2450	*Abrostola tripartita*	Spectacle	1	2004	2004	Common

2474	*Rivula sericealis*	Straw Dot	7	1986	2010	Common
2477	*Hypena proboscidalis*	Snout	5	1973	2005	Common
2484	*Schrankia costaestrigalis*	Pinion-streaked Snout	1	2010	2010	Local Nb
2485	*Hypenodes humidalis*	Marsh Oblique-barred	4	1986	2010	

Table 1. Moth species recorded on Flanders Moss.

English Name	Scientific Name	UK-wide percentage change over 35 years	IUCN Category
Autumnal Rustic	*Eugnorisma glareosa*	-92	Endangered
Garden Tiger	*Arctia caja*	-89	Vulnerable
Haworth's Minor	*Celaena haworthii*	-89	Vulnerable
Pale Eggar	*Trichiura crataegi*	-86	Vulnerable
Small square-spot	*Diarsia rubi*	-85	Vulnerable
Heath Rustic	*Xestia agathina*	-84	Vulnerable
Sallow	*Xanthia iceritia*	-82	Vulnerable
Crescent	*Cymatophorima leucostigma*	-82	Vulnerable
Neglected Rustic	*Xestia castanea*	-82	Vulnerable
Dark Brocade	*Blepharita adusta*	-78	Vulnerable
White Ermine	*Spilosoma lubricipeda*	-77	Vulnerable
Dusky Brocade	*Apamea remissa*	-76	Vulnerable

Table 2. Moths found on Flanders Moss that declined in their UK-wide abundance by more than 70% between 1968 and 2002.

REFERENCES

Bland, K. P. (1988). List of Lepidoptera recorded on Flanders Moss on 18.3.1988. Unpublished report, Scottish Natural Heritage

Bland, K. P. (2003). Species list from Argent and Sable Workshop, Flanders Moss NNR, 17th August 2003 unpublished report, Scottish Natural Heritage

Bradley, J. D. (2000) *Checklist of Lepidoptera Recorded in the British Isles*. Fordingbridge.

Bretherton, R. F., Goater, B. & Lorimer R.I. (1983). Noctuidae. Pp 141 -142 in Heath J. and Emmet, M.(editors), Moths and Butterflies of Great Britain and Ireland, Curwen Press, London, Vol 9.

Christie, I. C. (1986). Moths on SWT Reserve Flanders Moss Summer 1986 unpublished report Scottish Natural Heritage.

Department of the Environment, Transport and Regions (DETR) (1999). UK Biodiversity Group. Tranche2 Action Plans Vol1 Terrestrial and Fresh Water Species and Habitats. HMSO

Fox, R., Conrad, K. F., Parsons, M. S., Warren, M. S., & Woiwod, I. P. (2006*). The State of Britain's Larger Moths.* Butterfly Conservation and Rothamsted Research, Wareham, Dorset.

Kinnear P. & Kirkland P. (2000). *Regional Action Plan for Butterflies and Moths of South West Scotland*. Butterfly Conservation, Edinburgh.

Knowler, J. T. (2010). *An Annotated Checklist of the Larger Moths of Stirlingshire, West Perthshire and Dunbartonshire*. Glasgow Natural History Society, Glasgow.

MacLaurin, A. M. (1974). Butterflies and Moths from Flanders Moss. *Glasgow Naturalist* 19, 85-90

Morris, R. (1991) List of moths obtained from unpublished report, Scottish Natural Heritage.

Palmer, R. (1986). List of Lepidoptera recorded on Flanders Moss. Unpublished report, Scottish Natural Heritage

Riley, A.M. & Prior G. (2003). *British and Irish Pug Moths: a guide to their identification and biology*, Harley Books.

Scottish Entomologists (1989). Species collected on Flanders Moss during Scottish Entomologists weekend 3.9.1989.Unpublished report.

South, R. (1908) *Moths of the British Isles* (series 2). Warne, London.