The Moths of Craig-lais (Constitution Hill), 2016

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Introduction. With attractions including the *Rheilffordd Y Graig*, the *Y Consti Restaurant* and some of the most dramatic and beautiful scenery along the *Ceredigion Coastal Path*, Craig-lais (also known as Constitution Hill), immediately to the north of Aberystwyth, is one of the area's most visited places. It is also an important haven for a diversity of wildlife. Birds, including peregrine falcon and chough, nest on its cliffs. Several butterflies, including grayling and wall, breed on the scree slopes, while others, including painted lady and dark green fritillary, exploit the nectar provided by a profusion of wild flowers. The seaward slopes form part of the Craigyfulfran & Clarach Site of Special Scientific Interest (SSSI), designated on account of the readily visible geological features.

The cliffs are also home to a large number of largely unnoticed insect species. Among these, the moths are among the most important. As a large group (the UK has well over 2000 breeding species, compared with just 58 butterflies), they exploit a vast diversity of ecological niches and are an important part of many natural processes. Both as adults and larvae, moths are an essential food source for a large number of species of birds, small mammals, including bats, and invertebrates; in addition, adult moths pollinate many flowers.[2]

The diversity and ecological importance of moths make them a valuable indicator of the health of an ecosystem. Over the last 40 years, despite some species of moth increasing in their range and/or abundance, there has been an overall dramatic decline in moth numbers in Great Britain.[3,4] The causes of this decline are unknown but there is some evidence that climate change, habitat loss, light pollution and chemical pollution have each contributed to it.[3]

As a result, it is of considerable conservation value to survey moth numbers at a site. Despite this, I am aware of no previous attempt systematically to survey the numbers and diversity of moths on Craig-lais.

Method. During 2016, I periodically ran a light-trap at a single site on Craig-lais, near to Aberystwyth but within the southern boundary of the SSSI, approximately half-way up the hill where the cliff faces north-eastwards over the sea (Figure 1), at OS grid reference SN583826 (Figure 2). The trap used a 15W actinic blacklight, powered by a 12V battery. I set the trap at least once each month from May to October, choosing warm nights when the wind speed was relatively low (not above 15 miles per hour), as more moths fly in such conditions and a light-trap only samples those moths that are flying. In total, I trapped on eight occasions: 9th May, 9th June, 8th July, 21st July, 13th August, 14th September, 7th October and 26th October. On each night, I activated the trap at approximately the end of civil twilight and then either attended the trap until after midnight, counting the moths as they arrived, or left the trap and returned at dawn to count the moths in and near the trap. Some moths were retained briefly, to photograph; all moths were released unharmed at or near the trap site.

Figure 1. The light-trap in position.

Figure 2. A 1:25000 map[5], showing (an orange x) the position of the light-trap.

Findings. For each of the 145 species of moth recorded, I have presented, in Table 1 (pages 6-8), the date (ddmm) on which it was first seen, the date on which it was last seen, the total number of moths recorded during the year, the larval foodplant(s) of each species, and the status of the species within Britain as a whole.

119 of the moth species seen are described as Common, having been recorded in more than 300 10 km squares in Britain since 1960. Twenty have a more restricted distribution; fifteen are Local (recorded in

101-300 10 km squares), four are Nationally Scarce B (nb – recorded in 31-100 10 km squares) and one is Nationally Scarce A (na – recorded in only 16-30 10 km squares). The remaining six moth species are Immigrant; these species may breed and complete their life cycle within Britain, but each winter the entire population dies; within any one year, the occurrence of the species depends on the arrival of individuals from overseas.

It is useful to consider whether a moth is by diet a generalist, its caterpillars eating many species of plant, or a specialist, eating just one or a small number (although, in some species, what the caterpillars eat in the wild remains an open question). As the list of larval foodplants in Table 1 illustrates, there is a continuity of variation. Of the 145 species recorded, 103 have larvae that are commonly recorded feeding on more than four species of plants. Among the others, perhaps 18 are true specialists, not found unless a particular single species of plant is available. Another seven feed on lichens, a specialised diet in itself, though one about which an understanding of the variety eaten is less developed.

Some of the moths of Craig-lais.

The length given on each photograph is that of the moth's forewing.

Immigrants

Diamond-back moth – 2016 saw a mass irruption of this species across Britain.

Silver y – famed for its pitch invasion at the Euro 2016 Final, the only moth seen in every month of this survey.

Rusty-dot pearl – adults of this moth can be seen in any month of the year.

Rush veneer – a moth easily disturbed from vegetation during the day.

Vestal – as with all immigrant moths, the number that arrives varies greatly from year to year.

Dark sword-grass – occurs throughout Britain, but like most immigrants, it is most commonly seen in coastal areas.

Nationally scarce moths

Rhigognostis annulatella – this moth, one of several that overwinter as adults, is found on rocky coastal grassland.

Barrett's marbled coronet – this moth, one of several that overwinter as pupae, is found only on western coastal cliffs and shingle beaches – Craig-lais may be the most northerly site in Britain where the species breeds.

Four-spotted footman – this species (only the female has four spots – this one is a male) feeds on lichens growing on rocks and trees – the resident population in Britain is often increased by the arrival of immigrants (this individual might be one of them).

Hoary footman – a moth of rocky coasts.

Square-spot dart – another moth of rocky coasts.

A few others

Elephant hawkmoth.

Buff arches.

Bee moth – the caterpillars eat the nests of wasps and bumblebees, including the larvae of those insects, making this one of a small number of (partly or entirely) carnivorous moths.

Netted pug – this moth has only ever been seen at a handful of sites in Ceredigion.

Square-spot rustic – the most abundant moth in this survey, one of several that overwinter as caterpillars.

Caloptilia rufipennella – the caterpillar of this tiny moth first feeds within a mine inside a sycamore leaf, and later lives in a curl underneath the leaf.

Blair's shoulder knot – an adventive species, which has spread rapidly across Britain since it first established on the Isle of Wight in 1951, exploiting cypress trees grown in gardens and plantations.

Merveille du jour – one of several moths that overwinter as eggs.

Agriphila straminella – a species of grass moth.

Bird-cherry ermine – caterpillars of this moth live communally within silk webs.

A brief discussion of some issues affecting the interpretation of the data. There are a number of moths that fly in the early months of the year; having commenced surveying on 9th May will have reduced my chances of recording these species. There are also some moths that have a notably short flight period; intervals that sometimes exceeded four weeks may have caused some of these species to be missed; similarly, an entire flight period of a species with more than one flight period per year may have been missed. Beyond these issues, it should be noted that light-trapping is used as a means of surveying moths for practical reasons, not because the data it generates are easy to interpret. Moth species vary in their propensity to fly, vary in the circumstances under which they fly (some species are entirely day-flying), vary in their degree of attraction to various sources of light, and vary in their likelihood of being caught (and remaining caught) in any particular design of trap.

Therefore, my data do not indicate the absence of any species of moth. Further, the flight of moths is sometimes a means of dispersal, sometimes over long distances. Capturing a moth in a light-trap on Craig-lais does not indicate that the species completes its life cycle there, or even somewhere nearby. The adult may be exploiting flowers as a nectar source, or may be purely transitory. But, in practice, although the moths caught on Craig-lais may have come from elsewhere, even from across the sea, most of them will have come from Craig-lais. To determine whether a species is completing its life cycle at a site, it would generally be necessary to search the appropriate plant(s) at the appropriate time of year (and usually at night) for feeding caterpillars.

The status of a moth species refers to its distribution within Britain; it should be noted that this does not indicate the abundance of the moth. A Common species might be found across Britain but at a low density; conversely, a Nationally Scarce species might occur at a small number of sites but have a large population at each. To highlight species of conservation concern, both types of data, distribution and abundance, are important, though abundance data allows declines to be noted sooner, before large-scale local extinctions have occurred. Such data are, however, more difficult to obtain. A recent report[4] highlighted several species of moth whose abundance in Britain declined drastically between 1968 and 2007; among them, anomalous, white-line dart, rosy minor, lackey and grass rivulet, all found on Craig-lais, had declined by more than 90%.

The designation of a moth species as Nationally Scarce does not, in itself, indicate that the species is of particular conservation concern; some such species are, at present, increasing their range and abundance. However, of the five Nationally Scarce species recorded in this survey, only one, four-spotted footman, could perhaps be characterised in this way (though an understanding of the present fortunes of this species within Britain is difficult, due to some records representing Immigrant individuals). The remaining four Nationally Scarce species should be seen as having specialised habitat requirements, and Craig-lais as one of relatively few places that provide those requirements.

Conclusions. From a conservation perspective, species that have a restricted distribution are generally more vulnerable to population declines than those that are common. Further, moths that have a limited number of foodplants are generally more vulnerable than those that eat a wide variety of plants. It is therefore notable that Craig-lais supports a number of Nationally Scarce species and a number of species with specialised diets.

This, along with the large total number of moth species found on Craig-lais, indicates the desirability of maintaining habitats on and near the site. The foodplants of the various species indicate that, while some species are exploiting scrub habitat, the majority are exploiting the particular grassland habitat found on the unstable coastal scree. Due to the proximity of the sea and the unsheltered aspect of the coast along Craig-lais, these habitats are likely to be self-sustaining; necessary management interventions can be largely restricted to those already listed for the SSSI on account of its geological importance.[6]

A possible exception to this follows from concerns about light pollution. Research is beginning to reveal that the ways in which artificial lights impact upon moths (and other living things, including ground-dwelling animals[7] and plants[8]) are many and various.[2] Such lights can divert dispersing moths to less suitable habitat. Moths spend less time feeding when exposed to artificial light.[9] Female moths tend to lay eggs in unsuitable locations near artificial lights, reducing the survival chances of the eggs themselves and of the larvae when they start feeding. The nocturnal predators of moths, including bats and spiders, exploit the higher density of prey around artificial lights, increasing the predation risk of any moth drawn to the light. Given the roles of moths within ecosystems, it is now seen as urgently necessary to research the consequences of artificial light on moth populations as a whole. However, it is likely to be of benefit, where artificial light is in use, to ensure that it is of optimal spectral composition (without the shorter wavelengths that most strongly attract many moth species)[10,11] and of even greater benefit[7,9,12] that its use is minimised in terms of the number of lights installed, the number of nights on which they are used and the number of hours per night during which they are lit.

Table 1: a complete list of the moths recorded.

ABH[13]	Scientific name	Common name	First	Last	n	Larval foodplant(s)[14,15,16]	Status
12.016	*Nemapogon cloacella*	**cork moth**	0906	0906	1	bracket fungi	common
15.006	***Caloptilia rufipennella***	–	2107	2107	1	sycamore	common
15.015	***Aspilapteryx tringipennella***	–	0906	0906	1	ribwort plantain	common
16.001	*Yponomeuta evonymella*	**bird-cherry ermine**	2107	2107	1	bird cherry	common
18.001	*Plutella xylostella*	**diamond-back moth**	0906	0710	2	many brassicaceae	immigrant
18.005	***Rhigognostis annulatella***	–	1308	1308	1	common and danish scurvygrass, hairy bitter-cress	nb
28.017	***Batia lambdella***	–	0906	0906	1	gorse	local
35.010	***Aproaerema anthyllidella***	–	1308	1409	2	kidney vetch, other fabaceae	local
35.040	***Bryotropha terrella***	–	0906	0906	1	common bent, moss	common
35.047	***Bryotropha affinis***	–	1308	1308	1	mosses	common
35.093	***Mirificarma mulinella***	–	1308	1308	1	gorse, broom	common
35.146	***Teleiopsis diffinis***	–	0307	1409	3	sheep's sorrel	common
41.002	***Blastobasis adustella***	–	2107	1308	2	various	common
41.003	***Blastobasis lacticolella***	–	0710	0710	1	various	common
49.029	***Lozotaenia forsterana***	–	2107	2107	1	various	common
49.039	*Epiphyas postvittana*	**light brown apple moth**	1409	1409	1	various	common
49.091	***Pseudargyrotoza conwagana***	–	2107	2107	1	ash, privet	common
49.097	***Cochylimorpha straminea***	–	0906	0906	1	common knapweed	common
49.111	***Eupoecilia angustana***	–	0906	0906	2	various	common
49.294	*Notocelia uddmannniana*	**bramble shoot moth**	0906	0906	1	bramble, raspberry	common
49.325	***Cydia ulicetana***	–	1308	1308	1	gorse, broom, bird's-foot trefoil, greenweed	common
62.001	*Aphomia sociella*	**bee moth**	0906	0906	1	nests of wasps and bumblebees	common
62.015	***Delplanqueia dilutella***[17]	–	0906	1308	7	wild thyme	local
62.037	***Acrobasis marmorea***	–	0307	0307	2	blackthorn	local
62.054	***Homoeosoma sinuella***	–	0906	0906	3	ribwort plantain, other plantains	common
62.077	***Endotricha flammealis***	–	2107	2107	1	decaying leaves on ground	common
63.031	*Udea ferrugalis*	**rusty dot pearl**	1409	0710	2	various herbaceous	immigrant
63.052	*Nomophila noctuella*	**rush veneer**	1409	0710	2	various herbaceous	immigrant
63.066	***Scoparia pyralella***	–	0906	0906	5	ribwort plantain	common
63.067	***Eudonia lacustrata***	–	2107	2107	1	mosses	common
63.069	***Eudonia angustea***	–	1409	0710	11	mosses	common
63.074	***Eudonia mercurella***	–	0906	2107	5	mosses	common
63.080	*Chrysoteuchia culmella*	**garden grass-veneer**	0906	0906	2	grasses	common
63.090	***Agriphila inquinatella***	–	2107	1308	6	grasses	common
63.093	***Agriphila straminella***	–	2107	2107	1	grasses	common
65.008	*Thyatira batis*	**peach blossom**	0906	0906	1	bramble	common
65.009	*Habrosyne pyritoides*	**buff arches**	2107	2107	1	bramble	common
66.003	*Malacasoma neustria*	**lackey**	2107	2107	2	various hardwoods	common
69.016	*Deilephila elpenor*	**elephant hawkmoth**	0906	0906	1	rosebay willowherb, other herbaceous	common
70.009	*Idaea subsericeata*	**satin wave**	0906	0906	1	various herbaceous?	common
70.011	*Idaea dimidiata*	**single-dotted wave**	2107	2107	2	cow parsley, burnet-saxifrage, hedge bedstraw	common
70.016	*Idaea aversata*	**riband wave**	0307	2107	4	various herbaceous	common
70.024	*Scopula imitaria*	**small blood-vein**	0307	0307	2	honeysuckle, privet	common
70.038	*Rhodometra sacraria*	**vestal**	1409	1409	1	knotgrasses	immigrant
70.049	*Xanthorhoe fluctuata*	**garden carpet**	0905	1409	5	many brassicaceae	common
70.051	*Xanthorhoe spadicearia*	**red twin-spot carpet**	2107	2107	1	various herbaceous	common
70.059	*Camptogramma bilineata*	**yellow shell**	0906	2107	2	various herbaceous	common
70.061	*Epirrhoe alternata*	**common carpet**	0906	0906	1	many rubiaceae	common
70.079	*Thera britannica*	**spruce carpet**	0710	0710	1	many coniferous trees	common
70.097	*Dysstroma truncata*	**common marbled carpet**	0905	1409	2	various hardwoods	common
70.131	*Mesotype didymata*	**twin-spot carpet**	1308	1308	1	various	common
70.133	*Perizoma alchemillata*	**small rivulet**	2107	2107	2	common hemp-nettle	common
70.137	*Perizoma albulata*	**grass rivulet**	0906	0906	2	yellow-rattle	local
70.141	*Gymnoscelis rufifasciata*	**double-striped pug**	2107	2107	3	various	common
70.142	*Chloroclystis v-ata*	**v-pug**	0906	0906	1	various	common
70.151	*Eupithecia pulchellata*	**foxglove pug**	0906	0307	5	foxglove	common
70.155	*Eupithecia venosata*	**netted pug**	0905	0905	1	bladder campion, sea campion	local
70.168	*Eupithecia nanata*	**narrow-winged pug**	0307	0307	1	heathers	common
70.173	*Eupithecia centaureata*	**lime-speck pug**	0906	0906	2	various herbaceous	common
70.179	*Eupithecia absinthiata*	**wormwood pug**	0307	2107	2	many asteraceae	common

70.183	*Eupithecia vulgata*	**common pug**	0906	0906	1	various	common
70.190	*Eupithecia subfuscata*	**grey pug**	0906	0906	1	various	common
70.195	*Chesias legatella*	**streak**	2610	2610	1	broom	common
70.222	*Petrophora chlorosata*	**brown silver-line**	0906	0906	1	bracken	common
70.226	*Opisthograptis luteolata*	**brimstone moth**	0307	2107	4	many hardwood rosaceae	common
70.237	*Selenia dentaria*	**early thorn**	0307	2107	5	various hardwoods	common
70.240	*Odontopera bidentata*	**scalloped hazel**	0906	0906	1	various woody plants	common
70.243	*Ourapteryx sambucaria*	**swallow-tailed moth**	2107	2107	1	various	common
70.252	*Biston betularia*	**peppered moth**	0906	2107	3	various	common
70.258	*Peribatodes rhomboidaria*	**willow beauty**	0906	2107	3	various woody plants	common
70.265	*Alcis repandata*	**mottled beauty**	0307	2107	3	various	common
70.270	*Ectropis bistortata*	**engrailed**	2107	2107	1	various woody plants	common
70.280	*Lomographa temerata*	**clouded silver**	0906	0906	2	many hardwood rosaceae	common
70.283	*Campaea margaritata*	**light emerald**	2107	2107	1	various hardwoods	common
70.287	*Charissa obscurata*	**annulet**	2107	1308	7	various herbaceous	local
71.013	*Notodonta ziczac*	**pebble prominent**	0906	0906	1	many salicaceae	common
71.025	*Phalera bucephala*	**buff-tip**	2107	2107	2	various hardwoods	common
72.001	*Scoliopteryx libatrix*	**herald**	1308	1308	1	many salicaceae	common
72.013	*Euproctis similis*	**yellow-tail**	2107	2107	1	various hardwoods	common
72.020	*Spilosoma lubricipeda*	**white ermine**	0905	0905	1	various herbaceous	common
72.024	*Phragmatobia fuliginosa*	**ruby tiger**	2107	2107	1	various herbaceous	common
72.031	*Tyria jacobaeae*	**cinnabar**	0906	0906	1	common ragwort	common
72.035	*Miltochrista miniata*	**rosy footman**	2107	2107	2	lichens	local
72.041	*Lithosia quadra*	**four-spotted footman**	2107	2107	1	lichens	na
72.044	*Eilema griseola*	**dingy footman**	2107	2107	2	lichens	common
72.045	*Eilema lurideola*	**common footman**	0307	0307	2	lichens, hawthorn	common
72.046	*Eilema complana*	**scarce footman**	0906	2107	8	lichens	local
72.047	*Eilema caniola*	**hoary footman**	1308	1308	2	lichens	nb
72.053	*Herminia tarsipennalis*	**fan-foot**	2107	2107	1	fallen leaves on ground	common
73.015	*Autographa gamma*	**silver y**	0905	0710	25	various herbaceous	immigrant
73.045	*Acronicta rumicis*	**knot grass**	0905	0906	3	various	common
73.061	*Stilbia anomala*	**anomalous**	1409	0710	8	wavy hair-grass, tufted hair-grass	local
73.084	*Bryophila domestica*	**marbled beauty**	1308	1308	4	lichens	common
73.095	*Caradrina clavipalpis*	**pale mottled willow**	1409	1409	1	grasses	common
73.096	*Hoplodrina octogenaria*	**uncertain**	0307	2107	2	various herbaceous	common
73.113	*Phlogophora meticulosa*	**angle shades**	0905	2610	7	various	common
73.131	*Luperina testacea*	**flounced rustic**	1409	1409	2	grasses	common
73.156	*Apamea crenata*	**clouded-bordered brindle**	0307	0307	2	grasses	common
73.158	*Apamea sordens*	**rustic shoulder-knot**	0906	0906	1	grasses	common
73.162	*Apamea monoglypha*	**dark arches**	0906	1308	16	grasses	common
73.163	*Apamea lithoxylaea*	**light arches**	0307	2107	2	grasses	common
73.165	*Apamea furva*	**confused**	2107	2107	1	grasses	local
73.171	*Litoligia literosa*	**rosy minor**	2107	2107	2	grasses	common
73.172	*Mesoligia furuncula*	**cloaked minor**	2107	1308	6	grasses	common
73.176	*Oligia fasciuncula*	**middle-barred minor**	0906	0906	2	grasses	common
73.193	*Omphaloscelis lunosa*	**lunar underwing**	0710	2610	8	grasses	common
73.206	*Lithophane leautieri*	**blair's shoulder-knot**	0710	0710	1	several cypresses	common
73.224	*Griposia aprilina*	**merveille du jour**	0710	0710	1	oaks	common
73.233	*Aporophyla nigra*	**black rustic**	0710	2610	9	various	common
73.235	*Polymixis lichenea*	**feathered ranunculus**	1409	2610	44	various herbaceous	local
73.242	*Orthosia incerta*	**clouded drab**	0905	0905	1	various hardwoods	common
73.244	*Orthosia cerasi*	**common quaker**	0905	0905	1	various hardwoods	common
73.245	*Orthosia cruda*	**small quaker**	0905	0905	1	various hardwoods	common
73.247	*Orthosia gracilis*	**powdered quaker**	0905	0905	1	various	common
73.249	*Orthosia gothica*	**hebrew character**	0905	0905	3	various	common
73.250	*Anorthoa munda*	**twin-spotted quaker**	0905	0905	1	various hardwoods	common
73.264	*Lacanobia thalassina*	**pale-shouldered brocade**	0906	0906	1	various hardwoods	common
73.267	*Lacanobia oleracea*	**bright-line brown-eye**	0307	0307	1	various	common
73.273	*Hada plebeja*	**shears**	0906	0307	4	various herbaceous	common
73.278	*Conisania andalusica*	**barrett's marbled coronet**	0906	0906	4	sea campion, rock sea-spurrey, sand spurrey	nb
73.281	*Hadena bicruris*	**lychnis**	0307	0307	1	several campions	common
73.283	*Hadena confusa*	**marbled coronet**	0905	0906	5	several caryophyllaceae	local

73.286	*Hadena perplexa*	**tawny shears**	0905	2107	15	several caryophyllaceae	common
73.293	*Mythimna impura*	**smoky wainscot**	2107	2107	1	grasses	common
73.298	*Mythimna ferrago*	**clay**	0906	2107	2	grasses	common
73.301	*Leucania comma*	**shoulder-striped wainscot**	0906	0906	1	grasses	common
73.312	*Euxoa obelisca*	**square-spot dart**	1308	1308	4	various herbaceous?	nb
73.313	*Euxoa tritici*	**white-line dart**	1308	1308	1	various herbaceous	common
73.317	*Agrotis exclamationis*	**heart and dart**	0906	0307	4	various herbaceous	common
73.319	*Agrotis segetum*	**turnip moth**	0710	0710	2	various herbaceous	common
73.324	*Agrotis trux*	**crescent dart**	0307	2107	9	thrift?	local
73.325	*Agrotis puta*	**shuttle-shaped dart**	0905	0905	2	various herbaceous	common
73.327	*Agrotis ipsilon*	**dark sword-grass**	2107	2107	1	various herbaceous	immigrant
73.329	*Ochropleura plecta*	**flame shoulder**	0905	1308	5	various herbaceous	common
73.333	*Diarsia mendica*	**ingrailed clay**	0307	0307	2	various	common
73.338	*Lycophotia porphyrea*	**true lover's knot**	0307	2107	3	heathers	common
73.341	*Standfussiana lucernea*	**northern rustic**	0906	0307	2	various herbaceous	local
73.342	*Noctua pronuba*	**large yellow underwing**	0906	0710	22	various herbaceous	common
73.345	*Noctua comes*	**lesser yellow underwing**	0307	0710	7	various	common
73.348	*Noctua janthe*	**lesser broad-bordered yellow underwing**	2107	2107	2	various	common
73.357	*Xestia xanthographa*	**square-spot rustic**	1308	2610	60	various herbaceous	common
73.359	*Xestia c-nigrum*	**setaceous hebrew character**	1409	1409	2	various herbaceous	common
73.361	*Xestia triangulum*	**double square-spot**	2107	2107	1	various	common
74.003	*Nola cucullatella*	**short-cloaked moth**	0307	2107	2	many hardwood rosaceae	common
74.008	*Pseudoips prasinana*	**green silver-lines**	0906	0906	1	various hardwoods	common

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17. A new species, *Delplanqueia inscriptella*, formerly included within *Delplanqueia dilutella*, was described in 2015; some uncertainty now exists concerning the morphology and distribution of the two species; my identification must be viewed, at least at present, as provisional.

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