Lepidoptera of the Mokomoko Drylands Sanctuary, Alexandra

November 2021 (initial survey and report provided)
October 2022 (second survey and report updated)

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The moth species *Meterana exquisita* camouflaged on lichen at the Mokomoko Drylands Sanctuary

Introduction

There are over 1,800 species of butterflies and moths (Lepidoptera) in New Zealand. More than 90% of these species are found nowhere else and this is the highest proportion of endemic butterflies and moths in the world. About 70 species have also been introduced since European settlement (see: Butterflies and moths – Te Ara Encyclopedia of New Zealand).

There are no major differences between butterflies and moths – they are common names given to a group of insects called Lepidoptera (Greek for 'scaly wings'). Most butterflies and moths have a similar life cycle. Adults lay their eggs on plants or other surfaces such as rocks or lichens. Larvae (caterpillars) hatch from the eggs, feed, and grow. They become pupae, encased in a cocoon while their wings develop. They emerge from the cocoon as adults.

Central Otago, including the Alexandra area and Old Man Range, has quite a high diversity of moths. Moths can be found from the lowlands to high alpine in a wide variety of habitats, but forests, shrublands, wetlands, or tussock-lands with high botanical diversity may support more species.

Methods

The site

The Mokomoko Dryland Sanctuary is located near Alexandra, Central Otago at the base of the Old Man Range near Conroy's Dam. The sanctuary is a 14 hectare reserve enclosed within a mammal-proof fence, managed by the Central Otago Ecological Trust (COET) for the restoration of Central Otago's dryland ecosystems. The sanctuary is located within the Aldinga Conservation Area, which is public land managed by the Department of Conservation Alexandra Office.

Habitats within the sanctuary include dense grey/divaricating shrublands composed of matagouri (*Discaria tomatou*), small-leaved *Coprosma* species (e.g. *propinqua*), *Corokia cotoneaster*, and similar small-leaved shrubs. These shrublands are mixed with rank grassland, tussocks, wetland plants, and abundant *Muehlenbeckia complexa* and bush lawyer vineland. There are a number of *Olearia* trees or shrubs (*Olearia bullata* and *Olearia lineata*). There are also large areas of thyme shrubland and other exotic weeds.

A large damp gully runs through the sanctuary, and there are several smaller gullies that branch off from the main gully. Rock cover (schist) is abundant and complex, including loose rock, small bluffs, creviced rock platforms, well-creviced rocky gully systems, and rock tors on high ground.

These habitats provide excellent cover for lizards and invertebrates and there is a high diversity and/or abundance of both present. Three lizard species were translocated to the sanctuary in 2018 and appear to be establishing well: Otago skink (*Oligosoma otagense*), grand skink (*Oligosoma grande*), and jewelled gecko (*Naultinus gemmeus*). Three other lizard species were present prior to construction of the fence and all are in high abundance (higher abundance inside than outside of the fence due to the benefits of mammal exclusion): schist gecko (*Woodworthia* "Central Otago"),

McCann's skink (*Oligosoma maccani*), and southern grass skink (*Oligosoma* aff. *polychroma*: Clade 5). Other wildlife includes New Zealand falcon, dragonflies, and cave weta.

The predator exclusion fence at Mokomoko Dryland Sanctuary

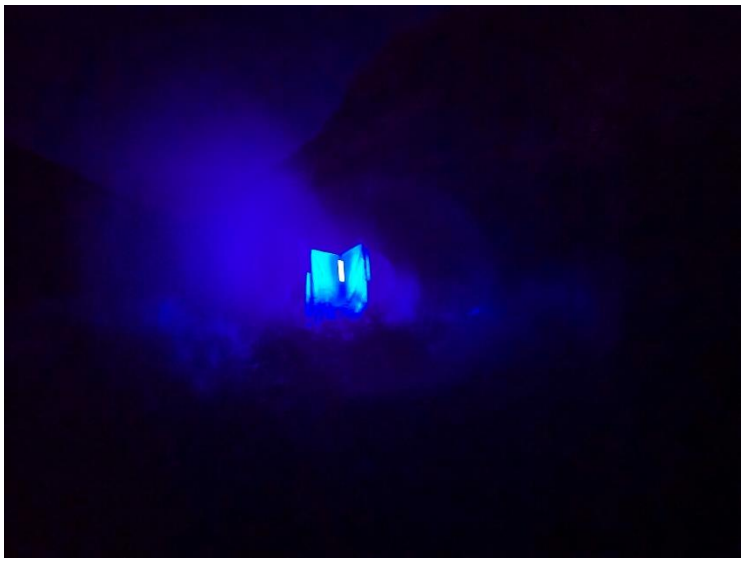
Lepidoptera detection methods: Day surveys

Day-flying moths were targeted by brief day-searches when time allowed outside of the surveys for grand and Otago skinks that occurred during both the 2021 and 2022 visits. Moths were flushed out from vegetation, or found on rock tors and bluffs, and where possible captured using a hand net and/or small plastic containers. In addition, whilst surveying for grand and Otago skinks, a plastic container was carried to opportunity catch any moths observed whilst navigating around rock tors or gully systems. These moths were then photographed, generally on white paper, and released.

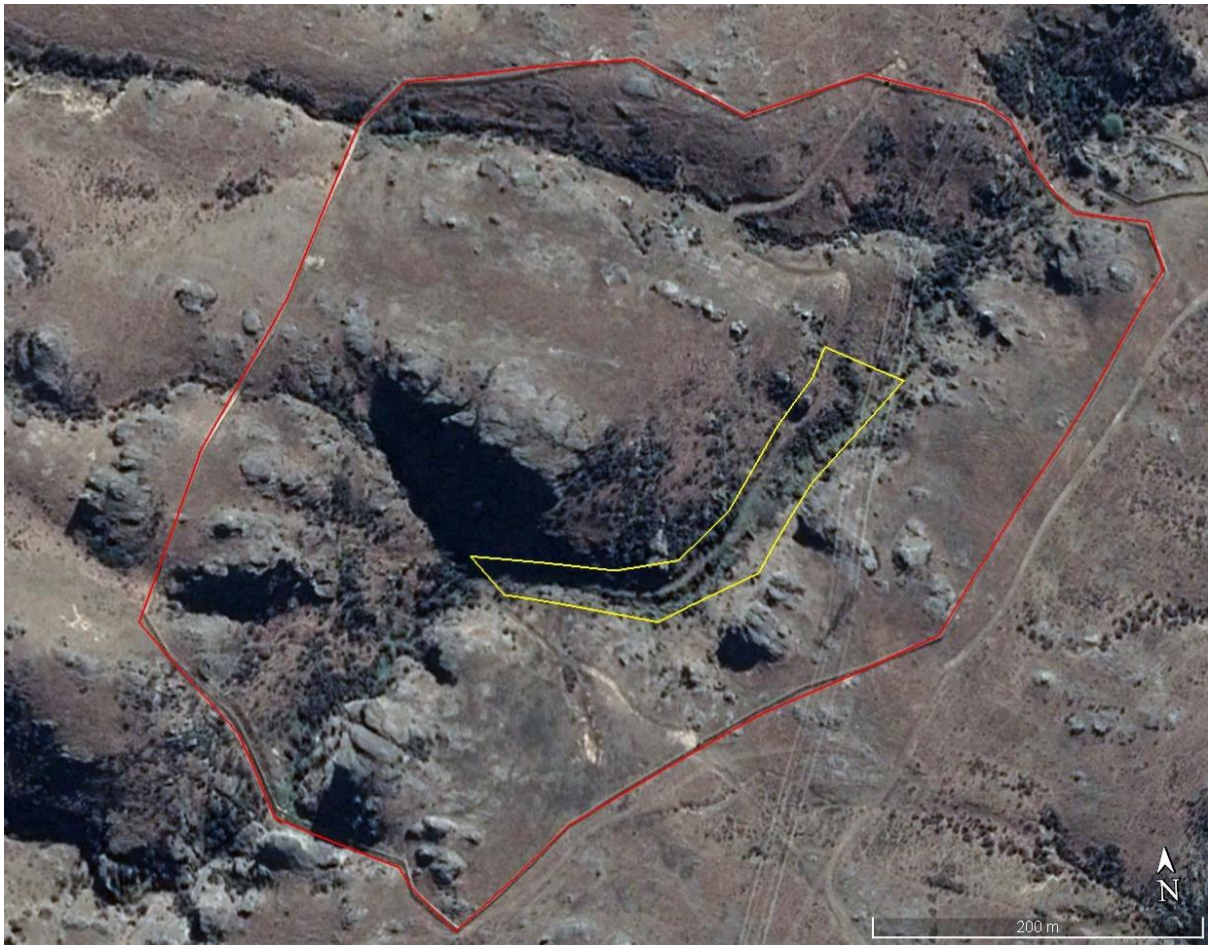
Meterana diatmeta recorded at Mokomoko Drylands Sanctuary in October 2022

Lepidoptera detection methods: Night surveys

Night surveys involved the use of two-four small 10W UV lights placed on top of white sheets each powered by a portable power bank. Lights were spread out in different locations around the gully with at least 50 metres between each light. Moths that were attracted to the light were photographed directly on the sheet, or were captured in small plastic containers, photographed, and released. Surveying occurred between the hours of about 11:30 pm and 2:00 am over two consecutive nights in both November 2021 and October 2022. Sites for the moth lights were chosen up on the lower rocky gully sides in locations which overlooked diverse shrubland or vineland below.



UV light used to attract moths at night (top left), UV light at night set up with a white sheet behind (top right). Moths attracted to a UV light (opposite).



Mokomoko Drylands Sanctuary. Night surveys were undertaken within the yellow outline

Results

A large abundance and diversity of moths were observed at the Mokomoko Drylands Sanctuary between 8-10 November 2021 and 12-14 October 2022. In particular, at night, large numbers of moths were attracted to the UV lights, but the different species varied greatly in their abundance. Weather conditions were generally sunny by day in both years and mild and calm by night; however, the temperatures were a lot cooler in the October survey – especially at night (about 8℃ versus 12℃ in November).

Five common butterflies were observed as follows: white butterfly (*Pieris rapae rapae*), red admiral (*Vanessa gonerilla gonerilla*), an undescribed copper butterfly (genus: *Lycaena*), New Zealand blue (*Zizina oxleyi*), and common tussock butterfly (*Argyrophenga antipodum*).

Sixty (60) different moth species were recorded at the Mokomoko Dryland Sanctuary between the two years (46 in 2021 and 42 in 2022). Of the moth species, the majority (56) were able to be identified to species level, with the remaining four identified to genus or family level. The moth species are listed in the table below from both the 2021 and 2022 survey with 'Y' indicating that the species was observed and photographed. The number of inaturalist observations in the table gives some indication of how rare or commonplace each species may be, but this is not necessarily an accurate or reliable

measure and is only a rough guide. Some species are photographed more than others due to their size or beauty, or existence near human populations (versus more remote areas). I have also included the unverified inaturalist records – most of which are likely to be correct, but just do not come with a photograph, and so are unable to be 'verified' by inaturalist users.

The highlighted moths in the table are species which are rare, or at least rarely reported on inaturalist. These species ecology and features will be emphasised in the following section in more detail, along with accompanying photographs.

The moths recorded on this survey are likely to represent only a small-moderate proportion of the total number of moth species which utitilise the sanctuary and surrounding area over the course of a year. Surveys at other times of the year would locate additional species, as many moths only emerge during specific seasons. For example, *Meterana grandiosa* could be present, but is only emergent from March to early June. In addition, different weather conditions may reveal different species and the day-surveying was not thorough.

It is likely that well over 100 moth species utilise the sanctuary over the course of a year. Further surveys at various times of the year would be illuminating and would no doubt add to this species list. In addition, moth traps or other light set-ups may attract more species.

Being mammal-predator free it is likely that the sanctuary provides important refuge for some moth species, but little is known in this area. It is likely that rodents, hedgehogs, and other mammals predate on moths or their caterpillars, so they probably benefit from mammal control or exclusion.

Moth species and common name	**Nov 2021**	**Oct 2022**	**Verified NZ inaturalist observations***	**Total NZ inaturalist observations***
Amblyptilia repletalis	Y	-	159	240
Agrotis admirationis	Y	-	8	9
Dark sword grass (*Agrotis ipsolin*)	-	Y	724	927
Asaphodes chlamydota	Y	Y	69	126
Austrocidaria similata	Y	Y	474	603
Austrocidaria gobiata (or *anguligera*)	Y	Y	299	474
Capua semiferena	-	Y	485	783
Chloroclystis inductata	Y	Y	1162	1304
Chloroclystis sphragitis	Y	Y	136	160
Ctenopseustis	-	Y	604	710
Gorse pod moth (*Cydia succedana*)	-	Y	282	324
Lucerne leaf-roller moth (*Clepsis divulsana*)	-	Y	214	236
Clematis triangle (*Deana hybreasalis*)	-	Y	212	318
Declana junctilinea	Y	Y	163	268
Dichromodes ida	-	Y	5	24
Dichromodes gypsotis	Y	-	4	32
Elachista (genus)	-	Y	213	386
Eudonia philerga	Y	Y	953	1086
Sod Webworm (*Eudonia sabulosella*)	Y	Y	687	1029

Gadira acerella	Y	Y	244	328
Hierodoris s-fractum	-	Y	14	19
Harmologa amplexana	Y	Y	98	151
Helastia christinae	Y	Y	8	45
Helastia corcularia	Y	-	481	727
Heterocrossa exochana	-	Y	76	85
Ichneutica acontistis	Y	Y	38	88
Ichneutica arotis	Y	-	195	311
Ichneutica cana	Y	-	13	60
Ichneutica disjungens	Y	-	39	134
Ichneutica lithias	Y	Y	41	143
Ichneutica mutans	Y	Y	2198	2621
Ichneutica moderata	Y	Y	212	442
Spear Grass Moth (*Ichneutica nullifera*)	Y	-	56	187
Ichneutica paracausta	Y	Y	45	116
Ichneutica plena	Y	Y	1013	1201
Ichneutica ustistriga	Y	Y	874	1130
Kiwaia brontophora	-	Y	9	31
Leptocroca (genus)	Y	Y	314	409
Common Bag moth (*Liothula omnivora*)	-	Y	728	758
Megacraspedus calamogonus	-	Y	48	124
Meterana exquisita	Y	-	38	67
Meterana coeleno	Y	Y	63	101
Meterana diatmeta	-	Y	50	81
Meterana ochthistis	-	Y	141	222
Mnesictena flavidalis	Y	Y	402	648
Orocrambus ramosellus	Y	Y	240	383
Orocrambus flexuosellus	Y	-	1335	1634
Emerald Pug Moth (*Pasiphila muscosata*)	Y	-	181	227
Senecio Blue Stem Borer, *Patagoniodes farinaria*	Y	-	184	216
Southern Armyworm (*Persectania aversa*)	Y	Y	346	636
Physetica phricias	Y	Y	111	294
Physetica cucullina	Y	-	30	106
Physetica homoscia	Y	Y	24	58
Proteuxoa tetronycha	Y	-	329	329
Pseudocoremia indistincta	Y	-	299	345
Dowdy Plume Moth (*Stenoptilia zophodactylus*)	Y	-	68	77
Scoparia excilis	-	Y	34	160
Tingena (genus)	Y	Y	1496	2170
Wiseana (genus)	Y	Y	1636	2044
Bog Porina (*Wiseana umbraculata*)	Y	-	278	411
Xanthorhoe semifissata	Y	-	691	854
TOTAL	46	42		

*As of writing (late-November 2022)

Agrotis admirationis

Agrotis admirationis · iNaturalist
Observations · iNaturalist

Agrotis admirationis was first described in 1868. Specimens of this species have been found in Christchurch. Its favoured host plants are herbs found in open areas (Patrick *et al*. 2011). Known records for this species come from Canterbury, Otago, and also the Waitakere Ranges near Auckland. One of very few reports prior to the field survey at Mokomoko Drylands Sanctuary was from a house in Alexandra. Although reports are rare, it has been noted as abundant in the Mackenzie Country (see https://www.inaturalist.org/observations/5389986). I have also recorded this species at Falls Dam, near Saint Bathans. Two individuals were attracted to UV light at Mokomoko Drylands Sanctuary.

Agrotis admirationis recorded at Mokomoko Drylands Sanctuary in November 2021

Dichromodes Ida

Observations · iNaturalist

Dichromodes is a genus of moths from Australia and New Zealand. There are six described endemic species in New Zealand and known to be another half a dozen or more undescribed taxa. The described species are sphaeriata, gypsotis, ida, niger, cynica, and simulans. *Dichromodes* are known from rocky regions of the South Island, particularly Central Otago and the Canterbury high country, as well as Banks Peninsula and the Port Hills near Christchurch. Sparse in the North Island, asides from the Wellington area.

The moth pictured here is Dichromodes ida which is only known from Otago. Records span from coastal Otago (Whare Flat, Tairei Gorge,) north and westwards through Central Otago (Macraes Flat, Sutton, Middlemarch, Hyde, Raggedy Range, Ida Valley, and Alexandra area), as far west as the Cairnmuir Mountains near Cromwell.

Dichromodes ida is a swift day-flying moth of rocky habitats, such as tors, bluffs, outcrops, and rocky gullies. The larvae feed on lichens which grow on their rocky habitat. All *Dichromodes* species are day-flying and only *D. sphaeriata* is known to come to light. Dichromodes moths can sometimes be hard to capture and photograph, due to their habit of launching into the air when approached or disturbed on rock tors. At Mokomoko Drylands Sanctuary, several Dichromodes ida were identified on the 'grand skink rocks' (large tors in the south-western corner of the sanctuary).

Dichromodes ida photographed on a rock tor

Dichromodes gypsotis

Observations · iNaturalist

A small, but very distinctive and beautiful moth species. *Dichromodes gypsotis* is a species of Lepidoptera in the family geometrid moths. They are a day-flying moth. A *Dichromodes gypsotis* was found by day at Mokomoko Drylands Sanctuary clinging to the under-side of a large rock tor. There were two individuals on top of each other, but one flew off when I approached. Dichromodes gypsotis appears to have a wide distribution with one report from near Gisborne, but all other reports on inaturalist are in the South Island.

Records are sparse through Canterbury and Otago, including Darfield, Peel Forest, near Dunedin, Waihola, Hindon, Macraes Flat, Alexandra, Lauder, West Eweburn Dam (near Naseby), and Ophir. There are two reports from Alexandra and one from Conroy's Road. Despite these wide reports, the individual photographed on the 2021 survey was the first verifiable (with photo) observation on inaturalist (now four, including three from the West Eweburn Dam). The verifiable records provide an important function by enabling others to compare any moths they have found to photos online.

Dichromodes gypsotis was observed by day resting in the shade on an under-hang on a large rock tor

Meterana exquisita

Observations · iNaturalist
Meterana exquisita · iNaturalist

Meterana exquisita is a beautiful endemic moth species in the family Noctuidae. The colour pattern is a pale blue/green mixed with contrasting white and black markings in a pattern form that resembles lichen and blends in well with their natural *Olearia* shrubland habitat. *M. exquisita* has been reported in Auckland, Waikato, Taupo, Whanganui, Wairarapa, Nelson, South Canterbury, Mackenzie country, Central Otago, Otago Lakes, and Southland, but is now rare in some regions and has been extirpated from sites, such as its type locality in Southland (Patrick *et al*. 2000). Recently found on Stewart Island.

The plant host species for the larvae of *M. exquisita* are small-leaved Olearia species, such as *O. hectorii*, *O. odorata*, *O. lineata*, and *O. bullata* (Lambert 2015). This species has only one generation a year (Patrick 2000). The larvae are bright green coloured and as a result are well camouflaged when feeding on their host species (Patrick 2000). Larvae feed for one month before they pupate. *Meterana exquisita* are on the wing from August to December but are most common from September to October.

They are classified as "At Risk, Relict'" by the Department of Conservation (Hoare *et al*. 2017). One of the reasons *Meterana exquisita* is considered “At Risk” is that the habitat of this species is under threat from land development (Patrick *et al*. 2000). The elimination of the host plants of this species has resulted in their extinction from sites (Patrick 2000). As such, protection, and expansion of shrublands containing small-leaved Olearias may be important for their conservation. Mokomoko Drylands Sanctuary has several Olearia lineata and Olearia bullata shrubs, mixed in with *Coprosma* and matagouri shrubland, and this is likely to provide important habitat. Planting of more Olearia shrubs could be undertaken to increase habitat availability for *Meterana equisata*.

The colour pattern is a pale blue/green mixed with contrasting white and black markings in a pattern form that resembles lichen and blends in well with Olearia shrubs.

Physetica homoscia

Observations · iNaturalist

Physetica homoscia · iNaturalist

Physetica homoscia is an endemic species of moth of the family Noctuidae. It is found throughout New Zealand including in the Auckland Islands. Appears to be most common in the inland South Island. I have often recorded it in the mountains of North Otago and Central Otago in the spring. *Physetica homoscia* lives at a wide range of altitudes from sea-level up to at least 1750 m and inhabits places where its host plants are common, including coastal dune habitat. The larvae of *P. homoscia* feed on *Ozothamnus leptophyllus* and *Ozothamnus vauvilliersii.* The adult moths are on the wing from September to June and are attracted to light.

Physetica homoscia (left). The larvae feed on *Ozothamnus* (right)

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