

## Lepidoptera of Kaitorete Spit, Canterbury

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### ABSTRACT

A survey of the Lepidoptera of Kaitorete Spit, Ellesmere Ecological District, records 130 moth species, 126 of which are native residents, and six endemic to the area. The host plants of many species are recorded, some for the first time. Some nationally rare moth species are also present. The history and biogeography of the moth fauna is discussed together with the significance of the site for conservation of biological features and natural processes.

**Keywords** Lepidoptera, Kaitorete Spit, Birdlings Flat, endemic species, biogeography, sand dunes, conservation, Ellesmere Ecological District

### INTRODUCTION

Kaitorete Spit lies between Lake Ellesmere and the Pacific Ocean, south-west of Banks Peninsula, about 40 kilometres south of Christchurch on State Highway 75. It is 28 km long with its width ranging from 3.2 km at the eastern (Birdlings Flat) end to 0.1 km at the western (Taumutu) end (Arnold 1985). A public road runs the length of the spit. Along with Banks Peninsula, the spit is formed on the basement rocks of the Chatham Rise which stretches east to the Chatham Island group (Wood *et al.*, 1989). This mainly submarine plateau is of Triassic age and was formed on the margin of Gondwana. Geologically the spit is young, being formed within the last 6000 years as a response to a rising sea level and continuing aggradation of the Rakaia and Waimakariri Rivers following the end of an ice-age (Armon 1974). More recently, dunes have formed on the gravel spit and the eastern end continues to prograde (Palmer 1980). Kirk (1979) discussed the international significance of Kaitorete Spit from a coastal processes perspective. He stated that it is more correctly termed a barrier rather than a spit because it is hinged at the opposite end to the direction of the sediment supply. Also, he noted the paucity of mixed sand and gravel beaches world-wide, although they are common on the east coast of the South I. and lower east coast of the North I. Kaitorete Spit is among the largest sequences of this type in New Zealand. Other distinctive features are the dryness of the dune hollows behind the foredunes, the predominance of native vegetation cover on the dune system and the presence of pingao (*Desmoschoenus spiralis*) as the dominant sand-binding species which has resulted in gentle contoured dunes (Arnold 1985).

Kaitorete Spit, together with Lake Ellesmere, make up the Ellesmere Ecological District of the Canterbury Plains Ecological Region (McEwen 1987). The flora and fauna have been documented by Speight (1930), Burrows (1969a, b), Partridge (1985) and Peace (1984). Johnson (1992), in an inventory of South Island coastal dunes, rated Kaitorete Spit among the most important for conservation, based on criteria such as number of native plants, degree of invasion of weeds, degree of modification, and native plant, landform and community diversity. The neighbouring Banks Ecological Region has been recently surveyed for the Protected Natural Areas Programme (Wilson 1993). Although native vegetation was the main criterion for the selection of the recommended areas for protection, mention is made of insects. Several of the selected areas in the Akaroa Ecological District of the region contain some of the features of Kaitorete Spit, especially Oruaka and Kinloch. Both of these areas lie very close to the Ellesmere Ecological District boundary.

Both Courtney (1984) and Johnson (1992) commented on the national importance of the Kaitorete Spit dunes for conservation. It is the largest dune system in New Zealand dominated by pingao (Peace 1984) and because of this, was studied in detail by Partridge (1991) who looked at the interaction of exotic marram grass and the pingao. The spit

has both endemic plants (Arnold 1985; Peace 1984) and insects (Johns 1986; Arnold 1985). It is biogeographically important as it contains not only endemic species, but is the distributional limit for a number of them (Arnold 1985; Burrows 1969b). Many authors have listed the flora and vertebrate fauna (Burrows 1969a, b) but the insect fauna, and in particular the large moth fauna, has not previously been reported in detail. Floral lists for dune areas north of Banks Peninsula (Pegg 1914; McCombs 1992) underline the great differences of the native flora there compared to Kaitorete Spit. Whereas *Pimelea prostrata* is present here, the dunes of New Brighton have (had) *P. arenaria* (now locally extinct). The shrub *Cassinia*, together with a distinctive moth fauna, are also features of these latter dunes that are absent in dunes further south.

Kaitorete Spit has a mixture of land tenures, with endowment, freehold, leasehold, legal road and reserve land. Sand mining is the subject of controversy (Peace 1984) as it threatens both the natural dune processes and rare native plant communities of the area (Rooney 1991). Most features of conservation importance are present on Crown land (Section 58 coastal strip, scientific or unclassified reserves and leasehold land), much of which is still grazed, mainly by sheep. The 171 ha scientific reserve has a management plan (Lands and Survey 1984) and has been the subject of proposed additions (Arnold 1985). Partridge (1985) documents the flora of a government purpose reserve currently used by Canterbury University Physics Department for ionosphere research.

The climate is harsh, being characterised by low annual rainfall (400-500 mm), a wide range of diurnal and seasonal temperatures, and strong dry or salt-laden winds. The infertile and porous substrate combined with these factors have resulted in a distinctive assemblage of dry plant communities with a range of mainly diurnal insect and reptile species. The flora, fauna and management issues of Lake Ellesmere, adjacent to the spit, have been reviewed by Hughes *et al.* (1974). They make useful recommendations on future management and research. Molloy *et al.* (1991) document the decline in the exotic tree lupin (*Lupinus arboreus*) on Kaitorete Spit due to a root fungus. They also note the impact that the kowhai moth *Uresiphita polygonalis maoralis* larvae have on this plant at times.

## METHODS

The present survey involved three phases. Firstly, I reviewed the literature relating to the area including entomology (Philpott 1930; Meyrick 1931; Lindsay 1930), botany (Speight 1930; Burrows 1969b), management planning (Palmer 1980) and ecology (Burrows 1969a). Secondly, I checked the moth specimens in the Canterbury Museum collected by S. Lindsay at Birdlings Flat, Kaitorete Spit, and J. S. Dugdale gave me other records from his numerous visits. Lastly, I spent 28 days in the field at Kaitorete Spit between 21 June 1986 and 31 October 1991 with a good spread over the warmer months. Additionally, 17 nights were spent there light trapping for adult moths and searching for larvae on host plants. Day-time survey was carried out by hand searching and netting of diurnal species in each recognised plant community, from coastal dunes and hollows back to the older hinddunes and grassland. An 8W 12V ultra violet lamp was used for the light trapping. Voucher specimens are stored in the B.H. Patrick private collection, Dunedin.

## RESULTS

Table 1 contains an annotated list of the 130 species that were found during this survey, together with those recorded in the literature and not rediscovered. Nomenclature follows Dugdale (1988). Host plants are noted where they have been ascertained for Kaitorete Spit moths. Other ecological data and months of adult emergence are also noted. Entries prefixed by an asterisk (\*) denote species not located on this survey but collected by S. Lindsay in 1930s—specimens have been examined in the Canterbury Museum, Christchurch. Those prefixed by # have Kaitorete Spit as their type locality.

## DISCUSSION

A total of 130 species of Lepidoptera are here recorded from Kaitorete Spit (Tables 1, 2), 126 of which are resident natives. Of these, 105 were found during this survey, many

**Table 1:** Annotated species list of Lepidoptera of Kaitorete Spit.

Family and Species	Ecology, Biology	Seasonality	Comments
<b>Hepialidae</b>			
<i>Wiseana cervinata</i> (Walker)	grassland	Oct-Nov	common
<b>Tineidae</b>			
<i>Erechthias fulguritella</i> (Walker)	shrubland, in dead wood	Oct	
<i>Monopis ethelella</i> (Newman)	grassland, in sheep's wool	Sept-Oct	common
<b>Psychidae</b>			
<i>Rhathamictis</i> n.sp.	shrubland, larvae in case	Nov	uncommon
<b>Yponomeutidae</b>			
<i>Plutella antiphona</i> Meyrick	grassland, in crucifers	Oct	
<b>Glyphipterigidae</b>			
<i>Glyphipterix acrothecta</i> Meyrick	immediately behind foredune	Oct	all four species recorded here have their type locality on the Port Hills nearby
<i>G. cionophora</i> (Meyrick)	hinddune, shrubland	Mar	
<i>G. euastera</i> Meyrick	immediately behind foredune	Oct-Dec	
<i>G. oxymachaera</i> (Meyrick)	foredune	Oct	
<b>Gelechiidae</b>			
<i>Anisoplaca achyrota</i> (Meyrick)	larvae bore in <i>Hoheria</i> and possibly <i>Plagianthus</i> spp.	Nov-Dec	resident in saltmarsh
<i>A. ptyoptera</i> Meyrick	larvae bore <i>Carmichaelia</i> spp.	Dec-Jan	common
<i>Athrips zophochalca</i> (Meyrick)	larvae on <i>Carmichaelia</i> spp.	Nov-Jan	
# <i>Kiwaia jeanae</i> Philpott	foredunes to hinddunes, endemic	late Jan-Apr	common, both sexes brachypterous
<i>K. brontophora</i> (Meyrick)		Oct	
* <i>K. cheradias</i> (Meyrick)		Mar	
<i>K. lithodes</i> (Meyrick)	foredune to hinddunes on <i>Raoulia australis</i>	Sept-Apr	common
<i>K.</i> n.sp. nr. <i>glaucoterma</i> (Meyrick)	dunes and cushionfield	Sept-Oct	common, brachypterous
<i>K. parapleura</i> (Meyrick)		Oct	
<i>K. pulverea</i> (Philpott)	foredune	Jan	rare
<i>K. schematica</i> (Meyrick)	foredunes	Nov-Dec & Mar	
* <i>K. quieta</i> (Philpott)		Oct	
<b>Momphidae</b>			
<i>Zapyastra calliphana</i> Meyrick	foredune shrubland larvae mine <i>Muehlenbeckia complexa</i>	Oct-Jan	common
<b>Coleophoridae</b>			
<i>Coleophora trifolii</i> (Curtis)	case larvae on clovers	Dec-Jan	introduced
<b>Lyonetiidae</b>			
<i>Bedellia psaminella</i> Meyrick	larvae mining <i>Calystegia soldanella</i> in foredune	Jan-Mar	type locality Port Hills

Table 1: —Continued

Family and Species	Ecology, Biology	Seasonality	Comments
<b>Oecophoridae</b>			
<i>Atomotricha ommatias</i> Meyrick	shrubland	Aug-Sept	common, female brachypterous
<i>Gymnobathra parca</i> (Butler)	foredune/hinddune	Sept-Oct	very common
<i>Leptocroca lindsayi</i> Philpott	shrubland	Oct	common, type locality Yaldhurst
<i>Oxythecta austrina</i> (Meyrick)	hinddune, larvae feed on <i>Leucopogon</i> <i>fraseri</i> , diurnal	Sept-Jan	common
* <i>Stathmopoda coracodes</i> (Meyrick)	scale insect predator	Nov-Dec	
<i>Tingena compsogramma</i> (Meyrick)	grassland, larvae in leaf litter	Oct	
<i>T. melanamma</i> (Meyrick)	grassland, larvae in <i>Poa cita</i> leaf litter	Sept-Oct	common
<i>Tingena</i> n.sp. (pale grey species)		Oct	
<i>T. paula</i> (Philpott)	shrubland	Oct-Dec	local, type locality on Banks Peninsula, female brachypterous
<i>T. siderodeta</i> (Meyrick)	shrubland	Oct	common
<i>Tingena</i> spp. (2 species of the yellow group— J S Dugdale pers. comm.)			
<i>Trachypepla euryleucota</i> (Meyrick)	shrubland	Oct	common
<i>T. anastrella</i> Meyrick	hinddune	Dec	
<b>Scythridae</b>			
# <i>Scythris niphozela</i> (Meyrick)	foredune, larvae on <i>Carmichaelia appressa</i>	Oct-Dec	common
<i>S. epistrotta</i> (Meyrick)	larvae on <i>C. appressa</i>	Nov-Jan	common
<i>Scythris</i> n.sp. (J S Dugdale pers. comm.)	chocolate coloured with a cream stripe	Oct	
<b>Elachistidae</b>			
<i>Cosmiotes ombrodoca</i> (Meyrick)	hinddune	Dec-Feb	
<i>Elachista gerasmia</i> (Meyrick)	hinddune, larvae bore <i>Juncus</i>	Dec	
<b>Choreutidae</b>			
<i>Tebenna micalis</i> (Mann)	foredune/hinddune, associated with <i>Raoulia</i> , larvae on <i>Craspedia</i> and thistles	Nov-Apr	common
<b>Tortricidae</b>			
<i>Bactra noteraula</i> Walsingham	foredune	Jan	very common
<i>Bactra xystrata</i> Meyrick	larvae in pingao, foredune/hinddune	Oct-Jan	common
<i>Crocidosema</i> n.sp.	larvae on <i>Malva</i>	Dec-Jan	
<i>Ericodesma aerodana</i> (Meyrick)	hinddune, larvae on <i>Pimelea prostrata</i> , crepuscular	Oct-Jan	common, local

Table 1: — Continued

Family and Species	Ecology, Biology	Seasonality	Comments
<i>Merophyas leucaniana</i> (Walker)	foredune/hinddune	Sept-Jan	common
<i>Eurythecta robusta</i> (Butler)	foredune, larvae on herbs and cushions	Sept-Jan	common
<i>Capua semifera</i> (Walker)	foredune/hinddune	Sept-Apr	common
<i>Harmologa amplexana</i> (Zeller)	foredune shrubland	Oct	common
<i>H. oblongana</i> (Walker)	foredune shrubland	Oct-Jan	common
<i>Harmologa</i> n.sp. 1	larvae on <i>Melicytus alpinus</i>	Oct-Jan	rare
<i>Harmologa</i> n.sp. 2	foredune/hinddune, larvae on herbs and leaf litter	Oct	very common
<b>Pterophoridae</b>			
<i>Pterophorus innotatalis</i> (Walker)	shrubland/grassland, larvae on <i>Dichondra</i>	Oct	common
* <i>Stenopitilia celidota</i> (Meyrick)	larvae on <i>Vittadinia</i> spp.	Oct	type locality is Christchurch
<b>Lycaenidae</b>			
<i>Lycaena boldenarum</i> White	widespread, larvae on <i>Muehlenbeckia axillaris</i>	Sept-Apr	very common
<i>L. salustius</i> (Fabricius)	shrublands, larvae on <i>M. complexa</i>	Oct-Apr	common
* <i>L. rauparaha</i> (Fereday)			recorded by Johns (1986)
<i>Zizina oxleyi</i> (Felder & Felder)	foredune, larvae on <i>Carmichaelia appressa</i> (Lindsay 1930)	Oct-Apr	common
<b>Pieridae</b>			
<i>Pieris rapae</i> (L)	adventive crucifers	Dec	introduced
<b>Pyralidae</b>			
<i>Loxostege affinalis</i> (Lederer)	foredune	Jan	rare
<i>Crocodypora cinigerella</i> (Walker)	widespread	Sept-Apr	very common
* <i>Sporophylla oenospora</i> Meyrick		Oct-Nov & Feb-Mar	
<i>Homoeosoma anaspila</i> (Meyrick)	larvae on <i>Pseudognaphalium lutealbum</i> and <i>Vittadinia</i> flowers	Dec	type locality is Christchurch
<b>Crambidae</b>			
<i>Diasemia grammalis</i> (Doubleday)		Oct-Nov	
<i>Hygraula nitens</i> (Butler)	aquatic larvae on pond weeds	Dec-Jan	common
* <i>Orocrambus abditus</i> (Philpott)		Oct-Mar	
<i>O. callirrhous</i> (Meyrick)	foredune	late Dec-Apr	very common
<i>O. cyclopicus</i> (Meyrick)	widespread	Jan-Apr	very common
<i>O. enchophorus</i> (Meyrick)		Mar	local
<i>O. flexuosellus</i> (Doubleday)		Dec-Jan	not common
<i>O. lewisi</i> Gaskin	foredune/hinddune, larvae on <i>Poa cita</i>	Oct-Dec	common

Table 1: — Continued

Family and Species	Ecology, Biology	Seasonality	Comments
* <i>O. ordishi</i> Gaskin			recorded by Gaskin (1987)
<i>O. ramosellus</i> (Doubleday)		Dec	not common
<i>O. vittellus</i> (Doubleday)	widespread	Dec-Apr	common
<i>O. vulgaris</i> (Butler)	widespread	Feb-Apr	very common
<i>O. xanthogrammus</i> (Meyrick)	foredune, larvae in <i>Raoulia australis</i>	Oct-Mar	local
# <i>Kupea electilis</i> Philpott	hinddune and inter-dune grassland,	Mar-Apr	local, endemic
<i>Gadira leucophthalma</i> (Meyrick)	foredune	Mar-Apr	common
<i>Mnesictena flavidalis</i> (Doubleday)	shrubland	Oct-Jan	common
<i>Eudonia leptalea</i> (Meyrick)	widespread	Nov-Apr	common
<i>E. manganeutis</i> (Meyrick)	foredune	Mar-Apr	common
<i>E. sabulosella</i> (Walker)	widespread	Oct-Feb	very common
<i>E. submarginalis</i> (Walker)	widespread	Jan-Apr	common
* <i>E. trivirgata</i> (F & R)			
<i>Scoparia chalicodes</i> Meyrick	foredune and hinddune	Oct-Dec	local
<i>S. exilis</i> Knaggs	widespread	Oct-Dec	common
<i>S. indistinctalis</i> (Walker)		Dec	
* <i>Tawhitia pentadactyla</i> (Zeller)		Mar	
<i>Uresiphita polygonalis maorialis</i> (F&R)	larvae on lupin	Jan	local
<b>Geometridae</b>			
* <i>Arctesthes catapyrrha</i> (Butler)		Oct-Nov	
<i>Chloroclystis filata</i> (Guenée)	shrubland, larvae on flowers <i>Senecio</i> spp.	Oct	
<i>Pasiphila</i> n.sp.	larvae on <i>Carmichaelia</i> spp.	Dec	rare
<i>Asaphodes aegrota</i> (Butler)	hinddune	Oct	local
<i>A. abrogata</i> (Walker)	shrubland/grasslands	Mar-Apr	common
<i>Austrocidaria gobiata</i> (F & R)	larvae on <i>Coprosma</i> spp.	Aug-Jan	common
<i>Epicyme rubropunctaria</i> Doubleday	larvae on <i>Haloragis</i>	Jan	local
<i>Epyaxa lucidata</i> (Walker)	grassland	Oct-Jan	local
<i>E. rosearia</i> (Doubleday)	widespread	Oct-Jan	common
<i>E. venipunctata</i> (Walker)	foredune	Oct-Jan	local
<i>Helastia corcularia</i> (Guenée)	grassland	Oct	local
<i>H. cinerearia</i> (Doubleday)		Jan	uncommon
<i>Scopula rubraria</i> (Doubleday)	grasslands, larvae on <i>Plantago</i> and <i>Geranium</i> sp.	Dec-Apr	very common
<i>Notoreas</i> n.sp. nr. <i>perornata</i> (Walker)	foredune/hinddune, larvae on <i>Pimelea prostrata</i>	Sept-Apr	common
<i>Pseudocoremia productata</i> (Walker)	larvae on <i>Muehlenbeckia complexa</i>	Jan	

Table 1: — Continued

Family and Species	Ecology, Biology	Seasonality	Comments
<i>Samana acutata</i> Butler	larvae on <i>Carmichaelia appressa</i> (Lindsay 1930)	Mar	local
<i>Zermizinga indociliaria</i> Walker	shrubland, larvae on <i>Discaria toumatou</i>	Aug-Oct	common
<b>Noctuidae</b>			
<i>Agrotis innominata</i> Hudson	larvae on <i>Calystegia</i> , foredune and hinddune	Dec	local
<i>Agrotis ipsilon aneituma</i> Walker	widespread	Dec-Mar	uncommon
<i>Euxoa admirationis</i> (Guenée)	foredune/hinddunes	Oct-Jan	common
<i>Rictonis comma</i> (Walker)	grasslands, larvae on herbs	Dec-Apr	common
<i>Aletia moderata</i> (Walker)	widespread, larvae on <i>Raoulia australis</i>	Aug-Jan	very common
<i>A. sistens</i> (Guenée)	widespread on <i>Poa cita</i> (Lindsay 1930)	Mar	common
<i>Bityla defigurata</i> (Walker)	larvae on <i>Muehlenbeckia complexa</i>	Dec-Jan, Mar-Apr	common
<i>Graphania disjungens</i> (Walker)	widespread	Oct-Nov	common
<i>G. lithias</i> (Meyrick)	shrublands, larvae on <i>Melicytus alpinus</i>	Sept-Oct	common
<i>G. morosa</i> (Butler)	larvae on grasses	Jan	uncommon
<i>G. mutans</i> (Walker)	larvae polyphagous on herbs	Oct-Dec	uncommon
<i>G. phricias</i> (Meyrick)	larvae probably on <i>Discaria toumatou</i>	Dec-Jan	type locality is Christchurch
<i>G. ustistriga</i> (Walker)		Jan	
<i>Graphania</i> sp.	foredunes, larvae on <i>Coprosma propinqua</i>		
<i>Mythimna separata</i> (Walker)		Dec-Jan	uncommon
<i>Persectantia aversa</i> (Walker)	grassland, larvae on grasses	Oct-Dec	common
<i>Physetica caerulea</i> (Guenée)	foredune/hinddune	Aug-Apr	very common
<i>Tmetolophota acontistis</i> (Meyrick)	hinddune, larvae on grasses	Oct	local
<i>T. atristriga</i> (Walker)		Jan	uncommon
<i>T. phaula</i> (Meyrick)	larvae on <i>Desmoschoenus spiralis</i>	Oct-Nov	type locality is Christchurch
<i>T. unica</i> (Walker)	grassland	Oct-Nov	common

**Table 2:** Summary of Lepidoptera species found.

Family	No. Species Present	No. Species Exotic	No. Species Probably Vagrant	No. Native Species Resident	No. Species Endemic to Area
Hepialidae	1	—	—	1	—
Psychidae	1	—	—	1	—
Tineidae	2	1	—	1	—
Yponomeutidae	1	—	—	1	—
Glyphipterigidae	4	—	—	4	—
Gelechiidae	12	—	—	12	1
Momphidae	1	—	—	1	—
Coleophoridae	1	1	—	—	—
Lyonetiidae	1	—	—	1	—
Occophoridae	14	—	—	14	1
Elachistidae	2	—	—	2	—
Scythridae	3	—	—	3	2
Choreutidae	1	—	—	1	—
Tortricidae	11	—	—	11	—
Pterophoridae	2	—	—	2	—
Lycaenidae	4	—	—	4	—
Pieridae	1	1	1	—	—
Pyralidae	4	—	—	4	—
Crambidae	26	—	—	26	1
Geometridae	17	—	—	17	1
Noctuidae	21	—	1	20	—
Totals	130	3	2	126	6

of them new records for the site. Six species (*Kiwaia jeanae*, *Scythris niphozela*, *Kupea electilis*, *Notoreas* n.sp., *Tingena* sp., *Scythris* n.sp.) are endemic to Kaitorete Spit. The first three of these have their type locality as Birdlings Flat at the base of Kaitorete Spit. This is a rich moth fauna for a dune area and, given the large size and naturalness of Kaitorete Spit, must surely make it of the highest conservation value for a dune area in New Zealand.

The moth fauna exhibits other important features apart from its overall richness and high proportion of endemics. Firstly, the scarcity of many common and widespread lowland species, such as *Graphania mutans* and *G. plena*, which have expanded their range with agricultural changes, highlights the general aridity of the area and the naturalness of the flora. Native dune and grass specialist moths predominate. It was unexpected to find a noctuid such as *Physetica caerulea* to be the commonest noctuid species at a lowland site during the warmer months, as species in the genera *Graphania*, *Aletia* or *Tmetolophota* usually greatly outnumber it in more modified areas.

Secondly, several nationally rare species are present at Kaitorete Spit. The oenochromine (Geometridae) *Samana acutata* has its type locality as Christchurch and has been rarely collected there or elsewhere. During this survey its larvae were found on *Carmichaelia appressa* on the foredunes. Lindsay (1930) also reported *S. acutata* from here. The tiny silvery-grey tortricid *Ericodesma aerodana* has a patchy distribution, but is common locally with larvae feeding within the buds of the sprawling *Pimelea prostrata*. The adults are crepuscular.

Thirdly, over 30 of the moth species here are diurnal, flying fast and low around their host plant or sunbathing on the hot bare sand. This is typical of sites with open or low vegetation. The small *Oxythecta austrina*, widespread in montane to low-alpine areas, flying in hot sunshine around the larval host (*Leucopogon fraseri*) is typical. The small colourful geometrid *Arctesthes catapyrrha* has been collected from Kaitorete Spit (Canterbury Museum collection), but was not found during this survey, although it was common west of Christchurch in an old Waimakariri riverbed cushionfield. The colourful tortricid *Eurythecta robusta* is confined to Canterbury. The tiny adults are diurnal with the fat-bodied females

being incapable of flight like *E. zelaea*, the Central Otago-Mackenzie Country sister species. A conspicuous diurnal moth was discovered during this survey. It is an undescribed species in the *Notoreas perornata* group (Fig. 1) and appears most closely related to the montane-alpine undescribed species of mid-Canterbury, Nelson and Marlborough. Another undescribed closely related species is found in montane-alpine South Canterbury, Otago and eastern Fiordland with a coastal relative occupying a small site south of the Shag River mouth (Patrick 1993). Three other related coastal species are known: one at Southland and Stewart Island, another at Wellington and a third on cliffs in Taranaki. All have various low shrubs of *Pimelea* species as larval hosts, many of which are now quite local in occurrence in coastal sites. This may account for the patchy distribution of coastal *Notoreas* species, some of which are rare. The new species at Kaitorete Spit is locally common in both fore and hinddunes (Fig. 2). The red-purple larvae are found under the sprawling mats of *Pimelea prostrata*. There are probably two generations per year as adults are found from late September until April.

*Kiwaia jeanae* and *Kiwaia* n.sp. are a special feature of the moth fauna of Kaitorete Spit. These small, brachypterous moths jump rather than fly. The former emerges in autumn, the latter in spring. Both are diurnal and occur abundantly in areas dominated by *Raoulia australis* cushion plants and bare sand (Fig. 2). While *K. jeanae* is endemic to Kaitorete Spit in both fore and hinddunes, the undescribed *Kiwaia* has been found recently on old river channels of the Waimakariri River west of Christchurch and near Tekapo in the Mackenzie Country (Patrick, 1992).

Grass moths are particularly diverse and abundant, with the sub-family Crambinae well represented. One species (*Kupea electilis*, the only member of its genus) is endemic and another (*Orocrambus abditus*) is at its southern distributional limit (Gaskin 1975). Other moths of interest are the elegantly patterned *O. xanthogrammus* with larvae in *R. australis* cushions (Lindsay 1930) and *O. callirrhous* common amongst pingao on which the larvae may feed.

Despite their subdued profile, the hinddunes contain a richer moth fauna than the younger foredunes (Fig. 2). Plant diversity is also higher on the hinddune, especially in and around the many sand blowouts. Some moths appear to be confined to the foredune, such as *Agrotis innominata* with larvae on *Calystegia soldanella*. The female of this moth is probably brachypterous here as reported for populations further south (Patrick & Green 1991) and a specimen in the Canterbury Museum collected at New Brighton (Christchurch) is clearly brachypterous. Populations further north generally have fully winged females.

Kaitorete Spit is nationally important for its large intact population of pingao (*Desmoschoenus spiralis*). It is especially dominant on the foredune, and the leaves are eaten by the coastal noctuid *Tmetolophota phaula*. The tortricid *Bactra noteraula* also appears associated with it and its larvae probably bore into the stems.

Another feature is the rows of windshrub *Coprosma propinqua* shrubs draped in the liane *Muehlenbeckia complexa*, often forming lanes sheltered from the wind. This habitat is rich in Lepidoptera, especially those dependent on *Muehlenbeckia*, including copper butterflies (*Lycena salustius*), the leaf mining momphid *Zapyrastra calliphana* and many litter feeding oecophorids. The endangered shrub *Muehlenbeckia astonii* and sprawling *M. ephedroides* occur here also and are host to lepidopterous larvae.

The sprawling *Carmichaelia appressa* is the only vascular plant known to be endemic to Kaitorete Spit. It is a common foredune plant and host to five Lepidoptera (*Anisoplaca ptyoptera*, *Athrips zophochalca*, *Scythris epistrotta*, *Samana acutata* and *Zizina oxleyi*). Katipo spiders (*Lactroedectus katipo*) are numerous amongst the tangle of low lying branches, together with fast moving skinks. An undescribed native woollyhead, *Craspedia* sp. (possibly endemic to the area) is host to the small diurnal *Tebenna micalis*, whose larvae burrow into the tomentum covered leaves. This moth is also known to feed on various exotic thistles. Another important host plant is the convolvulus (*Calystegia soldanella*) which has its leaves mined by *Bedellia psammimella* larvae and eaten by the caterpillars of the noctuid *Agrotis innominata*.

As in the rest of New Zealand, the Lepidoptera fauna is highly seasonal. Adult moths



are present in all months of the year, but very few species emerge in winter. The appearance of *Atomotricha ommatias* in August signals spring and by early October up to 28 species are present. Some of the most distinctive moths, such as the endemic *Kupea electilis*, *Kiwaia jeanae* and *Gadira leucophthalma* do not appear until late March or April.

Considering the young age of the dunes, the moth fauna must be derived from either Banks Peninsula (formerly an island), the Canterbury Plains expanding eastwards, or a combination of both. Johns (1986) considers Kaitorete Spit to be the last surviving example of a habitat common in the Pleistocene ice ages and earlier. This would help to explain the presence of a significant number of endemic species. It is also possible that the endemics are derived from a Banks Peninsula coastal fauna isolated for millions of years from the South Island. The dunes north of Banks Peninsula (New Brighton) may have contained some of these species, but were modified by grazing/fire before entomological study. Alternatively, their flora and fauna could be derived from dune areas further north and were always separated by the large Waimakariri River from the Banks Peninsula biota. Johns also believes that the Kaitorete Spit fauna is so distinctive that it warrants being recognised as a separate ecological region distinct from that of the Canterbury Plains. This is supported by the results of this survey, although the Canterbury Plains have undergone such a dramatic change in vegetation character and hence fauna, that it is difficult to be equivocal on the issue.

### CONCLUSIONS AND RECOMMENDATIONS

It is clear that the Kaitorete Spit dune system is outstanding and probably the best example of its kind in New Zealand. It contains a distinctive moth fauna that will be indicative of other insect orders, with both endemic and nationally rare species. Its large size and largely natural vegetation give it extra significance for nature conservation. It encompasses a range of dynamic natural processes and is largely unspoiled. The existing scientific reserve, although ecologically useful, does not fully encompass the biological features of the spit, particularly the older and richer inner hinddunes and shrubland lanes. These are contained mainly in Crown leasehold land which is currently grazed by cattle and sheep. If they are to be maintained, low intensity sheep grazing may be an appropriate management tool to control exotic grasses, but the areas may be better managed without stock. Appropriate vegetation and faunal monitoring should be set up to determine the stocking level best suited to maintain the natural features.

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