Investigation of a data deficient moth taxon: *Agrotis ceropachoides*

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Plate 1: Male *Agrotis ceropachoides*, Kaitorete Spit, July 2012.

INTRODUCTION

The Department of Conservation commissioned Wildland Consultants to investigate the threat classification of an indigenous moth species currently classified as 'Data Deficient'. The species is: *Agrotis ceropachoides* Guenée, 1868 (Noctuidae).

The Department maintains listings of all indigenous species it believes are threatened with extinction in some way. The threat

rankings are based on consistent criteria, and are updated regularly based on new information the Department receives, generally from specialist groups set up to give it advice. The listings are published regularly, to make them available to conservation staff, as part of their ongoing management of ecosystems and species, and to the wider public (e.g. Lepidoptera: Stringer *et al.* 2012). Data deficient species are species considered by specialist group members to be threatened, but for which there is insufficient information to make an informed decision.

This report, first published in Wildlands Report R3162 (Patrick, 2013), provides the results of the investigation of this species to ascertain its appropriate conservation status.

Agrotis ceropachoides

Discovery in the 1860s

Richard W. Fereday discovered this intriguing noctuid moth in the early 1860s at Oakleigh (Oakley) Station, the Rakaia River mouth farm of his brother, where he lived when he first arrived in New Zealand, from 1862-1864 (Johns 1993). Today the site of the farm is celebrated in the names of Fereday Island and Feredays Road on the true left side of the Rakaia River downstream from the township of Rakaia, about 15km from the Rakaia River mouth, near Southbridge in Mid Canterbury.

Fereday regularly sent insect specimens to his former colleagues in Europe and it was Achille Guenée in Paris who described this noctuid species as *Agrotis ceropachoides* in 1868 and returned the unique male holotype to the British Museum of Natural History (BMNH) where it still resides (Plate 2).

Plate 2: Holotype male of *Agrotis ceropachoides* Guenée, 1868 from Rakaia, Canterbury. Stored in BMNH, London. Image courtesy of Landcare Research Ltd.

The species was listed and illustrated in Hudson's fine book on New Zealand moths and butterflies as *Euxoa ceropachoides* (Hudson 1898, the first illustrated book on New Zealand moths). In it, he cites Fereday's records as "common from July to September, Rakaia", and figures the dull grey variety of the species. No other localities were noted for the species.

As Guenée saw only the grey variety of the species sent by Fereday, his narrow concept of the species has been consistently adopted by others and is the reason why so few examples were recognised. *A. ceropachoides* also became confused with the variable *Agrotis admirationis*, which occurs in the same localities. It was described simultaneously by Guenée. Most specimens under the name *A. ceropachoides* are in fact more unicolorous forms of *A. admirationis.*

Dugdale (1988), in a comprehensive catalogue of all New Zealand Lepidoptera, listed the species as *Euxoa cerapachoides* (sic) and the type locality as MC (denoting Mid Canterbury), but it is clear from

Hudson (1898) that Fereday discovered the species at Rakaia, and as this is the only locality noted, it must stand as the type locality. Additionally, in the preface of his book, Hudson acknowledges Fereday for his moth records, confirming that he relied on Fereday for information on species he was not familiar with. The type locality can be further defined as the Oakleigh Station farm of Fereday's brother. The type locality should be noted as: "Oakleigh Station, Rakaia River mouth", as Oakley Farm is still shown on current maps and has a close connection to both Fereday Island and Rakaia Island, where natural vegetation still exists.

In this report the original generic name and combination *Agrotis ceropachoides* is used, as the species belongs in that genus (Dr Robert Hoare, Landcare Research, pers. comm., 2013). A closely-related species, *Agrotis innominata*, is accepted in that genus so, for consistency, *Agrotis* is used here.

Richard Fereday died in 1899, and no more captures of this moth under the correct name appear to have been made until the author (BP) rediscovered it on 4 July 2012. As stated above, part of the reason for that is that the holotype is a dull grey colour morph which is not typical for the species, and this was also the variety of the species illustrated by Hudson (1898). We now know that this variety makes up less than 10% of males. The typical male colour pattern is shown in Plate 1, although many specimens are intermediate between this pattern and the colour pattern of the holotype. Hudson, in his major works of 1928 and 1939, adds no further information on *Agrotis ceropachoides*.

Lost and found: rediscovery in 2012

On a mild night on 4 July 2012 BP arrived home from work in darkness to find a noctuid moth struggling in a spider's web under the outside light of his home at Birdlings Flat, Kaitorete Spit. Without examining the moth it was removed from the spider's web,

and taken inside to see what it was. Surprisingly it was a species he had not seen previously at Kaitorete Spit, but it looked similar to *Agrotis innominata.*

A light trap was immediately set up at his home, and on that night and over the next five nights seven perfect males were collected. Additional light-trapping over the next three months found the species to be common, in fact the most common noctuid moth over the winter-early spring period, at Kaitorete Spit.

In total, over 80 males were recorded until mid-September, all attracted to UV light traps set along Kaitorete Spit, over 12 suitably warm and calm nights. At that time of year night time temperatures above 8ºC are high enough for this species to be active, even if there is quite a stiff wind off the sea. A comprehensive survey was not carried out, but these records indicate a large population in this coastal sand dune habitat.

Interestingly, no females were found, suggesting strongly that they are short-winged and flightless, as has been recorded for *Agrotis innominata* populations in dunes near Invercargill (Patrick 1994) and the coast around Dunedin (Patrick & Green 1991; Peat & Patrick 1995). Along with colleague Brian Lyford, night searches were undertaken for the female in suitable places along Kaitorete Spit, but with no success.

One male came to light on a warm night of 17ºC on 1 June 2013 at Birdlings Flat, Kaitorete Spit, expanding our understanding of its emergence period and consolidating it as also being a winter-emerging species.

Kaitorete Spit is close to the original locality of *Agrotis ceropachoides* at the Rakaia River mouth farm Oakleigh, with just 10km separating the Rakaia River mouth from the western tip of Kaitorete Spit and 45km from the likely type locality to the 2012 rediscovery site on the eastern end of Kaitorete Spit at Birdlings Flat.

Other Collections

The Canterbury Museum has three specimens of *Agrotis ceropachoides* with the same wing colour and pattern as per the original description and holotype, and the narrow concept of the species (Plate 2). Only one of the Canterbury Museum specimens has a locality label in addition to labels stating "Fereday Collection", and it states: "end of July Oakley Station". This timing is consistent with Hudson (1898), and the specimen is clearly a topotypic specimen with the holotype. Interestingly, the Natural History Museum in London (BMNH) has two specimens of *A. ceropachoides*: one is the holotype described by Guenée in 1868; the other, also of the plain grey form, is labelled 'Rakaia New Zealand RWF/85', and was presumably collected by Fereday in 1885 (R. Hoare, Landcare Research, pers. comm.).

In the Lincoln University Museum collection there are nine males that are very similar to the BP series of *Agrotis ceropachoides* from Kaitorete Spit. These were collected on 10 September 1966 at Oaro, south of Kaikoura, indicating that the distribution of the species extends well to the north of Christchurch. The Canterbury Museum collection also has many examples of the broader concept of *Agrotis ceropachoides* from New Brighton, Christchurch. Both Brian Lyford and BP also collected it there from 1977-2012. Because of confusion over the name *Agrotis ceropachoides*, most of these specimens were assigned to *Agrotis innominata*.

In the mild winter of 2013, *Agrotis ceropachoides* was attracted to light at Birdlings Flat from 1 June 2013 onwards. Frustratingly, again no females were either attracted to light or found on coastal vegetation despite some searching in suitable places.

Additionally a good series of males were found attracted to building lights along coastal Christchurch from North, Central and South Brighton from late July to early September 2013.

Ecology

Agrotis ceropachoides and its relatives are sand dune specialists, inhabiting most of the sandy coastline of New Zealand. Fortunately they have adapted to the modified dune systems now generally present along the New Zealand coastline, and feed as larvae on a range of both indigenous and exotic herbs and grasses. *Calystegia soldanella* is among the most favoured indigenous plants they feed on.

Adults emerge from late winter into spring, appearing to have a peak emergence in August. The fat drab larvae, coloured brown-grey with a broad white lateral band, can be commonly found buried in sand by day while by night they feed on various indigenous and exotic herbs and grasses. They grow to 35mm and pupate in a shallow cocoon in the sand.

Taxonomic Issues

Dr Robert Hoare (Landcare Research Ltd., Auckland) has recently examined a series of *Agrotis ceropachoides* from Kaitorete Spit, collected by the author in winter-early spring (July to September) 2012. This series of males shows the full variation of the colour pattern of the species, from plain grey individuals similar to the holotype (Plate 2) right through to distinctly-marked males similar to Plate 1.

Dr Hoare compared the genitalia of these males to the holotype's genitalia and has come to the conclusion that the series of moths supplied to him are the same as the holotype. So *Agrotis ceropachoides* has indeed been rediscovered or, more correctly, recognised as a more variable species than originally thought. Up to now the more highly-coloured males were put under *Agrotis innominata* as they didn't match the plain grey *A. ceropachoides* adults thought to exclusively represent that species. However, further work is needed to clarify the differences between *A. ceropachoides* and *A. innominata*.

At least three apparently closely-related species of *Agrotis* in this species-complex inhabit the New Zealand coastline, where the larvae are herb and grass feeders, and the adults emerge in winter and spring:

Agrotis ceropachoides Guenée, 1868 Type Locality Oakleigh Farm, Rakaia River mouth. Holotype in BMNH. Female possibly short-winged.
Agrotis innominata Hudson, 1898 Type Locality Wellington. Both syntypes lost. Female fully-winged. Adults known from numerous sites around the coast of the North Island, and the western and northern coastline of the South Island. Not threatened. Adults have been reared by the author from the type locality area.
Agrotis new species (*Agrotis* n. sp. near *A. innominata* of Patrick & Green 1991; Patrick 1994; Peat & Patrick 1995). Otago coastline at six sites, and southern coastline of Southland and Stewart Island. Female short-winged and flightless. Possibly not threatened.

While the taxonomy of this group of species is not entirely clear, *Agrotis ceropachoides* is the earliest name so will stand even if the concept is expanded to include other South Island populations with flightless females.

Conclusions

Agrotis ceropachoides

Based on the results of the survey at Kaitorete Spit, experience with this group of moths in other coastal sites in the South Island, and Dr Robert Hoare's analysis of the genitalia of this group, the following measures are proposed:

Agrotis ceropachoides is not threatened with extinction and can now be removed from the list of Data Deficient moths. It is abundant at Kaitorete Spit, which is close to and possibly continuous ecologically with its type locality of Oakley Station, Rakaia River

mouth. The problematic taxonomy of the group does not alter this assessment of its status

Agrotis ceropachoides is not a threatened moth species and appears to have adapted quite well to modified dunes that now dominate its coastal sand dune habitat

Fereday's cutworm is a suitable common name, celebrating R.W. Fereday's astute observations of this winter-emerging noctuid moth.

Funding should be found to clarify the taxonomy of this group of highly interesting coastal and winter-emerging endemic moths.

Acknowledgements

My family of Aiko, Tajimi, Hamish, and newly-hatched Aya, who emerged at Kaitorete Spit at the same time as did *Agrotis ceropachoides*, are thanked for their company and support during this ongoing investigation.

Dr Robert Hoare of Landcare Research Ltd carried out genitalic dissections of *Agrotis ceropachoides* and compared them to the type material in the British Museum of Natural History, and provided general support and collegiality. His comments on this manuscript are much appreciated.

Peter Johns provided useful information on Richard W. Fereday and discussion of this research. Additionally, Dr Cor Vink at the Canterbury Museum is thanked for his assistance in the examination of the Fereday Collection of moths in his care.

The Josef Langer Trust, particularly Robin Burleigh for liaison, is thanked for funding moth surveys of Banks Peninsula.

Rod Hitchmough (Department of Conservation) and his colleagues are thanked for involving me in the Lepidoptera specialist group and effective communication of the results of these specialist meetings to the public and rangers in the Department of Conservation, and for allowing me to publish these results in this magazine to make them more widely available.

William Shaw and Margaret Honey of Wildland Consultants Ltd assisted with editing and helpful comments on this report.

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