Beginners' guide to the macro-moths of Otago

Why are moths important?

Moths play an important role in the ecosystem, as food for native birds and pollinators for plants.

Lepidoptera (moths and butterflies) are the third largest group of insects in New Zealand with over 2000 known species. Most New Zealand moths are found nowhere else in the world (92% endemic). Otago is a hotspot for moth species within New Zealand.

Their largely nocturnal behaviour means moths are often overlooked, but they make great subjects for environmental monitoring. Their short life-cycle and good mobility mean their distributions often show clear geographic relationships with measurable environmental factors.

Despite the many unique and intriguing moth species in New Zealand, we have only a small number of professional lepidopterists.

We know relatively little about the distribution of moths across New Zealand, moth ecology or the potential impacts of artificial light on moth communities.

What determines which moths are where?

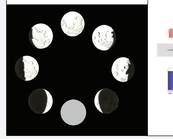
Each moth species has specific food and environmental requirements that it needs to survive. Important environmental factors for moths are food-plants, nectar sources temperature, humidity, and wind speed.

We can use the information about the environment where we find moths to better understand the ecology of moths. Once we understand the relationship between the species' presence and the environment we can start to make predictions about how moths will be affected by climate change.

Moonlight

The phase of the moon affects the number and type of moths that are flying. Moths tend to be more abundant on the new moon (when there is no moon light) and less on the full moon. To fairly compare catches we need to take into account the moon phase. For a small experiment we can set the moth traps on the same night or in the same moon phase. For a wide-ranging or long-term study we need to record the moon phase (or work it out later) to take it into account using statistics.

We can test the effect of the moon phase by trapping in the same place every few days over the cycle of moon phases.

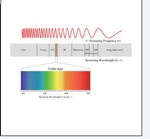


The effect of light

Moths are well known for their attraction to light. Lights come in different colours. The different colours are related to the wavelength of the light. Longer wavelengths look orange/red. Shorter wavelengths look blue/violet. Moths can see further into the short (Ultra-Violet) wavelengths than we can.

There are all sorts of artificial lights around our houses, schools and streets. Some give off yellow/orange light like classic street lights. Newer LED street lights come in a range of colours including white-blue.

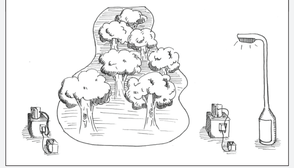
Recent evidence from overseas suggests that type and amount of artificial light affect the relative abundances of moths.



A suggested experiment

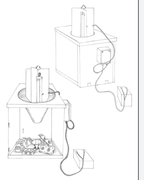
A scientific experiment needs:

1. A QUESTION (*e.g, what effect does an orange street light have on the moth community?*)
2. A TREATMENT designed to test the question, *e.g. a trap under a bright street light.*
3. A CONTROL for anything that might affect the results – aside from the one thing we want to test. The treatment and control should be as similar as possible in every way – EXCEPT the thing that we want to test, *e.g. a moth trap under a street light and another one away from the light, but the same in every other way (see factors that might affect moths).*
4. A RESPONSE that can be COUNTED or MEASURED to quantify the difference between the treatment and the control, *e.g. the number of moth species or the number of individual moths of each species.*
5. REPLICATION allows you to show that the effect of the treatment is real and not down to chance differences between the treatment and the control. Small differences need more replication to be detectable.



How to set up a Heath Moth trap

1. Slot the four sides together and slide them on to the base.
2. Push the small funnel into the centre hole in the base. This stops water collecting in the trap
3. Fit the lid over the trap.
4. Carefully place six to eight egg cartons in the trap. Make sure they overlap but do not cover the small funnel. These help the moths settle calmly in the trap.
5. Place the large funnel in the top of the trap.
6. Open out the fins of the vane unit and slide the clip on to hold them in place.
7. Place the vane unit in the top of the funnel.
8. Clip the Solar unit onto the trap.
9. Attach the RED (positive) contact to the 12V battery, followed by the BLACK (negative) contact.
10. Cover the Solar unit completely and slowly count to 30. The ACTINIC bulb should glow white/blue.
11. Place the trap in your chosen location. The solar cell will ensure the trap bulb switches on at dusk and off at dawn.
12. Come back in the morning and check the trap.



Moths vs Butterflies

Moths and butterflies have three main body parts: the head, thorax and abdomen. The two pairs of wings and six legs are attached to the thorax.

Moths and butterflies are all Lepidoptera. Although most butterflies fly during the day so do a lot of moths. Butterflies tend to be more brightly coloured, but not always – some moths are very brightly coloured. Butterflies have clubbed antennae, whereas moths have feathery or simple antennae.

Recording environmental data

Date:

Location:

Region code: DN | OL | SL

Latitude:

Longitude:

Altitude: **Slope:**

Aspect:
FLAT | N | NE | E | SE | S | SW | W | NW

Sunset: **Sunrise:**

Moon Phase:

Other light source:

Distance to artificial light source:

Cloud Cover:
UNSURE | CLEAR| MOSTLY CLEAR | FOG CLOUDY | MOSTLY CLOUDY | OVERCAST

Precipitation on trap night:
UNSURE | NONE |DRIZZLE | LIGHT RAIN -| MODERATE RAIN | HEAVY RAIN

Air temperature (°C)
Ave.: Min.: Max.:

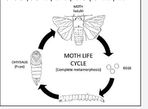
Relative humidity (%)
Ave.: Min.: Max.:

Wind Speed (km/h)
Ave.: Min.: Max.:

Surrounding vegetation:
NON-IRRIGATED PASTURE | PASTURE | SCHOOL FIELD | NATIVE GRASSLAND | COASTAL | RIVERSIDE | EXOTIC GARDEN | NATIVE GARDEN | SHRUBLAND | FOREST

Distance to nearest shrub/tree (m):
0–5 | 6–10 | 11–20 | 21–50

Height of surrounding canopy (m):
0–0.3 |0.3–1 | 1–2 | 2–5 | 5–12 | 12+



Making a collection

Once you have your moths, put them in a cool place or in the fridge. They will calm down so you can look at them more easily. If you are confident that many are the same species, you can count them and release most of them. Keep a couple of each species and put the rest on some vegetation close to where you trapped them.

We have to kill moths to make a collection so we do it as quickly and painlessly as possible.

Put the moths in the freezer for a couple of hours; they will go to sleep and then die peacefully. Moths breed fast so as long as you don't trap for more than a few nights in a row in the same place you won't impact the local moth population.

Entomologists collect samples for a variety of reasons:

To describe and classify new species: Every new species requires the designation of a type specimen. The name of the species is hinged on the type specimen. Future revisions and identifications can then be compared with this specimen.

To make a reference collection: A reference collection makes it easier to identify the different species and study them.

To catalogue species: It's important to ensure that when we talk to other entomologists we can check we are all calling the same species the same name. Sometimes two species look very similar and we need a specimen to be sure of the species identity. Other times species are very variable and two individuals of the same species may look very different. Therefore we need a range of specimens to know the variability of a species.

To compare variation traits: To understand the ecology and evolution of species we often need to study the variation between individuals within a species and between closely related species.

To detect changes over time: Sometimes we don't know what will be important in the future. Historical collections allow entomologists to compare species traits over time and detect the effect of environmental change or predict future changes

Logging the data ensures we get the most information from a specimen.

Labelling the samples

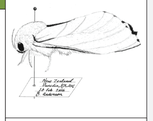
The label is what makes the moth a specimen. All labels need:

What: A unique code that refers to just this one specimen. Include the species name if you know it and the name of the person who identified it.

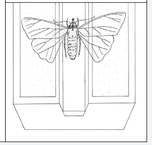
Where: The location where the specimen was trapped. By convention a region code *(see map),*

When: The collection date, by convention this is the day the trap was set, not the following morning.

Who: The name of collector.



4. Place a piece of tracing paper over the wings and pin the paper (not the wings) in place.
5. Place the moth somewhere cool, dark and dry and away from live insects.
6. Depending on the moisture in the air, it may take 1–3 weeks for the wings to completely dry in place. Check them regularly.



Pinning

1. Use special stainless steel insect pins. Larger moths need a size 3 pin.
2. Gently run the pin through the middle of the thorax of the moth.
3. Leave about 1/3 of the pin above the top of the moth. This gives enough room to hold the pin without touching the moth and enough room below the moth for the labels.

Further information

This guide contains only the most common larger moths in the Otago region; there are many more moths. If you find a moth that is not on this guide it may be rare, sparse (widespread but never very numerous), a range extension (not normally in the Otago region), a 'micro-moth' or a new species (there are many moth species in New Zealand still to be properly described and named).

Take a photo and post on Facebook | MothNet group and ask for help.

Facebook/MothNetNZ

Take a photo and post the photo on the NatureWatchNZ MothNet project.

NatureWatch.org.nz/project/MothNet

Check the Landcare Research online guide to larger moths of New Zealand www.landcareresearch.co.nz/resources/identification/animals/large-moths

Post the specimen to the "*Shedding Light on the Night*" Landcare Research, Private Bag 1930, Dunedin 1954.

MothNetOtago@gmail.com

What does that word mean?

Lepidoptera: Moths and butterflies
Endemic: Found only in that place
Ecosystem: all biological and physical processes interacting in an area
Nocturnal: Happens at night
Community: A group of different species in an area

Acknowledgements

The "Shedding Light on the Night" project is a partnership between Landcare Research, the Botany and Geography Departments of the University of Otago, Orokonui Ecosanctuary, and a collection of Otago schools. "Shedding Light on the Night" is funded by The Curious Minds Participatory Science Platform — Otago Pilot.

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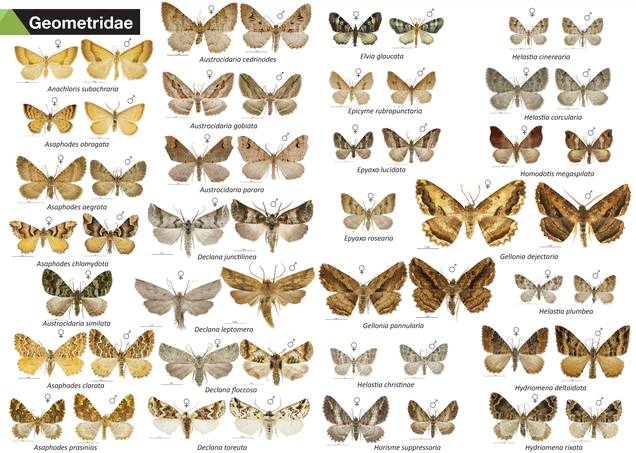
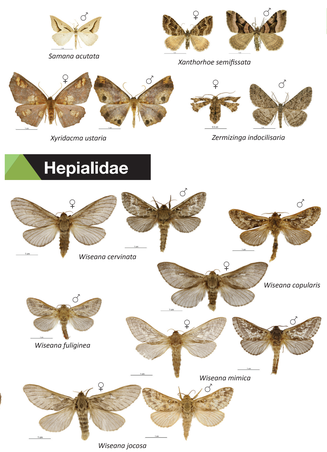
Geometridae



Hepialidae



Noctuidae