

Newsletter

August 2022

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How the 2021/22 season went

Catchments

This season saw a surge in catchment-based initiatives, with multiple dung beetle workshops held in the Manawatu, Marlborough, southern Canterbury and Westland. Catchments are the focus for councils and central government agencies. Marlborough's Linkwater catchment group were successful in securing funding from the Ministry for Environment, MPI, MDC, and landowners. Dung beetle releases featured amongst the mitigations. A great story about the programme can be found here <https://tinyurl.com/4med3t3d>.

This signals the door is now open for further dung beetle funding opportunities.



Wendy Sullivan from Landcare Trust and cow 283 being educated about the finer points of cow dung and dung beetles by Dr Shaun Forgie from Dung Beetle Innovations at Newbold's farm in Linkwater.

Working together as a catchment group carries more weight and achieves catchment-scale solutions to water quality, soil health, etc. So, if you aren't part of a catchment group already, we encourage you to join or form one with the help of Landcare Trust, Regional and District Council Land Managers, or farm

consultants. Dung Beetle Innovations is more than willing to provide workshops to catchment groups anywhere in the country. We even provide heavily discounted catchment group pricing when the group orders dung beetles!

Fieldays 2021 & 2022

After 2 years of pandemic woes National Fielddays at Mystery Creek came back with vengeance in July 2021. Dung Beetle Innovations was again present in the main exhibition pavilion and as with previous Fielddays we were one of the most consistently busy exhibits visited. Our popularity, and good Fieldday sales, gave us continued confidence that there is a lot of interest and support for dung beetles and the economic and environmental services they provide.

Fielddays in 2022 has been moved to 30 Nov. to 3rd Dec. So please come and see us! We are also considering exhibiting in the various South Island Field days.

Economic Value

The West Australian Regional Government estimated dung beetles to contribute approximately \$1 BILLION to its economy annually! <https://tinyurl.com/yxk6fyft> Hopefully through catchment led projects like Linkwater, the New Zealand Government understands what the Australian Government already sees as a major economic asset to its country.

Production at DBI mass rearing facility

Production of the African *Onthophagus binodis* was booming this season with conditions favouring a bumper emergence of overwintering adults in spring and resulting in colony sizes being virtually doubled.

In contrast the production of *Onthophagus taurus* was well behind schedule for most of the season. We suspect the unseasonal spring 2021 conditions in Auckland, while favouring *O. binodis*, seemed to hamper the emergence of adult *O. taurus* that had been dormant through winter. However, their numbers slowly recovered through the summer season at the facility. Under normal climatic conditions *O. taurus* and *O. binodis* stop nesting in mid-March and adults begin to fatten up then start to overwinter in a state of dormancy in sleeper cells underground. But given autumn 2022 was extremely mild, both varieties continued nesting through to May and we had an additional generation of new adults emerging through June. As a result, we were able to continue shipping *O. taurus* late into the season.

Other varieties such as the big blue Paua beetle, *Geotrupes spiniger*, started emerging in early November, a month earlier than expected. The decision was made to double our production capacity of the paua beetle to clear current and new orders, but also to make colonies available for those of you that have been patiently waiting for *Bubas bison* (see *Bubas bison* update below). As a result, we were unable to fulfil shipment to all our current orders of this species and would like to take this opportunity to extend our apologies for the delay. We humbly ask for your understanding and patience and will ensure

your shipment of the paua beetle will be completed this coming season. This beetle is worth the wait with confirmed establishment all the way to the bottom of the South Island.

The Mexican dung beetle, *Copris incertus*, continues to expand its range through the North Island and now into Marlborough. We expect with warming climates this species will take hold in a number of districts within Nelson, Canterbury and Westland. Not bad for a beetle that was introduced into New Zealand from tropical Western Samoa! We will also be shipping this beetle to our counterparts in Australia in the near future. Some rains in late January triggered an early mass emergence of Mexican dung beetles which we were able to capitalise on and cleared all orders for this variety by early March.

The ‘dry specialist’ *Digitonthophagus gazella* continues to make progress in building population numbers in production, as does *Onitis alexis*.

How much manure did we collect each week during peak production this season?

See the answer at the end.

Bubas Bison Update



Bubas bison has been coined the winter dung beetle because it starts to emerge from the ground in May and starts burying dung through winter when most other dung beetles are hibernating underground.

Unfortunately, this beetle is proving very tricky to mass rear. There are several reasons for this:

1. Development

It takes 2 years for this beetle to develop from eggs to a new adult in brood balls deep underground. A small percentage of new beetles developing in balls positioned higher (or shallower) in the nesting tunnels will emerge after 1 year. It took two years to complete a generation of rearing in quarantine for disease testing before being given a clean bill of health for release to the DBI mass rearing facility. Founding beetles were set up in outside rearing cloches.

2. Rainfall

Over successive years after setting up rearing populations, Auckland’s rainfall has become increasingly unpredictable

and more abundant with the last two years seeing dramatic sustained deluges at the mass rearing facility and the ground surrounding the rearing cloches being waterlogged. Recent feedback from overseas show this species apparently fail to establish in soils receiving over a meter of rainfall per annum. We suspect that while our cloches were equipped with plastic rain covers for part of the time, soil moisture content percolating horizontally may have become too great, potentially drowning the early stages of egg and grub development.

3. *Temperature*

In ideal conditions a week-long cold snap with a good amount of rain at the same time is what promotes emergence. This should usually be during May. Unfortunately, the last two Auckland seasons have experienced neither, with this current autumn experiencing a prolonged period of mild to warm temperatures. While that has had a positive impact on prolonging the seasonal activity of some of our beetle varieties, unfortunately it has contributed to a significant reduction in new *bison* adult emergence.

So, what have we done? All emergent adults now have to be reared in large raised bins filled with our ‘dung beetle soil mix’ under commercial greenhouse canopies. This is not ideal; however, these greenhouses have no sides, and the boxes are located near the fringes of the greenhouse to maximise wind and cooling minus rain inputs. We will keep you posted on progress.

Where to from here for customers waiting for *Bubas bison*?

We recommend *Geotrupes spiniger* (the paua beetle) if you have not received it already. This is why we held more *spiniger* back during the past season, so we could grow and distribute this species to our customers waiting on *bison* this coming season. *Spiniger* starts nesting in March and continues up to August, nests in the soil down to 60 cm, tolerates low and high rainfall and has confirmed establishment as far south as Invercargill. It is also emerging as a new adult in 6 months, and we are likely to have sufficient numbers this coming season to ship to you!

To be clear, *Bubas bison* is an extraordinary beetle and is active all the way through to October nesting down to 1 meter, however it turns out it is limited to rainfall areas up to 1m per annum (They will be suitable in irrigated pastures), and they won’t likely be available for another few years. The joys and uncertainties of animal rearing!

There are two options:

1. The default option. No action required. If you haven’t already received the paua beetle, we have switched you to this species. Expect to receive your fourth species this season.
2. Continue to wait for *Bubas bison*. You can let us know either by email or when we contact you prior to sending *spiniger*. We would like to apologise for this delay and kindly ask for your understanding, continued patience, and support. It is not an exact science mass rearing dung beetles, least of all when we are at the forefront of doing this internationally.

Dung beetles in the news

There has been a flurry of interest in dung beetles through the media in 2022. Here are links to the key ones:

Seven Sharp

March 2022

<https://dungbeetles.co.nz/videos/>

The Farmlander

April 2022

<https://dungbeetles.co.nz/wp-content/uploads/2022/05/FarmlanderApril2022.pdf>



Farmlands, in collaboration with DBI, will be producing a dung beetle Webinar that will be posted on its website in October. So watch out for that.

Today FM

Radio interview with Shaun, May 2022

<https://dungbeetles.co.nz/wp-content/uploads/2022/05/TodayFM-ShaunInterviewMay2022.mp3>

NZIPIM

NZ Institute of Primary Industry Management

Webinar, July 2022

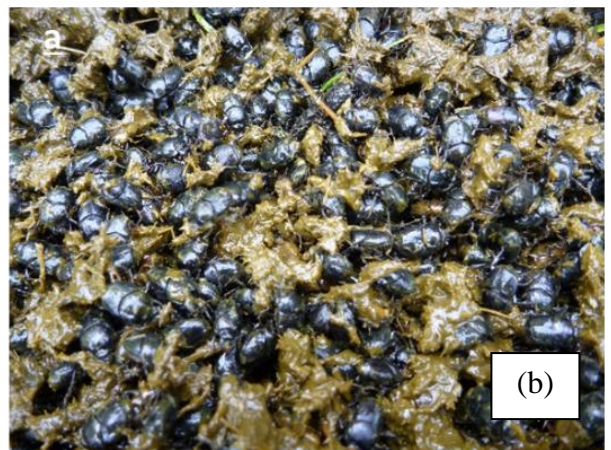
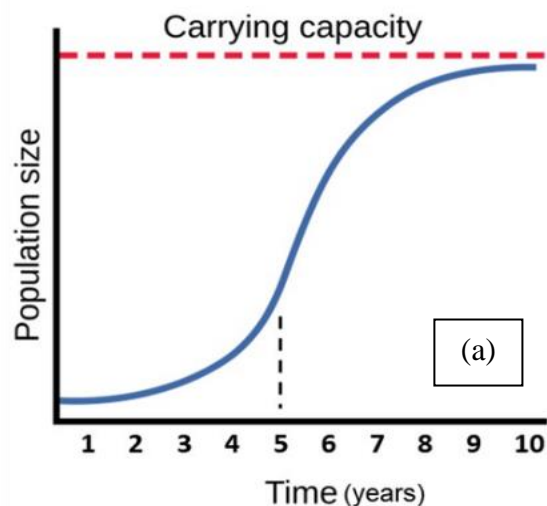
<https://youtu.be/6vxEwIkB2no>

Dung Beetle Innovations received a huge uptake in dung beetle enquiries and orders from the farming community following these media events.

DBI's own website

Lastly, please visit www.dungbeetles.co.nz and access the Media and Videos links under the 'Beetlemania' menu for additional material you may find of interest. The Blogs there are also very interesting!

Managing Expectations



Dung beetle population growth rate is exponential post release, then changes to a logistic rate as it reaches and maintains a heavy carry capacity (a). The carry capacity is proportional to the amount of manure sustainably produced on a farm. This can literally be many hundreds of beetles in each manure pile (b).

How long does it take before we see establishment?

Normally it takes between 2-3 years post release for you to see some sort of dung beetle establishment. It may not be at the release spot(s) and it is likely the beetles set up shop some distance away depending on stock movement. It takes this long because there is so much manure compared to so few beetles, which become nearly impossible to find until their numbers build to a point when they can be detectable. That said, we have feedback of establishment in 6 months and a year from customers who have chanced upon beetles flying to lights, or drowned in cattle troughs, or have made a concerted look for beetles at the right time of year to survey. Dung beetle numbers increase exponentially in the first 7 years, as depicted in the accompanying graph, particularly for the varieties of dung beetle that have more than one generation in the time of year they are active. For example, *Onthophagus binodis* has 3-4 overlapping generations in its active season from late August until May. One female may produce up to 60 offspring in her 3-month lifespan.

How long does it take to achieve carrying capacity of beetles on our farm?

Based on our findings, Year 5 post release marks the flashpoint in population growth. This is the part of the exponential growth curve when the population explodes in numbers, with each subsequent year witnessing a profound increase in beetle numbers until exponential growth gives way to a logistic growth rate and carrying capacity is achieved. Carrying capacity is usually from Year 9 onwards. Carrying capacity is self-sustainable and proportional

to the amount of manure produced on your farm. A Four Seasons Package contains sufficient numbers of beetles of each variety to achieve carrying capacity from Year 9 onwards, for manure produced by approximately 300 cows or 2000 sheep. A few 'ifs' to consider: if you have a greater number of stock then it is recommended you buy proportionally more Four Seasons Packages to achieve a similar time to reach a 9-year carrying capacity; if not, then it will take several years longer to reach carrying capacity because of the greater abundance of manure to manage; and finally, if you buy a greater ratio of beetles to number of cows or sheep, it will accelerate population growth and reduce the time to achieve carrying capacity.

How do we know if our dung beetles survived after we let them go on the farm?

If you have followed the release protocols offered in several formats including verbally, via text, on the shipping form, associated release documents provided with the shipment and on the website, then the likelihood of establishment are high. Establishment is never guaranteed, hence the terms and conditions of sale. The size of the beetle colonies and release protocols we provide help to maximise establishment success.

Dispersal and the rate of spread

Dung beetles we provide fly! Depending on the density of fresh manure and stock movement the release colonies may not establish where you released them. We ask you to release each colony in one spot in a paddock that has an abundance of fresh

manure. Why? This is to minimise their initial dispersal, because if dung is not abundant the release colony will disperse and dilute in pursuit of fresh manure. This makes it harder for them to find each other to pair-up and breed. In extreme cases over-dispersal of the initial colony could lead to a failure of the colony to establish. Dung on dairy farms tends to be more abundant and higher density per paddock than on beef and sheep farms. Thus, the rate of spread of a growing population of beetles is less on a dairy farm compared to a beef and sheep farm. The rate of spread is estimated to be approximately 1 km/year on a dairy farm and 1.5 km/year on a beef and sheep farm. This distance from point of establishment is what we refer to as the advanced scouts. The reinforcements comprising the bulk of the growing population, radiate out more slowly from ground zero. This is because there is a high energy cost to flight. If there is an abundance of manure nearby, then why waste energy?

So, if you are wondering if your neighbour is going to benefit from your investment, the answer is yes eventually, but by then you will have long reached carrying capacity and the economic and environmental benefits that go with it.

What time of the year is best to maximise the likelihood of seeing establishment or beetle activity?

February to May is the best time to look for dung beetle presence. Most of the varieties of dung beetle we provide are present in the field with the greatest abundance of dung beetles like *O. taurus*, *O. binodis* and *Copris incertus* before they hunker down for the coming winter. And autumn winter

active beetles like *Geotrupes spiniger* are starting to nest. A break in the late summer dry with rains triggers a mass emergence. Looking for establishment outside of this period in the first couple of years increases the risk of a ‘false negative’. That is to say a failure to find beetles in searches outside the best time does not mean they have not established.

What are the signs to look for to detect beetle establishment?

Larger body-size varieties like *Geotrupes spiniger*, *Copris incertus*, *Onitis alexis* and *Digitonthophagus gazella* create obvious soil push-ups on or around the perimeter of manure piles (Figure a). The colour of the soil casts can often tell you how deep the nesting dung beetles are tunnelling (if you have a stratified soil horizon at different depths), with some varieties burying down to 60 cm or more. Smaller-bodied beetles like *Onthophagus binodis* and *O. taurus* do not make it easy for you to find them in the first five years post release because they don’t provide obvious soil push-ups around the manure piles. Instead, they excavate under the crust of the dung pile removing the dung down into burrows. Looking from above you may not see any evidence of activity. To get some idea of what this may look like please visit the “Dung beetles leaving just a crust behind” video in the Videos link under the ‘Beetlemania’ menu on our website:

www.dungbeetles.co.nz or click on this link

<https://youtu.be/8Q7y9MbACbQ>



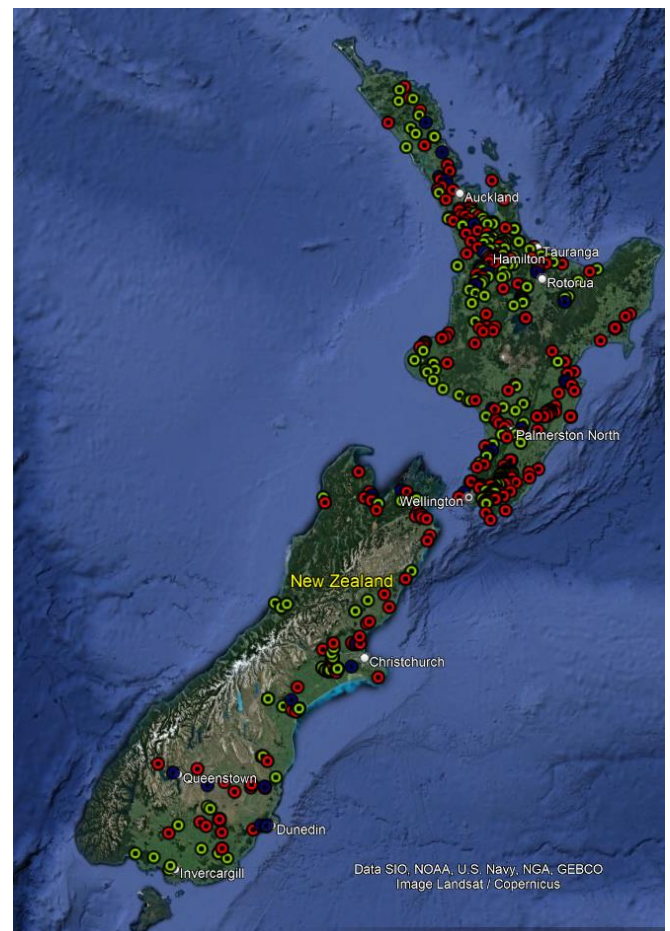
Dung Beetle Activity. Soil push-ups around or through dung piles are clear sign of establishment(a); shredding activity by a large abundance of dung beetles usually occurs after mass emergence and before nesting (b); annihilation of manure piles reduces forage foul on the surface and loads the soil with free fertiliser and carbon (c).

Digging in 1-2 day old dung piles during February to May at Years 3 and 4 tends to reveal a dozen or more *O. binodis* and/or *O. taurus* in most pads where they have established. Overturning seemingly intact dry dung crusts and finding portions of dung removed from beneath are clear signs of nesting. Beetles, and soil casts may also be found by turning over these crusts. As beetle populations explode, the sheer number of beetles results in shredding (Figure b) and annihilation of the pats (Figure c) making evidence of their activity rather obvious.

Dung Beetle Releases

Dung Beetle Innovations have now released 1,650 colonies of dung beetles across NZ onto 500 farms!

If we are going to reach NZ's freshwater targets by 2040, then we need to release just over 40,000 colonies by 2030. That is releasing beetles onto 30% of NZ farms, and then nature will do the rest in the following 10 years to 2040. We have made a start, now just 96% of the way still to go.



Red – sheep & beef, Green – dairy, Blue - Other

Answer:

Approximately 5,000 kg/week!!!