

# Makarora mohua fixed transect surveys, 2022.



Mohua | Yellowhead. Adult (above) and fledgling. Eglinton Valley, Fiordland, March 2014. Image © Glenda Rees by Glenda Rees <http://www.flickr.com/photos/nzsamphotofanatic/> (<https://www.facebook.com/NZBANP>)

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## Abstract / Summary

*Mohua mohoua ochrocephala* have been monitored in the silver beech-dominated Makarora River catchment, Mount Aspiring National Park, for the past 12 years. The persistence of mohua is a key indicator of predator control effectiveness. In that time, Central Otago Lakes Branch of Forest and Bird volunteers (COLB) have increased their trapping efforts in mohua 'hot spots' particularly, the Muddy grid / Blue Pools area, the lower Blue and the North Young where there are now more than 1200 traps targeting rats and stoats. In addition to the extensive trapping by Forest and Bird volunteers, there were two Department of Conservation (DOC) 1080 Operations, in 2017 and 2019, intended to aid mohua and other forest birds during this time.

In 2021 an analytical report written by Nathan Whitmore and commissioned by COLB to mark the end of a 10-year data gathering period, showed mohua indices have been steadily increasing (on transects) since the big dip in numbers was detected in 2012 (following a beech mast in 2011). This result was consistent with transect monitoring that DOC had been doing over the past decade. Of particular note, Whitmore (2021) showed that the mohua population would start to decline at a rat tracking rate of only 11%. Since 2020 mohua encounter rates overall have dropped slightly, while in the intensively trapped mohua hotspots, the encounter rate increased ever so slightly. The overall picture is of population stability.

The vulnerability of mohua to rats and mast events and the level of intervention needed to keep pest numbers below threshold mean that the previous 12 years of surveys that DOC has commissioned must be continued if the mohua population is to be maintained.

## Introduction

The Makarora River, in Mount Aspiring National Park is the major northern tributary flowing into Lake Wanaka. Its source is beneath Mount Brewster; it flows south for approximately 40km, past the township of Makarora collecting many other rivers on its way. The Young and Blue valleys join the Makarora River 3km and 8 km upstream from West Makarora and in these silver beech-dominated valleys remnant mohua populations persist. They are patchily distributed, from the river at 300m altitude, to the bush line at ~1050m altitude. Other birds present include kaka, kakariki, korimako, piwakawaka, Tui, titipounamu, miromiro, pipipi and kereru. Karearea and kea are also often heard, as are piwauwau and whio when in suitable alpine or riverine habitat. The Makarora mohua transect site lies between two other mohua populations (historically Operation Ark sites), in the Landsborough River and Dart Caples (O'Donnell 1996). With the establishment of mohua fixed transect surveys in Makarora, more has become known about this population.

In a recent threat classifications reassessment, mohua were identified as 'worsened' (now At Risk - Declining instead of Recovering), having suffered significant declines largely in Red Beech dominated forest across the South Island (DOC 2021).

The Central Otago Lakes Branch of the Royal Forest and Bird Protection Society (COLB) began the Mohua Protection Project in Makarora in 1998 and now maintain approx. 1200 predator traps along the Haast highway and in the Young and Blue Valleys, run as a joint venture with the Department of Conservation (DOC) and Southern Lakes Sanctuary (SLS). As well as maintaining an intensive network

of predator traps in this area, this consortium also does cat trapping, and small mammal monitoring in both the back country and front country. Southern Lakes Sanctuary has begun an additional mohua research project to track territory occupancy, population dynamics and breeding success of mohua in the Makarora Valley. Part of this study involves using acoustic recorders to record mohua songs for an artificial intelligence (AI)-based algorithm for detection and individual identification of mohua. This work is important to learn more about this population and how it is faring relative to other mainland populations.

The Makarora mohua fixed transect survey was established in 2011 and was designed to be completed annually over at least a 10-year period to:

- 1 estimate the size of the mohua population and abundance trends.
- 2 gauge the impact of the predator control program on the local mohua population
- 3 inform decision making regarding protection of the remaining mohua from further decline e.g., to establish whether or not more intensive predator control is needed.

The first two milestones have largely been met as much more information about the resident mohua and their response to predator control has been obtained and DOC has committed to continuing the annual survey. However, with regards to decision making, this is a moving beast. At a local level the SLS, COLB, DOC consortium have been very proactive at responding to recommendations made by establishing extra protection in newly discovered mohua areas. But there is a limit to what can be achieved by ground trapping alone. When the stakes are high, it would be good to know that we have extra support from a national level available.

## Methods

The annual Makarora mohua survey was carried out this year following the standard methodology for fixed transect counts described by (O'Donnell 1996). This 2022 – survey marks 12 years of continuous annual data collection for mohua fixed line transects and standard Five-Minute Bird counts (5MBC). The North Branch transect lines have slightly fewer data, having been added more recently in 2013. Each transect line is between 800m and approximately 1.2km in length and is walked slowly (0.8-1km/hr) taking from between half an hour to an hour per line. All mohua seen and heard are recorded, GPS'd and sex identity determined if possible. Printed survey forms are filled out which include environmental data such as wind and temperature. A Five-Minute Bird Count (5MBC) is carried out at the start and the end of each line. The method follows that of Dawson and Bull 1975. Refer to previous Mohua Survey reports (Tonkin and Taylor 2021, Forder 2021 and J Tilson 2017-2019)

For more specific details on the method please refer to methodology “musts” in Appendix 1.

## Transect Locations

Historically there were 10 transects between Haast Pass and the Lower Young. In 2013, three additional transects were added at the Young Forks and in the North Young. The numbering of these transects was not sequential, and in 2021 some changes were made both to the numbering of lines and the start and end points of some of the lines in an effort to improve the way the transect monitoring was done and interpreted.

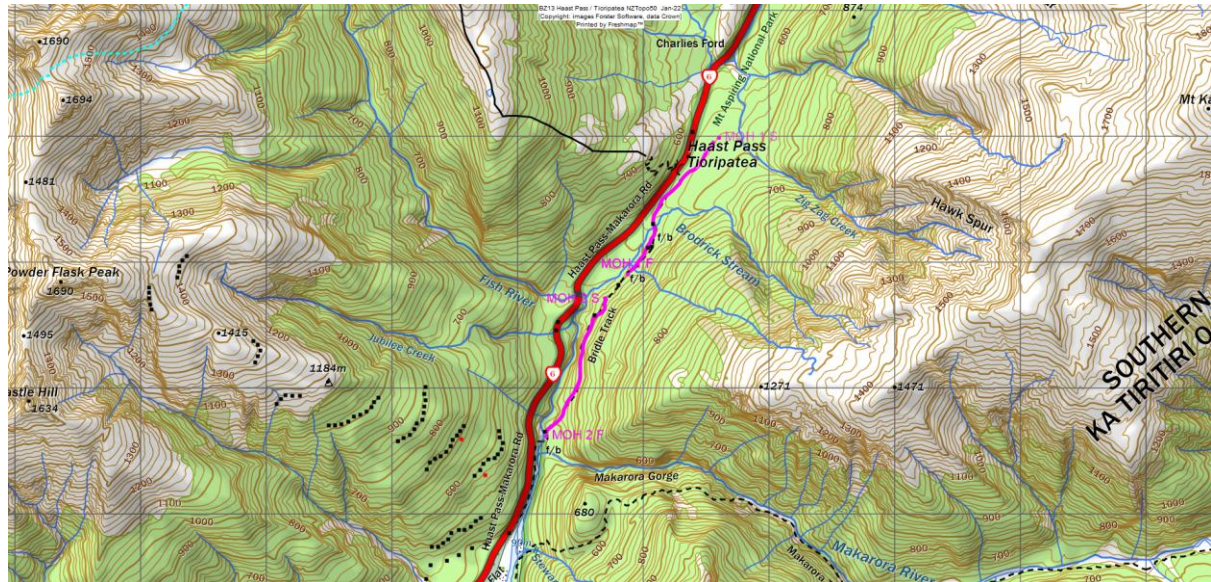
Some of the line changes affect the encounter rate, which complicates comparison of counts between years. This applies to new transect 4 on the Muddy Grid (Map 2) which has a new end point in a known mohua territory. Consequently, mohua are being detected where previously they would not have been.

Despite some doubt as to the value of some of these changes, in 2022 Southern Lakes Sanctuary staff who were doing the survey for DOC upheld the changes made in 2021.

As part of the re-vamp of the survey lines in 2021, the numbering was changed so that the lines begin at 1 at the top of the pass coming down the Makarora valley (2, 3, 4, 5), continue up the Blue Valley (6, 7) and then continue up the Young Valley (8, 9, 10) and up the North Branch (11, 12). The historic line 2 was dropped due to its non-productivity and the time it adds to get to it.

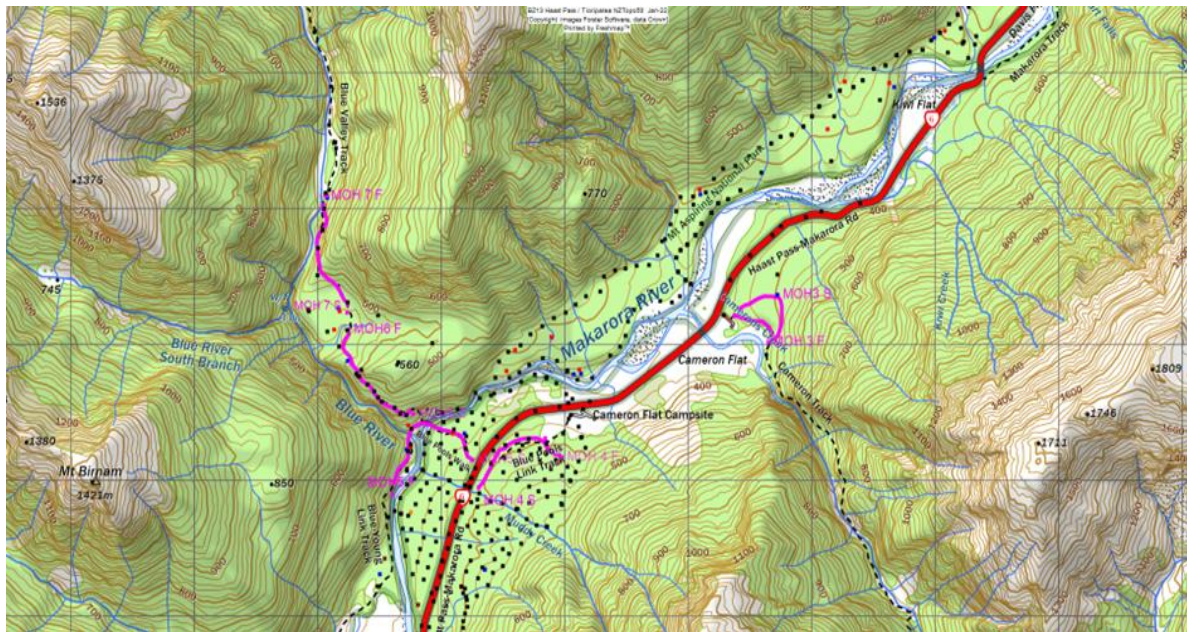
The GPX file for the new transect lines is stored in:

Doc/Operations/Biodiversity/BioAssets/Mohua/GPS Files (Forder, DOC 2021)

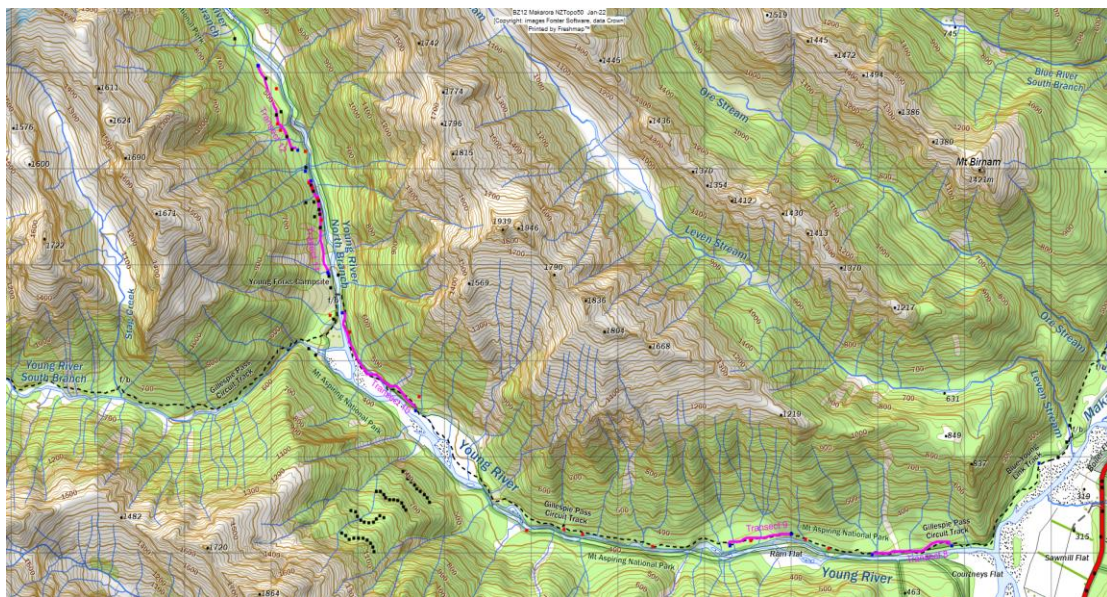


Map 1: Transects 1 & 2. Haast Pass, Bridle Track





Map 2: Transects 3 – 7. Cameron Ck, Muddy Ck, Blue Pools and Blue River



Map 3: Transects 8 -12. Young River, Forks & North Young

## Results

Table 1: Encounter rate of mohua on transects in 2022.

	MOH1 Haast Pass	MOH 2 Bridal trail	MOH 3 Came- ron Flat	MOH 4 Muddy grid	MOH 5 Blue Pools	MOH 6 Blue R a	MOH 7 Blue R b	MOH 8 Lower Young a	MOH 9 Lower Young b	MOH 10 Young Forks	MOH 11 North Young a	MOH 12 North Young b
Visit 1	2	0	0	2	2	2	2	0	1	1	7	0
Visit 2	2	0	0	1	1	1	2	0	1	0	8	4
Visit 3	2	0	0	3	2	2	4	0	2	1	10	10
Visit 4	2	0	0	4	3	0	3				5	10
<b>Average</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2.5</b>	<b>2</b>	<b>1.25</b>	<b>2.75</b>	<b>0</b>	<b>1.3</b>	<b>.66</b>	<b>7.5</b>	<b>6.0</b>

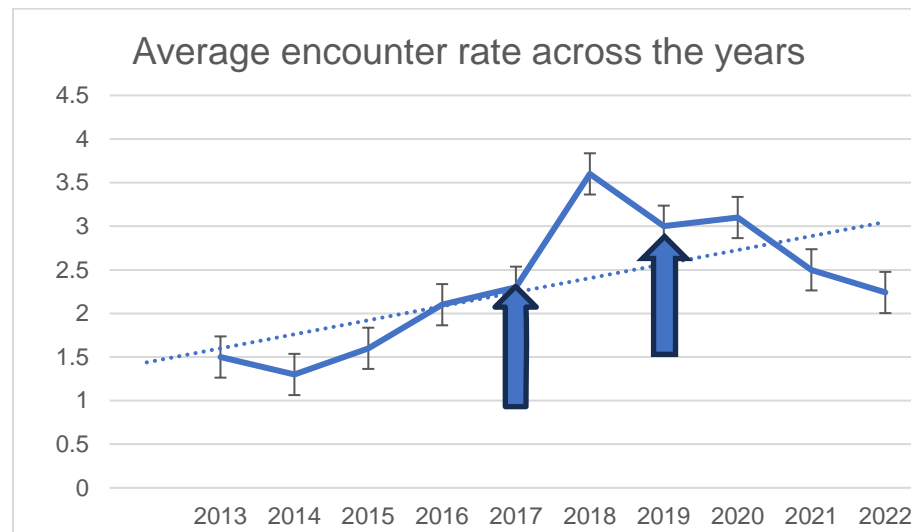
*The total number of encounters in 2022 was 102 individual detections, half of which were on transects 11 and 12 in the North Young. The population appears to be comprised of 30-35 individuals, which is similar to 2021 but fewer than in the previous four years.*

Table 2. Average encounter rates over the past 10 years

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
encounter rate	1.5	1.3	1.6	2.1	2.3	3.6	3	3.1	2.5	2.16

In 2022 the average number of mohua detections per transect was 2.16 which is the lowest seen in the past five years of monitoring. However, with so much variation in exact timing when repeat surveys are done as well as observer and line changes over the years, a lowered average encounter rate may not be of material significance. Table 2 (above) shows there was a positive jump in encounter rates in 2018, 2019 and 2020. A 1080 operation in 2017 in response to a mega-mast in 2017 benefited mohua the following year with juvenile mohua being encountered on at least 4 transects. An additional 1080 operation in October 2019 kept the numbers elevated through 2020. Since then, the numbers have dropped slightly. The 2022 average detection rate (i.e., 2.16) is well above historical lows and probably suggests stability since 2013. However, if the average encounter rate falls further in 2023, a population decline of concern may be indicated.

Figure 1. Average encounter rates on transects over the years with arrows showing 1080 interventions.



Nb. This graph does not include data from 2011 and 2012 as not all transects were surveyed then.

Table 3: Average encounter rates across all lines over the years

	Moh 1	Moh 2	Moh 3	Moh 4	Moh 5	Moh 6	Moh 7	Moh 8	Moh 9	Moh 10	Moh 11	Moh 12	Average
2011	2.75	1.75	0.25	1.75	6	0.25	5.75	1.75	3.25	-	-	-	2.6
2012	1	0	0.5	0.5	1	0.25	3.25	0	0.75	-	-	-	
2013	4.5	3.25	0	1.25	1	0.25	1.25	0	1	2.25	1.25	3.75	1.6
2014	3.25	0	0.5	0.5	0.75	0	1	0.75	0	1.75	1	7	1.3
2015	2.75	1.25	0	1.25	0.25	0	1.75	0	0.5	4.25	2.25	5.75	1.6
2016	1.5	0.5	0	0	0.75	0.25	1.25	0	1.75	8.25	3	8.5	2.1
2017	1	2.25	0	0	1.5	1.25	1.5	2.25	1.75	5	3.75	8	2.3
2018	6.75	1.25	0	0	4.25	2.25	4.75	0.75	1.75	5	6	10.75	3.6
2019	3.5	2.8	0	2.25	1.75	1.5	3	0.25	1.25	4	6.5	6.75	2.7
2020	3.25	0	0	1.75	1.5	0.5	4.5	0.5	3.5	3.5	6.25	7.5	2.7
2021	0.75	1	0	1.5	4.5	1.5	3.5	0	1.75	3.5	5.75	6.5	2.5
2022	2	0	0	2.5	2	1.25	2.75	0	1.3	0.66	7.5	6	2.16

The darkly highlighted columns show transects where mohua encounter rates are stable.

The transects receiving the most intensive predator control (ie the Muddy Creek Grid / Blue Pools (MOH4 and 5) and the Lower Blue (MOH7)) had the highest mohua encounter rates in the Makarora Valley. The North Young transects (MOH11 and 12) had the highest encounter rate of all transects monitored, (Figure 2). The North Young transects are more remote and east facing and so probably sustain fewer predators than the rest of the Young Valley transects which are located along the track and on the forest edge.

Looking back to 2018 there was a high encounter rate (relative to other years) on the Blue Pools transect. However, the following year (2019), the number was less than half. Mohua that were normally detected on the old Blue Pools track seemed to have moved across the road onto transect 4. With some of the transects being close together, slight movements by the birds can affect which

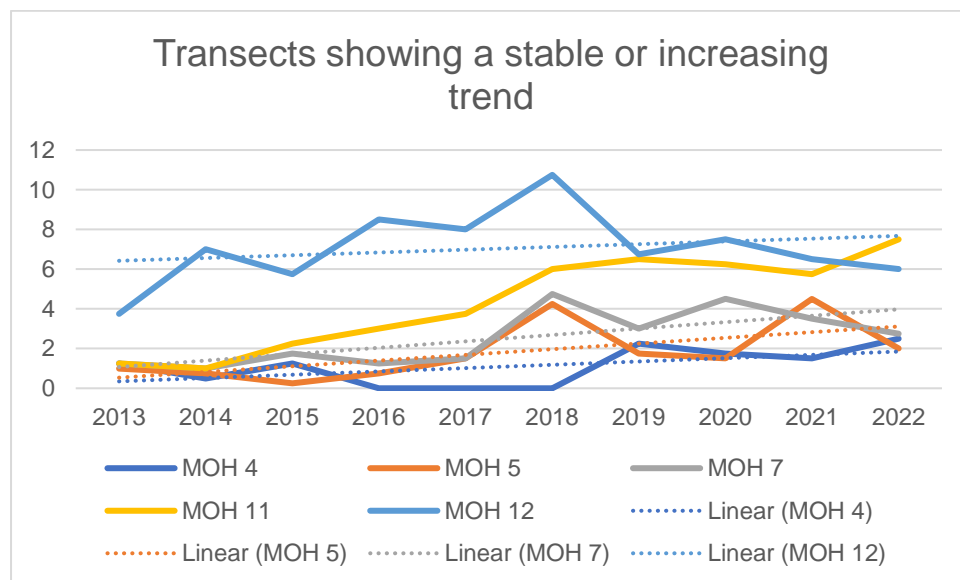


transect mohua are detected on and sometimes this can mean they are detected on both. Part of the rationale behind moving some of the start and end points in 2021 was to try and avoid this as it can lead to over-counting detections.

The Blue Valley (MOH6 and 7) has been monitored for 12 years. It started out with the highest encounter rate but fluctuated from a high of 5.75 in 2011 to 1.0 in 2014 then back up to 4.775 in 2018 and now back down to 2.75. Given this range of fluctuation, the 2.75 encounter rate for 2022 seems more indicative of stability than decline. However, if there is a further decline in 2023 this conclusion may require revision.

2018 was a bumper year for mohua and no subsequent year has proved quite as fruitful despite an additional 1080 operation in 2019 and extra traps being installed by COLB. However, the 2018 surveys were spread out over a six-week period and there were quite a few juveniles detected that season which led to an over-inflated count. So, whilst it was great to get proof that females do exist and breeding has occurred, it changes the type of data collected meaning the comparisons between years are not being assessed the same way. This should be avoided in future surveys.

Figure 2. Muddy Grid- Blue Pools / Lower Blue and North Young Transects



The ground-based predator control effort likely contributed to the persistence of mohua on the Blue Pools and Muddy Grid transects. The volunteer COLB group service approximately 200 stoat and rat traps in this area alone and it seems likely that mohua still persist here because of this. The Lower Blue and North Young also receive considerable trapping effort (62 and 67 traps respectively). However, these areas are also more remote and cold and so are less suitable habitats for rats to occupy, therefore are good places for mohua.

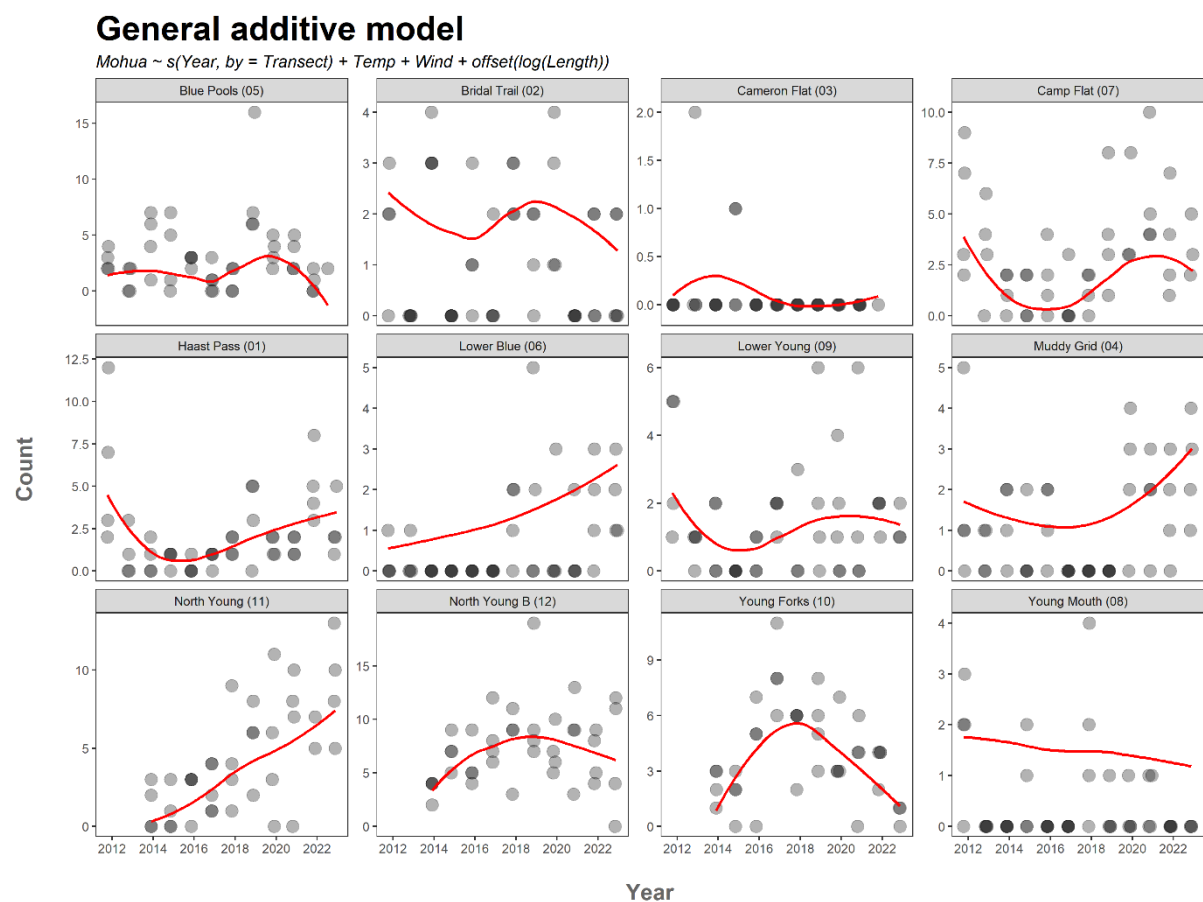
In contrast, encounter rates along the Lower Young and the Young Forks transects (MOH 8,9 and 10) seem to be slowly declining despite trapping efforts and two DOC managed 1080 operations. It may be that intermittent 1080 control with a comparatively low level of trapping effort are just not



enough to sustain a mohua population in these areas because they provide better habitats for predators.

Encounter rates along transects at Haast Pass and on the Bridle Track have fluctuated a lot over the past 12 years and although forest interior sites were subjected to reasonably intensive trapping (relative to area) by the COLB group this area too has shown a declining encounter rate over the last 4 years.

Figure 3. General Additive model showing trends across all transects (Whitmore, 2023) note downward sloping curve on half of the transects but the very positive upwards trends on the Muddy Grid and the North Young transects,



While declining encounter rates on some transects might seem alarming, the number of mohua we are working with is very small. Also, a lot of the transects are in front country sites on forest edges. These sites are likely to be favorable to predators so will be the hardest places to defend with ground-based control methods.

## Discussion

Although the average encounter rate across all transects has gone down this year, it's important to stress that this method is only measuring the relative abundance of mohua. There are many factors that can affect the detectability of mohua from year to year and what appears to be a slight dip one year may over time just be a blip and could be balanced out in future years.

The previous ten years of survey data as well as Whitmore's 2021 analytical report, both show that **average** encounter rates have been slowly increasing, approaching levels seen in 2011 when surveying first commenced. Immediately after that first survey season, there was a well-documented irruption of rats that caused a serious drop in mohua numbers in 2012. Since then, mohua have slowly recovered, aided in part by two 1080 treatments in 2017 and 2019. In 2018, encounter rates peaked, and breeding occurred throughout the study area. From 2020 encounter rates have been decreasing on half of the lines. The Muddy Grid/Blue Pools, Lower Blue and the North Young transects seem to be stable. The decreasing encounter rates described here should not be too much of a concern as rates are well within the historic range, suggesting stability overall. However, if further declines are observed in 2023, this would indicate an ongoing decline and be cause for concern.

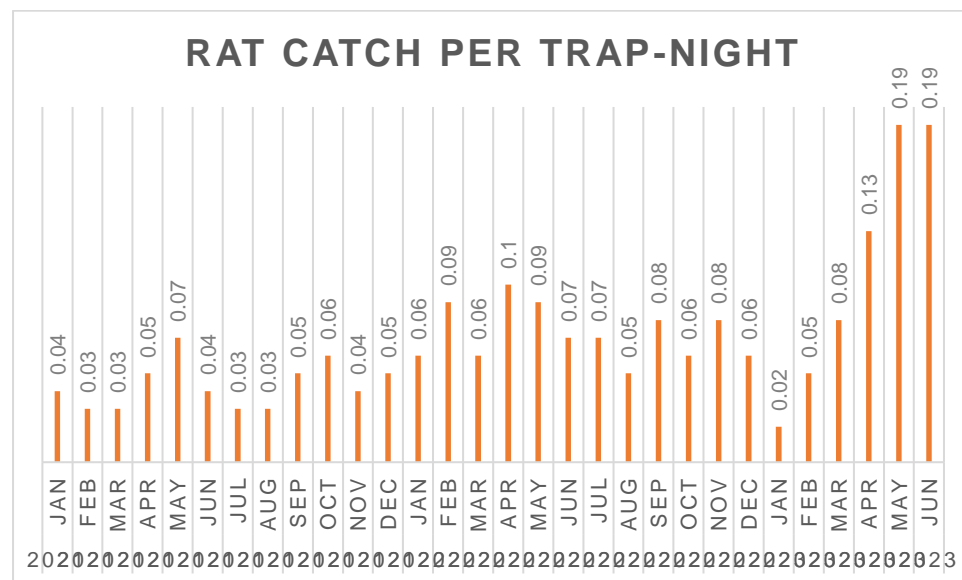
In Makarora, over the last few years more incidental detections of mohua are being made than ever before. This is largely due to the extra work being carried out by Southern Lakes Sanctuary staff and extra trap lines deployed by the COLB volunteers. New traplines in the Blue, the Makarora true right and in the North Young have meant more people are noticing mohua. There are also frequent detections of mohua at other locations in the Young Valley and in the vicinity of the Young hut and even some unconfirmed sightings in areas where they haven't been seen for many years. This is all encouraging and good for morale.

However, despite people having more mohua encounters I am worried about this population because it lacks resilience and could easily decline further in locations away from intensively trapped areas and in warmer locations that favor predators. Mohua are not a long lived species, they are highly vulnerable hole nesting birds and losses of key individuals over a single season could cause them to become functionally extinct within a few years. Whilst the COLB trapping grid at Muddy Creek has shown that it may be possible to arrest a decline through ongoing and comprehensive ground control, it is unrealistic to expect small intensively managed areas to sustain viable 'regional' populations long term.

During the 2021 distribution survey commissioned by Southern Lakes Sanctuary, there were more birds detected on a 6km section of the Makarora true right (which had no ground control at the time), than any other area surveyed (Tilson 2021). In response to this discovery, a new trapline has been established (Jo's line) to help protect these birds. This new line plus the additional Kiwi flat and Castle hill lines have added 112 extra traps to protect mohua on the Makarora TR between Davis Flat and the blue Pools.

However, this extra protection may not be sufficient to prevent mohua losses to introduced mammal predators. A nest found on one of the new lines last season failed and one of the two adult birds associated with that nest seems to have disappeared. A rat was caught in the nearest trap soon afterwards. While no direct evidence of nest predation was found, predation seems the most likely explanation. While two years of monitoring at one site is not enough to confidently identify trends, it does feel like there were fewer birds on the Makarora true right in 2022 compared with 2021.

Figure 4: Graph showing increases in trap catch throughout autumn and early winter 2023. Note that as of creating this graph not all data was in so 0.19 rat catch result will be even higher

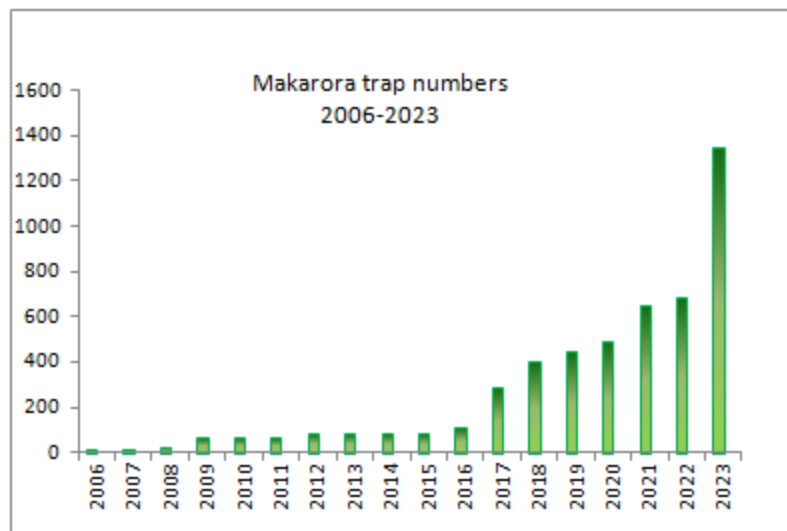


In the Makarora catchment mohua seem to persist on remote, slopes of moderately fertile silver beech forest that get very cold in winter. These sites support fewer rodents than on warmer north facing slopes. The Landsborough Valley 20km away, has a similar habitat and climate to Makarora and has been a priority site for management for more than 25 years with pulsed 1080 and low intensity trapping by DOC. It is now the only naturally occurring site on mainland NZ where mohua are thriving. If the Makarora were to receive the same pest control effort as the Landsborough, then it too would likely sustain a thriving mohua population capable of withstanding occasionally elevated rodent abundance. The difference is that more people would get to enjoy them!

Regardless of whether the population in Makarora today is stable, recovering or in decline the one thing we do know is that our population is at best, small, patchily distributed, and vulnerable. And with populations such as this, small changes can have big ramifications very quickly.

We need to do more to secure this population of mohua and we need to do it now!

Figure 5: Graph showing how trapping by the COLB,SLS,DOC consortium has increased over the years in an effort to combat predators.



## Recommendations

### For the fixed transect surveys:

- ‘Current monitoring of mohua in Makarora is effective and meaningful, and likely provides a reasonable representation of how the population may be tracking’ therefore it should continue (Whitmore 2021)
- No more changes to the lines, naming conventions or methods should be made. i.e., follow methodology “musts” in Appendix 1.
- There is a strong correlation between encounter rates and weather (Whitmore 2021) therefore do not survey in wet or windy conditions, ever. If it rains or blows a gale when on transect, repeat those lines.
- Where possible, use experienced staff already trained in doing transect counts and ideally familiar with mohua calls and flight habits. This is especially important for transects 10, 11 and 12 at Young Forks and the North Young. Training and succession planning should be considered.
- Aim to complete surveys within the 3-week period between mid - late October to mid-November. This will ensure that a consistent (adult) portion of the population is counted (i.e., before juveniles are encountered). Although it is nice to see juveniles, including these in the counts leads to inflated counts and should be avoided. Follow up surveys on most transects should happen regardless as part of the SLS project work.

### General:

- Rat numbers have been increasing rapidly in 2023 (because 2022 was an unusually warm year, leading to an abundance of food), therefore trapping by COLB, SLS and ideally DOC must continue.
- If catch rates continue to increase, then fortnightly trap clearances should be considered to try and keep on top of rat numbers leading into the breeding season.



- SMI monitoring must be continued and results of this as well as the trap catch rate should be feeding into decision making about pest control resources at a higher level.
- A bait station network is needed for Makarora true right (between Davis Flat and the Blue confluence) as this would add extra security to the front country population of mohua and would be a good tool to have when rats are on the increase.
- Lobbying to government to raise the profile and priority of this location for mohua management is needed. Makarora is just as protectable as the Landsborough and should be an equal priority. Both areas could be strongholds for mohua, and it would make both populations stronger too.
- Southern Lakes Sanctuary have a project to track territory occupancy, population dynamics and breeding success of mohua in the Makarora Valley. It is important to learn more about this population and how it is faring relative to other mainland populations. Part of this study involves using acoustic recorders to record mohua songs for an AI- based algorithm for detection and individual identification of mohua. This work was started last season and will be continued over the next few years. A banding project which was started by Sarah Forder in 2021 will also be continued this season and will help further our knowledge of pair dynamics and territory usage.

## Acknowledgements

A special thanks to the COLB group for their continued efforts to keep abreast of predator invasions into the Makarora Valley. Without this initiative and the ongoing dedication that goes into it that we would not have a mohua population along State Highway 6 as we do today. Thanks also to Theo Stephen, Mo Turnbull and Paul Kavanagh for much valued contributions to the editing of this report.

For more information please go to; [www.southernlakessanctuary.or](http://www.southernlakessanctuary.or); & [www.mohua.co.nz](http://www.mohua.co.nz); [www.doc.govt.nz](http://www.doc.govt.nz)

## References

- Nathan Whitmore, (2021) Analytical report into Makarora Mohua monitoring
- J Tilson (2021), Makarora Mohua Distribution Survey
- Jo Tilson (2017, 2018, 2019) Makarora fixed transect survey
- Tonkin and Taylor (2020) Makarora fixed transect survey
- Sarah Forder (2021) Makarora fixed transect survey
- Dawson, D.G. & Bull, P.C. (1975) Counting birds in New Zealand forests. *Notornis*, **22**
- Hartley, L. & Greene, T. (2007) Indices of relative abundance - Five minute bird counts - Point counts. Inventory and monitoring toolbox, Research & Improvement, Department of Conservation, Christchurch, N.Z.
- Manno, K. (2012) Mohua survey in the Blue and Young Valleys Nov – Dec 2012. Department of Conservation DOCDM-1136177.
- O'Donnell, C.F.J. (1996) Monitoring mohua (yellowhead) populations in the South Island, New Zealand, 1983–93. *New Zealand Journal of Zoology*, **23**, 221–22

## Appendix 1

### Methodology “musts”

- When walking the transect, focus first and foremost on the canopy in front of you as it is most important to detect the birds closest to the transect to fulfil data analysis assumptions.
- Accurately record distance off the transect (closest point) to the tree the mohua are first seen in using a range finder where possible. We paced the distance out to about 50m. Beyond this, we estimated, using the GPS distance by going to the tree and measuring back to where we left the transect.
- Spend up to 15 minutes locating the group and identifying sex of the individuals. We found with mobile groups it was worth putting in the time to get more accurate data and to give us confidence at the data reporting stage.
- If mohua are greater than 200m away or difficult to get to, record number heard and project a waypoint on the GPS
- If you walk back past the spot where you recorded mohua not long before and see 1 or 2 more than you recorded, do not change the number seen or heard
- Hours of counting are between 8am and 4:30pm to be consistent with a regular workday, except up the North Branch where it may be necessary to begin early and finish later, especially if doing 2 sets of counts in one day. There has been a lot of debate over whether it is OK to do repeat sets of counts in one day or not. However, as long as there is a decent break of at least 90 mins between counts, then two sets in one day is possible (and practical) for the north branch transects and even the Blue Valley transects.
- If mohua are heard during the 5MBC and not encountered during the walking survey, they can be included which means the total time taken for the survey now starts when the bird count starts and finishes when you finish the bird count
- Transects have ‘soft ends’ which means if you hear mohua off the ends of your transects FROM the transect, they are counted.

### New Transect Numbering and Station Relocations.

As part of Sarah Forder’s re-vamp of the survey lines in 2021, the numbering was changed so that the lines begin at 1 at the top of the pass coming down the Makarora valley (2, 3, 4), continue up the Blue Valley (5, 6, 7) and then continue up the Young Valley (8, 9, 10) and up the North Branch (11, 12). The historic line 2 was dropped due to its non-productivity and the time it adds to get to it. The GPX file for the new transect lines is stored in:

Doc/S:/Operations/Biodiversity/BioAssets/Mohua/GPS File

