

MAKARORA MOHUA FIXED TRANSECT SURVEY 2017

Report by

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SUMMARY

The seventh annual fixed transect mohua survey was completed in November 2017.

Ten fixed transects in the Makarora area were surveyed for mohua in 2011 and 2012. In 2013 three transects in the Young Valley were added. These 13 transects have since been surveyed annually in spring, using a slow walk and listen technique.

Mohua were detected on ten of the thirteen transects in 2017, up from 9 out of 13 transects in 2016. The average number of mohua per transect (with four visits to each transect) was 2.75. The total number of mohua individuals seen or heard during the 52 transect walks, including 30 out of count, was 143. Many of these were repeat records of the same birds. Of these 143 observations, 99 were in the Young (transects 10-14) a slight decrease from the 112 observations in the Young Valley last year. However, there was a significant increase in observations in both the Makarora Valley (transects 1, 5 & 6) and the Blue (transects 3 & 4) with 29 and 15 records respectively and overall there was a ten percent increase in birds seen or heard across all lines.

No mohua were detected on transects 2, 8 and 9.

INTRODUCTION

The Makarora River is in Mount Aspiring National Park, near the township of Makarora, 65 km north of Wanaka. The Young and Blue valleys join the Makarora River 3 km and 8 km upstream from Makarora. Silver beech dominates the bush canopy in these valleys, from the Makarora River at 300m altitude, to the bush line at ~800-900m altitude.

The Makarora mohua population lies between two Operation Ark mohua populations, in the Landsborough River and Dart-Caples (O'Donnell 1996). There is little historical data about the Makarora mohua population itself.

The Royal Forest and Bird Protection Society began the Mohua Protection Project in Makarora in 1998 and together with DoC now maintains 300 predator traps along the Haast highway, in the adjacent bush, and in the Young Valley. Nigel Babbage and the Mohua Charitable Trust provided funding for some of these traps to be upgraded from Fenn traps to DOC 1505 in early 2011.

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: measure the mohua population and population trends at Makarora; assess the impact of the trapping program on the mohua population; and provide a basis for deciding whether more intensive predator control is required.

The Mohua Charitable Trust provided funding to Florence Gaud at DOC Wanaka for mohua distribution surveys in the Blue, Young and Makarora valleys in 2012, and they have funded annual mohua transect surveys in the Makarora valley since 2013.

The Makarora mohua population was (in 2012) suspected to be small and sparsely distributed among the Young, Blue and Makarora valleys. Surveys to date support this view in regard to the Makarora and Blue Valleys. However, the surveys indicate that the upper and north Young Valley population, although only in a small area, is much denser than the rest of the study area.

METHODS

Thirteen fixed mohua transects were surveyed in 2016 in November, when birds are most vocal due to territoriality prior to nesting. Data were collected by Rose Cullen (transects 12-14) and Jo Tilson (transects 1 – 11). Weather during surveys was fine and calm and temperatures were significantly higher than normal for this time of year.

Ten transects were established in 2011 on tracks easily accessible from the highway near Makarora between Haast Pass and the lower Young Valley. (Appendix A). In 2013 three additional transects were added at the Young forks and in the North branch of the Young Valley. (Appendix B). All transects were established in areas of known mohua territory, except for transect two, near where a mohua was seen in previous years.

Each transect was surveyed four times between October 31st and November 24th 2017 between the hours of 07:00h and 18:30h. The survey followed the methodology of O'Donnell & Elliott (undated) and O'Donnell, Elliott, & Greene (2007). A minimum of 40 minutes, and sometimes longer than one hour, was spent on each transect, with the observer walking at a very slow pace. A standard data sheet (Appendix C) was completed in the field for each transect. A standard five-minute bird count of all species was completed at the start and finish of each transect, before/after surveying for mohua (Appendix D).

Mohua locations were recorded with GPS waypoints. The number, sex and age of mohua were recorded if possible. Additional details about the mohua distribution survey methodology were as follows:

- The observer walked slowly at 0.8-1.0 km per hour (O'Donnell 1996) along the designated transects between 07:00h and 19:30h.
- Birds were located visually or by listening for calls.
- When mohua were heard or seen, the observer attempted to locate the bird, establish how many birds were in each group, and identify bird gender and age by calls (male whistles, female buzzes), female/juvenile plumage, and behavior (courtship/juvenile feeding).
- Squeakers (polystyrene on glass) were used to attempt to determine group size once initial contact had been made (but not to solicit calls) as mohua often respond to a squeaker by coming closer and chattering. The time taken to locate and observe a specific group of birds was subtracted from total time surveying the transect - i.e. "the clock was stopped" when a bird was first seen/heard, and restarted when the observer left the bird/group and resumed walking the transect.

Squeaker use was avoided within 10 minutes of a five-minute bird count, so as to not influence the count.

The observer spent up to 10 minutes establishing contact with a group. If the number of birds was not ascertained in that time, then the transect walk was resumed.

Each group was recorded on a field sheet, noting number of birds and number of confirmed males, females and juveniles in each group.

Double-counting of birds was minimised by continually monitoring surrounding/adjacent calls of mohua.

Counts were undertaken in similar (good/fine) weather conditions and with little ambient noise (e.g. wind).

Binoculars were used to aid observations.

Five-minute bird counts (5MBC) followed the methodology of Dawson & Bull (1975) and Hartley & Greene (2007) and were conducted at both ends of every mohua transect at the permanent blue track tag marking the transect end.

Details of the 5MBC methodology are as follows;

The observer stood quietly and immediately began recording all individuals detected for exactly five minutes. The number of each species of bird seen or heard was recorded. No bird was knowingly counted twice within a single count.

If an individual bird was included in a count from a previous station it was counted again. No birds were assumed to be present without some visual or auditory clue to their presence (e.g. a flock of silvereyes was noted as the number of individuals heard calling, rather than the number the observer guessed such a frequency of calling would represent). If a bird called in one place and later one of the same species called some distance away, they were taken as two individuals unless there was evidence that the first bird moved to the second place.

Pre-printed data forms were used for recording observations (Appendix D).

If mohua were heard in a 5MBC, they were followed up once the count was finished, and their location was waypoint marked using a GPS. If mohua were seen during the 5MBC, this was noted, and the waypoint also became a mohua waypoint.

Incidental sightings/hearing of mohua outside of transect surveys were also recorded. These records were separated out for data analysis.

RESULTS

Up to six transects were completed per person per full survey day, and a total of 104 5-minute bird counts (5MBC) were completed during the survey. Excel spreadsheet DOCDM-850109 contains all data from the 2011-2017 5MBC.

FIVE-MINUTE BIRD COUNTS

In 2017 the number of native birds detected was significantly higher than in 2016. Tomtit, bellbirds and grey warblers being the most commonly detected birds. On average bird counts for native species were > 30 % higher than in 2016.

The chaffinch was still the most abundant bird overall, although there was no detectable change in total number (250 c.f 247 in 2016) as opposed to redpoll, whose detectable number dropped from 146 in 2016 to 65 this year. The increase in native species detected is probably due to the 1080 pest control operation in Feb 2017, which has reduced predator numbers over the year and enabled more

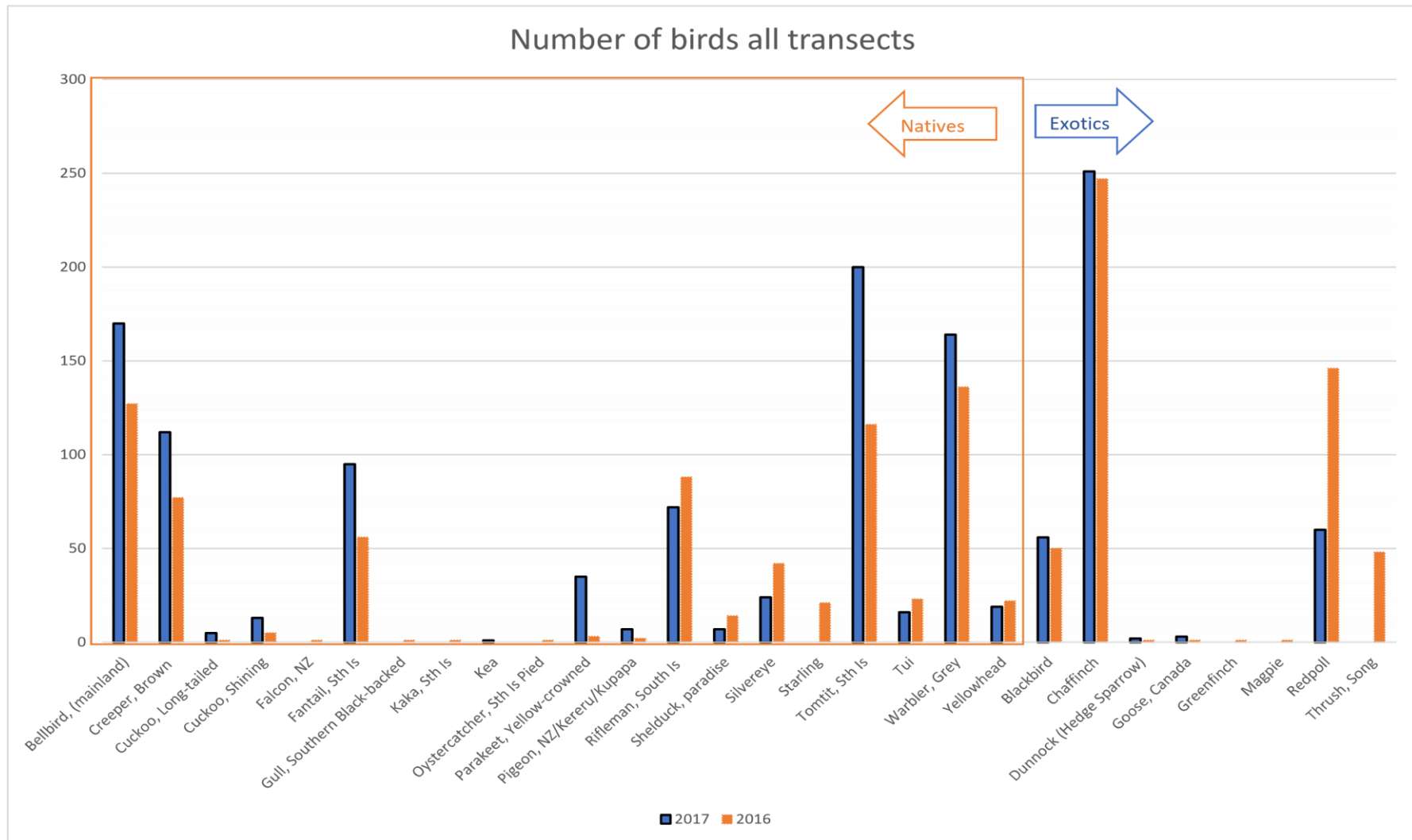
birds to successfully breed and fledge young (see below). The higher than normal temperatures and fine weather may also have triggered slightly earlier breeding this year.

In total twenty-one species were recorded, comprising 15 native and 6 exotic species. Mohua were heard 19 times during the 5MBCs meaning the average number of mohua recorded per 5MBC was 0.18. Figure 1 shows the total number of individuals of each species per 5MBC

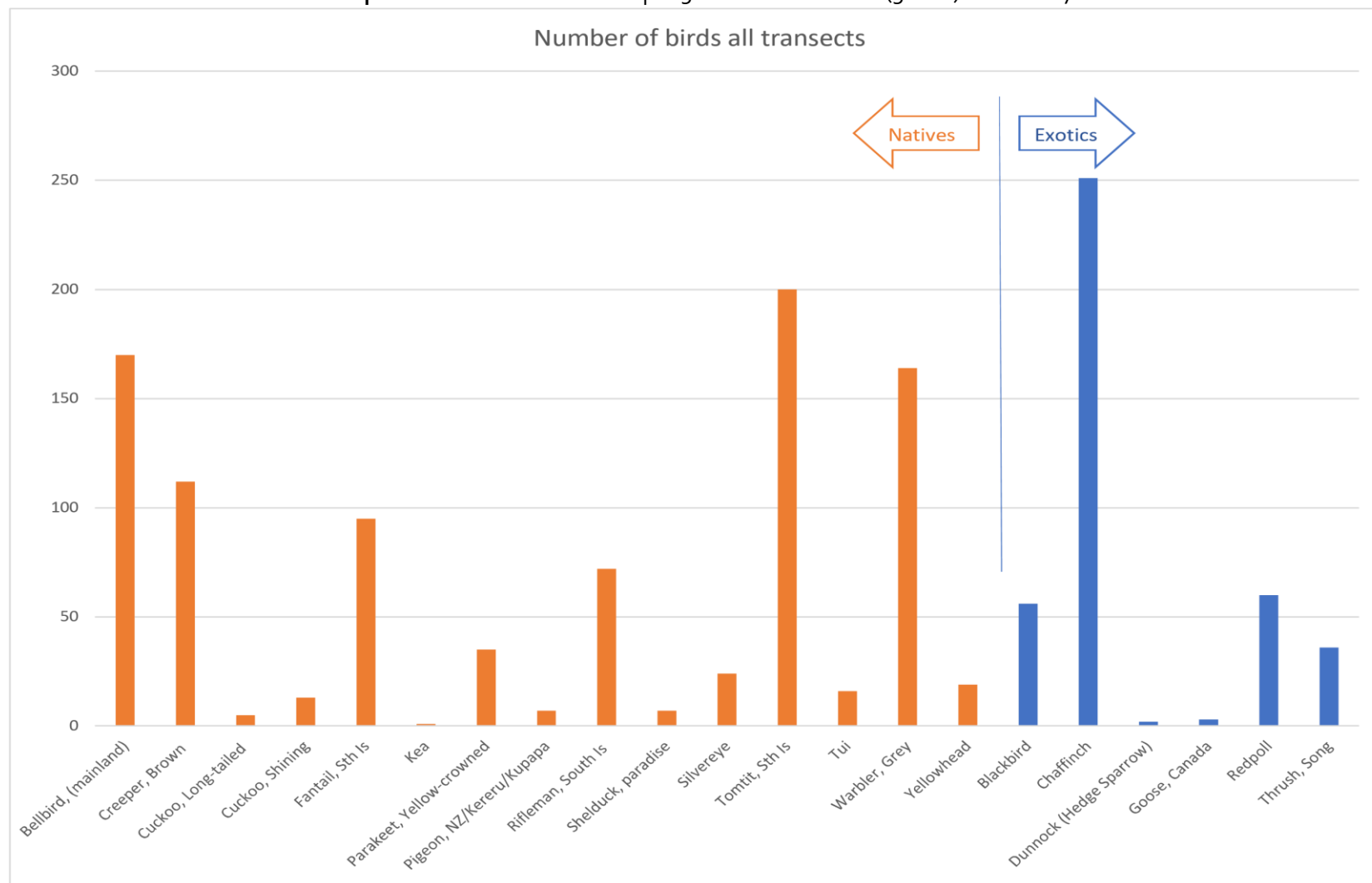
Table 1: total number of species recorded

Species Recorded	Number
Bellbird, (mainland)	170
Creeper, Brown	112
Cuckoo, Long-tailed	5
Cuckoo, Shining	13
Fantail, Sth Is	95
Kea	1
Parakeet, Yellow-crowned	35
Pigeon, NZ/Kereru/Kupapa	7
Rifleman, South Is	72
Shelduck, paradise	7
Silvereye	24
Tomtit, Sth Is	200
Tui	16
Warbler, Grey	164
Yellowhead	19
Blackbird	
Chaffinch	251
Dunnoek (Hedge Sparrow)	2
Species Recorded	Number
...	
Goose, Canada	3
Redpoll	60
Thrush, Song	36

Graph 1 total number of birds all transects



Graph 2. Total number of birds per 5-minute bird count (5MBC) in the 2017



MOHUA SURVEY

Mohua, both as individuals and groups, were recorded 143 times during the survey (Table 2), but many of these were repeat records of the same individuals. Thirty of these records were from outside survey times or locations (Table 3). The number of observations is not representative of the number of mohua present, as many birds are recorded twice when back tracking along lines or on subsequent visits. However on transects 1 – 11 where the population of mohua seems very sparse compared with the Young forks and North Young lines, it was possible to get a reasonable idea of 'actual' numbers of birds on these lines.

Bird observations have been indicated by blue squares in the corresponding maps. (Figures 2 a-d)

The largest group recorded was four (once, on transect 13), with two groups of three observed on transect 13. There were 41 recordings of 2 mohua and 48 individual records. However, it is not always possible to identify every bird in a group, especially those high in the canopy.

There was only one definite observation of courtship behavior between a pair, on transect 14. However several pairs were assumed to be nesting based on the type of calls heard and the locations observed over consecutive visits. Potential nesting behavior was observed in the pair at the end of line three (MOH3F), the pair towards the end of line four (MOH4), the Haast Pass pair (MOH5 5) and two pairs at the lower Young river, one near the mouth (near MOH11F) and one on MOH10, Refer maps 2 a- d

Also, a young bird and possible female were seen at the start of the Bridle Track in the same location where a single male was repeatedly heard on the way to transect 6 (MOH6F) on the 6th December, two weeks after the survey was completed.

Due to having different observers in the Young forks and North Young lines, it is not possible to estimate the actual number of birds / pairs compared to historical records for these lines.

Seventeen of the 52 transect surveys had zero mohua records. Transects eight, nine and two had zero records for all four counts (table 2).

Excel spreadsheet DOCDM-1320829 contains all data from the 2011-2017 mohua survey transects.

Table 2. *Number of mohua detected per visit, per transect in the 2017 Makarora Mohua survey (birds detected outside of transect survey times and locations excluded).*

Visit #	Transect #														Total
	1	2	3	4	5	6	8	9	10	11	12	13	14		
1	1	0	0	2	0	2	0	0	2	0	3	3	2	15	
2	2	0	1	1	2	3	0	0	3	1	9	9	6	37	
3	1	0	2	1	0	3	0	0	2	4	1	11	6	31	
4	2	0	2	2	2	3	0	0	0	4	2	9	6	32	
Total	6	0	5	6	4	9	0	0	7	9	15	32	20	113	

Table 3. *Mohua detected outside of transect counts, on way to/from or between transects.
Also, those heard on transect whilst back tracking along line.
Birds between transects are listed under the closest transect.*

Transect #													
1	2	3	4	5	6	8	9	10	11	12	13	14	Total
2	0	0	4	2	6	0	0	7	4	4	0	1	30

Table 4. *Combined total of all birds detected in 2016 c.f. 2017*

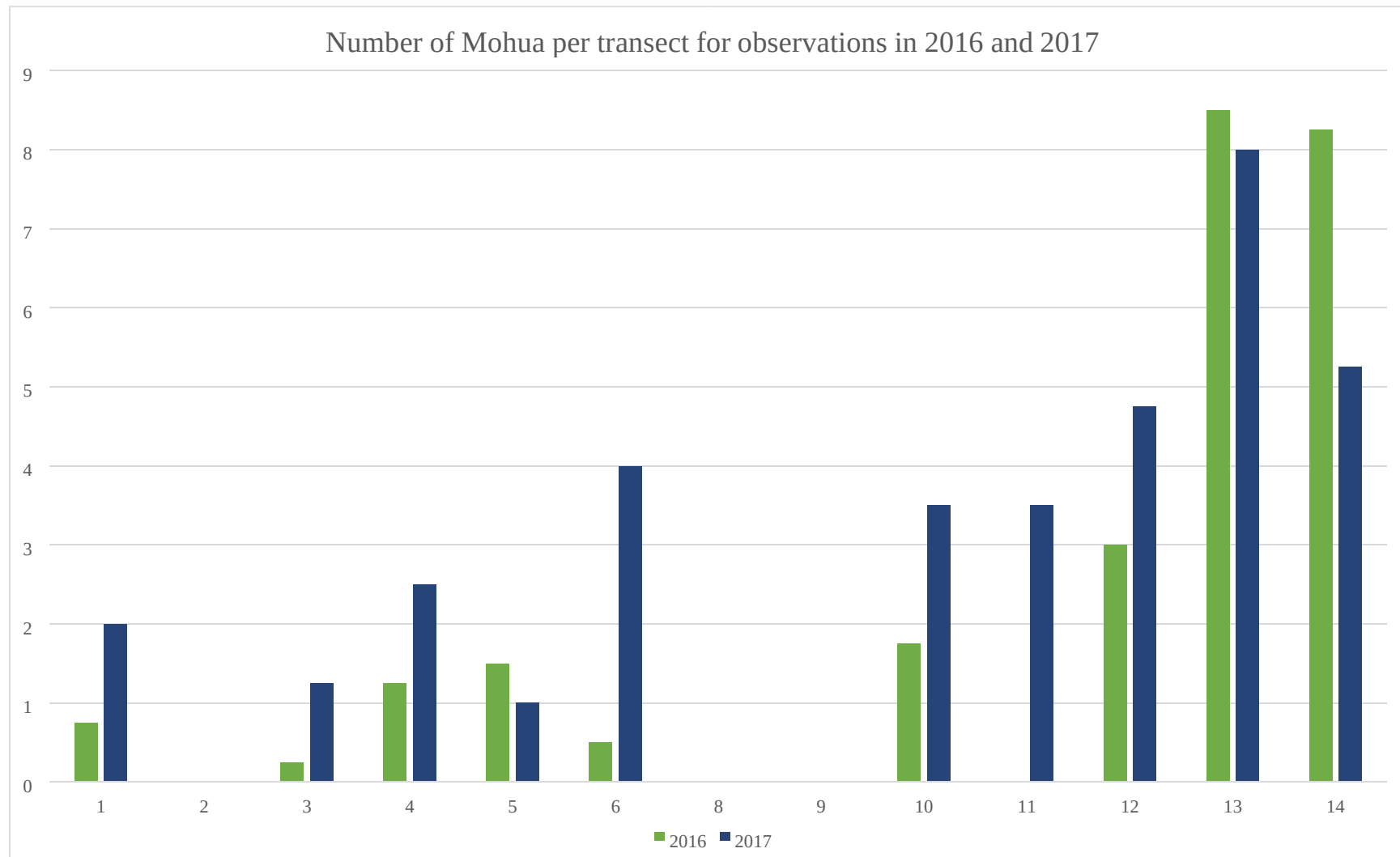
Transect	1	3	4	5	6	10	11	12	13	14	Total
2016	3	2	5	6	2	14	2	12	34	40	130
2017	8	5	10	6	15	14	13	19	32	21	143

Table 5. *Average number of mohua detected per visit on each transect, 2011-2017.*

Year	Transect #													Average per transect (#1-14)	Average per transect (#1-11 only)
	1	2	3	4	5	6	8	9	10	11	12	13	14		
2011	6	0	0.25	5.75	2.75	1.75	0.25	1.75	3.25	1.75					2.35
2012	1	0.33	0.25	3.25	1	0	0.5	0.5	0.75	0					0.76
2013	1	0	0.25	1.25	4.5	3.25	0	1.25	1	0	1.25	3.75	2.25	1.52	1.25
2014	0.75	0	0	1	3.25	0	0.5	0.5	0	0.75	1	7.00	1.75	1.27	0.68
2015	0.25	0	0	1.75	2.75	1.25	0	1.25	0.5	0	2.25	5.75	4.25	1.54	0.78
2016	0.75	0	0.25	1.25	1.5	0.5	0	0	1.75	0	3	8.5	8.25	1.98	0.6
2017	2	0	1.25	2.5	1	4	0	0	3.5	3.5	4.75	8	5.25	2.75	1.77

The mean number of mohua recorded per fixed transect in 2016 was 1.98. In 2017 this number had increased to 2.75. This increase in observations is due to more birds being detected on the lower transect lines, particularly 4, 6 and 11. There was a significant decrease in birds heard on transect 14 (Young Forks) this year. The reason for this difference is unknown.

Graph 3 number of Mohua per transect in 2017 and 2016

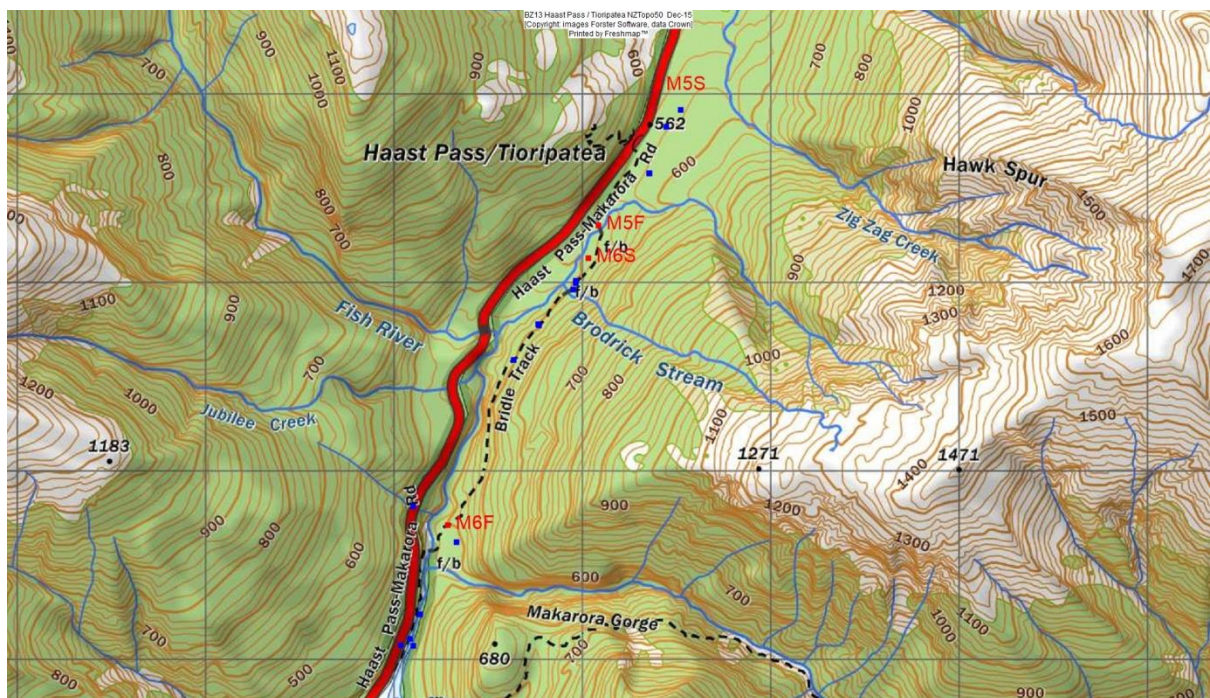


Maps 2a,b, c &d.

Maps showing locations of transects as well as birds observed in 2017

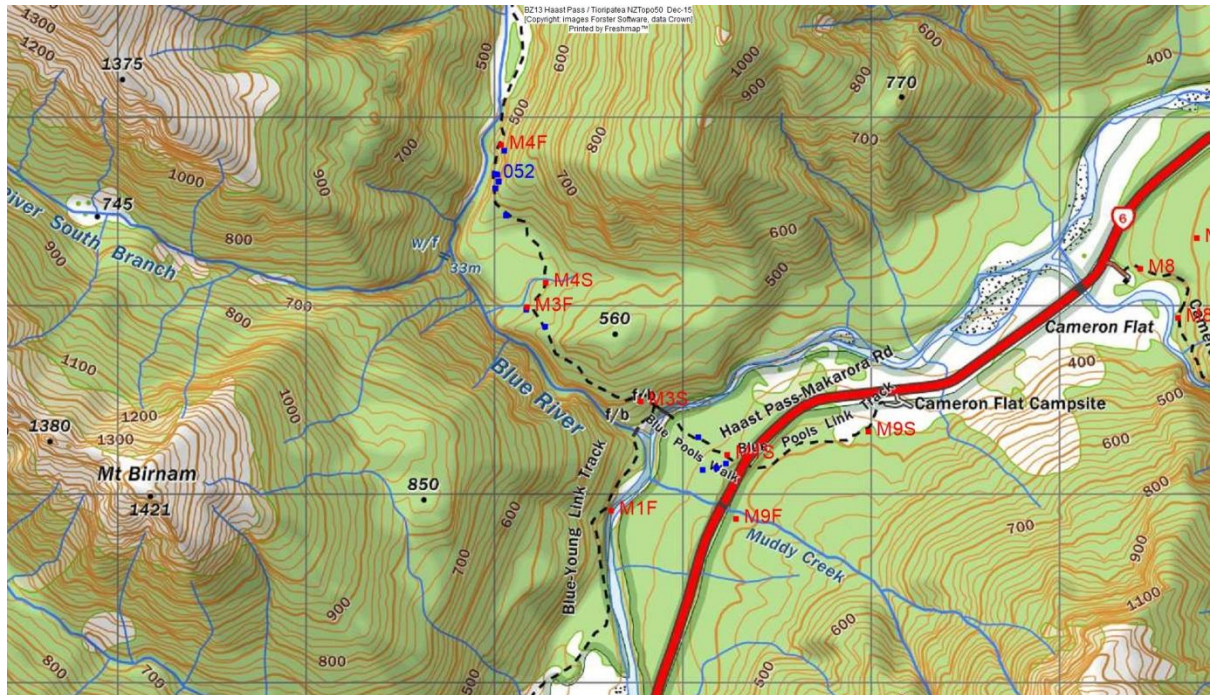
Birds observed/heard on Bridle Track 2017

Map 2a. 2017 Actual locations of mohua recorded during on the Bridle Track, transects 5 & 6. Blue squares are mohua locations, red dots are transect ends. Average number of mohua on transect 5 was 1 and on transect 6 was 2.25 (does not count birds heard outside of count or on way to line starts).



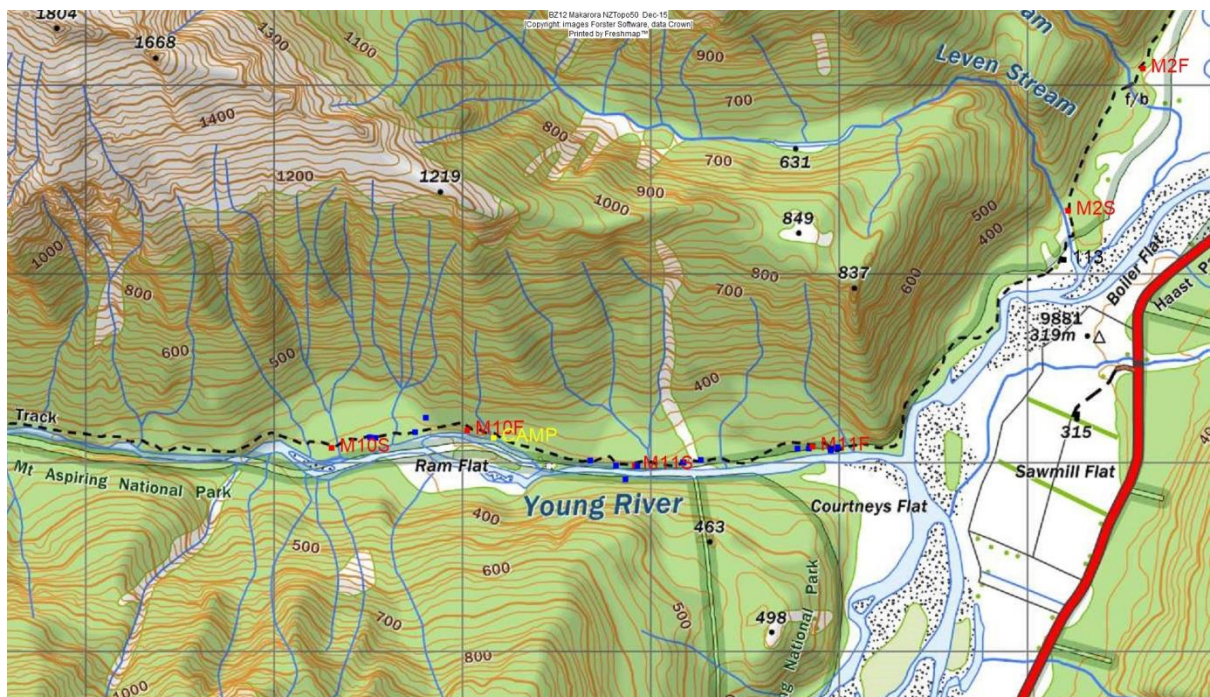
Birds observed on Blue River transects, 2017

Map 2 b 2017 Actual locations of Mohua seen/heard on transect 1, 3 & 4. Blue squares are mohua locations, red dots are transect ends. Average number of mohua on transect 1 (1), 3 (1.25) and 4 (1.5). Does not count birds heard outside of count or on way to line starts.



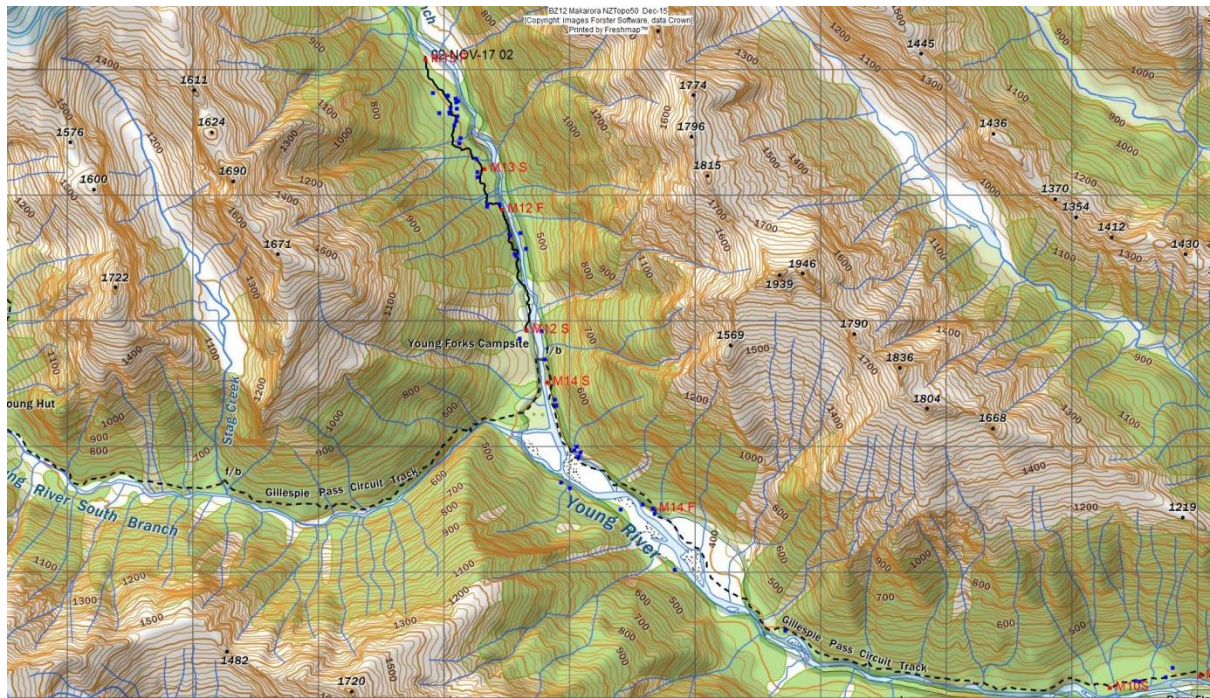
Birds heard on lower Young transects 2017

Map 2 c. Locations of mohua heard or seen on transects 10 and 11. Blue squares are mohua locations, red dots are transect ends. Average number of mohua on transect 10 (1.75) and on 11 (2.25). Does not count birds heard outside of count or on way to line starts.



Birds heard in North Branch of Young and Young forks, 2017

Map 2d Locations of mohua observations on transects 12, 13 & 14 with blue squares showing observations and transect start / finish highlighted in red. The average number of mohua detected on transect 12 was 4.75, transect 13 was 8 and on transect 14 was 5.25. Does not count birds heard outside of count or on way to line starts.



DISCUSSION

The mohua population in much of the Makarora area is challenging to monitor, particularly outside the upper Young Valley area, since the birds are widely dispersed and are usually silent. There is a small number of individuals overall, and their territories may be quite large. During this survey period, mohua favored being high in the canopy so were more likely to be heard than seen. This meant that it was very hard to detect whether there was more than one bird if only one was calling.

Despite the difficulty in seeing birds, the total number of mohua counted was the highest to date. This is attributable to the higher bird count in the lower i.e. pre2013 transects, especially transects 6, 10 and 11. Six of the ten transects that had mohua present had an increase of more than 100% from last year, and transect 6 and 11 had increases in the region of 400%. Disturbingly, transect 14 (Young forks) showed a 50% decrease in observations. The reasons for this are unknown at this stage and hopefully this trend will reverse in future years.

Transects 5 and 13 stayed relatively the same as last year while transect 12 showed a 50% increase.

Once again there were no mohua detected on lines 2, 8 & 9.

The increase in numbers of birds recorded in the Makarora, Blue and lower Young is encouraging. However the overall number of birds is still very low meaning the population is by no means secure.

Table 6. Combined total of all birds encountered in 2016 c.f. 2017

Transect	1	3	4	5	6	10	11	12	13	14	Total
2016	4	2	5	6	2	14	2	12	34	40	130
2017	8	5	10	6	15	14	15	19	32	21	143

As in previous years, there was some concern about the absence of female birds heard, with only one definitive display of courtship behavior observed in the entire survey. The vast majority of mohua heard/seen were single males/unknown gender birds or otherwise pairs of unknown gender.

However, on transects 1-11 the observer thought she was hearing females on at least 5 occasions (transects 1, 3, 4, 5 & 11) due to the different calls heard, but in hindsight a lack of experience differentiating between the variety of calls may have played a part in these assumptions. Regardless of this lack, a female and possible juvenile were seen low down on the Bridle Track near Davis flat approximately 2 weeks after the survey was completed. This was in a spot where previously only an individual male bird was heard.

We hope that the lack of definitive females / juveniles was because they were away nesting, rather than absent altogether. However, if the number of female mohua in the area was low, males may have been more conspicuous due to spending more time calling to attract a mate, leading to an inflated number of male birds being heard.

Also of concern is the impact of increased predator numbers resulting from beech masting in the Makarora area, with full or partial beech masts occurring every year over the past four years with another forecast for spring of 2018. Mast events are occurring much more frequently than before due to the fact that temperatures are getting warmer each year. 2017 has been no exception and all indicators point to another significant mast year in 2018. If mast years are not anticipated and dealt with proactively, then the likelihood of losing vulnerable bird species is high.

Fortunately, Makarora has now been listed on the Battle for our Birds (BFOB) 1080 program to try and tackle mast events and subsequent pest irruptions head on. In March 2017 there was an aerial

1080 operation at Makarora in response to the masting as part of BFOB, and this has almost certainly resulted in the increase in mohua along the road side lines, as well as the increase in other native forest birds heard on the 5MBC's.

Being hole nesters, Mohua are particularly vulnerable to predation, especially during the nesting season when the female alone is incubating the eggs. They are preyed on by both rats and stoats, which make them much harder to protect by trapping alone, and additional weapons such as 1080 poison are essential.

Hopefully in 2018 the Makarora area will again be subjected to aerial control using 1080 poison to counter the anticipated rodent plague. Regardless of this possibility, it is imperative that both Doc and community groups continue with ground trapping of animal pests, and if possible increase the area under protection. Without this effort, vulnerable species such as mohua are forever going to be living on the edge.

After seven years of mohua monitoring, there is a clearer picture of which habitat the Makarora mohua population uses. There is an obvious "hot spot" in the upper Young Valley, and some areas consistently show very low to no mohua at all.

Given the very small numbers of mohua at Makarora, we need to assess how many years of data will be needed before a statistically significant change in the population can be detected. It would also be good to determine if other mohua populations have persisted for many years at such low density. If they have, why have they not become extinct at this low population level? Possibilities are populations of predominantly ageing male birds who are not vulnerable to predation when trapped in a nest hole; trickle recruitment of new individuals from neighbouring populations (e.g. the Young and Landsborough); or strongholds (e.g. the Bridle Track and Blue Valley) from where a few birds successfully fledge and disperse through the valley each year.

Five-minute bird counts have consistently shown exotic species such as the chaffinch or redpoll to be the most common bird in the area in recent years. However, native birds exceeded exotics in both diversity of species and overall numbers in 2017. An analysis of trends of species numbers across survey years and, in particular, correlations between fluctuations in numbers of mohua and other bird species, would be useful. An analysis of correlations between mohua numbers, numbers of mammalian predators trapped/tracked, beech masting and BFOB 1080 operations would also be useful in order to assess the best way to allocate resources to aid mohua recovery at Makarora.

RECOMMENDATIONS

There is a critical need to continue mohua monitoring across the South Island in the next few years especially given recent, frequent beech masts fueling predator eruptions, and to assess the benefits to mohua of the Battle for our Birds 1080 operation(s). The fixed transect survey should be repeated in 2018 and on an annual basis thereafter, and the Young and Blue distribution survey undertaken in 2012 should be repeated in 2018.

With another beech mast forecast for the Makarora region in 2018, a very close eye should be kept on the local mohua population in the spring of 2018. If surveys confirm very few females, a study of nesting and fledging success, or some other gauge of the gender bias of the population may be necessary, and methods of better protecting nesting females, eggs and chicks from predation should be investigated.

Thought should also be given to whether the study needs to be redesigned, considering the importance of the population in the Young Valley, which surveys have revealed. It is suggested that the Young Valley and the Makarora Valley mohua are treated as separate populations for the study, as the large differences in concentrations of birds' skews data for both areas, if they are analyzed as a single population. Changes in the small population in the Makarora and Blue Valleys will be swamped by the larger numbers of birds in the Young.

It is suggested that transect two be omitted from the study in future, and the time saved be utilized in additional mohua surveys in the upper Young Valley, or in attempting some form of monitoring nesting success. Transects five (approx. 500m) and six (>1.6 kilometers) should probably be adjusted to even out the distances of each transect. This would also help to avoid double counting of the group usually seen near the intersection of these transects, near Broderick Stream. Historical data could be adjusted to reassign bird records to the correct, updated transect if necessary. The value of continuing to survey some of the other less mohua-dense transects, as opposed to an alternative use of time could also be considered.

As survey times vary somewhat from transect to transect, an analysis of birds per hour of effort may give more accurate results than a straight analysis of birds per transect.

ACKNOWLEDGEMENTS

Florence Gaud and Emma Bardsley organized the 2017 Makarora survey, Nigel Babbage and the Mohua Charitable Trust provided funding for this project and Graeme Elliott provided guidance with sampling design. Rose Cullen collected the data on Transects 11-14 in the Young Valley. Thanks also to Ian and Jane Turnbull for helping to edit this report.

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2016 survey notes

The GPS waypoint for MOH5s is 370m from the tag – down the Haast Highway - ? reason for this.

Banded trees in Blue Valley – old aluminium tree bands that historically protected mohua nests have fallen off. It would be good to nail them back in place before the 2018 breeding season (coordinates: 2211155, 5665820).

It is recommended that persons completing the survey in future years consult Katharina Manno for advice in navigating the difficult terrain in the North Young Valley.

Notes for navigation - North Young Mohua transects (12 and 13)

Watch out for deep rock crevices between giant boulders.

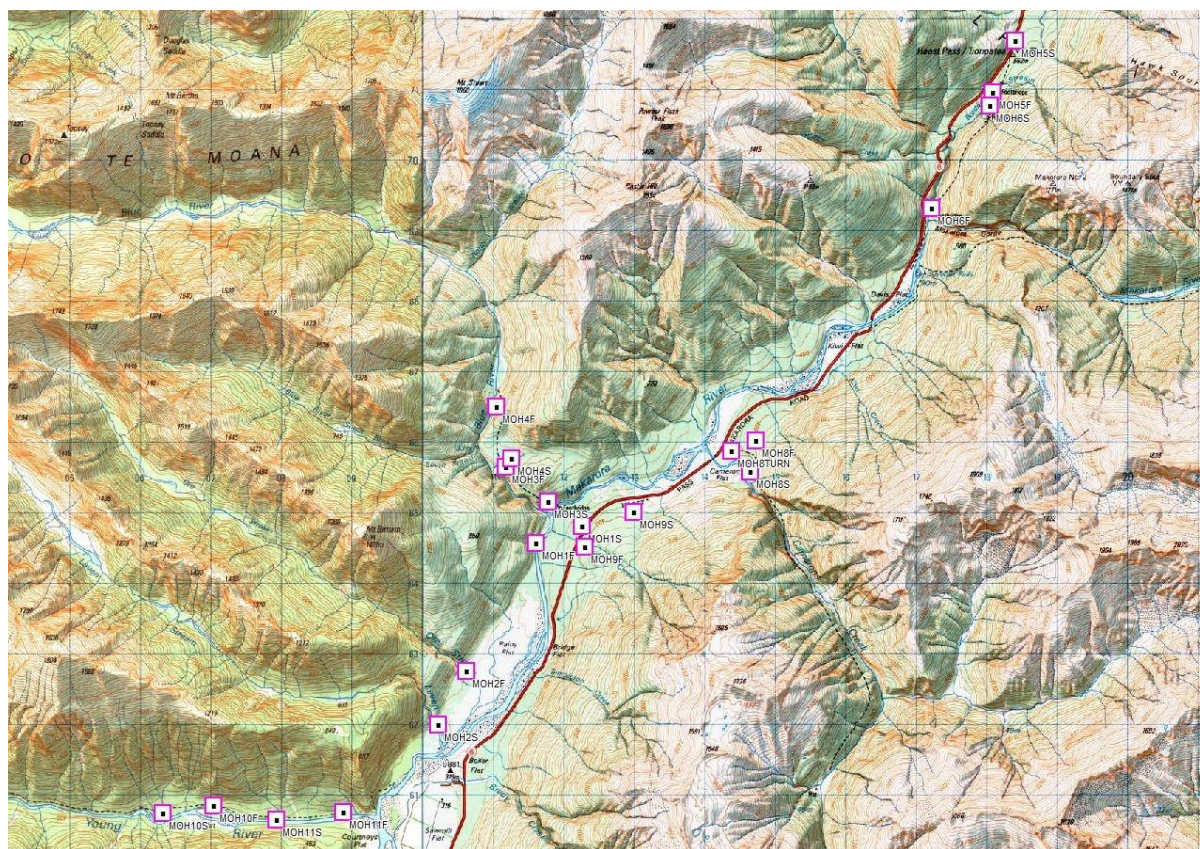
In general, try to stay close to the river.

Stay out of ribbon wood patches - tend to be full of boulder slips, stinging nettle, and general unpleasantness.

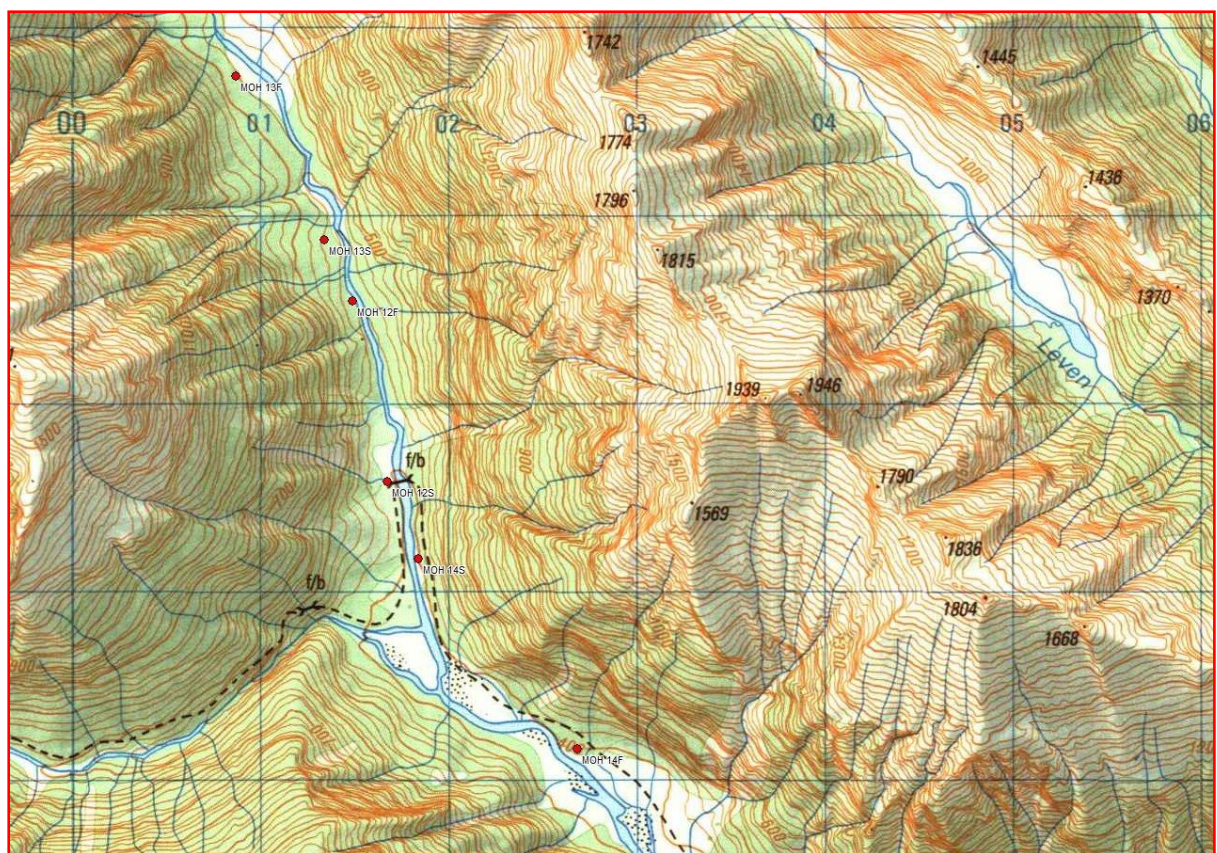
After leaving bivvy, past grassy clearings, go up onto first terrace. At stream close to MOH12f cross above the waterfall. There's a wide patch of ribbon wood to the left, and a bog to the right - stay in the bog. Follow stream by slip up, not down towards river (onga onga and windfalls below). After crossing slip go back down to river. Next old slip is ok to bash across wherever. Try to stay fairly close to river.

Past MOH13s, after crossing creek, climb up a couple of contours to cross next to creek - follow deer trails to cross at about 530m above sea level. Climb through old stream bed, then fairly easy going til transect ends.

Appendix A. *Locations of mohua transects surveyed in the Makarora area since 2011.*



Appendix B. Location of the three new transects (MOH₁₂, MOH₁₃, MOH₁₄) added to the Makarora fixed transect survey in 2013.



Appendix C. Mohua survey data sheet

[illegible]

Appendix D. 5MBC data sheet (p.1)

Transect#:	5MBC1 #:	5MBC2 #:
Name		
Date		
Start Time		
Easting		
Northing		
temperature (1-6)		
wind (0-3)		
other noise (0-2)		
sun (minutes)		
precipitation type (N,M,R,H,S)		
precipitation value (0-5)		

Bellbird		
B. Creeper		
Fantail		
G. Warbler		
Kereru		
Mohua		
Rifleman		
Silver Eye		
Tomtit		
Tui		
Blackbird		
Thrush		
Red Poll		
Chaffinch		
Starling		

Transect#:	5MBC1 #:	5MBC2 #:
Name		
Date		
Start Time		
Easting		
Northing		
temperature (1-6)		
wind (0-3)		
other noise (0-2)		
sun (minutes)		
precipitation type (N,M,R,H,S)		
precipitation value (0-5)		

Bellbird		
B. Creeper		
Fantail		
G. Warbler		
Kereru		
Mohua		
Rifleman		
Silver Eye		
Tomtit		
Tui		
Blackbird		
Thrush		
Red Poll		
Chaffinch		
Starling		

Transect#:	5MBC1 #:	5MBC2 #:
Name		
Date		
Start Time		
Easting		
Northing		
temperature (1-6)		
wind (0-3)		
other noise (0-2)		
sun (minutes)		
precipitation type (N,M,R,H,S)		
precipitation value (0-5)		

Bellbird		
B. Creeper		
Fantail		
G. Warbler		
Kereru		
Mohua		
Rifleman		
Silver Eye		
Tomtit		
Tui		
Blackbird		
Thrush		
Red Poll		
Chaffinch		
Starling		

Transect#:	5MBC1 #:	5MBC2 #:
Name		
Date		
Start Time		
Easting		
Northing		
temperature (1-6)		
wind (0-3)		
other noise (0-2)		
sun (minutes)		
precipitation type (N,M,R,H,S)		
precipitation value (0-5)		

Bellbird		
B. Creeper		
Fantail		
G. Warbler		
Kereru		
Mohua		
Rifleman		
Silver Eye		
Tomtit		
Tui		
Blackbird		
Thrush		
Red Poll		
Chaffinch		
Starling		

Appendix D. 5MBC data sheet (p.2)

Sun (0-5) Record approximate duration, in minutes, of bright sun on the canopy immediately overhead		
Time 24 hour clock, at the beginning of each count		
Unbounded Counts are unbounded		
Temperature	Wind The average for each five-minute count on a modified Beaufort scale:	
1 freezing < 0°C	0 Leaves still or move without noise (Beaufort 0 and 1)	
2 cold 0-5 °C	1 Leaves rustle (Beaufort 2)	
3 cool 6-10 °C	2 Leaves and branches in constant motion (Beaufort 3 and 4)	
4 mild 11-15 °C	3 Branches or trees sway (Beaufort 5, 6 and 7)	
5 warm 16-22 °C		
6 hot > 22 °C		
Other Noise i.e. Other than wind the average for the five minutes	Precipitation type Average for each count	Precipitation value
0 not important	N None	0 None
1 moderate	M Mist	1 Dripping foliage
2 loud	R Rain	2 Drizzle
	H Hail	3 Light
	S Snow	4 Moderate
		5 Heavy

Appendix E. Mohua recorded during fixed transect survey in 2016.

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH01</u>					
2/11/2017	1	10:52	Jo Tilson	53	Lots of calls mainly staccato. Did not see
6/11/2017	2	0:00	Jo Tilson	50	Staccato calls and male song. Not seen as too high in canopy
11/11/2017	1	1015	Jo Tilson	40	Heard some distance away in direction of previous records
13/11/2017	2	900	Jo Tilson	40	2 birds heard calling to each other from carpark.
18/11/2017	2	1250	Jo Tilson		2 birds (pair) heard on way down to bridge on way to transect 2
Total	8				
Mean	2				
<u>MOH02</u>					
13/11/2017	0	n/a	Jo Tilson	40	
18/11/2017	0	n/a	Jo Tilson	40	
19/11/2017	0	n/a	Jo Tilson	40	
23/11/2017	0	n/a	Jo Tilson	40	
Total	0				
Mean	0				
<u>MOH03</u>					
2/11/2017	0	n/a	Jo Tilson	47	
6/11/2017	1	1048	Jo Tilson	50	Only heard once (male) not seen
11/11/2017	2	1240	Jo Tilson	60	2 birds seen and heard at end of MOH3F. Lots of different calls heard
21/11/2017	2	1115- 1145	Jo Tilson	70	Birds heard on way to moh3F. Then seen and heard in same spot as previous. Moved around a bit and at times it sounded like more birds??? But couldn't be sure
Total	5				
Mean	1.25				

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH04</u>					
2/11/2017	2	1408	Jo Tilson	45	Pair heard above line where track traverses steep country
6/11/2017	2	1254	Jo Tilson		Pair heard on way back along line. Female calling softly to harsher staccato calls
6/11/2017	1	1158	Jo Tilson	50	Just a few staccato calls heard. No response to squeaker
11/11/2017	1	1520	Jo Tilson	45	Heard on way back along line, same place as survey # 1
21/11/2017	2	1230	Jo Tilson	45	Heard for some distance until right underneath. Similar location to birds heard during listen #1. Male calling often, female sometimes
21/11/2017	2	1305	Jo Tilson	45	Heard on way back, probably same pair as wpt 51 & 52 but may have just moved along track a bit
Total	10				
Mean	2.5				
<u>MOH05</u>					
8/11/2017	0	n/a	Jo Tilson	40	
14/11/2017	2	1430	Jo Tilson	50	Pair heard approx. 100m before the pass in similar spot to birds heard on Friday w Mark Eyre. Closed in on them but did not get a visual due to very high forest canopy. Female seemed to go quiet as I approached
15/11/2017	0	n/a	Jo Tilson	40	
24/11/2017	2	825	Jo Tilson	50	Pair heard on way to start of line, possibly another pair answering from the north. Once started I tried to close in on them but could not get visual as flying around a fair bit
Total	4				
Mean	1				

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH06</u>					
8/11/2017	1	1114	Jo Tilson	60	Single male heard calling across river on way to MOH6F
8/11/2017	2	1230	Jo Tilson	60	Staccato calls and possible female heard many times but could not id
14/11/2017	2	1345	Jo Tilson	60	Pair heard calling to each other just off track, only 34m from where i heard them on visit #1. did not respond to squeaker
14/11/2017	1	1330	Jo Tilson	60	Single male heard approx. 100m from wpt 90. Did not see
15/11/2017	1	1200	Jo Tilson	60	Birds went quiet as I approached so could not see or pinpoint
15/11/2017	0	1150	Jo Tilson	60	A couple of almost calls heard in same place as yesterday but not clear enough to count
24/11/2017	1	700	Jo Tilson	75	Bird heard across river near bottom end of bridal trail. Same as that heard on day 1. heard from road on way up to pass
24/11/2017	2	720	Jo Tilson	75	Birds (pair) heard on west side off highway approx. 100m above road
24/11/2017	2	807	Jo Tilson	75	Pair heard in same general location as heard previously on way to start of line (Haast pass pair)
24/11/2017	2	945	Jo Tilson	55	Pair heard some distance from track uphill of it.
24/11/2017	1	1033	Jo Tilson	55	1 male heard just after finishing 5MBC at end of line MOH6F
24/11/2017	1	1045	Jo Tilson	55	Same bird heard as earlier in day just over river. Short chip call only
Total	16				
Mean	4				

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH08</u>					
8/11/2017	0	n/a	Jo Tilson	50	No Mohua heard on this line
14/11/2017	0	n/a	Jo Tilson	50	No Mohua heard on this line
15/11/2017	0	n/a	Jo Tilson	60	No Mohua heard on this line
24/11/2017	0	n/a	Jo Tilson	60	No Mohua heard on this line
Total	0				
Mean	0				

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH09</u>					
6/11/2017	0	n/a	Jo Tilson	50	No Mohua heard on this line
14/11/2017	0	n/a	Jo Tilson	50	No Mohua heard on this line
15/11/2017	0	n/a	Jo Tilson	60	No Mohua heard on this line
24/11/2017	0	n/a	Jo Tilson	60	No Mohua heard on this line
Total	0				
Mean	0				
<u>MOH10</u>					
13/11/2017	2	1250	Jo Tilson	60	Heard on way to line start, at least 2 birds singing to one another quietly
13/11/2017	2	1325	Jo Tilson	60	Heard again on way back, same birds as above. Two different types of calls went quiet after I squeaked
13/11/2017	1	1348	Jo Tilson	60	Seen flying over track in between 10 & 11, staccato calls
18/11/2017	1	1715	Jo Tilson	60	Soft mewing calls heard on way to 10S approx. 100m off track
18/11/2017	2	1745	Jo Tilson	60	2 very soft calls heard in treetops above wee clearing, 1 short chip calls and soft mewing reply. 213 m from other calls heard half hr before
18/11/2017	4	2130	Ian Dench	60	2 pairs heard in tree tops on edge of clearing near campsite. Heard by visitor so not GPS-ed
19/11/2017	2	825	Jo Tilson	60	2 birds seen feeding high in canopy on way back to MOH10F, not very vocal and moving lots so hard to see
23/11/2017	0	n/a	Jo Tilson	50	No Mohua heard today while on transect but 2 pairs heard again on MOH11 when walking out
23/11/2017	0	n/a	Jo Tilson	50	No Mohua heard today while on transect but 2 pairs heard again on MOH11 when walking out
Total	14				
Mean	3.5				

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH11</u>					
13/11/2017	0	n/a	Jo Tilson	60	Possible Mohua heard at young mouth on way in to 11??
13/11/2017	1	1348	Jo Tilson	60	1 bird seen on way back along line in between 10 & 11
18/11/2017	1	1545	Jo Tilson	45	Heard on way to 11F - young mouth bird?
19/11/2017	2	1020	Jo Tilson	50	Heard on 5MBC in same spot as birds heard yesterday
19/11/2017	2	1025	Jo Tilson	50	Off transect, young river mouth birds (131 m from MOH11F)
19/11/2017	2	945	Jo Tilson	50	Heard 2 birds chattering high in canopy - not seen
23/11/2017	2	1330	Jo Tilson	55	Heard on 11F 4MBC. Lots of staccato calls a few soft mews, no response to squeaker
23/11/2017	2	1400	Jo Tilson	55	Male heard across river
23/11/2017	2	1430	Jo Tilson	55	Only quiet calls heard and shut up as I arrived.
Total	14				
Mean	3.5				
<u>MOH12</u>					
31/10/2017	1	1415	Rose Cullen	60	1 male heard
31/10/2017	2	1525	Rose Cullen	60	2 seen just off transect, 1 male
1/11/2017	3	855	Rose Cullen	60	3 seen (2 males)
1/11/2017	1	1445	Rose Cullen	55	Male heard singing across river, same place as yesterday & this AM
1/11/2017	1	940	Rose Cullen	60	off transect
1/11/2017	2	845	Rose Cullen	60	2 seen (1 male), 2 groups 5&6 made contact but seem to be competing groups
1/11/2017	3	840	Rose Cullen	60	3 seen (1 male)
1/11/2017	1	800	Rose Cullen	60	Male heard singing across river, same place as yesterday
1/11/2017	1	1335	Rose Cullen	55	off transect, male heard in same place as this AM
2/11/2017	2	1040	Rose Cullen	55	2 seen (1 male),
2/11/2017	1	1110	Rose Cullen	55	1 heard across river
2/11/2017	1	1120	Rose Cullen	55	Male heard across river
Total	19				
Mean	4.75				

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH13</u>					
31/10/2017	2	1650	Rose Cullen	55	2 seen (1 male)
31/10/2017	1	1655	Rose Cullen	55	1 male heard
1/11/2017	2	1220	Rose Cullen	60	2 males heard but then went quiet so couldn't locate
1/11/2017	2	1215	Rose Cullen	60	2 seen (1 male)
1/11/2017	1	1255	Rose Cullen	60	1 adult male seen on the move
1/11/2017	2	1235	Rose Cullen	60	1 male heard + 1 seem
1/11/2017	1	1300	Rose Cullen	60	1 male heard same place as this am
1/11/2017	1	1050	Rose Cullen	60	1 male seen singing
1/11/2017	2	1050	Rose Cullen	60	2 seen 1 male singing
1/11/2017	4	1040	Rose Cullen	60	4 seen, 2 male singing
1/11/2017	1	1035	Rose Cullen	60	1 male seen singing
1/11/2017	1	1005	Rose Cullen	60	1 male heard SW transect start
1/11/2017	2	1210	Rose Cullen	60	2 seen (1 male)
1/11/2017	1	1240	Rose Cullen	60	1 male seen singing
2/11/2017	1	905	Rose Cullen	55	1 male heard singing with flock of kakariki
2/11/2017	1	1010	Rose Cullen	55	1 heard same spot as yesterday
2/11/2017	2	940	Rose Cullen	55	2 males seen singing near each other and moving around a bit
2/11/2017	2	923	Rose Cullen	55	2 seen (1 male)
2/11/2017	1	910	Rose Cullen	55	1 male heard in distance
2/11/2017	2	920	Rose Cullen	55	2 males singing together
Total	32				
Mean	8				

Date	Nr of Mohua	Time	Observer	Time Surveying (mins)	Comment
<u>MOH14</u>					
1/11/2017	1	1525	Rose Cullen	45	Mle seen singing
1/11/2017	2	1705	Rose Cullen	45	Adult pair seen, courtship behaviour
1/11/2017	1	1720	Rose Cullen	45	Male heard singing but couldn't be seen
1/11/2017	1	1655	Rose Cullen	45	Male heard across river
1/11/2017	1	1645	Rose Cullen	45	Male heard across river
1/11/2017	1	1545	Rose Cullen	45	Male heard on other side of river
1/11/2017	1	1455	Rose Cullen	45	Adult male singing by swing bridge
1/11/2017	1	1640	Rose Cullen	45	Male heard singing and moving through area
2/11/2017	1	1435	Rose Cullen	55	Male heard singing and moving through area
2/11/2017	1	1255	Rose Cullen	45	1 male heard calling briefly
2/11/2017	2	1255	Rose Cullen		2 seen (1 male)
2/11/2017	1	1305	Rose Cullen	45	1 male singing across river
2/11/2017	1	1310	Rose Cullen	45	1 male singing across river
2/11/2017	1	1320	Rose Cullen	45	1 male seen singing and moving about
2/11/2017	1	1355	Rose Cullen	55	Male seen same as in # 3
2/11/2017	1	1400	Rose Cullen	55	Male heard across river same as in 3
2/11/2017	1	1415	Rose Cullen	55	Male heard across river same as in 3
2/11/2017	2	1418	Rose Cullen	55	2 males singing near each other
Total	21				
Mean	5.25				
Total all transects	143				