



Survey of Yarders and Rigging Configurations: 2018

Summary

The New Zealand forest industry has seen a significant change in yarder types and the rigging configurations used over the last six years since the last surveys were carried out in 2011/12. The results of the latest survey in 2018 show a total of 318 yarders currently operating in New Zealand, suggesting an increase of approximately 4% since 2012. There has been a shift towards more swing yarders, from 30% of the total in 2012 to 36% now, and a reduction in the proportion of tower yarders from 67% to 57%. The yarder brands of Madill and Thunderbird still make up over two-thirds of the total number of yarders, with the Madill 124 swing yarder now the most common model, with 32 machines (10% of total). A significant change has been recorded in preferred rigging configuration, with 50% now reporting the use of mechanical or motorised grapples, compared to North Bend and running skyline being the most preferred configurations in 2011. The increase in the number of yarders is driven by the increase in both harvest volume and proportion of steep country operations in New Zealand. The major move to grapple extraction is consistent with the overall increase in mechanisation over the last 5 years or so, as a result of the drive to improve safety of operations.

Hunter Harrill and Rien Visser,
University of Canterbury, School of Forestry

INTRODUCTION

Cable logging operations are a critical part of New Zealand's plantation forest management. In general they are lower productivity and have higher logging costs and greater safety risk than ground-based systems, but they provide the most common option for extracting timber on steep slopes.

A survey of yarders in New Zealand in 2002 indicated that there were 214 yarders active at that time (Finnegan & Faircloth, 2002). A 2012 survey of yarders indicated the number of yarders working in New Zealand had increased significantly to 305 (Visser, 2013).

The last 5 years has also seen considerable changes in New Zealand timber harvesting trends. The industry has focussed on improving safety management, leadership and performance since 2013 when there were ten fatalities in harvesting operations, leading to an independent review of health and safety in the industry (IFSR, 2014). Many new technologies were introduced into New Zealand during this period, influencing how harvesting operations are conducted, most notably winch-assisted harvesting machines (Visser, Raymond and Harrill 2014). This has enabled a significant increase in mechanisation of harvesting, with mechanised felling now present in 35% of cable harvesting operations,

and an increase in cable logging productivity of approximately 25% (Visser, 2018).

With the increase in annual harvest in New Zealand from 25.1 million m³ in the year to March 2011 to 30.6 million m³ in the 2017 March year (MPI, 2018), and the proportion of harvest on steep slopes increasing to over 50% (Visser 2016), it was considered timely to conduct a follow up yarder and rigging configurations survey.

The purpose of this yarder survey was to quantify and characterise the current New Zealand yarder population and identify the changes and developments that have occurred since the last survey was undertaken in 2012. The survey also provides a benchmark reference for future surveys.

SURVEY METHODOLOGY

Despite the fact that there is no formal industry or government registry for forestry equipment or harvesting crews in New Zealand, there have been a number of surveys undertaken of the logging industry over the years (Fraser *et al.* 1976, Liley 1985, Lyon & Raymond 1993, Finnegan & Faircloth 2002, and Visser 2013).

This survey recording the number of active yarders operating in New Zealand follows the method developed by the New Zealand School of Forestry at the University of Canterbury in 2012,



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building on the previous survey of yarders conducted by Finnegan and Faircloth in 2002.

The method used was to contact the previous 2012 survey participants and repeat the same survey questions used by Visser (2013). Questions included region, yarder make, model, type, and access to carriages, including make and model. Additionally, there were several new questions incorporated in this survey to determine crew characteristics, similar to the previous survey of rigging configurations (Harrill & Visser 2011) and recorded in the annual benchmarking results (Visser 2017, Visser 2018). These factors included the main rigging configuration used, access to winch-assist felling, use of a tension monitor, use of radio controlled chokers and the number of workers in the harvesting crew. The name of the contractor owner and company to whom they were contracted was also recorded, but only for the purpose of facilitating the survey accuracy and future surveys.

The survey procedure was conducted as follows:

1. The yarder survey spreadsheet was sent to previous survey participants to update; this accounted for the majority of inputs to the survey.
2. The updated spreadsheet was recirculated to participants to confirm that information collated was correct.
3. Possible discrepancies and individual leads to possible yarders were followed up by a personal phone call.

It should be noted that this is not a census, which is defined as a count of the whole population at one point in time, but a survey where efforts were made to identify and confirm as many yarder operations as possible over a six-month period. No doubt there will be yarders working for smaller companies or independent contractors that have not been identified in this survey.

Yarder entries that were not confirmed during the 2012 survey were dropped from the spreadsheet on the assumption that they have been retired out. Conversely, yarder entries identified in 2012,

but which have not been confirmed in 2018 have been retained, on the assumption they are still operating but not identified in this survey.

There is anecdotal evidence that very few machines have been sold overseas, so it has been assumed that these entries will have moved from the larger commercial forest estate into woodlot operations.

It is notable that 18 yarders were identified as being parked up for sale; these have been included in the survey numbers. During the course of the survey there were also newly imported machines and machines which have changed ownership and/or regions. Therefore, it must be recognised that this survey represents a “snapshot” as at June 2018 and that the population of yarders is dynamic. As such we estimate the accuracy of this survey to be approximately 90%.

RESULTS

Yarders

A total of 318 yarders were recorded in the survey, compared to 305 recorded in the 2012 survey, and only 214 in 2002. After the survey was sent to previous participants (i.e. the larger forest management companies) only two thirds of the yarders in the previous survey were verified, indicating that potentially 30% of yarders are now working in smaller forest estates / woodlots.

Table 1 shows the change in regional distribution of the yarder population from 2012 to 2018, using the forestry regions as defined by MPI.

The central North Island has the largest yarder workforce with 78 (24% of the total), followed by the southern North Island (17%) and Nelson/Marlborough (15%). Compared to 2012, the largest increase in numbers has been in the southern North Island, increasing from 33 to 53 yarders.

The largest decreases in numbers have been in Northland, currently operating 32 yarders (9%) down from 39 yarders (13%) in 2012, and in East Coast, down from 49 yarders (16%) in 2012 to 43 yarders (13%) now.



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Table 1: Regional distribution 2018 vs. 2012

Region	# 2018	% 2018	# 2012	% 2012
Northland	32	10.1%	39	12.8%
Auckland	11	3.5%	11	3.6%
Central North Is.	78	24.5%	76	24.9%
East Coast	43	13.5%	49	16.1%
Hawkes Bay	29	9.1%	27	8.9%
Southern North Is.	53	16.7%	33	10.8%
Nelson/Marlborough	49	15.4%	48	15.7%
Canterbury	7	2.2%	5	1.6%
West Coast	4	1.3%	5	1.6%
Otago/Southland	12	3.8%	12	3.9%
Total	318	100.0%	305	100.0%

The types of yarder were classified as tower, swing yarder or excavator-based (Table 2).

Table 2: Yarder type 2018 vs. 2012

Type	# 2018	% 2018	# 2012	% 2012
Tower	182	57%	204	67%
Swing	113	36%	92	30%
Excavator	23	7%	9	3%
Total	318	100%	305	67

The majority of yarders operating are tower yarders (57%) down from 67% in 2012. However, both swing yarders and excavator yarders are becoming more popular, with 35 more units since 2012. Swing yarders now represent 36% of the total fleet compared to 30% of the total in 2012. Excavator-based yarders have more than doubled since 2012 from 3% to 7% of total yarder numbers.

The summary of yarders found in New Zealand listed by manufacturer from 2012 to 2018 is presented in Table 3. The Madill range of yarders, with 120 machines, is still the most common make in New Zealand, representing 38% of machines surveyed. In 2012 it was also the most common make representing 38% of the population (115 machines). The second most popular make is Thunderbird with 29% of the population, down from 33% in 2012. Brightwater

yarders are the third most common make with 10% of the total population, similar to 11% in 2012.

The dominance of Madill and Thunderbird yarders, (213 of 318 machines, or 67%) continues on from the 2012 survey when these manufacturers represented 70% of the total.

Table 3: Yarders by manufacturer, 2018 vs. 2012

Yarder Make	# 2018	% 2018	# 2012	% 2012
Madill	120	37.7%	115	37.7%
Thunderbird	93	29.2%	100	32.8%
Brightwater	32	10.1%	34	11.1%
Harvestline	21	6.6%	6	2.0%
Berger	15	4.7%	15	4.9%
Washington	10	3.1%	8	2.6%
T-Mar	5	1.6%	0	0.0%
Skagit	4	1.3%	2	0.7%
Dispatch	4	1.3%	3	1.0%
Active	2	0.6%	0	0.0%
West Coast	2	0.6%	1	0.3%
Wilson	2	0.6%	4	1.3%
Koller	1	0.3%	0	0%
Pacific	1	0.3%	7	2.3%
Other	6	1.9%	10	3.3%
Total	318	100%	305	100.0%

The largest decline by manufacturer since 2012 was the Pacific yarder (reduced from seven to one). In the 2012 survey many PSY 200 machines were incorrectly labelled as Pacific. The PSY 200 was manufactured by Ross Corporation in the mid-80s and was the early precursor to the Thunderbird TSY 50 swing yarder, and these have been categorised as Thunderbirds in this survey.

The 2012 survey also noted the decline in older New Zealand makes such as Wilson and Dispatch which continues today (only six machines) as these brands are no longer manufactured and are slowly being retired out. A similar trend may soon begin with Brightwater yarders, as no more have been produced over the last few years.



While some New Zealand makes are on the decline, others are increasing; notably the Harvestline manufactured by Electrical and Machinery Services Ltd (E.M.S.) of Rotorua, which has increased from 2% to 7% of the total population since 2012. Active Equipment Ltd in Rotorua developed the Active 60 and Active 70 tower yarder in 2014 (Ellegard, 2014) based on the Madill tower and winches, but they went into receivership in March 2017. More recently DC Equipment Ltd in Nelson have built the Falcon 60 and Falcon 70 yarders.

There were also some new manufacturers entering the survey, such as T- Mar Industries Ltd from Campbell River, B.C., Canada which has sold at least five machines into New Zealand in the last 2 years (Ellegard, 2018), and Koller Forsttechnik GmbH from Austria, which has delivered one tower yarder, the Koller K602H (Ellegard 2015, Evanson & Hill, 2015).

There were 86 different models of yarders recorded in 2018, compared to 68 models in the 2012 survey. Table 4 shows the top ten most popular yarder models. The top ten models make up almost 60% of the total population.

Table 4: Ten most popular yarder models

Yarder Model	# 2018	% 2018	# 2012	% 2012
Madill 124	32	10.1%	17	5.6%
TMY 70	24	7.5%	31	10.2%
Madill 071	23	7.2%	26	8.5%
BE70/70LT	21	6.6%	13	4.3%
Harvestline	21	6.6%	6	2.0%
Madill 123	20	6.3%	18	5.9%
Madill 171	13	4.1%	17	5.6%
TSY 255	13	4.1%	10	3.3%
Madill 122	10	3.1%	9	3.0%
BE 85	9	2.8%	10	3.3%

The most common models are now swing yarders (Madill models 124, 123 and 122, and Thunderbird TSY255), making up almost 24% of the total. This is compared to 2012 when the tower haulers (Thunderbird TMY70 and Madill

071) were the most common, making up 19% of the total.

The Madill 124 swing yarder is now the single most common model of yarder in New Zealand with 32 machines (10% of total), compared to 2012 when it was the fourth most popular model with 17 machines. This increase is partly due to Brightwater gaining the rights to build this model in New Zealand between 2010 and 2014, when they built six machines; the rest are believed to be imported.

Rigging Configurations

Questions were asked in the survey as to the main rigging configuration (cable logging system) the yarder employed. The main rigging configuration used was supplied for 217 of the yarders surveyed (Figure 1).

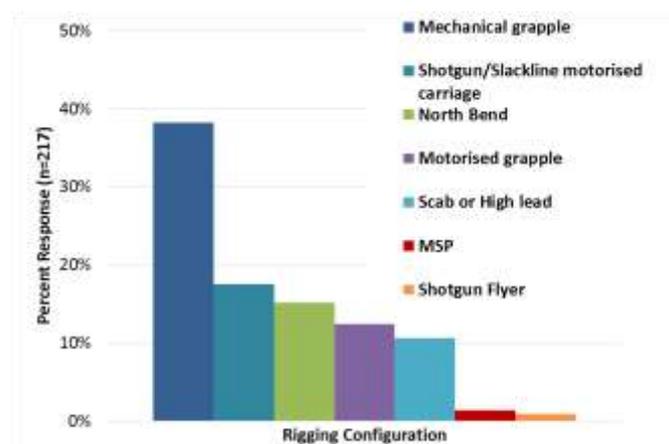


Figure 1: Most common rigging configuration used

In comparison with the previous rigging configuration survey from 2011, there have been substantial changes. Previously, North Bend followed by 'scab' (running skyline) and 'shotgun' (gravity return) were the three most common rigging configurations, and mechanical grapple was the least common.

In 2018 the most common rigging configuration used was the mechanical grapple employed by swing yarders (38%), followed by the motorised carriage operated either in a 'shotgun' (gravity return) or slackline rigging configuration (18%).



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From the 2011 survey, the North Bend / scab skyline / highlead systems reduced from 76% of operations down to 26%. Conversely there has been a large increase in the use of grapples (both mechanical and motorised) from 4% in 2011 to 50% in 2018.

Carriages

Carriage information was recorded for 309 of the yarders surveyed. A carriage as defined by this survey is either mechanical or motorised (including motorised grapples) and/or has the ability to pull slack. Butt rigging, simple Ryder blocks, shotgun carriages, fall blocks used for North Bend, scab or highlead, as well as mechanical grapples used on swing yarders were not classified as true carriages.

Of the 309 yarders recorded with carriage information, 60% did not have access to a carriage. Of the 126 yarders that did have access to carriages, 125 were able to provide further details of the make and model of carriages. These data indicated that 63% of carriages in the survey were motorised slack pulling (e.g. Acme, Eagle, Koller & Maki) or motorised dropline carriages (e.g. Boman), while only 10% were Mechanical Slack Pulling (MSP) carriages (e.g. Danebo). Results also suggested a new practice is emerging; 26% of carriages recorded were of the motorised grapple type (e.g. Falcon, Alpine and EMS Hawkeye), which have been developed and commercialised after the last yarder survey.

The major changes since 2011 could be attributed to recent industry emphasis and interest in mechanisation. Many tower yarders previously employing North Bend have invested in motorised slack pulling carriages or recently developed motorised grapples. Interestingly, combining the two grapple configurations (mechanical and motorised), half the cable logging crews (50%) are now practising mechanised cable extraction.

To be considered a fully mechanised cable logging operation in the right settings, mechanised felling, extraction and processing must be used. Since the 2012 yarder survey

winch-assist machines (enabling mechanised felling on steeper slopes) have been developed by several New Zealand manufacturers and sold throughout the country and to overseas markets. When asked whether the crew had access to a winch-assisted felling machine, 93 crews (29% of all yarders) said they did. Further investigation found that two-thirds of crews with winch-assist, employed one of the two grapple configurations. Assuming these crews also used mechanised processing (which according to 2017 FGR benchmarking data is present in 92% of cable yarder operations), it is estimated that approximately 18% of the current cable yarding operations could be defined as fully mechanised.

Two questions were also asked about the accessories that cable logging crews utilise. Radio controlled chokers, which are used to improve unhooking time at the landing and reduce reliance on a 'pole man' (a person responsible for unhooking chokers), are another development that has been around for several decades. Not all crews have the ability or need to use electronic chokers (e.g. grapple yarding). Of all the crews who commonly employ choker-based rigging configurations 42% (47 crews) had access to electronic chokers.

Another accessory which is traditionally used for safety purposes, but has also proved to be a production tool, is the tension monitor (Hartsough 1993, Harrill 2016). When asked if they used a tension monitor, only 199 responses were tallied and 20% (40 crews) had access to one (i.e. around 12% of the total yarder population or 22% of all tower yarders).

Crew Characteristics

Several additional questions were asked during the survey to determine more about crew characteristics. One question in the survey attempted to quantify crew size (Figure 2). Crew size based on yarder type was obtained from 169 crews. Previous benchmarking data indicated that cable logging crew size averages around eight people (Visser 2017). However, among other variables, yarder type was found to influence crew size and there was a wide range



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of crew size from four to 14 workers per crew. Using just four people to run a tower yarder does not seem possible, but further investigation found that the machine was the Koller 602H tower yarder which has no operator cab or designated operator. The yarder is remote controlled by both the breaker-outs and loader/processor operator.

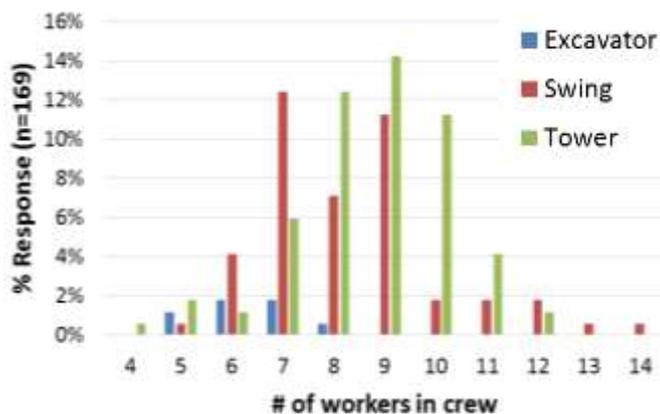


Figure 2: New Zealand crew size based on yarder type

Interesting to note is that based on the averages, swing yarders typically have smaller crew size than that of tower yarders; however some of the largest cable logging crews recorded (12-14 workers) were swing yarders. Further inquiry into these crews determined they were two-staging, hence the extra personnel to facilitate the second stage of extraction. Excavator yarders are similar to swing yarders but smaller in size and require fewer people.

DISCUSSION

The yarders used in New Zealand have historically been mainly of North American origin (Visser & Harrill 2017). There was a significant decline in North American yarder manufacturing capacity, with many recognised companies such as Pacific, Thunderbird, and Madill either merging or closing towards the end of the 20th century. Many of the machines produced from these companies have been rebuilt and are still working today as there is limited production of new machines by only a few manufacturers (Visser 2013). The results led to an ageing fleet of yarders in both New Zealand and North America.

During the collapse of the forest industry in North America in the early 2000's Madill went into receivership and the Madill factory in Nanaimo closed in 2008. Brightwater Engineers Ltd obtained the rights to build the Madill 124 swing yarder model, building six units from 2012-2014.

In 2011 Nicholson Manufacturing acquired the assets and IP of this leading forestry brand and began manufacturing the machines in Sidney B.C., Canada. Madill Equipment, a Nicholson Manufacturing company, announced in 2015 the completion of the first Madill 124 swing yarder to be manufactured in Canada since 2007.

Over the last 20 years there have been a few domestic yarder manufacturers, but they only represent a small portion of the total population of machines. The Brightwater BE70 and BE85, New Zealand's best known locally made yarders, manufactured by Brightwater Engineers Ltd in Nelson, are still common.

The trend of importing Pacific North-West machines continues in New Zealand, as noted by the dominance in makes and models used. However, there are now new machines being purchased by loggers.

A new competitor for larger scale swing yarders emerged in 2014, the Log Champ LC-550 and LC-650, manufactured by T-Mar Industries Ltd of Campbell River, B.C., Canada.

E.M.S. is the manufacturer of the Harvestline excavator-based yarder. The survey of yarders in 2012 identified only nine excavator yarders, comprising only 3% of the total number of yarders working in New Zealand at the time (Visser 2013). In 2016 E.M.S. manufactured their first three drum Harvestline yarder, based on a Caterpillar 330 excavator. There were 23 excavator yarders identified in the 2018 survey (7% of the total). A recent report reviewed specifications of 13 models of excavator yarder on the market (Evanson, 2016).

There continues to be some retrofitting of older yarders, mainly new cabs and control systems, when they are imported from overseas. Some



New Zealand equipment manufacturers like DC Equipment Ltd and Active Equipment Ltd took this a step further, refurbishing more than the cab and control systems, and mounting overhauled yarder towers on new track bases with new engines and transmissions, justifying the rebranding of models, such as the Falcon 60 and the Active 70 yarders (Campbell *et al.* 2015).

Active Equipment Ltd in Rotorua designed and built three modified yarder models in 2014, loosely based on the original Madill range: the Active 50, based on the Madill 071, the Active 60, with a taller tower; and the Active 70, based on the Madill 172. More recently DC Equipment Ltd in Nelson also released its first yarder, the Falcon 60 Tower Yarder on a Komatsu PC300 excavator base.

In recent years there has been growing interest in the use of smaller and lower cost yarders of European design (Visser *et al.* 2011). There are at least six recognised manufacturers in Europe producing more than 10 machines per year (Wasserman 2017). Historically there have only been a few sled-mounted European yarders (such as the Gantner and Wyssen winch systems) imported into New Zealand, but these found only niche applications (McConchie, 1992).

The advanced technology employed in these yarders manufactured in central Europe, is demonstrated in the Koller K602H yarder from Austria, which was introduced to New Zealand in 2015 (Ellegard 2015, Evanson & Hill 2015, Campbell 2016, Evanson *et al.* 2017).

A recent study has suggested that these smaller European yarders may have suitable power requirements to breakout New Zealand-size trees (Harrill & Visser 2017). The mobility, automation and reduced labour requirements of these smaller yarders is gaining attention as the industry faces labour shortages and transitions towards harvesting smaller forests and woodlots.

CONCLUSION

The New Zealand population of yarders is dynamic and continues to evolve. It is estimated that there are now approximately 318 yarders in New Zealand. The majority of yarders are tower yarders, but there continues to be growth in swing and excavator yarders which together now represent 43% of the population. The import of used machines from the PNW continues and the Madill and Thunderbird makes still dominate the market; the Madill 124 swing yarder is now the most popular model of yarder in New Zealand. However, there is still a demand for new machines, and several manufacturers have recently entered the market (e.g. T-Mar & Koller). Some domestic engineering firms have been competing with new machinery via complete overhaul of used machines with integration of new technology and control systems.

Carriage use has become more common amongst cable logging crews, especially with regard to motorised slack pulling and dropline carriages and the recently developed motorised grapple carriages.

Crew characteristics are diverse in terms of logging methods, accessories and personnel. Perhaps the most surprising change since previous surveys is in the rigging configurations employed. Previous surveys found a heavy reliance on non-carriage based systems like North Bend, scab skyline and highlead. The less practiced configurations like mechanical grapples as used with swing yarders and shotgun/slackline systems using motorised carriages are now the most popular rigging configurations. Newly developed motorised grapple carriages are also widely used.

The industry's aim of fully mechanised cable logging operations is becoming a reality. It is estimated that half of the cable crews in New Zealand (50%) are now practicing some form of grapple extraction and nearly 30% of cable logging operations utilise winch-assisted felling. Accessories to aid safe and productive cable yarding, like electronic chokers and tension monitors, while still in the minority among crews,



are becoming more widely used. The typical New Zealand cable logging crew has an average eight workers. However, there is a wide range from four to 14 workers depending on many factors such as the yarder type, level of mechanisation and two-staging.

Many changes have occurred in the industry in recent years, affecting cable logging crews and the way they operate. Newly developed technology during this period has widely been adopted. The concept of fully mechanised cable logging operations, which was somewhat of a dream several years ago, is now becoming a reality, with almost one in five crews considered to be fully mechanised, in appropriate settings.

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