An Analysis of New Zealand's Import Commodities and Potential Implications for New Zealand's Log Exporters

A dissertation submitted in partial fulfilment of the requirements for the Bachelor of Forestry Science degree with Honours

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Executive Summary

This report found that there is an increasing log vessel supply and a stagnate log vessel supply in New Zealand between 2012 – 2017 for the year ending 30th June. It was concluded that log vessel demand is likely to continue in the near future as China's domestic demand continues to grow as a consequence of the nation's ban for production harvesting of native forests, and the forests planted in the 1990's planting boom nearing maturity. There was no signals of an increasing level of log vessel supply to New Zealand in the near future. Consequently, competition to attain contracts for the use of log vessels is anticipated to grow.

Palm Kernel Expeller, Aluminium Oxide and Phosphates commodities were found to have an average market share of 59.5% of New Zealand's log vessel supply over the observed period. Consequently it is recommended to develop relationships with companies that import these commodities into New Zealand, to acquire inside information about what is happening in terms of log vessel supply. It also allows log exporters to focus their time and resources on a few commodities that have consistently provided the majority market share.

Of the identified key commodities, Aluminium Oxide was found to be relatively constant due to there being one customer in New Zealand for this product. However the other key commodities were relatively more volatile in the log vessel supply in a monthly and quarterly basis. There was found to be no significant relationship between the milk solid price at farmgate and New Zealand's import quantity of Palm Kernel Expeller, despite speculation.

Overall it is recommended that log exporting companies the likes of Pacific Forest Products Ltd. develop long-term contracts with vessel owners as the log vessel competition appears to be continuing on the increasing trajectory. This report also provides some recommendations for further study to be completed in order to better understand New Zealand's log vessel supply.

Acknowledgements

First and foremost, thank you David Evison at the School of Forestry for his supervision, guidance, and encouragement throughout my endeavours to complete this project. This busy man supplied hard questions, harder answers, and timely reminders and assurances throughout my dissertation.

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I would also like to make a special mention to Andy Wright at Pacific Basin Shipping Ltd for supplying industry information and expertise. I truly appreciate people like Andy who assist with research development that requires sharing information, this would not be possible without people like yourself, thank you.

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- Ports of Auckland
- Port of Tauranga
- Port Taranaki
- PrimePort Timaru
- South Port

Thank you to the Ngāi Tahu Research Centre and the NZIF Foundation Otago-Southland Award committee who acknowledged my studies as worthy to receive sponsorship. The financial assistance reduced the financial burden associated with gaining a university education before Aunty Jacinda took over the reins.

Finally, thank you to my family, friends and colleagues who have been an irreplaceable support crew and at times recipient of my variable moods. I will look fondly upon the memories and friends made in my undergraduate journey.

Chop it.

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1. Introduction

1.1. Background

New Zealand's forestry industry is currently its 3rd highest income earning industry, with a large proportion of the forestry industry revenue generated from exporting logs. New Zealand is the 2nd largest log exporter in the world following Russia, but solely depends on geared bulk vessel (hereafter known as log vessel) transportation to get forest products to the overseas markets. This places a large importance for the industry on having information to identify if there is a sufficient supply of log vessels to export logs, and whether it will be necessary to arrange alternative log vessels.

Log exporting companies have three options when it comes to organising transportation: 1) contacting log vessel owners who have their vessels open on New Zealand's shores; or create either 2) short-term, or 3) long-term time charter contracts with log vessel owners who have their vessels positioned overseas. The two latter options have relatively larger transportation distances associated with them, as they need to be ballasted to New Zealand before loading. Consequently, they have larger transportation costs per cubic metre, which results in the log exporting company having smaller profit margins and a relatively smaller competitive advantage when compared to using log vessels open on New Zealand's shores. Long-term contracts also risk this through an agreed freight rate which is fixed higher than the future market rate.

1.2. Purpose and Research Questions

The purpose of this study is to investigate the quantity of relevant commodities being imported into New Zealand in log vessels in recent years, to predict if log vessel supply is sufficient to meet log exporters' need to get their products to New Zealand's overseas log markets. With this information, seasonal and overall trends will be outlined for key commodities, which will highlight any associated implications in the near future, so log exporting companies can anticipate these. Finally, to help log exporting companies identify market signals for log vessel supply in the near future, this study aims to outline drivers influencing the key commodities. This report will achieve this by answering the following questions:

1. Has New Zealand's log vessel availability trend been declining, stagnating or growing over the past five years?
2. What is the likelihood of log vessel supply increasing in the near future?
3. Are there seasonal trends significantly affecting log vessel supply to New Zealand's ports?
4. What economic and other drivers affect log vessel supply to New Zealand?

This study was conducted in support from Pacific Forest Products Ltd. (PFP), a company that specialises in export log marketing and logistics. With this information, this report will make relevant recommendations to the log exporting industry on the how to address some of the implications highlighted.

2. Literature Review

This literature review provides a broad insight regarding the key factors relevant to logger vessels and their associated stakeholders. This will provide context on how log vessel supply is achieved in New Zealand, while also outlining the key strengths and weaknesses of previous studies relevant to analysing New Zealand's log vessel supply.

This study aims to describe New Zealand's recent log vessel supply and the associated drivers affecting this supply. The topics reviewed in this section of the report identify the relevant log vessel characteristics; log volume to weight conversion factors; non-log commodities that are transported by the type of identified vessels; external factors affecting vessel supply; and historic studies completed with similar aims on a national and global basis.

2.1. Log Vessel Characteristics

Log vessels are described as single-deck vessels with up to five holds/hatches intended for dry storing a single solid bulk commodity, which is not a liquid or gas. Fitted with up to four cranes, log vessels are categorised as "geared", meaning the vessel can self-load and unload independently (International Maritime Organisation, 2011). Log vessels generally fall in the 'handysize' and 'handymax' categories, which have load capacities ranging between 10,000 – 65,000 deadweight tonnes (DWT) (Bulk Carrier Guide, 2010). Since weight capacity is not achieved with hold storage alone, log vessels are fitted with collapsible stanchions and lashing

points to safely secure an above deck load (International Maritime Organisation, 2011). The International Load Line/Plimsoll Line is located amidships and outlines a vessel's load capacity when travelling through parts of the globe, as shown in Appendix 1. Log vessel are considered general cargo carriers.

2.2. Commodities Transported in Log Vessels and Cleaning Requirements

Due to log vessels being general cargo carriers, they require cleaning between changes of cargoes in the holds, as per contractual agreement between parties. The principle cargoes transported by log vessels are cements, coals and cokes, fertilisers, forest products, grains and agricultural products, metals, and minerals (Bulk Carrier Guide, 2010). Due to various cargo types transported within log vessels, there are multiple methods used to remove residue substances from the cargo holds after transportation. However, the fundamental rule applying to all cargo types is that cargo holds must be cleaned to the highest standard possible, regardless of the subsequent commodities that will be transported by the vessel (Marine Fuel and Marine Engine Users, 2017).

Standard hold cleaning procedure is shovelling and sweeping the holds prior to washing, reducing residue accumulating in bilge's pumping system. Caution must be taken with some commodities (i.e. cement) where constant water supply must be maintained to ensure no residues remain internally within pipes, pumps and/or valves (Spencer, et al., 2011). The hold's structure is another factor to consider. Large coaming frames can range up to the height of the hold dependant on ballast tank positions. These coaming frames are notorious for retaining cargo residues, especially in difficult access areas, as shown in Figure 1. If not properly removed, there is risk of future cargo contamination (Ministry for Primary Industries, 2010).

Figure 1: Cargo residue from previous load caught in coaming frame *(Spencer, et al., 2011)*.

The hold's drying time varies due to factors like the vessel's draught ventilation system, local weather, and sea and ballast water temperatures. If not carefully managed, there is risk of condensation which could lead to future cargo contamination (Maritime New Zealand, 2017). If the vessel is transporting agricultural food products, holds can be required to be fumigated prior loading to irradiate any invertebrates that may have been present. Once the fumigation has occurred, access to the hold is restricted until the final inspection to acquire the Vessel Certificate (Ministry for Primary Industries, 2010).

Once all holds are cleaned, dried and if required, fumigated; the Chief Officer performs a full and final inspection before being presented to the owner, who checks if the vessel has been returned in a satisfactory condition as per the contractual agreement (Spencer, et al., 2011).

2.3. Charter Contracts

The two prominent vessel chartering methods are voyage and time charter party contracts (Chernoshtan, 2016). In both scenarios, the vessel owner runs the day-to-day vessel business throughout the period of the contract, however, the charter party is responsible for loading and unloading the vessel at ports with the commodities outlined in the contract.

2.3.1. Voyage Charter Party Contract

The voyage charter party contract has been the most common form of chartering in recent years, which is when the vessel is hired for a one-way journey that goes through a route that has been previously agreed upon by the vessel owner and the charter party (Kimball, 2001). The charter party must detail which ports the vessel will be loaded and unloaded from, the laytime or associated period taken to complete this and specify the cargo type and amount that will be transported above and below deck. The vessel owner accounts for these factors which are reflected in a freight rate per cubic metre, which is agreed upon by all parties (Chernoshtan, 2016). If laytime is exceeded, the charter party must pay demurrage charges to the vessel owner, which is a form of liquidated damages for breaching the specified laytime (Intermarine, 2018). There are exceptions to this rule, where non-human events prevent business operations. This charter contract is relatively less flexible.

2.3.2. Time Charter Party Contract

The time charter party contract is a relatively flexible transportation method, as the vessel is chartered for a specified period where the charter party directs the vessel to any ports within a specified geographical zone (Isbester, 1993). The charter party pays for all transportation and port costs as well as the daily hire amount to the vessel owner and must adhere to agreed load capacity and maximum vessel speed (Plomaritou & Papadopoulos, 2017). If the vessel is used outside of the specified period, demurrage charges apply. When the charter party has completed the specified vessel use, the vessel is fully resumed to the owner's liability (also known as redelivered), when positioned in a specified geographical zone in the original condition (Intermarine, 2018). The redelivery zones are unique to vessel owners, from their relationships with other charter parties (Fearnley Consultants AS, 2012).

2.4. Log Volume to Weight Conversion Factors

Log exporters are paid on a Japanese Agricultural Standard (JAS) volumetric basis, but log vessels are loaded on a tonnage basis (International Maritime Organisation, 2011). A true volume-to-weight conversion is affected by multiple factors, making it difficult to accurately replicate in different climates and areas of New Zealand (Ellis, 2016). The driving factors are tree age, the temperature and climate it was harvested and stored in, the amount of bark remaining, the storage period, and the log size (Ellis, 2016; Mercker & Taylor, 2013; Visser, Berkett, & Spinelli, 2014). To create an accurate conversion factor, log truck tare weights were calculated using weighbridges at check point stations prior to unloading at ports (Ellis, 1993).

2.5. External Factors

A number of external factors that have increased bulk vessel demolitions and reduced the number the bulk vessel construction, which has consequently observed a slowing growth rate in the global vessel supply (Affinity Shipping LLP, 2018). This decreasing vessel supply has been trending since 2012 and is forecasted to continue in the near future, which will subsequently continue to push up freight rates (Affinity Research LLP, 2018).

Biofowling and ballast discharge have become increasingly more difficult to do in New Zealand since September 2017 (The Maritime Executive, 2017), as industry regulations are tightening to reduce the risk of invasive marine species being transported by vessels (Koch, 2015). Tighter emission regulations and increasing bunker prices are also having a significant impact on the costs of vessel transportation around the globe (Affinity Research LLP, 2018). Collectively, these factors are making it very difficult to meet the requirements to be fit for purpose. Consequently the older vessels are tending to be deconstructed rather than upgraded as the costs to get them to seaworthy specification, far exceeds the potential benefits (Koch, 2015).

The reduction in the global fleet in recent years has been observed by an increase in the Baltic Dry Index (BDI), which is a shipping and trade index that measures the costs of transporting various commodities in dry bulk vessels (United Nations Trade and Development, 2015). The BDI is often used as an economic indicator of global supply and demand trends (Bildirici, Kayıkçı, & Onat, 2015).

2.6. Previous Studies

There were no New Zealand studies conducted of a similar nature to this report. Both the Ministry of Transport, (2016) and Grimmond, Bell, & Yap (2014) recognised that a study of this nature is a necessities to improve the utilisation of New Zealand's primary industries, and to lift the productivity and profitability within individual industries. The Deliotte (2018) report offered insights in to port performances, efficiencies and growth around New Zealand.

2.7. Literature Learnings

This literature review identified that industry bodies have recognised a need for a project of this nature to be conducted, as currently there is no information available on a national basis. By reviewing fundamental factors affecting bulk vessel operations, an understanding of the vessel processes and the associated fluctuations affecting vessel supply was developed.

Using the research suggestions, this study will be performed in a hybrid manner by utilising both private information acquired from ports and public information provided from Statistics New Zealand and the Ministry for Primary Industries. This innovative approach will combine all

available information in attempt to provide industry insight, which has been outlined by multiple industry bodies as necessary information required to continue development in New Zealand's log exports. This insight will focus on estimating the log vessel demand and supply in recent years.

3. Method

This report aims to identify if there has been sufficient vessel supply in recent years to accommodate for New Zealand's log exports to the overseas markets. To identify if there has been sufficient supply in recent years, the demand had to first be estimated. Using the information outlined in the literature review, the quantity of commodities identified to be imported into New Zealand in log vessels was extracted using a hybrid method from both public and private sources. This data was further investigated by identify trends in the key commodities and respective drivers that significantly impacted New Zealand's log vessel supply over the observed period. This section of the report details the methodology used for this process. All data analysis was conducted using Microsoft Excel.

3.1. Historic Geared Bulk Vessel Demand

To identify if New Zealand has been importing an adequate quantity of commodities on log vessels, the total amount of log vessels required needed to be calculated. This was achieved by using MPI data for log exports only, on a quarterly basis over the 2012 – 2017 period (Ministry for Primary Industries, 2017). This data was given in a cubic metre format, which required conversion into weight as vessels are loaded on a weight capacity basis.

3.1.1. Conversion Factor

As mentioned in section 2.4, the volume to weight conversion rate has multiple factors that result in different conversion rates at different times and/or areas of New Zealand. Using log vessel departure condition reports supplied from PFP, conversion rate factors were analysed for various seasons in New Zealand's North and South Islands, as moisture content varied across seasons and geological areas. The conversion factors were prepared so they could be multiplied across the respective quarterly MPI log data, which was given in cubic metres. This allowed an estimate of individual ports' and New Zealand's total log exports by weight, which was comparable to a vessel's load weight capability.

3.1.2. Geared Bulk Vessel Load Capacity

The average load capacity of a log vessel was calculated using information provided from Pacific Basin Shipping Limited, detailing load capacities for each of the 1,251 log vessels around the globe. The vessel's load capacity was calculated by removing the following variables from the total weight capacity of the vessel, which is the maximum weight that a vessel can be to be considered safe to journey across the international water zones:

- Fuel oil
- Diesel oil
- Fresh water
- Ballast water
- Constants (i.e. weight of crew, clothes and safety gear, food, lashings, stanchions etc.)

3.1.3. Historic Geared Bulk Vessel Demand

Using the average load capacity of log vessels and New Zealand's estimated historic log export weights by port, the number of log vessels for New Zealand over the observed period was estimated on a seasonal and annual basis, which effectively is New Zealand's vessel demand over the observed period to export logs to the international markets. Using this information, vessel demand by port and island was also identified.

3.2. Historic Geared Bulk Vessel Supply

From the identified commodities discussed in section 2.2 and the data provided from some of New Zealand's importing ports, the relevant commodity import data over the observed period was extracted from Statistics New Zealand. The data was categorised to outline which commodity types were relatively more significant to New Zealand's log supply:

- Coals and Cokes
- Fertilisers
- Forest Products
- Grains and Agricultural Products
- Metal Products
- Mineral Products
- Sugars

The commodity quantities given in kilograms were converted to tonnes and then into the amount of vessel supply over the respective seasons by dividing the seasonal amount by the average log vessel size.

3.3. New Zealand's Log Vessel Market

Using the log vessel supply and demand data, observations were made for the respective vessel trends over the observed period. Using this information, the first two research questions will be satisfied by drawing conclusions for the log vessel market analysis.

3.4. Identification of Key Commodities

Using annual data of the commodities identified to be imported into New Zealand in log vessels over the observed period, key commodities were highlighted as those who supplied at least ten log vessels to New Zealand annually. This provided a means of simplification for analysing the commodities respective trends and drivers.

The key commodities then had their respective market share compared against the total quantity imported into New Zealand for the identified commodities that are transported of log vessels. This allowed an observation of the key commodities respective levels of variation, and the market share they held for the total quantity of imports from the identified commodities. With this information, commodity significance on New Zealand's log vessel supply in the near future could be commented on by the consistency associated with each identified key commodity.

3.5. Key Commodity Trends

This report then focused on identifying the key commodity's respective import trends between the observed periods, to identify any possible annual or seasonal trends. By identifying this, a better understanding of the commodity was developed, which was used to highlight to the log exporting industry why there are peaks and troughs in New Zealand's log vessel supply at various periods throughout the year, and how this information could be used to better understand log vessel supply in the near future.

3.6. Key Commodity Drivers

This section of the report focused on better understanding the influential drivers of respective key commodities that bring log vessels to New Zealand's shores. By extracting relevant commodity data on using the regression function on Excel, the relationship between import quantity and direct and indirect factors were observed to see the various levels of influence they had respectively.

4. Results

The results section details the findings of New Zealand's log vessel demand and supply over the observed period, and provides further analysis of key commodity trends and attempts to identify their respective drivers.

4.1. Historic Log Vessel Demand

This section estimates New Zealand's log vessel demand over the observed period. This was achieved by using a series of log vessel loading reports throughout New Zealand's ports to observe the respective cubic metre to weight conversion factor and finding the average log vessel's load capacity. Using the respective conversion factors, the public log export data was converted from cubic metres to DWT.

4.1.1. Conversion Factor

The average conversion factors estimated for the North and South Island over the various seasons is shown below in Table 1, which shows that logs at the time vessel loading are heavier throughout the spring and winter. This aligns with Ellis (2016) and Mercker & Taylor (2013) findings, as mentioned in the literature review section 2.4, due to a relatively wet and humid climate which subsequently increases the moisture content of logs. Table 1 also shows that logs loaded onto vessels in the South Island were relatively heavier per cubic metre than those in the North Island, which is due to the colder climate and relatively slower drying rates as aforementioned in literature review section 2.4.

Table 1: New Zealand's DWT per cubic metre conversion factors at various seasons.

Season	North Island Conversion Factor	South Island Conversion Factor
Autumn	0.962	1.028
Summer	0.940	1.007
Spring	0.970	1.042
Winter	1.010	1.058

4.1.2. Log Vessel Load Capacity

As discussed in the literature review section 2.1, log vessels have a significant range in load capacity. To estimate the quantity of vessels required to export New Zealand's logs to the overseas markets, a standardised vessel size was required. Figure 2 illustrates the size proportion and respective construction years for the 1,251 log vessels that were situated around the globe, as at January 2018. From this, it is observed that vessels come in different loading capacities ranging from 10,033 to 61,590 DWT. The average log vessel load capacity was 31,887 DWT, which was used for the purpose of this study as the standard log vessel load capacity.

Table 2 shows an estimate of how many cubic metres can be stowed on the average log vessel size of 31,887 DWT throughout the different seasons of the year in New Zealand's outlined main islands. Dependant on season, and location grown and loaded, there can be up to 3,783 m^3 or 12.6% difference in a log vessel's load. A smaller log volume quantity results in a relatively higher transportation cost per cubic metre.

Table 2: Estimate of true log volume on the average log vessel for various seasons on New Zealand's North and South Islands.

Season	North Island's load capacity (m^3)	South Island's load capacity (m^3)
Autumn	33,147	31,018
Summer	33,922	31,665
Spring	32,873	30,602
Winter	31,571	30,139

Figure 2 also shows the 85.7% or 1,072 of the fleet has a 25 – 40 DWT load capacity, of which 48.5 percentage points fall in the 2010 + construction category suggesting this is where the future log vessel load capacities will be focused around, as vessels are increasingly designed and constructed with superior performance abilities when compared to vessel constructed in the

2000 – 2010 category. This finding is supports the discussion in the literature review section 2.5, where it has been documented that handysize and handymax vessels load capacities are increasing, but the quantity of constructions per year are decreasing.

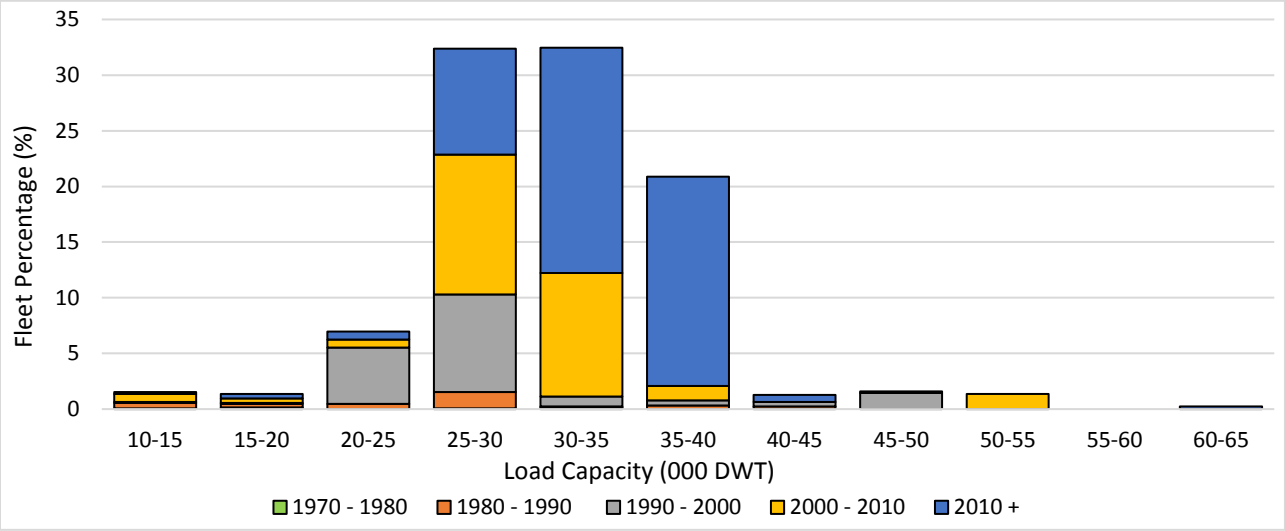

Figure 2: Global logging fleet load capability by age class as at January 2018.

4.1.3. Log Vessel Demand

Another factor discussed in the literature review section 2.5 that should be considered when defining a standardised log vessel size is destination countries. Due to the sea water density and associated buoyancy levels not being constant around the globe, there are various load capacities. These load capacities are dependent on where the log vessels are loaded, the route taken to get to the customer countries, and where the cargo is unloaded. Appendix 1 illustrates the highest Plimsoll Line log vessels can be loaded to for deliveries to New Zealand's main customer countries shown in Figure 3, is consistently the summer line. Subsequently the loading capacities for log vessels in terms of Plimsoll Lines are constant throughout New Zealand.

Figure 3 shows New Zealand's total and softwood log export weights, which subsequently shows the level of hardwood export weights through the difference between them, over the observed period. These values were generated using the volume to weight conversion factors shown in Table 1, and shows that over the observed period, New Zealand exported an average total log quantity by weight of 64.5% and 87.9% to China and the main exporting countries respectively.

Consequently, this is where the chartered vessels will predominately be redelivered to vessel owners. The secondary y-axis on the right shows the quantity of log vessels required to export New Zealand's logs, effectively representing New Zealand's log vessel demand. Overall there is an increasing level of vessel demand over the observed period, which has been predominately driven by log exports to non-main log exporting countries, shown through the increasing trend line gap between the 'Main Exporting Countries' and 'Total Log Exports' series.

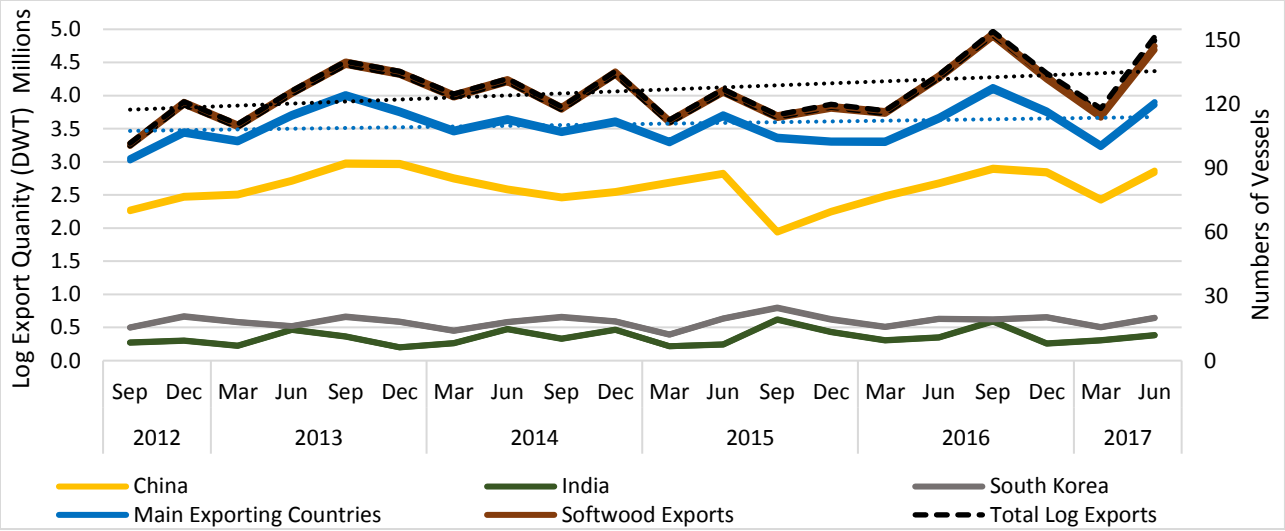

Figure 3: New Zealand's log export quantity from 30th June 2013 - 2017 (Te Uru Rākau, 2018).

Figure 4 shows New Zealand's total and island log vessel demand, illustrating the majority of the log vessel demand is in the North Island. Over the observed period New Zealand's quarterly log vessel demand ranged between 102 – 154 vessels and required an average of 126 log vessels per quarter. Of New Zealand's quarterly log vessel demand, the North Island's vessel demand ranged from 84 – 117 vessels, with an average of 99 log vessels per quarter.

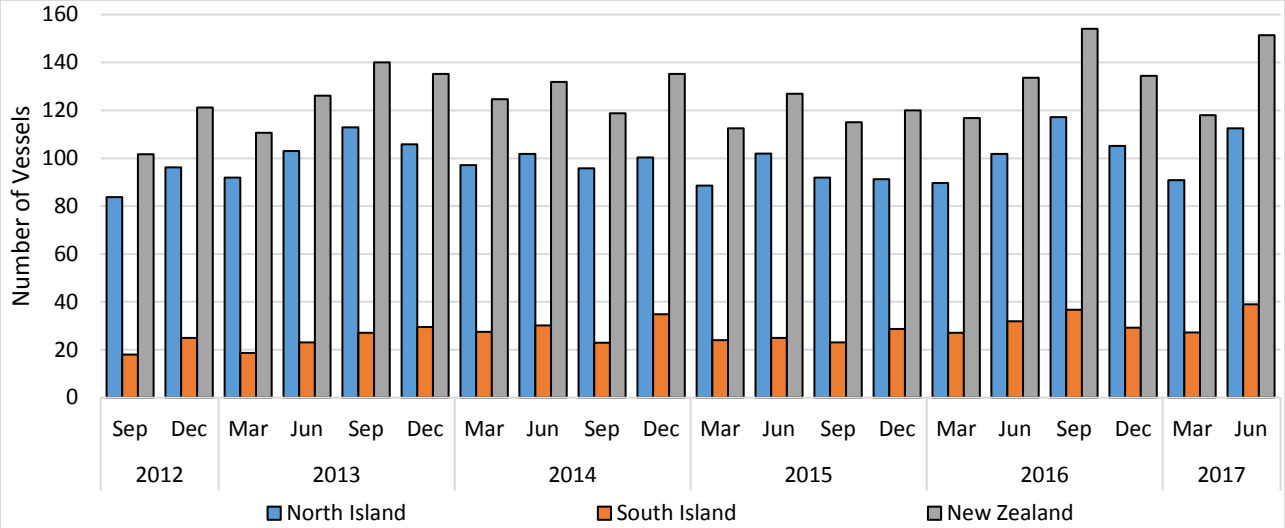

Figure 4: New Zealand's total and island log vessel demand over the observed period *(Te Uru Rākau, 2018)*.

To estimate where log vessel demand will be greater within New Zealand, Figure 5 shows New Zealand's total and individual port log exports by weight over the observed period. Figure 5 shows a significant proportion of New Zealand's log exports by weight are consistently loaded from Tauranga, Whangarei and Gisborne. This suggests these ports are where log vessels are likely to have the strongest demand for in the near future as the other ports are significantly lower in the level of log exports by weight.

As China's domestic demand for timber continues to increase as a direct result of their natural forest harvesting ban in early 2016 (Clever, 2017), and New Zealand continues to harvest the mature forest blocks that were planted in the 1990 planting boom in this current period of high log prices (Ministry for Primary Industries, 2017), it is likely that the demand for log vessels, port space, and infrastructure will continue to increase (Evans, 2018).

The steep change in log export quantity by weight at the Port of Tauranga in 2016 was a result of the significant decrease in China's log demand between the June – September quarters shown in Figure 3. This was driven by China being momentarily oversaturated with logs that were domestically supplied prior to the banning of their commercial logging in natural forests (Clever, 2017).

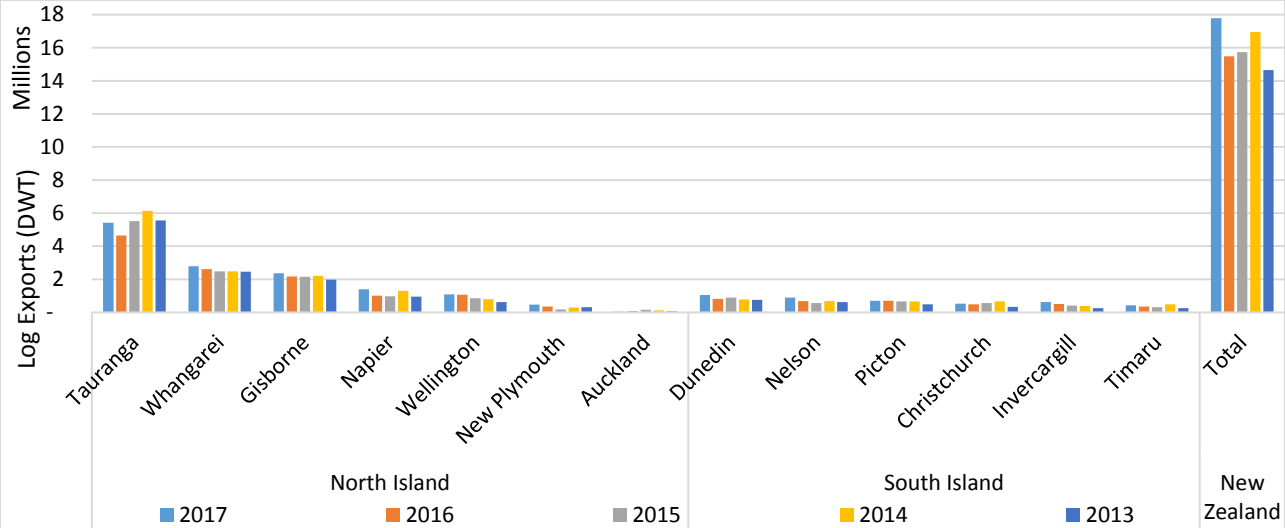

Figure 5: New Zealand's total and port log exports by weight for years ending 30th June 2013 – 2017 *(Te Uru Rākau, 2018)*.

Even though the Port of Tauranga is clearly New Zealand's largest log exporting port, Figure 6 shows that over the observed period, there is a decreasing trend in the log export market share for Tauranga, Whangarei and Gisborne who are New Zealand's largest log weight exporters by port, as shown in Figure 5. This is predominantly due to other ports increasing their respective level of log exports by weight, with exception to Ports of Auckland. From Figure 6, it is observed that the three largest ports have had an average of 63.4% of New Zealand's total log exports by weight over the observed period, suggesting this is where New Zealand's log vessel demand will be focused around.

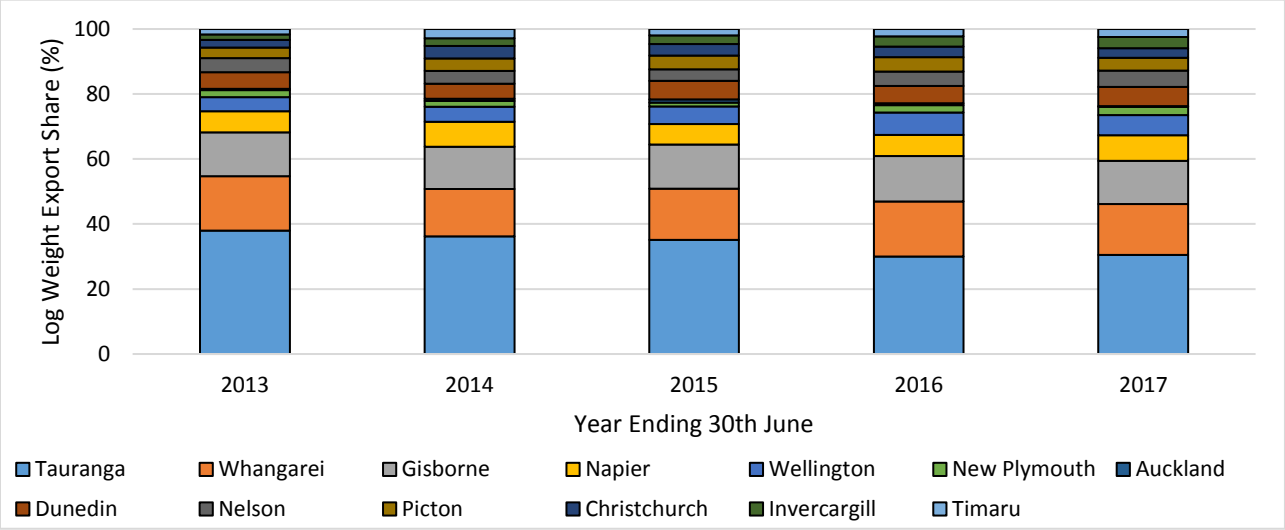

Figure 6: New Zealand's port log exports by weight for years ending 30th June 2013 – 2017 *(Te Uru Rākau, 2018)*.

4.2. Historic Log Vessel Supply

By extracting relevant commodity data from Stats New Zealand (2018), an estimate of New Zealand's log vessel supply was estimated over 2012 – 2017. Figure 7 shows New Zealand's log vessel supply for individual commodity categories and the overall total. Figure 7 highlights the 'Grains & Ag' and 'Minerals' commodity categories provide the largest log vessel supply to New Zealand, while the 'Forest' commodity is virtually non-existent over the observed period. An interesting observation to note is the sudden decrease in New Zealand's log vessel supply between the March – June quarters in 2016. This was largely driven by 'Grains & Ag', and was also observed in the 'Minerals' and 'Fertiliser' commodity categories.

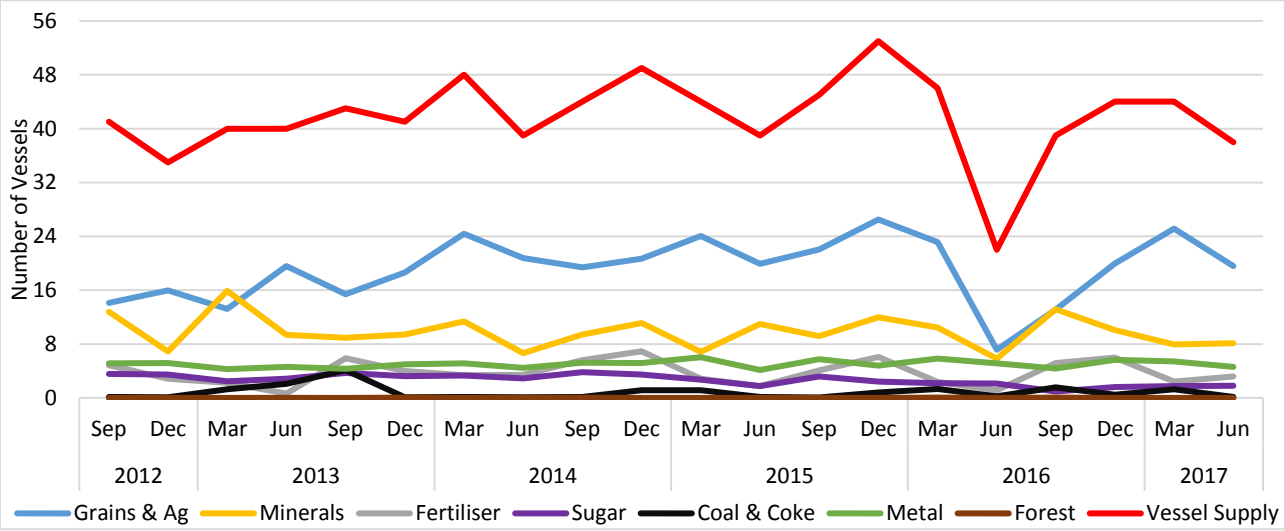

Figure 7: New Zealand's log vessel supply over the observed period *(Stats NZ, 2018)*.

4.3. New Zealand's Log Vessel Market

Using New Zealand's log vessel supply and demand estimates, the log vessel market is identified as shown in Figure 8, which highlights New Zealand's log vessel demand is significantly greater than the log vessel supply to New Zealand. Figure 8 also illustrates the New Zealand's log vessel demand has been increasing over the observed period, while log vessel supply has been stagnant as shown by their respective trend lines.

Under the assumption that all vessels supplying the identified commodity categories are solely used to export logs, then over the observed period, there was an average ratio of 2:1 ballasted vessels required for every readily available log vessel on New Zealand's shores. This means that on average, New Zealand was only able to supply one third of the log vessels required to export logs to the overseas markets, and had to ballast the balance from overseas. Due to the increasing trend in log vessel demand and a stagnant supply of log vessels to New Zealand, the number of ballasts required over the observed period having been increasing, as shown in Figure 8. Consequently, this would have increased the transportation costs for New Zealand's log exporters over the observed period, potentially reducing their competitive advantage if they were unable to source any of the log vessels that were open on New Zealand's shores.

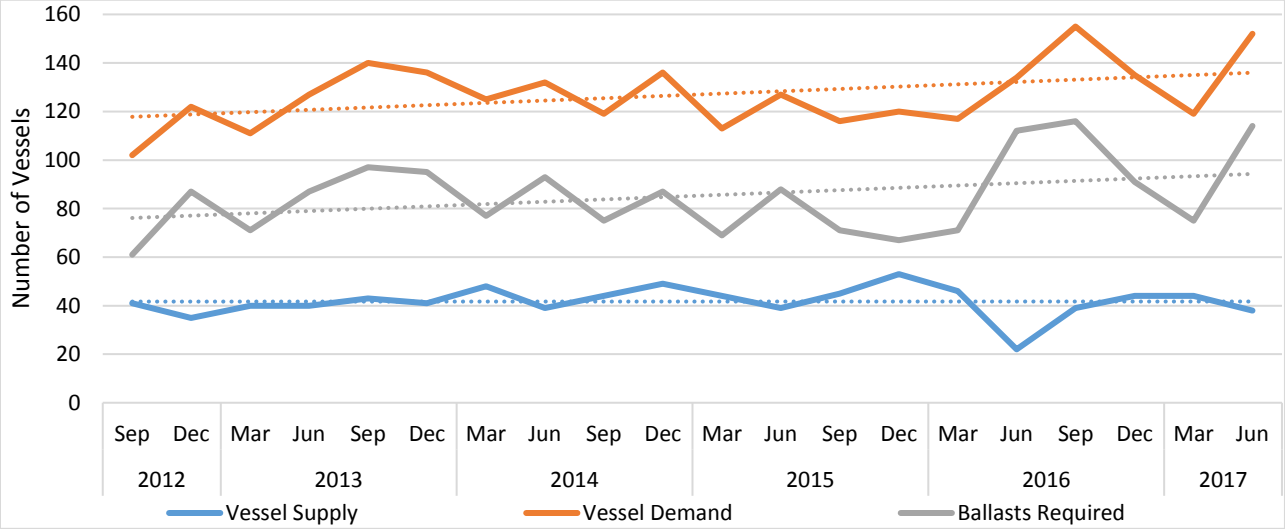

Figure 8: New Zealand's log vessel market over the observed period (Stats NZ, 2018; Te Uru Rākau, 2018).

4.4. Key Commodity Identification

For New Zealand's log exporters to be able to anticipate a significant change in log vessel supply, or to provide a means of sustained log vessel supply monitoring with minimal effort, log exporters need to know which individual commodities provide a significant proportion of log vessel supply to New Zealand. Figure 9 illustrates this over the observed period by outlining which individual commodities provide at least ten log vessels (red vertical line) to New Zealand annually, through their respective commodity demands.

Figure 9 shows these individual commodities are ‘Aluminium Oxide’, ‘Palm Kernel Expeller’ and ‘Unground Phoshpates & Chalk’. By looking out for key market signals from these commodities and/or generating dialogue with importing companies of the outlined commodities, log exporting companies could potentially reduce their transportation costs by knowing how many log vessels are going to be open on New Zealand’s coast at various periods throughout the year and where these log vessels are going to be located when completely unloaded.

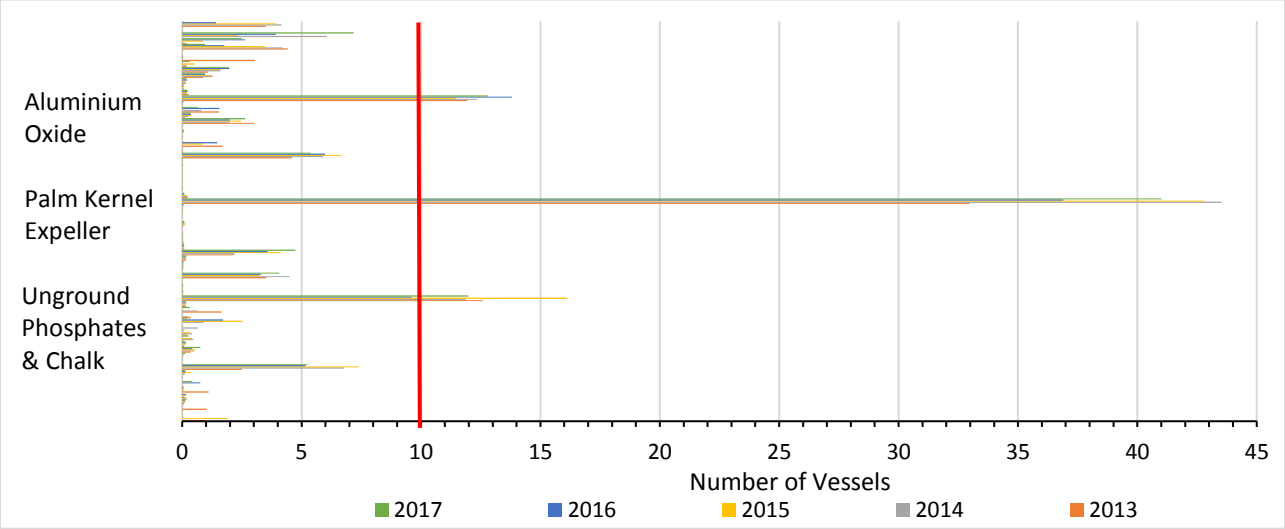

Figure 9: New Zealand’s log vessel supply by the individual commodities over the observed period *(Stats NZ, 2018)*.

To observe the significance of the identified key commodities shown in Figure 9, from the total level of commodities imported into New Zealand in log vessels, the respective market shares were identified on a yearly basis. This is shown over the observed period in Figure 10.

The three identified key commodities are observed having market share variability over the observed period, but hold a 59.5% average of all identified commodities over the observed period. This suggests that these three commodities alone can significantly impact New Zealand’s log vessel supply if their respective economic drivers were to change in the near future. By focusing on developing an understanding of the respective commodities markets and building relationships with the associated New Zealand importers of these commodities, log exporters will be able to provide a relatively means of log vessel supply to New Zealand, with minimal expenditure of time and resources.

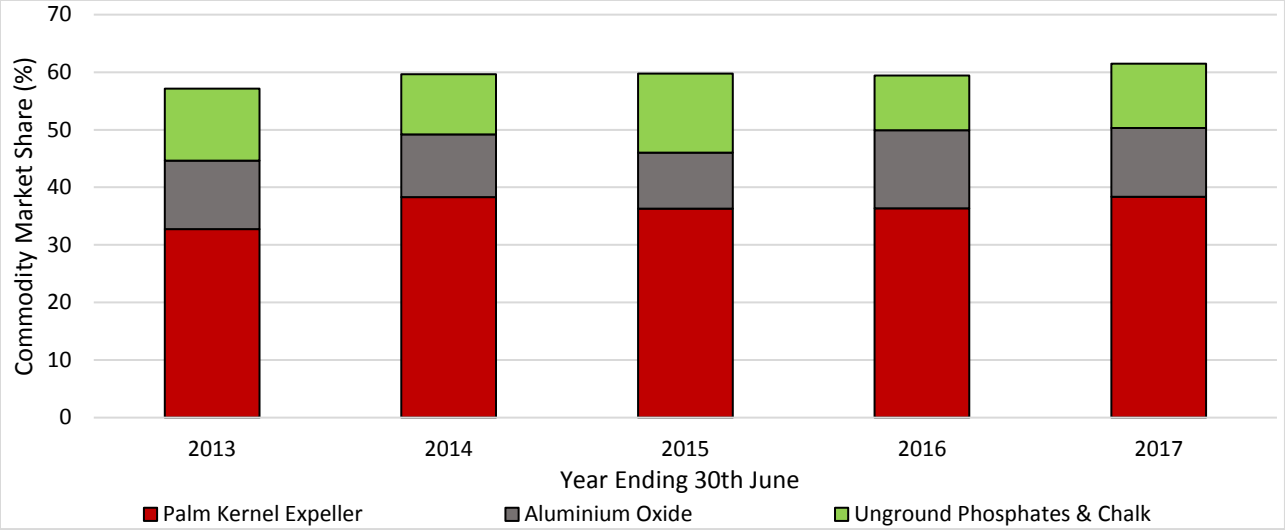

Figure 10: Key commodity market share of the identified commodities imported into New Zealand in log vessels over the observed period *(Stats NZ, 2018)*.

Table 3 shows the three key commodities respective change in market share, as a percent of the total quantity of identified commodities being imported to New Zealand in log vessels. Table 3 shows the three key commodities respective market shares are relatively volatile individually, but provide a relatively constant combined market share over the observed period as shown in the 'Total' row. For example, in 2015 when the 'Palm Kernel Expeller' and 'Aluminium Oxide' commodities significantly dropped their respective market shares, the balance was made up by a significant increase in the import quantity of the 'Unground Phosphates & Chalk' commodity, which had a significant increase in import quantity, as shown in Figure 9.

Table 3: Key commodity change in market share of the identified commodities imported into New Zealand in log vessels over the observed period *(Stats NZ, 2018)*.

	2013	2014	2015	2016	2017
Palm Kernel Expeller	-	16.9%	-5.2%	0.1%	5.5%
Phosphates	-	-16.5%	31.2%	-31.0%	18.4%
Aluminium Oxide	-	-8.3%	-10.6%	39.8%	-12.1%
Total	-	4.4%	0.2%	-0.6%	3.5%

4.5. Key Commodity Trends

This section of the results looks at identifying recent trends in the key commodities that are imported into New Zealand in log vessels, to make inferences on the likelihood of vessel supply to New Zealand by the respective commodities in the near future. Figure 12 illustrates the key commodity imports by vessel number on a yearly basis over the observed period. From this, it is observed that the 'Palm Kernel Expeller' commodity increased the quantity of vessels through increased imports between the 2013 – 2014 periods, where it has remained relatively stable since. It is worth noting the even though this commodity experienced a trough in import quantity between March – June 2016 as shown in Figure 13, there was little difference between the surrounding years. This was mainly balanced by the peak in the commodity's demand observed in December 2015.

Another result that should be noted is the relatively constant quantity associated with the 'Aluminium Oxide' commodity. Due to New Zealand only having one customer/aluminium smelter located at the bottom of Southland at Tiwai Point, the demand for this commodity is relatively constant when compared to the other commodities. For this reason, log exporters should be relatively confident that the quantity of log vessel supply should remain consistent in the near future, as New Zealand's Aluminium Smelter have made no signals of closing in the near future (New Zealand's Aluminium Smelter, 2018).

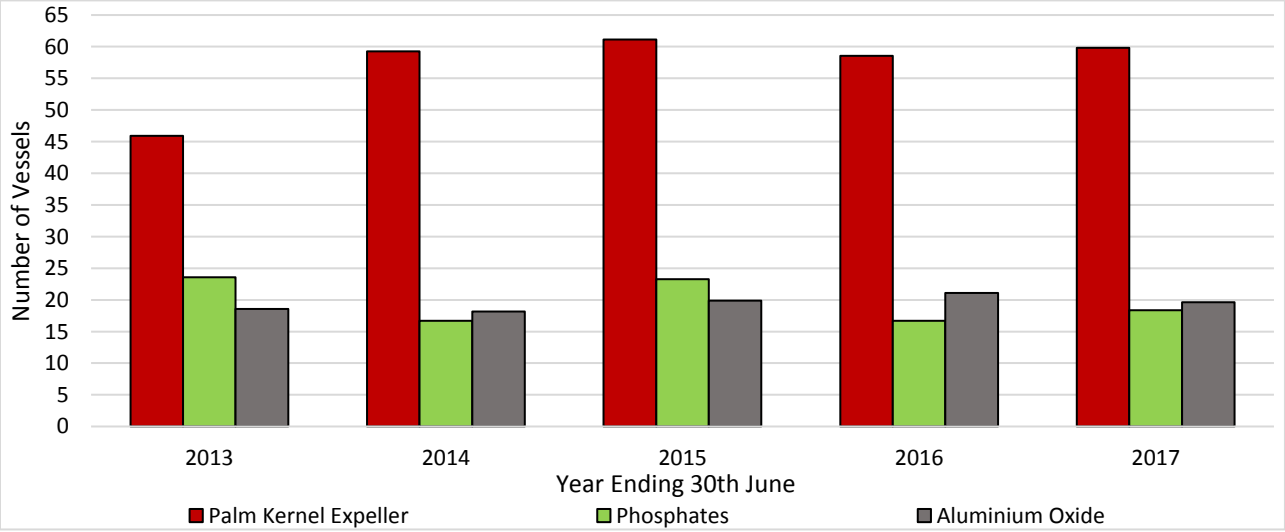

Figure 12: Key commodities imported into New Zealand in log vessels on a yearly basis over the observed period.

Figure 13 illustrates the key commodities imported into New Zealand in log vessels on a monthly basis over the observed period, and illustrates the 'Aluminium Oxide' commodity being relatively more consistent in terms of the number of vessels it brings to New Zealand through imports. Over the observed period, this commodity has an increasing trend line,

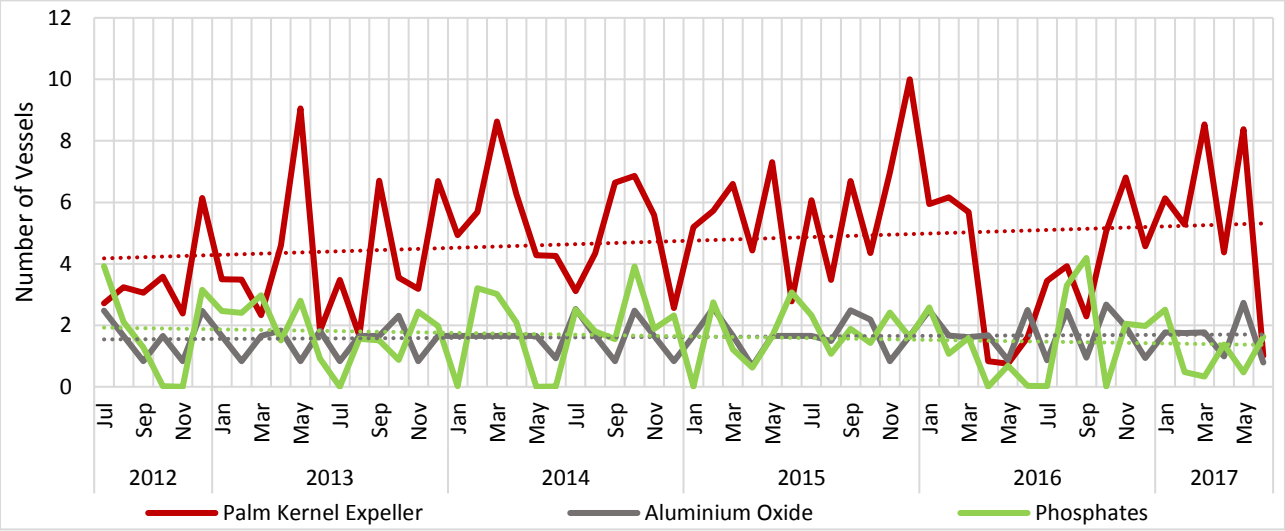

Figure 13: Key commodities imported into New Zealand in log vessels on a monthly basis over the observed period.

4.6. Key Commodity Drivers

Due to 'Palm Kernel Expeller' being the most significant commodity imported in log vessel to New Zealand, this report attempted to better understand the causal factors. Figure 14 illustrates that there was no significant relationship found between the price of milk solids at the farm gate and the quantity of the significant commodity being imported to New Zealand. This was shown in Figure 14 through two behaviours. The first being that the R^2 values for both the monthly and yearly data were low, which is a result of a weak fit/large distribution from the trend line.

The second behaviour in Figure 14 was that there was no increase in the monthly commodity import level as the price of milk solids at the farmgate increased. If a consumer's purchasing power is increased through their product increasing in value, then consequently the consumer has a larger means to purchase more of the commodity. Alternatively, the yearly commodity import level was shown to decrease as the consumer increased their purchasing power, which does not make sense in a real world situation.

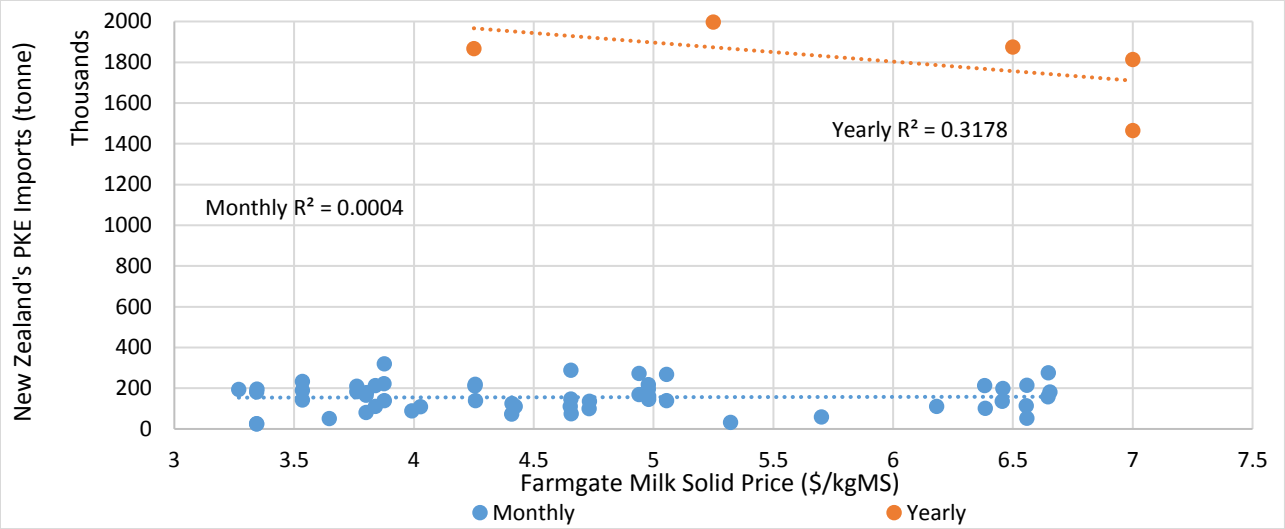

Figure 14: Regression analysis of the effect of milk solid prices at farmgate on New Zealand's Palm Kernel Expeller import quantity *(New Zealand's Exchange, 2018, Stats NZ, 2018).*

5. Discussion

Log vessel demand has been increasing over the observed period. This growth in vessel demand is being experienced throughout New Zealand's ports, however the main vessel demand in the near future is likely to be based around Tauranga, Marsden Point and Gisborne, as their existing facilities and infrastructure have proven to be relatively more capable of handling larger throughput quantities over the observed period.

The converted true log volume loads per average vessel size shown in Table 2, suggested that dependant on the season and geographical location where a log vessel was loaded, there was potential to store up to 3,783 m^3 more. For this reason, it is recommended that log exporting companies target the use of ballasts in the summer and autumn seasons in the North Island where possible, as the added transportation costs associated with ballasting will be spread over a greater volume quantity. This will reduce the added cost per cubic metre, which will reduce the impact on the log exporter's competitive analysis.

Due to China making it illegal to production harvest their native forests, their domestic markets remaining strong and their subsequent log demand increasing, the log prices have remained on a high in recent years. These high log prices are driving the log exports and is anticipated to continue into New Zealand's mature production forests from the 1990's planting boom. Consequently, the increasing trend in log vessel demand is expected to continue in the near future.

Over the observed period, log vessel supply varied considerably on a monthly and quarterly basis, but the overall trend was stagnant. Consequently there was an increasing need to ballast more vessels to New Zealand, with a 2:1 average ratio over the observed period. However this was under the assumption that all of the identified vessels supplied to New Zealand's coasts were used to export logs to the overseas markets. This situation in the real world is very improbable, as other general cargo commodity exporters in New Zealand are likely to be competing for the use of these vessels to get their products to their respective overseas markets. For this reason, it is likely that the competition for log vessels was higher than the balance identified between New Zealand's log vessel supply and demand over the observed period, and will continue to be in the foreseeable future.

Log exporters should be attentive to the 'Palm Kernel Expeller', 'Aluminium Oxide' and 'Phosphates' commodities, as the three combined commodities consistently held the majority of New Zealand's log vessel supply over the observed period, with an 59.5% average market share.

The commodity that provided the largest quantity of log vessel supply to New Zealand over the observed period was 'Palm Kernel Expeller'. There was speculation that this commodity was driven by milk solid prices at the farm gate, however, upon regression analysis, this report was unable to provide any conclusive evidence that these had a causal relationship for New Zealand's imports. Due to the important nature of this single commodity for log vessel supply to New Zealand, it is suggest that further analysis is conducted to better understand the factors that drives New Zealand's imports of this commodity.

It is also suggested that further analysis goes into identifying the proportion of identified commodities that are imported to New Zealand in log vessels from China, South Korea and India. Using this information, log exporting companies can target these markets to create long-term contracts with vessel owners, so that there is consistent work to transport to and from New Zealand, with no ballasting required.

6. Log Exporter Implications

Log vessel demand is likely to continue on an increasing trend in the near future, as China's domestic demand for the raw material will be required to appease the gap in supply created by the ban of production harvesting in their native forests. Over the observed period, the log vessel supply was stagnant.

Overall this has resulted in an increasing quantity of ballasted vessels required to transport New Zealand's logs to the overseas markets. This quantity is likely to be greater than the balance between New Zealand's log vessel supply and demand, as other general cargo commodities exported from New Zealand are likely to be competing for these vessels also. Consequently there is likely to be a significantly high demand for the relatively insufficient quantity of log vessels that are open on New Zealand's shores.

Bearing this information in mind, it is recommended that log exporting companies, the likes of PFP, develop relationships with companies that are importing the identified key commodities which are 'Palm Kernel Expeller', 'Aluminium Oxide' and 'Phosphates'. By developing relationships with companies that import these commodities into New Zealand, log exporters have the potential to acquire inside information about the respective commodity markets and their potential implications for New Zealand's log vessel supply. It also allows log exporters to focus their time and resources on a few commodities that have consistently provided the majority market share over the observed period, with an average of 59.5%.

Alternatively log exporting companies should also consider creating long-term contracts with vessel owners to ensure sufficient log vessel supply to export their logs to their overseas markets. Due to the increasing competition trend for log vessels, it is likely that vessel owners are going to have the ability to increase their contract prices.

7. Limitations

The cubic metre to DWT conversion factor was applied on a North Island and South Island basis, which is relatively broad when comparing the logs loaded onto vessels in Nelson and Bluff, which are likely to observe sizeable differences in conversion factors. For this reason, it is expected that there will be a degree of error with the density assumption made. However, for the purpose of this report it has provided an estimate that has served well where there is little public information available. If a study of this nature was to be repeated, it is suggested to contact multiple log exporting companies throughout New Zealand, to acquire their log vessel departure condition reports at various times throughout the year and provide a comprehensive conversion rate for all log exporting ports around New Zealand.

This study was not able to obtain comprehensive data relating to monthly or quarterly vessel supply, through the respective quantities of commodities imported by port. Even with the participation of the acknowledged ports, that method of analysis would have provided sufficient data if all of the ports participated. Unfortunately this was not the case in this scenario. To better understand log vessel supply and make inferences on where in New Zealand these will be focused around, it is suggested that a study focuses on identifying the key commodities through public information sources the likes of Statistics New Zealand. Thereafter, it is suggested that government bodies be contacted to provide port data over a monthly time period for the identified key commodities. This effectively reduces the amount of work associated to acquire this information for the government body, which would hopefully make it more likely to occur.

From the data that was acquired from Statistic New Zealand, there were instances where the data was not made available to the general public. For instance, coal. For this reason, it is likely that New Zealand's log vessel supply is going to be greater then what was estimated in this report. However, there was no basis to make estimates from to accommodate for this lack of data, which is why this report is limited to the data that was made available.

Unfortunately, the information used on the price of dairy milk solids could not be correlated to the 'Palm Kernel Expeller' commodity data that was acquired. Consequently, this report could not make suggestions on the relationship between the two and provide a method for estimate future supply. Due to this commodity being New Zealand's largest means of log vessel supply over the observed period, it is suggested further study goes into identifying a method to understand the driving factors influencing New Zealand's supply for this commodity.

The Trade War between USA and China, and other external factors will undoubtedly have a significant impact on New Zealand's vessel supply in the near future. However for the purpose of this report it was outside the scope of this study.

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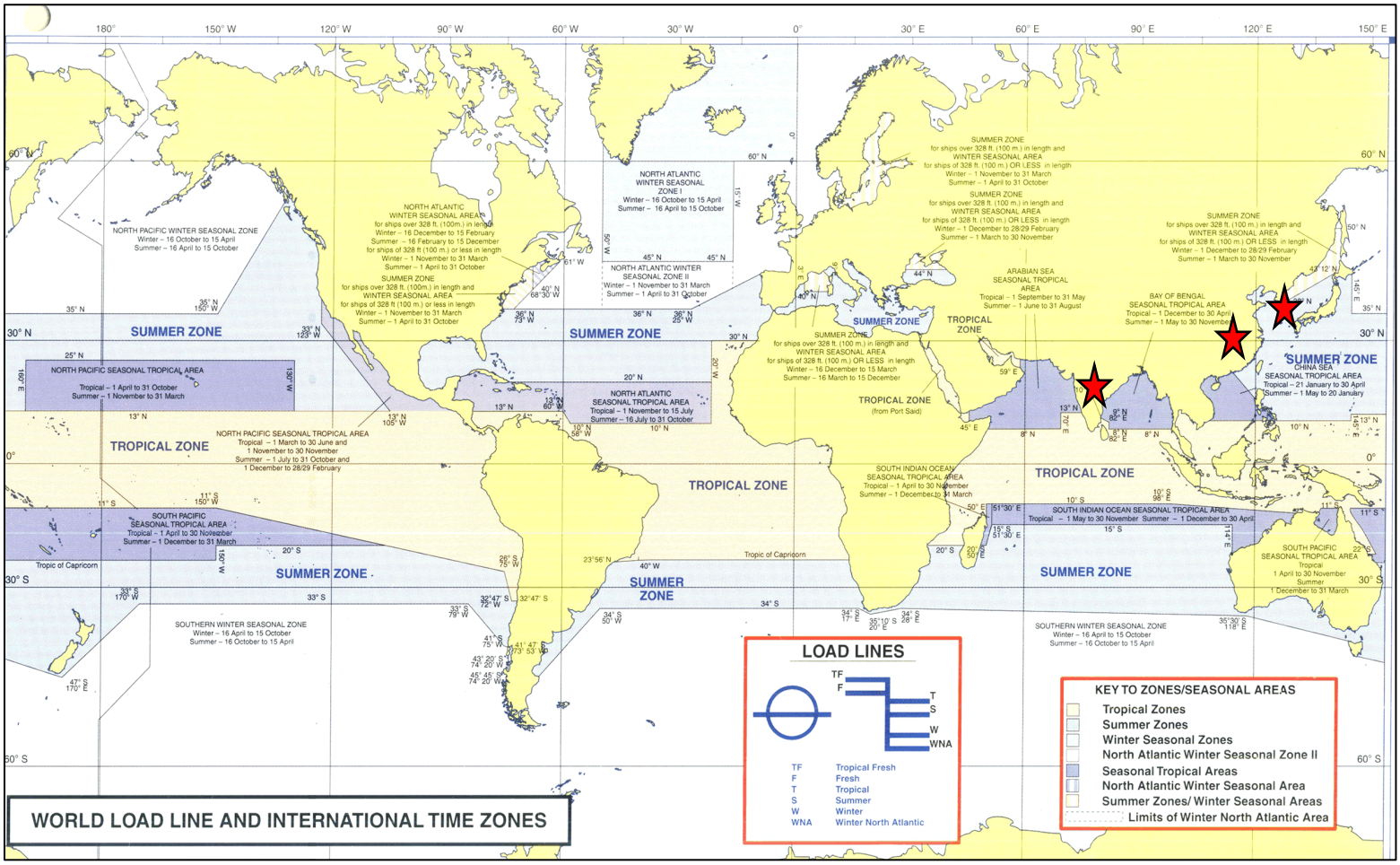
9. Appendix



Appendix 1: International load line by geographical location, with New Zealand's main log export markets marked with the red stars *(MySeaTime, 2009)*.