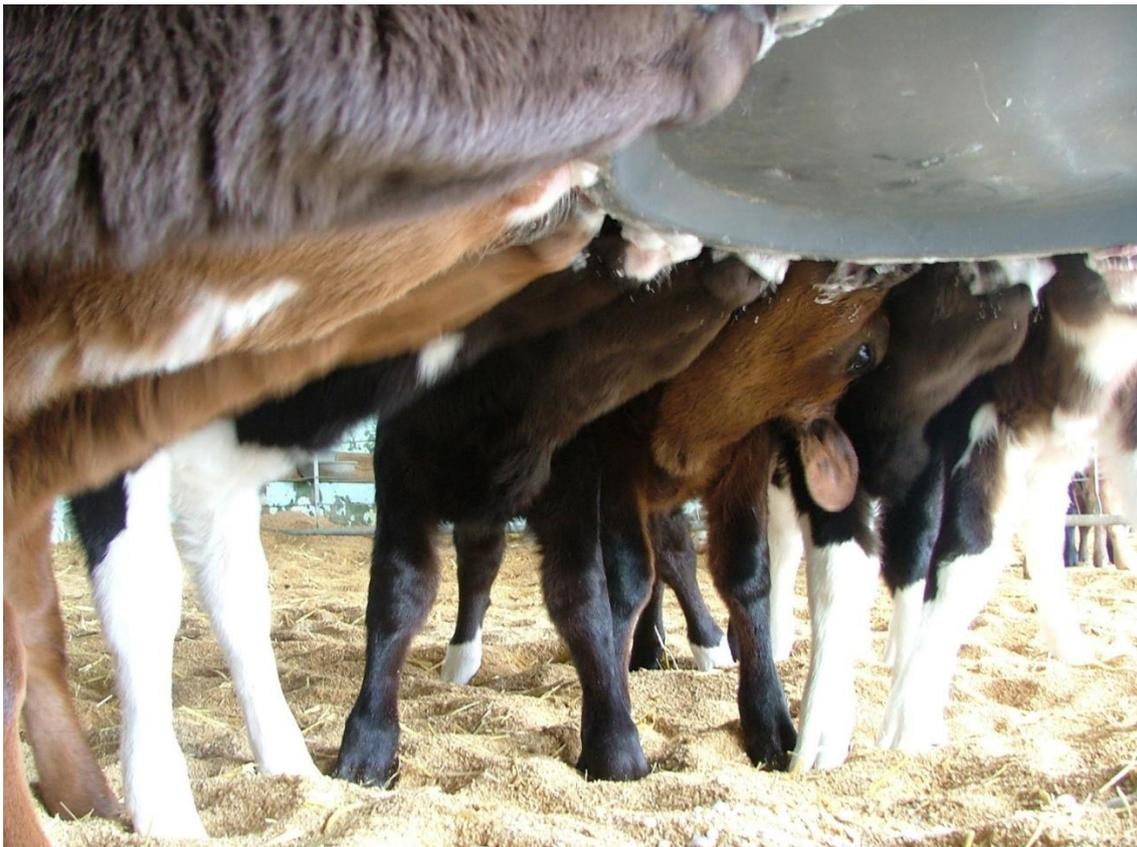


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Bobby calves – Industry benefits rather than wasteful perception

Kellogg Rural Leadership Programme

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I would like to thank all those involved with Kellogg's, the administrators, the tutors and all the guest speakers. This has been a great learning curve for me, and at times I have been pushed outside my comfort zone, this has enabled me to grow and develop new skills that I will take forward.

Thank you to LIC for having the confidence in me, to put me forward in the first place and then allowing me the flexibility to attend and work on my project. An extended thanks to my team who have had to pick up the slack as I have attended courses, done interviews and then the final hurdle of the project, you have simply made this possible.

To my fellow kelloggers, what a great bunch of people, I have enjoyed getting to know you all, the group chats, the private messages, and the support you have given me has been an incredible experience for me, and one I truly value.

Thank you to all the people across the industry that gave up your time selflessly to answer my questions, many of you repeatedly. I am not going to name you all or your companies as I have tried to keep my findings as an across market opinion piece to protect the individuals and your businesses.

And last but by no means least my wife Tina and our kids Jacob, Carlin and Tara, thank you all for your patience and understanding as the world of Kellogg's invaded our lives, this would not have been possible without your love and support.

Executive summary:

The world population continues to grow and so does the demand for animal proteins. The primary sector exports the majority of the dairy and meat products produced nationally and as a result contributes billions of dollars to the New Zealand economy. As a nation we want to achieve the highest premiums for our products to maximise our returns, as a result we are a consumer lead industry.

Consumers have more choices now than ever before and are much more conscious of the food they purchase. They are happy to pay extra to ensure the quality of the product, but these premiums also have to meet their expectations around environment and animal welfare, two aspects that are under constant scrutiny as the world moves into an era trying to deal with climate change.

New Zealand is seen by many as a clean and green country at the bottom of the world that produces dairy and meat products with the lowest environmental footprint, but our uniqueness doesn't come without some unique issues.

As an industry we send 1.9 million four day old calves to slaughter every year in a very short space of time, this practice has all but ceased in the rest of the world, and while we meet all animal welfare code requirements in the treatment of these calves, ethically people do not like the thought of killing four day old animals, and this is putting pressure on the future of the New Zealand bobby calf industry.

I have conducted many interviews over the last few months throughout the bobby calf supply chain, these have been conducted in person and via "Teams" meetings over the internet. Some of the interviews have been recorded, and others who wanted to remain anonymous I only took notes. Once I had conducted all my interviews I broke down the information into common themes to ascertain what current value these calves currently contribute to our economy and was their life a life worth living? Did that life add value?

While many people were happy to speak to me, due to the enormity of the topic it was less easy to acquire supporting information to validate my findings. Bobby calves are currently flying under the radar and nobody really wanted to draw unnecessary attention to their businesses.

I was able to identify that 100% of the calf is utilised and that it is broken down into many products that are exported around the world. Because of the age of the calf and New Zealand's disease free status compared to other countries the products the calf goes into achieve export premiums due to the high quality of goods.

One of the key insights was the continuity of employment these calves brought to the industry, helping keep meat processing plants operational in a quiet period of time. Being able to offer more staff full time employment was good for the processors the staff and the local communities and the economy.

While there weren't any products that could not continue to be produced from an adult animal, the quality of some of these products would be reduced. We could simply remove bobby calves overnight but the flow on costs to the industry would not counteract the additional value potentially achieved by growing these calves out to be slaughtered at an older age.

To remove the bobby calf from the industry is going to take considerable collaboration across the primary sector to come up with solutions and markets that we currently do not have, and is a cost that potentially have to be worn by the dairy farmer as the only way to rear these animals through to an older age is to displace some of the 4.9 million dairy cows.

While it was clear that the calf was treated humanely and added significant value to the industry, it did not answer the ethical debate of whether it will continue to be socially acceptable to slaughter four day old calves.

It seems ironic to me that the consumers in International countries like China or Europe that want dairy and meat products from animals that do not support a bobby calf industry are the same countries / consumers that will pay premiums for the co-products that are generated from the bobby calf.

To fully understand the financial and social benefits that the current 1.9 million bobby calves contribute to society and to our economy I would recommend a full industry review be carried out that can then be used as the benchmark for any proposed future solution for their removal.



Figure 1. Calf scene (LIC, 2020)

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Introduction:

The Bobby calf is not an easy issue to tackle and New Zealand farmer's number 8 wire entrepreneurial attitudes have not been able to come up with an easy or profitable alternative yet.

The world population continues to grow and so does the demand for animal protein. By 2050 the animal protein demand is expected to double (Henchion, Hayes, Mullen, Fenelon, & Tiwari, 2017). Along with that consumers have increased ethical and environmental concerns which requires a more sustainable food chain, protecting our ecosystems and the welfare of animals.

New Zealand currently sends to slaughter 1.9 million bobby calves mostly condensed over a four month period of July, August, September and October, every part of that calf is utilised into different products and makes a significant contribution to our export markets (*Livestock slaughter statistics for sheep, cattle, goats, horses and pigs, 2020*).

New Zealand is the only country that has a large seasonal pool of calves that are killed in a short period of time, if you look at Europe or the UK they moved away from the slaughter of young calves many years ago.

The first realisation I came to when I first started asking questions, is that the bobby calf is not an animal welfare or an economic issue in New Zealand but entirely an ethical issue, it's about our social license to operate and the risk to our reputation for the premium products that we export.

The general consensus is that the bobby calf is a waste product from the dairy industry that has little value. There is currently across sector collaborations going on, on how to address the problem of bobby calves and how we can get more revenue and value from these animals by growing them out to a larger size and / or developing markets and additional opportunities that deliver a better outcome.

But no one has asked that I'm aware of, is how lucrative is the current bobby calf industry? What exactly are we giving up in our race to be rid the industry of our "dirty little secret" that bobby calves are often referred too. How can we validate the value of new opportunities if we don't have a benchmark to measure against?

We are currently flying below the radar, we only need someone to step up and make a crusade about bobby calves and we'll be back in the headlines nationally and internationally and be forced to address the situation fully to protect our national and international markets, or potentially face being regulated.

Purpose:

The purpose of this report is to ***neither advocate nor oppose the slaughter of four day old calves***, but to get a better understanding of the consequences of removing them from our industry.

There have been plenty of studies current and historical, including previous Kellogg's projects that have looked at driving value from these calves into the red meat sector and while the industry across sectors continues to look for alternative solutions, we also need to fully understand the impacts of their removal, both from a national economic perspective and from a community perspective.

This report is ***not to debate the moral, ethical or animal welfare Issues*** around the killing of young animals either, but has been conducted and compiled to better understand and ascertain,

Does the bobby calf's current life adds value to New Zealand, regardless of how short it is, and is that worth giving up in pursuit of a re-modification of the entire industry?

Aim:

I aim to drill down to better understand what happens to that calf once it leaves the farm gate and primarily answer the following questions.

- Co-products accounted for 17% of total industry exports in 2019/20 (*MIA annual report 2020*) how much of that can be attributed to the New Zealand bobby calf?
- Once slaughtered how much of the calf is used?
- What products and industries does the calf co-products feed into?
- What impacts does removing the bobby calves have on our meat processors?
- The capacity and investment issues of our current structure from moving these animals to 3 weeks of age or 12 months of age?
- What is the tipping point for plant viability?
- Would the ethical debate be more acceptable if consumers had a better understanding of the calf's value to society?

Background: New Zealand's dairy industry

The New Zealand dairy industry is as unique as it is remote, built on generations of farmers capitalising on relatively stable climatic conditions that creates an environment for growing grass, and milking cows on a profitable low input cost system.

Approximately 50,000 people are employed in the dairy sector, on and off farms, currently generating around \$3.4 billion in wages, which flows directly back into the New Zealand economy and providing long term stability for our communities ("New Analysis Highlights Dairy's Economic Contribution," 2020).

In 2019 the export value was 50 percent higher than 10 years ago, showing the contribution of genetic gain and advances of breeding more efficient cows capable of converting more feed into production and delivering higher value for farmers (Mackle, 2020).

Herd Information:

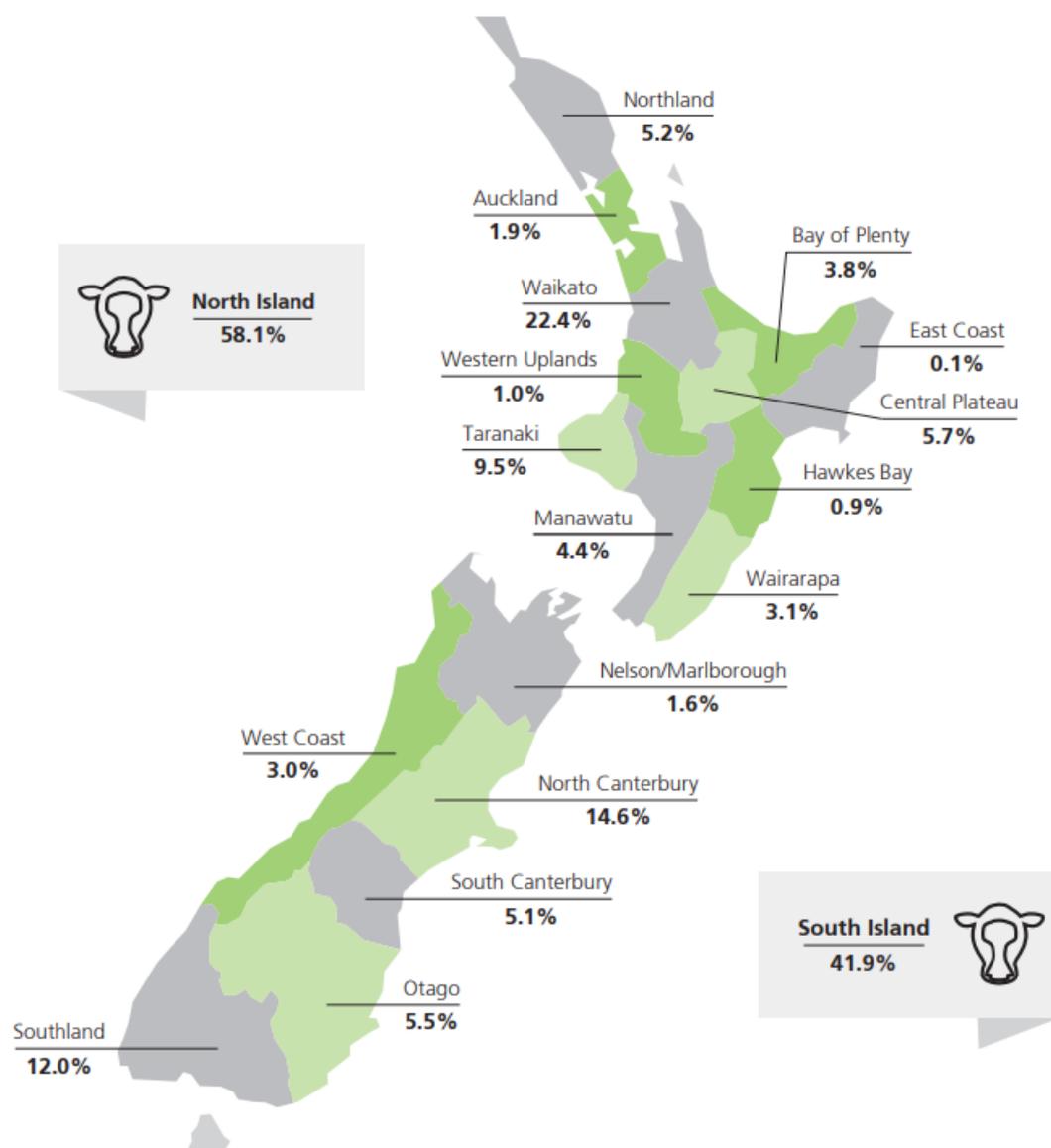


Figure 2. New Zealand cow distribution (New Zealand Dairy Statistics 2019-2020, 2020)

Nearly 42% of the cows now reside in the South Island however 71% of the herds still remain in North Island, indicating fewer but larger herds in the south (*New Zealand Dairy Statistics 2019-2020, 2020*).

Of the 11,179 dairy supply herds in New Zealand 3,200 are located in the South Island, with an average herd size of 645, 3.00 cows to the hectare and an average production of 414kg of Milksolids per cow (*New Zealand Dairy Statistics 2019-2020, 2020*).

There are currently 7,979 herds in the North Island with an average herd size of 358, milking 2.74 cows per hectare with an average per cow milksolid production of 364 (*New Zealand Dairy Statistics 2019-2020, 2020*).

This equates to the national average herd size of 440 cows being milked on 2.84 cows per hectare with a national average of 385kg of milksolids per cow (*New Zealand Dairy Statistics 2019-2020, 2020*).

Each year approximately 22% of the national herd is replaced with a new cohort of animals entering farmers milking herds (*New Zealand Dairy Statistics 2019-2020, 2020*).

Dairy growth:

Historically cow numbers more than doubled in New Zealand in the last 30 years from 2.4 million cows in 1990 to 4.9 million in 2019, and averaged growth of more than 100,000 animals per year for 25 consecutive years (*New Zealand Dairy Statistics 2019-2020, 2020*).

Cow numbers have stabilised over the last few years, as farmers have moved from a capital gains farming model and have put more emphasis on cow production and efficiency, as land prices have come down.

Farmers have been making adjustments over the last few years regarding their herd numbers. The reason behind this is that farmers have been aware that environmental regulations will be coming especially around Methane and Nitrogen and this is likely to affect national cow numbers to meet these regulations.

Being more environmentally aware has seen cow numbers stabilise and slightly decline as farmers start trying to generate a concentrated pool of replacements from their better cows rather than just trying to grow cow numbers.

With the Climate Change Commission releasing its final report (9.06.2021) which finds New Zealand is not on track to meet our 2050 emissions targets (Lawrence et al., 2020). For the Agriculture sector, outputs may need to be reduced without new technology to drive efficiencies (Lawrence et al., 2020).

Without new technologies being available yet, means New Zealand dairy farmer's potential only option to meet regulatory requirements around methane will be to reduce cow numbers even further.

With the government having until the end of 2021 to respond to the commission's climate roadmap, with its own emission plan I would expect that we could potentially see New Zealand's cow numbers reducing from 4.9 million to around 4 million by 2030, as we currently don't have the technology to meet Methane target reduction of 8 percent by 2025 and 12 percent by 2030 without dropping cow numbers (*Ināia tonu nei: a low emissions future for Aotearoa, 2021*).

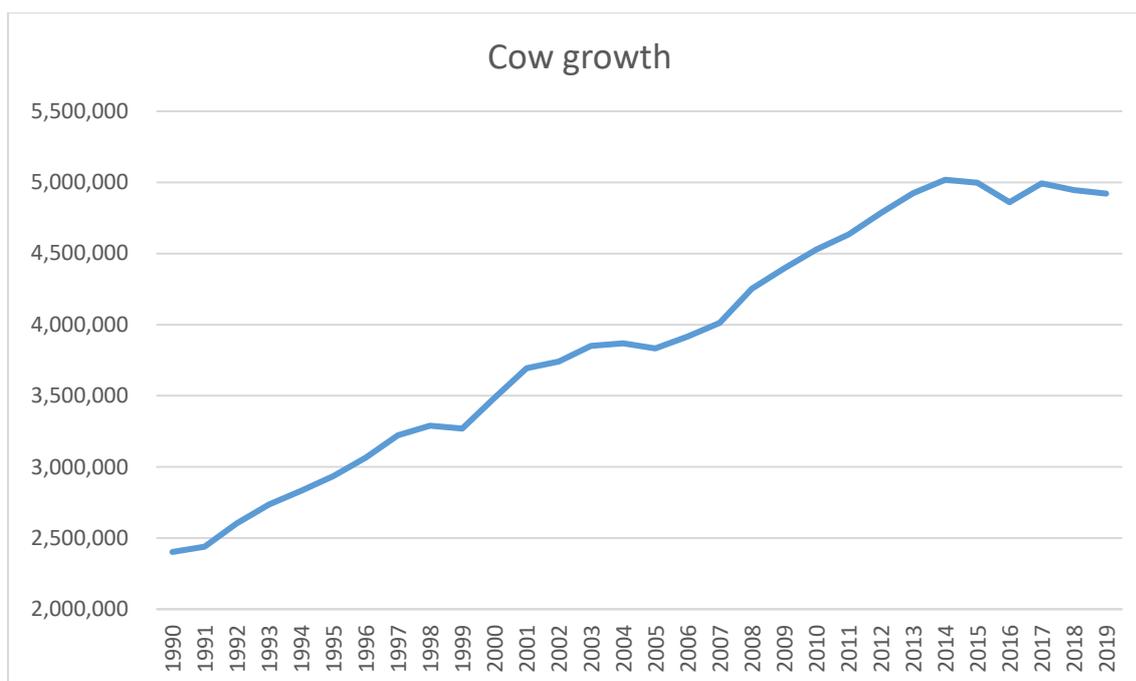


Figure 3. Cow growth statistics (New Zealand Dairy Statistics 2019-2020, 2020)

Cow Breed:

The number of Crossbred cows has continued to increase over the last decade, at the expense of the Jersey and Friesian population. Crossbred cows now make up the largest portion of the national dairy herd at 49.1% (*New Zealand Dairy Statistics 2019-2020, 2020*).

For many years farmers have utilised the benefits of hybrid vigour, and the superior efficiencies of the crossbred cow. We now see the crossbred cow producing within 2kg on the Friesian cow but with 40kg less liveweight, making the crossbred cow more efficient and profitable (*New Zealand Dairy Statistics 2019-2020, 2020*).

LIC's 2020 semen straw sales for the three main breeds consisted of 45.2% Holstein Friesian, 41.2% KiwiCross® and 13.6% Jersey. However only 34% of the Friesian and Jersey semen is actually inseminated into the same parent breed, 66% is inseminated to generate a crossbred calf (Hamill, 2021).

This means of the approximate 4 million dairy inseminations carried out by LIC in 2020, 80% of the resulting progeny being born in 2021 will be crossbred (Hamill, 2021).

The Jersey breed is likely to come under additional pressure as farmers look at dairy beef options to help reduce their bobby calf numbers. While the yellow fat in Jersey meat is gaining some popularity primarily in North America as an indication of free range grass fed meat, the ability to finish a Jersey beef animal compared to a higher Friesian beef animal before the second winter is less.

In a competitive dairy beef / reduced bobby calf environment we may see more farmers move away from Jersey to allow additional opportunities across their farming operation.

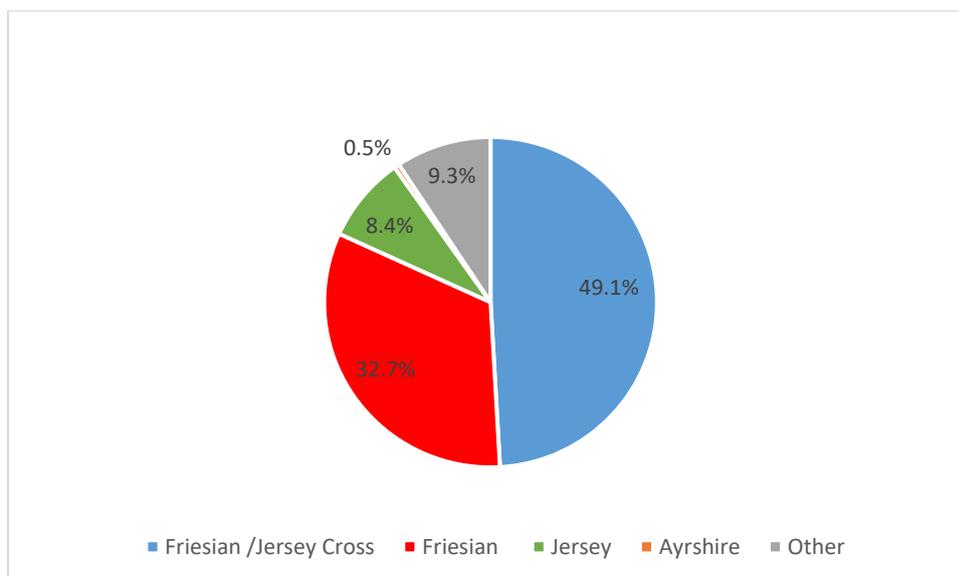


Figure 4. National cow breed population (New Zealand Dairy Statistics 2019-2020, 2020)

Grass based farming:

Grass being one of the cheapest source of animal feed available, has led New Zealand to traditionally farm on a seasonal basis, matching the seasonal grass growth curves and maximising grass utilisation.

Unlike many other countries where animals are housed inside either partially or fully throughout the year, and have access to cheaper locally grown feed that isn't as affordable here in New Zealand, because we either have the inability to grow it or the cost to ship it here is too high.

Approximately 90% of New Zealand dairy farmers have their mean calving period between the months of June through to August to maximise spring grass growth (Hamill, 2021).

Due to the seasonality of the New Zealand farming system, and to take advantage of as much of the pasture that is grown in New Zealand means we have a very condensed calving period resulting in the number of bobby calves coming into the system quite unique compared to other countries.

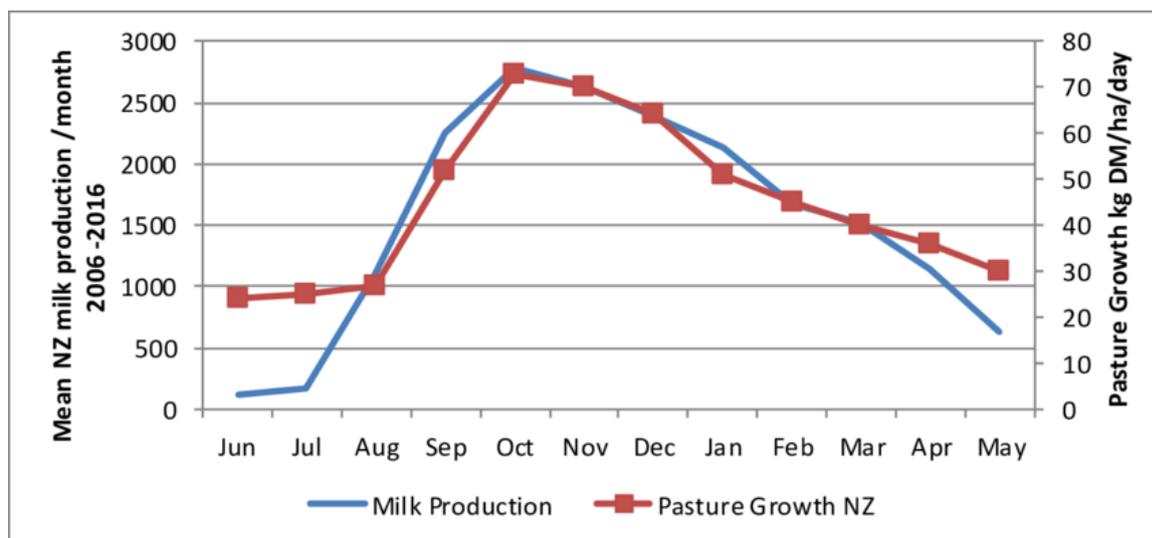


Figure 5. Seasonal milk production compared to grass growth (Shadbolt, 2016)

Calves born each year:

In order for a cow to produce milk she must first give birth to a calf. Therefore with a national cow population of 4.9 million animals, on average there are 4.9 million calves born each year in New Zealand (*New Zealand Dairy Statistics 2019-2020*, 2020).

Under natural circumstances a calf would suckle from its mother until weaning occurs between 7-9 months. However since the launch of the Herd Improvement Plan in 1939 the dairy cow has had genetic selection applied and has become highly efficient at converting feed into milksolids.

In the last 45 years alone the average cow has gone from producing 204kg of milksolids to 385kg of milksolids (*New Zealand Dairy Statistics 2019-2020*, 2020). In most conventional dairy systems it is now common practice for the calf to be removed from the cow within the first 24 hours of life this is so certain udder diseases in cows and intestinal problems in calves can be more effectively controlled with early separation (Ventura, von Keyserlingk, Schuppli, & Weary, 2013).

Of the 4.9 million calves born each year it is estimated that 22% or 1.1 million are retained as replacements and 1.9 million or 38.2% are sent to slaughter between 4-7 days of age (Jago, 2018).

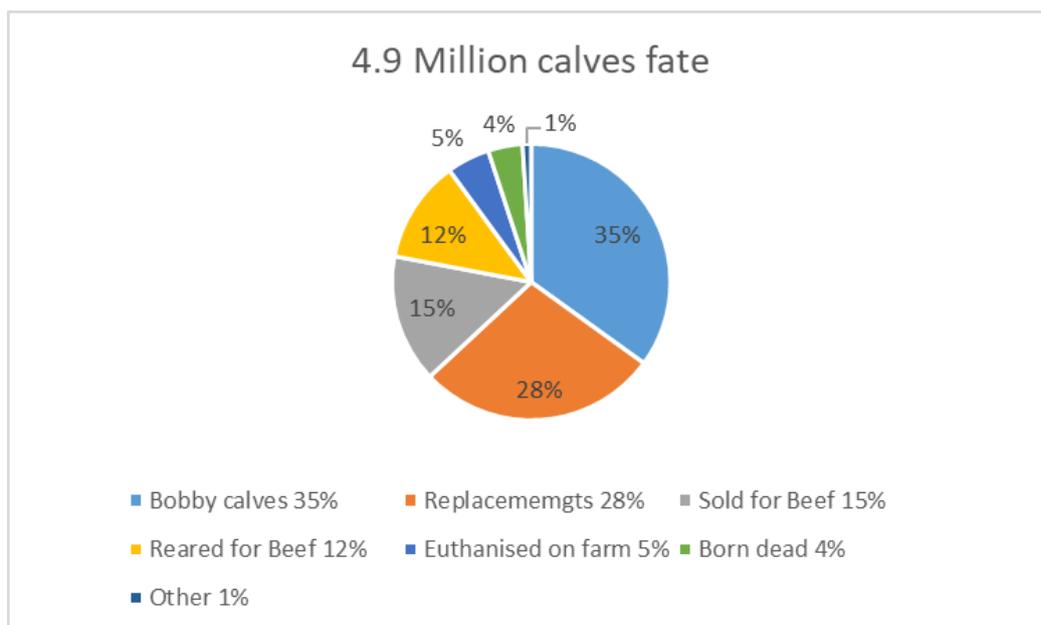


Figure 6. Fate of New Zealand calves (Edwards, Cuthbert, Pinxterhuis, & McDermott, 2021).

It is these 1.9 million calves that are now coming under scrutiny as more consumers are expecting their food to be produced more sustainably and in a socially acceptable manner. It is becoming increasingly more apparent that New Zealand Dairy farmers are ethically not going to be able to send four day old bobby calves to slaughter indefinitely.

What is a bobby calf?

A bobby calf is the progeny of a dairy cow that is not reared as a dairy replacement or reared for another purpose: for example a dairy beef calf reared to enter the red meat sector. These calves are considered surplus to the dairy industry and sent to slaughter at a minimum of four days of age for human or pet consumption (Boulton et al., 2018).

The origin of the term bobby calf comes from the period of the 1920s perhaps from bob, bobby calf being one of a number of collocations where bobby has the sense 'small, short'. Compare with the dialect term staggering bob for a very young calf or its meat, recorded from the late 18th century, perhaps from the pet form of Robert ("Bobby calf," 2021).



Figure 7. Bobby calf photograph ("Little bobby's many end uses," 2017)

New Zealand historical bobby calf numbers:

Since 1990 on average bobby calf numbers have sat at 37% of the national dairy cow numbers, with a high of 46% in 1996 and a low of 29% in 1993 and 1994 (*New Zealand Dairy Statistics 2019-2020, 2020*; "Total New Zealand by kill by animal type (Annual-Dec)," 2021). Bobby calf numbers exceeded two million for only two years in 2014 and 2015 with a high of 2,128,897 the same year dairy cow numbers exceeded 5 million (*New Zealand Dairy Statistics 2019-2020, 2020*; "Total New Zealand by kill by animal type (Annual-Dec)," 2021).

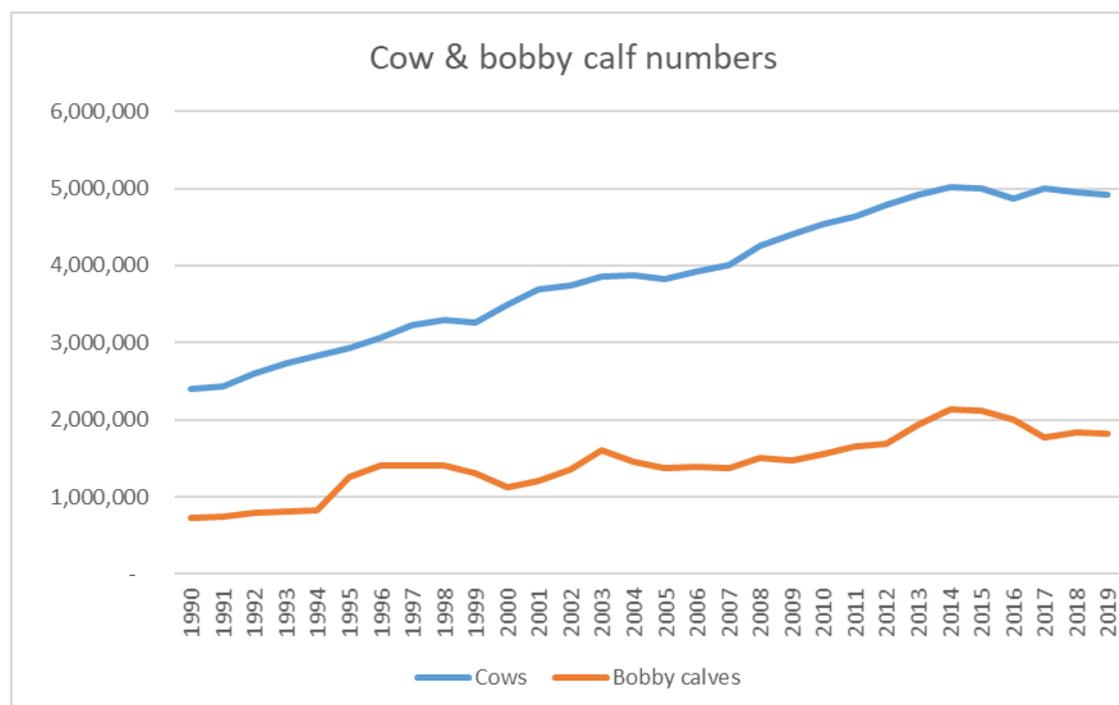


Figure 8. Cow and bobby calf numbers by year (New Zealand Dairy Statistics 2019-2020, 2020; "Total New Zealand by kill by animal type (Annual-Dec)," 2021)

Mortality rates in bobby calves:

Mortality rates at processing premises have been the primary measure of animal welfare for bobby calves since 2008 when 10,275 calves were condemned prior to slaughter, resulting in a 0.68% mortality rate (*Mortality rates in bobby calves 2008 to 2016, 2017; Mortality rates in young calves in the 2018 and 2019 spring calving seasons, 2020*).

The overall mortality rates includes all calves that fall into one of four categories, (DOA) dead on arrival, (COA) condemned on arrival, (DIY) dead in yards or (CIY) condemned in yards (*Mortality rates in bobby calves 2008 to 2016, 2017*).

Calf mortality can be caused by a combination of factors. In 2007 "The Bobby Calf Transport Forum" which included representatives from the Meat Industry Association, Road Transport Forum and other regulatory authorities met to discuss the welfare of young calves.

The Bobby Calf Transport Forum was broadened and in 2010 became the Farm to Processor Animal Welfare Forum (FTPWF) and became the formal government and industry forum to discuss animal welfare issues.

On the 1st of August 2016 four calf regulations took affect and these were: Blunt force trauma, Fitness for travel, maximum duration of travel and transport across the Cook Strait ("Bobby calf welfare," 2021).

- That young calves must be at least four full days of age and physically fit before they're transported off farm for sale or slaughter, or as a result of sale.
- The maximum journey time for young calves is 12 hours.
- The transport of young calves by sea across Cook Strait is prohibited.
- It is prohibited to kill calves by use of blunt force to the head, except in an emergency situation

In 2017 three more regulations were added, incorporating, loading and unloading facilities, Shelter requirements and maximum time off feed ("Bobby calf welfare," 2021).

- Young calves must be slaughtered as soon as possible after arrival at the slaughter premises and within 24 hours of the last feed on farm.
- Suitable shelter must be provided for young calves before and during transportation, and at points of sale or slaughter.
- Loading/unloading facilities must be provided and used when young calves are transported for sale or slaughter, or as a result of sale.

Mortality rates have continued to decline as handling and transporting rules around bobby calves have improved. From 1,771,639 calves sent to slaughter in the 2019 season only 789 calves or 0.04% were dead on arrival or condemned as unfit for processing (*Mortality rates in young calves in the 2018 and 2019 spring calving seasons, 2020*).

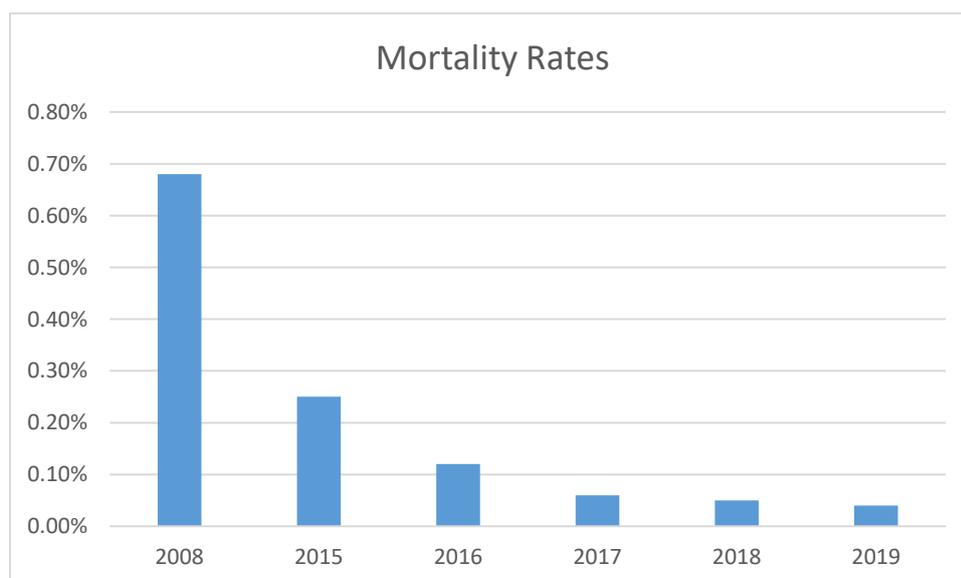


Figure 9. Mortality rates of bobby calves by year (*Mortality rates in young calves in the 2018 and 2019 spring calving seasons, 2020*)

Animal Welfare:

Various actions across the industry has continued to improve the mortality rates within New Zealand for bobby calves, and there are now strict rules for the handling and loading of calves for transportation to meat processors. Processors have their own site vets that inspect all calves. Video cameras are set up on sites to ensure correct animal handling protocols are followed.

The welfare of all farmed animals must always be at the forefront of, and at the heart of, a good farming business. When it comes to bobby calves, everyone in the supply chain - farmers, transporters, sale-yard operators and processors - has a responsibility and role to play in protecting their calf's welfare ("Bobby Calf Regulations," 2017).

Over the last several years the transportation and handling of bobby calves have continued to be monitored, improved and regulated to ensure that all calves are treated with the best animal welfare practices. Dairy NZ have supplied a fit for transport easy to follow guide. (Figure 10)



Figure 10. Fit for transport ("Fit for Transport," 2021)

Ministry for Primary Industries (MPI) have recently introduced seven new regulations after recognising that calves are vulnerable. The intention was to set clear guidelines and expectations for their care and so to strengthen the rules around calf welfare.

Four of the new regulations came into effect in August 2016:

- That young calves must be at least four FULL days of age AND physically fit before they're transported off farm for sale or slaughter, or as a result of sale.
- The maximum journey time for young calves is 12 hours.

- The transport of young calves by sea across Cook Strait is prohibited.
- It is prohibited to kill calves by use of blunt force to the head, except in an emergency situation.

Three of the new regulations were given delayed commencement dates, coming into force in 2017, to allow people in charge of animal's time to make the changes required:

- Young calves must be slaughtered as soon as possible after arrival at the slaughter premises and within 24 hours of the last feed on farm -in force from 1st February 2017.
- Suitable shelter must be provided for young calves before and during transportation, and at points of sale or slaughter -in force from 1st August 2017.
- Loading/unloading facilities must be provided and used when young calves are transported for sale or slaughter, or as a result of sale -in force from 1st August 2017 ("Bobby Calf Regulations," 2017).

Practices implemented over the last decade ensure that the bobby calf is treated humanely and I do not believe that animal welfare is the issue around consumers and the industry wanting the removal of the bobby calf process but rather the ethical perception of slaughtering a four day old animal.

Calves for Pet food:

Not all calves are sent to meat processors some are sent straight to pet food processors. Of the 44,191 calves processed for pet food in 2019 (not included in meat processor numbers) 21,004 were slaughtered on farm (*Mortality rates in young calves in the 2018 and 2019 spring calving seasons*, 2020). This means fewer calves went through the transportation process which causes the majority of calves being condemned.

Is New Zealand different to other countries?

There are approximately 250 million dairy cows worldwide ("About Dairy Cows," 2021). However there are few countries that farm on a predominantly pasture based system. New Zealand has a very tight calving interval due to our pasture based system.

Historically if cows have not got in calf within the season they have not been retained within the herd system. This tight calving interval due to our seasonality has meant that the majority of our 4.9 million calves are born in a very tight period, unlike other countries that tend to either split calve or calve all year round allowing them the ability to spread out their annual calf supply.

The graph below is an indication of New Zealand's tight calving interval compared to the rest of the world, and also an insight into why New Zealand's bobby calf issue is as unique as our farming systems. New Zealand has the best calving interval in the world, on average our cows calve every 367 days, compared to Japan where the re-calve on average every 431 days ("VanDrie Group," 2021).

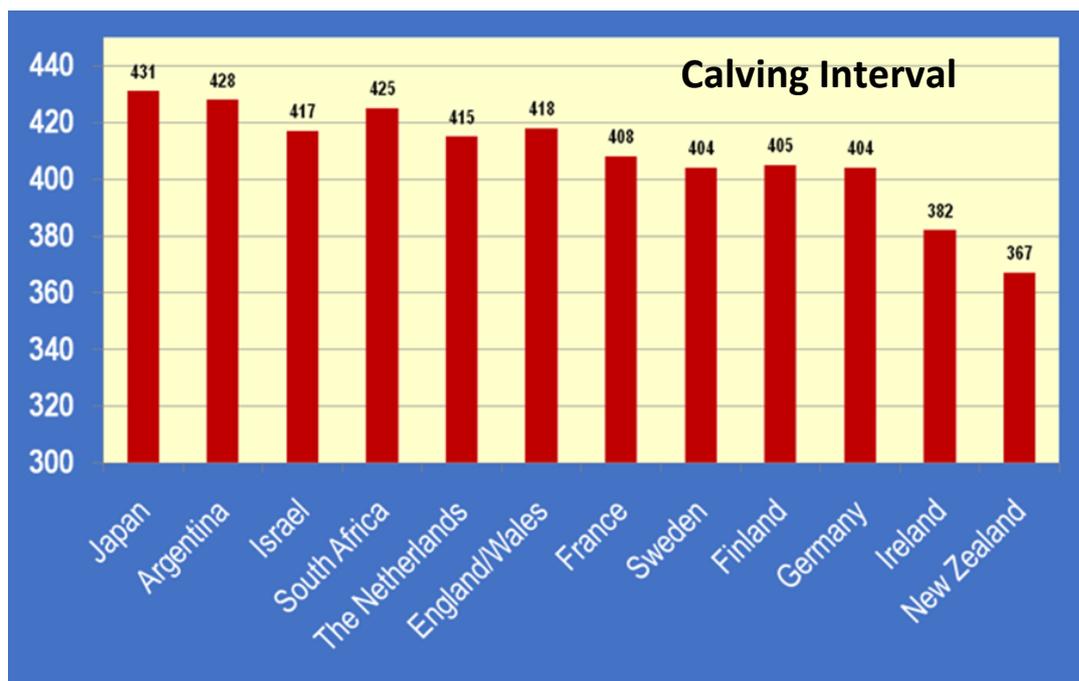


Figure 11. Calving Interval by Country ("VanDrie Group," 2021)

Because other countries do not have to deal with the seasonality of the New Zealand dairy system see calves being born often in an either autumn / spring calving period or an all year round system, which allows them to deal with their bobby calves in a different manner.

For example: The VanDrie group in the Netherlands with access to calves from an all year round calving system is now the world market leader in veal. With nearly 1.4 million calves going through their integrated chain for slaughter each year with 95% of their product being exported sees them providing >28% of the European veal need ("VanDrie Group," 2021).

Calf husbandry: The VanDrie Group's calves come exclusively from controlled farms. The number of calf-husbandry operations under the company's own control currently numbers of approximately 1.4 million. The VanDrie Group is a strong supporter of having calves housed in groups. All calves are housed in groups in spacious, well-ventilated stables with plenty of daylight. The calves get fed milk from milk powder and mainly a muesli that VanDrie makes up themselves and additionally either straw or maize ("VanDrie Group," 2021).

Slaughter houses: The VanDrie Group's production is made to measure. This begins at the farm, where calves are housed according to breed and origin. All veal products are delivered according to customer specifications. These may refer to the shape, weight and colour of the meat. Any desired cut can be produced during the processing of the meat. Products are packaged as requested by the customer: boxes, foil and product information stickers are produced according to agreed specifications.

The VanDrie Group therefore delivers a tailor made concept, at any time of day, around the world. The VanDrie Group's slaughterhouses in the Netherlands, T. Boer & zn in Nieuwerkerk a/d IJssel and Ekro & ESA in Apeldoorn, are the largest veal slaughterhouses in the world. A unique feature of the VanDrie Group's slaughterhouses is that each cut is labelled with the identification number of the individual animal, so that all information can be traced at any time ("VanDrie Group," 2021).

The Dutch veal calf industry in a nutshell: The Dutch veal calf industry produced both ‘rose’ and white meat veal products. White or ‘blank’ veal calves as we call them are calves that get slaughtered around 27 weeks and will have a liveweight of 270 kg. Young ‘rose’ meat calves get slaughtered around 32 weeks of age and have a liveweight of around 300 kg while old ‘rose’ veal’s will be around 11 or 12 months and have a liveweight of 360 kg. Normally older than 8 months is not seen as veal anymore.

It would be difficult in my opinion to set up a veal industry in New Zealand without creating an international market requirement, especially if we are going to compete internationally against companies who are already well embedded in the veal space. Because of New Zealand’s locality shipping of veal in a competitive market would also hinder this as an option for us. To set up a local veal market would also come with constraints as New Zealand as population are historically not big veal consumers ("VanDrie Group," 2021).

Bobby calves – Industry benefits rather than wasteful perception

My Journey:

In the milking season 2019/20, dairy companies processed 21.1 billion litres of milk containing 1.90 billion kilograms of milksolids (*New Zealand Dairy Statistics 2019-2020*, 2020). With New Zealand being the world’s 8th largest milk producer we export over 95% of the milk produced within New Zealand, generating over \$18 billion dollars in export earnings ("About the NZ Dairy Industry," 2021).

Over the past few decades earnings have yo-yoed between the dairy sector exports and tourism, with tourism exceeding dairy products through the 1990’ and 2000’s. From September 2010 through to about mid 2015 dairy earnings again surpassed tourism as cow numbers increased to 5 million (Cropp, 2015).

From 2015 to 2020 tourism which includes International students again exceeded dairy export earnings. In March 2020 the first impacts of Covid-19 were felt in NZ and tourism earnings came to a standstill as dairy export earnings continued to climb. Many believe that without the dairy industry New Zealand’s COVID-19 recovery to date would not have been as easy to achieve (Williams, 2020).

“Farming is likely to be the quickest to rebound from the fallout from coronavirus, says ASB rural economist Nathan Penny” (Flaws, 2020).

“For New Zealand to attempt an economic recovery from the Covid-19 pandemic without utilising the most lucrative sector - dairy - defies logic, Dr Jacqueline Rowarth writes.” (Rowarth, 2020).

While tourism and dairy have strived for the top spot in earnings, the success of both are intertwined. New Zealand is seen as clean and green and near organic status in the eyes of many internationally, our dairy industry leverages this image to pitch our dairy products at premium status.

This also inadvertently promotes New Zealand as a clean green place to travel. As tourism has grown dairy farmers have adjusted to ensure the rural image is protected. For example the removal of inductions. This began following a review in 2005 which lead to inductions being phased out

completely by 2014, with the only exceptions being for animal welfare instances ("Induction ban no biggie – vet," 2015).

This was embraced by the majority of the dairy industry as inductions were seen to potentially tarnish the image of New Zealand as a whole and not just confined to the reputation of the dairy Industry ("Induction ban no biggie – vet," 2015).

There have been a few negative publicity instances around bobby calves, the major one being the Farm watch video footage filmed in 2014 revealing the mistreatment of bobby calves at an abattoir which resulted in the prosecution of a worker.

This video made International headlines, and was followed a year later by more video footage of farmers picking up calves in paddocks mishandling them, and truck drivers mishandling calves when loading for transportation to meat processor plants.

The footage created a public outcry from urban and rural people alike. These videos resulted in the change of transportation regulations, and while this was deemed to be the actions of a minority of farmers it tarnished the New Zealand dairy Industry with comments like "The dark side of the New Zealand dairy Industry" and "Bobby calves' dairy farmer's waste product".

While bobby calves have not been in the news for a while the image has been tarnished and as we move into an era where environment and animal welfare are at the fore front of consumer minds, many dairy farmers are looking at ways to reduce their bobby calf footprint with a general consensus from the industry that at some point we will no longer be able to send to slaughter four day old calves.

Over the past three months I have conducted many interviews and had conversations with people throughout the primary sector, these include people from Meat Processors, Beef + Lamb, Land Corp, Beef Breeders, Genetics companies, Calf rearers, stock agents, Massey university, vets, Research companies, Ministry of Primary industry, Meat industry association and people within the blood serum industry to try and gauge what as an industry we would be giving up if New Zealand as a country moved to a no booby calf industry.

While the primary sector continues to collaborate to find potential solutions for New Zealand there does not appear to be a silver bullet but rather a redesign of the entire system and potentially new innovations required to address the number of surplus calves that are created.

However it is hard to find a compelling argument for change when no one can articulate the current value of the current system and what will be lost if we move away from it. Throughout my investigations I have continually heard bobby calves being described as a waste product for the dairy farmers.

Waste as defined by Wikipedia is "unwanted or unusable materials" ("Waste," 2021). Waste is any substance which is discarded after primary use, or is worthless, defective and of no use." While the 1.9 million calves that are sent to slaughter each year are largely unwanted by the dairy farmers, after my investigations I certainly would not consider them a waste product.

Bobby calves is a very emotive subject with a wide range of views. While it is relatively easy to pull statistics on adult cattle slaughter it is very difficult to get a lot of sound information on bobby calves this is not due to any animal welfare issues but I got more a sense that bobby calves are currently flying under the radar and any publicity in the bobby calf space is bad publicity.

Therefore it is important to remember that this report while it has had input from across the primary sector, the majority of those conversations were either off the record or not supported with any documentation. I have tried to ensure the accuracy of my investigation and the content and information within this document.



Figure 12. Bobby calf photo (LIC, 2020)

The value of Co-Products:

In the 1994 New Zealand Meat Products Board annual report for the financial year of 1994, co-products contributed \$770.6 million which was 6.7% of the total meat export revenue. 25 years later in the 2020, the Meat Industry Association annual report for the financial year of 2019, co-product exports contributed \$1.6 billion which is 17.3% of the total \$9.4 billion dollars generated from New Zealand total industry exports, a growth of 111% (*Meat Industry Association Annual Report 2020, 2020*).

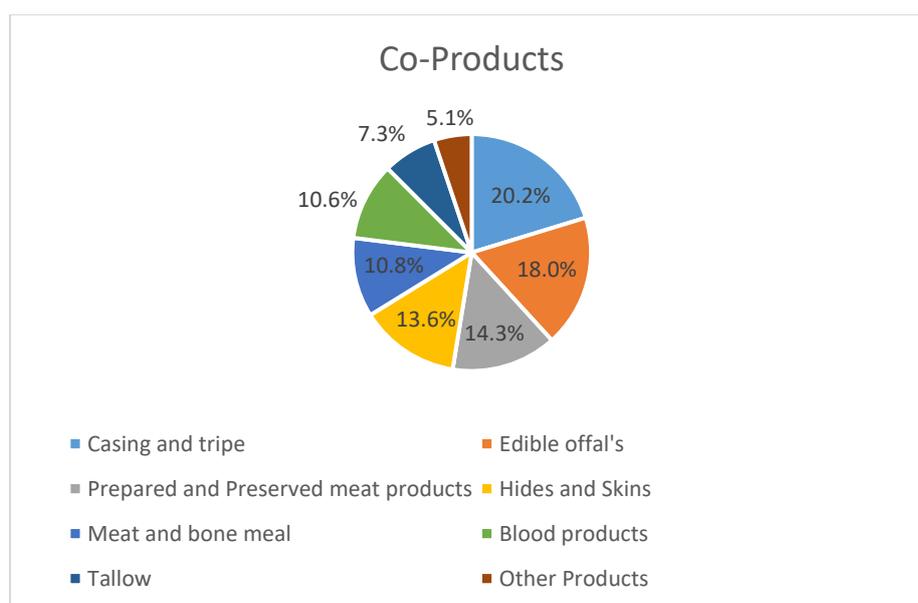
Table 1. Co-Product Breakdown (Meat Industry Association Annual Report 2020, 2020)

| Products | Value of exports | Annual change |
|--------------------------------------|------------------|---------------|
| Casings and tripe | \$329 Million | +1% |
| Edible offal's | \$293 Million | +11% |
| Prepared and preserved meat products | \$232 Million | -4% |
| Hides and skins | \$221 Million | -30% |
| Meat and bone meal | \$176 Million | -14% |
| Blood products | \$172 Million | +17% |
| Tallow | \$119 Million | +11% |
| Other products | \$83 Million | +91% |

Our three top markets for animal co-products are China, remaining the major market for co-product exports worth \$427 million up 8% on the previous year, followed by the United States down 6% at \$233 million and then Australia up 1% at \$150 million (*Meat Industry Association Annual Report 2020, 2020*).

Co-Products contribute significantly to the New Zealand economy and why I have spoken to many sources across the industry I have been unable to segment the bobby calf contribution to each of the segments within the list of products that make up co-products.

While the bobby calf contribution into each segment of products that make up co-products will be smaller. I estimate through my discussions that the per KG revenue return from bobby calves to be higher due to the higher quality products being manufacture. For example: Hides and skins are more pliable with less defects than older hides so can be used in higher end products, and the blood collected for serum being again a higher quality product than serum generated from older animals.

**Figure 13. Co-Product breakdown (Meat Industry Association Annual Report 2020, 2020)**

Once slaughtered how much of the calf is used?

Like adult cattle all parts of the calf is utilised. From the time the calf is first slaughter the blood is collected, followed by hide removal, stomach and internal organs. The meat is the collected, what isn't used in the first instance which will vary from processor to processor depending on their individual market requirements is rendered down usually for blood and bone fertilizer, however during the rendering process any fat is collected for Tallow uses. The below diagram shows the many products and uses of the calf.

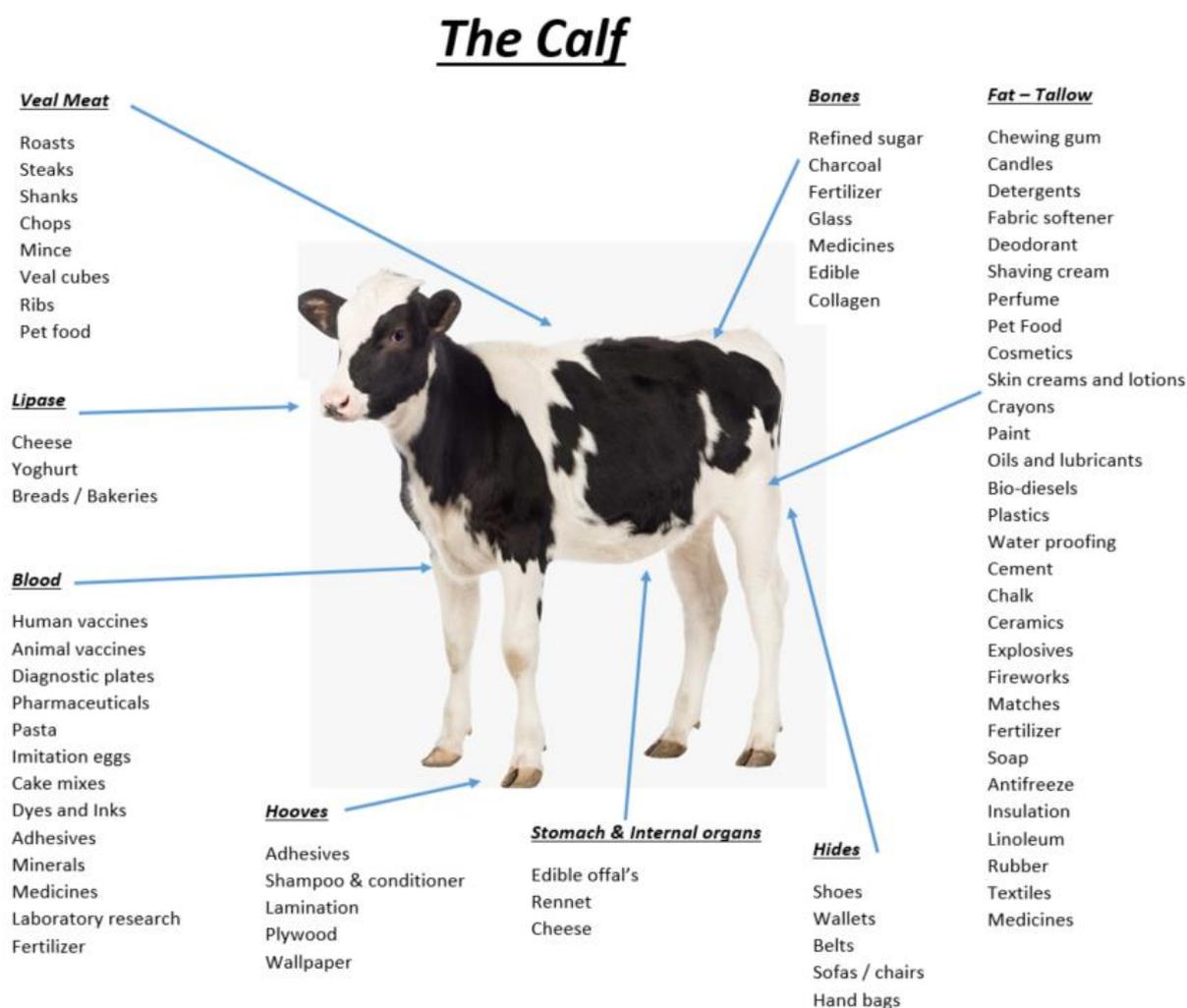


Figure 14. Products generated from a calf (Bricknall, 2021a; Versteegen, Murray, & Doelger, 2021)

I have not gone into detail on all the uses of the calf once it has been slaughtered, for the purposes of trying to get a basic understanding of the uses for this report I have tried to look at four high end products collected and marketed. These include the meat, blood, rennet /lipase and the hides.

Meat:

In the 2019 season New Zealand exported 22,014 tonnes of bobby veal, with export earnings of \$120,898 million dollars. This is 3% of the total export earnings for beef production. China was again New Zealand's largest market for beef, followed by the United States and then Japan ("Imports and Exports," 2021; *Meat Industry Association Annual Report 2020*, 2020).

The meat cuts from a calf come from one of six sections, the shoulder, the ribs, the sirloin, breast and foreshank, loin or the leg often referred to as round. Most of the calf is made into roasts, steak, chops, shanks, ribs, veal cubes for stewing and ground veal also known as veal mince (Corliss & Corliss, 2021).

New Zealanders are not traditionally veal eaters, this could be for a number of reasons but primarily because of the abundant access to other meat, however other countries are and there are some good reasons.

Veal is rich with vitamin B, an essential vitamin for energy and healthy metabolism, and is considered more healthy than traditional beef due to having less fat and less cholesterol. Veal is rich in protein and iron and is nutritionally per ounce better than chicken or beef. While veal is generally more expensive than beef it is more tender and leaner creating a better eating experience (Subhasish, 2014).

However there is a stigma around veal internationally due to many of the calves that are typically slaughtered for veal at the age of 16 to 18 weeks spending their short lives in confined areas ("Farm Animal Welfare: Cows," 2021). If New Zealand moved to a no bobby calf industry we would need to make sure we did not swap one ethical issue for another.

At meat processors not all the calf meat is produced for human consumption, waste and offcuts are processed for pet food along with approximately 44,000 other calves that are either sent direct to pet food facilities or are slaughtered directly on farm (*Mortality rates in young calves in the 2018 and 2019 spring calving seasons*, 2020).

Nearly two thirds of New Zealand households have at least one companion pet. With 41% of households having a cat and 34% having at least one dog which is up from 28% in 2015. Dogs may be man's best friend, but cats are not far behind. 78% of survey respondents consider their dog to be a member of the family, while this figure is only slightly lower at 74% for cats. This sentiment was echoed in thoughts on animal healthcare, where cats and dogs were the species considered most important to have vaccinations and veterinary visits if the animal becomes sick or injured (Paul, 2020).

Meat for pet food consumption is on the rise, and why we are seeing the number of calves being sent straight to slaughter for pet food. It has also been reported that approximately 25% of dogs and 10% of cats are fed some raw meats, with an annual increase of 15% annually (Stogdale, 2019). Raw meat is becoming more popular as some people try to differentiate their marketing angle.

For example Raw Essentials, not only do they have 13 stores nation-wide, they are now offering online delivery in Auckland and Wellington. They are even promoting testimonials with images of pets on line and their owners describing how much better health wise they are for consuming raw meat products ("Raw Essentials," 2021).



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OUR STORES
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OUR PRODUCTS
100% natural, raw food for cats, dogs, kittens & puppies. Including mixes, minces, bones, broth, treats and supplements.

DELIVERY
Now offering frozen raw pet food online delivery in Auckland on Monday, Wednesday and Thursday, and Wellington on Sunday.

Figure 15. Raw Essentials ("Raw Essentials," 2021)

Over the past few years, bobby calf returns have not been that favourable and many farmers are seeing supplying pet food companies as viable alternative.

Blood:

Blood from slaughtered animals is often collected at specific meat processing plants to generate animal serum which is used in the humane and veterinarian science areas for vaccine manufacturing, diagnostic manufacturing, life science research and biopharmaceutical manufacturing (Versteegen, 2021).

Once the blood is collected with specialty machines that reduces the risk of contamination, the blood is refrigerated after collection until coagulation is complete. The blood is then centrifuged to separate the serum from the blood clot and the serum itself is removed and then frozen in hygienic containers (Versteegen, 2021).

There are 16 different definitions of bovine serum types. For the purpose of this paper I'm going to break them down into four, fetal, the blood from an unborn calf, neo-natal, the blood from a born calf that hasn't suckled, new born, the blood collected from bobby calves and then adult bovine blood serum.

I spoke with the International Serum Industry Association (ISIA) to give me a better understanding of ISIA, bovine serum its importance and uses.

ISIA was founded in 2006 and they represent the suppliers of 90% of animal serum used in vaccine manufacturing, diagnostic manufacturing, life science research and biopharmaceutical manufacturing. ISIA certify companies selling animal derived products to give purchasing companies assurance of the quality, origin and traceability of the animal serum that they are purchasing.

New Zealand is considered to be the gold standard of blood serum producers worldwide due to the limited amount of disease in our bovine population compared to the rest of the world. For example

New Zealand is mad cow and foot and mouth free. This is very attractive for companies that use blood serums in their manufacturing (Versteegen, 2021).

I am not going to differentiate between New Zealand fetal blood serum and new born calf serum, as it is highly likely that the quality and quantity of New Zealand's new born calf serum will see it used in the same manufacturing fields as fetal blood serum.

New born calf serum will grow cells almost as well as fetal serum as it still contains copious amounts of growth factors. The benefit of using new born calf serum is that it is much more plentiful and less expensive to collect making the products it is used for cheaper to produce (Versteegen, 2021).

The longer a calf suckles or is fed colostrum the more outside factors with antibodies will be introduced, these antibodies could inhibit the ability to grow cells in serum. If New Zealand were to extend the collection days of a bobby calf from the current 4 days to between 10-20 it would make the serum collected from these calves less valuable (Versteegen, 2021).

Serum and other blood-derived products, have been widely used in the research and pharmaceutical arenas for many years. The use of these materials has contributed significantly to many and varied advances in medical and veterinary health. These products continue to have an important role in research and drug development and manufacturing (Versteegen, 2021).

The market still uses a lot of animal serum, animal serum has a lot of positives as it is easily available and faster to cultivate cells, you don't have to spend months acclimating your cells, to whatever you're trying to get them in, and your yield is almost always higher.

When vaccines were originally generated they would write down the protocol for how the vaccines had been developed, early on they were very specific as to what was used in the manufacture. That means it becomes very difficult to change how a vaccine is manufactured without going through all the trial work to redevelop the protocol, as that becomes very expensive. So it is very hard to move away from animal serum (Versteegen, 2021).

A lot of the defined media that people have been working on since the early 80's turned out to be very expensive between the components and the media and the decrease you get in the yield and sometimes the effectiveness of what you're trying to make, it can be very expensive to get away from animal serums (Versteegen, 2021).

There have been companies that have spent a lot of money changing processes to plant derived serums, only to discover there were so many unknown plant based pathogens popping up that they had to move back to using animal serums, for consistency of procedures and outcomes (Versteegen, 2021).

Animal serums have been used to culture cells for vaccines for over 60 years and date back to the first Polio vaccine. John Franklin Enders, Thomas Huckle Weller and Frederick Chapman Robbins were awarded the Nobel Prize for Physiology for their discovery of a method of growing the polio virus, something that would not have been possible without animal blood serum (Versteegen, 2021).

As of the 7.06.2021 there have been 3.73 million reported Covid related deaths and many unreported. Since the pandemic began scientists world-wide have been scrambling to come up with a vaccine ("COVID-19 Dashboard," 2021).

With normal vaccines you get injected with a half dead virus or injected with a protein that comes from that virus and that's what causes the immune response. However the two main Covid virus are

different as they are based on Messenger RNA rather than a protein going directly into the cells, which is a completely different manufacturing process (Versteegen, 2021).

In the body DNA will produce RNA that converts into protein, by injecting little pieces of RNA it can convert directly into proteins that will cause an immune response that will allow the immune system to recognise and respond to future infections of coronavirus (Versteegen, 2021).

To achieve what these scientists have achieved in the last 18 months, has come from many hours cultivating cells in media that was derived from animal blood serum .

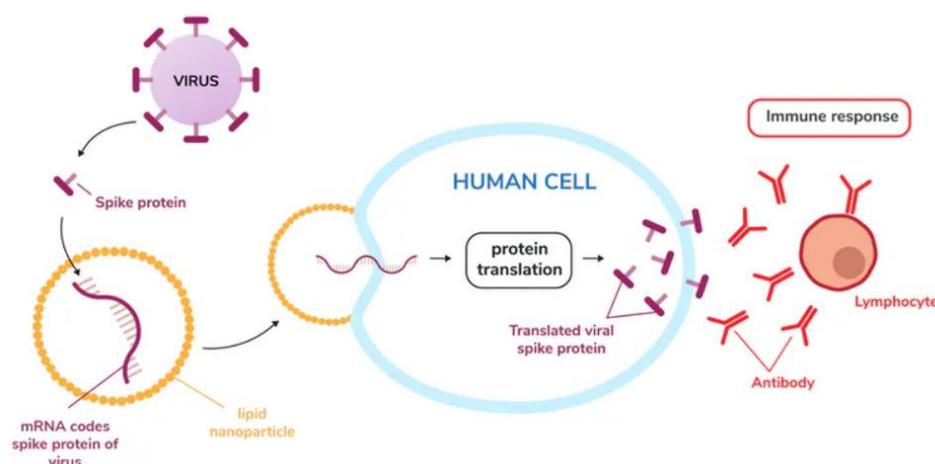


Figure 16. Mechanism of mRNA vaccines (Riggs, 2021)

Animal serum in Diagnostic manufacturing:

DNA is now part of everyday language, it allows us the insights into all the information necessary to build and maintain an organism, each living organism as unique as a person's fingerprint. The bovine and human genome is similar in size containing approximately 3 billion DNA base pairs (Spencer & Tomlin, 2004).

In recent times DNA has been used extensively to push the rates of genetic gain within the dairy population, it is however probably more recognised through television programmes like CSI and crime scene investigators where police extract pieces of human DNA to convict criminals.

Most diagnostic kits contain serum derived from bovine blood to protect the DNA. Animal derived serums are very important in diagnostic kits for blocking agents and washes. So before adding your antigen you block the plate with bovine serum and you may have serum in the wash that you use to use to rinse out the plates. Just about everything in the genomic world will use bovine serum (Versteegen, 2021).

Animal vaccines:

In recent years, various parts of the world have begun to classify the fact that animals are sentient beings. Sentient describes the capacity to have positive and negative experiences and thoughts of happiness and suffering. The world organization for animal health state the five freedoms (Versteegen et al., 2021).

- 1) Freedom from hunger, thirst and malnutrition
- 2) Freedom from fear and distress
- 3) Freedom from physical and thermal discomfort
- 4) Freedom to express normal patterns of behaviour
- 5) Freedom from pain injury and disease

In the Companion Animals New Zealand report 2020 showed that 41% of New Zealand households have at least one cat and 34% of New Zealand households have at least one dog. That is up 28% from 2015. Insuring your animal is less likely to succumb to disease is seeing pet owners responsibly vaccinating their pets against common diseases (Paul, 2020).

New Zealand cats need two primary vaccinations to protect them from common diseases. The first being Rabies, a neurotropic virus that is capable of infecting nerve cells and saliva once clinical symptoms appear rabies is virtually 100% fatal. The next is a three in one vaccine that protects them from Feline Viral Rhinotracheitis (feline herpes), Panleukopenia virus (feline distemper) and Calicivirus, (a highly contagious virus that causes severe respiratory and oral disease) (Grzyb, 2021).

For Dogs: Vaccines for canine parvovirus, distemper, canine hepatitis and rabies are considered core vaccines. Non-core vaccines are given depending on the dog's exposure risk. These include vaccines against Bordetella bronchiseptica, Borrelia burgdorferi and Leptospira bacteria ("Vaccinations for Your Pet," 2021).

The farming industry for Cows, Sheep and Deer routinely use vaccinations to ensure their livestock live long healthy and productive lives. The vet vaccine industry is extremely price conscious to provide people with affordable vaccines for their animals to reduce the spreading of common diseases. These vaccines are all likely to use calf serum to generate these vaccines, as this is the most cost effective product available to generate animal vaccines (Versteegen, 2021).

Rennet and Lipase:

As sustainability, environment and animal sentience move up the list of consumer prioritise so does demand for more natural based foods. Foods produced with all natural products. Consumers are happy to pay more for products they consume or products to feed their families if they know it's manufactured using all natural based products rather than foods manufactured with synthetic products or with products that contain preservatives.

I spoke with Renco New Zealand that said these food trends are causing an increased demand for Rennet and Lipase, two products created through the slaughter of bobby calves.

Renco products are manufactured at their modern production facility in Eltham, Taranaki. The company has held ISO 9001 quality system registration for over 20 years and holds the New Zealand Government regulatory authority Risk Management Programme registration. Renco also hold Halal

approval enabling halal production where necessary. All our products are proudly GMO-free ("Welcome to RENCO New Zealand," 2021).

The New Zealand bobby calf provides critical raw material to the global natural rennet business and the calf lipase business not just for Renco New Zealand but for other New Zealand rennet and lipase suppliers. The fourth stomach (vell) of a calf is used to make natural rennet which is then exported to many countries ("Welcome to RENCO New Zealand," 2021).

The fourth stomach of the bobby calf is very high in the enzyme called Chymosin. This enzyme is extracted and used to coagulate milk in the cheese making process. The rennet produced in New Zealand has a level of >93% of the Chymosin enzyme which naturally decreases as the calf ages, making New Zealand rennet sort after due to our four day old bobby calf industry ("Welcome to RENCO New Zealand," 2021).

The New Zealand rennet industry was generated off the back of the first world war when it was difficult to source rennet from the other side of the globe and cheese was needed to feed the people both at home and fighting for their country ("Welcome to RENCO New Zealand," 2021).

Today there are other coagulants, these are not rennet's. They include those produced by micro-organisms, fungi and also through genetic engineering processes using the Chymosin gene ("Welcome to RENCO New Zealand," 2021).

There are many small traditional European cheese makers that manufacture cheese under a Protected Geographical Status under European law which came into force in 1992. The purpose of the law is to protect the reputation and promote rural and agricultural activity, helping producers obtain a premium price for their authentic products ("Geographical indications and traditional specialties in the European Union," 2021).

This means they are required to use all natural / authentic products in their cheese making. These cheese makers look to New Zealand for their supply of natural high quality rennet. This sees rennet being exported to most European countries ("Geographical indications and traditional specialties in the European Union," 2021).

Fonterra exports approximately 340,000 tonnes of cheese each year, the majority of these cheeses use synthetic coagulants, however because Chymosin also provides a superior yield with flavour and texture benefits, natural rennet is often used to produce the stronger flavoured cheddars (Bricknall, 2021b).

Just about every calf that is slaughtered in New Zealand has the vell removed for processing onto rennet (Bricknall, 2021b).

Lipase is an enzyme extracted from the glands at the base of tongue of a calf and is used as a natural flavour enhancer in dairy products and in bakeries. Lipase is usually used in the manufacture of cheeses such as blue cheeses, Mozzarella, Feta, Asiago, Romano, Fontina, Manchego and Parmesan. The key benefits when added to dairy products is it reduces bitterness and modifies flavour intensity ("Welcome to RENCO New Zealand," 2021).

Lipase is one of a number of baking enzyme that is being used to help keep baked goods fresher for longer, thus reducing food waste. Baking enzymes offer label- friendly alternatives too many commonly used baking ingredients. POWERBake®4000 range (lipase) has the key benefits of

improved dough stability, increased volumes and improved dough handling and can be used in all types of bread / buns and rolls ("Baking Enzymes," 2021).

The Lipase enzyme can be found in both animal and plant sources. From what I have read and can ascertain if it is listed as an ingredient it usually means it has originated from an animal source.

Hides and Skins:

Reduction in consumer demand due to Covid-19 and reduced demand due to the increased social understanding of animal made products has seen the contribution of hides and skins to Co Product exports, reduce for the second year in a row (*Meat Industry Association Annual Report 2020, 2020*).

Hides and skins making up 14% of Co-Product exports brought in \$221 million dollars in the ended 2019 down 30% on the \$314 million dollars from the 2018 year which had been 11% down on the 2017 year. The top three export markets for hides and skins were Italy \$86 million, China \$69 million and Australia \$21 million (*Meat Industry Association Annual Report 2020, 2020*).

I have been unable to breakdown the hides and skins between, sheep, cattle and calves. Calf hides are considered better quality as they soft and pliable compared to other hides and are less likely to be damaged by scar tissue and hide damage often seen in older cattle.

While there are five different types of leather, three are used in grading Full Grain, Top Grain, and Genuine Leather. Because hides are a natural product the quality can be impacted by many factors due to the life and environment that the animal lived in (Dan, 2021).

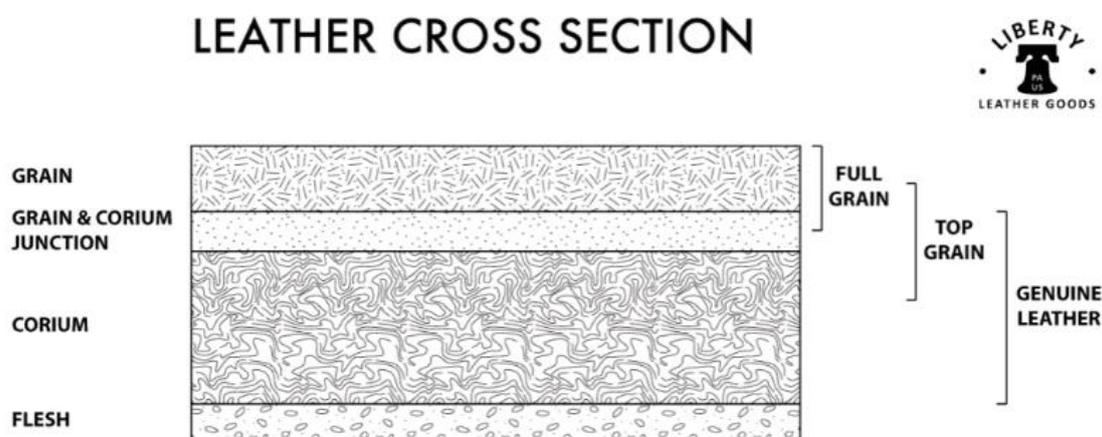


Figure 17. Leather cross section (Dan, 2021)

Full grain leather comes from the outer layer of the hide and contains strong surface fibres that make this leather strong and durable making this leather ideal for Saddlery, footwear and furniture. The outer layer also provides more water resistant qualities. Full grain is looked upon as the highest quality leather available (Dan, 2021).

Top grain is similar to full grain but with the top layer buffed to remove imperfections and irregularities. This process makes it softer and more pliable and is often used in high end leather goods including handbags, wallets and shoes. The trade-off for removing the outer layer is a higher quality look and finish but with a leather with less strength (Dan, 2021).

Genuine leather can come from any layer of the hide, and undergoes treatment to the surface to provide a more uniform appearance. It can be sanded or buffed to remove surface imperfections, then dyed or stamped to give it a final surface appearance. This process alters some of the preferred qualities of leather, so while not a top quality, it is often used for belts and similar goods (Dan, 2021).

Bobby calf skins are highly sort after because they have the soft and pliable qualities of top grain leather without any imperfections and then also have the strength fibres of full grain leather giving them a high level of durability, and a wider manufacturing product scope (Dan, 2021).



Figure 18. Cowhide ("Cowhides," 2019)

The majority of New Zealand bobby calf skin hides go to the Lowe Corporation for curing who have plants in Te Aroha, Hastings, Levin and Christchurch. The Lowe Corporation is a member of LASRA (leather and shoe research association in New Zealand) ("Lowe Corporation," 2021).

Meat processors:

I spoke with several people from several different meat processors, while they were all extremely happy to discuss the topic of bobby calves and the value to the industry from their perspectives it was extremely hard to extract any validating data to corroborate our conversations.

Many spoke with me off the record as all companies are very much aware of the ethical issues around bobby calves and didn't want to bring any possible negative connotations to their businesses.

Because the insights I received were commonly themed across processes and the industry the below is a summary of my conversations with them all.

According to Beef + Lamb there are 45 meat processing plants across New Zealand. 27 in the North Island and 18 in the South Island ("Meat Processing in New Zealand," 2019). Of the 45 plants 23 are set up to be able to process bobby calves. These plants are strategically placed to ensure they meet the animal welfare transport and slaughter guidelines ("Meat Processing in New Zealand," 2019).

If you take into account all the small meat processors as well according to the 2020 Meat Industry association there are more than 60 processing sites nationwide (figure 18), employing more than 25,000 people nationwide making the red meat industry one of the biggest employers in New Zealand (*Meat Industry Association Annual Report 2020, 2020*).

As part of this project I wanted to get an understanding of how meat processors viewed bobby calves, did they bring value to their business? With farmers utilising sexed semen would that impact the viability of running some plants? Was there a tipping point that would see bobby calves as we know it cease overnight?

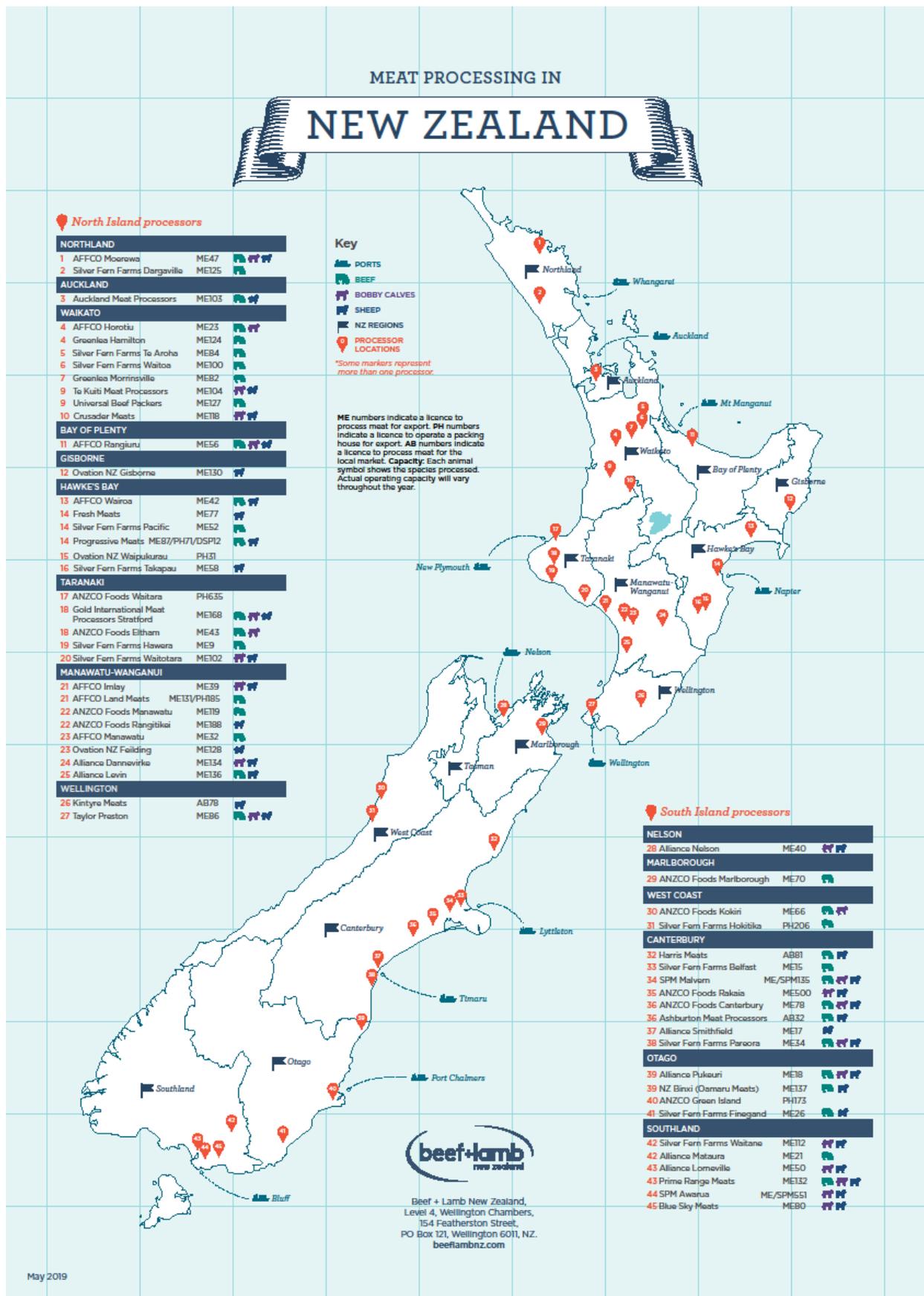


Figure 18. Meat processing locations ("Meat Processing in New Zealand," 2019)

Are bobby calves profitable for meat processors?

All the companies I spoke to agreed that the bobby calves were a profitable component of their processing businesses. There is a market not just from the meat collected but also from the other co-products that these animals contribute to. A market that has a continuing increase in demand, and an increasing return for farmers.

While processors are responsible for maximising return on each calf, ensuring none of the calf is wasted, one of the biggest benefits the processors agree on is that they allow them to get their plants up and fully staffed before the lamb season begins.

The lamb season traditionally follows the bobby calf season which allows processors the ability to meet the Xmas lamb export market. The current structure of bobby calves first then lambs gives them the ability to provide continuity for staff.

Bobby calves fill in a period when there is not normally a lot of animals going through the plants for processing, it's another link in the chain for them to be able to provide staff with 12 months employment, it's hard to put a price on that but they all recognised that as being extremely beneficial.

"If we can keep someone employed all year round it is not only good for us, it's good for them, the community and the country as a whole" one person commented.

What is the tipping point for viability?

As dairy farmers consciously start to use sexed semen over their better cows to generate better replacements, this has a flow on affect as they don't need to mate as many cows to achieve their annual dairy replacements, so they are utilising beef bulls to mate over their less productive animals generating more dairy beef animals and reducing the number of bobby calves (Hamill, 2021).

I asked the processors at what point does dairy farmer behaviour contribute to their ability to process bobby calves? The general feeling was they would comfortably absorb a current reduction of 10% in their processing numbers, a 20% reduction could see them looking at their business models around calves.

Although calves are currently a profitable product line for them all, it didn't appear to be hugely profitable one. They were all customer focused and believed that their part in the bobby calf supply chain was as much an enabler for continuity of employment in their communities, and a service to their customers and the dairy industry as it was about the profitability of the calves themselves.

What does life look like from a no bobby calf point of view as a processor?

Most if not all major meat processors have been involved in some manner over the last few years in across sector discussions on the future of bobby calves and potential solutions. I think this quote sums up the general feeling of what needs to happen if New Zealand is to achieve a zero bobby calf industry.

"Substantial innovation, redesign of the current industry structures and practices. This cannot be done by making small tweaks across the value chain, instead it will require shared vision and collaboration across the pastoral sector and the development of new products and markets, along with innovate change to farm systems and practices" (Anonymous, 2021).

The roll of the bobby calf still has a really good fit within their processing systems, and currently dairy farmers will still breed for what they need in a dairy cow, as their first priority. They know there is no silver bullet but until there is a full solution we will need to deal with these calves.

New Zealand meat like our milk products leverage our clean green image and health / disease standards to drive premiums for products. A hormone induced lactation was quickly put aside as having a huge negative impact with the processors businesses because (Anonymous, 2021):

- a) Losing the value of the calf contribution
- b) Would not be able to market the cows that had had a hormone treatment.

Would there be an impact if calves were reared to 21 days before slaughter?

70% of bobby calves are currently slaughtered on lamb chains with the average weight being 16.3kg carcass weight. If farmers were forced to hold on to the calves until they were 10-21 days of age, then this would require a huge capital out lay for new chains as the current lamb chains could not handle the additional carcass weight (Anonymous, 2021).

They did not believe this was a viable solution, as it just moved the ethical issue from 4 days to 21 days, and would also create capacity issues as currently the lambs follow immediately after the bobby calf runs delaying the slaughter until three weeks of age would cause an overlap in killing space required which the plants couldn't handle (Anonymous, 2021).



Figure 19. Dairy beef calves (LIC, 2020)

Public perception:

In 2017 Horizon surveyed just over 1000 people between late October and the beginning of November. This was a survey of the general public, not a survey only of farmers or those involved in the agricultural sector, and was designed to get an understanding of the urban view of dairy farmers and the treatment of bobby calves ("How little we know about dairy industry practices," 2017).

The survey showed 50% of surveyed people either thought it was false or did not know that a cow needs to give birth each year to produce milk. Over 80% of the public vastly underestimate the number of bobby calves killed per year. There is widespread condemnation of the killing of bobby calves soon after birth, with 60% of people feeling it is not acceptable. When asked how much trust and confidence they had in the dairy industry to ensure bobby calves are treated humanely, 47% were unconfident ("How little we know about dairy industry practices," 2017).

The survey went on to say that what came through strongly in the research was how misinformed kiwis are about the truth of dairy production ("How little we know about dairy industry practices," 2017). If I was being critical I would consider that potentially they aren't necessarily misinformed about dairy production, but rather have a lack of knowledge around rural farming practices and a lack of understanding around basic animal physics.

Also earlier in September 2017 UMR repeated a study on behalf of MPI that had been originally done in 2008. The purpose of this study was to explore urban and rural New Zealanders views of rural New Zealand and the primary sector (UMR, 2017).

Results showed that both urban and rural people still hold overall positive views of the primary sector, research suggested this was largely because of the critical role people felt the primary sector played in the economy, and over the last decade this positivity had decreased from very positive in 2008 to positive (UMR, 2017).

Almost all respondents (both rural and urban) agreed it was important that the welfare of all farmed animals in New Zealand be protected. 73% of rural respondents and 68% of urban respondents agreed that farm animals were treated well by farmers, however this was down from 82% and 71% respectively for the 2008 results (UMR, 2017). The main findings around animal welfare were,

- Many participants admitted they did not really know how animals were treated on farms, but they felt that New Zealand led the world in animal welfare standards and performance
- Participants felt most negative media reports about animal welfare were highlighting an exception rather than normal behaviour of New Zealand farmers
- Concerns tended to focus on caged farming and corporate farming
- Concerns in urban areas tended to focus around the mistreatment of dogs

I had thought about doing an urban interview myself to get a better understanding of people's attitudes towards bobby calves? And if they understood the contribution to society a bobby calf played even though it was slaughtered at four days old, and would that change their current opinion, assuming they were coming from a negative view point to begin with.

However after speaking with people from the survey industry and reading the results from the Horizon poll, the UMR survey results I quickly realised that when looking at the bell shape curve of society the top end already understand, the bottom will never be swayed from their opinion and the majority of the rest are too busy trying to make ends meet to support their families. The rest as long as I could put up a constructive argument, could be persuaded to the



Figure 20. Animal cruelty ad (Maxwell, 2015)

The biggest ability for New Zealanders to drive real change, whether it be around animal welfare, environment or even racial issues is for our media to deliver balanced articles so our society can make informed decisions rather than the negative misinformed opinions based from biased articles broadcasted to drive ratings. This does nothing for society other than drive an urban/ rural divide, racial divides and society conflicts rather than uniting our society to drive change based on science and reason.

Conclusion:

The words of my grandmother spring to mind as I contemplate summing up the previous pages. “Since Noah was a cowboy” humans have been slaughtering animals for food and products to make their lives more comfortable whether that’s with the meat they eat, the clothes they wear or merely the leather seats they sit on driving their cars to work.

Whether an animal is slaughtered at 4 days, 20 days, 10 months or even two years of age, the reality is dairy farmers will ultimately breed for their dairy replacements first and then for whatever the secondary requirement is whether that is for a bobby calf market as is currently, or a dairy beef calf market which could be if we have a zero bobby calf policy in the future.

The hard reality is if a calf born is not destined as a dairy replacement then the life expectancy of that animal in all probability is less than two years, and at every point there will be ethical questions, at four days we have the current ethical questions of the calf being torn from its mother, if we moved that to 20 days, the calf is still a baby, if we move the slaughter to a year old there will still be the ethical debate of whether that animal had a life worth living?

Or do we move to what is currently trying to be implemented in the state of Colorado where no animal can be slaughtered under five years of age? The question I’m concerned about and the focus of this report is does the animals life add value and was it treated humanely from birth to death.

In an article “A life worth living” he discusses the recognition of an animal to have both positive and negative experiences and then the development of a “life **not** worth living”, a life **worth** living” and “a **good** life” If the animal is treated with love and kindness is the value of life to that animal any different if it dies at 4 days of age or 3 months of age (Webster, 2016)?

Public perception is often driven by how and what things are reported in the media. For example in the published Horizon 2017 poll results it was reported that 47% of the people surveyed were unconfident in the industry to treat bobby calves humanely. This instantly gives a negative connotation to the treatment of bobby calves for anybody reading the results or the published findings rather than the positive angle of 53% of people surveyed had confidence in the humane treatment of bobby calves (“How little we know about dairy industry practices,” 2017).

Would a farmer’s perceptions change if they understood where an urban couples understanding of dairy farming was when they were buying dairy products for her children in the weekly groceries? Would that same urban couple make different decisions if the media portrayed a more balanced view?

I do believe to meet our market requirements for our premium products that ethically we will be unable to continue to kill four day old bobby calves, however my fundamental questions outside of the ethic debate was, does the bobby calves add value to the New Zealand dairy industry economy? And in their short life are they treated humanely is their life a valuable one?

Through all my conversations within the meat industry I can comfortably determine that the revenue through meat and co-products brings significant revenue to New Zealand through our export markets, while I have been unable to distinguish between adult cattle return and calf revenue it is clear that the Co-products that bobby calves contribute to is a significant earner per Kg of liveweight, due to the superior quality.

Before I started this project I had no idea of all the products a calf fed into, I had however wanted to differentiate the calf products and potentially show that there were certain products we would lose as an industry if we removed bobby calves completely.

What I did discover was that all products extracted from a calf were of the highest quality and as a consequence received the highest premiums. All but one products could be replaced with the same product from an adult cow or a synthetic product and while there were costs involved that could push prices up, this could still be achieved.

However rennet was the anomaly and as the world trends towards more natural products, bobby calf rennet demand increases for making cheese. There are synthetic alternatives but for many small cheese operations under European regulations New Zealand natural rennet is the best option, as they cannot use synthetic products (“Geographical indications and traditional specialties in the European Union,” 2021).

What did surprise me was the number of jobs that are associated with the bobby calf industry and how reliant the meat processors are with the three month supply period to provide continuity of jobs for their workers, this has a flow on affect to the wider communities and society as the more people we can keep fully employed the less reliant these workers would be on benefits if they became seasonal workers.

I also found that there is a lot of collaboration / discussions happening across the primary sector on potential solutions for what is considered a bobby calf problem. However while everyone agrees that there is no silver bullet and any solution will require across sector partnership which will require

give and take from all sides, each individual entity continues to work within their own silo's on their part of the issue which inhibits a solution for our dairy farmers.

When I look at whether the bobby calf's life is a life worth living I question who is determining that aspect? The judgement of an animal's quality of life into one of the categories of "a life **not** worth living" a life **worth** living' or "a **good** life" is flawed.

The judgement of life quality is done by humans rather than the animal. For example: a highly sensitive pet owner of a terminally ill cat may consider that its life is worth prolonging because it continues to give and receive love. Where an insensitive farmer may consider that the life of a severely lame cow has worth, so long as she continues to give milk .What these two examples have in common is that in neither case does the animal contribute to the decision (Webster, 2016).

If we look at how dairy farmers treat their bobby calves and then transport them to the meat processors, all of which have to adhere to strict animal welfare guidelines, meat processors also have to meet strict requirements, no one can argue that the New Zealand bobby calf treatment does not meet the strict New Zealand animal welfare requirements?

I would argue that the value the bobby calf returns to the primary industry and the jobs it creates and the communities it supports, that bobby calves can no longer be deemed a by-product of the dairy industry but rather be recognised for the value of co-products it creates which are very desirable secondary goods.

The removal of bobby calves will have a significant financial impact on the livelihoods of many New Zealanders, their rural communities and the New Zealand economy.

However no matter how much we educate our urban New Zealand citizen's about the rural sector they are primarily not the end consumer of our dairy products. If we want to continue to receive premium dollar for our dairy products on the international stage then our social licence to operate will not allow our dairy industry to continue to slaughter four day old calves indefinitely.

So where to from here? New Zealand is not growing more land, and with more land going into trees then we are losing land, the majority of that land would not be suitable for raising the 1.9 million additional animals but some certainly is, and these calves will also be competing with an increasing horticulture sector.

The reality is these calves will displace some current stock and possibly dairy cows. There are not enough rearers and for farmers to guarantee that their calves each year have somewhere to go they will have to invest in infrastructure to get these calves to 100kg weaning weight.

I don't believe all these bobby calves can be taken through to 600 days some will need to be slaughtered early, probably 6-10 months for a veal market that has not been created.

Yes there is an opportunity to create more revenue from what it currently creates, by growing that animal out to a larger carcass, I just can't see that the overall cost to the industry and society will be more positive, and is the reason why the industry hasn't already moved there.

While some farmers are proactively reducing their bobby calf numbers I don't think that industry as a whole will move to zero Bobbies until they are forced.

Recommendation:

It is clear that there is no silver bullet for the perceived bobby calf issue, and that many factors across sectors will need to be pulled together to find a solution. It is not helped that bobby calves is considered to be a dairy farmers issue only and a problem they need to solve, where many dairy farmers believe that bobby calves are just a part of farming. (Source from Cuthbet)

If the bobby calf industry was to be removed there would have to be a multitude of solutions as there simply is not enough viable land to finish all these animals at today's current slaughter numbers to finish them to 600 days.

I do see that these calves do contribute to New Zealand's economy and the products derived are seen to be the highest quality and attract premiums.

The bobby calf industry supports 1000's of jobs and communities, the financial implications of removing this industry and replacing it with growing calves out to a greater carcass weight is unclear and needs further investigation to see if as a country we would be any better off.

My recommendation would be to do a full industry review to full understand the financial and social benefits that the current 1.9 million bobby calves contribute that can them be used as the benchmark for any proposed solution for their removal.

The New Zealand dairy industry also needs to think seriously about promoting their story within New Zealand we are fixated on protecting our premium export market that we are not fixing the increasing urban rural divide within New Zealand. We need our own country to support our industry and understand that our farmers not only care for the environment but care about the welfare of their animals.

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