



KELLOGG

RURAL LEADERSHIP
PROGRAMME



**‘Potential threats to New Zealand deer pet food from
international wild deer supplies’**

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1. Executive Summary

“The large-scale commercial farming of deer started in New Zealand, and New Zealand remains the world's largest and most advanced deer farming industry” (DINZ, n.d.).

Recently, a significant increase in demand for pet food products has developed. This has been fuelled by American and European customers buying for pets which are now so highly regarded they are seen as members of the family. This is leading to greater importance being placed upon nutrition, taste and overall wellbeing of the animal, driving the customer to invest in high quality and novelty pet foods.

Venison has been counted as a novelty meat in the pet food ingredient classification. “Venison is seen as a natural, high-quality, lean snack in the pet industry which appeals not only for its nutritional values but because dog owners in particular think it’s something their animal’s ancestors might have eaten” (NZ Farm Life Media, 2016).

Mechanically Deboned Meat (MDM) is the product produced from the crushing and separating of bone from meat. As well as MDM, the organs from deer are able to be added to pet food products in small quantities, enabling labelling claims which indicate to customers that venison is present in the product but also enables a relatively high return per kilogram back to the New Zealand exporter who in turn can pass these benefits to the New Zealand farmer in the form of higher schedule prices for their livestock.

International pet food manufacturers have signalled however that they are dissatisfied with the cost per kilogram and are therefore searching the globe for alternative sources of venison. It appears that Spain and potentially Australia are able to meet a proportion of this demand, with more investigation required to determine if other nations are able to meet this demand.

What becomes apparent in this is that the disease status of the supplier country plays a significant part in market access. Freedom from Foot and Mouth Disease, Chronic Wasting Disease and BSE prevent the United States of America (US) and in some areas of the European Union (EU) from utilising their own deer population to meet this demand. The key suppliers of venison to the pet food market are at present left to Spain and New Zealand and some internal EU countries.

This poses a threat of substitution, rivalry in the industry and a new entrant threat to the New Zealand farmed-deer industry.

2. Introduction

Deer are defined as, 'any ruminant artiodactyl mammal of the family Cervidae, including reindeer, elk, muntjacs and roe deer, typically having antlers in the male' (Collins English Dictionary, n.d.). The Collins English Dictionary also points out that the word 'deer' originates from a combination of the Old English word *deor* meaning beast, the Old High German word *tior* meaning wild beast and the Old Norse word *dyr*.

"Deer are widely distributed, with indigenous representatives in all continents except Antarctica and Australia, though Africa has only one native deer, the Barbary stag, a subspecies of red deer that is confined to the Atlas Mountains in the northwest of the continent. However, fallow deer have been introduced to South Africa" (Wikipedia, 2018).

"The large-scale commercial farming of deer started in New Zealand, and New Zealand remains the world's largest and most advanced deer farming industry" (DINZ, n.d.). Deer farming in New Zealand is a commercial operation undertaken often along-side sheep and/or beef farming. The predominant commercial objectives of New Zealand deer farming focus on the production of velvet for the Asian medicinal market and the production of meat (venison) for export markets, which are mainly focused in the USA and EU.

Deer meat and internal organs are called 'Venison'. This originates from the word *venari* (to hunt or pursue) (Wikipedia, 2018).

Farmers are paid per kilogram for velvet based on quality and weight grading and for meat a per kilogram on a hot carcass weight. Prices for venison are set in schedules each week by exporters and are influenced by a number of factors. The three main factors being; market returns, exchange rates and procurement competition.

With reference to market returns, a stand out contributor to this recently has been the demand for Petfood ingredients.

"Venison is seen as a natural, high-quality, lean snack in the pet industry which appeals not only for its nutritional values but because dog owners in particular think it's something their animal's ancestors might have eaten" (NZ Farm Life Media, 2016).

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“Venison prices were predicted to remain strong at \$11 to \$11.75 per kilogram until the end of December, to \$10.40 to \$11 a kilogram for the first three months of 2019. The pet food market continued to underpin prices, but markets were resisting further price increases” (Stuff, 2018). This ‘resistance to pricing increases’ is in part due to pet food manufacturers indicating the products are currently fully priced. Industry commentary indicates that international pet food manufacturers have been looking elsewhere for venison pet food products.

This report investigates what international, regulatory impediments exist, that apply to wild deer supplies, that may hinder or help the supply of New Zealand deer pet food products, destined for worldwide venison pet food manufacturers.

3. Aims and Objectives

The aim of this research is to understand at a high level the reality of a competitive supply, from overseas (relative to New Zealand) wild deer pet food raw material products. The majority of the deer on the globe exist in the wild, while in New Zealand a mature and relatively large deer industry is built on farmed deer.

International Petfood manufacturers are keen to secure venison products applicable to pet food, consisting of bones, trim and organs. Recent activity by pet food manufacturers indicates that provenance is not highly valued, so their ability to substitute New Zealand venison products as raw material for pet food is high.

Due to this the objective has been to determine if there are any regulatory restrictions, or lack of, that help or hinder the US and EU based pet food manufacturers, to meet their demand for venison via a substitute venison product or reducing the current value due to an increase in supply.

Given the constraints of time and information the method has been to conduct a literature review spanning news print, industry commentary, US and EU import and export regulations. Following which the well-known competitive advantage framework (Porter's Five Forces) has been included to add structure to the analysis of the literature review data.

4. Methodology

Research into deer of the world has been undertaken via a literature review. This research noted locations, animal sizes (shoulder height and approximate liveweights) from information in Rue's (2002) *The Encyclopedia of Deer*, and Whitehead's (1993/2008) *The Whitehead Encyclopedia of Deer*, as well as a range of reports from different environmental and regulatory bodies. Assistance to ensure that the most accurate and relevant sources were being used was sought from Deer Industry New Zealand via Producer Manager Tony Pearse and Lincoln University Professor Geoff Kerr.

Following this deer specific research, the literature review encompassed pet food industry commentary, analysis and predictions to understand the driver behind the deer pet food products.

To effectively assess the threats that may or may not be faced by New Zealand deer pet food part of Porter's Five Forces framework was useful to apply as a framework. "The five-forces framework allows a firm to see through the complexity and pinpoint those factors that are critical to competition in its industry, as well as to identify those strategic innovations that would most improve the industry's and its own – profitability" (Porter, M.,1985, p.7).

In 'The Key Elements of Success and Failure in the NZ Venison Industry' (Shadbolt, McDermott, Williams, Payne, Walters & Xu, 2008) the authors published a comprehensive full industry 'Porter's Five Forces' analysis. In the 10 years since this report some parts have changed to be either more or less relevant.

The focus of this particular research, as demonstrated in *Figure 1* has meant that the focus is on three of the forces; Potential Entrants, Substitutes and Rivalry.

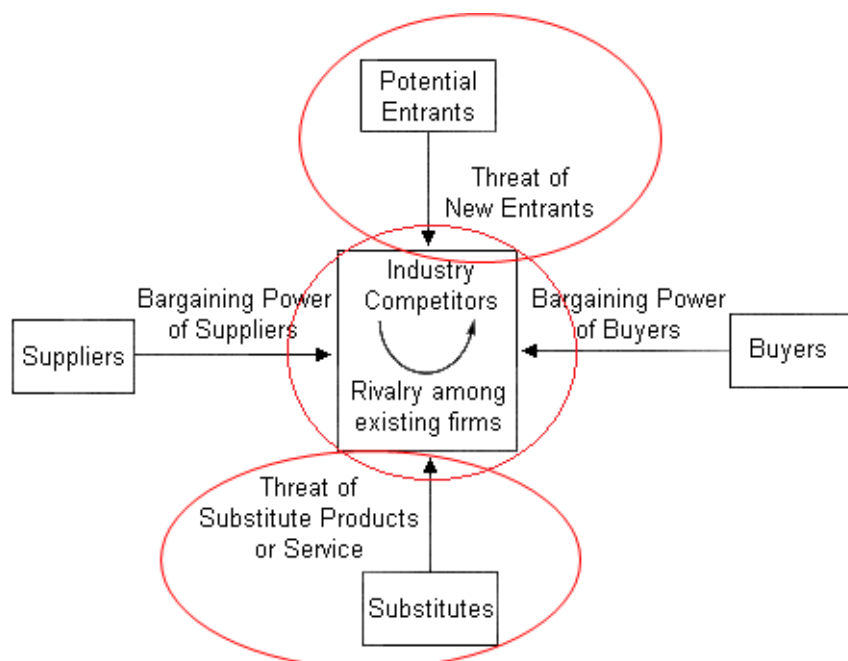


Figure 1:

Porter's Five Forces Simple Diagram with red circled focus areas specific to this research

5. Literature Review

5.1. Deer

'Taxonomy is the science of naming, describing and classifying organisms and includes all plants, animals and microorganisms' (Convention on Biological Diversity, n.d.). Deer are classified by taxonomists as being from the Kingdom of *Animalia*, the Phylum within that of *Chordata* and Classed as *Mammals*, these mammals belong to the Order of *Artiodactyl* and Sub-order of *Ruminantia*. Within that they belong to the Family of either *Cervidae* or *Moschidae* and then one of the three sub families of either *Capreolinae*, *Cervinae* or *Hydropotinae*.

At this point the Taxonomy becomes contested between the apparent expert sources on the appropriate Genus. Rue (2002) points out, "Taxonomy has never been set in concrete - classifications are constantly changing" (p.11) he also states in his book, "there are forty-six species in the Cervidae Family, and if you add the five species from the *Moschidae* family, as most taxonomists do, there are 51 species in total" (p.11).

The other renowned author in this field is Whitehead (1993/2008) who states, "the family [*Cervidae*] contains sixteen genera which consist of about 41 species" (p.467). The Encyclopedia Britannica (2018) also mentions that, "Deer (*Cervidae*), any of 43 species of hoofed ruminants in the order of *Artiodactyla*, notable for having two large hooves on each foot and also having antlers in the males in most species".

The evolving species list is not critical to this report but is important to be aware of for further research. To avoid complicating this topic further, a template combining the above sources, is available in Appendix 1.

5.1.1. Deer Habitats

"The requirement for nutrients and energy has severe repercussions on the ecology of deer. It confines deer to relatively productive habitats, excluding them from deserts, dry grasslands, and geologically old landscapes leached of nutrients" (Encyclopedia Britannica, 2018).

5.1.2. Relevant deer species to this research

The population of deer around the world is constantly evolving number due to climate, habitat changes and human or other animal influences. It is not therefore possible to provide specific figures but as an alternative, classifying these species into categories is essential, to gain some appreciation of the extent of the populations.

The International Union for Conservation of Nature (IUCN) provides detailed reports where possible on each Deer species due to the organisations goal: "To provide information and analyses on the status, trends and threats to species in order to inform and catalyse action for biodiversity conservation" (IUCN, 2017). "The IUCN is the global authority on the status of the natural world and the measures needed to safeguard it. Our experts are organised into six commissions dedicated to species survival, environmental law, protected areas, social and economic policy, ecosystem management, and education and communication" (IUCN, 2018).

The summarised categories below are based on the IUCN (2001) categories and used as part of categorising the deer of today for understanding populations.

- **Extinct**
 - No reasonable doubt that the last individual has died.
- **Extinct in the Wild**
 - Known only to survive in cultivation, in captivity or as a naturalised population(s) well outside the past range.
- **Critically endangered**
 - Facing an extremely high risk of extinction in the wild
- **Endangered**
 - Facing a very high risk of extinction in the wild
- **Vulnerable**
 - Facing a high risk of extinction in the wild
- **Near threatened**
 - Is closest to qualifying for or likely to qualify for a threatened category in the near future.
- **Least Concern**
 - Widespread and abundant.
- **Data deficit**
 - No data to determine.
- **Not evaluated**
 - Has not been evaluated.

By researching the IUCN (2017) information on each of the above species and sub species, categorising them further into categories was possible. The categorisation adapted from the IUCN structure can be viewed in Appendix 1 as to where it allocates each deer species.

To remain focused on the object of this study the removal of data relating to deer populations that are 'critically endangered' through to 'near endangered' threatened status is essential. The targeting of animals for harvest, that have a significant perceived and/or real threat to their population's sustainability, is not practical for a commercial venture. The study from this point will focus on the deer species that are classified by the IUCN (2018) as 'Least Concern'.

A further filter on these animals comes via the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an international agreement between governments, aimed to ensure that international trade in specimens of wild animals and plants does not threaten their survival (CITES, n.d.). The CITES (n.d.) website also states, "CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union)".

With respect to the 'Least Concern' (IUCN, 2017) category of deer, CITES (n.d.) also has three appendices as part of its classification system which further help to clarify the deer within this category.

In Appendix 3 of this report are noted the sub-species of deer that fall into the CITES appendices. CITES (1983) explains the fundamental principles of each appendix and the sub species which is impacted by this has been added by the author to indicate some of the relevant animals that apply:

- “[CITES] Appendix I shall include all species threatened with extinction which are or maybe affected by trade”. *Cervus Elephus hanqlu (Kashmir)*
- “[CITES] Appendix II shall include all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival”. *Cervus elaphus bactrianus – ‘Bactriam Deer’ (a small amount said to still exist in Afghanistan)*
- “[CITES] Appendix III shall include all species which any part identifies as being subject to regulation within its jurisdiction or the purpose of preventing or restricting exploitation, and as needing the co-operation of other parties in the control of trade”. *Cervus elaphus barbarus (Algeria, Tunisia) & Odocoileus virginianu mayensis (Guatemala)*

Understanding the omissions that the three appendices stipulate is important if further work were to be done to the subspecies level within the ‘Least Concern’ species. Additional to note is The Federal Agency for Nature Conservation (BfN), which “is the German Government’s scientific authority with responsibility for national and international nature conservation” (BfN, 2010).

The BfN (2010) state the following:

- Corsican red deer (*Cervus elaphus corsicanus*)
 - BfN (2010) “subject to a national prohibition on ownership and commercial use”
- The following species are “not protected” (BfN, 2010) pointing out that import permits are not required for bringing trophy items from these animals back into Germany.
 - North American white-tailed deer (*Odocoileus virginianus*)
 - Mule deer (*Odocoileus hemionus*)
 - Red deer – central European population (*Cervus elaphus*)
 - Reindeer -Caribou (*Rangifer tarandus*)

The majority of Muntjacs are small animals with Whitehead (1993/2008) and Rue (2002) categorising adult Muntjac within a weight range of 10-33kg collectively. Due to this and the small yield that would be anticipated in a harvesting operation of commercial proportions, we will at this point exclude this species from the potential deer available in this study going forward.

The species of interest to this report are itemised in Table 1.

Table 1: Deer Species of the world with IUCN classifications applied and data from Rue (2002) & Whitehead (1993, reprinted 2008)

IUCN Category	Latin Name	Species	Subspecies	Weight Range	Shoulder Height
LEAST CONCERN	<i>Alces alces</i>	Moose		200-825kg	1400-2350
	<i>Capreolus capreolus</i>	Roe Deer	European	15-50kg	650-1100
	<i>Capreolus pygargus</i>	Roe Deer	Siberian	15-50kg	650-1100
	<i>Cervus nippon</i>	Sika Deer (Japanese Deer)	-	80kg	640-1000
	<i>Cervus elaphus</i>	Red Deer (Maral)	-	76-300kg	750-1270
	<i>Cervus canadensis</i>	Wapiti/Elk (North America)	-	75-544kg	750-1500
	<i>Odocoileus hemionus</i>	Mule Deer (Black Tailed Deer)	-	64-213kg	860-1360
	<i>Odocoileus virginianus</i>	White-Tailed Deer	-	20-215kg	550-1100
	<i>Axis axis</i>	Axis Deer	Axis Deer (Chital Deer)	27-110kg	594-990
	<i>Dama dama</i>	Fallow Deer	-	40-100kg	792-1100
	<i>Muntiacus reevesi</i>	Muntjacs (Barking Deer)	Reeve's	10-33kg	406-780
	<i>Muntiacus muntjak</i>	Muntjacs (Barking Deer)	Indian	10-33kg	406-780

5.2. NZ Deer Industry explained

5.2.1. Brief history

New Zealand was the first and is still the “largest and most advanced deer farming industry” (DINZ, n.d). The industry developed from deer that were introduced to New Zealand for game shooting in the late 1800’s. The deer flourished to pest proportions in the Southern Alps and surrounding hills. Government initiatives to cull the deer by foot were soon surpassed by the introduction of helicopter shooting operations. These helicopter operators developed their businesses to include carcass retrieval, “the export of venison from wild deer started in the 1960’s” (DINZ, n.d.). Initially these markets centred on the established European game meat market. Realising the potential of this meat to compete in offshore markets, the pilots and their teams then quickly realised that the capture of live deer, which began “in the early 1970’s” (DINZ, n.d.) and development of farming operations would enable operations to meet the market’s demand for New Zealand venison. Today there are “around 2000 farmers farming approximately one million deer” (DINZ, n.d.).

5.2.2. Current

Today there are five New Zealand Venison processor/exporter companies. Silver Fern Farms, Alliance Group, Mountain River, Duncan New Zealand and First Light Foods. Today the U.S.A is New Zealand’s largest export destination for venison with export volumes of “3,437 tonnes in the end August 2017” (Meat Export NZ, 2017). “In contrast Germany received 2,570 tonnes” (Meat Export NZ, 2017). These tonnages refer to the carcass meat cuts specifically. Other value is returned from exports via by-products and co-products, either sold directly by the aforementioned exporters or in the case of pet food by-products, several companies process the raw material to a state fit for export. These companies are Meateor foods, Wilbur Ellis, Oceania Meat Processors and Pasture Petfoods.

DINZ Executive chef Graham Brown, on his mid 2017 trip to the USA, noted two trends as “stylised street food coming from the food truck craze and the use of cheaper cuts” (Meat Export NZ, 2017). Glenn Tyrrell, the General Manager of Marketing at Duncan New Zealand recently summed up the current returns to venison at the DINZ Conference in 2018, explaining that the \$11/kg schedule was based on “the industry’s long term investment in New Zealand Venison”, as well as “diversification of venison markets towards higher value niches in Europe and North America, less product availability, a major increase in the value of pet food products and firm demand from Asia” (Meat Export NZ, 2018). The final comment referring to Asia touches on the co-products that include, pissles, sinews and tendons that are used in traditional Asian products.

Pet food, however, is the notable change which this project is particularly interested in.

5.3. International Deer summary

5.3.1. International farming prevalence

Commercial Deer farming occurs in various parts of the world for a variety of reasons. These include venison production for domestic or export markets, supplying the by-products markets, velvet production and other co-product markets as well as the raising of trophy standard animals for the sport of trophy hunting. Countries involved in this according to the Food and Agriculture Organisation of the United Nations (FAO) (1980) included New Zealand as the largest, Australia, Russia, Korea, China, Austria, United Kingdom and Germany. Since 1980 this spread has increased further. Shadbolt et al. (2008) show that deer farming, in addition to the FAO (1980) information, is in varying stages of development in managed herds of reindeer in Scandinavia, and farming behind fences in the EU, the U.S.A, Canada.

Tony Pearse, Deer Industry New Zealand Producer Manager, indicated in early November that some farmed population estimates for China were between 600,000-700,000 of Sika deer with about 30,000 Maral (Red) deer, Australia had about 45,000. To add further data to this Dr Tomas Landete-Castillejos (President of International Deer & Wild Ungulate Breeders Association (IDUBA)) was able to provide farmed deer numbers for Europe in 2010 from a survey of 18/20 EU countries by Kotrba & Bartos, (2010) in Appendix 2.

The North American Deer Farming Association (NADeFA) states they “represent the owners of over 75,000 cervid livestock”, the organizations data shows the following species mix: Axis 9.2%; Fallow 23.7%; Red deer 30.4%; Sika 21.1 % Whitetail 26.9%; Wapiti/Elk 4.6% other 3%” (North American Deer Farming Association, 2018). When compared to the New Zealand farmed deer industry herd size indications show that the North American farmed herd is less than 10% of that. Shedding more light on this population of farmed deer in the USA is Frye (2006) who states “nationwide, there were just about 11,000 or so deer farms, raising about 550,000 deer and employing 23,000 people in 2005 according to Phyllis Menden, executive director of the North American Deer Farmers Association”. Table 2 is a compilation of two sources to easily demonstrate where deer farming occurs on the globe.

Table 2:

Compilation of data regarding global prevalence of deer farming operations

	Food and Agriculture Organisation of the United Nations (FAO) (1980)	IOWA State University: AGMRC Agricultural Marketing Resource Centre (2018)
Red Deer	New Zealand, Russia, Australia, China, Austria, United Kingdom, Germany	New Zealand, Russia, Australia, South Korea, China, Austria, United Kingdom, Germany, Argentina, USA
Reindeer	Russia, Alaska, Canada, Norway, Sweden, Finland	Russia, North America (Alaska & Canada), Norway, Sweden and Finland.
Wapiti	Russia, Mongolia, Korea, China, New Zealand	Russia, Mongolia, South Korea, China, North America, New Zealand
Sika	China, Korea, Russia, Japan, New Zealand	China, South Korea, Russian, Japan, New Zealand,
Rusa	Australia, Papua New Guinea	Mauritius, Australia, Papua New Guinea (experimentally)
Fallow	Germany, Australia, New Zealand	Europe, U.S.A
Musk	China, Russia	China, Russia, Experimentally in (South Korea, Nepal, Bhutan)
White tail		USA for trophy genetics

The mentioning of farmed populations at this point adds some context to help understand that although the farmed collective herd size in New Zealand is large, the wild populations of deer significantly out-number the farmed deer.

Having identified in Table 1, the locations of wild deer in the world that are classified by the IUCN as ‘Least Concern’, this report will remain focused on those wild species (Moose, Roe Deer, Sika, Red, Wapiti/Elk, Mule, White-tailed, Axis, and Fallow Deer).

Estimations of these animals in the wild are difficult to come by in any organised and accurate format, however, the specific population size is not essential to this particular research.

5.3.2. International wild herd prevalence

Identifying exact population numbers of each species in available literature is either dated or not present. The most comprehensive has been the ‘Population’ section of the individual species reports that the IUCN publishes. Even though the IUCN information is helpful, the purpose of the Red List (IUCN, 2018) reports is not specifically to quantify the world’s deer herd populations, so a simplified table has been developed from the IUCN (2018) Red List data as well as Rue (2002) and Whitehead (1993/2008).

Appendix 4 indicates where each species is found according to the IUCN Red list species reports. Appendix 5 also indicates population density of the main deer species in European Union (EU) in 2005 countries as well as some estimated harvest rates, which will become more relevant later in this report.

There could very well be some species not noted as being present in some countries and this omission is due to the huge amount of data that is available with differing levels of accuracy. The most important point to determine is that if there are deer present in these counties then could they be of significant numbers that they could attract commercial ventures to harvest them and dependent upon terrain and harvest method this would need to be undertaken case by case.

5.3.2.1. Europe

In 2008, Shadbolt et al., (2008), explained that “most of the world’s venison is provided by feral herds of Northern Europe, North America and Russia as well as farmed deer from New Zealand”. With the largest amount of venison originating from Scandinavia and Russia it is important to understand that “around 80% of this is consumed by hunters and only 20% sold commercially” (Shadbolt et al., 2008).

Professor Geoff Kerr of Lincoln University has been able to provide data compiled from Apollonio, M., Andersen, R. and Putnam, R. (2010) in Fig 3.

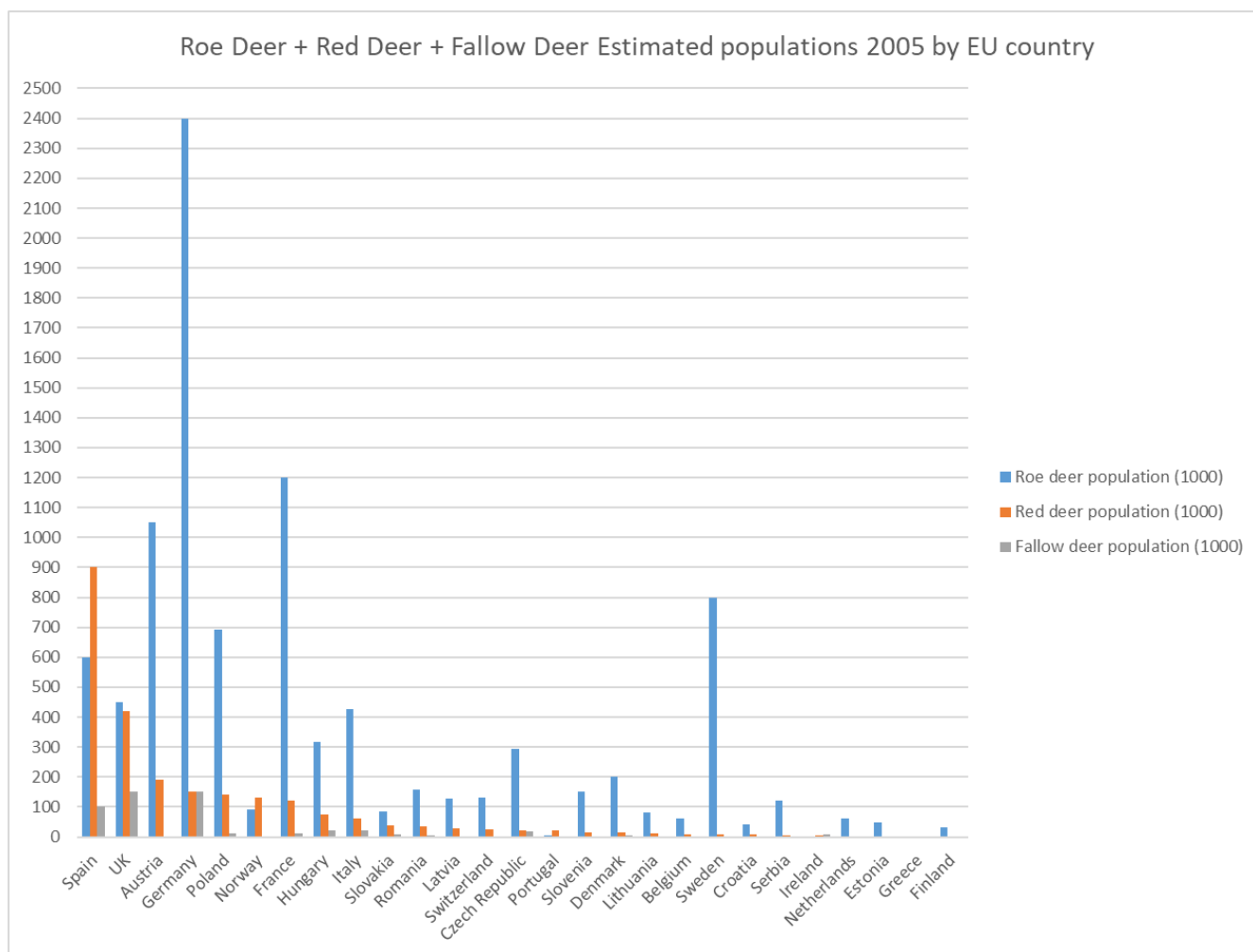


Figure 3:

Estimated populations as at 2005 of the three main deer species in Europe

Source: Apollonio, M. et. al. (2010)(eds).

Figure 4 goes on to demonstrate that the percentage slaughtered by hunters is in the majority of cases under 50% of the estimated population, enabling sustainability.

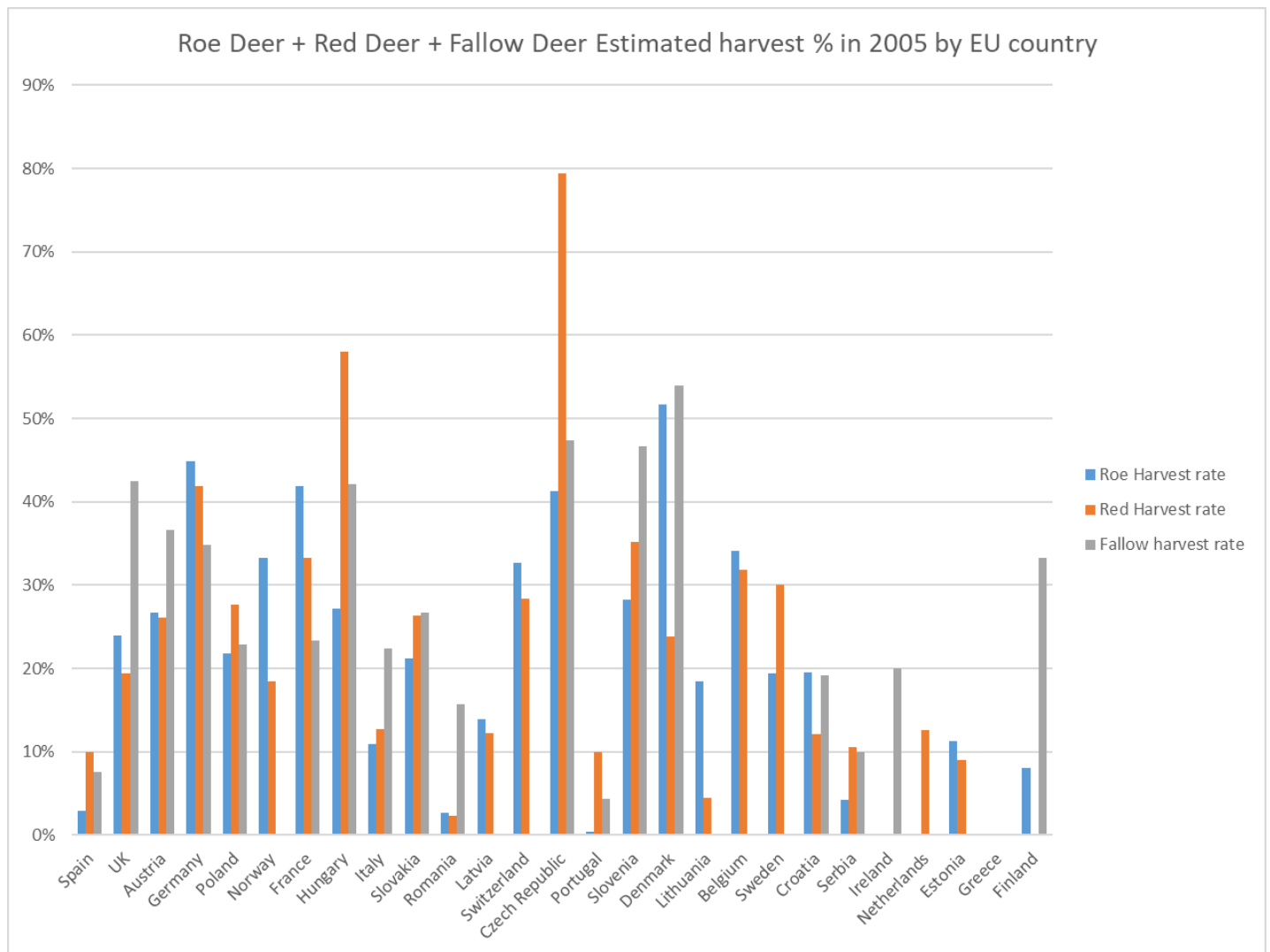


Figure 4:

Roe, Red and Fallow Deer Harvest % estimates per EU country (2005)

Source: Apollonio, M. et. al. (2010)(eds).

Given that Spain appears in Figure 3 to have the highest Red Deer population in the EU and 5th highest Roe Deer population, followed by Figure 4 which shows a relatively low harvest rate. It is therefore interesting to note its exporting intensity of venison products. “Spain is the second main exporter of deer meat. In Spain 225,000 deer are shot per year” (International Deer & Wild Ungulate Breeders Association (IDUBA), 2018). The first exporter of deer meat (venison) is New Zealand as discussed earlier.

5.3.2.2. USA

The Quality Deer Management Association's (QDMA) Kip Adams (2016) stated that "White-tailed deer are the most important game species in North America. More hunters pursue whitetails than any other species, and whitetail hunters contribute more financially than any other hunter segment. Collectively speaking, whitetails are the foundation of the entire hunting industry".

A not for profit, research project in the USA state named 'Deer Friendly' (n.d.) noted that, "The total U.S. deer population in 2014 was about 32.2 million; 28.6 million whitetails and 3.6 million mule deer, blacktails, and other. That's down from 33.5 million in 2013; 29.9 million white tails and 3.6 million mule deer, blacktails, and other. Recent peak U.S. deer population is estimated to have occurred around the year 2000 at 38.1 million, 33.5 million whitetails and 4.6 mule, blacktails, and others".

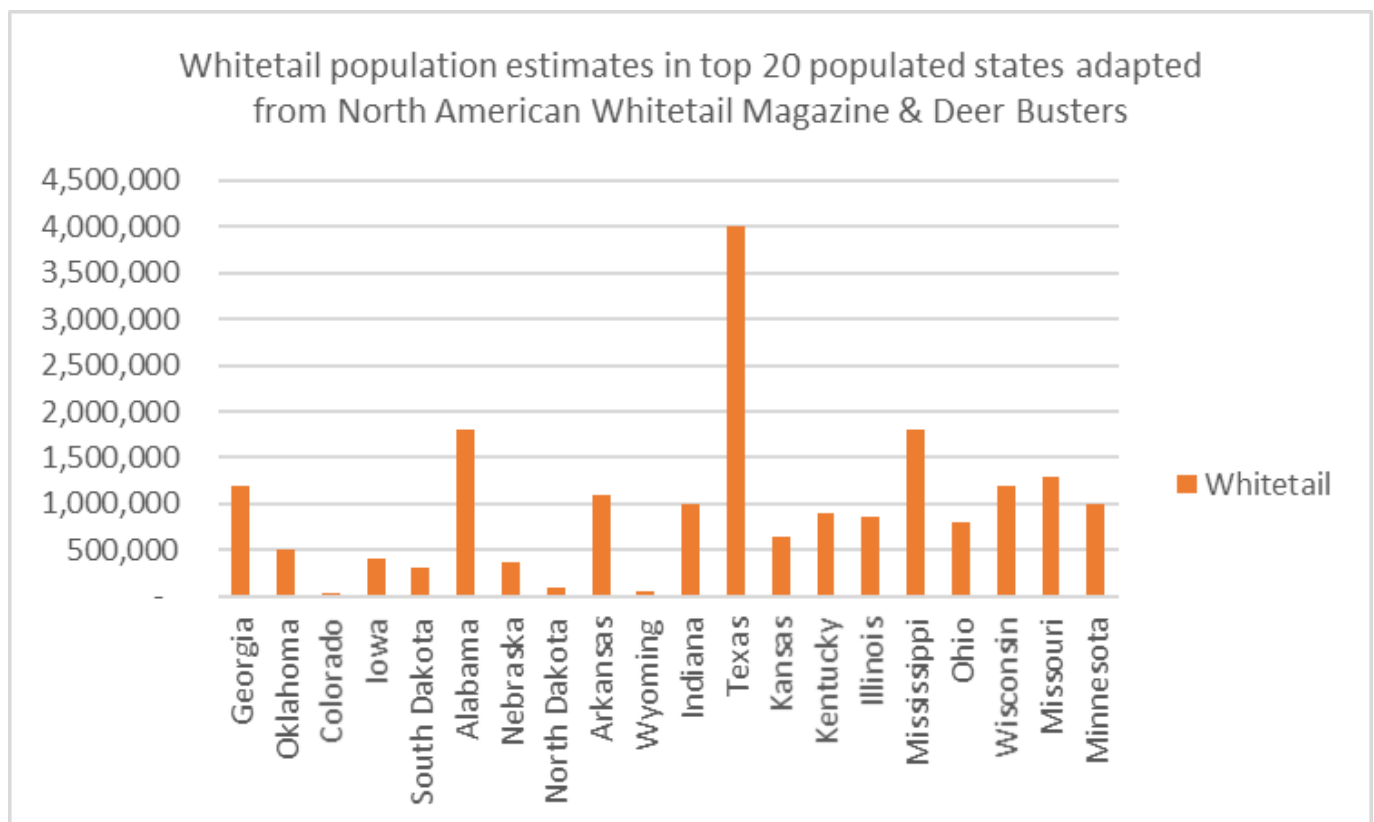


Figure 5:

Whitetail population estimates in the top 20 most populated states in the USA.

Source: Deer Busters.com via North American Whitetail Magazine

5.4. The World Pet Food Market

5.4.1. Pet Ownership Facts

Dogs and cats have been companions of humans for thousands of years transitioning from 'working' animals involved in guarding livestock, people and property (Pet Food Institute, n.d.). A most notable change since the industrial revolution has been the increase in pets as companion animals. Dietary considerations have also increased with disposable income. Through the 1800's animal would have dined on whatever their owners could find to feed themselves often lower grade items such as "knuckles of bone, cabbage, potatoes, onions and crusts of bread" (Pet Food Institute, n.d.). The Pet Food Institute (n.d.) also explain that it was James Spratt who saw old ships biscuits being fed to dogs and following this example formulated a dog biscuit to sell to sporting dog owners in England. Following this, more companies became involved and the development of kibbles and canned products eventuated with a focus on horse meat as the major protein component at the time. Table 8 demonstrates where pet ownership is currently in the EU and USA.

"In the mid-1980s, the U.S. National Academy of Sciences' National Research Council published nutritional requirements for dogs and cats and released updated profiles in 2006 that reflected the evolving science and understanding of animal nutrition. Most commercially-prepared U.S. pet food is now formulated to be "complete and balanced," meaning that it provides all of a pet's nutritional requirements at the correct levels" (Pet Food Institute, n.d.).

Based on the 'Packaged Facts National Pet Owner Survey for Pet Food Forum 2018', Sprinkle (2018) explained that the major finding was that "taste, ingredient quality and functional attributes all play their parts in how consumers choose pet foods" (p. 51).

An interesting point in the same survey data related to the ingredient quality is that "most notably, given ongoing consumers' concerns triggered the recent history recalls (and distrust of ingredient sources from China, in particular), 43% of dog owners and 38% of cat owners report buying pet foods with 'Made in USA' claims" (Sprinkle, 2018., p.52).

"The value to using venison, rabbit and buffalo in the production of pet foods is added choice in the pet aisle for the consumer and their pets. The appeal of a story, a connection to the pet's past and a feeling by the owner that they are doing something special for their animal is sometimes as important (if not more so) to the merchandising of pet foods as the status quo. These ingredients help to portray that feeling and connection" (Petfood Industry.com, 2014).

"Pet owners are already buying as much pet food as they need, so volume sales can no longer be relied on for significant growth. Instead, growth is coming from the drive pet owners have to give their pets the best. (Sprinkle, 2018).

"In the US, more than perhaps any other country in the world, humans are treating their pets like members of the family and are willing to spend with that idea in mind" (Sprinkle, 2018).

Venison in pet food ranks as a “novel protein ingredient” (Aldrich, 2014). Aldrich (2014) in his article also explains how this novelty centres around the wild or ancestral themes of animals that would have been hunted by dogs and cats in past century’s.

Lindsay Beaton (2018) in Pet Food industry.com explains the pet ownership trend that is impacting the increased demand for pet food succinctly here, “As millennials put off home ownership and stick with apartments or condos and gravitate to a city lifestyle that makes large pet ownership more difficult, they nevertheless continue to be determined to own pets. Baby boomers, facing empty nests and aging into the desire to downsize, are likewise disinclined to live a pet food life. The solution? Small dogs, which are more portable, more likely to meet apartment weight limits and can, in some cases, even be trained to be completely indoor animals, with litter or puppy pads”.

In the Asia Pacific Pet Food Market growing middle classes and the urbanization of populations are leading the way for pet owners to become more focused on their pets. (Sprinkle, 2018)

Table 3:

Dog and Cat ownership statistics comparison between EU and USA

Region	USA 2017-2018 Survey	EU 2017 Survey
Dog	89.7 million (60.2% of household own a dog)	66 million (18% of households own at least one dog)
Cat	94.2 million (47.1% households own a cat)	74 million (26% of households own at least one dog)
Source:	https://www.americanpetproducts.org/press_industrytrends.asp	http://www.fediaf.org//who-we-are/european-statistics.html

5.4.1. Top 50 Pet Food companies of the world

Table 4:

Percentage of the Top 50 Pet Food companies by turnover based in 4 regions

US & Canada	Asia/Pacific	EU	South America
19	10	19	2
38%	20%	38%	4%

Table 4 shows where the top 50 pet food companies of the world rank relatively on annual revenue (refer Appendix 6 for source data). The US and EU, although equal in percentage in Table 4 are not equal in terms of market share or annual return. The US for example is the base for the top 8 pet food companies of the world.

“The European Union (EU) pet food retail environment is the second-largest in the world, after the United States, with retail value sales of US\$21.5 billion in 2014. The top five EU countries with the largest retail value sales were the United Kingdom (US\$5.3 billion), France (US\$3.7 billion), Germany (US\$3.4 billion), Italy (US\$2.5 billion), and Spain (US\$1.2 billion). These five countries combined accounted for 74.9% of the overall EU market in 2014, indicating a very concentrated retail environment” (Agriculture and Agri-Food Canada, 2016, p.4).

5.1. Meeting the demand today

“Ingredients are derived from trimmings, mechanical separation of meat and fat from bones, and/or various organ meats, intestines and glands. The composition of these "game meats" runs 65% to 75% moisture, 10% to 12% protein, 6% to 15% fat and 0.5% to 5% ash. In other words, they are comparable to most domestic "mechanically deboned meats" in our pet food ingredient supply chain” (Aldrich, 2014).

Venison as a novelty meat protein is a small part of the pet food industry that pet owners value the link back to a time when wolves/dogs and cats would have had wild venison as part of their natural diet.

Aldrich (2014) explains correctly that venison inclusion in US manufactured Pet Food is from New Zealand Farmed venison rather than wild stocks. Information from several confidential sources explain that Spanish exports are also making their way to the USA pet food manufacturers at present.

Alastair Kendon, the General Manager of Pasture Petfoods New Zealand explained in 2016 that, “MDM – mechanically deboned meat, also known as mechanically recovered meat (MRM) or mechanically separated meat (MSM) – is important in the sector as it can be listed as “meat” in ingredients an appealing word customers’ look for. Offals are also sought as they raise the nutritional content compared to grain. Kendon said pet food manufacturers can pay high prices for such ingredients because depending on the market, labelling laws allow them to brand products as venison-based with as little as 3%, though 18-19% inclusion would be more typical. Consequently, a little goes a long way” (NZ Farm Life Media, 2016).

Product is exported from New Zealand in large frozen blocks to the pet food companies who then add the ingredient to their pet food mixes. Other methods involve exporters sending cartoned product direct from meat processing facilities to pet food companies based in the US or Europe. Other venison proteins competing in this space are currently exports from Spain and a potential Australian export industry being developed currently.

5.1.1. Transmissible Spongiform Encephalopathies (TSE's)

A significant issue facing wild populations in the USA is that of Chronic wasting disease (CWD) which is a Transmissible Spongiform Encephalopathies or 'TSE'.

TSEs "are a family of diseases occurring in man and animals and are characterised by a degeneration of brain tissue giving a sponge-like appearance leading to death. Chronic wasting disease is found in members of the deer family in USA, Canada, South Korea and Norway" (EFSA, 2016). It's like livestock diseases such as BSE (mad cow disease) infecting cattle and scrapie infecting sheep" (Department of Conservation, 2016). There is no known relationship between CWD and any other TSEs of animals or people" (USDA, 2017).

DOC (2016) factsheet on exotic diseases also notes "In early 2016 CWD was discovered in Norway in reindeer and moose. Its ongoing spread is a major threat to wild deer populations".

According to the 'TSE Roadmap 2' (Directorate-General for Health and Consumers of the European Commission) (2010), a survey was done in 2007 "to detect the possible presence of TSEs in wild and farmed cervids in the EU". The information goes on to confirm that "about 13,000 tests were performed on wild and farmed cervids and no positive test was detected" (Directorate-General for Health and Consumers of the European Commission, 2010).

Figure 6 shows the spread of the disease in the US currently. "Eradicating CWD from North America appears infeasible, given its extensive distribution and other epidemiological attributes" (EFSA, 2016).

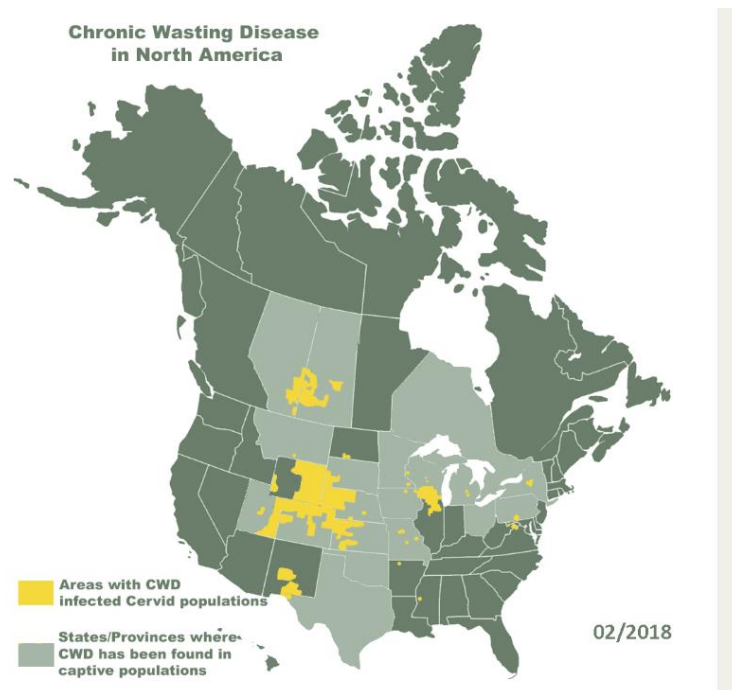


Figure 6:

Chronic Wasting Disease (CWD) locations 2018 in the USA

Source: <http://cwd-info.org/map-chronic-wasting-disease-in-north-america/>

6. Analysis of EU and USA pet food importing regulations

With the demand for deer pet food items based predominantly in the USA and Europe and the subsequent production facilities largely based there, imports to those countries and domestic deer utilisation are important points.

6.1. USA domestic of deer pet food raw materials

There appears to be no definitive tonnages reported on wild venison pet food products manufactured from domestic deer supplies, however, a recent article in the USDA Food Safety and Inspection Service newsletter (2016) explains that “most wild game is not amenable to mandatory FSIS inspection” as wild game is technically not classed as “meat” but rather “wild game” or derived from ‘exotic animals’. Wild game is administered in the US by the United States Food & Drug Administration (FDA) rather than other red meat that is managed by the United States Department of Agriculture (USDA).

The FDA’s primary objective is to enforce the Federal Food, Drug and Cosmetic Act and within the organisation the Centre for Veterinary Medicine is tasked (FDA, 2018) with managing the Animal Feed Safety System (AFSS). The AFSS was established as a response to issues “in international markets like BSE, Chronic Wasting Disease, and microbial contamination” (FDA, 2016).

“Since 2001, CWD has been identified in free-ranging cervid populations in 21 States: Colorado, Illinois, Kansas, Maryland, Minnesota, North Dakota, Nebraska, New York, New Mexico, South Dakota, Utah, Virginia, Wisconsin, West Virginia, Iowa, Michigan, Missouri, Pennsylvania, Arkansas, Texas and Wyoming. The first CWD-positive free-ranging moose was identified in Colorado in 2005” (USDA, 2017).

“In most States, wild game species that may be legally hunted under Federal and State regulatory authority may be harvested for personal consumption only and may not be sold” (Amann, 2016). If, however the FSIS, who have the authority to do so, are approached to “provide voluntary inspection of these species under the Agricultural Marketing Act” (Amann, 2016), are produced in a “sanitary manner, ‘Exotic animals’ inspected and passed under voluntary FSIS inspection receive a triangular USDA mark of inspection”.

Wild harvested animals struggle to meet this requirement, “Inspected establishments are required to provide assurance that all ingredients, including non-amenable animal tissues, used in FSIS-inspected products are clean, sound, healthful, wholesome, and properly identified” (Amann, 2016). Contrasting that is wild harvested animals cannot often be appropriately or physically transported to the FSIS mandatory inspected establishments and therefore the mark of inspection, either voluntary or required, cannot be applied as there is doubt about the quality of the product.

“Certified pet food is a specific kind of product intended for consumption by dogs, cats, and other meat-eating animals that is manufactured under FSIS voluntary reimbursable inspection services (9 CFR Part 355) which provides for the inspection, certification, and identification of pet food.” (USDA, 2007). “Certified pet food is manufactured under fee-for-service inspections in a facility approved for manufacture of animal food” (USDA, 2005) while “most food for animal consumption produced in a Federal facility is non-certified. It is not an inspected product; therefore it is inedible product and does not bear any mark of inspection” this means that labelling must be noticeable as a requirement administered by the FDA (USDA, 2005).

The FDA’s BSE feed regulation (21 CFR 589.2000) describes FDA’s recommendations regarding the use in all animal feed of all material from deer and elk that are positive for Chronic Wasting Disease (CWD) or are considered at high risk for CWD” (USDHHS, 2016). The US Department of Health and Human Services (2016) also goes on to note in their advice that they believe elk/ deer that are not from declared states of CWD prevalence or herds that were CWD positive are able to be used in pet food products, while deer/ elk in endemic or eradication areas not be placed into the pet food supply chain, these points are non-enforceable but “Material from CWD-positive animals may not be used in any animal feed or feed ingredient according to Sec. 402 (a)(5) of the Federal Food, Drug and Cosmetic Act” (USDHHS, 2016).

Interestingly the, “FDA continues to consider materials from deer and elk NOT considered at high risk for CWD to be acceptable in NON-RUMINANT animal feeds” (FDA, 2018). Given that a deer or elk is not considered high risk if it is “(1) not declared by state officials to be endemic for CWD and/or to be CWD eradication zones; and (2) deer and elk that we not at some time during the 60-month period immediately before time of slaughter in a captive herd that contained a CWD-positive animal” (FDA, 2018). Based on this and the fact that South Carolina as you will note in Figure 2 is not classified as an CWD infected state.

In 2011 the US Senate “rejected a South Carolina bid to turn waste products from deer processing into pet food, turning away a bill that would have allowed deer processors to grind up and sell as pet food the parts of the animals they now throw out—organs, bones and other viscera” (Petfood Industry.com, 2011). This Petfood Industry.com (2011) article goes on to confirm that no other Southeast states process the ‘leftovers’ for pet food.

The House of Representatives in the USA in June 2018 put forward a bill to increase the investigation into CWD in the US, in which they state, “ CWD continues to spread in the wild, free ranging cervid herd and in captive cervid herd across the United states and as of June 2018, is in 25 states”, also noted in that “ there is no known cure” and it is “100 percent fatal” (Congress.gov, 2018). Given that wild deer are not bounded by state boundaries, it is interesting to note the number of states which are CWD free in Figure 6 but also count the number of adjoining states that are currently free, but by proximity do possess a risk of contraction, these free but adjoining states number 14.

6.2. USA importation of deer pet food products

“Non-specified red meats, such as bison, rabbits, game animals, zoo animals, and all members of the deer family including elk and moose, are under FDA jurisdiction”. (Registrar Corp, 2018).

The FD&C Act defines the term “food” as “articles used for food or drink for man or other animals...and articles used for components of any such article.” (USFDA, 2018). Meat can still be classed as an additive but due to it being in common use prior to 1598 it does not appear on any approved additive list as suggested for new products,. This absence could be explained by, “substances added to food that are generally recognized as safe (GRAS) by qualified experts aren’t food additives and don’t need to be reviewed and approved by FDA before being marketed, for a substance to be GRAS, there must be a “general recognition of safety.” The general recognition of safety is thought to come from venison products having been in common use of food for a significant period of time.

The FDA’s regulation of pet food is similar to that for other animal food. There is no requirement that pet food products have premarket approval by the FDA. However, the Federal Food, Drug, and Cosmetic Act (FFDCA) requires that pet foods, like human foods, be pure and wholesome, safe to eat, produced under sanitary conditions, contain no harmful substances, and be truthfully labelled. Figure 3 demonstrates where the current FMD statuses are around the world, while Figure 4 demonstrates similar but indicates BSE prevalence instead.

Figure 7 is adapted from the USDA Animal Product Manual (USDA, 2014) it shows the parameters that must be met for importing of cervid protein products. It demonstrates that in order to bring cervid animal feed products in the exporting country must be free of BSE, free from FMD or have a negligible risk of FMD and some special requirements as part of that, and all must have the correct importation certification while Canada requires a specific Annex document. Figures 8 and 9 show the status of BSE on the globe today.

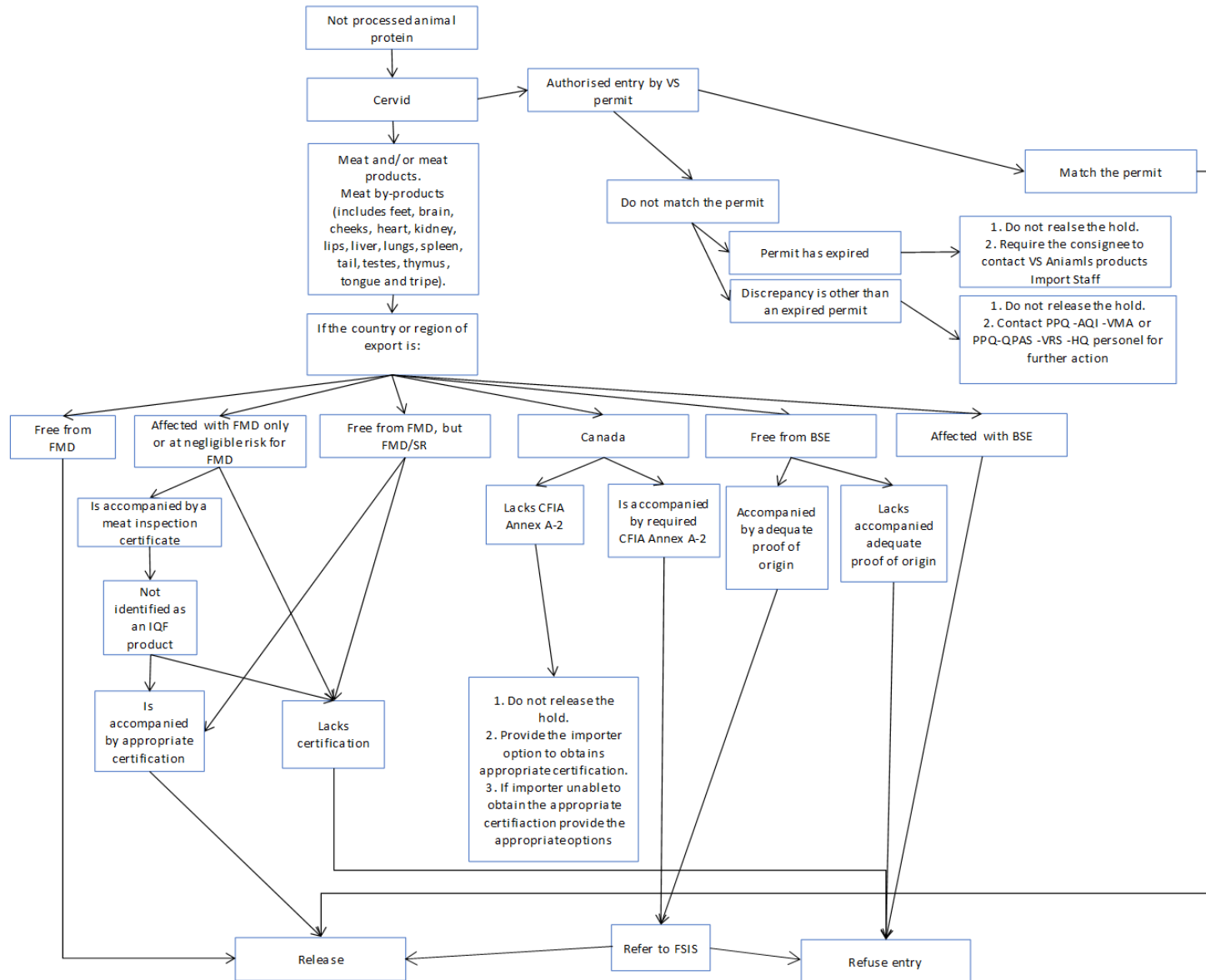


Figure 7:

Source: Adapted from the USDA Animal Product Manual the process to determine eligibility for cervid product imports to the USA

OIE Members' official FMD status map

Last update October 2018

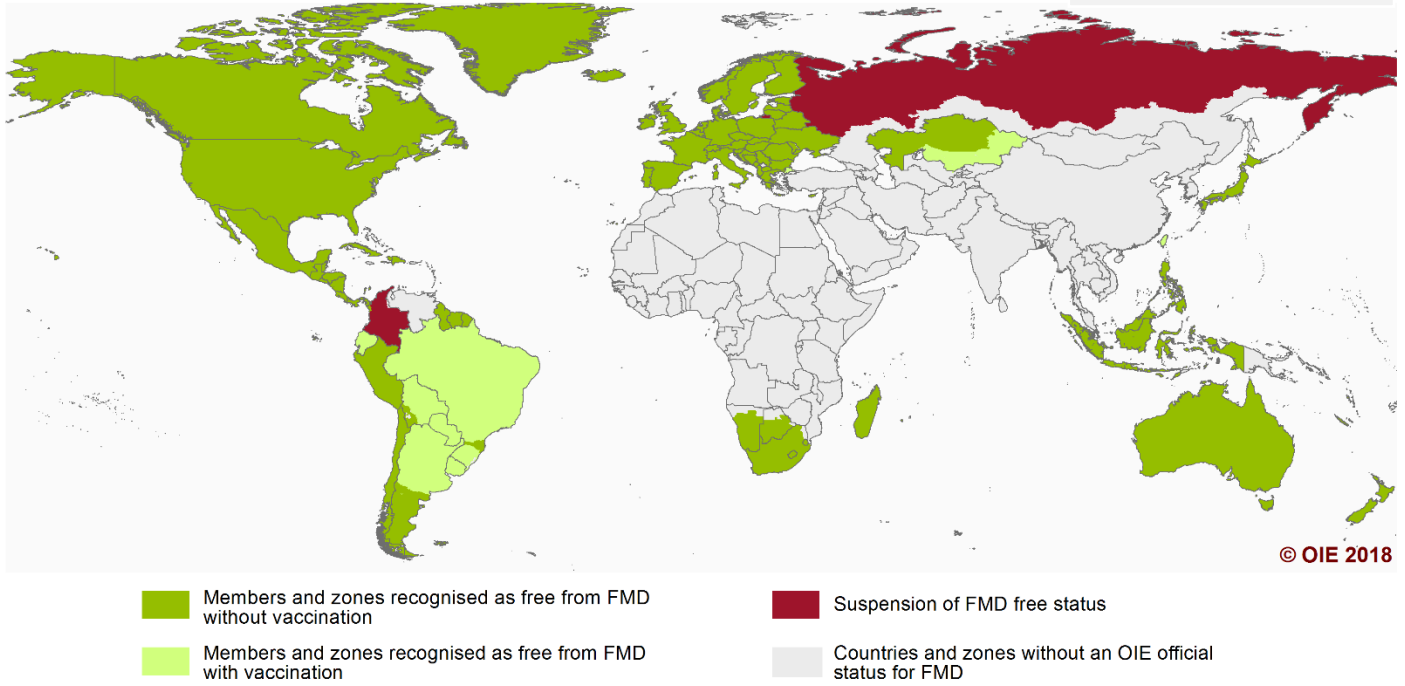


Figure 8:

Source: World Organisation for Animal Health – Foot and Mouth Disease Status map

OIE Members' official BSE risk status map

Last update May 2018

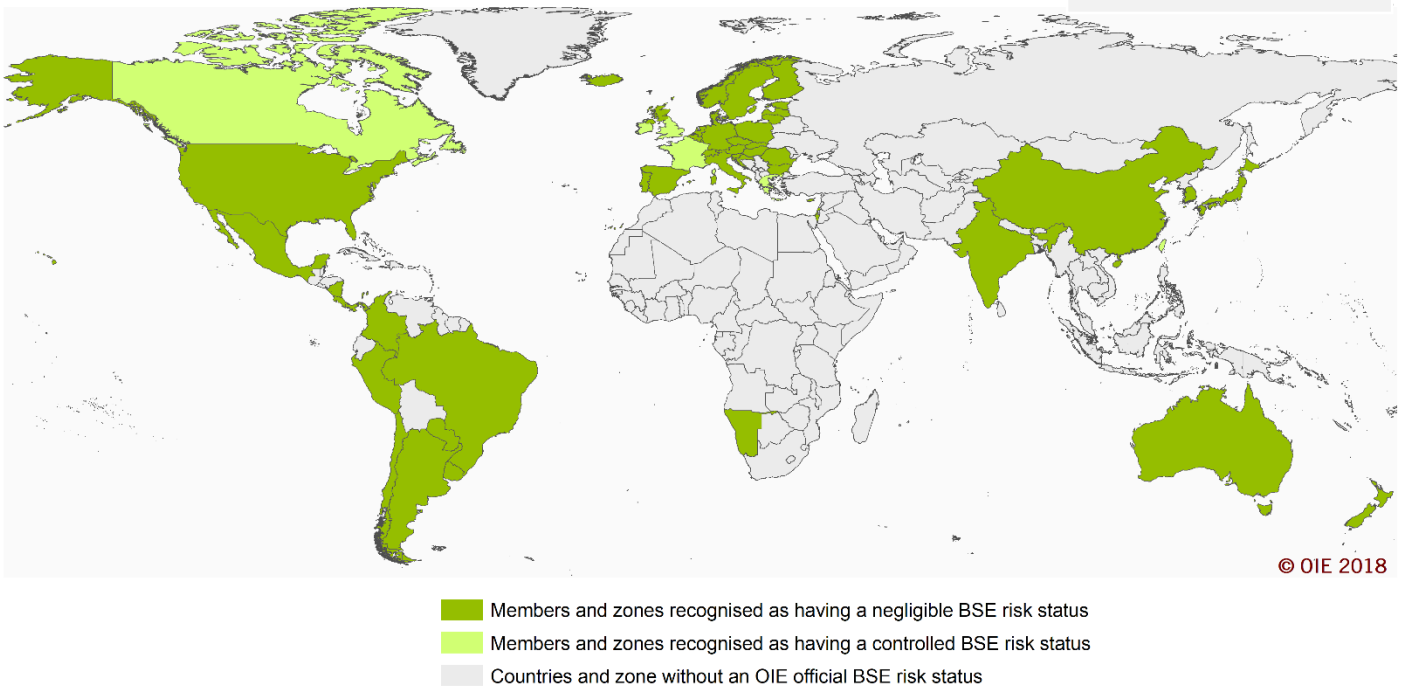


Figure 9

Source: World Organisation for Animal Health – Bovine spongiform encephalopathy BSE Disease Status map

“FDA is not authorized under the law to approve, certify, license, or otherwise sanction individual food importers, products, labels, or shipments. Importers can import foods into the United States without prior sanction by FDA, as long as the facilities that produce, store, or otherwise handle the products are registered with FDA, and prior notice of incoming shipments is provided to FDA” (FDA, 2018).

All wild game products are subject to examination by FDA (2018) where “Animal food imported into the United States must be composed entirely of ingredients judged acceptable for use in such products. Sections 402 and 403 of the Federal Food, Drug, and Cosmetic Act (the FD&C Act) require that foods and feeds be safe and wholesome, contain no deleterious, harmful, or unapproved substances, and be truthfully labelled” (FDA 2018).

There must be information to prove that the substance has been commonly used in food for animals since before 1958, with a lengthy and known history of a significant number of animals consuming the food” (USFDA, 2018). ‘Venison’, ‘exotic meat’, and ‘deer’ are not listed in the AAFCO guidelines presumably because they were in use prior to 1958.

Increased regulatory effort is expected in this area following “On September 10, 2007, the President’s Interagency Working Group on Import Safety reported the burdens facing border officials caused by the growth of imports and an increased focus on security” (FDA, 2018a). The report goes on to explain that there is a gap between the required attention that should be given to import verification and what is currently occurring, an important point is made that “all imported products are required to meet the same standards as domestic goods” (FDA, 2018a) but at present due to the lack of specific regulations there is no standard to effectively measure this against to ensure imports are all safe, so it would be fair to assume more regulation in this area is likely.

6.3. EU domestic of deer pet food raw materials

In 2007 Petfood Industry.com reported that, “there is no legislation in the EU written specifically for pet foods. The legislation which is relevant to pet foods is produced for other purposes - mainly livestock feed - but includes provisions for pet foods” (Petfood Industry.com, 2007). The USDA Foreign Agricultural Service (2018) supports this by saying, “In the EU, pet food is not regulated by one specific piece of legislation. Exports of U.S. pet food are subject to both the EU’s feed marketing legislation and veterinary legislation”.

The EU have classified animal by-products, not for human consumption, into three categories, summarised here:

Category 1: High risk as it could be infected with TSE’s or as part of an eradication operation

Category 2: Also classed as high risk, these include items that are rejected from processors due to diseases, manure and digestive tract contents

Category 3: Low risk product resulting from abattoir processing waste and or products and foods originally meant for human consumption

Regulation (EC) No 1069/2009 of the European Parliament and the Council (2009), lays out the rules for the disposal of all three categories of ABP. Neither category 1 or 2 are suitable for pet food products and are to be disposed off outside of the animal food supply chain. This confirms that Category 3 ABP’s are the only suitable for the pet food industry in the EU. The regulation (EC) 1069/2009 goes on to stipulate in *Article 10* that Category 3 material is that which comes from animals that were fit for human consumption or those rejected fit for human consumption but did not show any signs of having communicable disease with human or animals.

The European Food Safety Authority’s (EFSA) (2017) report on CWD states, “there is no evidence of an absolute species barrier between CWD-affected cervids and humans”. The report also points out that there currently isn’t an experimental model to test the extent of the human contact risk, although squirrel monkeys in testing have shown the disease can be transmitted to that species.

6.4. EU importation of deer pet food raw materials

The EU advice on importing of deer products is very clear with regard to Chronic Wasting Disease (CWD).

Following the discovery of several CWD cases in Norway in 2016 the EU began an investigation, using the European Food Safety Authority (EFSA), to reduce the chance of this disease spreading into the EU. The EU has several trade restrictions in place currently related to this. “You can’t import reindeer and other cervid species (deer) from Norway to EU Member States, also, you can’t import deer products into the UK if they were manufactured in USA, Canada, South Korea and Norway (where CWD is present) or produced from deer products from those countries” (GOV,2017). CWD has been documented in captive and free-ranging deer in 24 states of the USA and three Canadian provinces (EFSA Journal, 2016).

Although there appears to be some discrepancy with this and the ability to accept some products, is likely due to the USA's prevalence of CWD in 25 states, not all 50 of them.

The Commission Regulation (EU) 2016/1396 that was amended on the 18th of August 2016 includes:

“When fresh meat, minced meat, meat preparations and meat products as defined in points 1.10, 1.13, 1.15 and 7.1 respectively of Annex I to Regulation (EC) No 853/2004, derived from wild cervid animals, are imported into the Union from Canada or the United States of America, the health certificates shall be accompanied by a declaration signed by the competent authority of the country of production, worded as follows:

“This product contains or is derived exclusively from meat, excluding offal and spinal cord, of wild cervid animals which have been examined for chronic wasting disease by histopathology, immunohistochemistry or other diagnostic method recognised by the competent authority with negative results and is not derived from animals coming from a region where chronic wasting disease has been confirmed in the last three years or is officially suspected.” (EUR-Lex, 2016)

As part of the EFSA (2016) report they note the current measures with an interesting stipulation that links import access with already established fresh cervid meat acceptance.

“At import into the EU, an attestation is required for meat and meat products from wild and farmed cervids coming from the USA or Canada (Chapter F of Annex IX to Regulation (EC) No 999/2001), confirming that the products:

Exclude the offal and spinal cord, are derived from animals tested for CWD with negative results, and –are derived from animals which do not come from a herd (for farmed animals) or a region (for wild animals) where CWD has been confirmed or officially suspected.

In addition, in accordance with Regulation (EU) No 206/2010, the import into the EU of live cervids from the USA and Canada is prohibited.

The conditions for imports into the EU of certain animal by-products derived from cervid materials can be summarised as follows:

- The import of unprocessed urine for hunting lures is prohibited when derived from farmed cervids. The import of processed urine from farmed animals is subject to treatment requirements laid down in the ABP Regulations. The import of urine from wild cervids is out of the scope of the EU ABP Regulations.*
- The import of pet food containing cervid materials and of products derived from cervids (including PAP) and destined for the manufacturing of pet food is permitted provided that the requirements of the ABP Regulations are met. Raw materials must be derived from cervids slaughtered for human consumption.*

•For hides and skins, blood and blood products, animal by-products intended for technical uses, rendered fats, gelatine and collagen, hydrolysed protein, di- and tricalcium phosphate, fat derivatives, the principle followed in the ABP Regulations can be summarised as follows:

–For raw products: imports are permitted only from third countries that are authorised for the import of fresh meat of cervids;

–For processed products derived from cervids: imports are permitted from all third countries listed in the Part I of Annex II to Regulation (EC) No 206/2010;

–For fully processed game trophies or hides and skins: imports are permitted from any third countries.

On the reverse side it is interesting to note that “Japan prohibits the importation of any US cervid products because of Chronic Wasting Disease (CWD). This includes products of deer, elk, moose, and caribou” (USDA, n.d.).

7. Discussion

For the purposes of this report's research question, which focuses on overseas wild deer as the supply factor and seeks to understand what threats or opportunities exist that impact NZ deer pet food products, we will focus on three parts of the five-forces: threat of substitute products, threat of new entrants and rivalry within the industry.

7.1. Threat of substitutes

Shadbolt., et al. (2008) note in their Five Forces analysis a point that remains relevant to this research which is the availability of substitutes, "Wild Shot venison is a key substitute available from Eastern Europe". The authors' other points in substitution focus on farmed deer and other forms of protein of which are a reality and include products such as wild boar, rabbit and bison for example.

The threat of substitution in this instance is that of wild venison by-products. The threat specifically is if significant numbers of wild deer overseas were able to be harvested. This has the potential to increase the supply of a product that is a sought-after protein source for the pet food manufacturers. If this could then be presented to the market at a lower price point, yet still meet the manufacturer's needs, it could have a depressing effect on the demand for the New Zealand venison industry's bones and offal (and potentially other venison industry products).

Porter (1985) explains that "penetration against substitutes is a major reason why industries and firms grow, and the emergence of substitutes is a major reason why they decline (p.273). Porter then goes on to confirm that substitutes are products that perform the same generic function or functions as the industry's product" (Porter, 1985, p.274).

The ability of wild venison to meet the demands of the pet food market today, (described earlier) is driven by several leading factors. These factors centre around the owner having more disposable income due to delaying major purchases or people whose children have left home, while also the trend of increased information about dietary requirements and nutrition has also made its mark with pet owners keen to serve their pets a meal which has a desirable taste, a novelty factor that links back to a time when animals survived in the wild and the confidence in its food safety as key part of quality. The problem is wild venison, as long as it meets the health standard requirements of the importing country, can do all this for the pet food market. It may not do it as well as New Zealand by-products but if it could satisfy the pet food manufacturer enough and in turn meet their market requirements at a lower price, then New Zealand venison by-products have a significant threat to maintain their current values.

Porter (1985) also points out that "a substitute may also perform a wider range or narrower range of function than an industry's product" (p.275). Examples of this is rabbit or bison. Rabbit and Bison are substitutes which can achieve in part some of the market demands. This in addition to the potential wild deer supply means the value that New Zealand venison operations pitch their products at must always be tempered with the fact that other novelty proteins can, at a particular price point, provide a real threat to demand/value, in effect providing an upper ceiling to venison products.

Substitution threat fixes on three factors according to Porter (1985):

1. *The relative value/price of a substitute compared to an industry's product*

Anecdotally there is little difference for consumers (pet owners) between wild venison by-products compared to New Zealand venison by-products. This is largely due to the low percentage part that venison makes up in pet food meals. So the lower cost of alternative venison supplies is not thought to prove a barrier to substitute as long as the market requirements are also at their required standard.

2. *The cost of switching to the substitute*

The cost of switching for a pet food manufacturer based in Europe or the USA, would be largely related to freight costs as the harvest costs are the exporting parties cost of business. Simply, the switch between New Zealand venison by-products and overseas by-products is simple and not thought to be at a significant cost to the USA or EU pet food manufacturers.

3. *The buyers' propensity to switch*

The quality of product that New Zealand's established venison industry produces is a positive factor for the industry and when compared with wild-harvested product may prove the difference in some cases for pet food manufacturers to remain committed to NZ product. However, if that quality is not markedly different and no experiences have shaped this view, then the propensity to switch could be high.

These three factors show no significant barrier to switching, confirming that if wild venison by-products are available then they will prove a real challenge to the NZ sourced product.

7.2. Threat of New Entrants

A significant new entrant to the venison by-products market supply would have similar consequences to the impact of substitution as the product may differ slightly from the New Zealand venison pet food products in a few areas. Quality issues such as 'inferior item inclusions' may be higher if the processing standards are not as stringent or well managed as the New Zealand processing industry, which is, the most mature in the world-wide industry.

The threat of a new entrant with wild venison could be serious if their methods of harvest and product-processing allow for a reduced cost but deliver almost equivalent quality.

In summary, there is a theoretical threat to the NZ deer pet food market if wild deer products are able to be presented to the pet food manufacturers. The pet food manufacturers are, like demand, predominantly based in the US and secondary to that in the EU. The size and spread of these manufacturers and the turnover statistics indicate that this industry is large and turnover levels are high. Trends in pet food consumers have shown us that novelty meats (which includes deer pet food products) are in demand and will continue to be as they help manufacturers meet the changing and increasingly demanding customers' nutritional needs for companion animals that have become smaller, effective members of the family who also now have nutritional considerations made for them by their discerning and higher disposable-income owners.

7.3. Industry Competitors/ Rivalry

Porter (1985) explains that "the intensity of rivalry influences prices as well as the costs of competing in areas such as plant, product development, advertising and sales force".

If wild deer supplies entered the supply chain to the EU or USA pet food manufacturers, then rivalry could increase in the New Zealand deer industry. Assuming a new entrant came in with a substitute product (wild deer organs and MDM) then this could be purchased by international pet food manufacturers at a lower price as discussed as above. However, if not all the tonnage needs of the pet food manufacturers are met then it is feasible to expect that because they have paid lower prices for the substitute venison, in doing so meeting a proportion of their requirements, then the percentage amount NZ pet food supply is lower than currently but may still be necessary for the manufacturers.

This could mean the price per kg is increased in-line with the demand to complete the required tonnages. It is at this point that the New Zealand-based suppliers could experience an increase in rivalry when they compete to supply this smaller but potentially higher paying market: in this case rivalry within the industry is a feasible scenario.

8. Conclusion

In summary, the importing country, whether that be part of the EU or the United States of America, each have specific rules that focus on origin, certification throughout the process and standards that each part of the supply chain must adhere to, as with any commercial import and export supply chain. These are detailed and outlined in Overseas Market Access Requirements, by the FDA and the EFSA.

The focus of this research has been to identify any regulations that could limit, or not, the access of cervid products for pet food being accepted or declined into the two current predominant pet food manufacturing markets.

The drivers of the pet food industry's growth include: customer demand for novelty meats, the ability and willingness to pay for high quality with increasing disposable income and a demand for nutritious pet food for pets that have now become companions/ members of families. Novelty or exotic meats have the appeal of linking back to the more primitive, wild dwelling days of today's pets' ancestors and include such items as rabbit and bison that can compete with venison in this category, this link to earlier times has also proven a desirable attribute in customers' buying decisions.

There are nine species of deer, most with potential to be investigated further, based on their average size, population status and perceived population size. These include Moose, Roe Deer, Sika Deer, Red Deer, Wapiti/Elk, Mule Deer, White-tailed Deer, Axis Deer and Fallow Deer. Given the demand and also the identification of potential deer species that effectively consist of the raw material that can meet this demand, the ability, or inability, to effectively use these deer for that is critical to understand.

The prevalence of CWD in the USA and recently in Norway has brought to light the regulations around pet food ingredient quality.

The US is clear, as is the EU, on the standard of materials that can be used in pet food. Defined as Category 3 in the EU. The FDA in the USA require the ingredients to be 'safe to eat', with their view that carcasses at risk of being or are infected with CWD are not suitable. Both the EU and US ban imports of cervid material from countries with FMD and BSE. Additional to this, both the EU and the US have large wild populations, but as wild shot animals struggle to meet the inspection criteria due to their proximity to inspection facilities, the majority of the wild-shot products are consumed by hunters.

This leaves NZ venison as the major venison supplier to the world pet food market, with most exports flowing to the largest demand market, at present the USA.

The opportunity and therefore the threat of 'substitution' and/or 'new entrant' as Porter (1985) termed it, lies in those countries with the above-mentioned deer, that are free from BSE, FMD and CWD and already have access to these markets through approved supply chains that supply human consumption cervid meat. Countries that qualify in this category are Australia, Spain, South America (Argentina, Chile, Peru), the EU (excluding Scotland and Norway).

These countries have the ability in terms of deer populations and regulatory compliance to provide venison by-products to the world pet food market and in doing so challenge New Zealand by-products in that market. The question is for each of them: are the returns available and do they justify the investment level required to supply. Individual country case studies would need to be undertaken from here to determine the feasibility of each country in this venture.

Anecdotal evidence suggests that already US pet food manufacturers are sourcing Spanish wild deer. The Spanish wild deer harvest (called montería), utilise dogs to chase deer (European Journal of Wildlife Research, 2009). This new entrant has already shown that their existence has a downward impact on the price received and given that the method of harvest is likely to induce more stress than the New Zealand deer processing methods this is also a potential example of how substitute product doesn't necessarily need to be a replica but it can in fact be below the current quality and still disrupt the market.

Australia is an example of how being free of BSE, FMD and CWD is advantageous when combined with the right natural resources and a lack of domestic export impediments. "The Australian Deer Association has pushed for more than a year for wild deer to be used for human and pet consumption" (Somerville & Condon, 2018). ABC News (2018) reported in March that, "The Victorian Liberal-National coalition has committed to making the kangaroo pet food trial permanent if they win the election. Leader of the Nationals in Victoria, Peter Walsh said he also wanted the policy to include hunted deer". Deer have reached pest proportions in Victoria and with a kangaroo harvesting programme already established which could also physically process deer carcasses effectively for pet food markets already established across Australia's eastern states, the inclusion of deer as a targeted species would be entirely possible. With similar distance from the US and EU markets as NZ and the disease-free status this could prove a significant challenge.

9. Recommendations

- The report has highlighted how countries with TSE's and or FMD pose a significant impediment if not complete rejection for cervid products to be exported and successfully imported. This has demonstrated how advantageous it is for New Zealand to remain free of these for a plethora of reasons, one of which being our ability to export pet food products, at a premium, as by-products of the venison industry. The recommendation therefore, is to ensure that our biosecurity procedures are robust enough to avoid these diseases taking hold in New Zealand.
- Further research should be undertaken to determine if deer in USA states, not infected with CWD, could become a source of pet food products domestically.
- Understanding the Australian, specifically the State of Victoria, wild deer herd and the November state Government election result that has been signalled as a turning point for access to these animals. If this proves to be the case, then understanding the logistics and therefore the realistic quantities available to the market over time will be of use to the New Zealand Industry.
- Understanding the techniques of the Spanish wild deer harvest system as well as the potential Australian harvest will also be of use. This may enable some positioning in the market to ensure New Zealand venison products can achieve a premium if there are some benefits inherent to the established and mature New Zealand system.

10. Next Steps

- Work closely with New Zealand pet food exporters to develop a greater understanding of the overseas deer pet food product supply flows.
- Develop further understanding of alternative pet food markets outside of the US and EU.
- Determine if there are any synergies between the New Zealand venison industry and overseas harvest operations.

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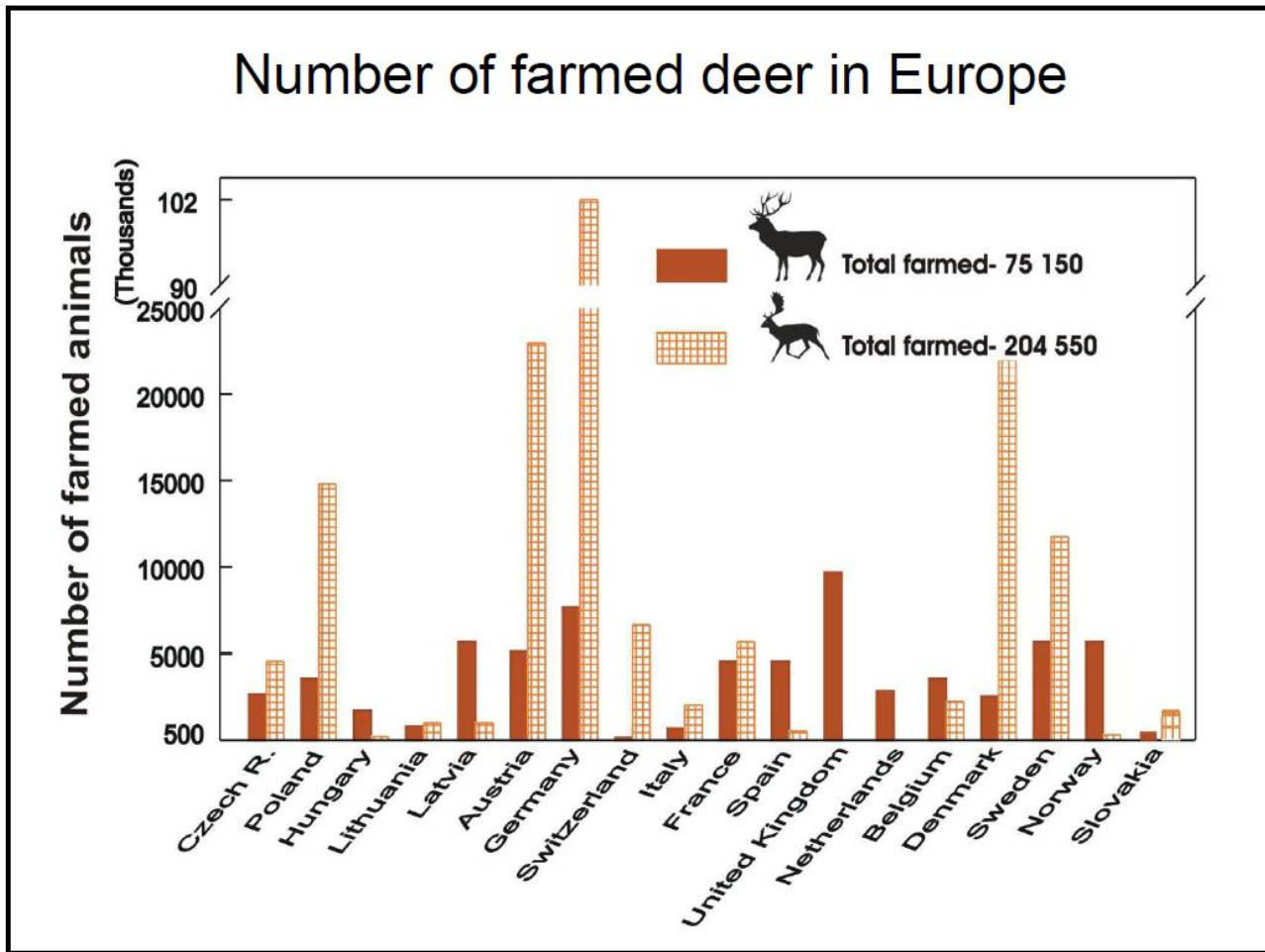
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12. APPENDICES

12.1. Appendix 1: Deer Species of the World compiled from Rue (2002) & Whitehead (1993, reprinted 2008). With IUCN classifications added.

IUCN Category	Family	Sub Family	Genus	Sub genus	Latin Name	Species
LEAST CONCERN	Cervidae	Alcinae	Alces	-	<i>Alces alces</i>	Moose
	Cervidae	Odocoileinae	Capreolus	-	<i>Capreolus capreolus</i>	Roe Deer
	Cervidae	Odocoileinae	Capreolus	-	<i>Capreolus pygargus</i>	Roe Deer
	Cervidae	Cervinae	Cervus	Sika	<i>Cervus nippon</i>	Sika Deer (Japanese Deer)
	Cervidae	Cervinae	Cervus	Cervus	<i>Cervus elaphus</i>	Red Deer (Maral)
	Cervidae	Cervinae	Cervus	Cervus	<i>Cervus canadensis</i>	Wapiti/Elk (North America)
	Cervidae	Odocoileinae	Odocoileus	Eucervus	<i>Odocoileus hemionus</i>	Mule Deer (Black Tailed Deer)
	Cervidae	Odocoileinae	Odocoileus	Odocoileus	<i>Odocoileus virginianus</i>	White-Tailed Deer
	Cervidae	Cervinae	Axis	Axis	<i>Axis axis</i>	Axis Deer
	Cervidae	Muntiacinae	Muntiacus	-	<i>Muntiacus reevesi</i>	Muntjacs (Barking Deer)
NEAR THREATENED	Cervidae	Muntiacinae	Muntiacus	-	<i>Muntiacus muntjak</i>	Muntjacs (Barking Deer)
	Cervidae	Cervinae	Dama	-	<i>Dama dama</i>	Fallow Deer
	Cervidae	Odocoileinae	Ozotoceros	-	<i>Ozotoceros bezoarticus</i>	Pampas Deer (Stinking Deer)
	Cervidae	Odocoileinae	Pudu	-	<i>Pudu pudu</i>	Pudu
VULNERABLE	Cervidae	Muntiacinae	Muntiacus	-	<i>Muntiacus atherodes</i>	Muntjacs (Barking Deer)
	Cervidae	Muntiacinae	Elaphodus	-	<i>Elaphodus cephalophus</i>	Tufted Deer
	Cervidae	Hydropotinae	Hydropotes	-	<i>Hydropotes inermis</i>	Chinese Water Deer
	Cervidae	Cervinae	Cervus	Rusa	<i>Cervus timorensis</i>	Sambar
					<i>Cervus unicolor</i>	
					<i>Cervus mariannus</i>	
					<i>Cervus alfredi</i>	
	Cervidae	Cervinae	Cervus	Przewalskium	<i>Cervus albirostris</i>	Thorold's Deer (White Lipped Deer, Przewalski's Deer)
	Cervidae	Cervinae	Cervus	Rucervus	<i>Cervus duvauceli</i>	Barasingha (Swamp Deer)
	Cervidae	Rangiferinae	Rangifer	-	<i>Rangifer tarandus</i>	Caribou/Reindeer
	Cervidae	Odocoileinae	Blastocerus	-	<i>Blastocerus dichotomus</i>	Marsh Deer
	Cervidae	Odocoileinae	Hippocamelus	-	<i>Hippocamelus antisensis</i>	Huemuls
	Cervidae	Odocoileinae	Mazama	-	<i>Mazama gouazoubira</i>	Brocket Deer
	Cervidae	Odocoileinae	Mazama	-	<i>Mazama rufina</i>	Brocket Deer
Cervidae	Odocoileinae	Mazama	-	<i>Mazama chunyi</i>	Brocket Deer	
Cervidae	Odocoileinae	Pudu	-	<i>Pudu mephistophiles</i>	Pudu	
Cervidae	Muntiacinae	Muntiacus	-	<i>Muntiacus crinifrons</i>	Muntjacs (Barking Deer)	
Moschidae	Moschinae	Moschus	-	<i>moschus moschiferus</i>	Musk Deer	
ENDANGERED	Cervidae	Cervinae	Cervus	-	<i>Rusa alfredi</i>	Philippine Spotted Deer
	Cervidae	Cervinae	Cervus	Panolia	<i>Rucervus eldii</i>	Thamin, Eld's Deer
	Cervidae	Cervinae	Cervus	Hyelaphus	<i>Axis calamianensis</i>	Calamian (Philippine Deer)
	Cervidae	Odocoileinae	Hippocamelus	-	<i>Hippocamelus bisulcus</i>	Huemuls
	Cervidae	Cervinae	Axis	Hyelaphus	<i>Axis pocinos</i>	Hog Deer
	Moschidae	Moschinae	Moschus	-	<i>Moschus chrysogaster</i>	Musk Deer
					<i>Moschus leucogaster</i>	
				<i>Moschus fuscus</i>		
Moschidae	Moschinae	Moschus	-	<i>Moschus berezovski</i>	Musk Deer	
CRITICALLY ENDANGERED	Cervidae	Cervinae	Cervus	Hyelaphus	<i>Axis kuhlii</i>	Bawean or Kuhl's (Java Sea Deer)
EXTINCT	Cervidae	Cervinae	Elaphurus	-	<i>Elaphurus davidianus</i>	Pere David's Deer
	Cervidae	Cervinae	Cervus	Thaocervus	<i>Rucervus schomburgki</i>	Schomburgk's Deer
Data Deficient	Cervidae	Muntiacinae	Muntiacus	-	<i>Muntiacus feae</i>	Muntjacs (Barking Deer)
	Cervidae	Muntiacinae	Muntiacus	-	<i>Muntiacus gongshanensis</i>	Muntjacs (Barking Deer)
	Cervidae	Muntiacinae	Muntiacus	-	<i>Muntiacus rooseveltorum</i>	Muntjacs (Barking Deer)
	Cervidae	Odocoileinae	Mazama	-	<i>Mazama americana</i>	Brocket Deer



Source: Dr Tomas Landete-Castillejos, the President of Internatioanal Deer & Wild Ungulate Breeders Association (IDUBA) was able to provide data from a survey by Kotrba & Bartos, (2010)

12.3. Appendix 3: Appendices I, II and III from Convention on International Trade in Endangered Species of Wild Fauna and Flora

	Appendices		
	I	II	III
FAUNA (ANIMALS) PHYLUM CHORDATA CLASS MAMMALIA (MAMMALS)			
Cervidae Deer, huemuls, muntjacs, pudus	<i>Axis calamianensis</i> <i>Axis kuhlii</i> <i>Axis porcinus annamiticus</i> <i>Blastocercus dichotomus</i> <i>Cervus elaphus hanglu</i> <i>Dama dama mesopotamica</i> <i>Hippocamelus spp.</i> <i>Muntiacus crinifrons</i> <i>Muntiacus vuquangensis</i> <i>Ozotoceros bezoarticus</i> <i>Pudu puda</i> <i>Rucervus duvaucelii</i> <i>Rucervus eldii</i>	<i>Cervus elaphus bactrianus</i> <i>Pudu mephistophiles</i>	<i>Axis porcinus</i> (Except the subspecies included in Appendix I) (Pakistan) <i>Cervus elaphus barbarus</i> (Algeria, Tunisia) <i>Mazama temama cerasina</i> (Guatemala) <i>Odocoileus virginianus mayensis</i> (Guatemala)

12.4.

Appendix 4: Compilation of Deer locations around the world from CITES, IUCN, Rue 2002 & Whitehead (1993, reprinted 2008)

	Moose	Roe Deer	Sika (Japanese Deer)	Red Deer	Wapiti/Elk (North American)	Mule Deer	White-Tailed Deer	Axis Deer	Muntjacs (Barking Deer)	Fallow Deer
Europe	Present	Present		Present						Present
North America	Present			Present	Present	Present				Present
Alaska	Present					Present				
Albania										Present
Argentina				Present				Present		Present
Australia			Present	Present						Present
Austria	Present									
Baltic States										
Bangladesh								Present	Present	
Belarus	Present									
Bhutan								Present		
Bosnia										Present
Brazil								Present		
Bulgaria										Present
Canada	Present					Present	Present			
Central America	Present		Present				Present			
Chile				Present						Present
China		Present	Present		Present			Present	Present	
Corsica				Present						
Croatia								Present		
Cyprus										Present
Czech Republic	Present									
Denmark			Present							
East Asia										
England			Present							
Estonia	Present	Present								
Europe										
Fiji										Present
Finland	Present									
France			Present							
Germany				Present						
Greece										Present
India								Present		
Ireland			Present							
Italy										Present
Japan			Present							
Kazakhstan		Present								
Korea		Present								
Mexico						Present				
Moldova								Present		
Mongolia		Present								
Mongolia	Present	Present								
Nepal								Present	Present	
New Zealand			Present	Present	Present					Present
Norway	Present			Present						
Pakistan								Present	Present	
Papua New Guinea								Present		
Peru				Present						Present
Poland	Present		Present							
Russia	Present				Present					
Russia	Present	Present		present						
Scandinavia	Present									
Scotland			Present	Present						
Serbia	Present									
Siberia					Present					
South Africa										Present
South America							Present			
South Korea										
Spain				Present						
Sri Lanka								Present	Present	
Sweden	Present		Present	Present	Present					
Switzerland			Present							
Taiwan			Present							Present
Tibet			Present	Present	Present					
Turkey		Present								
Turkistan				Present						
Ukraine	Present	Present								
Ukraine	Present							Present		
Uruguay								Present		
Vietnam			Present							

12.5. Appendix 5: Deer & Harvest Rates in the EU Countries

Sources												
Land areas, human populations: Wikipedia												
Ungulate populations & harvests (2005 estimates): Apollonio, M., Andersen, R. and Putnam, R. (2010) (eds). <i>European Ungulates and their Management in the 21st Century</i> . Cambridge University												
Country	Land Area (1000 km ²)	2015 Human population (million)	Roe deer population (1000)	Roe deer harvest (1000)	Roe Harvest rate	Red deer population (1000)	Red deer harvest (1000)	Red Harvest rate	Fallow deer population (1000)	Fallow deer harvest (1000)	Fallow harvest rate	
Spain	506	46.4	600	17.85	3%	900	90.05	10%	100	7.6	8%	
UK	245	65	450	108.05	24%	420	81.5	19%	152	64.6	43%	
Austria	84	8.6	1050	280.5	27%	190	49.6	26%	1.5	0.55	37%	
Germany	357	81.4	2400	1077	45%	150	62.9	42%	150	52.2	35%	
Poland	313	38.5	692	151	22%	141	39	28%	13.1	3	23%	
Norway	385	5.2	90	30	33%	130	24	18%				
France	644	66.4	1200	503.1	42%	120	40	33%	12	2.8	23%	
Hungary	93	9.8	316	86	27%	74.1	43	58%	21.6	9.1	42%	
Italy	301	61	426	46.5	11%	63	8	13%	21	4.7	22%	
Slovakia	49	5.4	85	18	21%	38	10	26%	7.5	2	27%	
Romania	238	19.8	158.7	4.3	3%	36.1	0.83	2%	5.9	0.93	16%	
Latvia	65	2	129.5	18	14%	28.4	3.47	12%				
Switzerland	41	8.3	130	42.5	33%	25	7.1	28%				
Czech Republic	79	10.5	292.8	121	41%	23.3	18.5	79%	19	9	47%	
Portugal	92	10.3	5	0.02	0%	20	2	10%	3	0.13	4%	
Slovenia	20	2.1	150	42.4	28%	14	4.92	35%	0.3	0.14	47%	
Denmark	44	5.7	200	103.3	52%	14	3.34	24%	5.8	3.13	54%	
Lithuania	65	2.9	81.3	15	18%	12.6	0.57	5%				
Belgium	31	11.3	60	20.47	34%	10	3.18	32%	0.2			
Sweden	450	9.9	800	155	19%	10	3	30%				
Croatia	57	4.2	41.5	8.13	20%	9.6	1.16	12%	1.2	0.23	19%	
Serbia	88	7.1	120	5.1	4%	5	0.53	11%	3	0.3	10%	
Ireland	70	4.6				4		0%	10	2	20%	
Netherlands	41	17	60		0%	2.7	0.34	13%	1.15			
Estonia	45	1.3	48.4	5.46	11%	1.55	0.14	9%				
Greece	132	10.8				0.65		0%	0.4			
Finland	338	5.5	30	2.4	8%				0.6	0.2	33%	
Total	4873	521	9616.2	2861.08	30%	2443	497.13	20%	529.25	162.61	31%	
Min	20	1.3	5	0.02	0%	0.65	0.14	0%	0.2	0.13	4%	
Median	88	9.8	150	36.2	21%	24.15	6.01	19%	5.9	2.4	25%	
Max	644	81.4	2400	1077	52%	900	90.05	79%	152	64.6	54%	
NZ at European means						134.4	27.3		29.1	8.9		
New Zealand	268	4.4										

Source: Information provided by Professor Geoff Kerr, Lincoln University, New Zealand

12.6. **Appendix 6:** Top 50 Petfood Companies by annual turnover as at 2017 according to Petfood.com

TOP 50 PET FOOD COMPANIES, 2017

RANK	Company	Annual revenue (USD)	Country
1	Mars Petcare Inc.	\$17,224,400,000	United States
2	Nestlé Purina PetCare	\$12,500,000,000	United States
3	Hill's Pet Nutrition	\$2,292,000,000	United States
4	J.M. Smucker	\$2,100,000,000	United States
5	Diamond Pet Foods	\$1,500,000,000	United States
6	Blue Buffalo	\$1,275,000,000	United States
7	Spectrum Brands/United Pet Group	\$801,120,000	United States
8	Ainsworth Pet Nutrition	\$800,000,000	United States
9	Unicharm Corp.	\$752,653,669	Japan
10	Deurer	\$721,100,000	Germany
11	Thai Union Group	\$720,823,520	Thailand
12	Heristo AG	\$700,000,000	Germany
13	WellPet	\$700,000,000	United States
14	Agrolimen SA	\$532,660,815	Spain
15	Jeil Feed	\$494,189,000	South Korea
16	C & D Foods	\$455,000,000	Ireland
17	Real Pet Food Company <small>(formerly K1 P, Petfoods)</small>	\$450,000,000	Australia
18	American Nutrition	\$390,000,000	United States
19	Central Garden & Pet	\$390,000,000	United States
20	Merrick Pet Care	\$350,000,000	United States
21	Sunshine Mills	\$350,000,000	United States
22	Partner in Pet Food	\$326,299,800	Hungary
23	Neovia (ex InVivo NSA)	\$313,650,000	France
24	Simmons Pet Food	\$260,000,000	United States
25	Perfect Companion	\$246,908,000	Thailand
26	Versele-Laga NV	\$228,061,000	Belgium
27	Monge & C.	\$226,000,000	Italy
28	C.J. Foods	\$200,000,000	United States
29	Tuffy's Pet Foods	\$200,000,000	United States
30	Nippon Pet Food Co.	\$187,000,000	Japan
31	Champion Petfoods	\$180,000,000	Canada
32	MG Group	\$165,671,030	Japan
33	DoggyMan H.A. Co. Ltd.	\$163,266,000	Japan
34	Rondo Food	\$160,000,000	Germany
35	Empresas Carozzi	\$158,200,000	Chile
36	Freshpet	\$156,400,000	United States
37	United Petfood Producers	\$140,000,000	Belgium
38	Morando	\$134,340,000	Italy
39	Nisshin Petfood	\$128,248,000	Japan
40	GA Pet Food Partners	\$121,160,001	United Kingdom
41	Bynsa Pets	\$120,000,000	Spain
42	Petline Ltd.	\$113,000,000	Japan
43	Butcher's Pet Care	\$112,990,000	United Kingdom
44	Normandise Pet Food	\$106,000,000	France
45	Irish Dog Foods Ltd.	\$100,000,000	Ireland
46	Kent Corp.	\$100,000,000	United States
47	Grupo Pilar	\$95,759,000	Argentina
48	Inspired Pet Nutrition	\$93,193,000	United Kingdom
49	Almo Nature	\$92,183,404	Italy
50	Landini Giuntini SPA	\$90,000,000	Italy

Source: <http://www.petfoodindustry-digital.com/201805/index.php#/1>