Dissertation - Report 2

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June 2024

Data Exploration

Comparison between Twins (Taken from - Lamb 2016 data)

The figure shows the comparison between two lamb's weight distributions.

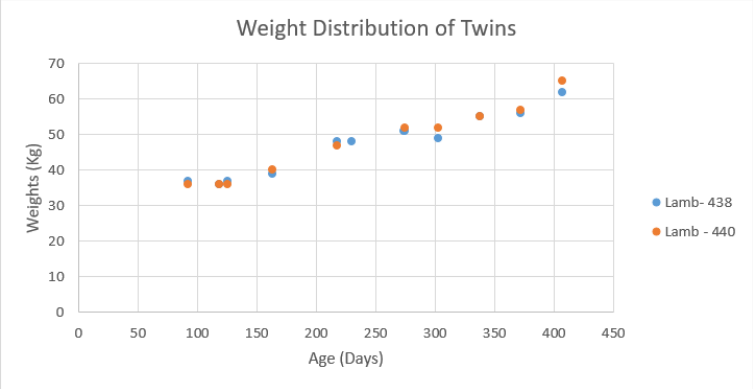

Figure 1: Weight Distribution Of Twins from the lamb2016 data.

The plot shows that the weight distribution of both the lambs seems to be almost the same, following the same pattern over the days.

Comments: The weights for both the lambs are almost the same over the months. We know that both the lambs were born of the same "Dam" (Twins), however, only at one or two instances "lamb 440" had more weight than "lamb 438". It's not a significant increase in weight, however, when compared to weights at other instances it shows a significant difference.

Types of Lambs in the Dataset

- **Pedigree:** 444
- **Commercial:** 133

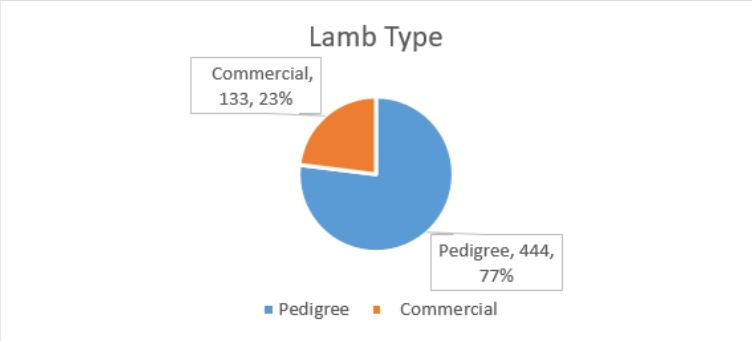

Figure 2: Lamb Distribution for Pedigree and Commercial.

This shows that most (77%) of our data consists of commercial lambs, which come to around 133 of the total 577 lamb data available.

Now let's have a look at the distribution of these two types of lambs over the years:

Years	**Pedigree**	**Commercial**	**Total**
2016	99	0	99
2017	15	48	63
2018	80	0	80
2019	69	17	86
2020	66	27	93
2021	62	21	83
2022	53	21	74

Table 1: Lambs Distribution Over the Years

Surprisingly, in 2017, the majority of the lambs were commercial rather than pedigree as compared to other years where pedigree lambs were the majority.

However we can see that the number of pedigree lambs has been gradually decreasing over the years if the year 2017 is not considered in the trend (from 99 to 53).While the total number of lambs hasn't shown any significant difference over the years, fluctuating between 80-90 lambs each year.

Questions we can ask:

Year 2017 shows a very different distribution compared to others: (was there any particular reason for this?)

- Lowest number of lambs.
- Commercial lambs in majority.

As we have seen earlier that mostly male lambs are butchered, let's see if there's any relation between the types of lambs and if they are butchered or not butchered over the years.

Years	Pedigree		Commercial	
	Butchered	Not Butchered	Butchered	Not Butchered
2016	32	67	0	0
2017	11	4	22	26
2018	34	46	0	0
2019	27	42	17	0
2020	33	33	18	9
2021	17	45	19	2
2022	16	37	21	0

Table 2: Distribution Of types of lambs butchered or not butchered.

Comments: From the above table, we can infer that commercial lambs are mostly butchered while pedigree lambs are often used for breeding or sold for breeding and as pet lambs. For pedigree types, only a small number of lambs are butchered, whereas the rest are used for breeding purposes or sold as pet lambs. This shows that pedigree types are often kept alive due to their varied benefits.

Gender-Based Analysis

Let's have a look at the percentage of males and female lambs over the years:

Percentage of Males and Females Over the Years

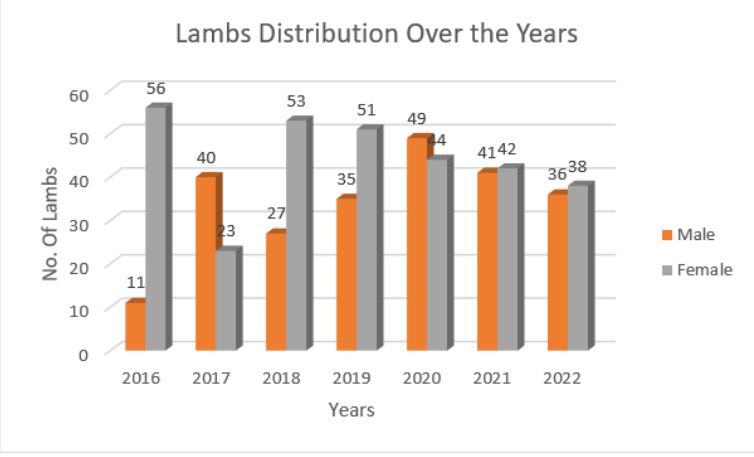

Figure 3: Lamb Distribution Over The Years.

Year 2016 saw the highest difference in the number of males and females where the count of male lambs was 11 and females were 56 (almost 5 times that of males). The years 2017, 2018, and 2019 had significant differences in the count of male and female lambs where the count was almost double compared to the other gender. The number remained almost the same for the following years during 2019 to 2022.

As per the data, the average weaning weight of male lambs is much higher than females which can impact the average weaning weights for a specific year considering both males and females.

Let's look at the male percentage distribution over the years to understand where the average weaning weight of a lamb could go higher.

Year	Male	Female
2016	11	56
2017	40	23
2018	27	53
2019	35	51
2020	49	44
2021	41	42
2022	36	38

Table 3: Male and Female Distribution Over the Years

Percentage Distribution of Males Over the Years

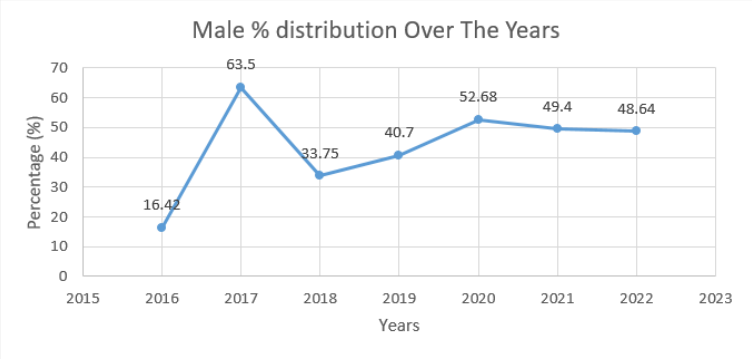

Figure 4: Percentage of Male lambs over the years.

Comments: As per the figure, we can see that the male percentage in 2017 is heavily dominated compared to other years which impacts our average weaning weight curve in the next figure. Interestingly, in 2016, the percentage of male lambs was the least with only 16%.

Average Weaning Weights of Males and Females

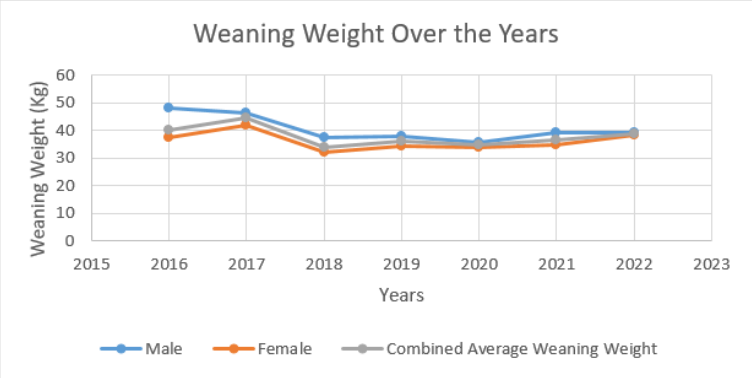

Figure 5: Weaning Weight Over The Years

Years	Male	Female	Combined Average Weaning Weight
2016	48	37.68	40.02
2017	46.28	42.04	44.73
2018	37.55	32.26	34.05
2019	38.03	34.59	35.99
2020	35.63	33.89	34.81
2021	39.19	34.63	36.63
2022	39.39	38.2	38.8

Table 4: Average Weaning Weights Over the Years

The figure shows the weaning weight distribution over the years compared between males, females, and the average weaning weight. We can see that except for the year 2017, the average weaning weight has almost remained the same throughout the years. This can be attributed to the majority of lambs in 2017 being males which led to an increase in the average weaning weight.

Here we can further look at the average weaning weight curve for commercial and pedigree types. However, we can assume that commercial lambs will have higher average weaning weight compared to pedigree types as it is heavily dominated by male lambs and are butchered for their meat products.

Discussion

Questions: Converting the data as per age and weights for a specific lamb can be done, but how can we organize or form the data for all the lambs with age and weights to apply on the model?

Target: As of now, thinking to predict the average weaning weight (with confidence interval) of a lamb at the age of 200 days conditioned being male or female.

Hypothesis: If the average weight or standard deviation varies based on gender, i.e., $H_0 : G_{male} = G_{female}$

Approach for the above:

- Cleaning the data and preparing it for analysis.
- Understanding Growth/Longitudinal/Functional curve models.Look for references.
- Look how the data can be converted so that we can apply growth curve models.
- Supervisor comments