ruminants

MDPI

Article

A Survey of the Current Farming Practices and Perceptions on Adopting Orphan Lambs in the United Kingdom: How Do "Ewe" Do It?

Louise Whatford *, Benedict Delahaye Chivers, Megan Rowe and Nicola Blackie

Pathobiology and Population Sciences, Animal Welfare Science and Ethics Group, Royal Veterinary College, Hawkshead Lane, North Mymms, Hatfield AL9 7TA, UK; nblackie@rvc.ac.uk (N.B.)
* Correspondence: lwhatford@rvc.ac.uk

Abstract: Fostering orphan lambs is common in the United Kingdom and therefore it is important to understand more about these practices to support sustainable sheep farming. Data were collected on current approaches to adopting lambs and the perceived success of these methods using an online survey. Of the 543 responses, 93.7% reported that they attempt to foster lambs with the most common reasons reported as high litter size and ewes with little to no milk production. Although respondents reported that the best method was wet, non-tethering techniques, the most commonly used methods were tethered (restraint of the ewe) followed by untethered (birth fluids and skins from dead lambs). Other techniques included disguising the smell of the lamb. There was a significant association between increased flock size and using tethered methods as well as increased numbers of methods used and orphan lambs ($p \leq 0.001$). However, larger flocks were also associated with decreased lamb survival rates ($p \leq 0.001$). Time and patience were mentioned as important tips for fostering and could be a factor in which method is chosen. Research on the impacts of these methods is warranted as some may be stressful, affecting long-term flock performance, survival, welfare and health.

Keywords: adoption; fostering; orphan lamb(s); sheep husbandry

Citation: Whatford, L.; Chivers, B.D.; Rowe, M.; Blackie, N. A Survey of the Current Farming Practices and Perceptions on Adopting Orphan Lambs in the United Kingdom: How Do "Ewe" Do It? *Ruminants* **2023**, *3*, 468–482. https://doi.org/10.3390/ruminants3040038

Academic Editor: John Webster

Received: 4 October 2023
Revised: 20 November 2023
Accepted: 28 November 2023
Published: 5 December 2023

1. Introduction

Sheep farming is an important part of the agricultural sector in the United Kingdom (UK) and a valuable contributor to the national economy. The national sheep flock was reported to be 33,066,000 in 2022, an increase of 0.3% from 2021, with almost half a million people working on commercial farms [1]. With increasing pressures on the sector, such as climate change impacts and policy and subsidy changes, the livestock sectors need to identify areas to improve efficiency and become more sustainable to maintain a fit and resilient system.

Lambing is a key time in the sheep production year, which highly influences farm profitability through the production of lambs later for sale, or retention as breeding stock. Mortality is one aspect which can greatly impact a successful lambing and a profitable outcome. Lamb mortality figures on UK farms have remained relatively constant at around 10–15% [2–5]; this is consistent with unpublished data collected by Royal Veterinary College students on lambing placements in 2018. A recent survey in Ireland reported a lower than previously published mortality of 7.9% [6]. Litter size impacts this, with multiple births leading to increased mortality [7,8], particularly triplets [2]. Low birthweight is another risk factor for mortality [8], with triplet lambs often having a lower birthweight [9,10] than single or twin lambs. High litter sizes, with three or more lambs, can improve farm productivity and thus profits [11]. However, triplet lambs have higher mortality and lower weaning rates in comparison to twins [12]; this is associated with reduced colostrum and milk consumption per lamb, potentially through less time spent suckling [13]. Lower reproductive performance and slower lamb growth rates also threaten a farm's efficiency

and profitability, and potentially increase farm emissions [14]. There are many different techniques farmers may take to positively impact their efficiency around lambing, and one of these practices is orphaning/adopting lambs. Orphaning involves removing one or more lambs from the dam, whereas adoption/fostering refers to encouraging another ewe to take the lamb on.

Orphan lambs are common in UK sheep-rearing enterprises. Lambs may be orphaned through ewe death, rejection by the mother, removal due to too many lambs born to one ewe or insufficient milk production by the ewe. These lambs then have to be adopted onto another ewe or artificially reared. The majority of farmers (93%) undertake some form of adoption, particularly when dealing with litters greater than twins [15] and ewes with reduced/no milk production.

Methods for adopting lambs onto ewes include; skinning, where the skin of a dead lamb is removed and transferred to the potential adopting lamb [15], covering in birth fluids (wet fostering) [15,16], disguising the scent of the lamb through artificial odorants [15,17–19], transferring the scent of lambs (through rubbing the lamb on the newborn of the adoptive ewe or in birth fluid) [20,21] and restraint (tethering) of the ewe [15,22–24] in a pen or similar, usually by the head (this stops the ewe being able to turn around or move away from the lamb). The latter is potentially stressful for the ewe as she is restricted in her movements and possibly socially isolated depending on the farm setup [25]. The risk of perinatal mortality is higher in flocks that use wet adoption [2]; this was thought to indicate that farms may have had a high multiple birth rate. An Irish study in 2017 found that 76% of respondents adopted lambs; most were wet fostered (61%) (on its own or in combination with another method), followed by dry fostering (60%) and skinning (10%) [6]. Where farms only used one method of fostering, wet fostering was 29%, with dry fostering being 27% and skinning being rarer (1%) [6]. Respondents from that study thought all three methods had similar success rates [6].

From the authors' personal observations, there are a variety of different methods of fostering/adopting lambs that are currently being utilised across UK sheep farms. Each approach will have varying degrees of success and impact the ewe and lambs differently, including their welfare, requiring differing scarce resources and so on. This will all have an impact on ewe and lamb productivity and survival, and therefore the overall success and impact of the farm. To the authors' knowledge, there is a dearth of knowledge and research amalgamating these important data and teasing out best practices for welfare, efficiency, and productivity. Hence, the aim of this project was to gather information and perspectives about the different techniques used to deal with orphan lambs on UK sheep farms.

2. Materials and Methods

2.1. Survey Population and Distribution

An online questionnaire was developed and circulated using Jisc online surveys. All sheep farmers living and farming in the United Kingdom and who were over the age of 18 were able to complete the survey. It was promoted using various channels including personal and organisational Twitter and other social media accounts, personal contacts and industry email newsletters. It was opened on 29 March 2022 and closed for responses on 18 July 2022.

2.2. Survey Content

A pilot questionnaire was designed and commented on by sheep farming experts. The final survey had thirty-six questions divided into three main sections (see Supplementary Materials). The first section asked questions regarding flock information, such as flock size, breed and lambing management. The second and larger section asked questions on the management of orphaned lambs and the final section focussed on demographics. There was a combination of open and closed questions, allowing for quick response time and areas for respondents to provide more detailed information in free-text answers. There were questions on adoption/fostering methods and artificial rearing of lambs; this paper

will focus only on the answers relating to the adoption of lambs. The survey received ethical approval from the Social Sciences Research Ethical Review Board (SSRERB) at the Royal Veterinary College (URN: SR2022-0045). A full copy of the survey is available as Supplementary information.

2.3. Statistical Analysis

Following the data being exported from the online survey platform, manual data checking and cleaning were carried out. This involved identifying missing responses and coding as such, giving each column the question number rather than the actual question and coding the options for each closed question as a number in place of the text response. For the open questions, themes were identified to allow for categories to be developed.

Data analysis was performed using SPSS (version 28.0, IBM Corp, New York, NY, USA) and RStudio (Version 4.1.1). Categorical data were described as percentages (of the total number of responses for that question) and non-normally distributed responses were summarised using median and interquartile range (IQR); as some of the data was ordinal categorical data, the IQR is interquartile interval rather than range. The distribution of variables across categories of flock size was analysed with Chi-squared tests or Kruskal–Wallis H tests as appropriate. To identify if there was an association between (1) ranked adoption success and tethering (restraint) or non-tethering methods and (2) ranked adoption success and categorised methods, univariable ordinal regression models were performed with the ordinal package in R, using the PLUM procedure. To investigate risk factors for the use of tethering methods when adopting, multivariate binary logistic regressions were performed. A model was created with the binary outcome variable of whether a respondent mentions the use of a tethering method in their response to question 15 (see Supplementary material) or not. Predictor variables in this model included flock size, breed type, number of helpers at lambing, number of orphans, respondent age and respondent experience.

3. Results

3.1. Demographics

In total, 544 responses were received; however, one response was discarded for not answering any questions beyond flock size; therefore, 543 responses were analysed. Respondents were from all parts of the UK with the highest percentage being from England (367/543, 67.5%), followed by Wales (73/543, 13.4%), Scotland (71/543, 13.1%), and Northern Ireland (27/543, 5%). Two respondents did not provide their location. With a reported 65,637 sheep holdings in Great Britain in 2022 and assuming one response per holding, this would mean a 0.78% response rate for Great Britain. Respondent signalment is presented in Table 1.

The median flock size was 250–349. Approximately 50% of flocks were of lowland breeds (such as texels and lleyns) with approximately 12% of respondents reporting farming a mixture of breed types. The most common types of holding reported were commercial sheep and cattle (174/540, 32.2%), commercial sheep only (105/540, 19.5%), and commercial sheep, cattle and arable (93/540, 17.2%) (Table 2). There was a significant association between flock size and breed type (χ^2 (28) = 68.25, $p < 0.001$) with lowland flocks tending to be of a smaller size, with a median of 150–249 sheep and the most common responses being either a flock size of 51–149 (51/18.3%) or 150–249 (33/11.9%) (Table 2, Figure 1). From the 541 respondents that provided information, lambing occurred predominantly indoors for 58% (314/541) of respondents and outdoors for 19.8% (107/541) of respondents. The remaining 22.2% (120/541) of respondents reported a mix of indoor and outdoor lambing. Due to the large number of different sheep breeds being reported, they were categorised into lowland, upland, hill, and mixture based on which region the breed was most associated with.

Table 1. Demographics of the 543 respondents.

Question (Total Answers for Question)	Responses	*N*	% of Total Answered
Age (543)	<20	32	5.9
	21–30	142	26.2
	31–50	212	39
	51–70	143	26.3
	70+	12	2.2
Gender (539)	Female	355	65.4
	Male	184	33.9
Country (542)	England	366	68.2
	Wales	73	13.6
	Scotland	71	13.2
	N. Ireland	27	5.0
Sheep experience (541)	<2 Years	11	2.0
	2–5 Years	56	10.4
	5 Years+	77	14.2
	10 Years+	129	23.8
	20 Years+	94	17.4
	30 Years+	174	32.2
Farm role (542)	Family/Family Business	145	26.8
	Manager	19	3.5
	Partner/Owner	282	52.0
	Shepherd	51	9.4
	Tenant	10	1.9
	Worker	30	5.5

Table 2. Farm and flock information for the 543 respondents.

Question (Total Answers for Question)	Responses	*N*	% of Total Answered
Type of holding (540)	Commercial sheep only	105	19.5
	Commercial sheep and arable	40	7.4
	Commercial sheep and cattle	174	32.2
	Commercial sheep and cattle and arable	93	17.2
	Commercial sheep and Pedigree	15	2.8
	Pedigree breeder	46	8.5
	Smallholder (sheep)	27	5
	Smallholder (mix of animals)	37	6.9
Flock size (543)	50 or less	61	11.2
	51–149	105	19.3
	150–249	78	14.3
	250–349	57	10.5
	350–449	48	8.8
	500–699	59	10.9
	700–999	37	6.8
	1000+	98	18
% flock as breeding stock (519)	0–19	9	1.7
	20–39	19	3.7
	40–59	45	8.7
	60–79	77	14.8
	80–100	369	71.1
Breed type (536)	Lowland	277	51.7
	Upland	20	3.7
	Hill	69	12.9
	Mixture	65	12.1
	Unknown	105	19.6

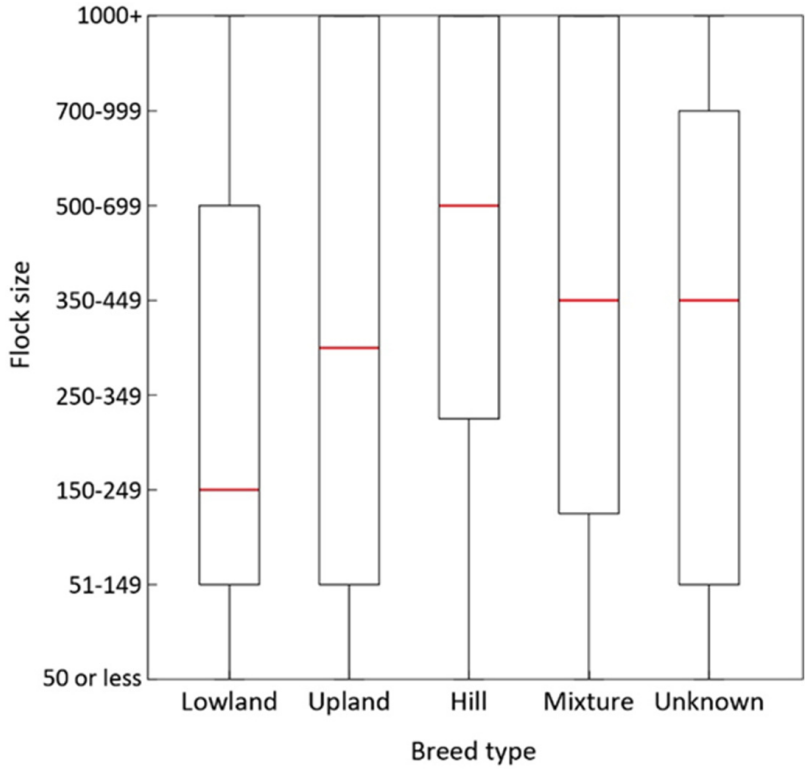

Figure 1. Distribution of flock sizes across breed types typically associated with the lowlands, uplands or hill regions. Red lines indicate medians, boxes indicate interquartile ranges/intervals (IQR).

3.2. Adoption Methods

Of the 543 respondents, 506/543 (93.2%) reported using at least one method for adopting lambs, with 37/543 (6.8%) respondents indicating that they do not attempt to adopt or artificially rear exclusively (Table 3). If attempting adoption, the median number of used methods reported was 3—with 403/543 (74.2%) respondents reporting that they used more than one method for adopting lambs (Table 3). There was a significant association between flock size and the number of adoption methods used (χ^2 (35) = 94.43, $p < 0.001$) with more methods being reported in flocks with increasing size (Figure 2). There was no association between breed type and number of methods used ($p = 0.80$). The most mentioned methods of adoption were skinning and wet adoption (Table 3); however, only 18/543 (34.2%) respondents used these non-tethering methods exclusively (or did not attempt adoption). In total, 318/543 (58.6%) respondents mentioned using at least one tethering method (Figure 3), with single adoption pens being the most mentioned from this subgroup (210/318, 66%; Table 3). Nineteen (19/534, 3.5%) respondents reported using tethering techniques exclusively, while 185/534 (34.6%) reported using non-tethering techniques exclusively. Over half (299/534, 56%) of respondents used at least one tethering and one non-tethering technique. In addition to the 37 respondents reporting that they did not attempt to adopt/foster lambs exclusively, there were 19 (3.5%) mentions of not attempting to adopt by those who used at least one other method to adopt lambs. Of the 103 (19.0%) respondents who reported using just a single method of adoption, the most commonly reported method was wet adoption (Table 3). The method mentioned was not significantly associated with a higher suggested rank of adoption success.

Table 3. Adoption/fostering information provided by the 543 respondents.

Question (Total Answers for Question)	Response	Used	% of Total Answered	Used Exclusively	% of Total Answered
Adoption method reported (543)	Where possible, use skin from a lamb that has died	313	57.6	19	3.5
	Cover in birth fluid from ewe + do not tie legs	278	51.2	28	5.2
	Cover in birth fluid from ewe + tie legs	263	48.4	29	5.3
	Adoption pen (single)	210	38.7	9	1.7
	Tether in standard pen	98	18	4	0.7
	Adoption pen (multiple in one place)	86	15.8	3	0.6
	Attempt to disguise the smell of the lamb/make similar to other lamb	58	10.7	3	0.6
	Do not attempt to adopt/foster lambs	49	9.0	33	6.1
	Do not attempt to artificially rear lambs	10	1.8	1	0.2
	Other	13	2.4	3	0.6
Mentions of methods used (543)	Tethered	318	58.6	16	2.9
	Not tethered	185	34.6	79	14.5
	Do not attempt to adopt/artificially rear	37	6.8	33	6.1
	Other	3	0.6	4	0.7
Mentions of methods thought best (543)	Tethered	65	12	46	8.5
	Not tethered	423	77.9	404	74.4
	Other	NA	NA	28	5.2

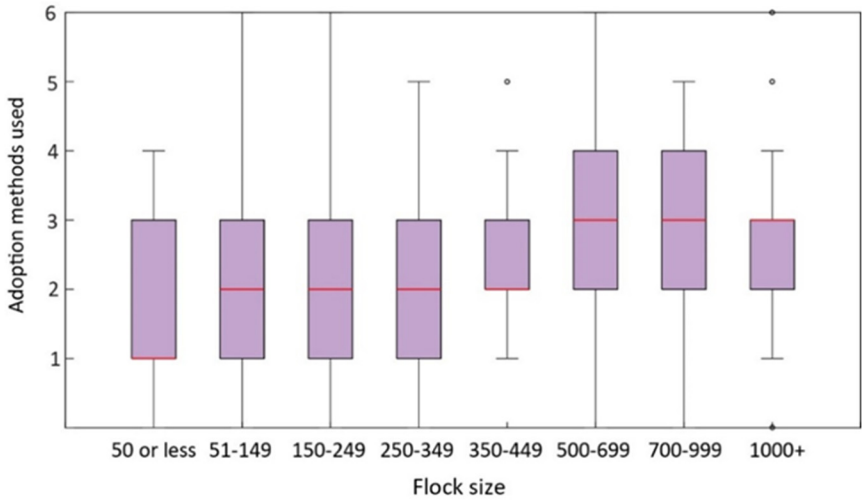

Figure 2. Number of adoption methods used for each flock size category. Red lines indicate median number of adoption methods used, boxes indicate interquartile ranges (IQR)/interquartile intervals, and circle markers indicate outliers >1.5 * IQR away from the box.

The respondents who selected adoption pens also provided data on how often the pens were cleaned out. The majority of the respondents (140/224, 49.8%) reported cleaning out after every use, followed by 12.8% (36/224) mentioning cleaning out daily (Table 4). Further information was provided on what they used with the most common answers mentioning straw 21.7% (61/224), lime 21.7% (61/224) and disinfectant 18.1% (51/224).

In total, 76 respondents reported using the method of attempting to disguise the smell of the lamb or making it similar to another lamb. Besides birthing fluid being used for wet adoption, the most common odours used were human cosmetic products (e.g., deodorants or perfumes) and iodine (Table 5).

The number of helpers at lambing significantly increased with flock size, as did the number of orphans (Figure 4a,b). However, the number of orphans increased 'more' than the staff number. Therefore, each member of staff had to deal with more orphans in larger farms than in smaller farms (Kruskal–Wallis: χ^2 (7) = 138.13, $p \leq 0.001$; Figure 4c).

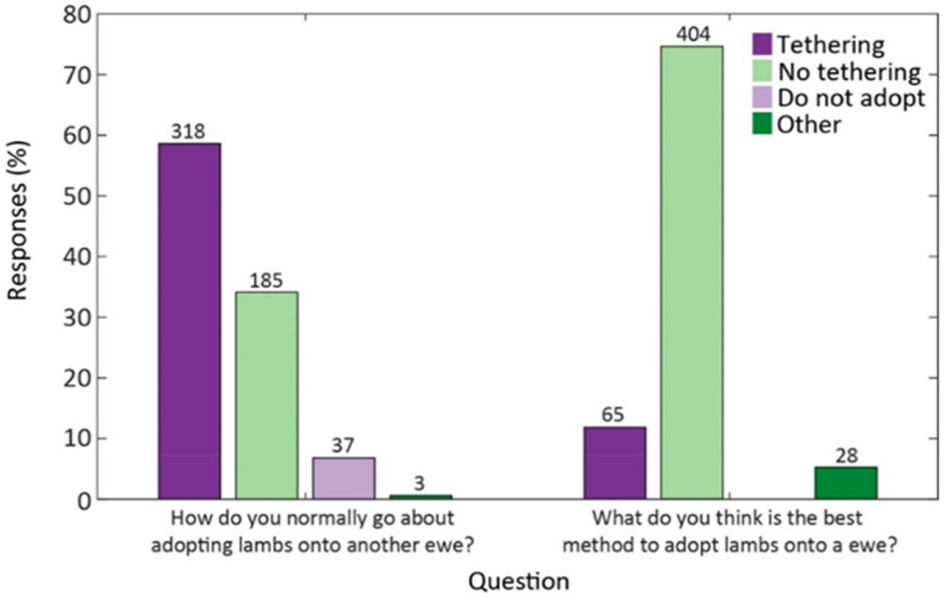

Figure 3. Percentage of the 534 respondents whose answers to the questions on what normal adoption methods are used and what they think is the best method are split by whether they use tethering and non-tethering techniques NB: No tethering includes only mentions of wet adoption and/or skinning dead lambs with no mention of adoption pens or tethering techniques. Tethering includes any restraint of the ewe and/or lambs during the process.

Table 4. Adoption pen cleaning regimes reported by 224 respondents.

How Often and with What Is the Adoption Pen Cleaned Out (n = 281)	*N*	% of Total Answered
Every use	140	49.8
Daily	36	12.8
Two weeks	3	1.1
Three weeks	1	0.4
Monthly	1	0.4
End of lambing	11	3.9
Do not clean out	5	1.8
With what is the adoption pen cleaned out?		
Lime	61	21.7
Disinfectant	51	18.1
What bedding is used for ewes and lambs?		
Straw	61	21.7
Shavings	7	2.5
Nonspecific bedding	20	7.1

Table 5. Methods mentioned by 76 respondents that are used to disguise smells while adopting.

Smells Used for Disguise (76)	*N*	% of Total Answered
Birthing fluid/smell of ewes lamb	18	23.7
Human cosmetic product	15	19.7
Iodine	13	17.1
Salt water	7	9.2
Human non-cosmetic	6	7.8
Adoption spray	6	7.8
Other	5	6.6
Skin of dead lamb	4	5.3
Ewes milk	2	2.6

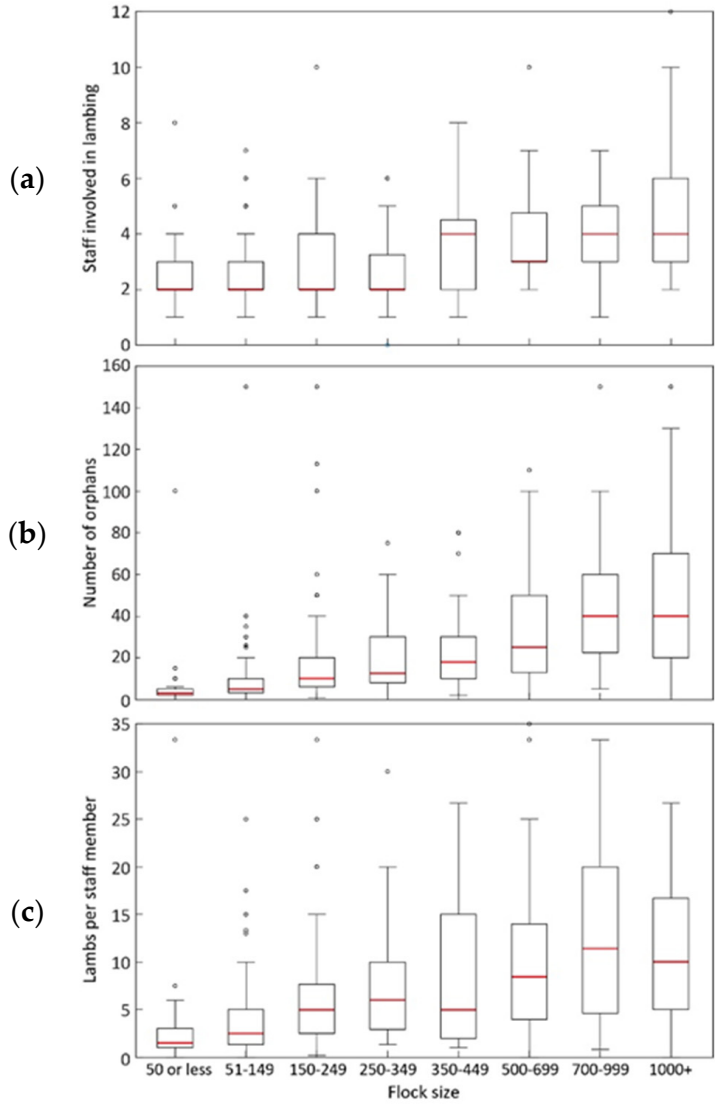

Figure 4. Distribution of number of staff involved in lambing (**a**), number of orphans (**b**), and number of orphans per staff member (**c**) for each flock size. Red lines indicate median, boxes indicate interquartile ranges (IQR), and circle markers indicate outliers > 1.5 * IQR away from the box.

The overall survival rate of orphans decreased with increasing flock size from ~95% in smaller flocks to ~86% in larger flocks (Kruskal–Wallis: χ^2 (7) = 80.33, $p \leq 0.001$; Table 6). There was no significant association between survival numbers and the adoption method used (Table 7).

Table 6. Average number of orphans and their survival by farm flock size for 530 respondents.

Flock Size	Average Orphan Number	Average Orphan Surviving Number	Average Survival Rate (%)
50 or less	5.6	5.1	96.5
51–149	10.2	9.5	94.7
150–249	19.5	18.7	99.6
250–349	18.6	16.3	85.7
350–449	25.3	20.9	86.7
500–699	34.0	31.1	89.2
700–999	45.6	41.4	87.0
1000+	61.7	54.1	85.9

Table 7. Average number of orphans and their survival by adoption method for 530 respondents.

Adoption Method	Av. Orphan Number	Av. Orphan Surviving Number	Av. Survival Rate (%)
Adoption pen (multiple in one place)	29.6	28.2	97
Adoption pen (single)	27.2	24.4	90.3
Attempt to disguise the smell	34.8	26	87.7
Cover in birth fluid from ewe + do not tie legs	33.6	29.1	90.1
Cover in birth fluid from ewe + tie legs	33	30.5	91.7
Do not attempt to adopt/foster lambs onto other ewes	22.2	21.1	94.2
Do not attempt to artificially rear lambs	15.8	14.1	87.7
Other	32.9	30	93.1
Tether in standard pen	28.4	25.5	89.7
Where possible use skin from a lamb that has died	31.5	27.7	91.5

3.3. Adoption Opinions

The respondents were provided with a choice of seven options, to rank in order for the reasons as to why they adopt lambs; therefore, their most common method would be ranked a 1 and the one they considered to be the least important reason or not something that ever was a problem for them was ranked a 6 (Figure 5). The most common reason for adopting onto a ewe was to put a lamb from a ewe that had triplets or quads onto a ewe who had only a single lamb or whose lambs had died (Figure 5). When asked what method was thought 'best' for adoption, 77.9% (423/543) of respondents mentioned wet adoption and/or skinning with no mention of tethering (unless they include that as part of the process), with 404 of these mentioning those methods exclusively. In total, 65/543 (12%) of respondents mentioned that a tethering method was best, with 46 of these mentioning tethering exclusively. Note that in this free-text answer, respondents mentioned multiple methods.

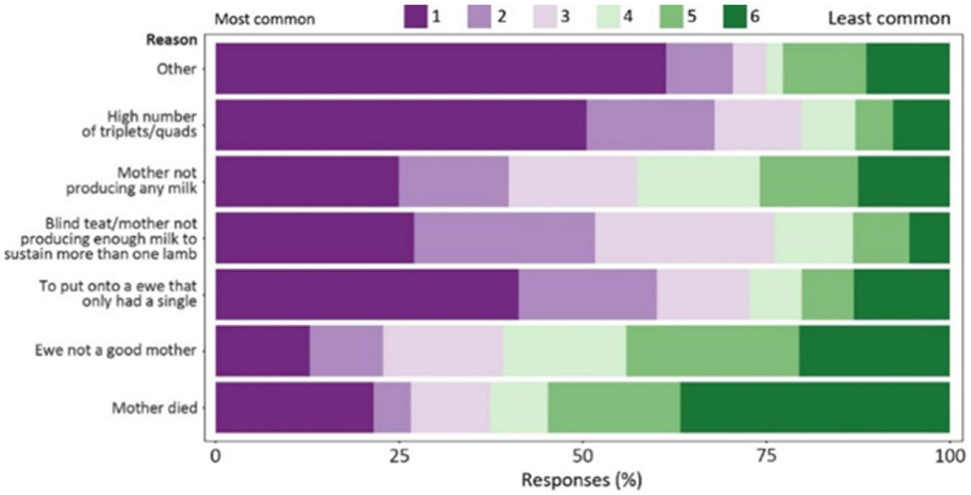

Figure 5. Respondents ranked seven reasons for adopting lambs from their perspective of most common (1) to least common (6). Few different reasons for 'Other' were given; a common one was to give a lamb to a ewe who birthed dead lambs or whose lambs have died.

Over 80% of respondents reported that they think that both adoption and artificial rearing are 'always' or 'somewhat' successful on their farms. Artificial rearing was reported to be the more successful method, with 42.6% (231/543) of respondents reporting that it was 'always successful' (Figure 6). Adoption was reported to be 'always successful' in 21.9% (119/543) of farms (Figure 6). The majority of respondents consider the growth rate of adopted lambs to be the same (69.2%) or better (6.7%) when compared to those reared by their dam, with a minority (24.0%) of respondents reporting that they think the growth rate to be worse.

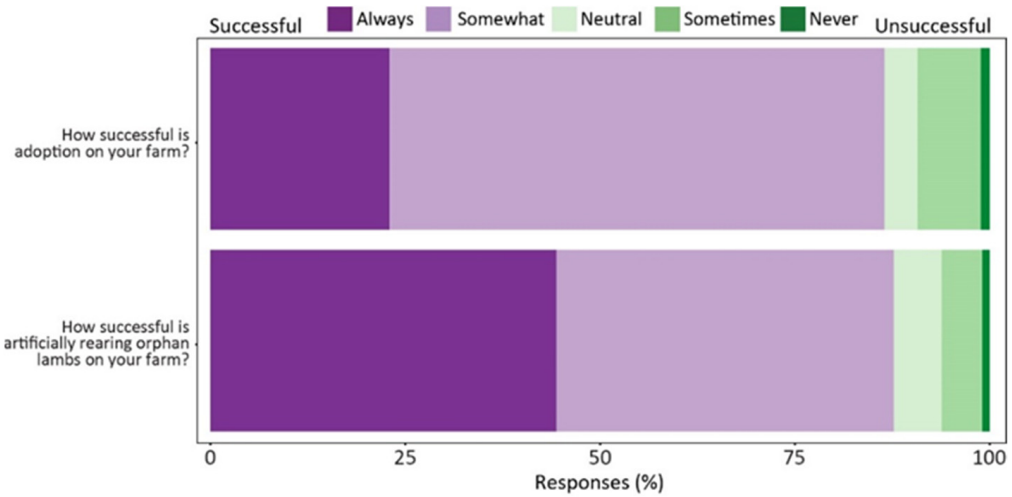

Figure 6. Ranked success of adoption and artificial rearing of orphans from always successful to never successful.

The respondents were also asked what their top tips are for adopting orphan lambs; the top common themes included the use of the birthing fluid, timing this when the ewe is lambing, tethering and tying legs, and having patience and perseverance (Figure 7).

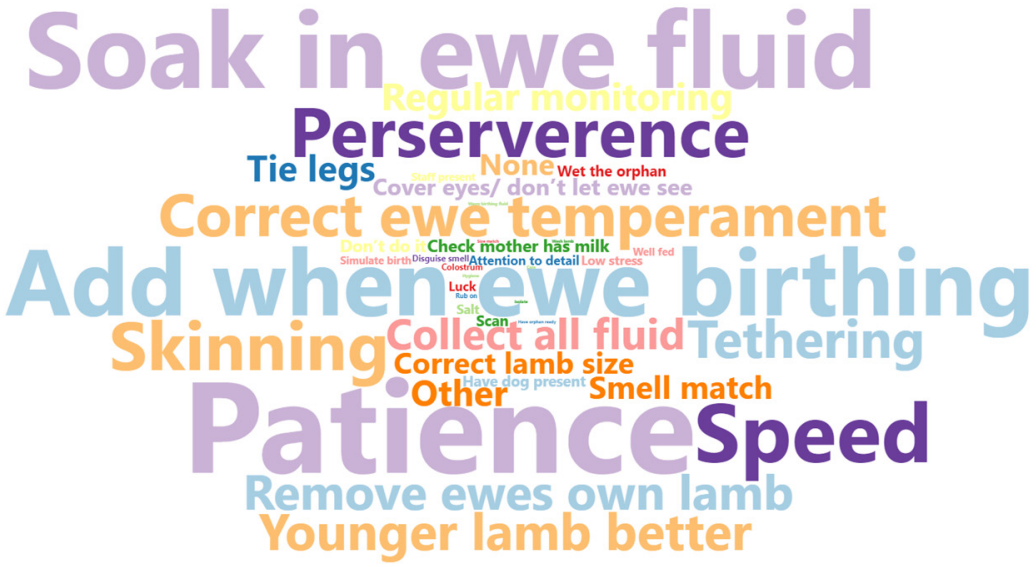

Figure 7. Word cloud created from respondents' top tips for adopting (after thematic categorisation). The larger the word, the more frequently this was mentioned.

3.4. Predictors for the Use of Tethering Methods

Mentions of tethering adoption methods tended to increase with increasing flock size (Figure 8), and logistic regression modelling suggested that those with a flock size of 50 or less mentioned the use of tethering significantly less than those with the median UK flock size group of 250–349 (p = 0.014; Table 7). Conversely, those with a flock size of 500–699 mentioned the use of a tethering method significantly more than those with the average flock size (p = 0.016; Table 8). No other predictors were significant in this model.

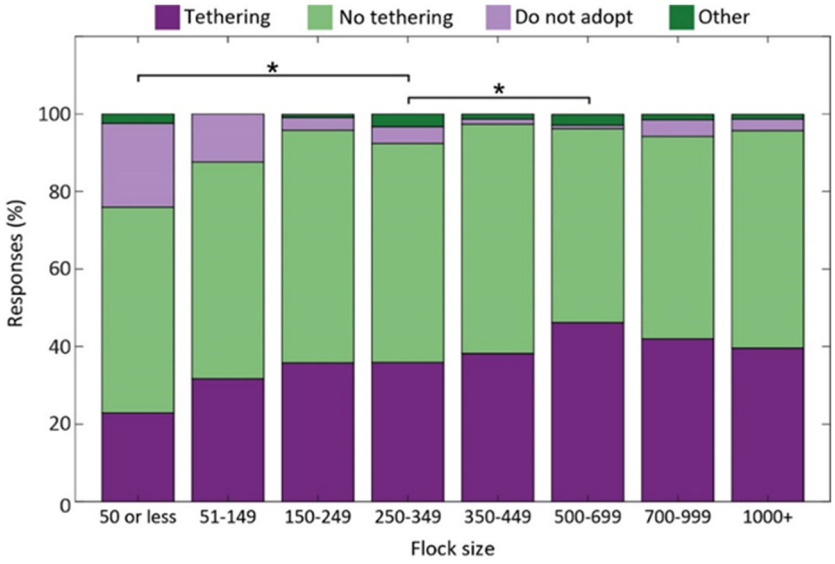

Figure 8. Mentions of tethering and non-tethering methods in reported adoption methods used for each flock size. Respondents can answer as using both tethering and non-tethering methods. * $p < 0.05$.

Table 8. Statistically significant binary logistic regression results for predictors of mentions of tethering in adoption methods used.

Outcome Variable	Model Fit	Predictor Variables	N (%)	Effect Size	*p*-Value
Mention of tethering in adoption methods (534)	$\chi^2(8) = 58.73$, $p = 0.001$	Flock size	n/a	Wald: 24.56	<0.001
		250–349	56 (10.5)	Reference	Reference *
		50 or less	60 (11.2)	OR: 0.36, CI: 0.16–0.81	0.014
		51–149	105 (19.7)	OR: 0.71, CI: 0.35–1.45	0.353
		150–249	75 (14.0)	OR: 0.88, CI: 0.42–1.87	0.745
		350–449	48 (9.0)	OR: 1.10, CI: 0.46–2.62	0.825
		500–699	57 (10.7)	OR: 3.03, CI: 1.23–7.45	0.016
		700–999	37 (6.9)	OR: 2.32, CI: 0.85–6.34	0.102
		1000+	96 (18.0)	OR: 1.33, CI: 0.60–2.94	0.479

* Reference category is average flock size for UK flocks (250–349). Only variables with significant effects ($p < 0.050$) are reported. OR: odds ratio, CI: 95% confidence interval. NB: Model included flock size, breed type, number of helpers at lambing, number of orphans, respondent age and respondent experience. Odds ratios are given in relation to the reference category indicated and significant results are in bold.

4. Discussion

The current study provides an update on farm techniques used to deal with fostering orphan lambs in the UK. As well as providing data supporting current practices, it also outlines what they consider best practice. Through the uptake of the survey and the level of detail given in the answers, it is clear this is an area in which respondents were very passionate, as they spent a lot of time answering. We received responses from a range of farm sizes, with the majority being lowland producers, which is representative of the UK stratified sheep industry. In the UK, there are three tiers to the industry; Hill, Upland and Lowland, the latter being more common in England, where we received the most responses. There was a spread of demographics with more female respondents (65.4%) than male, with most respondents having 5 or more years of experience. The most common flock size was 51–149 (19.3%), with the next highest being 1000+ ewes (18%).

The most common cause of orphaned lambs was a high number of triplets/quads. The second most common was fostering them onto a ewe with a single lamb. Therefore, litter size appears to be a driving factor in the number of orphans on UK farms. Consequently, it

is possible that optimising litter size, with genetic selection to two lambs per ewe [26], could reduce labour, financial costs, fostering need and unnecessary deaths due to large litter sizes. This may also positively impact the risk factor for other diseases, such as mastitis, which increases with litter size [27].

Only 6.3% of respondents said they did not attempt adoption, highlighting how common fostering is. Due to the high use of fostering methods, this emphasises that understanding their success rates and impact on the farm staff, ewes, lambs and the environment is important. Nearly 60% of respondents mentioned tethering as part of their adoption strategy in the present study. This could be stressful and impact the welfare of the ewe and lambs as it depends on where the adoption pen is situated and where the ewes are tethered. For example, social isolation is stressful to ewes [28] in comparison to those in pens with familiar conspecifics and groups [25]. This would also possibly imply that isolation is stressful for lambs too, although this needs to be researched further to properly understand this. Similarly, sheep which were subjected to 6 h of restraint and isolation showed a high stress response as demonstrated by high serum cortisol [29]. As the process of adoption using tethering takes longer than 6 h, it is, therefore, suggested that ewes should be separated from flocks in at least pairs [28]. The process of also being tethered and unable to move as they wish may also affect their emotional state, as evidenced by others who saw a difference in sheep after exposure to restraint and isolation, with these affecting their judgement bias and risk-taking threshold, suggesting a negative impact on their emotional state [29]. Stressed ewes could also be expressing more cortisol into their milk, affecting their lambs; others have seen that not only did rats with increased cortisol display 'depressive like' behaviour and spent less time nursing, but their offspring exhibited anxiety-like behaviour in adulthood [30]. This suggests that lamb health and welfare could possibly be affected by the ewe's response to post-natal stress. The current study also found that as flock size increased, so too did the responses of using tethering methods, as did the number of orphans; however, the lamb survival rate went down. This may suggest that tethered fostering techniques may be one of the factors associated with decreased lamb survival. This may be linked to stress or other factors affecting their survival in various ways, such as those already discussed. Further investigation around this is needed. What should also be noted is that in the current study, there was an error in the original survey categories with the category jumping from 350–449 to 500–699. This was only noticed during the analysis phase. The participants may have either picked the category closest if they had a flock in the missing 50 or read it as 350–499. However, the authors do not believe this will have affected the results.

Another interesting finding was the fact that although respondents stated that they thought non-tethered methods were the best, this did not match what was actually reported to be used, with tethered methods being the most common. This difference could be due to the time and depend on the situation of using wet methods, having to be there at the right time to be able to use the birthing fluid and have a lamb at the correct age to foster, for example. It also requires more technique and time from the individual carrying this out, as lambing can be very time-demanding and one may not have the time to dedicate to wet methods or the skill. These trade-offs may allude to why although non-tethered methods are seen as best, they are not always carried out.

Good hygiene during lambing is important for decreasing the chances of infectious diseases [31–33]. When considering tethering and an animal being confined to a certain location for several days while acceptance of both mother and lambs takes place, faecal matter, bodily fluids, etc., are building up. As most of the respondents suggested that they clean out after use, this build-up of bacteria could be a risk factor for disease development and could also impact welfare with suboptimal bedding being wet and uncomfortable.

Wet adoption, with a focus on the volume of fluids used, was also the most common top tip given by respondents and wet adoption with or without tying the lambs' legs had a significant correlation with adoption success. Adoption using foetal fluids has been found to increase fostering success [16]. However, wet adoption has been linked with increased

perinatal mortality [2,34] so high cleanliness levels are vital. Skinning was stated as a single adoption method by 10–11% of respondents in previous studies [6,15]. Conversely, in the current study, skinning was only mentioned as a single method for 3.5% of respondents; however, 57.6% of respondents mentioned it within a number of methods used on their farm. Skinning is a highly skilled method and as such these skills have to be passed on to new entrants to the profession. Future studies should aim to look at training opportunities for farm staff and helpers at lambing. Skinning was a highly selected method; however, it was not seen as the best method available, which could suggest that it is not always suitable or practical. For wet adoption, as mentioned, the farmer needs to be present during lambing and have an appropriately aged orphan for fostering. Therefore, it may be less well suited to hill farms or flocks with reduced monitoring. Speed and patience were frequently mentioned in the top tips, emphasising the time-critical nature of fostering and wet adoption. Another explanation for the discrepancy between the methods used and those considered 'best' practice could be due to farmers sticking to historical practice or answering what they think the researchers would like to hear.

We found no association between breed type and number of methods used as they did in Ward et al. (2011) [15]. Also, in contrast to Ward et al. (2011) [15], we did find a relationship between flock size and choice of method, with those with larger flocks being more likely to mention tethering. This may be due to the time aspect of adopting and if you have a larger flock with all lambing at the same time, time may be a scarce resource.

Where respondents tried to disguise the scent of the lamb, a slight majority (24.3%) used birth fluids or the scent of the ewe. There was a surprising mix of artificial odorants used to disguise the scent of the lamb. These included human cosmetic products (19.7%) with deodorant (many with a musk element) and perfumes being mentioned frequently. The next most common product used was iodine (17.1%) with other options including salt water, human non-cosmetics, adoption spray, ewe milk, skins or other products. Some of the products used seem to be to encourage the ewe to lick the lamb, such as using salt water and sprinkling feed onto the lamb. The majority of odorants seem to aim to overwhelm the ewe with an alien scent. Some suggested odorants have the potential to be aversive, such as Vicks VapoRub; however, there needs to be an investigation into this to see if it does impact the ewe and/or lambs and if they have any preference or aversions to the scents used. Where a method of disguising the scent was used exclusively, 58% used birth fluids (with or without tying lambs' legs) and 3% used some other odorant. These results are similar to Ward et al. (2011) [15], who found that 62% of farmers use birth fluid when asked if they were going to use a single method [15]. It has also been reported that trying to adopt lambs without some form of odorant/disguise of smell can be highly unsuccessful [17], again emphasising the need for more understanding as to what odorants are best.

Results demonstrated that 75.9% of respondents believed growth rates between adopted lambs and those reared by their biological dams were the same or better. Similar research showed that despite an initial difference in weights between natal and adopted lambs at 7 days old, there was no significant difference in weights recorded at 30, 90 and 180 days [35]. Growth rates are also reported to be similar between adopted and non-adopted groups [16]. This suggests that when done correctly, adoption can be a successful technique to rear orphaned lambs, without output compromise. Conversely, 24.0% of respondents believed the growth rates of adopted lambs to be worse than that of natal lambs. This could be due to multiple external factors including lower colostrum consumption and initial lower consumption of milk before the ewe has accepted the orphan.

5. Conclusions

Management of orphan lambs is an important area of sheep farming in the UK, with multiple factors affecting success rates and lamb mortality. Methods selected to foster lambs and success vary with flock size and experience levels but are also dependent on farmer selection to best suit individual circumstances. Wet adoption and skinning of dead lambs proved to be the most popular methods utilised. However, although untethered methods

were reported to be the best, they were not as commonly carried out in practice as tethered methods. What is not known is the short- and long-term impacts of these different methods on the health and welfare of the ewes and lambs, particularly the tethered methods. There also seems to be a dearth of research on post-natal stress impacts on ewes and lambs. Therefore, research into the short- and long-term impacts of the different methods on people, animals and the environment as well as the barriers and opportunities of these methods being used on farms has the potential to improve the health and welfare of farmed sheep and the efficiency and sustainability of these farms.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ruminants3040038/s1, File S1: Lamb Adoption—How Do "Ewe" Do It?

Author Contributions: Conceptualisation, L.W., M.R. and N.B.; methodology, L.W., N.B. and M.R; formal analysis, B.D.C. and L.W.; investigation, L.W., N.B. and M.R.; data curation, M.R. and B.D.C.; writing—original draft preparation, B.D.C., L.W. and N.B.; writing—review and editing, B.D.C., M.R., L.W. and N.B.; visualisation, B.D.C. and L.W.; supervision, L.W. and N.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Social Sciences Research Ethical Review Board (SSRERB) at the Royal Veterinary College (URN: SR2022-0045); approval date: 22 March 2022.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Survey data are available on request.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. DEFRA. Structure of the Agricultural Industry in England and the UK at June 2022. Available online: https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june (accessed on 16 January 2023).
2. Binns, S.H.; Cox, I.J.; Rizvi, S.; Green, L.E. Risk factors for lamb mortality on UK sheep farms. *Prev. Vet. Med.* **2002**, *52*, 287–303. [CrossRef] [PubMed]
3. Dwyer, C.M.; Conington, J.; Corbiere, F.; Holmøy, I.H.; Muri, K.; Nowak, R.; Rooke, J.; Vipond, J.; Gautier, J.M. Invited review: Improving neonatal survival in small ruminants: Science into practice. *Animal* **2016**, *10*, 449–459. [CrossRef] [PubMed]
4. Green, L.E.; Morgan, K.L. Mortality in early born, housed lambs in south-west England. *Prev. Vet. Med.* **1993**, *17*, 251–261. [CrossRef]
5. Johnston, W.S.; Maclachlan, G.K.; Murray, I.S. A survey of sheep losses and their causes on commercial farms in the north of Scotland. *Vet. Rec.* **1980**, *106*, 238–240. [CrossRef]
6. Shiels, D.; Loughrey, J.; Dwyer, C.M.; Hanrahan, K.; Mee, J.F.; Keady, T.W.J. A Survey of Farm Management Practices Relating to the Risk Factors, Prevalence, and Causes of Lamb Mortality in Ireland. *Animals* **2021**, *12*, 30. [CrossRef] [PubMed]
7. Corner, R.A.; Mulvaney, F.J.; Morris, S.T.; West, D.M.; Morel, P.C.H.; Kenyon, P.R. A comparison of the reproductive performance of ewe lambs and mature ewes. *Small Rumin. Res.* **2013**, *114*, 126–133. [CrossRef]
8. Ridler, A.L.; Flay, K.J.; Kenyon, P.R.; Blair, H.T.; Corner-Thomas, R.A.; Pettigrew, E.J. Factors Associated with Mortality of Lambs Born to Ewe Hoggets. *Animals* **2022**, *12*, 319. [CrossRef]
9. Holmøy, I.H.; Waage, S.; Granquist, E.G.; L'Abée-Lund, T.M.; Ersdal, C.; Hektoen, L.; Sørby, R. Early neonatal lamb mortality: Postmortem findings. *Animal* **2017**, *11*, 295–305. [CrossRef]
10. McHugh, N.; Pabiou, T.; McDermott, K.; Wall, E.; Berry, D.P. Impact of birth and rearing type, as well as inaccuracy of recording, on pre-weaning lamb phenotypic and genetic merit for live weight. *Transl. Anim. Sci.* **2017**, *1*, 137–145. [CrossRef]
11. Bohan, A.; Shalloo, L.; Creighton, P.; Earle, E.; Boland, T.M.; McHugh, N. Investigating the role of stocking rate and prolificacy potential on profitability of grass based sheep production systems. *Livest. Sci.* **2018**, *210*, 118–124. [CrossRef]
12. Kenyon, P.R.; Roca Fraga, F.J.; Blumer, S.; Thompson, A.N. Triplet lambs and their dams—A review of current knowledge and management systems. *N. Z. J. Agric. Res.* **2019**, *62*, 399–437. [CrossRef]
13. Gronqvist, G.; Hickson, R.; Kenyon, P.; Morris, S.; Stafford, K.; Corner-Thomas, R. Behaviour of twin- and triplet-born lambs and their dam 3 to 18 h after birth is not a useful predictor of lamb survival to weaning. *Anim. Biosci.* **2020**, *33*, 1848–1857. [CrossRef] [PubMed]

14. Rivero, M.J.; Lee, M.R.F. A perspective on animal welfare of grazing ruminants and its relationship with sustainability. *Anim. Prod. Sci.* **2022**, *62*, 1739–1748. [CrossRef]
15. Ward, S.J.; Liste, G.; Tinarwo, A. Attitudes of UK sheep farmers towards fostering methods: A national survey. *Small Rumin. Res.* **2011**, *99*, 87–92. [CrossRef]
16. Basiouni, G.F.; Gonyou, H.W. Use of Birth Fluids and Cervical Stimulation in Lamb Fostering. *J. Anim. Sci.* **1988**, *66*, 872–879. [CrossRef] [PubMed]
17. Alexander, G.; Stevens, D. Fostering in sheep. III. Facilitation by the use of odorants. *Appl. Anim. Behav. Sci.* **1985**, *14*, 345–354. [CrossRef]
18. Price, E.; Dally, M.; Erhard, H.; Gerzevske, M.; Kelly, M.; Moore, N.; Schultze, A.; Topper, C. Manipulating odor cues facilitates add-on fostering in sheep. *J. Anim. Sci.* **1998**, *76*, 961–964. [CrossRef] [PubMed]
19. Price, E.O.; Dally, M.R.; Hernandez, L. A note on the use of odor manipulation to facilitate the adoption of alien lambs by ewes bearing twins. *Appl. Anim. Behav. Sci.* **2003**, *81*, 127–131. [CrossRef]
20. Price, E.O.; Dunn, G.C.; Talbot, J.A.; Dally, M.R. Fostering Lambs by Odor Transfer: The Substitution Experiment. *J. Anim. Sci.* **1984**, *59*, 301–307. [CrossRef]
21. Rubianes, E. Will Corriedale ewes accept odor-transferred lambs? *Appl. Anim. Behav. Sci.* **1992**, *35*, 91–95. [CrossRef]
22. Alexander, G.; Bradley, L.R. Fostering in sheep. IV. Use of restraint. *Appl. Anim. Behav. Sci.* **1985**, *14*, 355–364. [CrossRef]
23. Otal, J.; Lévy, F.; Cornilleau, F.; Moussu, C.; Keller, M.; Poindron, P. Preventing physical interactions between parturient ewes and their neonate differentially impairs the development of maternal responsiveness and selectivity depending on maternal experience. *Appl. Anim. Behav. Sci.* **2009**, *120*, 140–149. [CrossRef]
24. Price, E.O.; Dunbar, M.; Dally, M.R. Behavior of ewes and lambs subjected to restraint fostering. *J. Anim. Sci.* **1984**, *58*, 1084–1089. [CrossRef]
25. Guesdon, V.; Meurisse, M.; Chesneau, D.; Picard, S.; Lévy, F.; Chaillou, E. Behavioral and endocrine evaluation of the stressfulness of single-pen housing compared to group-housing and social isolation conditions. *Physiol. Behav.* **2015**, *147*, 63–70. [CrossRef]
26. SanCristobal-Gaudy, M.; Bodin, L.; Elsen, J.-M.; Chevalet, C. Genetic components of litter size variability in sheep. *Genet. Sel. Evol.* **2001**, *33*, 249–271. [CrossRef]
27. Waage, S.; Vatn, S. Individual animal risk factors for clinical mastitis in meat sheep in Norway. *Prev. Vet. Med.* **2008**, *87*, 229–243. [CrossRef]
28. Carbajal, S.; Orihuela, A. Minimal Number of Conspecifics Needed to Minimize the Stress Response of Isolated Mature Ewes. *J. Appl. Anim. Welf. Sci.* **2001**, *4*, 249–255. [CrossRef]
29. Doyle, R.E.; Fisher, A.D.; Hinch, G.N.; Boissy, A.; Lee, C. Release from restraint generates a positive judgement bias in sheep. *Appl. Anim. Behav. Sci.* **2010**, *122*, 28–34. [CrossRef]
30. Brummelte, S.; Pawluski, J.L.; Galea, L.A. High post-partum levels of corticosterone given to dams influence postnatal hippocampal cell proliferation and behavior of offspring: A model of post-partum stress and possible depression. *Horm. Behav.* **2006**, *50*, 370–382. [CrossRef]
31. Scott, P.R. A Questionnaire Survey of Ovine Dystocia Management in the United Kingdom. *Anim. Welf.* **2003**, *12*, 119–122. [CrossRef]
32. Van Eetvelt, A. Pitfalls during Lambing in Modern Sheep. Ph.D. Thesis, Ghent University, Ghent, Belgium, 2020.
33. Whatford, L. Improved Understanding of the Transmission of Mastitis in Ewes and Strategies for Its Control. Ph.D. Thesis, University of Warwick, Coventry, UK, 2019.
34. Douglas, F.; Sargison, N.D. Husbandry procedures at the point of lambing with reference to perinatal lamb mortality. *Vet. Rec.* **2018**, *182*, 52. [CrossRef] [PubMed]
35. Ward, S. The Welfare and Production Implications of Fostering Methods in Sheep. Ph.D. Thesis, University of Northampton, Northampton, UK, 2013.