Study on shifting from transport of unweaned dairy calves over long distance to local rearing and fattening

Final report

Written by Wageningen Research
For the Directorate General For Health and Food Safety
March/2022

DG SANTE

EUROPEAN COMMISSION

Directorate-General for Health and Food Safety

Directorate G Crisis Management in Food, Animals and Plants

Unit G5 - Animal Welfare and Antimicrobial Resistance
Contact: Sandra Sanmartin

E-mail: Sandra.Sanmartin@ec.europa.eu

European Commission

B-1049 Brussels

This study has been coordinated by Ron Bergevoet and Francesca Marcato. Major contributions came from Kees van Reenen, Coen van Wagenberg, Giulio Cozzi, Isabella Lora, Dayane Texeiria, Maria Vilain Rörvang, Sonia Marti and Antonio Velarde.

LEGAL NOTICE

PDF ISBN: 978-92-76-50118-3 doi: 10.2875/072915 EW-01-22-217-EN-N

Manuscript completed in March/2022

Luxembourg: Publications Office of the European Union, 2022

Contents

1 Introduction

1.1 Reasons for this study

Animal welfare is a key component of sustainability in our food chain, and an integral part of the Farm to Fork Strategy (F2F). It is within this context that the Commission committed to revising animal welfare legislation, with the aim of ensuring a higher level of animal welfare in the European Union (EU), broadening the scope of EU animal welfare legislation, aligning it with the latest scientific evidence and current political priorities, as well as citizen's expectations, and making it easier to enforce.[1]

Unweaned calves belong to the group of vulnerable animals that are especially exposed to animal welfare and animal health risks during transport activities. Avoiding transport of these animals as much as possible, and with special attention to their circumstances during transport when transport is unavoidable, is therefore an important issue for the Commission, the European Parliament, the livestock sector, NGOs and the general public.

Welfare of unweaned calves during long-distance transport has gained substantial attention from animal welfare organisations as well as in politics and national and EU policy making. Journeys beyond eight hours ("long journeys") represent a higher risk to the welfare of animals than shorter journeys.[2]

The EU adopted Council Regulation (EC) No 1/2005 on the protection of animals during transport ('Transport Regulation') to protect animals' welfare during transport in context with economic activities in December 2004 and it came into force in January 2007.[3] Since its introduction, this regulation has continued to have a positive impact on the welfare of transported animals when correctly implemented and enforced. However, in some areas weaknesses still persist, largely due to insufficient implementation, unclear regulation and lack of enforcement in different Member States (MS), as well as a lack of detail on specific norms and thresholds, which makes enforcement difficult.[4] Under the Farm to Fork Strategy, the European Commission will revise the EU animal welfare legislation for farmed animals, including for their transport and slaughter. This is to align it with the latest scientific evidence, broaden its scope, make it easier to enforce and ultimately ensure a higher level of animal welfare. As a basis for this revision, amongst other actions, an evaluation ("Fitness Check") of the legislation and an impact assessment is being performed.[5]

There was a twofold reason for the study underlying this report: 1) a request from the European Parliament based on the 2020 *Inception impact assessment* [6], and 2) the coming Commission's revision of the Regulation (EC) No 1/2005, and both call for exploring alternatives for the long journeys of unweaned calves. This report presents the results of the analysis of the problems linked with the transport of unweaned non-replacements dairy calves over long journeys in the EU and explores existing initiatives and good practices that can be implemented to address such problems.

---

[1] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12950-Animal-welfare-revision-of-EU-legislation_en

[2] Simonin, D. & Gavinelli, A. In Animal Welfare: From Science to Law (ed. Hild, S. & Schweitzer, L.), Chapter 4. La Fondation Droit Animal, Éthique et Sciences, Paris, 2019, https://www.fondation-droit-animal.org/documents/AnimalWelfare2019.v1.pdf.

[3] Regulation 1/2005 applies to all livestock and transported within and from the EU, regulating rest periods, the training and authorisation of drivers, stocking densities and general transport conditions.

[4] European Parliament, Directorate-General for Parliamentary Research Services, Baltussen, W., Spoolder, H., Wagenberg, C., et al., Regulation (EC) No 1/2005 on the protection of animals during transport and related operations: European implementation assessment, Dinu, A.(editor), European Parliament, 2018, https://data.europa.eu/doi/10.2861/15227.

[5] https://ec.europa.eu/food/animals/animal-welfare/evaluations-and-impact-assessment/evaluation-eu-legislation-welfare-farmed-animals_en

[6] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12950-Animal-welfare-revision-of-EU-legislation_en

1.2 Objective of the study and study questions

The general objective of the study can be split in two:

- Establish a comprehensive state of play on the transport of unweaned calves on long (> 8 hours) journeys in the EU, which would help to assess the current system.
- Identify current practices at both EU and national level, including those aiming at replacing, reducing or refining transport of unweaned calves. Gather data and analyse costs and benefits of these practices and, based on the collected evidence, identify possible best practices.

To achieve these objectives 3 themes were identified:

1. State of play in the transport of unweaned non-replacement dairy calves over long journeys
2. Identification and analysis of existing alternatives
3. Assessment of alternatives and identification of best practices

Each theme is split into detailed topics. The combined assessment of these topics addresses the objective of the study. Each of these themes, their objective as well the approach to address topics related to these themes are described in the following sections.

Theme 1: The transport of unweaned non-replacement dairy calves on long journeys

Objective:

- To describe the key economic players involved in the long-journey (> 8 hours) cross-border transport of unweaned calves in the EU.
- To map and analyse the data related to the long duration (> 8 hours) transport of unweaned calves within the EU, and their market value.

Specific insights are gained by addressing the following topics:

1.1 The extent of the cross-border transport of unweaned calves and a description of the underlying economic model. This description includes economic and social data represented by this supply chain (turnover, generated benefits, employment, commercial value of the calves, etc.).

1.2 The number of unweaned calves transported on long cross-border journeys per year and the main routes used in the last five years. The percentage of unweaned calves transported on long cross-border journeys per year compared to the number of unweaned calves born per year.

1.3 The mortality rate of calves during long cross-border journeys and within the seven days after being transported, including culling due to poor growth or diseases after the transport.

1.4 The types and rate of non-compliance with requirements related to the long duration cross-border transport of calves (fitness for transport, means of transport, transport practices, feeding and watering intervals, space allowances, etc.) reported.

1.5 The measures taken by the economic players involved to ensure compliance with EU legislation on animal transport and a description of the monitoring tools used.

Theme 2: Identification and analysis of existing alternatives

Objective:

- To map and analyse the data related to different existing alternatives to the long-journey transport of calves, both at EU and national levels. These alternatives are characterised as production methods in which long duration journeys do not occur at all (replacement); as production methods with significantly less long-journey transport of calves (reduction); or as production methods in which the negative impacts of long-journey transport on the welfare of calves have been significantly mitigated (refinement).

Specific insights are gained addressing the following topics:

2.1 Mapping and presentation of the current practices at both EU and national level, including those aimed to replace, reduce or refine the transport of unweaned calves. For each of the alternative practices, the below points are addressed.

2.2 A description of the key economic players involved and how this economic model works: who is doing what and what are the key drivers and interests to maintain this type of supply chain (dairy farmers, feed industry, traders, slaughterhouses, retailers, consumers). This description includes economic and social data represented by this supply chain (turnover, benefit generated, employment, commercial value of the calves, etc).

2.3 The number of unweaned calves per year in the last five years, and the percentage this number represents compared to the number of non-replacement calves born per year.

2.4 Data on the mortality of calves during transport (of more than 8 hours) and within the seven days after being transported, including culling due to poor growth or diseases.

2.5 A description of how economic operators shifted from an economic model where calves are transported on long journeys to a model where animals are either kept on farm for fattening or transported for less than eight hours.

Theme 3: Alternatives and best practices

Objective:

- Taking the findings of the previous work packages as a basis, the study analyses the identified alternatives to the transport of unweaned non-replacement calves.

Specific insights are gained addressing the following topics:

- This work package should cover at least the three most promising and animal welfare-effective alternatives.
- Considering all the evidence collected and the cost-benefit analysis, best practices amongst these alternatives will be identified and described.

1.3 Outline of the report

This report comprises of seven chapters, including the preceding introduction:

- Chapter 2 describes the overall approach.
- Chapter 3 describes the main production methods involving unweaned non-replacement dairy calves in the various parts of the EU.
- Chapter 4 provides a detailed assessment of the transport of unweaned calves between MS.
- Chapter 5 identifies and analyses existing alternatives.
- Chapter 6 provides conclusions and recommendations.

The report is accompanied by 6 annexes:

- Annex 1 presents the e-survey sent to Contact points and EU stakeholders.
- Annex 2 lists the stakeholders interviewed.
- Annex 3 gives a detailed description of all transport of unweaned calves between MS.
- Annex 4 describes the transport of unweaned calves between MS in which the duration of the journey exceeds 8 hours.
- Annex 5 gives the mortality data after arrival on Dutch veal farms from different MS of origin.
- Annex 6 gives the underlying details of the calculation of the costs and benefits of using sexed semen.

2 Overall approach

2.1 Scope of the study

Unweaned non-replacement dairy calves

Since an increasing number of female dairy calves are not used for replacement, we include these female calves in the analyses and will use the term unweaned non-replacement dairy calves. In case we discuss topics on transport we will just speak of unweaned calves.

Geographical coverage and time period covered

The data collection and analysis covered the last five years (2015-2020). In terms of geographical scope, the study covers the different regions of the EU (North, West, East and South), including the United Kingdom.[7]

Scope and issues

The study focus is on alternatives and good practices shifting from transport of unweaned dairy calves over long distance to local rearing and fattening and on alternatives and good practices mitigating the negative effects of long-distance transport.

Both male and female unweaned non-replacement dairy calves are included in the study, because an increasing number of female dairy calves are not used for replacement. The destination of these female unweaned non-replacement dairy calves is similar to that of the male calves.

Within the scope of this study, it was not possible to disentangle the effect of transport from other risk factors related to mortality and poor growth, like mixing animals from multiple origins, different ages and colostrum management, actions taken to reduce impact (preventive antibiotics) etc. We therefore limit ourselves to reporting on the overall mortality and poor growth without an effort to disentangle the different risk factors.

Most unweaned non-replacement calves do not stay on their farm of birth to reach slaughter weight. Transport is needed to move these animals to fattening farms, being either beef farms or veal calves farms. EU legislation (Regulation (EC) No 1/ 2005) and recommendations[8] for improving the welfare of unweaned calves during transport are already in place, taking into account the duration of the journey.

A substantial number of unweaned calves in the EU are moved on long journeys (> 8 hours). Long journeys for unweaned calves can involve both transport within a MS and between MS. Transport between MS (i.e. inter-MS) is recorded in TRACES, whereas transport within MS (i.e. intra-MS) is recorded in national Identification and Registration (I&R) systems. However, the quality of these intra-MS transport data varies between MS. Therefore, for long journeys, the analysis in this study is limited to long-distance transport between MS. Long-distance transport within a MS and long-distance transport to third countries are not included in the analysis.

2.2 Data sources

The data collection was tailored to the needs of every specific study question and sub-questions. Data sources used in the study consisted of literature, statistical resources and database, and expert knowledge.

Review of literature

Literature has been reviewed to update the identification of techniques and practices relevant for each of the study questions and to identify a number of key publications.

[7] Data from the UK were included until the Brexit.
[8] See e.g. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/690874/IPOL_STU(2021)690874_EN.pdf

Review of statistical resources and databases

The databases explored were as follows:

- EU data bases: EUROSTAT, COMTRADE, TRACES, FADN. TRACES data were made available, following a request to DG SANTE.
- National databases: National databases were explored from a selected number of MS (relevant for this research). Because data are not publicly available, specific requests to access the data were submitted. The exploration of the national databases was restricted to the three countries that are the main destination for cross-border transport of unweaned calves.
  - For the Netherlands: data from CBS (national statistics), RVO (Farm data, I&R data, Paying Agency) and Agrimatie (extended FADN database), cattle registry, as well as NVWA (Dutch Food Safety and Consumer Product Authority).
  - For Italy: data from the Official National Cattle Registry (official source for number of farms, number of cattle, mortality rates, cattle origin and movements) and Public Veterinary Service of the Ministry of Health (in charge of the official controls on cattle health, welfare and transport).
  - For Spain: data from Official National Cattle Registry (official source for number of farms, number of cattle, mortality rates, cattle origin and movements) and Public Veterinary Service of the Ministry of Health (in charge of the official controls on cattle health, welfare and transport).

Expert knowledge

Experts consulted included business operators, representatives of sector organisations, NGOs and national and EU public policy makers.

2.3 Data collection activities

Development and implementation of an e-survey

An e-survey was developed and after approval by DG SANTE sent to the stakeholders. The following stakeholders were invited to complete the survey:

- Network of Competent Authorities (CA) contacts via National Contact Points in the EU MS and UK.
- EU representatives of farmers and industry feed industry, retail organisations, and NGOs.
- The survey design was completed, approved by DG SANTE, and sent to the National Contact Points and EU stakeholders on 15 November 2021. A total of 57 surveys were sent to the CONTACT POINT LIST as referred to in Article 24(2) of Council Regulation (EC) No 1/2005 on the protection of animals during transport. The survey sent is presented in Annex 1. 20 surveys were returned: 13 from National contact points and 7 from EU stakeholders.

Interviews

Interviews were conducted with national stakeholders in the Netherlands, Spain, Italy, Ireland, Sweden, and with Eurogroup for animals. Annex 2 gives an overview of the conducted interviews.

To avoid approaching stakeholders several times, data collection activities to answer the study questions were combined and coordinated as much as possible.

2.4 Methods of analysis

Evaluation of collected data

Primary source of data for the analysis were (inter)national databases and statistics. In case data gaps occurred, they were filled using data from other sources like industry data, expert opinion from our team and experts from stakeholders.

Missing data

In case of missing data, data were estimated by experts and stakeholders. The source of the data is recorded and reported (both in the report and complementary data file).

Validation of data

The validation of data on collected practices was done using triangulation of data, obtained from desk research, stakeholder consultation, and scientific and individual independent sector expert inputs. Both qualitative and quantitative methods were used in order to reach 'triangulation', and to cross-check information. Especially when information collection was based on qualitative data, efforts were made to collect information from multiple sources of information.

State of play of the transport of non-replacement dairy calves over long journeys

We provide a description of a typical value chain of calves on long journeys (> 8 hours) seen from the perspective of the three MS that receive the most calves (Netherlands, Spain and Italy) as well as other MS (Section 4.2).

Economic performance of the value chains and the individual actors

Economic performance was calculated for the value chain as a whole in the Netherlands. For the veal calves sector in the Netherlands, a detailed input-output table was available.[9] However, due to the high level of value chain integration, allocation of turnover or added value to the different components or actors in the value chain was not possible. Some data on economic performance of value chain actors was available in Eurostat. However, especially for the other value chain actors, data were not available on the level of the calf supply chain. Due to the lack of data for Italy and Spain, insight into economic performance of the value chains were based on stakeholder estimates.

The number of calves transported on long journeys per year and the main routes used in the last five years

These data were presented both in absolute numbers as well as the percentage this number represents compared to the number of non-replacement calves born per year. Insight into the number of unweaned calves born per year in each MS and the movement of animals that were transported from one MS to another MS was gained using data from EUROSTAT about the number of dairy cows and international trade data (COMEXT and TRACES).

- COMEXT: the number of calves (< 80 kg not intended for breeding) transported between EU MS and the UK in the period 2015-2020, but this does not include duration of the transport.
- TRACES: the number of animals transported between EU MS and the UK and the duration of the transport. The database distinguishes within cattle the following categories: animals for breeding, for slaughter, for fattening, for any other purpose. Unweaned calves most likely are in the category fattening. However, there is overlap with other animals (e.g. broutards, weaned fattening calves).
- To get an insight into the proportion of the number of unweaned dairy calves exposed to long-distance transport, both the COMEXT and TRACES data were used. To verify the outcome, results of the analysis

[9] Bergevoet, R. H. M., Daatselaar, C. H. G., van Horne, P. L. M., Hoste, R., Jongeneel, R. A., & Verhoog, A. D. (2021). Robuuste agroclusters: het belang van de primaire sectoren. (Rapport / Wageningen Economic Research; No. 2021-041). Wageningen Economic Research. https://doi.org/10.18174/545424

were compared with data received from other sources. For the Netherlands, detailed data were available about the country of origin of calves that entered the Netherlands. The results of the other MS were included in the e-survey to the MS CA for verification.

- EUROSTAT: The number of unweaned calves born per year was estimated based on the number of dairy cows multiplied by the number of calves born per dairy cow per year, minus the number of replacement calves. The number of dairy cows was retrieved from Eurostat (variable name TAG00014). Based on expert judgement, the number of calves born per year was set at one and the annual number of replacement calves at 30% of the number of dairy cows (this includes replacement calves to account for mortality of replacement calves). We assumed that 50% of the calves born were female and 50% male.

Data on the mortality of calves during long journeys and within the first seven days after being transported, including culling due to poor growth or diseases

Although bovine databases in different MS record mortality of animals in their system, analysing whether animals had been transported involving long journeys was not possible. Therefore, to get insight into mortality of calves during long journeys and within the first seven days after being transported, including culling due to poor growth or diseases, we gathered data from literature, a survey, and interviews with stakeholders.

Data on the type and rate of incompliances regarding the requirements related to the transport of calves during long journeys and a description of the measures taken by the economic players involved to ensure compliance with the EU legislation on animal transport, their monitoring tools and the results obtained (qualitatively and quantitatively)

To get insight into non-compliances with legal requirements for the transport of calves during long journeys (fitness, means of transport, transport practices, feeding and watering intervals, space allowances, etc.), secondary data analysis, a survey, and interviews were used. Descriptive data analysis was used to analyse the number and reasons of announced consignments with a long duration (> 8 hours) of cattle for fattening refused at origin and the number and reasons of such consignments rejected at destination retrieved from TRACES. These numbers were cross-checked with the CA in the e-survey. In this survey, the CA had the opportunity to add non-compliances with the transport legislation not recorded in TRACES. These data were complemented with the interviews with key stakeholders using a semi-structured interview template and incompliances mentioned in audit reports in the period 2015-2021 from the DG Health and Food Safety addressing transport of animals from the MS to non-EU countries. Additional audits targeting long journeys of unweaned calves within the EU are planned for 2022 and 2023.

Analysis of topics related to theme 2: Identification and analysis of existing alternatives

Based on the literature review, survey and stakeholder interviews, a number of alternative practices related to limiting the welfare problems because of the long-distance transport of unweaned dairy calves were identified. The main characteristics of each alternative are described.

Analysis of topics related to theme 3: alternatives (best practices)

A shortlist of possible alternatives that could be presented as best practices was discussed and approved by the steering committee of the project. For the shortlist of alternatives, costs and benefits for the different actors involved were described.

2.5 Limitations of the study

Improving animal welfare encompasses many dimensions including economic, social, health, environmental and financial issues. Therefore, the scope of our exploration is bounded and guided by the objectives introduced in the previous section. The limitations of this report stem from the limited number of consultations that were possible to conduct within the study period and the limited amount of publicly available information regarding the implementation of alternative practices. Discussions on the effectiveness of alternatives are kept to a general level.

This study gathered existing alternatives and best practices to reduce, replace or refine the long journeys of calves in the EU and present these in an easy-to-read and understandable way for the relevant stakeholders. The results and conclusions in this report should be interpreted considering the following limitations:

- The study did not aim to generate new research into potentially useful practices but instead focused on collecting practices used or applicable in commercial settings at the different stages of production and processing.
- Many data were difficult to obtain or only partially available. In these cases we used the information available to make estimations and explicitly present the underlying assumptions and calculation methods.
- Our study gathered alternatives and best practices currently used or applied in commercial settings at the different stages of production and processing. We tried to identify practices within the EU, but also in other countries (such as the UK and Switzerland). Using such an approach has the advantage that the presented alternatives and best practices are actually applicable in practice. However, this does not ensure that such alternatives are applicable in all MS or regions of the EU or for all types of supply chains that concern non-replacement dairy calves. For this, a more detailed analysis is needed at the regional and supply chain type level, which goes beyond the scope of our study. Because existing alternatives and best practices were limited, not-yet applied alternatives and practices were also included into this study, especially if these could potentially be a good solution for improving welfare of unweaned calves.
- Specific data about cross-border transport of unweaned calves in the EU were not available in publicly available databases because these animals do not have a separate code. Therefore, we had to combine data from TRACES with data from EUROSTAT to estimate the number of unweaned calves moved on long journey cross-border transport. TRACES provided the number of cattle for fattening moved in long journeys, but this also included other cattle for slaughter such as broutards and weaned fattening calves. EUROSTAT provided the number of calves weighing less than 80 kg and not intended for breeding transported between MS, but this includes all journey times. Verification of our estimations with data received from the Netherlands and through the e-survey indicated that our estimations were quite accurate. However, they remain estimations and the actual number of unweaned calves moved between MS might be different.
- In our study, we only included cross-border long journeys (> 8 hours) of unweaned calves between MS. However, transport of such animals with a duration of over eight hours could also occur within MS. Publicly and centrally available data on national long journeys of animals within each MS is lacking. This complicates identification of the total amount of long journeys of unweaned calves within the EU, including both cross-border as national transports. Data about long journeys within each MS would be helpful in identifying the full extent of long journeys within the EU. It should be further assessed whether alternatives and best practices for long journey cross-border transport are also effective and efficient for long journeys within a MS.
- Part of the data gathered and used in our study was retrieved from industry, since these data were not available in public databases. Where possible, we triangulated these data with data from the literature and non-industry expert knowledge (e.g. researchers). Nevertheless, some bias might remain in the data presented.

3 Economic performance of the value chains and the individual actors involved in the transport of unweaned non-replacement dairy calves on long journeys

This chapter describes the current state of play in the transport of unweaned calves over long journeys in the EU. It addresses the key economic players involved in these journeys, and maps and analyses the number of journeys, the animal welfare issues related to these journeys, and their market value. Each section starts with a short summary of the main findings.

3.1 Beef production in the EU

Summary: In 2020, France was the largest beef producer in the EU, followed by Germany and Italy. Germany had the largest production of beef from bulls and bullocks, followed by France, Poland, Italy, and Ireland. The Netherlands had the largest production of beef from calves (veal), followed by France and Italy. Spain had the highest production of beef from young cattle, followed by the Netherlands and Denmark.

In 2020, a total of 6.8 million tonnes of beef and veal was produced in the EU from 22.9 million heads of cattle slaughtered (Table 1 with the 5 largest producers per category in bold). The majority of this originated from cows and heifers (47%), both beef and dairy, and from bulls and bullocks (39%). Beef production from calves (veal) amounted to 610 000 tonnes, or 9% of total beef production, and production from young cattle to 346 000 tonnes, or 5% of total beef production. France was the largest beef producer in the EU with a production of 1.4 million tonnes from 4.5 million heads of cattle in 2020, followed by Germany and Italy. In most MS, the majority of the slaughtered heads of cattle were cows and heifers. Germany had the largest production of bulls and bullocks (1.3 million heads), followed by France and Poland (1.0 million each), and Italy and Ireland (0.9 million each). The largest part of these animals originated from calves born at dairy farms, as will be discussed in the remaining part of this chapter. Most calves were slaughtered in the Netherlands (1.4 million heads), France (1.2 million heads) and Italy (0.6 million heads). Together they produced 76% of the veal in the EU. Spain had the largest production of beef from young cattle (0.9 million heads).

Table 1. Beef production in the different EU MS in 2020 (in 1 000 tonnes and in 1 000 heads)

	Total		Cows and heifers		Bulls and bullocks		Calves		Young cattle	
Member State	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads
Austria	218.4	644.7	95.0	286.3	113.1	283.1	5.6	56.1	4.6	19.2
Belgium	254.6	782.7	132.2	340.4	70.5	147.4	**50.2**	**286.5**	1.7	8.4
Bulgaria	6.3	30.4	4.1	19.3	1.5	7.0	0.1	1.2	0.5	2.9
Croatia	43.3	169.7	14.1	48.2	25.2	75.5	3.5	43.2	0.5	2.8
Cyprus	4.7	15.3	1.5	6.1	2.2	4.7	0.0	0.2	0.9	4.3
Czechia	72.5	234.6	34.7	127.3	37.2	99.7	0.4	5.5	0.3	2.0
Denmark	121.5	448.1	67.1	223.0	22.4	76.7	0.0	1.0	**32.0**	**147.4**
Estonia	9.0	35.2	6.3	23.8	2.3	8.2	0.1	2.0	0.2	1.2
Finland	86.5	261.7	36.1	126.4	50.2	133.8	0.0	0.4	0.2	1.1
France	**1 434.6**	**4 486.5**	**821.4**	**2 235.7**	**421.2**	**989.9**	**173.4**	**1 185.5**	**18.6**	**75.5**
Germany	**1 090.0**	**3 263.0**	**527.0**	**1 665.0**	**516.0**	**1 271.0**	**47.0**	**312.0**	0.0	15.0
Greece	33.6	144.5	10.6	42.6	14.3	51.3	1.3	10.9	7.4	39.6
Hungary	28.0	105.6	21.7	78.0	5.6	21.3	0.3	3.0	0.5	3.4
Ireland	633.4	1 881.9	**310.7**	**981.1**	**320.0**	**872.0**	2.4	26.9	0.4	1.8
Italy	**732.3**	**2 694.4**	**345.5**	**1 174.6**	**306.7**	**873.6**	**73.5**	**601.1**	**6.7**	**45.1**
Latvia	14.6	67.1	10.3	40.6	3.4	14.3	0.5	9.1	0.5	3.1

	Total		Cows and heifers		Bulls and bullocks		Calves		Young cattle	
Member State	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads	1 000 tonnes	1 000 heads
Lithuania	41.8	149.7	24.3	88.1	17.1	54.9	0.3	5.8	0.1	0.9
Luxembourg	10.3	27.7	5.5	15.5	4.6	10.9	0.1	0.4	0.2	0.9
Malta	1.2	4.1	0.5	2.1	0.6	1.9	0.0	0.0	0.0	0.1
Netherlands	**432.9**	**2 088.6**	153.6	473.3	26.6	56.5	**221.8**	**1 406.7**	**31.0**	**152.0**
Poland	559.4	1 851.2	**228.7**	**828.1**	**328.0**	**975.8**	2.1	43.1	0.6	4.3
Portugal	97.8	393.4	34.3	131.4	38.8	119.6	7.0	47.2	**17.7**	**95.1**
Romania	32.3	131.9	16.3	63.4	6.6	22.5	0.9	8.1	8.6	37.9
Slovakia	5.1	15.7	2.3	8.9	2.8	6.7	0.0	0.1	0.0	0.0
Slovenia	36.6	118.2	11.7	40.3	23.0	62.0	1.4	12.9	0.5	2.9
Spain	**677.8**	**2 422.4**	212.1	763.5	236.4	718.4	18.3	90.1	**211.1**	**850.5**
Sweden	141.0	434.5	65.1	206.2	73.7	214.7	0.4	2.8	1.8	10.7
TOTAL	**6 819**	**22 902**	**3 192**	**10 039**	**2 670**	**7 173**	**610**	**4 161**	**346**	**1 528**

*Per category top 5 countries are in bold. Source https://agridata.ec.europa.eu/extensions/DashboardBeef/BeefProduction.html

3.2 Production of unweaned non-replacement dairy calves

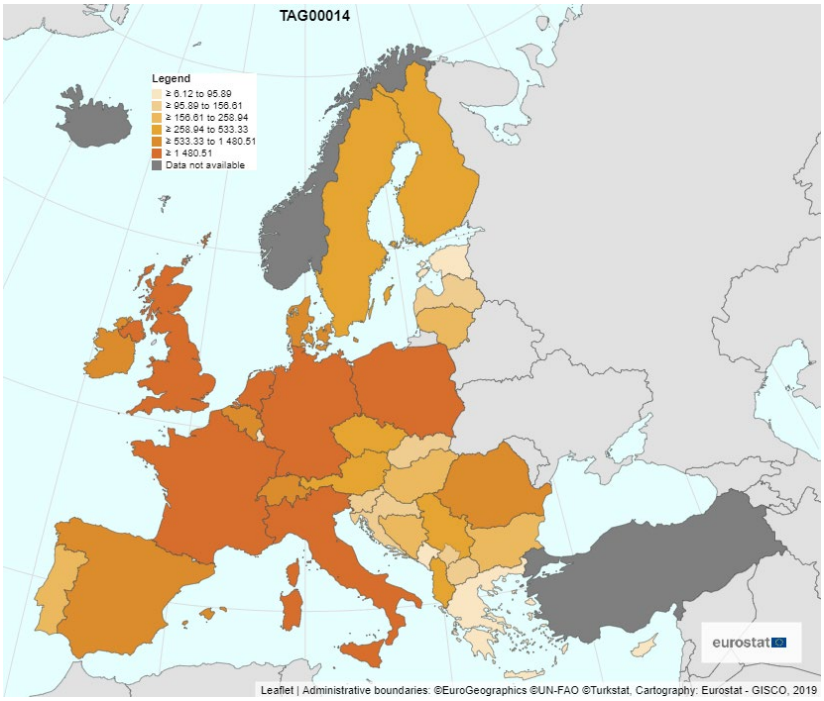
Summary: *in 2020, the EU 27 MS and the UK together had 22.6 million dairy cows. The MS with the most dairy cows were Germany (4.0 million dairy cows), France (3.5 million dairy cows), Poland (2.2 million dairy cows), Italy (1.9 million dairy cows), the United Kingdom (1.9 million dairy cows), the Netherlands (1.6 million dairy cows), Ireland (1.4 million dairy cows), and Romania (1.1 million dairy cows). About 30% of the calves, born from dairy cows, are used to replace dairy cows. The remaining 70% are non-replacement dairy calves – male and female – for which dairy farmers have to find an alternative solution, such as fattening them on their own farm or selling them for beef or veal production for fattening. If fattening options are not available in the MS, animals (mostly unweaned dairy calves) have to be transported to other MS.*

Dairy calf production system

The EU has a large dairy cow population, with dairy cows present in all MS (Figure 1). In the last decade, the number of dairy cows decreased while milk production per cow gradually increased. In 2010, the EU had 23.4 million dairy cows compared to around 21.1 million in 2019. In 2020, the EU 27 MS and the UK together had 22.6 million dairy cows, slightly higher than in 2019. In 2019, the MS with the most dairy cows were Germany (4.0 million dairy cows), France (3.5 million dairy cows), Poland (2.2 million dairy cows), Italy (1.9 million dairy cows), the United Kingdom (1.9 million dairy cows), the Netherlands (1.6 million dairy cows), Ireland (1.4 million dairy cows), and Romania (1.1 million dairy cows).[10]

[10] https://ec.europa.eu/eurostat/databrowser/view/ef_lsk_bovine/default/table?lang=en

Figure 1. Dairy cow population in the EU per December 2019 in thousand heads (source: Eurostat)



Calving is needed for a cow to produce milk. About 50% of the calves born are female. Given a replacement rate of approximately 30% per year, about two thirds of the female calves are raised on the dairy farm for the replacement of culled dairy cows (Figure 2). A very small fraction of the male calves are raised on the farm for the replacement of breeding bulls (max 1 or 2 per farm). For the 70% of non-replacement dairy calves – male and female – dairy farmers have to find an alternative solution, such as fattening them on their own farm, selling them for beef or veal production to traders or meat calve farmers for fattening.

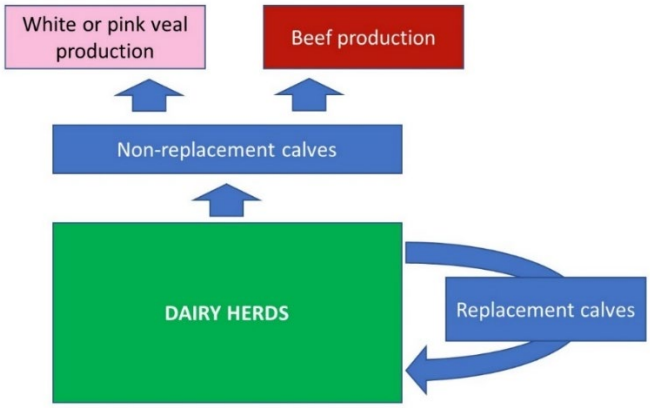
The contribution of the dairy herd to the total beef output of many countries can be substantial, often surpassing the contribution of the respective national beef herd. Interest in beef-on-dairy production is intensifying.[11] At the moment of insemination, a dairy farmer has to consider which cows are to be inseminated with semen from dairy type bulls to provide replacement dairy heifers. Other cows can be inseminated with semen from beef-type bulls (e.g. Belgian Blue, Limousin, Piemontese, Aberdeen Angus), to improve the genetic predisposition of calves for meat production. These crossbred calves are able to yield higher income for the dairy farmer, because prices of non-replacement crossbred calves are higher than those of dairy calves sold for beef production. The prices of crossbred calves are a little lower than those of typical beef animals. For example, in the Netherlands in 2019, up to 25% of the cows per dairy herd were inseminated with semen from beef-type bulls (more than 90% of the semen used of beef type bull has Belgian Blue origin).[12] In Nordic countries in 2018, 41% of the beef × dairy calves had a Belgian Blue sire, and an additional 28% had a Blonde d'Aquitaine sire; in Denmark in the same year, 80% of the beef × dairy calves had a Belgian Blue sire.[11] Whereas in most MS these cross-bred animals are used for beef production, in the Netherlands these cross-bred animals are used, to a large extent, for pink veal production.

Dual purpose breeds (e.g. Fleckvieh /Simmental, MRIJ, Dexter, Shorthorns) are also used for dairy production. Dual purpose breeds implicitly combine the qualities for both dairy and beef production. Their non-replacement calves have the genetic predisposition of calves for meat production. Most non-replacement dairy

[11] D.P. Berry, Invited review: Beef-on-dairy—The generation of crossbred beef × dairy cattle, Journal of Dairy Science, Volume 104, Issue 4, 2021, Pages 3789-3819, ISSN 0022-0302, https://doi.org/10.3168/jds.2020-19519.
[12] Buiting, J. 2019. Jaarstatistieken 2019. Cooperatieve Rundveeverbetering, Arnhem.

calves of dual-purpose breeds are used for beef production. The exception is the Netherlands, where these calves are mostly reared for veal meat in intensive (housed) veal production systems.

Figure 2. General flow of calves from dairy herds to intensive veal and beef production systems.



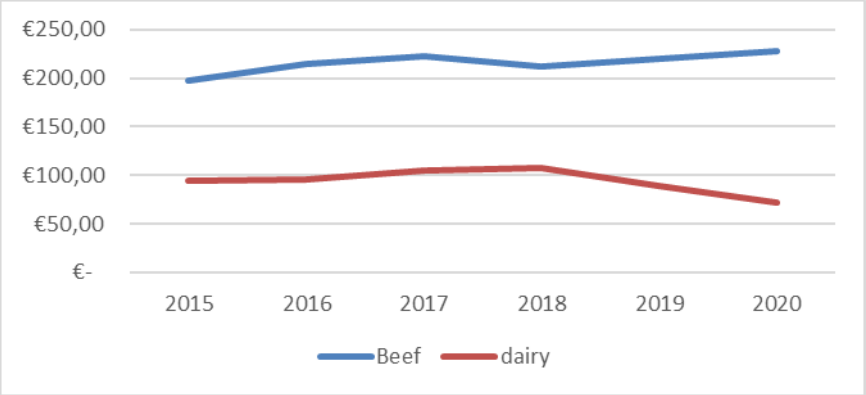
3.3 Market prices of unweaned calves, beef and veal calf meat

Summary: Farm-gate prices of unweaned calves of crossbred beef types are more than twice those of dairy types. Veal meat prices differ between MS, depending on the market outlet, and fluctuate throughout the year. The price of beef from young bulls differs between MS and showed a gradual 10% decline from 2018 to 2020.

Farm-gate prices of unweaned calves

Figure 3 shows that the average EU farm-gate prices of unweaned calves of crossbred beef types (around €220 per head) were more than twice that of unweaned calves of dairy types (around €100 per head), reflecting the lower value of unweaned calves of dairy types for the veal and beef fattening sector. This difference was fairly stable between 2015 and 2020.

Figure 3. Average annual farm-gate prices of unweaned calves of dairy and beef calves in the EU (€ per animal) (source: DG AGRI Dashboard)[13]



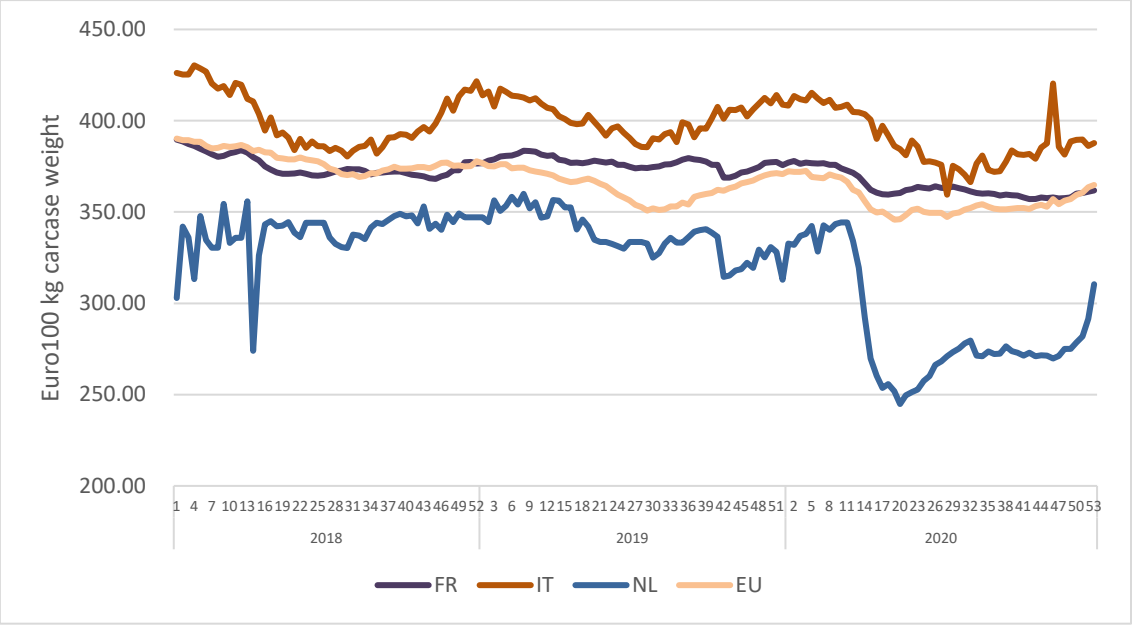
Farm-gate prices of veal calves

Figure 4 shows the EU average price of veal meat in the period 2018-2020 and the price in the three main veal meat producing MS in the EU: the Netherlands, France and Italy. A possible explanation for the low price in the Netherlands is that the data for the Netherlands only includes prices for the veal producers that don't have a contract with an integration to produce for a fixed fee per animal and exclude prices for farmers within an integration (around 80% of the farmers). In 2020, due to the Covid pandemic, travel restrictions and the

[13] https://agridata.ec.europa.eu/extensions/DashboardBeef/Dashboard.html

lockdowns including the closing of restaurants caused a serious drop in out-of-home consumption of veal meat, which is the main destination of Dutch veal calf meat. As a consequence, Dutch veal calf prices dropped substantially (Figure 4)

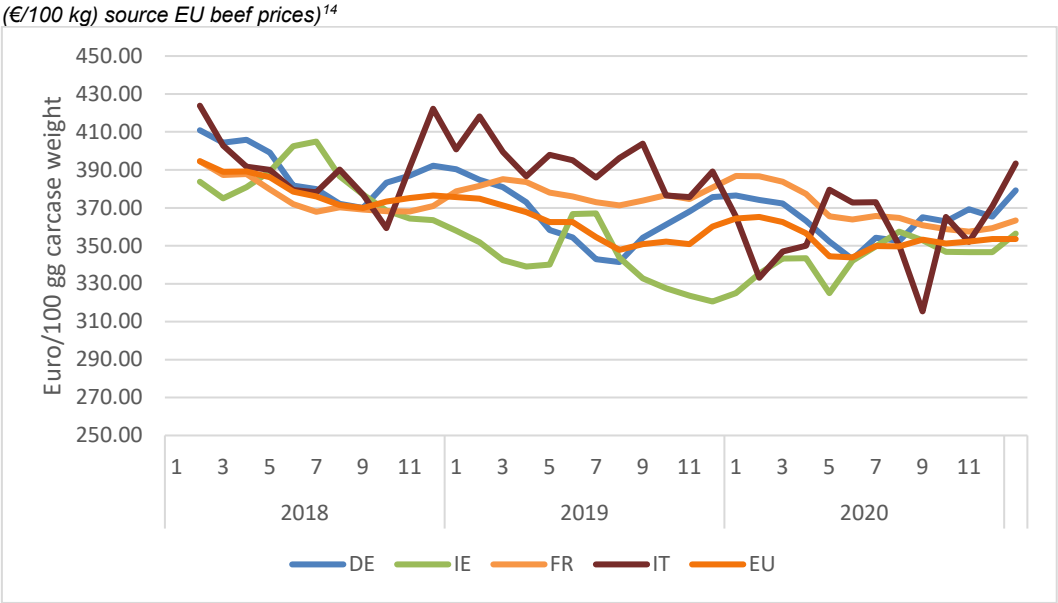
Figure 4. Farm-gate prices of veal in 2020 in the EU and the main producing EU countries in the period 2018-2020 (€/100 kg) (source: EU beef prices)



Farm-gate price of young bulls

Figure 5 shows the EU average price of meat of young bulls in 2020 and in the four main producing MS in the EU: France, Germany, Italy and Ireland. In the 2018-2020 period, prices showed a gradual decline. The beef price in Italy showed a larger variation within the year compared to the other countries and the EU average. The prices in France and Germany were mostly higher than the EU average, whereas the price in Ireland was mostly below the EU average. Prices in Spain and Italy fluctuated around the EU average.

Figure 5. Farm-gate price of meat of young bulls in the period 2018-2020 in the EU and the main producing EU countries (€/100 kg) source EU beef prices)[14]



3.4 Economic actors in the veal calf and beef calf value chains

Summary: Economic actors in the veal and beef chain in the EU include dairy farmers, cattle traders, (inter)national transporters, assembly centres, beef and veal calf farms, feed producers, slaughterhouses, (inter)national meat traders and retailers and restaurants. In number of MS, like Spain, Italy, France, and the Netherlands, beef and veal production is highly integrated in dedicated value chains.

As described in the previous section, most non-replacement dairy calves enter beef or veal calf value chain. The following individual actors can be distinguished in these value chains:

1. Dairy farmers
2. Local cattle traders

3. Transporters (local and international)
4. Assembly centres
5. Beef and veal calf farms
6. Feed producers
7. Slaughterhouses

Integrator

8. International traders of beef and veal meat (carcasses)
9. Retailers and restaurants

Dairy farmers either fatten non-replacement dairy calves themselves or sell them as unweaned calves. Most unweaned calves are sold. Local traders gather these calves and sell them on to other traders or directly to beef or veal calf farms. Transporters move the unweaned calves between locations, often commissioned by a trader. Sometimes, especially when international transport is involved, calves are moved from the dairy farm to an assembly centre or a livestock market, after which they are transported further to their next destination, a beef or veal calf farm. After the calf has reached the slaughter weight, it is transported to the slaughterhouse. The meat is processed and sold to consumers through retail stores and restaurants.

In a number of MS, like Spain, Italy, France and the Netherlands, beef and veal production is highly integrated in dedicated value chains. In case of such integrated production, activities performed by several consecutive

[14] https://ec.europa.eu/info/food-farming-fisheries/farming/facts-and-figures/markets/overviews/market-observatories/meat/eu-historical-series_en

actors are integrated into one company (for example the actors identified in the box). In such integrated companies, or integrations, the people performing the activities are employees of the integration or work on contracts, for example contract farming. The most common integrations combine between four to eight of the above-mentioned actors.

3.5 Beef and veal calf production systems in the EU

Summary: Beef calves are raised on a diet of solid food, forage and concentrates, after an initial period with milk or milk replacers. Systems differ widely between regions according to the local market outlet.

- *Beef calves are produced across the EU.*
- *Veal calves are mostly raised on a diet consisting of milk replacer, concentrates and some roughage throughout their lives. Veal calves are only produced in a limited number of regions.*

Beef calf production systems

Many calves from dairy cows destined for both replacement and beef production are separated from their mothers almost immediately (within hours) after birth and artificially reared first on colostrum then by milk or milk replacer, plus solid food for a six-to-nine-week period. After being weaned off milk or milk replacer, they depend, as functional ruminants, on a diet of solid food (i.e. forage, such as hay, straw, grass, silage) or forage plus concentrates. This early rearing stage takes place on the farm of origin or in specialist calf rearing units, and these animals subsequently enter beef fattening systems. The fattening system and slaughter weight depend on the region, tradition, type of diet available and market outlet.[15] In most MS, the Netherlands being an exception, a large proportion of non-replacement dairy calves enter such beef production systems. This especially holds true for Holstein and Belgian Blue or Simmental crossbreeds and animals descending from dual-purpose breeds.

In 2020, 7.2 million bulls and bullocks were slaughtered, of which 1.3 million were in Germany, 1.0 million in both France and Poland, and 0.9 million in both Italy and Ireland (Table 1). 1.5 million heads of young cattle were also slaughtered, of which 0.9 million were in Spain, and 0.2 million in both the Netherlands and Denmark. Average carcass weight of bulls and bullocks slaughtered in the EU was 350 kg/carcass. However, large variation existed between MS. For example, in Bulgaria slaughter weight was 215 kg/carcass compared to 478 kg/carcass in Belgium.[16]

Veal calf production systems

Veal calf production is a traditional form of production with a central position in the EU market industry. On a diet consisting of milk replacer and solid feeds (concentrates and some roughage), non-replacement dairy calves are fattened until an age of 25-27 weeks and a live weight of 225 kg for white veal; 30-32 weeks and a live weight of 300 kg for pink veal; or 40 weeks and a live weight of 360 kg for baby beef production. Approximately 68% of all veal calves produced in the EU are fattened until slaughter on a diet consisting of both solid and liquid feeds, while the remaining calves are fattened on a liquid diet. To obtain a light-coloured meat, preferred by consumers, white veal calves are reared under intensive conditions (housed on slatted floors without access to bedding) and are fed a diet low in iron content.[17,18] Due to welfare issues related to a liquid diet, the amount of solid feed in the diet of white veal calves has significantly increased in the last decade. This has resulted in the mitigation of welfare issues such as abnormal oral behaviour and the

[15] EFSA Panel on Animal Health and Welfare. 2012. Scientific Opinion on the Welfare of Cattle Kept for Beef Production and the Welfare in Intensive Calf Farming Systems. Vol. 10.
[16] Eurostat EU https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_production_-_livestock_and_meat#Meat_production
[17] Pardon B., Catry B., Dewulf J., Persoons D., Hostens M., De Bleecker K., Deprez P. Prospective study on quantitative and qualitative antimicrobial and anti-inflammatory drug use in white veal calves. J Antimicrob Chemother. 2012 Apr;67(4):1027-38. doi: 10.1093/jac/dkr570. Epub 2012 Jan 18. PMID: 22262796.
[18] Pardon, B., B. Catry, R. Boone, H. Theys, K. De Bleecker, J. Dewulf, and P. Deprez. 2014. Characteristics and challenges of the modern Belgian veal. Vlaams Diergeneeskd. Tijdschr. 83:155–163.

stimulation of normal rumen development.[19] As well as the shift in the colour of the meat from pale to pink, it has also resulted in an increase in the emissions of methane per animal.

In 2020, 4.2 million veal calves were fattened in the EU, of which 1.4 million were in the Netherlands, 1.2 million in France, and 0.6 million in Italy (Table 1).

There is a limited number of regions with veal calf production

The market value of non-replacement calves from specialised dairy breeds is subject to several critical success factors, such as the genetic predisposition of the calf for meat production (either based on breed choice or by crossing with beef breeds), the health of the calf, the availability of specialised nutrition, housing and care, the health risks associated with the transport of young animals, the bringing together of young calves from various farms and countries of origin, the logistical costs involved with the collection of calves from various dairy farms and with the distance between the place of birth, the place of fattening and place of slaughter, consumer demand/acceptability, and access to and proximity to wealthy markets. This complexity requires highly skilled producers and has resulted in several core areas with the highly specialised integration of veal farming in the EU: the Netherlands, the Flanders region in Belgium, the North Rhine-Westphalia and Lower Saxony regions in Germany, Brittany in France and the Po valley in northern Italy.[20]

3.6 Veal and beef production systems in the EU that depend on unweaned calves from other MS

Summary: The Dutch veal sector is highly integrated. A large proportion of unweaned calves are sourced from neighbouring MS and Ireland. The importance of long-distance transport has decreased substantially in the last decade, and the largest integrator plans to abolish this practice in the near future.
The structure of the Italian veal calf industry is similar to that in the Netherlands. The dependency on unweaned calves from other MS is limited to a small but significant number of calves and a specific time period (spring) due to the lack of availability of domestic calves.
In Spain, the beef production units that depend on unweaned calves of other MS are located in Catalonia (27.4% of the beef cattle) and Aragon (18.3%). Although most calves are of domestic origin, an increasing number of unweaned calves originate from other MS. The growth is mainly due to exports driven by significant demand in the Middle East.
Production systems that use substantial amounts of unweaned non-replacement dairy calves, create substantial economic value. The total production value of the veal calf sector in the Netherlands was €6.2 billion. In Italy, the total economic value of the 700 000 veal calves that are annually produced is approximately €600 million. Spain is slaughtering more than 2.5 million animals per year and producing more than 650 000 tonnes of young beef with an annual production value of €3 billion. A substantial amount originates from the regions of Catalonia and Aragon. In Spain, the annual economic value of the trade to other MS and third countries is around €1.128 million: 45% of this value is fresh meat and 35% is live animals.

In this section we describe the veal production systems in the main veal producing MS (the Netherlands and Italy) and the beef production system in a major beef producing MS (Spain).

Veal production systems in the Netherlands

Veal production in the Netherlands is organised in highly integrated value chains, with a key role for a small number of integrators connecting the different parts of the value chain (Figure 6). The main integrators in the Netherlands are the Van Drie Group, the Denkavit Group and the Pali Group. They are active in all parts of the

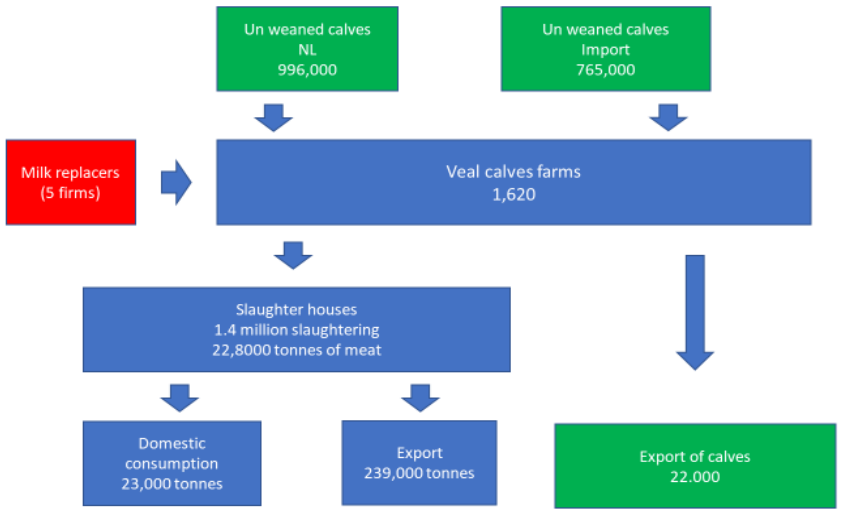
[19] L.E. Webb, et al., Effects of roughage source, amount, and particle size on behavior and gastrointestinal health of veal calves,
Journal of Dairy Science, Volume 96, Issue 12, 2013, Pages 7765-7776, ISSN 0022-0302,
https://doi.org/10.3168/jds.2012-6135., (https://www.sciencedirect.com/science/article/pii/S0022030213006553)
[20] https://fefac.eu/wp-content/uploads/2021/04/Vision_Paper_veal_Sector_final_Friday-15-04-2021.pdf

value chain. They do not limit their activities to the Netherlands and are increasingly active in other MS, such as France and Italy. The activities of these integrators include: veal production at farms using contract farming (in the Netherlands and France), trade and transport, veal feed (the Netherlands, France, Italy and Germany), dairy raw materials (the Netherlands, France and Italy), veal slaughterhouses (the Netherlands and France), cattle slaughterhouses (the Netherlands), veal skins, and information organisation for the promotion of veal.

In 2020, about 1.5 million veal calves were produced on 1 620 farms in the Netherlands.[21] This number of calves exceeded the number of non-replacement dairy calves born on Dutch dairy farms. Although almost all non-replacement calves born in the Netherlands were used in Dutch veal calf production, more than half of veal calves produced needed to come from other MS. Of the 765 000 calves entering in 2020, 77% originated from Germany, 6% came from Ireland, 5% from Denmark, and 6% from eastern EU MS (

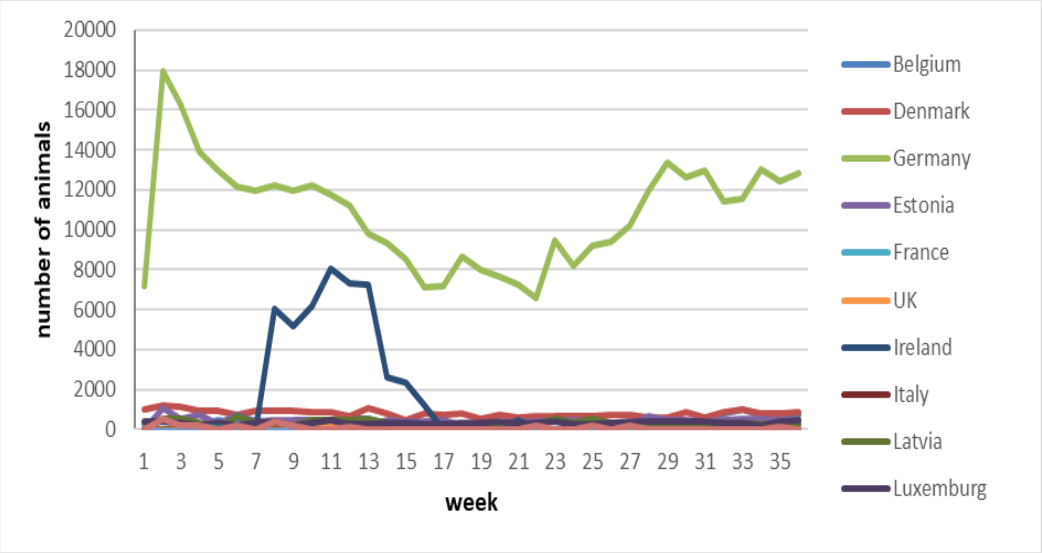
Figure 7). Transport from Ireland and eastern EU MS involved long-distance transport. While the share of non-replacement calves originating from these eastern EU MS was 36% in 2010, it has decreased over the last decade.[22] This reduction has been partly driven by welfare reasons (e.g. regulation limiting transport time), the prevention of animal health risks (e.g. introduction of contagious livestock diseases), and societal/political pressure. The VanDrie group, the largest veal calf integrator in the Netherlands, is planning to stop the sourcing of unweaned calves from Eastern European MS and Ireland by 2026.[23]

Figure 6. Value chain of the veal calves production in the Netherlands in 2020 (source: Wageningen Economic Research Agrimatie)[24]



[21] CBS stat line: https://opendata.cbs.nl/#/CBS/nl/
[22] RVO I&R Dierregistraties
[23] https://jaarverslag.vandriegroup.nl/FbContent.ashx/pub_1000/downloads/v210705141238/VanDrie_Group_MVO_verslag_2020.pdf
[24] https://www.wur.nl/nl/Onderzoek-Resultaten/Onderzoeksinstituten/Economic-Research/Over-ons/Data-modellen-en-tools/Agrimatie.htm

Figure 7. Number of unweaned calves entering the Netherlands from other MS in 2020 (source: data RVO)[25]



Economic performance of a veal farm

To gain insight into the economic performance of a typical Dutch veal farm, data from the publication Kwantitatieve Informatie Veheouderij 2020-2021 were used.[26] A typical Dutch veal farm produces 1.7 cycles per year. Calves enter the farm at an average weight of 44 kg at an age of 14 days when they originate from NL and DE. Calves that arrived after a long journey are typically a few days older.[27] Their live weight after a fattening period of 190 days at slaughter is 235 kg, with a carcass weight of 148 kg. Their average daily gain is 1 005 grammes. During this time, they consume 250 kg of fattening milk, 350 kg of milk replacer mix and 35 kg of straw per animal. The gross margin of a typical Dutch veal farm is €95 per place per year (Table 2).

Approximately 80% of the Dutch veal farms have a contract with one of the three integrators and work with contract fees.[28] The integration is the contracting party, the owner of the calf, and supplies the feed. The veal farmer provides housing and labour, and receives a fixed fee for taking care of the calves and for the costs of housing, energy, waste-water, water, administration, health etc. Such veal farmers with a contract have a reasonably stable income over the years, averaging approximately €40 000 per unpaid annual work unit. The contract duration is usually two to five rounds and there is no guarantee that contracts will be extended. In 2020, the average contract fees were €215 per fattening place.

Table 2. Gross margin calculation for a typical Dutch veal farm

	Total €/calf
Revenues	
Meat 166 kg * €4,50/kg	€666

[25]https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.rvo.nl%2Fonderwerpen%2Finternationaal-ondernemen%2Fhandel-planten-dieren-producten%2Fmarktinformatie%2Fstatistieken&data=04%7C01%7Cron.bergevoet%40wur.nl%7C4a4736d1c5954a54f34c08d9af57fe24%7C27d137e5761f4dc1af88d26430abb18f%7C0%7C0%7C637733615459317757%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=tH7aTHPb4TmMBzSTUm%2BJM4ZKfy0qr2XQUkVSa45%2FGX0%3D&reserved=0

[26] KWIN-Veehouderij 2020-2021, Wageningen, 398 pp. This annual publication contains price information about livestock farms and standards for making (balance) calculations, company evaluations and budgets.

[27] Santman-Berends, I. M. G. A., A. J. G. De Bont-Smolenaars, L. Roos, and J. Velthuis, A, G. 2018. "Using Routinely Collected Data to Evaluate Risk Factors for Mortality of Veal Calves." Preventive Veterinary Medicine 157(January):86–93

[28] Bergevoet, R. H. M., Daatselaar, C. H. G., van Horne, P. L. M., Hoste, R., Jongeneel, R. A., & Verhoog, A. D. (2021). Robust agro cluster (in Dutch) Robuuste agroclusters: het belang van de primaire sectoren. (Rapport / Wageningen Economic Research; No. 2021-041). Wageningen Economic Research. https://doi.org/10.18174/545424

Costs consisting of:	
Purchase costs unweaned calf	€127
Feed costs	€416
Mortality costs	€5
Feed margin per animal delivered:	**€118**
Other direct costs:	
Animal health	€10
Energy, water etc	€29
Gross margin per animal	**€79**
Gross margin per place (including manure cost of €40 per animal place per year)	**€95**

(source: Kwantitatieve Informatie Veehouderij 2020-2021)

Economic performance of the rest of the Dutch veal production chain

In 2019, total production value of the veal calf sector in the Netherlands was €6.2 billion. Veal calf farms accounted for €2.3 billion, or 38% of the total, and supply and processing jointly for €3.7 billion. In 2019, the added value realised in the veal calf complex amounted to €1.8 billion, of which the primary sector contributed €200 million, or 9% of the total. This is substantially lower than the share of the primary sector in the pig, dairy or poultry sectors (average 20%). The explanation for this difference is that more than 80% of veal calf farmers work with contract fees with an integrator and the margins made in the various links then benefit the owner of the integrator (particularly in processing and distribution) rather than the farmers. Approximately 22 400 full-time persons were employed in the sector, of which 3 600 were on veal calf farms.[29]

Most important stakeholders in the veal calves value chain

The various stakeholders in the veal calf sector are represented by Stichting Brancheorganisatie Kalversector which is officially approved by the Dutch government. It represents the interests of both farmers' organisations, the meat industry (COV), and the feed industry (Nevedi). It also organises the Vitaal Kalf quality system.

Strengths and weaknesses of the veal calf value chain

The value chain is considered to be competitive. However, its level of innovation is considered limited and it is under increased pressure from Dutch society due to welfare and environmental issues.[30]

Policy issues related to the Dutch veal value chain

Long journeys of unweaned calves are a major policy issue in the Netherlands. There are major concerns regarding the welfare of these animals during long journeys. The Dutch Ministry of Agriculture, Nature and Food quality holds the opinion that the Dutch veal industry should not be dependent on these calves and that long journeys should banned for unweaned animals.[31] It has therefore put pressure on the Dutch veal industry to sharply reduce, and eventually cease, all long journeys of unweaned calves.

[29] Source Wageningen Economic Research own calculations

[30] Bergevoet et al., 2021, Robuuste agroclusters: het belang van de primaire sectoren (in Dutch), WEcR https://doi.org/10.18174/545424

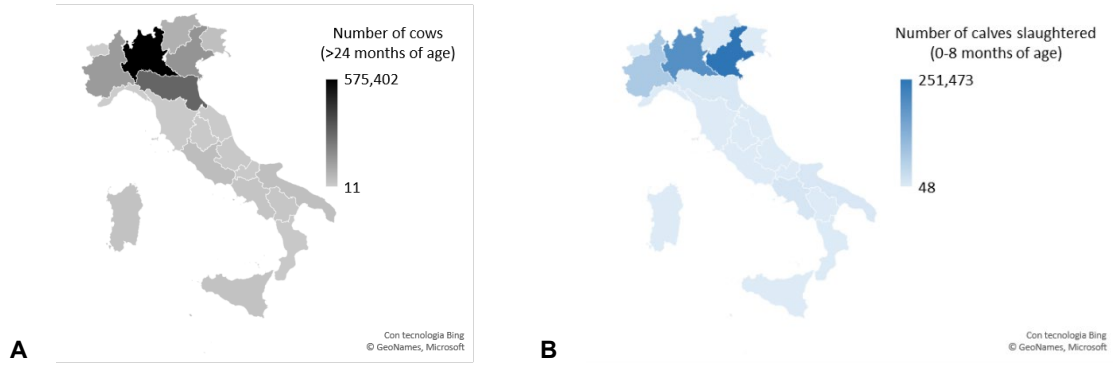
[31] https://www.europarl.europa.eu/cmsdata/230287/Questions-Answers_Dutch%20Ministery%20of%20Agriculture_NEW%20VERSION_EN.pdf

Veal production systems in Italy

According to the official national cattle registry, approximately 1.5 million cows were reared for dairy production in Italy in 2019. The main district for dairy production (a highly specialised sector), and therefore the main source of dairy calves, is the Po valley in northern Italy (Figure 8A). According to data from the National Breeders Association, in 2017 about 12.7% of the dairy cows were bred with beef semen, thus giving birth to calves – male and female – that are highly suitable for beef production. The remaining dairy cows were inseminated with semen from dairy breeds, with non-replacement dairy type calves entering the veal calf production chain. In Italy in 2019, 558 250 veal calves were slaughtered (approximately 10% of total EU production). Veal calves represent approximately 25% of the 2.5 million cattle slaughtered in Italy per year. The veal calf production system is intensive and highly integrated, similar to the system in the Netherlands. Calves (mainly Holstein males) are collected from dairy farms, sorted, and delivered to the veal fattening units that are located in the same geographical areas that are vacated for dairy production (Figure 8 B).

Housing and management practices of veal calves in Italy are similar to those in the Netherlands. Calves enter the fattening veal farms at 50 kg (Holstein) or 60 kg (crossbred) in weight and between 15 and 40 days of age. The veal calf feeding system is based on a liquid diet (milk replacer) and a quota of roughage. They are kept in individual pens ("baby-boxes") on a slatted floor until eight weeks of age[32] and before being housed in multiple pens of six to ten animals until the end of the fattening period. The average size of the Italian veal farm is 500 to 600 calves, but there is wide variability ranging from 100 to more than 2 000 calves per farm. The fattening cycle lasts 185-190 days with a final live weight at the slaughter between 275 and 300 kg.

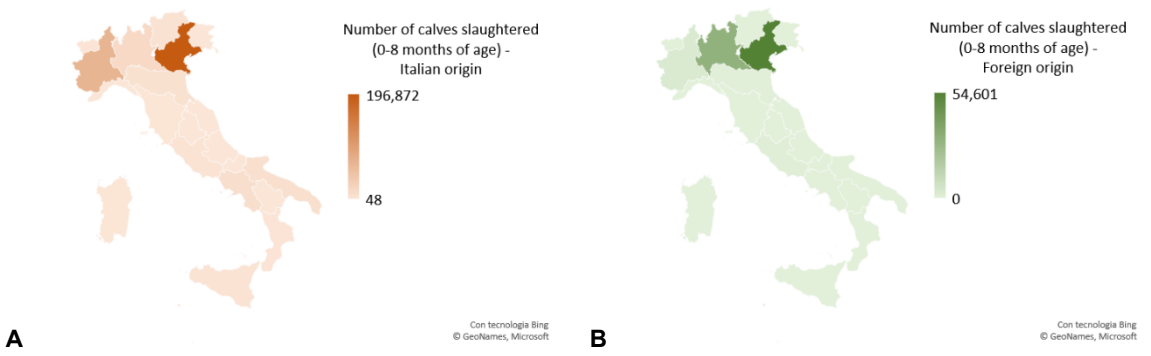
*Figure 8. Distribution of dairy cow population (cows over 24 months of age; **A**) and of calves slaughtered (from 0 to 8 months of age; **B**) in 2019 among Italian regions (source: official national cattle registry)*



The Italian veal sector has a rearing capacity of more than 600 000 calves per year. Because domestic supply is not sufficient, unweaned calves need to be imported. In 2019, 84% of the veal calf slaughtered in Italy were of national origin, while 16% originated from other MS (
Figure *9*). Slaughter usually takes place in the same region as the rearing. These unweaned calves are usually Holstein purebred, or Holstein and Belgian Blue or Simmental crossbreds The highest number of calves originating from other MS can be found in the veal fattening units of the Veneto region, which has a long tradition of receiving cattle for fattening from eastern European countries.

*Figure 9. Distribution of calves slaughtered (from 0 to 8 months of age) in 2019 among Italian regions depending on the native country: Italy (**A**) or other countries (**B**) (data from official national cattle registry)*

[32] COUNCIL DIRECTIVE 2008/119/EC, of 18 December 2008 laying down minimum standards for the protection of calves https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0119&from=EN



Most foreign unweaned calves originate from Lithuania (also crossbred calves), the Czech Republic, Ireland, the Netherlands, Germany, Austria (Simmental and crossbred calves) and France (Holstein and crossbred calves).[33] These foreign-sourced calves are needed only during a limited period of the year, running approximately from April-June, to compensate for the poor national supply over this period. Though limited, this share of unweaned calves is needed by the veal sector for three main reasons:

- To ensure veal meat when the demand is higher (December-January): national calf supply is insufficient 6 months before (May-June) because Italian dairy cows are less fertile (heat stress) during the late summer period (August-October).
- To control excessive fluctuations in the price of domestically-born unweaned calves, which would become too high during the critical period of April-June, despite the fact that foreign calves are more expensive than nationals (20% higher price for Holstein purebred calves).
- To avoid a cessation in veal farm activity for a certain period of the year due to the calf shortage.

For these reasons, there is consensus in the sector that it cannot totally exclude foreign calves (i.e. a proportion of long-distance transport) from their production chain over the year. The main concern of the veal calf sector is that the meat price has remained unchanged for several years while production costs have increased. Animal efficiency and farm and feed management cost savings have been already maximised and so there is no margin for paying more for the young calves entering the fattening units.

Economic performance of the rest of the Italian veal production chain

Official information regarding the veal sector in Italy (number of fattening units, herd size per unit, number of employees, calves' morbidity and mortality rates, domestic demand of veal meat, etc.) is not publicly available, which makes it difficult to have a clear view of sector economics. The total economic value of the 700 000 veal calves that are annually produced is approximately €600 million.[34]

Strengths and weaknesses of the veal calf value chain in Italy

Strengths

The veal calf sector benefits from synergies with the dairy sector through valorisation of "poor value" calves, and through the use of by-products of the dairy and cheese production chain. There is a robust national production chain in Italy. The fact that the chain (both dairy and veal farms, as well as slaughterhouses) is concentrated in northern Italy results in limited transport journeys. There is good demand for veal meat in Italy, with a self-sufficiency rate amounting to 50-60% of the veal meat production. Italian consumers often ask for an Italian born, bred, produced, and slaughtered product.

Weaknesses

According to interviews with the representatives of Italian veal calve producers, the robustness of the national Italian young calves entering the veal farms compared with those originating from other MS is poor (i.e. higher

[33] Source: interviews with Italian national stakeholders
[34] Estimate interviewees

susceptibility to diseases and higher mortality rates). According to these representatives, the main reason is poor colostrum management at the dairy farm. This results in a poor quality of calves entering the fattening units and leads to high levels of antimicrobial treatment to avoid excessive mortality rates. The slaughtering process is highly centralised with only a few actors, leading to limited competition in the meat price. The sector also depends on milk replacer supply companies from abroad.

Policy issues and societal pressure on the Italian veal value

The operators of the veal sector do not perceive much societal pressure to enhance animal welfare or environmental safeguarding from consumers. Sector representatives are of the opinion that the sector has achieved a sufficient level of calf welfare (animal density, etc.) and it is significantly improving in terms of environmental impact and effluent management. Pressure comes from the big food retail chains for marketing purposes, particularly with regard to antibiotic-free meat. Further requests from the big food retail chains address calf welfare and environmental sustainability issues.[35]

Beef production systems in Spain

Spain is slaughtering more than 2.5 million animals per year and producing more than 650 000 tonnes with an annual production value of €3 092 million. In Spain, calves are fattened in beef production systems, veal production is practically inexistent. Although the number of farms is decreasing every year, the production level is not decreasing, indicating that the size of the farms is increasing. In Spain, 35% of calves are slaughtered between 8-12 months of age, followed by 30% of calves older than a year.

Spanish livestock exports increased substantially in recent years, mainly driven by significant demand in the Middle East for cattle.[36] The annual economic value of the trade to other MS and third countries is around €1 128 million: 45% of this value is fresh meat and 35% is live animals. Inside the EU, Portugal (35.5%), Italy (18.3%) and the Netherlands (10.3%) are the main destinations. Algeria (3.5%), Canada (2%) and Indonesia (1.2%) are the main export countries. Of the live ready to slaughter beef animal transported from Spain to other countries, 23.7% go to EU MS and 76.4% to third countries.[37]

Table 3. Number of calves < 80 kg entering Spain from other MS

Year	# calves
2007	319 853
~	
2017	427 064
2018	470 029
2019	462 917
2020	466 157

Source: Asoprovac, associationespanola de productores de vacuno de Carne Elaboración propia. Fuente (AEAT)

In Spain 30.9% of the animals entering fattening units were younger than 2 months of age, 37.8% between 2 and 6 months, and 27% between 6 and 12 months. A large part of the calves entering the fattening units originate from Spain, with an internal movement of animals from the origin farm to the fattening farm. However, an increasing number of unweaned calves originate from other MS (**Table 3**). The main countries of origin were France, Ireland and Germany. Beef cattle farms in the north-eastern regions (Catalonia and Aragon), where the biggest fattening units are located, mostly receive calves from other MS. Since 2007, the number of unweaned calves originating from other MS increased from 320 000 animals per year to almost 470

[35] Source: interviews with Italian national stakeholders

[36] https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Exports%20Continue%20to%20Drive%20Spanish%20Livestock%20Production%20_Madrid_Spain_10-04-2021.pdf

[37] https://www.mapa.gob.es/es/ganaderia/temas/produccion-y-mercados-ganaderos/estudiodelsectorespanoldecebodevacuno2019_tcm30-512343.pdf

000 (Table 3). Of these calves, 51.4% were transported directly to a fattening farm.[38] 63% of those went to the fattening units in Catalunya. The destination of those animals was a fattening operation (51.4% of cases), an assembly centre (40.7%) or a commercial operator (7.8%).[37]

Spain accounts for 20 357 fattening units, with the size depending on location and degree of intensification. Of these fattening units, 38.7% are located in Galicia (north-west), 16.6% in Castile and León (central region), 12.0% in Catalonia and 10.5% in Aragon, the north-eastern regions of Spain. However, the number of animals is not distributed the same way. Catalonia produces the highest number of animals (27.4%), followed by Aragon (17.7%) and Castile la Mancha (16.5%) (Figure 10)

Beef production in Spain is characterised by highly intensive systems. Although crossbred calves are predominant in Spain (47.3%), 28.5% of the animals fattened are Holstein male calves. Calves that enter the fattening units at less than two months of age are fed with milk replacer for six to eight weeks until weaning, and then with concentrate and straw until slaughter (between 10 and 18 months of age and 550-650 kg in body weight). Unweaned calves are mainly transported from the western and north-western regions, where most of the dairy farms are located, to fattening units located at central regions (Castile and León and Castile La Mancha) in journeys of less than 8 hours.

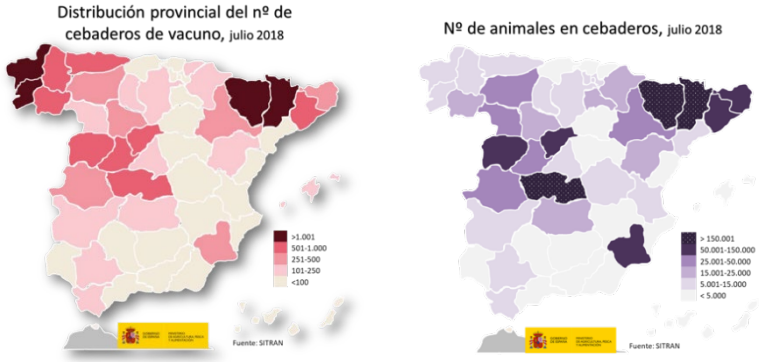
During fattening time, calves will be fed a high concentrate growing diet for the first month, followed by a high concentrate finishing diet, always with straw as a source of fibre (depending of the region and availability they may be fed a more high quality hay). Those animals will be in pens of 16-20 calves. The barns are 3-wall barns with natural ventilation (there is a space between the wall and the roof) and a front part open where the concentrate and straw feeder and the water through are allocated. Although there are barns with slat, the most common are barns have a concrete floor with deep straw bedding.

In Spain, four different production regions can be distinguished based on the characteristics of the production system (Figure 11).

- In region 1, Catalonia and Aragon, the size of farms is very variable, from 750 to 5 500 animals. Most of them are organised as integrations where there is an agreement between the integrator to cover the cost of animals, feeding and health, while the farmer contributes labour, buildings, straw for feeding and bedding and others such us water and power. The integrator pays a fixed fee per animal and day to the farmer. The most common breeds fattened in these farms are Holstein crossbred calves or dual-purpose breeds such as Simmental or Montbeliard. Most of the unweaned calves that enter these farms are transported from other EU MS.
- In region 2, Galicia, the size of farms is small (fewer than 200 animals/farm) and the most common breeds are autochthonous to the area and Holstein crossbred calves from dairy farms are common in this area of Spain. Transport of animals from other parts of the EU is uncommon.
- In region 3, Castile and León and Castile-La Mancha, farms are medium sized (from 425 to 1 600 animals/farm). The most common animals fattened on those farms are weaned calves (around 6-8 months of age) coming from pasture from autochthonous crossbreds bought from local or regional markets. Also, it is common that the small size farms combine cow-calf production and fattening.
- Finally, in region 4, Andalucía, some beef producers fatten their animals in a community farm. In this case, cow-calf producers send their calves to this type of farm where the fattening is standardised from the reception, value, management and diets, until the slaughter and commercialisation of the meat. The fattening farms distribute the benefits with the producers according to the number of animals sent to the fattening unit.

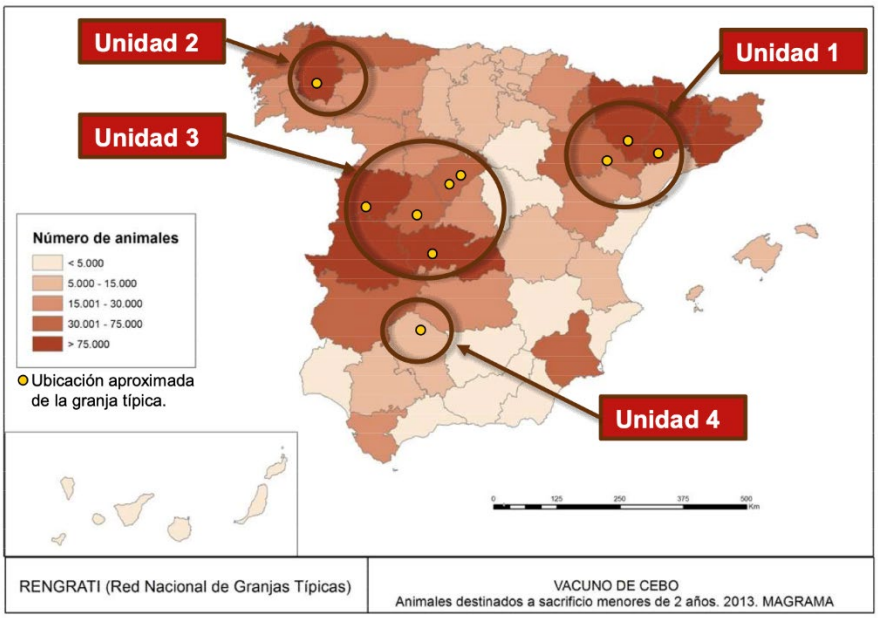
[38] Asoprovac interview

Figure 10 . Distribution of farm operations and animals in Spain)



(source https://www.mapa.gob.es/es/ganaderia/temas/produccion-y-mercados-ganaderos/estudiodelsectorespanoldecebodevacuno2019_tcm30-512343.pdf)

Figure 11. *Beef fattening areas in Spain*



(source https://www.mapa.gob.es/es/ganaderia/temas/produccion-y-mercados-ganaderos/estudiodelsectorespanoldecebodevacuno2019_tcm30-512343.pdf)

In conclusion, there are two main beef production systems in Spain based on the origin of the animals:

- **Unweaned calves**: these animals are surplus calves from the dairy industry, mainly Holstein or Holstein crossbred calves, that arrive to the fattening units with 40-60 kg of body weight and between 14 and 28 days of age. Upon arrival those calves are placed in groups in collective hutches or pens (groups of 5 and 10 calves) and they are fed milk replacer for approximately 6 weeks, concentrate (pellets or mash) and straw as a source of fibre. After weaning, calves are moved to fattening pens until their slaughter (around 8-9 month) with 450-470 kg of final body weight.
- **Weaned calves**: these animals come from cow-calf operations and are beef crossbred calves that arrive to the fattening unit with 200-250 kg of body weight and 6-8 month of age. Upon arrival, those animals are placed directly to the fattening pens until slaughter (around 4-6 month) with a final weight of 580-620 kg.

3.7 Production methods in other Member States

The production systems described in the previous section depend to a large extend on unweaned calves originating from other MS. In the systems described in this section, this dependency on other MS is (mostly) absent.

Examples from Scandinavian MS: Sweden

There are approximately 1.4 million heads of cattle in Sweden, of which 300 000 are dairy cows, 200 000 are cows kept to produce calves for the beef production, and 900 000 are calves and young cattle (including bulls) kept for beef production[39]. In 2020, the number of calves under the age of 1 year was 462 149, representing a 2.6% increase from 2019. These calves were kept on 13 266 farms/units, resulting in an average of 34.8 calves/farm. In 2018, the total number of slaughtered cattle was 425 630[40]. Swedish production of meat was approximately 133 000 tons in 2015, and from this approximately 65% was from the dairy industry. This meat production constituted only half of the total amount of meat consumed in Sweden, with the rest being imported. Dairy and beef production accounted for €980 million and €490 million of agricultural revenue, respectively.[41]

A dairy cow in Sweden lives on average 5-6 years on the dairy farm before being slaughtered. Almost all dairy cows in Sweden are inseminated with semen from dairy bulls, with only a few being inseminated with beef breeds. The Swedish meat production employs approximately 5 000 people on farms and approximately 5 000 in the breeding industry. Dairy and beef production constitutes €10 and €5 billion, respectively, of agricultural revenues per year (Swedish meat 2019).

Almost all male calves from the dairy industry are slaughtered, either as calves or as young bulls/steers. This involves approximately 150 000 calves per year, which is a small number compared to the total annual number of slaughtered animals in Sweden. When slaughtered, calves they weigh approximately 300 kg and are 8 months old. When slaughtered as young bulls/steers, they weigh approximately 600-630 kg and are between 19-36 months old (Swedish Board of Agriculture). In 2020, 13 480 calves were slaughtered in Sweden. The number of slaughtered calves remains more or less stable throughout the year, with the least amount of calves being slaughtered in August (910) and the highest number in March (1 380).

Fattening farms are allowed to source calves from a limited number of dairy farms. Farmers who buy calves are further advised to buy new calves as infrequently as possible, and to buy calves from dairy farms geographically close to their own farm to limit the negative consequences of transport.[42]

Non-replacement dairy calves are mostly used for beef production. Beef fattening farms who receive calves need to comply with the recommendations for receiving calves for fattening. If more than 50 calves are received from more than one farm per year, the farmer needs to have a special receiving unit on the barn where the animals can be placed upon arrival to the farm. In such units, the total number of calves can be a maximum of 100. The purpose of the receiving unit is 1) to protect the calves already on the farm and 2) to protect the newcomers from infection on the farm and the stress from mixing with new calves. In instances where farmers receive fewer than 50 calves from more than one farm per year and are unable to use a receiving unit, the maximum number of calves in the fattening unit is 100.

Examples from eastern EU member states

Poland

[39] Sveriges officiella statistik (2019) Antal nötkreatur i december 2018.
[40] Sveriges officiella statistik (2019) Animalieproduktion. Års- och månadsstatistik 2018:12.
[41] Svenskt Kött. Om kött. Link: www.svensktkott.se,
[42] Farmers are allowed to transport their own 2-week-old calves without a permit if the travelling distance is shorter than 65 km, and if this only occurs to a limited extent (i.e. less than 8 times per year).

Poland is the largest producer of beef of the Eastern EU MS with a production of 559 400 tonnes of beef from 1.82 million animals slaughtered (Table 1). The calf population is around 1.7 million calves. From 2019 to 2020, the number of calves decreased by approximately 3.5%. Since 2010, the production of calves for slaughter has continually decreased. According to data from Statistics Poland, about 2 million calves were born in 2019 and calf mortality was about 7% (144 000 animals). Of the population of 1 750 000 calves under one year old (about 28% of the total cattle population), 107 000 (6%) were allocated for slaughter and the rest for rearing. Thus, the number of young slaughter calves (fed with milk) is a relatively small fraction in the total number of calves born in Poland. Young slaughter calves in Poland are traditionally fed on whole milk for 50-60 days, up to a weight of 80 kg. The next stage of feeding for white meat calves or 'baby beef' (live weight of more than 120 kg) is based solely on milk replacers. A pasture-based suckling system also seems to be a more economical option in veal production. This can generate benefits for local producers since animal-friendly meat production systems are increasingly well perceived by retailers and consumers. Veal production in Poland therefore also involves suckler beef to a limited extent, comprising mainly of Limousin calves reared by dams on the pasture. These animals are usually slaughtered at weights of 250-350 kg, shortly after weaning. Over the last 10 years, the number of Holstein cows for milk production has increased.

Czech Republic

In the Czech Republic, calf fattening is carried out to the age of four to five months and a live weight of 140-180 kg (maximum 200 kg). According to market requirements, it is possible to increase slaughter weight to 400 kg as the quality of the meat in this range is similar. Fattening is implemented in several strategies. An important strategy is so-called cereal fattening which, following the starter rearing of calves, uses mashed cereals (barley, maize, wheat) and shaped protein supplements with additional minerals and vitamins. An alternative, more affordable strategy allows fattening up to 270 kg of live weight, which results in meat characterised by darker pink colouring.

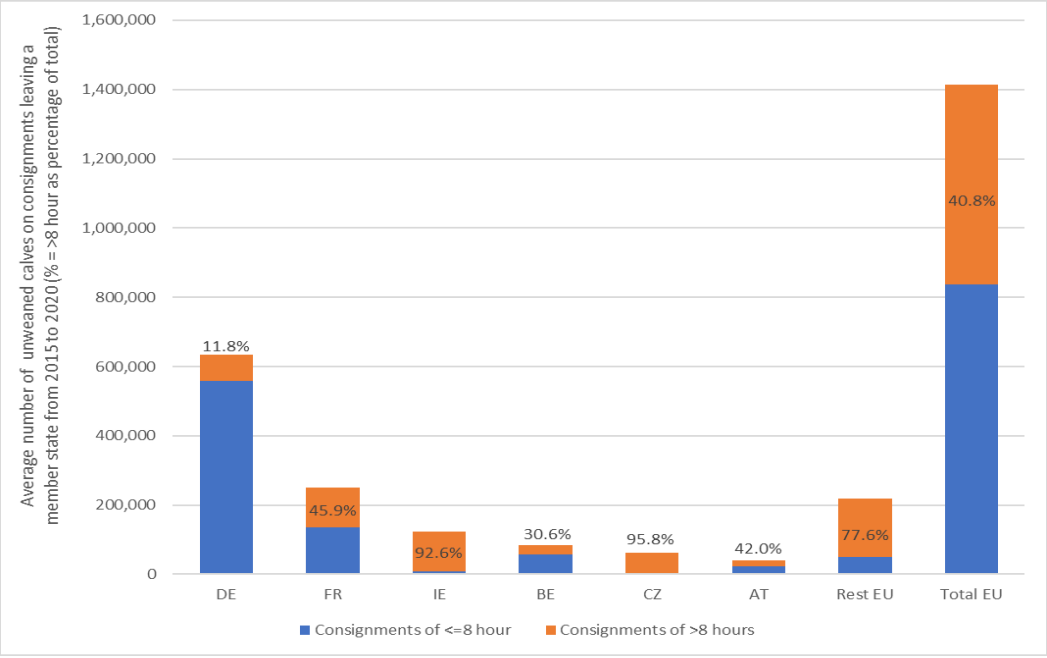
4 Long distance transport of unweaned calves

4.1 The number of young calves transported on long journeys between MS per year

Summary: From 2015 to 2020, around 1.4 million unweaned calves annually, of the approximately 20 million unweaned non-replacement dairy calves born annually in the EU, were moved across MS borders. Of these animals, 42% (580 000) were moved on long journeys (> 8 hours). The most important MS of origin for long duration journeys were France (115 000 animals/year), Ireland (114 000 animals/year) and Germany (75 000 animals/year). Although limited in absolute numbers, a substantial proportion of unweaned calves born in Estonia (34 400 animals/year, 42.1%), Czech Republic (60 000 animals/year, 25.1%) and Latvia (3 200 animals/year 26.4%), were moved to other MS on long journeys. Most calves transported on long journeys had the Netherlands, Spain, Belgium or Italy as their destination

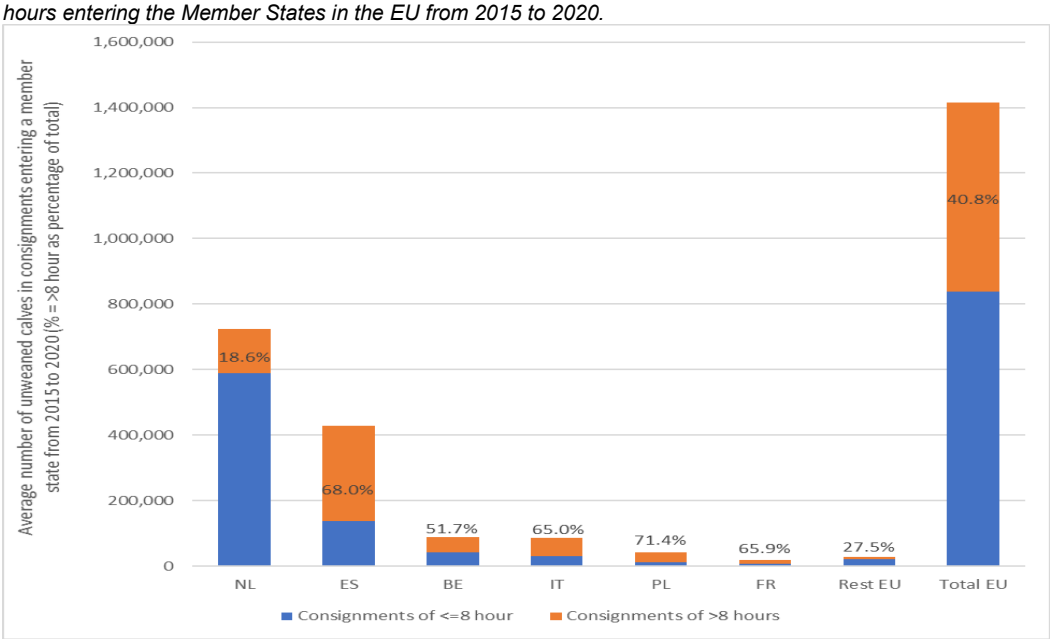
In the 2015-2020 period, approximately 1.41 million unweaned non-replacement calves were estimated to be moved annually between MS (figure 11 and Annex 3). Of these, approximately 42%, or 580 000 unweaned calves annually, were estimated to be moved on long journeys from 2015 to 2020 (Figure 122 and Annex 4). This percentage varied between 38.3% to 43.3% per year in the evaluated period. Germany, France, and Ireland accounted for around 70% of these animals transported (Figure 12). Of the unweaned calves moved from Ireland to other MS, over 90% were on long journeys, with approximately 45% coming from France and 10% from Germany. The most significant destinations for these calves were the Netherlands, Spain, Belgium and Italy, which together accounted for over 93% of the animals (Figure 13). In the Netherlands, approximately 20% of the calves transported were on long journeys from other MS. For Spain and Italy, this number is approximately 65% to 70% while for Belgium it is approximately 50%.

Figure 12. Estimated average annual number of unweaned calves on consignments of 8 hours or less and of more than 8 hours leaving the Member States in the EU from 2015 to 2020.



Source: Own calculations based on data from COMEXT and TRACES (see Section 2.4).

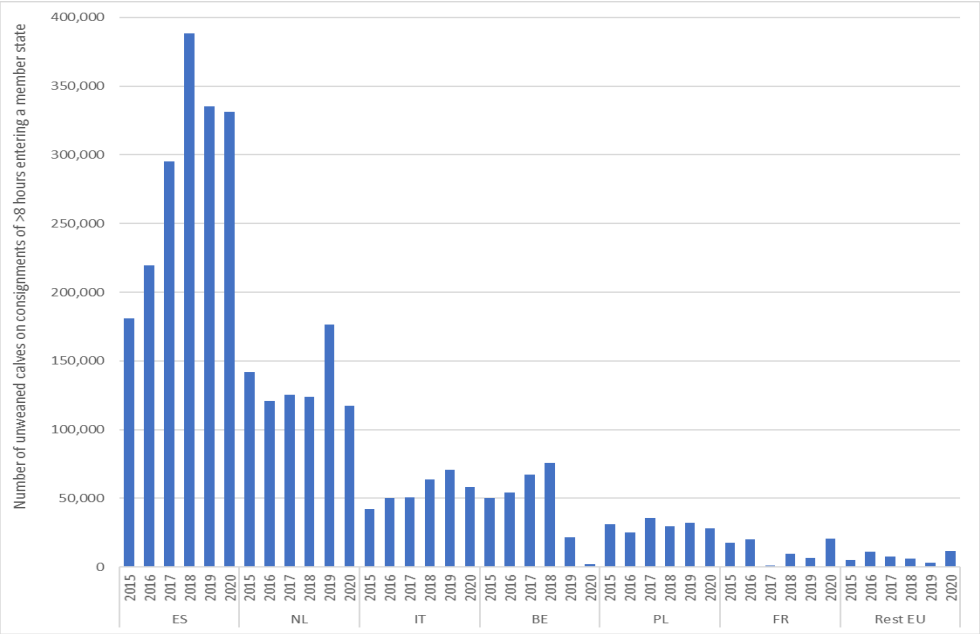
Figure 13. Estimated average annual number of unweaned calves on consignments of 8 hours or less and of more than 8 hours entering the Member States in the EU from 2015 to 2020.



Source: Own calculations based on data from COMEXT and TRACES (see Section 2.4).

Long journeys of unweaned calves arriving from other MS were concentrated in a few Member States (Figure 14). On average from 2015 to 2020, the most significant receiving MS were Spain (292 000 heads per year), Netherlands (134 000), Italy (56 000), Belgium (45 000), Poland (30 000), and France (13 000). Other MS received 3 000 heads per year or less. Long journeys of unweaned calves sent to other MS were more evenly distributed between MS than the distribution of calves received (Figure 15). The MS that transported the most unweaned calves on long journeys to other MS were Ireland and France (both approximately 115 000), Germany (75 000), and the Czech Republic (60 000). Nine MS sent between 10 000 and 50 000 unweaned calves per year on average to other MS, and 15 MS sent fewer than 10 000 calves per year. The estimated number of unweaned calves moved on long journeys grew from 470 000 in 2015 to a peak of almost 700 000 in 2018, after which it dropped to 570 000 in 2020 (Annex 4). The growth until 2018 was mainly caused by increased numbers of animals sent to other MS from Ireland, Belgium and France. The reduction since 2018 was mainly caused by decreasing numbers from Germany, Belgium and Ireland.

Figure 14. Estimated annual number of unweaned calves on consignments of more than 8 hours entering the Member States in the EU from 2015 to 2020.

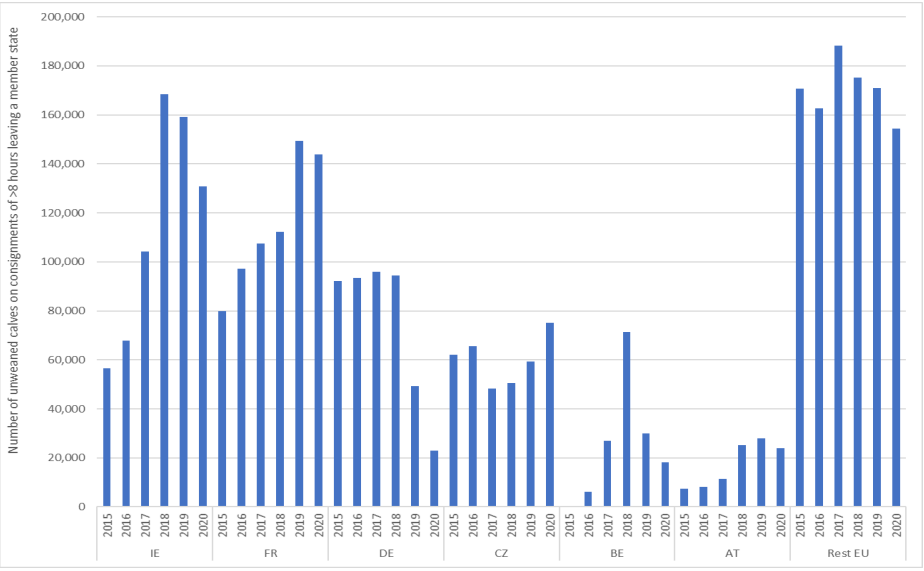


Source: Own calculations based on data from COMEXT and TRACES (see Section 2.4).

The origins of long journeys accounting for the highest average numbers of unweaned calves to Spain includes France (100 000 calves per year), Ireland (52 000), Germany (41 000), Belgium (19 000), the Czech Republic (28 000), and the Netherlands (16 000). For most of these routes, the number of calves increased between 2015 and 2020 (Annex 4).

The highest long journey volume routes to the Netherlands were from Ireland (41 000), Denmark (25 000), Germany (23 000), Latvia (16 000), and Estonia (13 000). For most of these routes, the number of calves received by the Netherlands from other MS was quite stable between 2015 and 2020 (Annex 4). An exception was the number of calves originating from Ireland, which almost tripled from 27 000 in 2015 to 67 000 in 2019, before dropping steeply to 47 000 in 2020.

Figure 15. Estimated annual number of unweaned calves on consignments of more than 8 hours leaving the Member States in the EU from 2015 to 2020.



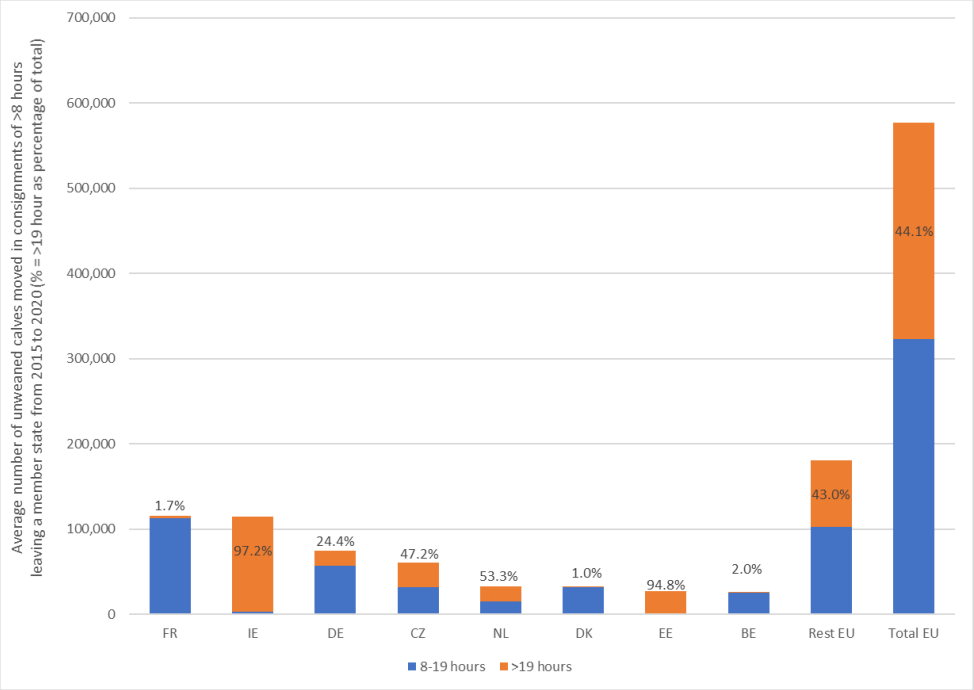
Source: Own calculations based on data from COMEXT and TRACES (see Section 2.4).

The most important MS of origin for unweaned calves received in Italy were Ireland (12 000) and France (10 000). From 2015 to 2019, both these routes experienced almost a tripling in the number of calves (Annex 4). In 2020, calves received from Ireland more than halved compared to 2019, whereas those from France further increased by almost 20%.

The highest volume routes to Belgium were from the Czech Republic (18 000) and Estonia (12 000). Both of these routes maintained a steady volume until 2018, before dropping to zero in 2020 (Annex 4). All other routes transported fewer than 10 000 heads per year.

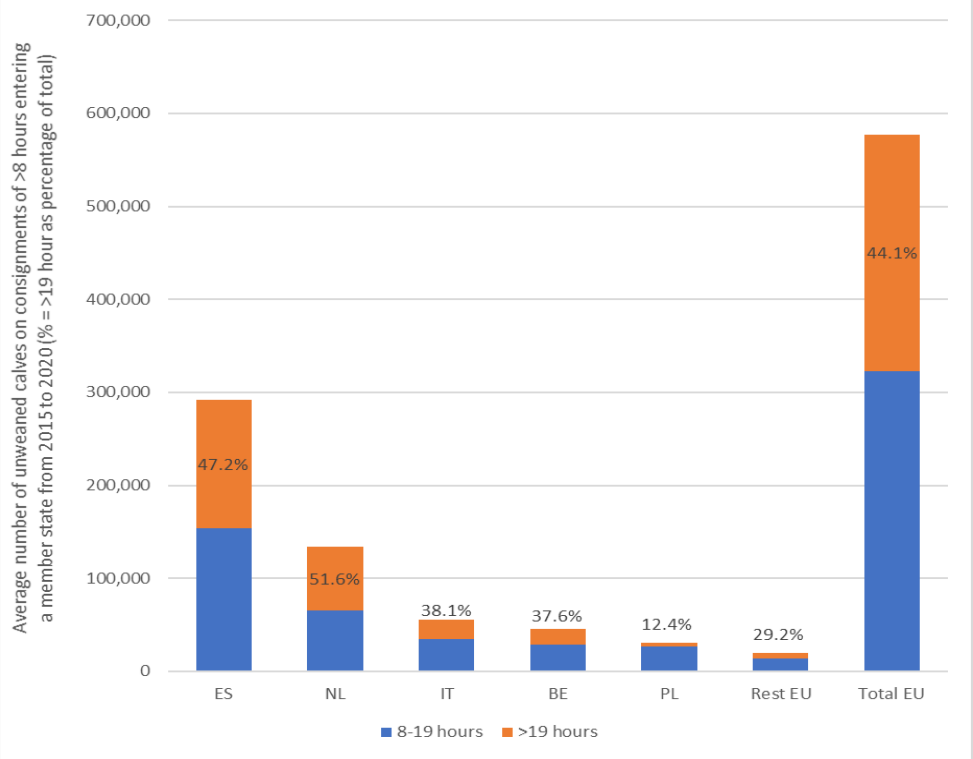
Between 2015 and 2020, an estimated average of 323 000 unweaned calves were transported annually on journeys with a duration of between 8 and 19 hours (Figure 16 and Annex 4). This is approximately 56% of the estimated number of unweaned calves transported cross-border on long journeys in the EU. Consignments with these animals needed to make a stop of one hour to rest and feed the calves at a control post after a maximum of 9 hours travelling time. On average from 2015 to 2020, an estimated 255 000 of unweaned calves were transported annually on cross-border journeys with a duration of over 19 hours (Figure 16 and Annex 4). This amounts to approximately 44% of the calves on long journeys. Consignments with these animals also made a stop of at least 24 hours at a control post after a maximum of 19 hours travelling time, in addition to the 1 hour stop after a maximum of 9 hours travelling time. The most important MS of origin for journeys of over 19 hours were Ireland (111 000 calves per year), the Czech Republic (28 000) and Estonia (26 000) (Figure 16). The most frequent countries of destination were Spain (138 000), the Netherlands (69 000), Italy (21 000), and Belgium (17 000) (Figure 17).

Figure 16. Estimated average number of unweaned calves on consignments of between 8 and 19 hours and of more than 19 hours leaving the Member States of the EU from 2015 to 2020.



Source: Own calculations based on data from COMEXT and TRACES (see Section 2.4).

Figure 17. Estimated average number of unweaned calves on consignments of between 8 and 19 hours and of more than 19 hours entering the Member States of the EU from 2015 to 2020.



Source: Own calculations based on data from COMEXT and TRACES (see Section 2.4).

The estimated number of unweaned non-replacement calves born in the EU decreased by around 4% from 20.0 million in 2015 to 19.2 million in 2019 (Table 4). In 2020, this number decreased further to 17.5 million, but this was mainly due to the UK leaving the EU. The estimated number of unweaned non-replacement calves born in the 27 MS in 2020 was around 170 000 lower than in 2019. The share of each MS in this total was stable over the years. Most unweaned non-replacement calves were born in Germany (18%), France (15%), Poland (9%), Italy (9%), the Netherlands (7%) and Ireland (6%).

Table 4. Estimated[1] number of non-replacement calves born per year from dairy cows in each EU Member State from 2015 to 2020

Member State	2015	2016	2017	2018	2019	2020	Average
Austria	458 890	453 985	461 907	452 940	445 460	446 063	453 207
Belgium	451 002	449 463	441 286	449 863	457 266	459 927	451 468
Bulgaria	237 082	240 516	221 663	207 706	192 687	205 649	217 550
Croatia	124 950	129 200	118 150	115 600	110 500	93 500	115 317
Cyprus	24 191	22 262	25 636	27 098	29 767	31 204	26 693
Czech Republic	312 214	313 701	310 641	304 810	307 216	303 459	308 673
Denmark	480 250	484 500	488 750	484 500	478 550	480 250	482 800
Estonia	73 185	77 010	73 440	72 420	72 250	71 655	73 327
Finland	234 073	239 896	230 044	224 094	220 099	217 277	227 580
France	3 091 467	3 091 467	3 057 314	3 021 096	2 967 189	2 936 733	3 027 544
Germany	3 585 045	3 641 944	3 569 159	3 485 731	3 409 920	3 333 199	3 504 166
Greece	90 100	94 350	82 450	80 750	73 100	73 100	82 308

Member State	2015	2016	2017	2018	2019	2020	Average
Hungary	207 400	212 500	207 400	203 150	206 550	192 100	204 850
Ireland	1 100 946	1 053 907	1 141 805	1 163 735	1 211 896	1 237 643	1 151 655
Italy	1 751 400	1 748 289	1 734 094	1 648 558	1 594 362	1 590 580	1 677 880
Latvia	130 917	138 049	127 806	122 800	117 649	115 634	125 476
Lithuania	242 930	255 425	231 880	217 770	204 765	197 965	225 123
Luxembourg	44 175	41 761	44 302	45 050	46 028	46 096	44 568
Malta	5 525	5 415	5 219	5 296	5 202	5 151	5 301
Netherlands	1 524 900	1 459 450	1 415 250	1 319 200	1 351 500	1 333 650	1 400 658
Poland	1 810 415	1 813 985	1 829 965	1 881 985	1 841 865	1 806 845	1 830 843
Portugal	203 074	206 771	202 836	200 150	199 096	197 838	201 627
Romania	1 013 710	1 012 095	999 090	984 470	967 980	968 830	991 029
Slovakia	112 719	118 371	110 381	108 690	106 973	103 743	110 146
Slovenia	91 664	95 914	92 506	87 304	85 714	84 329	89 572
Spain	709 283	717 494	699 882	694 187	690 940	689 129	700 152
Sweden	277 202	286 280	274 924	266 093	256 173	258 740	269 902
United Kingdom[2]	1 613 300	1 630 300	1 618 400	1 597 150	1 586 950		1 609 220
Total	**20 002 005**	**20 034 296**	**19 816 178**	**19 472 191**	**19 237 642**	**17 480 284**	**19 608 636**

[1] Based on an estimate of one calf born per dairy cow per year, replacement percentage of 30% of female calves, and 50% of born calves to be female., [2] United Kingdom was not part of the EU in 2020, so average is over 2015 until 2019.
Source: Own calculations based on data from EUROSTAT (see Section 2.4).

Dividing the estimated number of unweaned calves moved on long journeys by the estimated number of unweaned non-replacement calves born in each MS and each year provides the estimated percentage of unweaned calves born in each MS that were moved on long journeys (Table 5). On average from 2015 to 2020, around 3% of the unweaned non-replacement calves born in the EU were moved on long journeys. From 2015 to 2018, this percentage increased by over 50% from 2.4% to 3.7%, and since then it decreased again to 3.4% in 2020. On average from 2015 to 2020, in 20 of the EU MS, less than 5% of unweaned non-replacement calves born were moved on long journeys. In Ireland (9.9%), Lithuania (7.4%), Denmark (6.7%), and Belgium (5.6%), 5-10% of the unweaned non-replacement calves born were moved on long journeys. In the three MS of Estonia (34.4-42.1%), Czech Republic (15.7-25.1%) and Latvia (3.2-26.4%), more than 10% of unweaned non-replacement calves born were moved on long journeys. Comparing 2020 to 2015, Latvia (from 26.4% to 3.2%) and Estonia (from 41.5% to 34.4%) exhibited the strongest decreases. In contrast, Lithuania (0.9% to 9.1%), Ireland (from 5.1% to 10.6%), Slovakia (from 0.7% to 6.0%), Czech Republic (from 20.2% to 25.1%), Belgium (from 0.0% to 3.9%), and Austria (from 1.6% to 5.4%), showed the largest increases.

Table 5. Estimated percentage of unweaned non-replacement calves born moved on long journeys per Member State of origin from 2015 to 2020

Member state of origin	2015	2016	2017	2018	2019	2020	Average
Austria	1.6	1.8	2.5	5.6	6.3	5.4	3.8
Belgium	0.0	1.4	6.1	15.8	6.6	3.9	5.6
Bulgaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Croatia	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Cyprus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Czech Republic	20.2	21.1	15.7	16.8	19.6	25.1	19.7
Denmark	5.0	6.2	5.7	6.5	8.9	8.1	6.7

Member state of origin	2015	2016	2017	2018	2019	2020	Average
Estonia	41.5	32.1	42.1	36.4	36.0	34.4	37.1
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0
France	2.8	3.4	4.0	4.2	5.5	5.4	4.2
Germany	2.6	2.6	2.9	2.7	1.5	0.7	2.2
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary	0.2	0.1	0.3	2.0	2.1	1.6	1.0
Ireland	5.1	6.5	9.1	14.5	13.1	10.6	9.9
Italy	1.7	1.5	0.4	0.2	0.1	0.1	0.7
Latvia	26.4	19.0	22.4	8.5	7.7	3.2	14.9
Lithuania	0.9	3.1	10.6	13.7	8.2	9.1	7.4
Luxembourg	0.0	0.0	0.6	0.5	0.2	0.3	0.3
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	0.6	2.2	2.6	2.6	3.1	3.1	2.3
Poland	1.2	0.4	0.1	0.0	0.1	0.0	0.3
Portugal	0.8	0.2	0.1	0.0	0.0	0.3	0.2
Romania	0.0	0.0	0.0	0.0	0.3	0.0	0.1
Slovakia	0.7	0.1	2.5	4.4	4.1	6.0	2.9
Slovenia	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spain	2.1	1.0	1.1	1.4	1.5	1.7	1.5
Sweden	0.0	0.0	0.0	0.0	0.0	0.0	0.0
United Kingdom	0.0	0.0	1.7	1.5	0.9		0.8
Total	**2.4**	**2.5**	**3.1**	**3.7**	**3.5**	**3.4**	**3.0**

Source: Own calculations based on data from COMEXT, TRACES and EUROSTAT (see Section 2.4).

4.2 Transport of calves from farm of birth to their production destination

Summary: Transporting unweaned calves from dairy farms to their final destination includes collecting, sorting, transporting, sorting (again), transporting and placing at the beef or veal calf farm. After fattening, animals are transported to a slaughterhouse. In the transport from farm of birth to fattening farm, a number of livestock traders and representatives of integrators are involved. The process might take multiple days and multiple changes of ownership before the animals reach the fattening beef or veal calf farm. In most MS, only a limited number of transporters are involved in long-distance transport. Unweaned calves that are transported to other MS have a minimum age of 14 days. The calves are collected in assembly centres where they can remain for up to six days prior to transport.

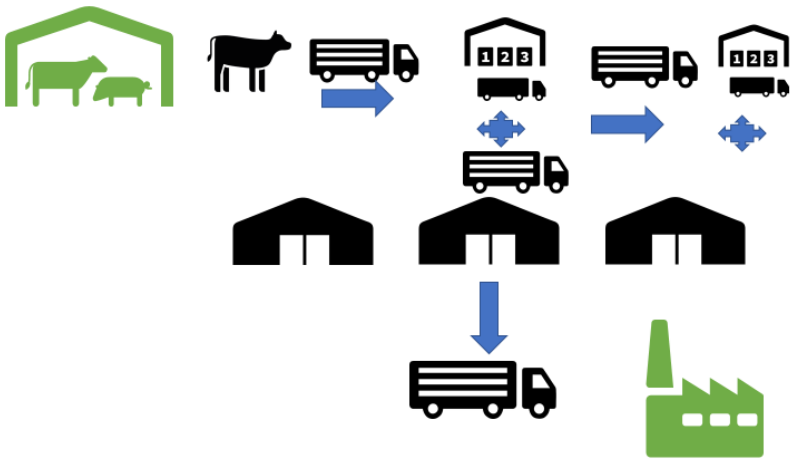
Unweaned non-replacement calves born on dairy farms are legally required to remain at the dairy farm of birth for a minimum of 14 days before they are allowed to be transported.[43] Unweaned non-replacement calves are collected at the dairy farms of origin, usually by local traders. The local traders transport the calves to local or regional markets or assembly centres. From these local or regional markets or assembly centres, the calves are transported either to other assembly centres or sent to farms dedicated to the production of veal or beef production, which is their final destination.

When unweaned calves pass through a control post, the feeding and watering of animals is to be carried out in such a way as to ensure that every animal accommodated at the control post can have at least sufficient

[43] Regulation (EC) 1/2005 (annex I, Chapter VI Section 1.9)

clean water and sufficient and appropriate feed to satisfy its bodily needs during its stay and for the expected duration of its journey to the next feeding point. Control posts may not receive animals with special feeding needs, such as young calves needing liquid feed, unless they are properly equipped and staffed to satisfy those needs. [44]

Figure 18.Transport of calves from farm of birth to their production destination



Situation in the different MS

In the section below we describe the situation in a number of MS and the UK based on information received in the interviews and e-survey sent to the CAs and NGO's. In summary:

The Netherlands

Unweaned non-replacement dairy calves born on Dutch dairy farms usually enter the veal supply chain. The vast majority of unweaned calves are first transported to an assembly centre. At the assembly centre, calves are classified according to breed, weight, and sex, before uniform batches of animals are then transported to a veal farm. The transport from an assembly centre in the Netherlands to a veal farm takes between one and four hours. For the transport of unweaned calves from other MS to the Netherlands, 62 transporting companies are involved (in 2020, 4 025 transports entered the Netherlands from other MS).[45] On average, the short-term transport costs of unweaned non-replacement dairy calves from Germany to the Netherlands is estimated at €3 per calf transported. The costs of long-journey transport vary depending on the MS of origin, but range between €12 and €18 per calf for transport from Eastern European MS to the Netherlands.

Italy

Unweaned non-replacement calves born on Italian dairy farms are usually separated from the cows soon after birth and reared until at between least 15-40 days of age. The calves are collected at dairy farms and are transported either directly to veal farms or to traders' or integrators' assembly centres. They usually stay in an assembly centre for about one day (i.e. the minimum time needed to sort them), before being transported to a veal farm. This short duration stay is also for sanitary and health protection reasons. The Italian veal industry is mainly located in the Po valley (northern Italy), which is also the core of the Italian dairy sector. Therefore, national journeys usually take less than 8 hours, though journeys from southern Italian regions and islands may be longer.[46]

[44] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:01997R1255-20070105&from=EN
[45] Data SKV
[46] Source/: interviews with Italian stakeholders

Germany

In Germany, new legislation which will come into force 1st Jan 2023, changing the age of at least 14 days before being allowed on transport to 28 days of age and limiting the transport time within Germany to 8 hours.[47] Substantial numbers of unweaned calves are transported to other MS after being collected in assembly centres. There are three very typical routes for transports of unweaned calves in Germany:

- *Transports from Eastern/Northern/Western Germany to The Netherlands/Belgium*
  Unweaned non-replacement calves are taken from local farms to assembly centres, where they receive some electrolytes. Within very few hours, sometimes only minutes, they are being placed on a transport to another assembly centre, this time in Western Germany (<8h). There they receive electrolytes again and after approximately 6 hour go onto another transport, this time to the Netherlands or Belgium for fattening. Each of these transports are short transports of less than 8 hours in themselves, however the combined journey with only short breaks at each assembly centre could exceed 8 hours ("assembly centre hopping").
- *Transports from Southern Germany to Italy/Spain*
  Unweaned non-replacement calves are taken from local farms to assembly centres, where they receive some electrolytes. Within very few hours they are being placed on a long transport following the 9-1-9 protocol. Currently, long transports of unweaned calves are officially dispatched from Germany to Spain from two assembly centres in Baden Württemberg and Bavaria. The transport distance to these assembly centres for the majority of calves is more than 100 km, also from other federal states.
- *Transports transiting Germany*
  Transports from Eastern Europe (Latvia/Lithuania/Estonia) to the Netherlands or Spain often transit Germany. Quite frequently, they have their 24-hour-rest at a control post in Germany.

Ireland

Also the minimum age of calves to be transported to other MS is 14 days in Ireland. Transporters have arrangements with dairy farmers to move unweaned calves from the farm to markets/assembly centres. Most unweaned calves are moved in small/medium size trucks to assembly centres. The maximum duration of the journey between farm and assembly centre is 2.5 hours. The calves are allowed to stay at the assembly centre for up to six days, providing sufficient time for a trader to arrange further transport, which is mostly overseas. Two days before the actual overseas transport takes place, veterinarians check whether documents are in compliance with transport regulation. A health check is performed by veterinarians at the assembly centres. The quality of calves at the assembly centre is overall good with around 0.5 to 1% of the calves rejected, e.g. following a positive test for the Bovine Viral Diarrhoea virus or for animal welfare issues.

Sweden

In recent years, it has become increasingly common for Swedish dairy farmers to transport 2 to 4-week-old bull calves to specialised farms for fattening.[48] Approximately two-thirds of the unweaned non-replacement calves born (of the approximately 150 000 born annually) are sold and transported to a fattening farm. The fattening farms are within Sweden. They can be both within the same area/region, but also further away. Farmers buying unweaned calves for fattening, are advised to buy them from as few dairy farms as possible to limit transmission of diseases, to buy as infrequent as possible, and to buy from dairy farms geographically close to their own farm to limit the negative consequences of transport. Farmers receiving unweaned calves need to comply with the recommendations for receiving calves for fattening. If more than 50 calves are received from more than one farm per year, the farmer needs to have a special receiving unit where the animals can be placed upon arrival to the farm. In such units the maximum number of calves can be 100

[47] https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl121s4970.pdf%27%5D__1644148345302

[48] Axelsson, L., Segerkvist, K. A., Hagelsås, E., Johansson B., 2020. Friska kalvar vid förmedling av två veckors tjurkalvar. Swedish University of Agricultural Sciences, link: https://www.slu.se/institutioner/husdjurens-miljo-halsa/forskning/forskningsprojekt/tidig-formedling-av-tjurkalvar-av-mjolkras/ visited 15/12/2020.

animals. The purpose of the receiving unit it to 1) protect the calves already on the farm, and 2) to protect the new comers from infection on the farm and the stress from mixing with new calves. It is recommended that the calves stay in the receiving unit for 5 weeks before they are moved to the fattening unit.[48]

Slovakia

Two typical situations occur:

- Unweaned calves are transported to an assembly centre on Mondays and Tuesdays, some on the previous Friday. On Tuesday evening, after get fed, they are loaded for international transport. Thus, the calves are kept at the assembly centre for 1-5 days.
- Unweaned calves are coming to an assembly centre the day before and on the day of a planned long journey. Before the long journey, all calves are always fed.

In the summer months, space per animal is increased, the trip is planned for the night, and the supply of drinking water for the animals is checked before the trip.

Austria

A large amount of the unweaned non-replacement calves are collected in an assembly centre in Bergheim/Salzburg. Most of the unweaned calves are transported from the assembly centre in Salzburg to Spain, Italy and Poland. In 2020 40% of all calves that were transported to other MS were transported to Italy, 33% to Spain and 26% to Poland. Special adjustments need to be implemented in transport vehicles that transport unweaned calves. According to the Austrian Animal Transport handbook, for suckling calves, rubber attachments for nipple drinkers with bite nipples or gag drinkers are required. These attachments must be made of flexible synthetic material, be permanently soft, and not be damaged by environmental influences or cleaning agents or disinfectants. Some sources insist on electrolyte drinks; the Netherlands currently also consider pure water to be sufficient. The teats should be placed 50 cm to 100 cm above the floor and at least 10 cm below the ceiling. There must be enough space around the trough so that the calves can comfortably stand in front of it and suckle. There should be at least one drinker per 3.5 m² and at least 2 drinkers per compartment. The water pressure must be set so that the slightest pressure on the nipple – by sucking the calves – water flows, but no water flows out without actuation. The drinkers with teats must be installed in such a way that they are not broken off by the calves and thus unusable, but that the calves cannot injure themselves. If the means of transport to be approved do not have such facilities, approval must be restricted to weaned animals!

Belgium

There are assembly centres for unweaned non-replacement calves in Belgium. These are used as a place of departure for transport to other countries, but they are also used as a place of destination for calves arriving after a long journey. At the assembly centre, unweaned calves received from other MS are regrouped and then sent usually sent on a short journey to the holding. The CA in Belgium reports they have no real data on the average length of stay of calves at an assembly centre, but the journey- and resting times of Regulation (EC) No 1/2005 have to be respected.

Denmark

The typical journey for a Danish unweaned calf is:

- collection from the farm early morning
- transport to the assembly centres where they stay for up to 6 hours
- same afternoon they will be transported to the place of destination, where the journey normally takes 12-17 hours.

Portugal

The assembly centres, which are involved in the intracommunity cattle trade, are not specifically focussing on the trade of unweaned dairy calves. In Portugal, the transport of unweaned dairy calves to other MS is very limited.

Slovenia
The CA does not issue certificates to road vehicles for the transport of unweaned calves Certificates are issued according to the species and category of animals transported (e.g. vehicle is approved for the transport of bovines excluding the transport of unweaned bovines). The exit point and control post at the Port of Koper is not approved for receiving unweaned animals as a result no export of unweaned dairy calves takes place from Slovenia from there exit point.

Romania
There are assembly centres where unweaned calves spend up to six days, but usually they are kept for approximately one day before being placed on transport to another MS.

Lithuania
According to the legislation, assembly centres are not allowed to keep animals longer than 6 days after arrival. On the day of departure for long journeys unweaned calves are not allowed to be younger than 15 days of age. Restrictions apply for extremely hot and cold weather conditions, starting from postponement of long journeys until weather conditions will be suitable. In hot weather, the journeys could be allowed in night time when temperatures are lower and not harmful to the calves. In addition, more strict inspections are carried out before the journey to check if water supply is sufficient for the planned journeys. Journey logs are inspected after the journey is over. For local rearing and fattening calves are not transported for long journeys from assembly centres.

United Kingdom
There have been no unweaned calf exports from England and Wales for some years. Calf exports from Scotland came to an end in 2020 when, during judicial review proceedings against them, the Scottish Government decided that the length of the journeys from Scotland to the control post in northern France where unweaned calves were rested (from farms in Scotland to assembly centre in southern Scotland, to Ramsgate, a port in the south of England, and then shipped to northern France), exceeded the permitted travelling times laid down in Council Regulation (EC) No 1/2005. Accordingly, the Scottish Government no longer permits calf exports. Unweaned calves continue to be exported from Northern Ireland to Spain. They are taken by road to the Republic of Ireland from where they are sent on an 18-hour sea journey to northern France. Finally they are driven through France to Spain. No additional measures were or are implemented by the transport companies for long-journey transport of unweaned calves.

4.3 Legislation on long-journey transport

Summary: Revision of Regulation (EC) No 1/2005 is ongoing. Available information shows that the current Regulation contains weaknesses in the design, implementation, compliance and enforcement. The lack of clarity of certain provisions results in divergent transposition and implementation across the EU MS. This creates an uneven level playing field for EU business operators and poses additional challenges to a proper and uniform enforcement by the CAs. Several MS adopted additional rules to implement Regulation (EC) No 1/2005 in their national legislation. For example, Germany included two laws that requires a minimum stay on the dairy farm of 28 days and a maximum national transport duration of 8 hours, starting 01-01-2023. Sweden prohibits long journeys on young, unweaned animals.

This overview is based on the outcomes of the e-survey and the interviews with stakeholders. Since not all MS responded to the e-survey, information can be missing.

Regulation (EC) No 1/2005, the animal transport regulation

Regulation (EC) No 1/2005 is aimed at protecting the welfare of animals during transport. It lays down common rules for the transport of live vertebrate animals between EU or with non-EU countries in order to prevent injury or unnecessary suffering to the animals. It aims to avoid injury or undue suffering to animals during transport and to harmonise the EU market. It applies to all live vertebrate animals transported in connection with an economic activity within the EU, as well as to all consignments entering or leaving the customs territory of the European Community. The regulation also defines the responsibilities of the actors involved in the transport of live animals across MS, entering or leaving the EU. Together with this regulation, the European Commission developed and disseminated Guides to Good and Better Practice for the transport of animals.[49] Specific guidelines were drafted for calves.[50]

In the 2018 assessment of Regulation (EC) No 1/2005, it was concluded that progress for the standard of welfare had been made since the adoption of the regulation, but the long-journey transport of unweaned calves was identified as a problematic issue, and progress is needed in the future.[51]

To gather further evidence to support the revision of Regulation (EC) No 1/2005, in 2020 the Commission initiated a fitness check of the current rules on the welfare of animals at farm, during transport and at slaughter, to be concluded in 2022. Preliminary findings of the fitness check indicate that there are significant shortcomings related to EU animal welfare legislation in force, which result in sub-optimal levels of animal welfare for farmed animals. The shortcomings relating to the transport of unweaned calves are as follows:

- A lack of tools to properly monitor, measure and report the result and impacts of the legislation.
- Poor management of animals due to the lack of appropriate skills and competences of staff handling animals; lack of tools and resources to assess said skills and competencies.
- A lack of sufficiently specific and detailed requirements for the protection of certain animal species, resulting in inadequate protection of the welfare of those species.
- Enforcement issues, further aggravated by the low quality of monitoring data and specific welfare indicators. Lack of coherent enforcement of requirements by CA. The implementation of remedial action following non-compliance is uneven across the MS.
- The use of Directives to protect animals at farms has contributed to differing levels of animal welfare between MS. While regulations are binding in their entirety and directly applicable in all MS, directives are only binding as to the results to be achieved, leaving the choice of forms and methods to national authorities. These variations in animal welfare standards have led to competitive distortions in the internal market.52

The ANIT Public Hearing on the long-journey transport of live animals within the EU presented a number of shortcomings in the enforcement of Regulation (EC) No 1/2005 in relation to the long-journey transport of unweaned calves. The main issues were:

- There is inconsistent enforcement of Regulation (EC) No 1/2005 and there is a lack of a harmonised approach.
- Strict enforcement of Regulation (EC) No 1/2005 on long-journey transport of unweaned dairy calves is not possible, since animals cannot be supplied according to their needs during transport (Art. 3). This especially holds true for the long-journey transport of unweaned calves. For example, the adequate provision of water and feed is often not possible.
- Enforcement of the regulation is difficult due to the lack of emergency unloading stations for animals.

[49] http://animaltransportguides.eu/
[50] http://animaltransportguides.eu/wp-content/uploads/2016/05/Cattles-Calves-FINAL.pdf
[51] European Parliament, Directorate-General for Parliamentary Research Services, Baltussen, W., Spoolder, H., Wagenberg, C., et al., Regulation (EC) No 1/2005 on the protection of animals during transport and related operations : European implementation assessment, Dinu, A.(editor), European Parliament, 2018, https://data.europa.eu/doi/10.2861/15227.
[52] DG SANTE. (2020a). Fitness check of the EU legislation on animal welfare of farmed animals. Brussels: European Commission. Retrieved from https://ec.europa.eu/food/system/files_en?file=2020-05/aw_fitness-check_roadmap.pdf

- Exchange of information between authorities: approximately 75% of exports of live animals from the Netherlands are carried out by transporters from other MS. So, MS experience challenges when imposing sanctions on those transporters, for example in the case of non-returned journey logs and refusal to submit satellite navigation system (SNS) data and temperature recordings.[53]
- Many of the problems in animal transport originate from unclear legislative provisions, misleading requirements and the lack of clear definitions, which leave room for interpretation The source of systematic violations originate from unharmonised and uneven application of the rules, increasing the risks for animals and for their well-being, which can undermine the level playing field between operators in the sector, leaving the companies and MS which abide by the rules facing unfair competition from those which do not, which in turn can lead to a 'race to the bottom' regarding animal welfare standards during transport.,[54]

National regulation on animal transport

Article 1(3) of Regulation (EC) No 1/2005 allows MS to adopt stricter national measures aimed at improving the welfare of animals during transport taking place entirely within their territory or during sea transport departing from their territory. A number of MS have adopted additional legislation or implementation rules to regulate the transport of unweaned calves.[55]

The Netherlands

The position of the Dutch Minister of Agriculture is that long distance transport of farm animals, including unweaned calves, should be avoided as much as possible. The Netherlands wants a transition to more local slaughter and transport of meat and genetic material. For slaughter animals and unweaned animals, long-distance transports (under current rules >8 hours) should not take place and should be forbidden in the upcoming revision of Regulation (EC) No 1/2005. In addition, long-distance transports of live animals by road and by sea to third counties should be banned as well. In fact, transport of live animals as such is currently under scrutiny in the Netherlands. At this moment, the protection of young, unweaned animals, in the opinion of the Dutch government is not sufficiently guaranteed by Regulation (EC) No 1/2005.

Before any changes in policy will be made, the Dutch Ministry of Agriculture will wait for propositions of the EU, and a scientific advice of EFSA. Legally speaking, there is limited room for a more specific, welfare friendlier policy in the Netherlands. This can be done by national interpretations of Regulation (EC) No 1/2005, for example as a "work instruction. An example of such a work instruction is a maximum outside temperature of 35 degrees for animal transports. The other option is to make stricter national rules that, according to Article 1.3 of Regulation (EC) No 1/2005, only apply for transports that start and end on the territory of the Netherlands. This option is not favoured because animal transports are mostly cross-boundary operations and national stricter rules lead to practical difficulties for the industry and the CAs. In addition, alternative transport operations may develop to avoid the national stricter rules. This may even lead to negative effects on the welfare of animals (increase of intra-EU trade and therefore longer transport times, for example). In the opinion of the Dutch government, at this moment, there is a distinct lack of harmonisation in the field of animal transport between MS, in terms of interpretation of the rules, and the level of enforcement and the sanctions that are applied in case of non-compliance. Proper harmonisation within the EU is considered to be of the utmost importance.

No additional regulation related to the transport of live animals is in place, although a number of work instructions are available to ensure compliance with Regulation (EC) No 1/2005.[56] On a national level, a number of additional regulations and quality systems developed and implemented by private organisations and NGOs are in place, including:

[53] https://www.europarl.europa.eu/cmsdata/230287/Questions-Answers_Dutch%20Ministery%20of%20Agriculture_NEW%20VERSION_EN.pdf
[54] https://www.europarl.europa.eu/doceo/document/A-9-2021-0350_EN.pdf
[55] This overview is based on information for the e-survey and the in-depth interviews.
[56] https://www.nvwa.nl/onderwerpen/vervoer-levende-dieren

- The so-called 'Kalf Volg Systeem' (Calf Surveillance System), which involves a data system that allows for the identification and tracking of each individual calf across the production chain, from birth until slaughter.
- A specific heat protocol in the Netherlands which stipulates the temperature thresholds above which the transport of live animals is not allowed.
- The animal transport sector has implemented a quality system for the pig sector, i.e. Quality Livestock Transport (QLT). A similar system will also be launched in the veal sector in the near future. All companies affiliated to the sector organisation of the Dutch animal transport sector Vee&Logistiek have to comply with QLT in order to be officially recognised.
- In the veal sector, the so-called Guarantee System for Tracing SKV Veal Calves (GTSKV) is in place. This allows for the identification of international transport movements of unweaned calves, from the moment of departure, e.g. an assembly centre abroad, until the final destination in the Netherlands. SKV is the 'Stichting Kwaliteitsgarantie Vleeskalveren' (Foundation Quality Guarantee Veal Calves). It was originally founded to promote the quality of veal and to guarantee that veal is produced without the use of undesirable growth-promoting agents. Membership of SKV (by veal farmers, legal owners, assembly centres, processors or their transporters) demonstrates that you meet the current quality requirements within the veal sector.
- In the Netherlands the Dutch Society for the Protection of Animals has developed the so-called 'Better Life Label' which indicates for animal products (such as meat, eggs and milk) the level of welfare of the farm animals that provided these products. The conditions defined in this label also include specific requirements with regard to the transport of farm animals, including unweaned calves.

Italy

In Italy there is no additional national legislation, only Regulation (EC) No 1/2005 is in force.

Spain

In Spain, Law 32/2007 (November 7)[57] is a general regulation for applicable penalties related to animal welfare. This Law aims to: a) establish the basic rules on exploitation, transport, experimentation and sacrifice for the care of animals and a common system of infractions and sanctions to ensure compliance, and b) regulate the sanctioning power of the General Administration of the State on export and import of animals from or to non-EU countries with regard to their attention and care and on the animals used for experimentation and other scientific purposes.

Furthermore, two *Real Decreto*s were put in place to implement Regulation (EC) No 1/2005 into Spanish national legislation. *Real Decreto 1047/1994* establishes the minimum standards for the protection of confined calves for breeding and fattening.[58] *Real Decreto 542/2016* establishes application provisions of Regulation (EC) No 1/2005 with regard to authorisation and registration of carriers, authorisation and registration of means of transport and containers, transport documents, staff training, obligations of carriers and other operators regarding the protection of animals during transport and related operations. It also designates the entry points through which road transport vehicles for live animals of the equine, porcine, bovine, ovine and goat species, loaded or empty, as well as road transport vehicles for feed, loaded or empty, may enter (empty, coming from certain third countries). Finally, it establishes provisions for the application of Law 8/2003, of April 24, on animal health, in relation to the transport of animals.[59]

Germany

[57] https://www.boe.es/buscar/pdf/2007/BOE-A-2007-19321-consolidado.pdf
[58] https://www.boe.es/buscar/act.php?id=BOE-A-1994-15800
[59] https://www.boe.es/buscar/doc.php?id=BOE-A-2016-11708

Two types of legislation are implemented: Tierschutztransportverordnung – TierSchTrV[60] and the Verordnung zur Änderung der Tierschutz-Hundeverordnung und der Tierschutztransportverordnung.[61] As per 1/1/2023 calves will be banned from being transported up to 28 days of age in Germany. The duration of journeys within Germany should be less than 8 hours.

Ireland

No additional regulation is in place, however to comply with Regulation (EC) No 1/2005, Trader Notice 01/2019[62] and Trader Notice 01/2021[63] were implemented, with conditions for long-journey transport being reviewed.

Sweden

Calves should be at least 1 month of age before being moved (SJVFS 2017:24, Saknr. L104). Transporting calves under 1 month of age is not advised but can under certain circumstances be allowed. In the latter situation, calves need to be at minimum 2 weeks old, the transporter needs to be approved for such transport and the transport duration cannot exceed eight hours. Farmers are allowed to transport their own 2-week-old calves without a permit if the travelling distance is shorter than 65 km and if this only occurs to a limited extent (i.e. less than eight times per year). Farmers can also transport their calves less than two weeks of age if the calves are healthy and fit for transport. This can only be done with transporters which are fit for loading and unloading such young animals and only over distances shorter than 50 km.

4.4 Data on the mortality of calves during long journeys and within the first seven days after being transported, including culling due to poor growth or diseases

Summary: The mortality rate of calves during and after long journeys to the Netherlands is approximately 1.5% in the first 56 days after arrival, according to data from the industry. This rate is similar to the mortality rate of domestic calves and of unweaned calves that arrived after short-journeys. Similar mortality rates of calves during and after long journeys were reported in Italy and Spain. Research shows that the most likely reason for this that calves that were transported on long journeys were heavier and older than domestic calves at the moment of arrival.

Impact of long-journey transport on animal welfare, health and mortality

Although EFSA has extensively reviewed the various welfare aspects of intensive calf farming systems,[64] transport has not been considered in this opinion. Gerritzen et al. (2016) reviewed the literature on the possible impact of frustration regarding physiological and ethological needs during long journeys on the welfare of unweaned calves.[65] They concluded that despite the fact that not all physiological and ethological needs can be met during transport, long journeys in accordance with the Regulation (EC) No 1/2005 appear to be acceptable from the point of view of adaptability of young calves. Their study provides grounds for the assumption that good health and an adequate nutritional condition of young calves prior to loading on the truck are important preconditions for coping with long journey transport.

In a recent study, the differences between 6 and 18 hours journeys from an assembly centre to the veal farm, in interaction with feeding either milk or electrolytes at the assembly centre prior to transport, demonstrated

[60] https://www.gesetze-im-internet.de/tierschtrv_2009/BJNR037500009.html
[61] https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl121s4970.pdf%27%5D__1644148345302
[62] https://assets.gov.ie/89405/de833343-d78b-4443-b7cd-106ff0cdc59d.docx
[63] https://assets.gov.ie/131580/d20aa145-72d4-4593-b31b-271239d1e83b.pdf
[64] EFSA Panel on Animal Health and Welfare. 2012. Scientific Opinion on the Welfare of Cattle Kept for Beef Production and the Welfare in Intensive Calf Farming Systems. Vol. 10
[65] Gerritzen, M. A., M. Kluivers-Poodt, and C. G. van Reenen. 2016. Fysiologische En Ethologische Behoeften van Niet Gespeende Kalveren in Relatie Tot Transport Langer Dan 8 Uur. Wageningen.

that unweaned calves transported for 18 hours were more dehydrated, as suggested by increased concentrations of albumin and osmolality 48 hours post transport. Feeding milk prior to transport did not prevent these increases in blood values when transported for 18 hours. However, calves recovered quickly since calves restored their (below) pre-transport values within a 24 hour post-transport period. The authors remarked, however, that values related to minerals and fat mobilisation obtained prior to transport at the assembly centre were already markedly different from reference values in the literature, suggesting that calves used in this experiment, under practical conditions, were already challenged by the transport to and their stay at the assembly centre when the first blood sample was taken. The authors suggested that this might be due to multiple use of medical treatments in the first weeks. Alternatively, it might be that the collective effects of the transition from the dairy farm to the veal farm, and of the husbandry conditions during the subsequent rearing period, on the adaptive capacity of calves were so large that effects of individual transport-related factors were overruled. [66] A follow-up study with the same animals showed that the transport-related factors did not have any long-term effects on the clinical health of the calves [67]

A presentation of the Animal Welfare Science Centre at the University of Melbourne supports this view. Australia (400 000-700 000 calves per year) and New Zealand (2 million per year) have a system for slaughtering unweaned calves at a very young age, so called 'bobby calves'.[68] These countries do not have a well-established industry for rearing calves for beef or veal production. Bobby calves are destined for human consumption or pet food. The majority are transported over long journeys to regional abattoirs and killed under the age of seven days. Animal welfare legislation requires calves to be at least five days old and fed within six hours prior to transport. In addition, they are required to be fit and healthy for journeys lasting up to a maximum of twelve hours. To measure the direct effects of transport on the welfare of calves, bobby calves could be regarded as 'canaries in the coal mine'. Blood was collected from >4 500 bobby calves at three Australian abattoirs and checked for energy status, hydration and colostral immunity. Preliminary results suggested that most bobby calves had adequate hydration and energy, but poor colostral immunity was found in around 33% of them, suggesting that these young calves possibly run the risk of getting ill when used for fattening. An earlier Australian study in bobby calves clearly demonstrated that overall mortality increased exponentially from 0.2% (100 km) to 2.5% (800 km) with increased transportation distance.[69] In a case-control study with bobby calves, it appeared that the risk of mortality increased when calves were transported for longer. Importantly with regard to travel duration, no threshold for increased mortality was apparent, meaning that any increase in journey time increased the risk, implying the shorter the journey, the lower the risk (MPI, 2018).[70] Although caution should be exercised in extrapolating these results to the EU context because of differences in age and conditions, it is reasonable to expect that with increasing journey distances the condition of calves would become progressively weakened due the stresses of transportation and adverse environmental conditions. Gerritzen et al. (2016) reported that some researchers therefore advise against the transport of unweaned calves over longer journeys until they are at least four weeks old.

Recent research on the relation between MS of origin and health problems after arrival at the veal calves farm gives mixed results. Based on routinely collected data from seven different data sources, containing information from 2.4 million white veal calves that were fattened between 2011 and 2014. Higher risks were identified for calf mortality in calves originating from Poland and Lithuania, compared with calves from

[66] Marcato, F., H. van den Brand, B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020a. "Effects of Pretransport Diet, Transport Duration, and Type of Vehicle on Physiological Status of Young Veal Calves." Journal of Dairy Science 103(4):3505–20.
[67] Marcato, F., H. van den Brand, H., B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020b. Transport of young veal calves: effects of pre-transport diet, transport duration and type of vehicle on health, behavior, use of medicines, and slaughter characteristics. Frontiers in Veterinary Science (doi: 10.3389/fvets.2020.576469)
[68] Roadknight, Natalie and Andrew Fisher. 2018. "The Australian System for Managing Non-Replacement Dairy Calves." 30.
[69] Cave, J. G., A. P. L. Callinan, and W. K. Woonton. 2005. "Mortalities in Bobby Calves Associated with Long Distance Transport." Australian Veterinary Journal 83(1–2):82–84.
[70] Cave, J. G., A. P. L. Callinan, and W. K. Woonton. 2005. "Mortalities in Bobby Calves Associated with Long Distance Transport." Australian Veterinary Journal 83(1–2):82–84

Germany.[71] A recent study of critical success factors in the Dutch veal industry, however, indicated that batches with 100% Dutch calves, corrected for starting weights, had a higher antibiotic use (up to 10%) than comparable batches from other countries of origin. The authors assumed that this was because the Dutch calves were not usually selected for quality beforehand, and almost all Dutch surplus calves were fattened as veal calves.

A study on risk factors for respiratory disease in veal calves obtained the prevalence of this clinical condition on a total of a total of 174 veal farm distributed across the three main veal producing MS in Europe (France, Italy and the Netherlands). Notably, the MS of origin of the calves (i.e. national versus foreign, including Ireland and Eastern Europe) did not affect the prevalence of respiratory disease.[72]

An important finding made by Santman-Berends et al. (2018) was that a higher body weight of calves at arrival was associated with a lower mortality, even after correction for age at arrival as a confounder.[73] These results were in agreement with those of Brscic et al. (2012), who found that a lower body weight at arrival was associated with an increased risk of developing respiratory infections, which is an important contributor to mortality.[74] Winder et al. (2016) also confirmed the relationship between body weight at arrival and risk of death in the first six months.[75] Bokma et al. (2017) confirmed that body weight at arrival at the veal farm is highly relevant for reducing antibiotic use. Within the bandwidth of the starting weights in the study population (i.e. approximately 40-53 kg), antibiotic use was found to decrease by at least 1% per kg higher average starting weight of the batch. Heavier calves are generally more robust and/or had fewer health problems.[76]

Santman-Berends et al. (2018) also pointed to the possible effects on calf price. Apart from higher body weights at arrival on the fattening farm, Belgian Blue crossbreds appeared to have a lowered mortality risk. The authors hypothesised that this could be due to the fact that Belgian Blue calves are very valuable, resulting in better healthcare to maximise the probability of survival. Supporting evidence for this hypothesis came from the veal industry, stating that they only select specific farmers for fattening Belgian Blue calves.

Research on the relations between MS of origin and health problems after entry to veal calf and beef farms farm gives mixed results. It is difficult to disentangle the transport effect from factors such as age and live weight at arrival, robustness of calves or MS of origin.[77]

Besides the issues above, attention will also be given to the following issues that have an impact on the welfare of unweaned calves during transport and possibly increase the mortality rate during and after transport:

- Mixing of calves from different origin sources**:** potential exposure of calves to pathogens against which they may not have antibodies. This results in the higher susceptibility of calves to specific pathologic agents, resulting in disease.

[71] Santman-Berends, I. M. G. A., A. J. G. De Bont-Smolenaars, L. Roos, and J. Velthuis, A, G. 2018. "Using Routinely Collected Data to Evaluate Risk Factors for Mortality of Veal Calves." Preventive Veterinary Medicine 157(January):86–93
[72] Brscic, M., L. F. M. Heutinck, M. Wolthuis-Fillerup, N. Stockhofe, B. Engel, E. K. Visser, F. Gottardo, E. A. M. Bokkers, B. J. Lensink, G. Cozzi, and C. G. Van Reenen. 2011. "Prevalence of Gastrointestinal Disorders Recorded at Postmortem Inspection in White Veal Calves and Associated Risk Factors." Journal of Dairy Science 94(2):853–63
[73] Santman-Berends, I. M. G. A., A. J. G. De Bont-Smolenaars, L. Roos, and J. Velthuis, A, G. 2018. "Using Routinely Collected Data to Evaluate Risk Factors for Mortality of Veal Calves." Preventive Veterinary Medicine 157(January):86–93
[74] Brscic, M., H. Leruste, L. F. M. Heutinck, E. A. M. Bokkers, M. Wolthuis-Fillerup, N. Stockhofe, F. Gottardo, B. J. Lensink, G. Cozzi, and C. G. Van Reenen. 2012. "Prevalence of Respiratory Disorders in Veal Calves and Potential Risk Factors." Journal of Dairy Science 95(5):2753–64.
[75] Winder, Charlotte B., David F. Kelton, and Todd F. Duffield. 2016. "Mortality Risk Factors for Calves Entering a Multi-Location White Veal Farm in Ontario, Canada." Journal of Dairy Science 99(12):10174–81.
[76] Bokma-Bakker, M. H., van Riel, J. W., de Lauwere, C. C., Antonis, A. F. G., & Kluivers-Poodt, M. (2017). Onderzoek naar kritische succesfactoren voor een laag antibioticumgebruik bij vleeskalveren: Rapport van het project Kritische Succesfactoren Vleeskalveren (KSF Vleeskalveren). (Livestock Research rapport; No. 1068A). Wageningen UR Livestock Research. https://doi.org/10.18174/427965
[77] .H. Bokma-Bakker, J.W. van Riel, C.C. de Lauwere, A.F.G. Antonis en M. Kluivers-Poodt, 2017., Onderzoek naar kritische succesfactoren voor een laag antibioticumgebruik bij vleeskalveren, Wageningen Livestock Research, Rapport 1068A

- Young age of calves: calves are usually transported around 14-20 days of age, when their gastrointestinal tract and thermoregulatory ability still have to be developed and their adaptive immune system is not yet fully functional.
- High stocking density: high stocking density during transport has a negative impact on calves because they cannot lie down and adjust their posture (especially during long journeys), meaning their stability decreases and the risk of stress and injuries increases. An excessively low stocking density might be also associated with loss of stability and risk of injuries.
- Suboptimal transport conditions (temperature, humidity, draught, vibrations): the physical conditions within the vehicles represent a challenge for calves. Calves, in particular, have a limited thermoregulatory ability because of their young age, so high or low ambient temperatures and high levels of humidity transport outside the comfort zone of calves (15-25°C) are likely to cause thermal stress. It is necessary to avoid temperature extremes.
- Access to water: the ample availability of water during transport may reduce dehydration of calves.
- Prolonged hunger and thirst from withdrawal of food during transport: fasting and effects related to negative energy balance have a negative impact on animals.
- Long transport duration (> 8 hours): long journeys increase fatigue in calves, lack of water leads to dehydration and Lack of feed to hunger and fatigue.
- Absence of comfortable bedding in the truck: the truck should be provided with adequate bedding material to guarantee the comfort of calves.
- Rough handling, especially during loading/unloading: the behaviour of drivers/handlers can affect the stress levels of calves.
- Driving (sudden accelerations/breakings): careful driving is crucial for good welfare and is necessary to avoid problems related to falls or bruising.

Results from the interviews and e-survey

Respondents from the industry from both the Netherlands and Italy indicated that the incidence of morbidity and mortality of calves originating from other MS was substantially lower than that of domestic calves. This topic is further elaborated upon in the next section on animal health and welfare issues.

The Netherlands

The Dutch veal industry has detailed record keeping systems. Upon request, the sector organisation of the Dutch veal calf industry (SBK)[78] provided cumulative annual mortality rates during the first 56 days after arrival on the veal calf farm (Table 6). Data for the separate years are presented in Annex 5. For the period 2017-2020, the average mortality rate during the first 56 days was 1.5%. As Table 6 shows,

Table 6 mortality on day 1 and 2 of the fattening period is low, but increases between 7 and 14 days after transport. The average mortality rate before day 56 of calves originating from the Netherlands and neighbouring MS (Belgium, Denmark, Germany, and Luxembourg) in the period 2017-2020 was 1.58%, and that of calves from more distant MS (the Czech Republic, Estonia, Ireland, Latvia, Lithuania and Slovakia) was 1.51%. There are considerable differences in the mortality rate between MS of origin. Please note that these numbers exclude the postnatal mortality rate (<14 days of life) on the dairy farms which was for Dutch dairy farms 3.3%. [79]

Table 6. Cumulative mortality rates on Dutch veal calf farms on day 1 and 2, and up to day 7, 14 and 56 of the fattening period by MS of origin in the period 2017-2020 (source: data SBK)

MS of origin	Average number calves received per /year	On day 1	On day 2	Up to day 7	Up to day 14	Up to day 56

[78] Stichting Brancheorganisatie Kalversector

[79] I.M.G.A. Santman-Berends, Y.H. Schukken, G. van Schaik,, Quantifying calf mortality on dairy farms: Challenges and solutions, Journal of Dairy Science, Volume 102, Issue 7, 2019,Pages 6404-6417, ISSN 0022-0302, https://doi.org/10.3168/jds.2019-16381. (https://www.sciencedirect.com/science/article/pii/S0022030219304102)

Belgium	22 434	0.00%	0.04%	0.20%	0.74%	1.84%
Czech Republic	17 713	0.00%	0.01%	0.14%	0.31%	1.08%
Germany	545 228	0.00%	0.01%	0.19%	0.64%	1.75%
Demark	31 423	0.00%	0.00%	0.10%	0.28%	1.23%
Estonia	21 649	0.01%	0.02%	0.26%	0.49%	1.35%
Ireland	57 935	0.00%	0.01%	0.20%	0.42%	1.12%
Italy	103	0.00%	0.00%	0.00%	0.24%	0.97%
Lithuania	7 098	0.00%	0.03%	0.36%	0.82%	2.19%
Luxembourg	18 813	0.00%	0.01%	0.14%	0.50%	1.10%
Latvia	22 608	0.00%	0.00%	0.36%	0.78%	1.97%
Netherlands	920 533	0.00%	0.01%	0.12%	0.43%	1.39%
Poland	610	0.00%	0.00%	0.66%	1.48%	3.81%
Romania	66	0.00%	0.00%	0.00%	0.38%	5.30%
Slovakia	2 109	0.00%	0.01%	0.15%	0.36%	1.34%
Total	**1 668 320**	**0.00%**	**0.01%**	**0.15%**	**0.51%**	**1.50%**

Italy

Stakeholders interviewed did not see any problems linked to long-journey transport. They were unanimously convinced that calves coming from abroad are significantly more robust than domestic calves transported via a short journey. Calves originating from other MS need less antimicrobial treatment (20–30% lower health costs per batch compared with nationals) and have lower mortality rates. The stakeholders ascribed the higher robustness of the calves from other MS to: better calf care (particularly colostrum management; internal screening indicates that 90% of foreign calves have an adequate level of serum immunoglobulins, compared to 30% of domestically born calves); health status (i.e. they are free from certain infectious diseases such as Bovine Viral Diarrhoea, Infectious Bovine Rhinotracheitis, and salmonella); and management practices (e.g. vaccination plans or genetic type) adopted in the countries of origin. Other positive factors in favour of the calves originating from other MS include the selection of animals made before transport, as well as the higher average weights and the older average age of the foreign calves upon arrival to Italian veal farms. Stakeholders reported that, in order to avoid health problems, the desirable Holstein calf's live weight should be around 47 kg and the age at arrival as near as possible to 45 days (but not older for commercial reasons). Stakeholders estimated the mortality rates during long-journey transport of unweaned calves originating from other MS at less than 0.02% and mortality and culling within seven days after transport at between 0.05 and 1.0% (Table 7).

Table 7. Mortality rates of unweaned calves in Italy originating from other MS (opinion of representatives of Italian veal calf sector)

Journey time	Mortality rate during transport (%)	Mortality within 7 days after transport (%)	Culling within 7 days after transport (%)	Mortality and culling (%)
8 hours or less	0	0	0	Less than 1%
From 8 to 19 hours	0	0	0	Less than 1%
More than 19 hours	0.02% (max 0.10%)	0	0	Between 0.05–25%
All journey times	0.02%	0	0	Less than 1%

The companies transporting unweaned calves to Italy usually originate from the MS of origin of the calves (mainly Ireland and the Netherlands). No other details on transport over long journeys were available. Representatives of the industry were not familiar with long-journey transport conditions. In general, they did not notice many differences between the characteristics of cattle transported over long or short journeys. They reported that transport companies respect the requirements of the law in force (for example of animal density,

litter, water availability) and that the best transport conditions are applied by companies from the Netherlands (air conditioning present on the trucks is considered a great benefit for calf welfare and state upon arrival).

Spain

Representatives of a farmer association, a transport company and a retailer/food services in Spain all indicated that the mortality rate during and shortly after transport of calves entering Spain originating from other MS is low.[80] They observed no difference in mortality rate related to the duration of the journey. As an example, data from the week preceding the survey indicated no dead animal out of 4 000 calves transported from one of the consulted sources. Another consulted source indicated that mortality within the first seven days after transport was 0% of calves originating from Germany, 1% from Ireland and 1% from France. A study published in 2011 reported a mortality of 0.6%, independent of the destination (other farms, slaughter) and that the number of injured animals during transport was 2.7%, with the most common injuries being lameness, leg injuries and unspecific wounds.[81]

Results of the e-survey from other MS

Most respondents of the e-survey were not aware of data recorded on mortality during transport of unweaned calves. The limited data provided varied between 0.01% and 0.3%.

4.5 Requirements related to the transport of calves during long journeys: non-compliance, measures taken, monitoring tools and the results obtained

Summary: From 2015 to 2020, 0.1-0.2% of the consignments of cattle for production in TRACES had instances of animal welfare non-compliance, and 0.3-1.0% had instances of animal health non-compliance. Welfare non-compliance concerned exceeding travelling times (20% of consignments with welfare non-compliance), supplementary measures for journeys of long duration (16%), data registration in the logbook (15%), and watering and feeding (14%). Animal health non-compliance concerned document mismatch (33% of consignments with instances of health non-compliance), other examples of non-compliance (33%), absence of additional guarantee (16%), and invalid destination address (16%).

Animal welfare non-compliance in TRACES

Each year from 2015 to 2020, 0.1-0.2% of the total number of consignments of cattle for production recorded in TRACES had one or more instances of animal welfare non-compliance. In these years, instances of animal health non-compliance were recorded for between 0.3 and 1.0% of these consignments, with the lowest percentages in the last three years. Several stakeholders, both CA and NGOs, state that follow up of complaints differ between MS. Both priority and fines differ substantially.[82]

The ANIT committee noted that “it is particularly difficult to enforce Regulation (EC) No 1/2005 where a transport passes through a number of Member States and where various Member States have approved the journey log and have issued the transporter with the authorisation and the registration certificate for the vehicle, and the certificate of competence for the driver; it noted further that where Member States identify violations of the provisions of Regulation (EC) No 1/2005, they must notify such violations to all other Member States, in accordance with Article 26.[83]

[80] Source: response to questionnaire by Asporovac dd 22/11/2021)
[81] Reference: Averós, X., Riu, M., López, J., Herranz, A., Ribó, O., Gosálvez, L.F. Transport of Cattle in Spain. Technical, Administrative, and Welfare Aspects According to the Destination. Arch. Zootec. 2011; 60 (230): 163-173.
[82] https://www.europarl.europa.eu/committees/en/hearing-on-long-distance-transports-insi/product-details/20201120CHE07861
[84] Roche, J., Berry, D., Delaby, L., Dillon, P., Horan, B., Macdonald, K., & Neal, M. (2018). Review: New considerations to refine breeding objectives of dairy cows for increasing robustness and sustainability of grass-based milk production systems. Animal, 12(S2), S350-S362. doi:10.1017/S1751731118002471

Table 8. Number of consignments of cattle for production and percentage of these with animal welfare or animal health non-compliances from 2015 to 2020 (source: TRACES)

	2015	2016	2017	2018	2019	2020	Average
Total number of consignments	58 474	65 028	69 660	67 502	68 399	70 128	66 532
% with animal welfare non-compliances	0.1%	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%
% with animal health non-compliances	0.6%	1.0%	0.4%	0.3%	0.3%	0.3%	0.5%

The number of consignments of cattle for production per year with instances of animal welfare non-compliance recorded in TRACES varied between 72 and 172, with an average of 100 per year (Table 9). One instance of non-compliance was recorded for 60 to 92% of these consignments, depending on the year. Consignments with up to seven instances of non-compliance were also recorded. The most recorded welfare non-compliance concerned exceeding travelling times (20% of consignments with welfare non-compliance), supplementary measures for journeys of long duration (16%), data registration in the logbook (15%), and watering and feeding (14%) (Table 10).

Table 9. Number of consignments with number of simultaneous animal welfare non-compliances for cattle moved for production from 2015 to 2020 (source: TRACES)

Number of simultaneous instances of non-compliance	2015	2016	2017	2018	2019	2020	Total
1	59	65	49	58	77	158	466
2	10	37	17	13	20	12	109
3	0	6	6	2	2	1	17
4	1	1	0	0	0	1	3
5	1	0	0	0	0	0	1
7	1	0	0	0	0	0	1
Total	72	109	72	73	99	172	597

Table 10. Number of consignments[1] with each animal welfare non-compliances for cattle moved for production from 2015 to 2020 (source: TRACES)

Animal welfare non-compliances	2015	2016	2017	2018	2019	2020	Total
8.1. Transporter authorisation invalid	4	1	1	7	1	3	17
8.2. Non-compliance of the means of transport	9	12	7	5	3	3	39
8.3. Stocking density exceeded	5	1	0	3	1	2	12
8.4. Travel times exceeded	10	22	22	24	30	9	117
8.5. Watering and feeding not fulfilled	7	35	15	14	4	7	82
8.6. Mishandling or negligence to the animals	3	1	1	0	1	1	7
8.7. Supplementary measures for the journeys of long duration	7	25	16	13	27	10	98
8.8. Certificate of proficiency of the driver	2	5	2	0	2	1	12
8.9. Data registered in the log book	25	18	16	6	13	9	87
8.10. Other	23	41	21	18	41	144	288

[1] Sum of consignments per year exceeds number of consignments with non-compliance, because consignments can have multiple non-compliances.

The number of consignments with cattle for production per year with instances of animal health non-compliance recorded in TRACES varied between 211 and 628, with an average of 317 per year (Table 11). Instances of animal health non-compliance were recorded three times more than those of animal welfare non-compliance. One instance of animal health non-compliance was recorded for 67 to 88% of these consignments, depending on the year. Consignments with up to four instances of animal health non-compliance were also recorded. The most recorded instances of non-compliance concerned document mismatch (33% of consignments with instances of health non-compliance), other examples of non-compliance (33%), absence of additional guarantee (16%), and invalid address of destination (16%) (Table 12).

Table 11. Number of consignments with number of simultaneous animal health non-compliances for cattle moved for production from 2015 to 2020 (source: TRACES)

Number of simultaneous non-compliances	2015	2016	2017	2018	2019	2020	Total
1	293	554	244	182	167	147	1 587
2	46	63	28	25	49	66	277
3	7	9	6	4	4	4	34
4	3	2	0	0	0	1	6
Total	349	628	278	211	220	218	1 904

Table 12. Number of consignments[1] with each animal health non-compliances for cattle moved for production from 2015 to 2020 (source: TRACES).

Animal health non-compliances	2015	2016	2017	2018	2019	2020	Total
9.1. Absence/Invalid certificate	27	54	13	4	13	8	119
9.2. Mis-match with documents	130	169	100	61	80	89	629
9.4. Non approved region/zone	1	0	1	2	0	0	4
9.6. Absence of additional guarantee	45	57	42	31	49	84	308
9.7. Non approved holding	1	4	0	0	3	8	16
9.8. Diseased or suspect animals	4	0	6	3	3	1	17
9.9. Unsatisfactory tests	2	3	1	2	0	1	9
9.10. Absence or non-legal identification	16	15	10	13	9	9	72
9.11. National requirements not fulfilled	24	94	22	12	14	9	175
9.12. Address of destination invalid	56	80	53	37	43	28	297
9.13. Other	112	239	70	79	63	58	621

[1] Sum of consignments per year exceeds number of consignments with non-compliances, because consignments can have multiple non-compliances.

Animal welfare non-compliance from interviews

The Netherlands

Most of the non-compliances are detected by the competent authorities within Member States. In the Netherlands this is the NVWA (Netherlands Food and Consumer Product Safety Authority). There are differences between Member States with regard to the way competent authorities actually perform their controlling task; therefore, a level playing field seems to be lacking. This is a point of concern, and it is of the utmost importance that a level playing field on this topic is achieved and maintained within the European Union.

Italy

The Italian stakeholders consider non-compliance to be very rare, and that it is uncommon for refusal of entry to the MS due to non-compliance in the case of long-journey transport. They believe that this kind of transport is subjected to sufficient controls, even though there is potential for additional implementation efforts. The latter should concern the quality of the controls rather than the frequency, as they consider frequent delays in long-journey transport as being very undesirable, particularly from an animal welfare point of view.

Spain

The Spanish stakeholders interviewed had no information on this subject.

Non-compliance prior to transport

Besides the non-compliances reported in Traces, non-compliance can also be observed prior to the transport and as a result the transport will not be approved and not certified.

The e-survey provided a number of incompliances observed prior or during transport. The frequency of the incompliance observed differs substantially (between < 0.01% and 100%) and might depend on the respondent's vision on the transport of unweaned calves. The most mentioned incompliances are:

- Transport is carried out in vehicles that are not specifically approved for the transport of unweaned animals;
- Unsuitable drinking facilities for unweaned calves;
- Transport of unweaned calves on journeys over 8 hours even though calves not given water or feed after 9 hours transport;
- Exceeded journey time;
- No one hour rest period after 9 hours transport;

- Different driver and vehicle details;
- Unloading of unweaned calves for feeding with milk replacer after the first transport section (after 9 hours) to a control post for 1 hour which is not approved for this purpose;
- Calves exported from Northern Ireland go for 28 hours or more without feed between the last feed before loading and being fed at a control post in northern France;
- The duration of transport from farm to first assembly centre is not being considered in transport duration;
- Maximum transport time has been exceeded for many years (loading and unloading were not counted as transport time);
- "Assembly centre hopping" (calves do not stay for at least 48 hours at the second assembly centre);
- Incomplete journey logs;
- Non-sufficient planning, means of transport not suitable for the journey, missing drivers competence; and
- In a number of occasions, the places of destination mentioned in the transport applications are distribution hubs where animals stay only a few hours before being transported further.

MS of origin of the transporting companies

In a number of MS, the main transporters involved in the long-journey transport of unweaned calves from their territory are based in their MS. However, a large number of MS mention that transport is carried out by transporting companies in other MS. The most frequent MS of origin are: the Netherlands, Germany, Italy, Poland and Hungary. For Ireland, the majority of the transporters involved in unweaned calf transport are based in Ireland, but a substantial number are also based in Northern Ireland (UK).

5 Identification and analysis of existing alternatives

Summary: Reduction and replacement are currently only used to a limited extent as alternative strategies for transport of calves over long journeys. Multiple strategies exist to refine the long-journey transport of unweaned calves.

In this chapter, we examine and evaluate alternative strategies for long journeys. The selection and description is based on a literature review, interviews, e-survey and expert opinion. Alternative strategies for transport of unweaned dairy calves on long journeys can be grouped into 3 basic strategies based on the "3Rs" principle. The "3 Rs" principle refers to the expression "replace, reduce or refine" applied in animal testing. In the context of this study:

- "Replace" means any alternative where transport irrespective of the distance of unweaned dairy calves on long journeys (> 8 hours) is not practiced.
- "Reduce" means any alternative whereby the number of long journeys by unweaned dairy calves (> 8 hours) is reduced.
- "Refine" means any alternative whereby the impacts of long journey conditions on unweaned dairy calves (> 8 hours) is mitigated.

We examine and evaluate alternative strategies for long journeys. The selection and description is based on a literature review, the interviews, e-survey and expert opinion. The alternatives that prevent transport of dairy are described in the section **replace**, the alternatives that limit transport time are describes in the section **reduce**. The section **refine** focuses on those measures can contribute to increase animal welfare of unweaned calves during long-journey transport.

5.1 Strategies to replace long-journey transport of unweaned calves

Summary: Strategies to replace long-journey transport of unweaned calves include avoiding that unweaned non-replacement calves are born (breeding strategies to increase milk production), fattening the calves on the dairy farm of birth, fattening the calves on specialised fattening farms very close to the dairy farms of birth, and using sexed dairy semen and beef semen to improve beef production characteristics of the non-replacement calves for fattening in the MS of birth.

Breeding strategies to increase milk production

A first strategy to replace long-journey transport of unweaned claves is a further reduction of the number of non-replacement dairy calves born by breeding strategies. The number of dairy calves born can be reduced by raising average milk production per dairy cow, assuming that the market volume for dairy products will not change. The same volume of milk will then be produced from fewer dairy cows, thus needing fewer births. In addition to this reduction strategy, breeding for a higher persistency in lactating cows could also reduce the number of surplus calves, since a longer inter-calving interval reduces the number of calves born per year.

The obvious benefit of this strategy is that fewer calves are born and as a result the number on non-replacement calves decreases. However, increasing milk production implies high levels of craftmanship and management. If this cannot be provided, negative implications on animal welfare of the dairy cows might occur. This strategy is difficult to combine with the increased emphasis on the efficiency with which natural resources are used, because this strategy requires more and high-

quality feed. It might be difficult to increase the amount of fodder produced from existing farmland while simultaneously reducing environmental degradation, maintaining or improving the animal's quality of life and providing a sustainable economic return to the farmer.[84] This strategy is especially feasible for those MS in which dairy production is characterised by a high-input-high-output system (e.g. the Netherlands, Germany, Denmark). In MS that depend to a large extent on a pasture-based system (e.g. Ireland) this strategy is less feasible.

Fattening non-replacement calves on dairy farms in dairy-beef systems

These systems are characterised by fattening all unweaned non-replacement calves on the dairy farm of birth for veal or beef production. This system requires specialised dairy farms with the capacity to take good care of these calves.[85] An example of such a dairy-beef system is the production system 'bulls from dairy calves' in the South of Germany that links milk production and beef finishing as described in Deblitz et al. (2008).[86] Breeds used are typically Holstein and are usually recruited from the own dairy herd on the farm. Other systems include dairy cows which also nurse their calves. Some producers, mainly organic farmers, explore a system where calves are allowed – more or less restricted – to suckle either their dams or foster cows until the natural weaning age.[87] This system is also common practice in MS with a large number of small dairy farms (e.g. Romania) in which born male calves are fattened on the farm of birth. In a number of MS in which environmental regulation limits the number of animals present at the farm (e.g. due to regulation on nitrogen or greenhouse gasses emissions), keeping the unweaned non-replacement calves will not be possible unless the number of dairy cows is decreased. This will result in a decrease of farm income.

Fattening on specialised fattening farms very close to the dairy farm of birth

This concept has been developed in Switzerland where unweaned non-replacement calves were purchased and transported directly from neighbouring dairy farms of birth to outdoor fattening farms with a car drive of 30 min or less.[88] Calves were vaccinated upon arrival at the fattening unit and they had to be in quarantine for at least three consecutive weeks. Calves were then placed in an outdoor group pen and the group composition remained the same until slaughter. These measures compensated for conditions that compromise animal health and are yet inherent to veal production, such as purchase of calves from other farms and calves' immature immune system at the beginning

[84] Roche, J., Berry, D., Delaby, L., Dillon, P., Horan, B., Macdonald, K., & Neal, M. (2018). Review: New considerations to refine breeding objectives of dairy cows for increasing robustness and sustainability of grass-based milk production systems. Animal, 12(S2), S350-S362. doi:10.1017/S1751731118002471

[85] Rell, J., N. Wunsch, R. Home, M. Kaske, M. Walkenhorst, and M. Vaarst. 2020. Stakeholders' perceptions of the challenges
to improving calf health and reducing antimicrobial use in Swiss veal production. Prev. Vet. Med. 179, 104970. doi:
10.1016/j.prevetmed.2020.104970.

[86] Deblitz, C., J. Brommer, and D. Bruggemann. 2008. Beef production in Germany-production systems and their spatial distribution. Landbauforschung Volkenrode, 58(1/2), 29.

[87] Johnsen, J.F., K.A. Zipp, T. Kälber, A.M. de Passillé, U. Knierim, K. Barth, and C.M. Mejdell. 2016. Is rearing calves with the dam a feasible option for dairy farms?—Current and future research. Appl. Anim. Behav. Sci. 181, 1–11. doi: 10.1016/j.applanim.2015.11.011.

[88] Becker, J., G. Schüpbach-Regula, A. Steiner, V. Perreten, D. Wüthrich, A. Hausherr, and M. Meylan. 2020. Effects of the novel concept 'outdoor veal calf'on antimicrobial use, mortality and weight gain in Switzerland. Prev. Vet. Med. 176, 104907. doi:10.1016/j.prevetmed.2020.104907.

of the fattening period.[89,90] This system is only feasible in some MS during a limited period of the year, because the climatic conditions do not allow year-round outdoor keeping of young calves. Large scale implementation of this strategy is not likely to occur.

Using sexed dairy semen and beef semen to improve beef production characteristics of the non-replacement calves for fattening in the MS of birth

Sexed dairy semen can be used to reduce the number of male dairy calves born on dairy farms.[91] The development of recent technologies to produce sexed semen, which have substantially improved its fertility[92], can lead to the birth of 90% of female calves.[93] The use of sexed semen will not entirely solve the problem of surplus, but can definitively reduce the number of unweaned males of the dairy type on a dairy farm. This strategy is effective when the use of sexed semen in the dairy herd to breed a specific number of replacement heifer calves, is combined with using beef semen of excellent beef breeds like Belgian Blue, Piemontese, or Aberdeen Angus for the remaining dairy cows. Using sexed dairy semen and beef semen does not decrease the total number of calves born, but it replaces non-replacement dairy calves with crossbred calves. Using sexed dairy type semen does not decrease the total number of calves born, but it replaces non-replacement dairy calves with crossbred calves. The latter have several advantages over typical non-replacement dairy calves that might reduce long-journey transport or improve welfare during and after transport.

- Crossbred calves are more suited for beef production than dairy calves. Decreasing the proportion of typical dairy calves in favour of crossbred calves contributes to the performance of the national beef production, since growth rate, meat quality and the body composition of crossbreeds surpasses that of typical dairy calves.
- Second, the higher birth weight of crossbreed calves compared to that of dairy-type calves results in heavier animals at the moment of transport. As a consequence of being heavier and more robust, these calves have a lower probability of developing welfare issues during and after transport when they are transported at a young age.

A pilot study in Ireland showed that the main purpose of sexed dairy semen was to improve the genetic gain of animals, but survey respondents perceived the costs of this technique as a barrier. Despite the discussion on high costs and concerns on lower conception rates, more difficult calving and higher stillbirths, sexed semen was seen by veterinarians, farmers and the advisors as a promising strategy that could positively impact animal welfare.

Economic analysis (see Annex 6) shows that using sexed dairy semen to inseminate the top-performing cows and beef semen on the other dairy cows is economically more favourable than using only non-sexed dairy semen if the revenue price of an unweaned crossbred calf is about €33

---

[89] Lava, M., B. Pardon, G. Schüpbach-Regula, K. Keckeis, P. Deprez, A. Steiner, and M. Meylan. 2016. Effect of calf purchase and other herd-level risk factors on mortality, unwanted early slaughter, and use of antimicrobial group treatments in Swiss veal calf operations. Prev. Vet. Med. 126, 81-88. doi: 10.1016/j.prevetmed.2016.01.020.

[90] Schnyder, P., L. Schönecker, G. Schüpbach-Regula, and M. Meylan. 2019. Effects of management practices, animal transport and barn climate on animal health and antimicrobial use in Swiss veal calf operations. Prev. Vet. Med. 167, 146-157. doi: 10.1016/j.prevetmed.2019.03.007.

[94] M. de Vries, C.E. van Middelaar, I.J.M. de Boer, Comparing environmental impacts of beef production systems: A review of life cycle assessments, Livestock Science, Volume 178, 2015, Pages 279-288, ISSN 1871-1413, https://doi.org/10.1016/j.livsci.2015.06.020.

[94] M. de Vries, C.E. van Middelaar, I.J.M. de Boer, Comparing environmental impacts of beef production systems: A review of life cycle assessments, Livestock Science, Volume 178, 2015, Pages 279-288, ISSN 1871-1413, https://doi.org/10.1016/j.livsci.2015.06.020.

[94] M. de Vries, C.E. van Middelaar, I.J.M. de Boer, Comparing environmental impacts of beef production systems: A review of life cycle assessments, Livestock Science, Volume 178, 2015, Pages 279-288, ISSN 1871-1413, https://doi.org/10.1016/j.livsci.2015.06.020.

higher than that of an unweaned non-replacement dairy calf. It is economically more favourable than using non-sexed dairy semen and beef semen if the revenue price of an unweaned crossbred calf is about €80 higher than for an unweaned non-replacement dairy calf. As shown in Figure 3, the prices for unweaned crossbred calves (around €220 per head) were more than twice that of unweaned non-replacement dairy calves (around €100 per head), reflecting the lower value of unweaned non-replacement dairy calves for the veal and beef fattening sector, suggesting that this can be a feasible option.

The success of using the sexed semen option in combination with the use of beef semen on cows not needed for producing replacement dairy calves in reducing long-journey transport of unweaned calves depends to a large extend on the possibility to increase beef production within the MS of birth of these calves.

Number of cows to be inseminated with sexed dairy semen in the EU to reduce or replace long-journey transport of unweaned non-replacement dairy calves

As the analysis in Section 4.1 shows, of the approximately 17.5 million unweaned non-replacement calves born annually in the EU, approximately 580 000 annually were estimated to be transported in the EU over long journeys (>8 hours). Thus, the largest part of the unweaned non-replacement calves were either not moved, transported locally, or moved in transport between MS with a travel time of less than 8 hours. Using the data from the Netherlands, we estimated how many cows need to be inseminated with sexed semen to replace this number of unweaned dairy calves moved on long journeys with crossbreed calves. Using sexed dairy semen in 38 out of every 100 dairy cows and beef semen in the remaining 62 dairy cows can reduce the number of born unweaned non-replacement dairy calves with 55 per 100 cows (from 58 to 3). This would mean that around 400 000 dairy cows in the EU (and the remaining non-replacement cows with beef semen) would have to be inseminated with sexed dairy semen annually, with the majority in France, Ireland, Germany and the Czech Republic (Table 13). At additional insemination costs of sexed semen around €21 (minimum €14, maximum €27, depending on the bull) per inseminated cow (prices CRV, dairy Holstein black and white published on 8 December 2021), this would mean an increase in insemination costs of around €8.4 million annually (ranging €5.6 to €10.8 million). However, these costs can be compensated by the higher revenue price of unweaned crossbred calves compared to unweaned non-replacement dairy calves, if the additional beef on the market does not have too large of a negative impact on the market price of crossbred cattle.

Table 13. Estimated number of dairy cows to be inseminated with sexed semen to compensate for the number of unweaned dairy calves moved on long journeys in the EU from 2015 to 2020 (source: own calculations).

MS	2015	2016	2017	2018	2019	2020	Average 2015-2020
Austria	5 074	5 662	7 910	17 505	19 396	16 605	12 026
Belgium	139	4 311	18 653	49 386	20 826	12 519	17 639
Bulgaria	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0
Czechia	43 093	45 426	33 381	34 986	41 138	52 059	41 680
Germany	63 887	64 673	66 556	65 466	34 105	15 815	51 750
Denmark	16 527	20 786	19 378	21 912	29 541	26 906	22 510
Estonia	20 968	16 797	21 390	18 259	17 966	17 087	18 745

MS	2015	2016	2017	2018	2019	2020	Average 2015-2020
Spain	10 160	4 890	5 158	6 606	7 160	7 846	6 970
Finland	0	0	0	0	0	0	0
France	55 357	67 370	74 519	77 743	103 564	99 739	79 714
GB	0	10	13 663	13 984	6 405	2 588	6 109
Greece	0	0	0	0	0	0	0
Croatia	0	0	0	136	0	0	23
Hungary	218	117	437	2 866	3 009	2 169	1 470
Ireland	39 122	47 004	72 190	116 660	110 324	90 721	79 336
Italy	21 067	17 668	4 574	2 029	1 022	1 407	7 959
Lithuania	1 511	5 509	17 066	20 707	11 668	12 523	11 497
Luxembourg	0	0	176	0	0	0	30
Latvia	23 928	18 171	19 831	7 227	6 240	2 569	12 995
Malta	0	0	0	0	0	0	0
Netherlands	6 650	22 749	25 812	23 842	29 038	28 503	22 766
Poland	15 538	5 628	777	256	1 227	439	3 978
Portugal	1 112	327	141	0	6	337	321
Romania	1	0	127	252	2 120	232	456
Sweden	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0
Slovakia	540	65	1 907	3 347	3 013	4 307	2 196
total	324 893	347 165	403 648	483 167	447 767	394 370	400 168

Environmental impact of increased beef production

A transfer from veal calf production of dairy type calves with long journeys to local beef production of cross breeds will have an environmental impact. The older age at slaughter and a diet with more roughage will increase greenhouse gas emissions per kg of meat produced. On the other hand less transport is needed and less high-quality nutrients, like milk powder, might be needed. However, whether the additional greenhouse gas emissions result in local or national environmental problems largely depends on type of beef production (extensive versus intensive) and the area of production (existing environmental problems).[94,95]

5.2 Strategies to reduce long-journey transport of unweaned calves

Summary: Strategies to reduce long-journey transport of unweaned calves include voluntary or compulsory banning of long journeys and fattening in beef or veal farms in the close vicinity of the dairy farms. This will affect veal and beef production both in the MS of origin and in the MS of destination. It is likely that long journeys will be replaced by short journeys, increasing the number of unweaned calves transported on short journeys as well as the risk of assembly centre hopping. A

[94] M. de Vries, C.E. van Middelaar, I.J.M. de Boer, Comparing environmental impacts of beef production systems: A review of life cycle assessments, Livestock Science, Volume 178, 2015, Pages 279-288, ISSN 1871-1413, https://doi.org/10.1016/j.livsci.2015.06.020.

[95] Mollenhorst H, Berentsen PBM, Berends H, Gerrits WJJ, de Boer IJM. Economic and environmental effects of providing increased amounts of solid feed to veal calves. J Dairy Sci. 2016 Mar;99(3):2180-2189. doi: 10.3168/jds.2014-9212. Epub 2016 Jan 21. PMID: 26805966.

number of MS from which a large amount of unweaned calves are currently transported on long journeys will face serious challenges due to the lack of feasible alternatives on the short-term.

Banning of long journeys

An alternative to reduce long-journey transport is a ban of long journeys for unweaned calves. Banning of all transport of unweaned calves is currently considered unfeasible. This would imply that non-replacement calves need to stay on the farm of birth until weaning age. Most dairy farms are not equipped to house a large number of unweaned calves for an extended period. Therefore, the rest of this section focusses on a ban of long journeys.

At present, a number of MS already restrict long journeys of unweaned calves. This is either based on legislation (e.g. Sweden) or voluntary measures taken by integrators (e.g. the Netherlands). The Dutch voluntary ban on long journey transport resulted in a replacement of long journeys from eastern EU MS by short journeys originating in neighbouring MS, especially Germany, within a few years. The largest veal integrator in the Netherlands, the Van Drie Group, announced in their 2020 Corporate Social Responsibility Report that they will completely abolish receiving calves from Ireland and eastern EU MS in 2026. Another Dutch veal integrator, the Pali Group, currently does not import calves from eastern EU MS. Despite this development in the Netherlands, the number of unweaned calves moved on long journeys in the EU remained high at on average 544 000 animals per year, with Spain and Italy, and also still the Netherlands, sourcing a significant number of unweaned calves with transport times exceeding 8 hours.

To evaluate the challenges related to a ban on long journey transport, attention should be given to factors in the MS of origin of long journeys of unweaned calves and in the MS that are the destination of these calves.

MS of origin for long-journey transport of unweaned calves

Around 90% of the unweaned calves moved from Ireland to other MS, around 45% moved from France, and around 10% moved from Germany, were on long journeys. For Estonia and Latvia, the absolute numbers of unweaned calves transported on long journeys are limited, however these represent a large fraction of the total amount of unweaned non-replacement calves born (Table 5). In all these MS, the number of unweaned non-replacement calves exceed the locally available veal and beef production capacity.

Ireland

In Ireland, the number of dairy cows increased substantially after abolishment of the milk quota system and as a consequence the number of unweaned non-replacement calves born increased as well. Given the geographical location of Ireland, all transport to other MS almost by definition involves long-journey transport. Environmental constraints limit an increase of the cattle population.[96] A ban on long journeys would require that 1) the dairy population would need to be decreased to allow the local fattening of the unweaned non-replacement calves currently transported abroad, 2) the current beef production would need to be restructured to be able to use these calves or 3) these calves would need to be killed directly after birth (which is unlikely to be accepted). Local fattening of the unweaned non-replacement calves would increase the environmental impact of beef production in Ireland, probably raising it above the allowed limits. Restructuring the current system, which is mainly based on suckler cows, to a system of fattening of unweaned calves based on dairy cows inseminated with beef semen could reduce the

[96] Interview with Competent Authorities in Ireland

environmental impacts of Irish beef production.[97] This would allow for more unweaned non-replacement calves to be fattened in Ireland and reduce the number of calves needed to be transported on long journeys to other MS. Although several initiatives are explored to find alternatives to fatten these calves are in an experimental stage, willingness to implement these alternatives is still limited.[98]

France

France has a veal calf production to add value to unweaned non-replacement dairy calves. However, the current capacity to use domestic calves is only half the number of the unweaned non-replacement dairy calves born per year. Beef production is mainly using specialised beef breeds. Therefore, substantial numbers of unweaned calves are transported to other MS. Given the localised dairy production (Northwest of France), this mostly involves long journeys. Banning of long-journey transport would imply local fattening of these animals, most likely in veal calf production. This would mean a doubling of the current veal meat production and would involve substantial investments in the industry.

Germany

In Germany, although substantial numbers of unweaned dairy calves are transported on long journeys, this is only about 10% of the total number of unweaned non-replacement dairy calves born. Banning of long journeys would imply local fattening of these animals, most likely for veal calf production. This would mean an increase in the current veal and beef meat production.

Estonia and Latvia

For the Baltic states Estonia and Latvia, replacing long journeys with short journeys is challenging because the closest MS that sources a substantial number of their calves (i.e. Poland) already involves long-journey transport. Domestic fattening is challenging given the small current beef production in these MS.

MS receiving unweaned calves on long-journey transport

Most unweaned non-replacement dairy calves that are involved in long journeys are transported to Spain (beef calf production) or the Netherlands and Italy (veal calf production). Both production practices are highly specialised and depend on available local suppliers (feed and services) and specialised slaughter and packing facilities to create maximum value of the veal meat. There are substantial economic benefits of integrating regionally concentrated veal and beef production. However, both high initial investments and a high production capacity is needed to create and maintain competitive advantage. Because domestic supply of unweaned non-replacement dairy calves is insufficient to create and maintain substantial economy of scale, sourcing from other MS is needed.

The Netherlands

In the Netherlands, the expected decline in dairy cows due to environmental legislation will increase the dependency on unweaned non-replacement dairy calves from other MS. However, substantial

[97] M. de Vries, C.E. van Middelaar, I.J.M. de Boer, Comparing environmental impacts of beef production systems: A review of life cycle assessments, Livestock Science, Volume 178, 2015, Pages 279-288, ISSN 1871-1413, https://doi.org/10.1016/j.livsci.2015.06.020

[98] Maher, J. W., et al. (2021). "Exploring the Opinions of Irish Dairy Farmers Regarding Male Dairy Calves." Frontiers in Veterinary Science **8**. www.frontiersin.org/article/10.3389/fvets.2021.635565

public and political pressure exists to ban long-journey transport (local function), which has resulted in a voluntary reduction of long journeys and ultimately a voluntary ban.

Italy
In Italy, there is a seasonal shortage of calves, due to the reduced fertility in the hot summer season. A ban on long-journey transport would most likely result in sourcing from neighbouring MS.

Spain
For Spain, a ban of long journeys cannot easily be replaced by short journeys, because no unweaned non-replacement dairy calves are available in areas within a distance that would involve journey times of less than eight hours. As a consequence, a compulsory ban of long-journey transport would result in a restructuring of the beef industry, especially the Catalunya and Aragón regions, which depend to a large extent on unweaned calves originating from other MS.

Effects on unweaned calves transported
A long-journey transport ban without a decrease in veal calf and production in the Netherlands, Italy and Spain, will result in a strong incentive for veal calf or beef integrations to maintain the supply of unweaned calves. This means that they will need to source from MS that are closer to ensure transport time is less than eight hours. Most likely, calves that originally were fattened in those MS will be transported to their neighbours. Empty places in these MS will then be filled with unweaned calves from other MS. Thus, the number of long journeys will effectively decrease but the total number of animals transported on short-journeys would increase. For a number of MS, the supply of unweaned calves from neighbouring MS will be insufficient to meet their demand. In that case, the risk of the assembly centre hopping (i.e. dividing one long journey into several shorter journeys from one assembly centre to another) could increase.

Price effects
A ban on long-journey transport of unweaned calves is likely to have a price effect for dairy producers as well as for veal and beef producers.

Dairy producers
In MS that currently receive substantial number of unweaned animals from long journeys and in their neighbouring MS, dairy farmers are likely to receive higher prices for their unweaned non-replacement dairy calves, because demand for these calves of local origin increases. For dairy producers in MS where calves on long journeys originate, such as Ireland, Estonia and Latvia, the lack of alternatives to fattening unweaned non-replacement calves are likely to result in substantial lower prices of all unweaned non-replacement calves. Prices might even become that low that taking care of these animals might be jeopardised, resulting in welfare problems or killing of these calves on dairy farms.

Veal calf producers and beef producers
Veal calf producers in France and Germany will likely have to pay less for unweaned non-replacement calves when long journeys is banned, because the available number of unweaned non-replacement calves exceeds the production capacity of veal calves. For the Netherlands and Italy, a ban will likely result in higher prices for unweaned non-replacement dairy calves in the short run, because the demand for these calves from local production will increase. Beef producers in Spain face the same challenges as the veal calf producers in the Netherlands and Italy. When the supply of locally available calves is so small that production needs to be restructured, producing in MS with a surplus might be considered.

Fattening in beef farms in the close vicinity of the dairy farms

Fattening unweaned non-replacement calves either at specialised beef farms in the vicinity of the dairy farms of birth or at the dairy farm itself is a strategy is applied in most MS (and compulsory in MS like Sweden) and is the most predominant way of adding value to the unweaned non-replacement dairy calves. As Table 5 indicates, in most MS only a limited fraction of the non-replacement unweaned calves are transported over on a long journey. In some MS (as in Sweden), long-journey transport is banned and all animals are fattened either at specialised beef farms in the vicinity of the dairy farms or at the dairy farm itself.

5.3 To refine long-journey transport of unweaned calves

Summary: Strategies to refine long-journey transport of unweaned calves include various measures to mitigate potential negative effects of long journeys on health and welfare of calves. Several best practices within the framework of the current Regulation (EC) No 1/2005 can be implemented by the CA and transport companies. Best practices prior to transport include sound documentary check and application process prior to transports (e.g. agent details, payment of fees, truck or vessel plan, records of livestock transports, international certificates planned journey times, resting times, geographical route, declaration on handling extreme temperature), sound inspection of the transport vehicle and sound loading of animals. Moreover, aspects of importance prior to transport are appropriate genetics and good management practices, optimal feeding strategy prior to transport and optimal type of vehicle, ease of handling before, during and after transport and increasing the minimal age at which calves are allowed to be transported. Practices that can be taken to improve transport conditions consists of creating optimal climatic conditions, avoidance of extra loading and correct unloading procedures, mitigation of driving events (acceleration, breaking and cornering), provision of deep bedding material, water provision during transport, optimal stocking density during transport, and reducing commingling of calves during transport. Finally, CA could implement stricter enforcement if malpractices occur.

Best practices during transport

An important part of improving animal welfare of unweaned calves is making sure that appropriate practices are applied in terms of the safeguarding the health and welfare of the animals before, during and after transport. These practices are described in the next sections. In some MS, these practices are laid down in quality systems.

A healthy start at the dairy farm

Appropriate genetics and good management practices

A first alternative to reducing the impact of transport might be to start with calves that can better cope with the challenges they face during transport. Problems with transport of unweaned calves increase when calves weigh less and travel longer.[99,100] Body weight as well as immune status are critical factors in coping with these challenges. Genetic predisposition influences the ability to cope

[99] Santman-Berends, I.M.G.A., A.J.G. de Bont-Smolenaars, L. Roosa, A.G.J. Velthuis, and G. van Schaik. 2018. Using routinely collected data to evaluate risk factors for mortality of veal calves, 2018. Prev. Vet Med. 157, 86–93. doi: 10.1016/j.prevetmed.2018.05.013

[100] Winder, C.B., D.F. Kelton, and T.F. Duffield. 2016. Mortality risk factors for calves entering a multi-location white veal farm in Ontario, Canada. J. Dairy Sci. 99(12):10174-81. doi: 10.3168/jds.2016-11345.

with challenging situations by influencing the viability of calves.[101] There are breeds with a lower calf mortality within 24 hours after calving than Holstein Friesians (12.7%), such as Norwegian (3.4%) and Scandinavian Red Holsteins (4.7%).[102] Significant differences in mortality rates within 28 days after birth exist between breeds, varying from 2.8% in Jerseys, 1.5% in Holsteins to 0.7% and 0.2% in Simmental and Belgian Blue calves respectively.[103] Crossing specialised dairy breeds with excellent beef breeds increases the market value of calves, likely increasing the interest of the dairy farmer in taking better health care, and so resulting in the better condition of the calves and higher body weights when put on transport. Furthermore, keeping the calves for longer on the farm of origin seems to make them more resilient after arrival on the veal farm, and may also help them to better cope with the stresses of long duration transport. However, so far, the effect of age of unweaned calves on their ability to cope with transport has not been studied so far. [104,105]

The most common problems associated with transport of young calves are related to digestive tract disorders (especially diarrhoea), respiratory disorders and navel inflammation/infection.[106,107] These problems can be reduced with good colostrum management, farm hygiene and adequate calf management on the dairy farm.[71,108] Approximately 40% of calves that enter the veal industry suffer of failure of passive transfer and after arrival at the veal farm had a substantial higher risk for bovine respiratory disease.[82] Thus, feeding high quality colostrum at the dairy farm can confer adequate immune protection to calves against pathogens encountered during commingling procedures and transport. [109,110] Moreover, the amount of immunoglobulins in colostrum had a long-term influence on the amount of immunoglobulins in serum of calves.[73] The authors found that IgG titers in colostrum were positively related to IgG titers in serum of calves in week 1 after birth (ß = 0.614), a day prior to transport (ß = 0.620) and in week 2 (ß = 0.676) and 10 (ß = 0.189) at the veal farm. The high prevalence of navel inflammation in calves (especially bulls) upon arrival at veal farms is often reported in literature.[70,77,111,112,113] Male calves with enlarged and inflamed navels upon arrival at

[101] Mee, J.F. 2008. Newborn dairy calf management. Vet. Clin. N. Am-Food A. 24(1):1-17. doi: 10.1016/j.cvfa.2007.10.002.
[102] Mee, J.F., C. Sánchez-Miguel, and M. Doherty. 2014. Influence of modifiable risk factors on the incidence of stillbirth/perinatal mortality in dairy cattle. Vet. J. 199(1), 19-23. doi: 10.1016/j.tvjl.2013.08.004.
103 Bleul, U. 2011. Risk factors and rates of perinatal and postnatal mortality in cattle in Switzerland. Livest. Sci. 135(2-3), 257- 264. doi: 10.1016/j.livsci.2010.07.022.
104 Marcato, F., H. van den Brand, B. Kemp, B. Engel, S. Schnabel, F.A. Hoorweg, M. Wolthuis-Fillerup, and K. van Reenen. 2022b. Effects of transport age and calf and maternal characteristics on health and performance of veal calves. J. Dairy Sci. 105(2), 1452-1468. https://doi.org/10.3168/jds.2021-20637.
105 Marcato, F., H. van den Brand, B. Kemp, B. Engel, S. Schnabel, C.A. Jansen, V.P.M.G. Rutten, F.A. Hoorweg, A. Wulansari, M. Wolthuis-Fillerup, and K. van Reenen. 2022a. Calf and dam characteristics and calf transport age affect immunoglobulin titers and hematological parameters of veal calves. J. Dairy Sci. 105(2), 1432-1451. https://doi.org/10.3168/jds.2021-20636.
Sci. 105(2), 1452-1468. https://doi.org/10.3168/jds.2021-20637.
106 Thomas, G.W., and P. Jordaan. 2013. Pre-slaughter mortality and post-slaughter wastage in bobby veal calves at a slaughter premises in New Zealand. N. Z. Vet. J. 61:127–132. doi: 10.1080/00480169.2012.734374.
107 Pardon, B., J. Alliet, R. Boone, S. Roelandt, B. Valgaeren, and P. Deprez. 2015. Prediction of respiratory disease and diarrhea in veal calves based on immunoglobulin levels and the serostatus for respiratory pathogens measured at arrival. Prev. Vet. Med. 120(2):169-76. doi: 10.1016/j.prevetmed.2015.04.009.
108 Tyler, J.W., D.D. Hancock, J.G. Thorne, C.C. Gay, and J.M. Gay. 1999. Partitioning the mortality risk associated with inadequate passive transfer of colostral immunoglobulins in dairy calves. J. Vet. Intern. Med. 13:335–337. doi: 10.1111/j.1939-1676.1999.tb0219.x.
109 Quigley J.D., A. Lago, C. Chapman, P. Erikson, and J. Polo. 2013. Evaluation of the Brix refractometer to estimate immunoglobulin G concentration in bovine colostrum. J. Dairy Sci. 96, 1148–55. doi: 10.3168/jds.2012-5823.
110 Autio, T., T. Pohjanvirta, R. Holopainen, U. Rikula, J. Pentikainen, A. Huovilainen, H. Rusanen, T. Soveri, L. Sihvonen, and S. Pelkonen. 2007. Etiology of respiratory disease in non-vaccinated, non-medicated calves in rearing herds. Vet. Microbiol.119(2-4):256-65. doi: 10.1016/j.vetmic.2006.10.001.
[111] Wilson, L., J. Smith, D. Smith, D. Swanson, T. Drake, D. Wolfgang, and E.F. Wheeler. 2000. Characteristics of veal calves upon arrival, at 28 and 84 days, and at end of the production cycle. J Dairy Sci. 83(4):843-54. doi: 10.3168/jds.S0022-0302(00)74948-4.
[112] Bähler, C., A. Steiner, A. Luginbühl, A. Ewy, H. Posthaus, D. Strabel, T. Kaufmann, and G. Regula. 2012. Risk factors for death and unwanted early slaughter in Swiss veal calves kept at a specific animal welfare standard. Res. Vet. Sci. 92(1), 162-168. doi: 10.1016/j.rvsc.2010.10.009.

[113] Marcato, F., H. van den Brand, B. Kemp, B. Engel, S. Schnabel, F.A. Hoorweg, M. Wolthuis-Fillerup, and K. van Reenen. 2022b. Effects of transport age and calf and maternal characteristics on health and performance of veal calves. J. Dairy Sci. 105(2), 1452-1468. https://doi.org/10.3168/jds.2021-20637.

the veal farm are at higher risk for early mortality and late mortality compared to calves with a normal navel.

Preconditioning: prepare the calf prior to transport

Optimal feeding strategy prior to transport and optimal type of vehicle

Feed and water deprivation during transportation can result in dehydration and poor body condition upon arrival at the veal farm.[114,115] Various solutions are possible to avoid problems related to a negative energy balance.

A recent study[116] demonstrated that feeding calves with 1.5 litres of milk replacer before their transport from an assembly centre in Germany to a Dutch veal farm, is a good practice to avoid problems related to the negative energy balance. This study suggested that the higher nutrient and energy content of milk protected calves against the effects of transport on the mobilisation of body reserves (reflected in lower post transport levels of glucose, NEFA, B-HB and urea) and thus on body weight losses.

It is important to ensure an adequate feeding program (both quantity and quality of milk) of calves before being transported to the assembly centres, auction markets or rearing farms.[117] An important aspect to consider is the time of feeding. Calves should drink milk approximately three hours before their journey to allow them to properly digest the milk components and avoid gastrointestinal problems during and after transport.[118] Another aspect is sudden changes in the feeding habits of calves before the time of transport, which in combination with stress, fatigue and fasting period during transport, can contribute to intestinal problems.[119] With regard to the feeding method, milk or milk replacer should be administered by a flexible rubber teat in order to meet the behavioural/physiological need of calves to drink by suckling. It should also be provided at a temperature of 30ºC.[120]

In addition to feeding, the set-up and the type of trailer used for transport of unweaned calves can affect the animals during transport and their recovery after the journey. There is not a lot of knowledge on this field yet, but recent studies[121,122,123] showed that transport of unweaned calves

[114] Marcato, F., H. van den Brand, B. Kemp, and K. van Reenen. 2018. Evaluating potential biomarkers of health and performance in veal calves. Front. Vet. Sci. 5:133. doi: 10.3389/fvets.2018.00133.
[115] Creutzinger, K., J. Pempek, G. Habing, K. Proudfoot, S. Locke, D. Wilson, and D. Renaud. 2021. Perspectives on the management of surplus dairy calves in the United States and Canada. Front. Vet. Sci. 8, 344. doi: 10.3389/fvets.2021.661453.
[116] Marcato, F., H. van den Brand, B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020a. Effects of pre-transport diet, transport duration, and type of vehicle on physiological status of young veal calves. J. Dairy Sci. 103(4):3505-3520. https://doi.org/10.3168/jds.2019-17445.
[117] Devant, M., and S. Marti. 2020. Strategies for feeding unweaned dairy beef cattle to improve their health. Animals. 10, 1908. https://doi.org/10.3390/ani10101908
[118] Marahrens, M., and L. Schrader. 2020. Animal Welfare during Transport: technical requirements for long-distance transport of unweaned calves. Friedrich-Loeffler-Institut, Institute of Animal Welfare and Animal Husbandry (ITT), D-29223 Celle, https://www.openagrar.de/receive/openagrar_mods_00060429
[119] Research for ANIT Committee - Particular welfare needs in animal transport: unweaned animals and pregnant females (europa.eu)
[120] Research for ANIT Committee - Particular welfare needs in animal transport: unweaned animals and pregnant females (europa.eu)

[121] Marcato, F., H. van den Brand, B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020a. Effects of pre-transport
diet, transport duration, and type of vehicle on physiological status of young veal calves. J. Dairy Sci. 103(4):3505-3520. https://doi.org/10.3168/jds.2019-17445.
[122] Marcato, F., H. van den Brand, B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020b. Transport of young veal calves: effects of pre-transport diet, transport duration and type of vehicle on health, behavior, use of medicines, and slaughter characteristics. Front. Vet. Sci. 7, 1076. doi: 10.3389/fvets.2020.576469.
[123] Marcato, F., H. van den Brand, B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020c. Transport of young veal calves: effects of pre-transport diet, transport duration and type of vehicle on health,

in a conditioned truck (side-ventilated, well isolated and with climate control in terms of inlet and outlet of air) can affect the animals differently from transport in a regular truck (open, lacking climate control). However, the comparison between conditioned and regular transport provided contradictory results from an animal health and welfare perspective. For example, a study showed that the prevalence of loose or liquid manure in the first three weeks post-transport at the veal farm was lowest in electrolyte-fed transported in a conditioned truck (18%) in comparison with electrolyte-fed calves transported in an open truck (28%) and milk-fed calves transported in both the conditioned and open truck (31% on average).[124] Apparently, in combination with the pre-transport diet, the environment in the conditioned truck exerted protective effects on the likelihood of calves exhibiting loose or liquid manure during the first three weeks of the rearing period at the veal farm. However, additional results from this experiment[125] showed that physiological indicators including osmolality, sodium and rectal temperature were higher in calves transported in the conditioned truck compared to calves transported in the regular truck. Higher osmolality and sodium values usually reflect dehydration, and thus it could be speculated that calves in the conditioned truck experienced more dehydration, which might have compromised their thermoregulatory abilities, resulting in increased rectal temperature.[126] Since results did not demonstrate clearly what type of truck was better for physiological and behavioural needs of calves, further research is necessary to provide solid recommendations on the type of truck to use for transport of unweaned calves.

Ease of handling before, during and after transport

Younger calves have been shown to be more difficult to move compared to older cattle because they have not yet learned to herd and follow each other.[127] This difficulty in moving might expose them to an increased risk of poor handling. It is thus important to handle calves with ease and care to avoid stress and negative consequences of rough procedures. Negative practices that can increase slips during unloading and turning back during loading due to incorrect use of the facilities (e.g. parking leaving gaps between the ramp and the truck, sidewards deviations, or even incorrect levelling by choosing the wrong ramp when different ramp heights were available at the markets) should be avoided.[128] Additionally, during loading and unloading procedures, ramps should fulfil the requirements of having slopes ≤ 14°, slip-proof floors, side protection and an absence of sharp surfaces that might harm the animals.[88]

Increasing the minimal age at which calves are allowed to be transported

Age at transport is an important predictor of health status of calves in the weeks following transport.[129] Under the current practices, calves are transported to a veal farm at a legally required minimum age of 14 days.[67] However, at this age the immune system of calves is not completely functional. Such calves are in the “immune gap period” due to the combination of a decreased

---

behavior, use of medicines, and slaughter characteristics. Front. Vet. Sci. 7, 1076. https:// doi.org/10.3389/fvets.2020.576469.

[124] Marcato, F., H. van den Brand, B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020b. Transport of young veal calves: effects of pre-transport diet, transport duration and type of vehicle on health, behavior, use of medicines, and slaughter characteristics. Front. Vet. Sci. 7, 1076. doi: 10.3389/fvets.2020.576469.

[125] Marcato, F., H. van den Brand, B. Kemp, B. Engel, M. Wolthuis-Fillerup, and K. van Reenen. 2020a. Effects of pre-transport diet, transport duration, and type of vehicle on physiological status of young veal calves. J. Dairy Sci. 103(4):3505-3520. https://doi.org/10.3168/jds.2019-17445.

[126] Minka, N.S., and J.O. Ayo. 2010. Physiological responses of food animals to road transportation stress. Afr. J. Biotechnol. 9(40):6601-13.

[127] Jongman, E.C., and K.L. Butler. 2013. Ease of moving young calves at different ages. Aust. Vet. J. 91:94–98. doi: 10.1111/avj .12014.

[128] Bravo, V.M., T.G. Knowles, and C. Gallo. 2020. Transport, associated handling procedures and behaviour of calves marketed through chilean auction markets. Animals, 10(11), 2170. doi: 10.3390/ani10112170.

[129] Roadknight, N., P. Mansell, E. Jongman, N. Courtman, and A. Fisher. 2021. Invited review: the welfare of young calves transported by road. J. Dairy Sci. doi: 10.3168/jds.2020-19346.

passive immunity and the absence of a mature adaptive immune system.[130] A recent study showed that transport at 28 days of age might be better than transport at 14 days of age because calves have higher IgA and IgM titers (Δ = 0.56 and Δ = 1.19, respectively) in their serum in week 2 post-transport, which is a sign of improved adaptive immunity.[131] One day prior to transport, calves transported at 28 days of age had a higher lymphocyte count (Δ = 0.63×109/l) and a lower neutrophil count (Δ = -1.1 ×109/l) in their blood compared to calves transported at 14 days of age. These might also be indicators of an improved resilience of calves transported at an older age. Von Konigslow et al. (2020) showed that lymphocyte counts between 4.6 and 5.8 × 109/L were associated with a decreased hazard of mortality compared to lymphocyte counts < 4.6 or > 5.8 × 109/L, whereas lymphocyte counts > 5.8 × 109/L reduced the hazard of morbidity of calves upon arrival at the veal farm compared to lymphocyte counts < 5.8 × 109/L.[132] Elevated neutrophil counts (> 6.0 × 109/L) increased hazard of mortality by more than 5 times. These authors also concluded that especially an elevated lymphocyte count (> 7 × 109/L) might be used as an indicator of resilience to stress, in particular related to transport. In addition to blood biochemistry, there was a difference in performance data between calves transported at 28 and 14 days of age. Compared to transport at 14 days, transport at 28 days resulted in an enhanced performance as indicated by the following data: 1) lower mortality rate at the veal farm (2.8% vs. 5.9%); 2) lower prevalence of calves treated with medicines, other than antibiotics; and 3) higher carcass weight at slaughter (167 kg vs. 152 kg), even when corrected for differences in body weight upon arrival at the veal farm.[133]

A minimum age and body weight at transport are important parameters to avoid high morbidity and mortality in the fattening period. Masmeijer et al. (2019) observed that low body weight calves (< 46 kg of body weight and 2 to 4 weeks of age) even after 2 hours of transport showed leucocytosis and more pro-inflammatory stage compared with higher body weight calves (> 46 kg of body weight).[134] Moreover, Scott et al. (2020) reported that a lower weight at transport was associated with a decreased weight gain thereafter.[135] Other studies have also shown that calves with a lower body weight at transport/upon arrival at the veal farm were at greater risk of death in the first weeks of their rearing period on the farm.[63,136,137]

Germany

[130] Chase, C.C., D.J. Hurley, and A.J. Reber. 2008. Neonatal immune development in the calf and its impact on vaccine
response. Vet. Clin. N. Am-Food A. 24(1), 87-104. doi:10.1016/j.cvfa.2007.11.001.
[131] Marcato, F., H. van den Brand, B. Kemp, B. Engel, S. Schnabel, C.A. Jansen, V.P.M.G. Rutten, F.A. Hoorweg, A. Wulansari,
M. Wolthuis-Fillerup, and K. van Reenen. 2022a. Calf and dam characteristics and calf transport age affect immunoglobulin
titers and hematological parameters of veal calves. J. Dairy Sci. 105(2), 1432-1451. https://doi.org/10.3168/jds.2021-20636.
[132] von Konigslow, T. E., D. L. Renaud, T. F. Duffield, C. B. Winder, and D. F. Kelton, D.F. 2020. Assessing the utility of leukocyte differential cell counts for predicting morbidity, mortality, and growth in a grain-fed veal facility: A prospective single cohort study. J. Dairy Sci, 103(10), 9332-9344. doi: 10.3168/jds.2020-18532.

[133] Marcato, F., H. van den Brand, B. Kemp, B. Engel, S. Schnabel, F.A. Hoorweg, M. Wolthuis-Fillerup, and K. van Reenen.
2022b. Effects of transport age and calf and maternal characteristics on health and performance of veal calves. J. Dairy
Sci. 105(2), 1452-1468. https://doi.org/10.3168/jds.2021-20637.
[134] Masmeijer, C., B. Devriendt, T. Rogge, K. van Leenen, L. De Cremer, B. Van Ranst, P. Deprez, E. Cox, and B. Pardon. 2019. Randomized field trial on the effects of body weight and short transport on stress and immune variables in 2-to 4-week-old dairy calves. J. Vet. Intern. Med. 33(3):1514-1529. doi: 10.1111/jvim.15482.
[135] Scott, K., D.F. Kelton, T.F. Duffield, and D.L. Renaud. 2020. Short communication: Risk factors identified at arrival associatedwith average daily gain at a grain-fed veal facility: a prospective single cohort study. J. Dairy Sci. 103, 858-863. doi: 10.3168/jds.2019-17220
[136] Renaud, D.L., T.F. Duffield, S.J. LeBlanc, S. Ferguson, D.B. Haley, and D.F. Kelton. 2018. Risk factors associated with mortality at a milk-fed veal calf facility: a prospective cohort study. J. Dairy Sci. 101(3):1-10. doi: 10.3168/jds.2017-13581.
[137] Goetz, H.M., D.F. Kelton, J.H.C. Costa, C.B. Winder, and D.L. Renaud. 2021. Identification of biomarkers measured upon arrival associated with morbidity, mortality, and average daily gain in grain-fed veal calves. J. Dairy Sci. 104(1), 874-885. doi:10.3168/jds.2020-18729.

In Germany, from the first of January 2023, the minimum transport age for all unweaned calves will be 28 days instead of 14 days. Moreover, the duration of journeys within Germany will be limited to eight hours. This adjustments in the legislation will have several consequences for both dairy farmers and veal farmers. Keeping male unweaned calves longer on dairy farms will result in higher costs, estimated by representatives of the German dairy sector at €4.20 per calf per day.[138] Thus, keeping calves on dairy farms for two more weeks would result in costs of €60 per calf, which is higher than the current selling prices of calves. Although raising calves for a longer period on dairy farms might result in additional costs, it might also have some benefits. Older calves are likely to be able to better cope with long journeys because they are more robust than younger calves, but this has to be scientifically demonstrated. As indicated above in the study of Marcato et al. (2022b)[139], the higher robustness of older calves can also result in a higher health status and production results, such as carcass weights of these animals at the veal farm. Thus, higher carcass weights of calves transported to the veal farm at an older age, may allow the veal industry to pay a better price for these calves and therefore further compensate for the rearing costs for keeping calves longer on dairy farms.

Improving transport conditions

Optimal climatic conditions

As stated by Regulation (EC) No 1/2005, a sufficient ventilation should be provided in the truck the effective temperature inside the vehicle should range between 5 and 25ºC (+/− 5 °C). The automatic control of mechanical ventilation by the monitored temperature of a control system is technically feasible and beneficial in transport of unweaned calves. Additional preventative measures can be taken to avoid extreme temperatures (below freezing or > 30°C) which can cause poor welfare in transported animals.[140] Unweaned calves have low body fat reserves and are less able to thermoregulate during transport, with temperatures below their lower critical values.[141] Preventative measures that can be taken to avoid cold stress include avoiding transport during the coldest hours of the day, pre-warming vehicles by using heaters prior to loading, partially closing of ventilation openings (boarding) in the truck in order to reduce (cold) air flow, and adding a layer of at least 5 cm of styrofoam insulation to the vehicle ceiling.[142] Bedding on the truck floor such as woodchips, sawdust, cellulose or straw[143] – dry and absorbent – can also be used to prevent cold stress. In very high temperatures, calves can experience a significant increase in their body temperature as an inflammatory response to transport, body weight losses and alterations in their blood values associated with dehydration.[144,145,146] Thus, transport should be avoided in the

---

[138] https://www.topagrar.com/rind/aus-dem-heft/28-tage-mehrwert-fuer-kaelber-12751100.html

[139] Marcato, F., H. van den Brand, B. Kemp, B. Engel, S. Schnabel, F.A. Hoorweg, M. Wolthuis-Fillerup, and K. van Reenen.
2022b. Effects of transport age and calf and maternal characteristics on health and performance of veal calves. J. Dairy
Sci. 105(2), 1452-1468. https://doi.org/10.3168/jds.2021-20637.

[140] Grandin, T. 2014. Livestock handling and transport. 4th ed. CABI, Boston, USA.

[141] Hulbert, L.E., and S.J. Moisá. 2016. Stress, immunity, and the management of calves. J. Dairy Sci. 99(4):3199-216. doi: 10.3168/jds.2015-10198.

[142] Gonyou, H., and J. Brown. 2012. Competitive feeding systems. Science of Ethology 1.

[143] Schwartzkopf-Genswein, K., L. Faucitano, S. Dadgar, P. Shand, L. González, and T. Crowe. 2012. Road transport of cattle, swine and poultry in North America and its impact on animal welfare, carcass and meat quality: a review. Meat Sci. 92, 227-243. doi: 10.1016/j.meatsci.2012.04.010.

[144] Knowles, T.G., P.D. Warriss, S.N. Brown, J.E. Edwards, P.E. Watkins, and A.J. Phillips. 1997. Effects on calves less than one month old of feeding or not feeding them during road transport of up to 24 hours. Vet. Rec.140:116-24. doi: 10.1136/vr.140.5.116.

[145] Earley, B., M. Murray, and D.J. Prendiville. 2010. Effect of road transport for up to 24 hours followed by twenty-four hour recovery on live weight and physiological responses of bulls. BMC Vet. Res. 6(1), 1-13. doi:10.1186/1746-6148-6-38.

[146] Bernardini, D., G. Gerardi, A. Peli, L. Nanni Costa, M. Amadori, and S. Segato. 2012. The effects of different environmental conditions on thermoregulation and clinical and hematological variables in long-distance road-transported calves. J. Anim. Sci. 90(4):1183-91. doi: 10.2527/jas.2011-4113.

warmest hours of the day as well as changes of internal air quality during hauling when loaded trucks stop for 1 hour during long journeys.[147,148] Sand or sawdust bedding might also be used for transport of calves in high temperatures, because it retains less heat than straw. Air conditioning in vehicles prior to loading can also be used a preventative measure to avoid heat stress.[149]

The cost for a fully climatised transport are approximately 50% higher than costs of a current transport, according to a representative of the Dutch livestock transporting organisation. Due to space requirements for the additional machinery, 10 to 15% less animals can be transported per truck. Transverse ventilation system which enables filtration and monitoring of incoming air before reaching the inner space of the trailer increases the costs with approximately 25%. In the latter situation, loading capacity is not affected.

Avoidance of extra loading and unloading procedures

Extra handling during long journeys can cause additional stress to calves. Grandin et al. (2014) reported that loading and unloading animals into and out of transport vehicles can have very severe effects on animals, evidenced in behavioural and physiological responses.[93]

Mitigation of driving events (acceleration, breaking and cornering)

The driving style, especially sudden acceleration, braking, or cornering and rough road surfaces can cause instability, loss of balance and falls.[150] This can ultimately result in discomfort and alterations in the resting behaviour of calves. To avoid these circumstances, drivers should always avoid frequent and sudden vehicular adjustments to respond to road features.

Besides the compulsory certification system for trucks for transport between MS, a number of MS (e.g. Ireland and the Netherlands) introduced a training and certification system for truck drivers involved in the transport of live animals, in which there is a regular training update foreseen. The Dutch qualification requirements cover the following subjects:

- understanding animal behaviour and handling animals (required by Regulation (EC) No 1/2005),
- basic knowledge of notifiable animal diseases,
- relevant provisions of Regulation (EC) No 1/2005 and related (national and EU) legislation (required by Regulation (EC) No 1/2005),
- specifics about driving with livestock (required by Regulation (EC) No 1/2005),
- cleaning and disinfection, and
- communication.[151]

Provision of deep bedding material

[147] Wikner, I., G. Gebresenbet, and C. Nilsson. 2003. Assessment of air quality in a commercial cattle transport vehicle in Swedish summer and winter conditions. DTW. Deutsche Tierarztliche Wochenschrift, 110(3), 100-104.

[148] Honkavaara, M. 2003. Development phases of long distance transport vehicles for cattle in Finland. Acta Veterinaria Scandinavica. Supplementum, 100, 27-32.

[149] Velarde, A., D. Teixeira, M. Devant and S. Martí. 2021. Research for ANIT Committee – Particular welfare needs of unweaned animals and pregnant females, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels.

[150] Cockram, M.S., and J.Y. Spence. 2012. The effects of driving events on the stability and resting behaviour of cattle, young calves and pigs. Anim. Welfare. 21(3), 403-417. doi: 10.7120/09627286.21.3.403.

[151] https://www.europarl.europa.eu/cmsdata/230287/Questions-Answers_Dutch%20Ministery%20of%20Agriculture_NEW%20VERSION_EN.pdf

The use of a deep layer of bedding material is recommended for young calves. Provision of adequate bedding is important to soak up fluids and especially for comfort and insulation in cold conditions.[88] When bedding is sufficiently deep (at least 20 cm), calves can nest and trap a boundary layer of warm air, reducing the lower critical temperature.[102,152] Long straw of 20 cm provides excellent isolation for calves up to 6 weeks of age and is recommended in cold environment conditions.[153]

Water provision during transport

Unweaned calves have the behavioural and physiological need to drink the milk from a teat and not from a surface.[154] These are important aspects that need to be considered in order to ensure an appropriate milk intake before transport and a proper water intake of calves on the truck during transport. With regard to provision of milk before transport, drinkers need to be equipped with a flexible rubber teat to enable sucking with a negative and positive pressure phase triggering the abomasal groove reflex.[155] Knowledge on water provision in the truck during transport is still scarce. In the Netherlands, specifications about the drinking systems for transports longer than eight hours have been established.[156] The water provided should not contain additives and should be heated (warm water). The teats in the truck should be synthetic (rubber), flexible and durable and provide easy water release. The height should be between 50 and 100 cm above the floor and 10 cm below the ceiling. The number of teats is one per 3.5 m^2 of floor space and a minimum of two teats for compartment. Moreover drinkers should be installed in the truck in a position without hurting the calves. Despite this advice having been suggested, this topic still requires research and new mechanical technology to be developed to provide calves with water inside the truck.

Stocking density during transport

A high stocking density during transport can cause higher creatine kinase (CK) activity in calves, which is indicative of more muscle fatigue or damage compared to lower stocking densities.[157,158] To ensure that the resting behaviour of calves is not compromised, stocking densities should allow all calves to lie down at the same time (0.3-0.5 m^2 per 40 kg calf).[71,80] This is also supported by Regulation (EC) No 1/2005, which shows that the minimum space allowance for small calves (≈ 50 kg) should be 0.30-0.40 m^2/calf. Moreover, the minimum space allowance for small calves (≈ 50 kg) to change from a lying to standing position should be 0.62 m^2/calf.

Reduce commingling of calves during transport

---

[152] Nordlund, K.V. 2008. Practical considerations for ventilating calf barns in winter. Vet. Clin. N. Am. 24, 41-54. doi: 10.1016/j.cvfa.2007.10.006.

[153] Sutherland, M.A., M. Stewart, and K.E. Schütz. 2013. Effects of two substrate types on the behaviour, cleanliness and thermoregulation of dairy calves. Appl. Anim. Behav. Sci. 147, 19-27. doi: 10.1016/j.applanim.2013.04.018.

[154] De Passillé, A.M., 2001. Sucking motivation and related problems in calves. Appl. Anim. Behav. Sci. 72, 175-187.
https://doi.org/10.1016/S0168-1591(01)00108-3

[155] Khan, M., D. Weary, and M. Von Keyserlingk. 2011. Invited review: Effects of milk ration on solid feed intake, weaning, and
performance in dairy heifers. J. Dairy Sci. 94, 1071-1081. https://doi.org/10.3168/jds.2010-3733

[156] Research for ANIT Committee - Particular welfare needs in animal transport: unweaned animals and pregnant females (europa.eu)

[157] Todd, S.E., D.J. Mellor, K.J. Stafford, N.G. Gregory, R.A. Bruce, and R.N. Ward. 2000. Effects of food withdrawal and
transport on 5- to 10-day-old calves. Res. Vet. Sci. 68:125–134. doi: 10.1053/rvsc.1999.0345.

[158] Jongman, E.C., and K.L. Butler. 2014. The effect of age, stocking density and flooring during transport on welfare of young dairy calves in Australia. Animals. 4(2):184-99. doi: 10.3390/ani4020184.

Commingling between calves during transport can lead to high transmission rates, resulting in health issues and economic losses at the veal or bull fattening farm.[159] Bovine coronavirus infections, for example, can easily spread via nasal secretions among commingled calves during transport.[160] Methods to reduce commingling, such as transportation of calves from one single source or avoidance of contact during transport among calves originating from multiple sources, should be applied. Places such as assembly centres or auction markets also expose calves to a greater risk of infections and should be avoided. In fact, calves originating from multiple sources arrived at these locations and are frequently commingled in order to establish different body weight classes. Another solution is proposed by Becker et al. (2020) in the "outdoor veal calf" concept.[161] Calves are transported directly from a neighbouring dairy farm to a fattening farm, and then calves stay in a 3-week quarantine period (such as the Swedish model described in Section 3.7). Thus commingling occurs only after this period when calves are moved from individual to group pens. Using this strategy, the risk of transmitting pathogens between calves can be lowered.

Implementing quality assurance systems

All the best practices identified in this section can be implemented. A way to contribute to implementation is to include them into quality assurance systems. An example of such a system is the 'Quality Livestock Transport' system in the Netherlands. All companies affiliated to the Dutch sector organisation of the animal transport sector 'Vee&Logistiek' ('Livestock & Logistics') have to comply with the sector's quality system in order to be officially recognised. This system involves, for example, proper heat protocols.

Solutions upon arrival at the veal farm

To prevent the onset of health problems in the post-transport period, different strategies upon arrival of calves at the farm can be used. For example, 1) provision of a warm and high energy meal directly post-transport, in combination with warmth (especially in the winter months) to prevent calves from suffering from negative energy balance effects and hypothermia, 2) provision of extra warmth from the bedding (e.g. wooden crates with heating system or at the use of heating lamps installed above the baby-boxes on the veal farm), and 3) implementation of strict biosecurity measures to prevent the spread of pathogens inside the herd and to ensure internal biosecurity.[89,162]

Best practices for CAs in relation to long-journey transport of unweaned calves: Safeguarding appropriate practices

One area for improvement for CAs that emerges from both literature and interviews is the differences between CAs in different MS in approving and controlling long-journey transport of

[159] Damiaans, B., V. Renault, S. Sarrazin, A.C. Berge, B. Pardon, S. Ribbens, C. Saegerman, and J. Dewulf. 2019. Biosecurity practices in Belgian veal calf farming: level of implementation, attitudes, strengths, weaknesses and constraints. Prev. Vet. Med. 172, 104768. doi: 10.1016/j.prevetmed.2019.104768.

[160] Fulton, R.W., D.L. Step, J. Wahrmund, L.J. Burge, M.E. Payton, B.J. Cook, D. Burken, C. J. Richards, and A.W. Confer. 2011. Bovine coronavirus (BCV) infections in transported commingled beef cattle and sole-source ranch calves. Can. J. Vet. Res. 75(3), 191-199.

[161] Becker, J., G. Schüpbach-Regula, A. Steiner, V. Perreten, D. Wüthrich, A. Hausherr, and M. Meylan. 2020. Effects of the novel concept 'outdoor veal calf'on antimicrobial use, mortality and weight gain in Switzerland. Prev. Vet. Med. 176, 104907. doi:10.1016/j.prevetmed.2020.104907.

[162] Bokma, J., R. Boone, P. Deprez, and B. Pardon. 2019. Risk factors for antimicrobial use in veal calves and the association with mortality. J. Dairy Sci. 102(1), 607-618. doi: 10.3168/jds.2018-15211.

unweaned calves and to the enforcement in case of malpractice. The interpretation and execution of tasks by CA following Regulation (EC) No 1/2005 differs between MS. In the following paragraphs we describe the best practices identified using literature review, interviews and expert consultation.

The first step is the documentary check and application process. This should consist of a documentary check process that needs to be completed before inspection for approval can go ahead. This should consist of a request for approval, submission of documentation that includes previous EU approval disclosure of, for example, vehicles, agent details, payment of fees, truck and plan, records of livestock transport, and international certificates.

The documentation should include a journey log. All information required to assess the planned journey times, resting times and the geographical course of the route (for assessment of weather and route at time of travel) and province of destination must be submitted two days in advance. Certain information may be submitted on the day of travel (e.g. full addresses of all destinations). Journey time must be calculated by a route planner as e.g. using Routenet.nl (set for ’40 tonne vehicles’) and included with the certificate application. Appropriate time for loading and unloading (30 minutes each at minimum) should be included. For periods in which extreme temperatures (<-5ºC or > 30 ˚C) can be expected, for all long journeys through and to areas with forecast temperatures over 30˚C, the organiser must provide a declaration describing how the provisions of Regulation (EC) No 1/2005 on extreme temperatures are met. They must also include the temperature forecasts along the route (e.g. using the website of Meteoblue.com). The temperatures on the route and at destination may not be lower than -5 ˚C or exceed 30 ˚C. Exceptions are possible for vehicles with active climate control systems.

The second step is the inspection of the transport vehicle, vessel or truck, by the CA. A certificate of approval is issued if results of the inspection indicate that the vehicle is fully compliant with the relevant legislation. Currently, a certificate is valid for five years according to Regulation (EC) No 1/2005. An option is to reduce this maximum, for example to two years. The certificate of competence for truck drivers is valid for three to five years, after which drivers must take a fresh training course.

At the day of transport an Official Veterinarian should be present at the loading of the animals to check compliance with animal health and welfare requirements. After the journey, satellite navigation reports and journey logs should be sent to the CA in order to carry out retrospective checks on a proportion of the journeys.

Enforcement measures currently in place include warnings, fines, suspensions of transporter authorisation, suspension of vehicle approval, and suspension of driver certificate of competence. In severe cases transporters can permanently lose their authorisation.

An active enforcement culture surrounding calf transport, and welfare teams that carry out ongoing communication with transporters and drivers to advise them of any conditions which could impact animal welfare during transport and to create a culture of compliance. Strict enforcement should provide sufficient incentive for transporters to comply with the regulation.

5.4 Need for an integrated package to replace and reduce transport of unweaned calves

As the analysis above shows that among the identified strategies to replace, reduce or refine long-journey transport of unweaned calves, there is no one *silver bullet.* While all strategies have advantages, the disadvantages also need to be considered in order to be successful.

- The extent to which a strategy can be successfully implemented in a MS largely depends on the conditions and constrains in that MS. This means that per MS, a tailor-made strategy that includes a blend of the described alternatives should be applied.
- Most unweaned non-replacement dairy calves born in the EU enter a beef production system in the MS of birth or are transported to such a farm in another MS which involves a journey time of less than eight hours. Improving the characteristics of the unweaned calves to be used in beef or veal production (e.g. using cross breeding) as well as improving the beef or veal fattening system in the MS with a surplus of unweaned calves can result in a reduction of the long-journey transport of unweaned calves. Increasing the number of places for fattening at beef of veal calve farms should involve the improvement of the production characteristics of the beef production system. However more research is needed how that improvement can be accomplished given economic and environmental constraints.
- A voluntary or compulsory ban of the long-journey transport of unweaned calves will affect veal and beef production both in the MS of origin and in the MS of destination. Given the high investments in the infrastructure by integrators in MS with large scale veal or beef production, there will be substantial efforts by them to maintain their production volume. It is likely that, where possible, long journeys will be replaced by short journeys. The number of unweaned calves that are transported on journeys of less than eight hours is likely to increase, as is the risk of assembly centre hopping. A number of MS from which a large number of unweaned calves are currently transported on long journeys will face serious challenges due to the lack of feasible alternatives in the short-term. Integrators in the beef and veal calf industry have a strong economic interest to maintain current production practices, which include the sourcing of unweaned calves in other MS. The Dutch example of a voluntary ban on long journeys shows that these practices can be adjusted (e.g. due to public pressure).
- If long journeys cannot be replaced or reduced for a MS, refinement should be implemented to minimise impaired animal welfare issues. Different refinement strategies are available and are ready to be routinely implemented. Most of these strategies can be summarised as good stockmanship.
- For a successful implementation and ensuring a level playing field, uniform enforcement of Regulation (EC) No 1/2005 by CA of different MS is important. A revision of Regulation (EC) No 1/2005 should facilitate this by improving the design, implementation, compliance and enforcement of the regulation.
- If a MS cannot implement any of the strategies to replace, reduce, or refine the long-journey transport of unweaned calves, restructuring of the dairy industry in that MS might be the only option to avoid welfare issues due to long journeys of unweaned calves.

5.5 Benefits and challenges of current practices at both EU and national level

In the previous sections we described a number of alternatives that are implemented to replace, reduce or refine the long journeys of unweaned non-replacement calves. In this section we briefly describe the benefits and challenges of these alternatives including their current uptake in the different MS.

Table 14. Benefits and challenges of alternatives to replace, reduce or refine long-journey transport of unweaned calves.

Alternative	Benefits	Challenges	Mapping within EU/MS
Replacement			
Breeding strategies to increase milk production	Reduction of number of calves born on dairy farms and a reduction of unweaned non-replacement calves	High levels of craftmanship and management needed risk of lower welfare on dairy cows Combination of this alternative with usage of natural resources in not easy	High-input-high-output production dairy systems
Fattening calves on the dairy farms for veal or beef production	Unweaned non-replacement calves do not need to be transported because they are fattened on dairy farms Cow-calf rearing system until weaning of calves leads to a higher welfare Recruitment of dairy breeds from the dairy herd	Specialised system for rearing unweaned non-replacement calves on dairy farms needed	Dairy-beef systems common in small scall scale farms in Eastern MS.
Outdoor veal calf concept	Only short transport (max 30 minutes) from the dairy farm to the fattening farm Same group pen composition until slaughter	Implies a completely new system in each MS where calves are fattened close to their dairy farms of origin	A very limited number of farms adopted this system. Not ready yet for large scale implementation

Alternative	Benefits	Challenges	Mapping within EU/MS
		New specialised system for rearing veal calves outdoor Might be not suitable for a larger number of non-replacement calves	
Reduction			
Use of sexed semen	Reduction of number of male unweaned non-replacement calves born on dairy farms Improvement of genetic gain of unweaned calves Use of dual-purpose breeds to improve beef production qualities of unweaned calves	Higher insemination costs Lower conception rates More difficult calving Higher stillbirths Might be not applicable on a larger scale	Sexed semen is widely available in the EU – uptake amongst dairy farmers is limited
Banning of long journeys	Animal welfare Lower risk of introducing diseases from other MS	Redirection of transport to other MS (including of long journeys)	At the moment a number of MS (e.g. Sweden) legally banned long journeys. Other MS (e.g. the Netherlands) a voluntary ban of long journeys
Fattening in beef farms in the close vicinity of the dairy farms	Avoidance of long journeys Use of crossbreds, which are more robust than specialised dairy breeds	Specialised farms in close proximity to dairy farms	Common practice in most MS for largest part of the non-replacement animals
Refinement			
Good management practices at the dairy farm	Colostrum management on dairy farms (which involves good quality colostrum) results in high immune protection at the time of transport.	Dairy farmers should provide optimal care also to non-replacement calves, including a high quality colostrum and disinfecting the navel properly after birth. Without proper	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in

Alternative	Benefits	Challenges	Mapping within EU/MS
	Good hygiene after birth results less navel inflammation at the veal farm Reduction of health problems and early mortality at the veal farm	care, calves can experience failure of passive transfer and are more susceptible to diseases	quality assurance systems (e.g. the Netherlands)
Selection of more robust calves with higher body weight at transport	The use of crossbred calves increases the market value of calves and this may result in a better health care of calves on the dairy farms. This in turn leads to a better condition and a higher body weight of calves at transport		For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Feeding calves prior to transport	Feeding milk results in a less negative energy balance, a higher glucose and a lower fat and protein utilisation and cortisol after transport	Feeding the correct amount and using the correct feeding strategy	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Optimal transport conditions	Reduction of health problems after transport	Develop further recommendations on the type of truck for transport of unweaned calves	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Ease of handling before, during and after transport	Good handling, use of ramps with slopes ≤ 14°, slip-proof floors, side protections and absence of sharp surfaces result in reduced stress and a in a reduction of slips/accidents during loading/unloading of animals on the truck	Educate/train the truck driver and personnel to avoid rough and incorrect practices during loading/unloading of calves	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Increasing the minimal age at which calves are allowed to be transported	Robust calves with a more developed adaptive immunity, a better performance at the veal farm (lower mortality, lower prevalence of calves treated with medicines	Extra rearing costs on dairy farms for keeping calves longer	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in

Alternative	Benefits	Challenges	Mapping within EU/MS
	other than antibiotics) and a higher carcass weight at slaughter		quality assurance systems (e.g. the Netherlands). German federal provision after 01.01.23
Transport of calves with higher body weight	Lower morbidity and mortality at the veal farm Less pro-inflammatory stage after transport Crossbreeding with beef breeds can result is more robust calves	Keeping calves longer on dairy farms results in extra rearing costs, which might not be covered by higher prices of these calves	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Thermo comfort during transport and avoidance of temperature extremes during transport	Lower stress, lower dehydration, less body weight losses and alteration in blood values of calves during and after transport	Optimal control of climate settings in the truck Optimal choice of the type of truck for transport of calves	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Avoidance of unnecessary loading and unloading procedures	Lower stress of calves	Avoid assembly centre hopping	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Mitigation of driving events (acceleration, breaking and cornering)	Avoidance of falls and injuries following loss of balance of calves during transport	Training for truck drivers	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Provision of deep bedding material	(Thermal) comfort during lying A sufficiently deep bedding can soak up fluids	Extra attention should be given to the provision of adequate bedding before transport of calves	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in

Alternative	Benefits	Challenges	Mapping within EU/MS
	Long straw is a good insulation material for calves transported in cold environmental conditions	Use of proper bedding materials (e.g. long straw against cold vs. sand/sawdust bedding with high temperatures)	quality assurance systems (e.g. the Netherlands)
Water provision during transport	Meet the behavioural and physiological needs of calves to suckle during transport	Good maintenance of water pipes in winter – to avoid frozen water in pipes Drinkers should be positioned at an optimal height Proper material to use for the teats Calves should be trained to drink properly from the teats already before transport Actual usage of drinkers during transport Calves may spill water on the bedding which can become wet and be the cause of additional health problems of the animals	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Proper stocking density during transport	Avoidance of falls/ injuries related to too low stocking densities Avoidance of muscle fatigue/damage (seen with high stocking density) Provision of adequate comfort to rest/lie down in the truck	Proper calculation of space allowances for calves on the basis of their body weight	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)
Reduce commingling of calves during transport	Lower risk to develop diseases and infections	Transportation of calves from one source instead of multiple sources	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the

Alternative	Benefits	Challenges	Mapping within EU/MS
		Avoidance of assembly centres/auction markets and direct transport from dairy farms to veal/fattening farms	Netherlands). Sweden has a national provision
Good management upon arrival of calves at the veal farm	Provision of warm/high energy meal, which is beneficial against negative energy balance effects from transport Provision of extra warmth is a good remedy against hypothermia Strict biosecurity results in a lower spread of pathogens in the herd	Extra commitment of the veal farmer to provide adequate care of calves upon arrival	For all the items mentioned under this topic: a number of stakeholders in industry are adopting these practices either in national guidelines of good practice (e.g. Ireland) or in quality assurance systems (e.g. the Netherlands)

6 Conclusions

- Most of the approximately **20 million unweaned non-replacement dairy calves born annually in the EU** enter into the beef or veal beef production systems in the MS in which they were born.
- From 2015 to 2020, around **1.4 million unweaned calves were moved annually across MS borders**. 42% (**580 000 animals**) of these animals **were moved on long journeys with a duration of eight hours or more**.
- The most important **MS of origin for long-journey transport** were France (115 000 animals/year), Ireland (114 000 animals/year) and Germany (75 000 animals/year). While less significant in absolute numbers, a substantial proportion of the unweaned calves born in Estonia, Czech Republic and Latvia were transported to other MS on long journeys of over 8 hours (Estonia: 34 400 animals/year, or 42.1% of the unweaned calves born; Czech Republic: 75 100 animals/year, or 25.1%; Latvia: 3 200 animals/year, or 26.4%).
- The major **destinations of long-journey transport** of unweaned calves were Spain (292 000 animals/year), the Netherlands (134 000), Italy (56 000) and Belgium (45 000), together accounting for over 93% of the animals moved on long-journey transport.
- **Production practices** that depend on a large number of unweaned, non-replacement calves from other MS consists of highly integrated veal or young beef production. In the Netherlands, a large proportion of unweaned calves are sourced from other, mostly neighbouring, MS. However, the importance of long-journey transport in the Netherlands has decreased substantially over the last decade, and plans exist to abolish this practice in the near future. The Italian veal calf industry's dependency on unweaned calves from other MS is limited to a small but significant number of calves from Lithuania that are needed at a specific time period (spring) due to a lack of domestic calves. In Spain, the increasing beef production in the regions Catalunya and Aragon depends to a substantial extent on unweaned calves from other MS.
- Using the Netherlands as an example, the **mortality rate** of unweaned calves during and after long journeys is approximately 1.5% in the first 56 days after arrival. The mortality rate did not differ from that of domestic calves or calves arriving after short journeys.
- From 2015 to 2020, 0.1-0.2% of the consignments of cattle for production in TRACES had instances of **animal welfare non-compliance**, and 0.3-1.0% had instances of **animal health non-compliance**.
- Alternative strategies to **reduce or replace** long-journey transport of unweaned calves are currently only marginally implemented and need further development before large scale implementation.
- Multiple strategies exist to **refine** the long journeys of unweaned calves and these can be implemented on a large scale. The **implementation** of these best practices could substantially **improve the welfare of unweaned calves during transport**.
- An **increase in minimum age for transport** is a measure of refinement that is about to be implemented in Germany.
- While a voluntary or compulsory **ban of long-journey transport** is practiced in MS like Sweden, there are a number of challenges: its implementation will affect veal and beef production both in the MS of origin and in the MS of destination, increase the number of unweaned calves that are transported by short journeys, and increase the risk of assembly centre hopping. Several MS from which a large number of unweaned calves are

currently transported by long journeys will faced serious challenges because feasible short-term alternatives are lacking.

- A successful EU wide strategy to reduce long-journey transport of unweaned calves should consist of a **tailor-made strategy for each MS** that includes a blend of the described and new alternatives.

Annex 1 e-survey sent to stakeholders

Survey:
Study on shifting from the transport of unweaned male dairy calves over a long journey to local rearing and fattening (SANTE/2020/G5/056)

Name

Organisation

E-mail address

Telephone number

General information

1. In what country/region are you working?

Entire EU	□
Austria	□
Belgium	□
Bulgaria	□
Croatia	□
Cyprus	□
Czech Republic	□
Denmark	□
Estonia	□
Finland	□
France	□
Germany	□
Greece	□
Hungary	□
Ireland	□
Italy	□
Latvia	□
Lithuania	□
Luxembourg	□
Malta	□
the Netherlands	□
Poland	□
Portugal	□

Romania	□
Slovakia	□
Slovenia	□
Spain	□
Sweden	□
United Kingdom[1]	□

[1] Although today the UK is not a Member State of the EU anymore, this was still the case during most of the period covered by the project (2015-2020). Therefore, the UK is included in this table.

2. What sector are you working in?

Private sector/industry	Government	NGO	Research
□	□	□	□

In case you are not working for the government and do not have insight into the actual number of animals transported you can ignore question 3 and directly move to question 4.

3. Check on the estimated number of unweaned dairy calves moved on long journeys in the EU (> 8 hours)

Through this research, we want to gain insight into the number of unweaned dairy calves that are transported annually between the Member States over long journeys (> 8 hours). Below you find our estimates of the number of unweaned dairy calves sent from each Member State (question 2a) and received by each Member State (question 2b) that involved a long journey (> 8 hours) in the period between 2015 and 2020. Could you please check if these estimated numbers are correct? If the estimated numbers are correct, please leave the cells empty in the table below the table with the estimated numbers. If not, please fill in the correct number in the empty table with the corresponding year.

- Only intra-EU movements between MS are considered.
- Our estimates are the results of multiplying the number of heads of cattle for production transported on long journeys (> 8 hours) according to Traces with the fraction of cattle weighing up to 80 kg (excluding for breeding) in all cattle (excluding for slaughter and breeding) transported according to the Comext database.

a Please check the estimated number of unweaned dairy calves that were transported from your Member State on long journeys (> 8 hours) and were destined for another EU Member State.

Sending Member state	2015		2016		2017		2018		2019		2020	
	Est.	Corr.	Est.	Corr.	Est.	Corr.	Est.	Corr.	Est.	Corr.	Est.	Corr.
Austria	7 323		8 171		11 415		25 263		27 993		23 963	
Belgium	199		6 223		26 921		71 274		30 057		18 067	
Bulgaria	0		0		0		0		0		0	
Croatia	0		0		0		196		0		0	
Cyprus	0		0		0		0		0		0	
Czech Republic	62 191		65 558		48 174		50 489		59 370		75 131	
Denmark	23 855		30 000		27 966		31 623		42 633		38 831	
Estonia	30 262		24 241		30 870		26 350		25 929		24 660	
Finland	0		0		0		0		0		0	
France	79 894		97 229		107 544		112 199		149 462		143 942	
Germany	92 201		93 338		96 055		94 484		49 220		22 822	
Greece	0		0		0		0		0		0	
Hungary	315		168		631		4 136		4 343		3 131	
Ireland	56 462		67 837		104 185		168 362		159 219		130 929	
Italy	30 405		25 497		6 602		2 928		1 475		2 030	
Latvia	34 534		26 225		28 619		10 429		9 005		3 707	
Lithuania	2 182		7 950		24 630		29 883		16 840		18 072	
Luxembourg	0		0		254		0		0		0	
Malta	0		0		0		0		0		0	
The Netherlands	9 599		32 832		37 251		34 410		41 906		41 136	
Poland	22 425		8 123		1 122		369		1 771		634	
Portugal	1 606		472		203		0		9		486	
Romania	1		0		183		364		3 060		335	
Slovakia	780		94		2 752		4 830		4 349		6 217	
Slovenia	0		0		0		0		0		0	
Spain	14 664		7 055		7 444		9 533		10 335		11 322	
Sweden	0		0		0		0		0		0	
United Kingdom[1]	0		15		19 719		20 181		9 243		3 735	

[1] Although today the UK is not a Member State of the EU any more, this was still the case during most of the period covered by the project (2015-2020). Therefore, the UK is included in this table.

I am not an expert on this/ do not have information on this	If so, please indicate □

b Please check the estimated number of unweaned dairy calves that were transported on long journeys (> 8 hours) and of which the destination was your Member State.

Receiving Member state	2015		2016		2017		2018		2019		2020	
	Est.	Corr.	Est.	Corr.	Est.	Corr.	Est.	Corr.	Est.	Corr.	Est.	Corr.

Austria	0		0		28		1		0		2	
Belgium	50 308		54 166		67 063		75 885		21 805		1 960	
Bulgaria	0		0		0		0		0		96	
Croatia	239		537		92		50		34		928	
Cyprus	0		0		0		0		0		0	
Czech Republic	0		476		667		3 794		15		0	
Denmark	0		0		0		0		0		0	
Estonia	0		0		30		99		0		0	
Finland	0		0		0		0		0		0	
France	17 511		20 269		1 172		9 446		6 677		20 438	
Germany	180		957		456		394		166		4	
Greece	135		3		0		103		0		4	
Hungary	3 445		6 630		2 191		729		893		4 300	
Ireland	86		530		352		0		0		123	
Italy	42 152		50 066		50 688		63 634		70 612		58 160	
Latvia	0		0		0		0		0		0	
Lithuania	3		97		28		144		113		159	
Luxembourg	0		0		0		0		105		0	
Malta	0		0		0		0		0		0	
Netherlands	141 836		120 708		125 212		123 947		176 493		117 572	
Poland	31 021		24 955		35 721		29 706		32 286		28 180	
Portugal	0		0		0		0		122		0	
Romania	195		210		1 378		247		1 044		4 379	
Slovakia	6		125		212		0		62		991	
Slovenia	3		69		137		129		99		65	
Spain	180 761		219 763		295 270		388 485		335 130		331 064	
Sweden	0		0		22		37		7		0	
United Kingdom[1]	1 017		1 467		1 821		473		556		725	

[1] Although the UK is not a Member State of the EU, this was still the case during most of the period covered by the project (2015-2020). Therefore, the UK is included in this table.

I am not an expert on this/do not have information on this	If so, please indicate □

4. Additional national legislation related to the handling and transport of unweaned dairy calves (G)

Is there, in addition to EU Regulation (EC) No 1/2005, on a local or national level, animal welfare regulation related to the handling and transport (short national journeys and long international journeys) of unweaned dairy calves currently in place in your Member State?

Additional regulation implemented	Yes/no
Name of the regulation	
Reference/link	

I am not an expert on this/do not have information on this	If so, please indicate □

a. Please describe the main characteristics of this regulation. For example, additional regulation related to transport duration, travel distance from the farm of birth, minimum age or weight, or transport vehicle requirements, etc.

Name of the regulation	Main characteristics/key points related to the handling and transport of unweaned calves

I am not an expert on this/do not have information on this	If so, please indicate □

5. Description of national chain prior to export (G)

We are interested in whether regional and national collection centres are involved in your Member State. If so, for research purposes we would like to have information regarding the number of days between the transport from the farm of birth and the day the international transport to another Member State starts. For example, in the Netherlands, before dairy calves are placed on international transport to another Member State and recorded into Traces, unweaned dairy calves might have already been travelling from their farm of birth to a collection centre.

Please describe the journey of typical unweaned dairy calves that are transported over a long distance for local rearing and fattening (including collection centres and the number of days the animals are kept in collection centres).

Are any additional measures implemented by the transport companies for long-distance transport of unweaned dairy calves (e.g. stocking density, additional water and feed, measures during extremely hot and cold weather conditions)?

I am not an expert on this/do not have information on this	If so, please indicate □

Additional information

6. Unfortunately, not all transports are compliant with the transport regulations and occasionally non-compliances are observed. Non-compliances that occur during and after transport are registered into Traces. However, in this hypothetical scenario, we assume that not all

data in Traces is accurate. In that case, please give your estimation of the type and rate of non-compliances during long journeys (for example: dead-on-arrival) of unweaned dairy calves transported on long journeys.

	Type of incompliance (description)	Estimated rate for transports entering your country (in % of the total number of transports)	Estimated rate of transports leaving your country (in % of the total number of transports)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

I am not an expert on this/do not have information on this	If so, please indicate □

7. Animal welfare non-compliance with transport regulation can also be observed before a transport takes place while assessing for a transport certificate. However, such non-compliances are often not reported into Traces. Please provide a list of such non-compliances before or at the start of long-distance transport of unweaned dairy calves and the total number of transports with such non-compliances from 2015-2020.

Year	Animal welfare incompliance	Number of transports with incompliance
2015		
2016		
2017		
2018		
2019		
2020		

8. Please give an estimate of the mortality rate (dead-on-arrival) of unweaned dairy calves transported on international journeys between the Member States. If possible, please provide a separate estimate for different journey times, otherwise please provide an overall average of all journey times. Please provide a percentage of the number of animals transported. So, if 1 in 1,000 animals dies during transport, the mortality rate is 1/1,000 * 100% = 0.1%

Journey time	Mortality rate during transport (%)
8 hours or less	
From 8 to 19 hours	
More than 19 hours	
Average of all journey times	

I am not an expert on this/do not have information on this	If so, please indicate □

9. Please give an estimate of the mortality rate of unweaned dairy calves that die within the first seven days after being transported between the Member States, including culling due to poor growth or diseases. If possible, provide a separate estimate for different journey times, otherwise an overall average of the journey times. Please provide it as the percentage of the total number of animals transported. For example, if 1 in 1,000 animals dies within the first 7 days after being transported, the mortality rate is 1/1,000 * 100% = 0.1%. The last column is the sum of the first two columns.

Journey time	Mortality within 7 days after transport (%)	Culling within 7 days after transport (%)	Mortality and culling (%)
8 hours or less			
From 8 to 19 hours			
More than 19 hours			
Average of all journey times			

I am not an expert on this/do not have information on this	If so, please indicate □

10. Are the transporting companies involved in long-distance (> 8 hours) transport of unweaned dairy calves located mainly in your Member State?

Yes/No

If No, the main countries of origin of the transporting companies are ...

11. One of the objectives of the project is to identify existing alternatives to the transport of unweaned dairy calves on long journeys. Do you know existing alternatives to the transport of unweaned dairy calves on long journeys which are aimed to replace, reduce or refine the transport of unweaned dairy calves? If so, please provide a short description or name the alternative and a contact person in the table below. Please use a separate cell for each alternative.

We would like to gain insight into the characteristics of identified alternatives:

- What is the aim of the identified alternative?
  - Reduce (less transport over long journeys is needed e.g. local production)
  - Replace (e.g. the current production is replaced by local beef production)
  - Refine (e.g. transport circumstances are improved).
- Regional presence.

- Main advantages and disadvantages compared to the current situation

		Reduce/replace/refine	Where is the alternative practice located	Main advantage	Contact person		
	Description or name of the existing alternative				name	email	phone
1							
2							
3							
4							
5							

I am not an expert on this/do not have information on this	If so, please indicate □

Weighing factors for criteria to assess existing alternatives

During this project, alternative practices for long-distance transport of unweaned calves are collected and characteristics of alternatives will be described. These characteristics give insight into the impact of the alternatives on aspects like animal welfare, economic performance, and environmental impact. To enable an objective evaluation, the importance of each of these characteristics will be weighed. Therefore, your input is welcomed. We kindly ask you to provide a score between 0 (totally not important) and 100 (extremely important) for each of the characteristics. If you think animal welfare is most important then this should receive the highest score.

12. Please rate the importance of each aspect on a scale from 1 (totally not important) to 100 (extremely important) when alternatives are evaluated.

Characteristics	**Score (from 0 to 100)**
Animal welfare	
Environmental impact	
Economic performance	
Possibility to upscale to country or EU level	

I am not an expert on this/do not have information on this	If so, please indicate □

The electronic version that was sent to the Contact points and the other stakeholders can be found here https://ec.europa.eu/eusurvey/runner/SANTEG5056survey2020

Annex 2 Conducted stakeholder interviews

Table A2 1 : Stakeholder interviews for the study on shifting from transport of unweaned male dairy calves over long to local rearing and fattening

Country	Stakeholder
Netherlands	Representative of the Branche Organisation of the Dutch Veal Industry
	Head Quality Assurance of veal integrator
	Head Calf Husbandry of veal integrator
	Head Calf Husbandry of veal integrator
	Head Calf Husbandry of veal integrator
	Division Manager Livestock Transport of veal integrator
	Representative of Dutch Branche Organisation Livestock & Logistics
	Civil Servant, Livestock Transport and Animal Welfare, Ministry of Agriculture, Nature and Food Quality
	Civil Servant, Veal Chains, Animal Welfare, Ministry of Agriculture, Nature and Food Quality
Italy	Veterinarian of veal integrator
	Chief Executive Officer of the Italian branch of an international feed supply company for veal calves
	Veterinary Executive of the Official Public Veterinary Service
	Veterinary Executive of the Official Public Veterinary Service
Spain	MS Competent authorities
	Scientific Institute
	Transport companies Association
	Slaughterhouses and Meat processors
	A combined reaction of farmer association, a transport company and a retailer/food services in Spain
Ireland	Representatives of the Division, Animal Welfare Department of Agriculture, Food and the Marine
Nordic countries	Swedish Board of Agriculture (Jordbruksverket, Sweden) National advisory and consultancy on agriculture and farm animals (Gård och Djurhälsan, Sweden) Specialised researchers from Aarhus University, Denmark Head of European Union Reference Centre for Animal Welfare (EURCAW Ruminants & Equines)

Annex 3: Estimated number of non-replacement calves moved between EU Member States from 2015 to 2020.

Table A 3.1: Estimated average number of young calves moved per year within the EU in 2015 – 2020.

	Destination																											
Origin	*AT*	*BE*	*BG*	*CY*	*CZ*	*DE*	*DK*	*EE*	*ES*	*FI*	*FR*	*GB*	*GR*	*HR*	*HU*	*IE*	*IT*	*LT*	*LU*	*LV*	*MT*	*NL*	*PL*	*PT*	*RO*	*SE*	*SI*	*SK*	Total
AT	*0*	*0*	*0*	*0*	*21*	*1 643*	*0*	*0*	*7 370*	*0*	*0*	*0*	*0*	*69*	*337*	*0*	*28 645*	*0*	*0*	*0*	*0*	*0*	*3 225*	*0*	*0*	*0*	*5*	*0*	41 315
BE	*0*	*0*	*0*	*0*	*414*	*1 212*	*0*	*0*	*18 562*	*0*	*4 554*	*1*	*0*	*0*	*0*	*10*	*3 575*	*0*	*0*	*0*	*0*	*54 786*	*0*	*0*	*0*	*0*	*0*	*0*	83 114
BG	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0
CY	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0
CZ	*1*	*18 094*	*0*	*0*	*0*	*1 620*	*0*	*0*	*29 105*	*0*	*4 213*	*0*	*0*	*128*	*18*	*0*	*1 439*	*0*	*18*	*0*	*0*	*8 088*	*55*	*0*	*0*	*0*	*0*	*4*	62 783
DE	*11*	*39 579*	*16*	*0*	*168*	*0*	*1*	*0*	*40 577*	*0*	*1 842*	*44*	*0*	*0*	*49*	*0*	*5 932*	*1*	*65*	*0*	*0*	*537 809*	*7 189*	*0*	*8*	*0*	*0*	*0*	633 291
DK	*5*	*6 840*	*0*	*0*	*0*	*293*	*0*	*0*	*55*	*0*	*36*	*36*	*1*	*0*	*1*	*2*	*0*	*18*	*0*	*0*	*0*	*28 833*	*180*	*0*	*8*	*11*	*0*	*0*	36 319
EE	*0*	*11 796*	*0*	*0*	*0*	*6*	*0*	*0*	*71*	*0*	*0*	*0*	*0*	*0*	*489*	*0*	*425*	*728*	*0*	*56*	*0*	*12 610*	*1 800*	*0*	*0*	*0*	*12*	*0*	27 993
ES	*0*	*216*	*0*	*0*	*282*	*0*	*0*	*0*	*0*	*0*	*4 168*	*0*	*0*	*0*	*19*	*0*	*8 351*	*29*	*0*	*0*	*0*	*185*	*169*	*0*	*0*	*0*	*10*	*10*	13 439
FI	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0
FR	*0*	*469*	*0*	*0*	*17*	*716*	*0*	*0*	*230 326*	*0*	*0*	*0*	*1*	*0*	*0*	*14*	*13 239*	*0*	*0*	*0*	*0*	*5 903*	*0*	*0*	*0*	*0*	*0*	*0*	250 685
GB	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*11 930*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*35*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	11 965
GR	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0
HR	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*33*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	34
HU	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*559*	*0*	*0*	*0*	*23*	*135*	*0*	*0*	*1 338*	*0*	*0*	*0*	*0*	*0*	*17*	*0*	*1 436*	*0*	*5*	*139*	3 653

	Destination																											
Origin	*AT*	*BE*	*BG*	*CY*	*CZ*	*DE*	*DK*	*EE*	*ES*	*FI*	*FR*	*GB*	*GR*	*HR*	*HU*	*IE*	*IT*	*LT*	*LU*	*LV*	*MT*	*NL*	*PL*	*PT*	*RO*	*SE*	*SI*	*SK*	Total
IE	*0*	*4 895*	*0*	*0*	*0*	*0*	*0*	*0*	*52 206*	*0*	*3 186*	*9 622*	*0*	*0*	*0*	*0*	*11 609*	*0*	*0*	*0*	*0*	*40 655*	*1 427*	*20*	*0*	*0*	*0*	*0*	123 620
IT	*4*	*5*	*0*	*0*	*38*	*6*	*0*	*0*	*8 296*	*0*	*0*	*0*	*17*	*94*	*199*	*0*	*0*	*5*	*0*	*0*	*0*	*183*	*2 714*	*0*	*6*	*0*	*10*	*32*	11 609
LT	*0*	*120*	*0*	*0*	*0*	*0*	*0*	*7*	*4 975*	*0*	*0*	*0*	*0*	*4*	*877*	*0*	*2 721*	*0*	*0*	*23*	*0*	*3 511*	*7 946*	*0*	*760*	*0*	*0*	*0*	20 944
LU	*0*	*219*	*0*	*0*	*0*	*90*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*13*	*0*	*0*	*0*	*0*	*13 664*	*30*	*0*	*0*	*0*	*0*	*0*	14 016
LV	*0*	*288*	*0*	*0*	*0*	*0*	*0*	*0*	*82*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*577*	*0*	*0*	*0*	*15 548*	*3 698*	*0*	*0*	*0*	*0*	*0*	20 193
MT	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0
NL	*0*	*4 925*	*0*	*0*	*0*	*390*	*1*	*22*	*16 443*	*0*	*1 109*	*360*	*0*	*190*	*1 418*	*155*	*5 169*	*0*	*0*	*0*	*0*	*0*	*8 303*	*0*	*154*	*0*	*55*	*190*	38 884
PL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2 282*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2 393*	*10*	*0*	*0*	*0*	*1 066*	*0*	*0*	*0*	*0*	*0*	*0*	5 751
PT	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*3 750*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	3 750
RO	*0*	*0*	*0*	*0*	*0*	*4*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*1 281*	*0*	*627*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	1 914
SE	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0
SI	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0
SK	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2 606*	*0*	*0*	*0*	*0*	*0*	*249*	*0*	*400*	*0*	*0*	*0*	*0*	*171*	*5 724*	*0*	*0*	*0*	*0*	*0*	9 150
Total	*22*	*87 446*	*16*	*0*	*940*	*5 980*	*2*	*29*	*429 195*	*0*	*19 108*	*10 063*	*42*	*622*	*4 938*	*181*	*85 944*	*1 368*	*83*	*79*	*0*	*723 012*	*42 477*	*20*	*2 372*	*11*	*97*	*375*	1 414 422

Table A 3.2: Estimated average number of young calves moved per year within the EU in 2015 – 2020 in consignments with a duration of 8 hours or less.

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
AT	0	0	0	0	20	1 608	0	0	0	0	0	0	0	69	333	0	21 800	0	0	0	0	0	121	0	0	0	5	0	23 956
BE	0	0	0	0	0	1 211	0	0	0	0	1 519	0	0	0	0	0	141	0	0	0	0	54 786	0	0	0	0	0	0	57 657
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	1	0	0	0	0	1 547	0	0	0	0	4	0	0	42	13	0	183	0	0	0	0	8	42	0	0	0	0	4	1 844
DE	11	36 549	0	0	82	0	1	0	0	0	993	0	0	0	0	0	4 582	0	65	0	0	514 177	932	0	0	0	0	0	557 392
DK	0	46	0	0	0	276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 504	7	0	0	0	0	0	3 833
EE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	690	0	56	0	0	76	0	0	0	0	0	822
ES	0	1	0	0	0	0	0	0	0	0	3 169	0	0	0	0	0	49	0	0	0	0	0	0	0	0	0	0	0	3 219
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	349	0	0	0	605	0	0	119 658	0	0	0	0	0	0	0	2 088	0	0	0	0	1 094	0	0	0	0	0	0	123 794
GB	0	0	0	0	0	0	0	0	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HU	1	0	0	0	0	0	0	0	0	0	0	0	0	132	0	0	109	0	0	0	0	0	17	0	1 130	0	5	138	1 532
IE	0	0	0	0	0	0	0	0	0	0	3	9 034	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	9 044
IT	4	0	0	0	13	6	0	0	0	0	0	0	0	54	32	0	0	0	0	0	0	0	0	0	0	0	4	1	114
LT	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	23	0	0	4 322	0	0	0	0	0	4 352
LU	0	219	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13 588	0	0	0	0	0	0	13 897

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
LV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	577	0	0	0	0	861	0	0	0	0	0	1 438
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	4 925	0	0	0	271	1	0	0	0	817	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6 028
PL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	10
PT	0	0	0	0	0	0	0	0	3 279	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 279
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 256	0	0	0	0	0	0	0	0	0	0	0	0	0	1 256
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	0	8	0	0	0	0	0	5 724	0	0	0	0	0	5 981
Total	17	42 089	0	0	115	5 614	2	7	123 059	0	6 505	9 048	0	297	1 884	0	28 960	1 277	65	79	0	587 164	12 102	0	1 130	0	14	143	819 571

Table A3.3: Estimated average number of young calves moved per year within the EU in 2015 – 2020 in consignments with an unknown duration.

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
AT	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3
BE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	0	0	0	0	0	0	0	672	0	18	0	0	13	0	0	24	0	0	0	0	59	0	0	0	0	0	0	786
DE	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 086	43	0	0	0	0	0	1,214
DK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EE	0	69	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	16	13	0	0	0	0	0	118
ES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	151	0	0	0	0	0	7	0	0	0	0	0	161
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	3	0	0	0	5	0	0	10 673	0	0	0	0	0	0	0	904	0	0	0	0	263	0	0	0	0	0	0	11,848
GB	0	0	0	0	0	0	0	0	3 027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,027
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IE	0	2	0	0	0	0	0	0	0	0	0	6	0	0	0	0	17	0	0	0	0	54	0	0	0	0	0	0	79
IT	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	0	0	0	0	0	0	76

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
LV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PT	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	159	0	0	0	5	0	0	14 389	0	18	6	0	13	23	0	1 098	0	0	0	0	1 554	63	0	0	0	0	0	17,328

Annex 4: Estimated number of non-replacement calves moved on long journeys (> 8 hours) between EU Member States from 2015 to 2020

Table A4.1: Estimated annual number of non-replacement calves transported on long journeys (> 8 hours) within the EU in 2015.

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
AT	0	0	0	0	0	95	0	0	0	0	0	0	0	0	0	0	6 992	0	0	0	0	0	236	0	0	0	0	0	7 323
BE	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	197	0	0	0	0	0	0	0	0	0	0	0	199
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	24 086	0	0	0	0	0	0	15	0	10 214	0	0	0	0	0	2 237	0	0	0	0	10 579	74	0	0	0	0	1	62 191
DE	0	5 66	0	0	0	0	0	0	38 293	0	0	34	0	0	163	0	552	3	0	0	0	37 113	10 383	0	0	0	0	0	92 201
DK	0	1 156	0	0	0	47	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	22 648	0	0	0	0	0	0	23 855
EE	0	17 02	0	0	0	34	0	0	0	0	0	0	0	0	2 283	0	0	0	0	0	0	8 798	2 124	0	0	0	3	0	30 262
ES	0	208	0	0	0	0	0	0	0	0	5 665	0	0	0	0	0	8 455	0	0	0	0	0	336	0	0	0	0	0	14 664
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	2	0	0	0	2	0	0	70 975	0	0	0	0	0	0	86	4 865	0	0	0	0	3 964	0	0	0	0	0	0	79 894
GB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HU	0	0	0	0	0	0	0	0	0	0	0	0	135	0	0	0	0	0	0	0	0	0	0	0	175	0	0	5	315
IE	0	510	0	0	0	0	0	0	21 066	0	0	979	0	0	0	0	7 339	0	0	0	0	26 568	0	0	0	0	0	0	56 462

	Destination																										
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
IT	0	3	0	0	0	0	0	0	23 709	0	0	0	0	239	0	0	0	0	0	0	0	986	5 448	0	20	0	0	0	30 405
LT	0	0	0	0	0	0	0	0	157	0	0	0	0	0	999	0	586	0	0	0	0	274	166	0	0	0	0	0	2 182
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LV	0	1 663	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25 455	7 416	0	0	0	0	0	34 534
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	0	0	0	1 247	0	1 632	0	0	0	0	0	1 882	0	0	0	0	0	4 838	0	0	0	0	0	9 599
PL	0	0	0	0	0	0	0	0	8 708	0	0	0	0	0	0	0	8 266	0	0	0	0	5 451	0	0	0	0	0	0	22 425
PT	0	0	0	0	0	0	0	0	1 606	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 606
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	780	0	0	0	0	0	0	0	0	0	0	0	780
Total	0	50 308	0	0	0	180	0	0	180 761	0	17 511	1 017	135	239	3 445	86	42 152	3	0	0	0	141 836	31 021	0	195	0	3	6	468 898

Table A4.2: Estimated annual number of non-replacement calves transported on long journeys (> 8 hours) within the EU in 2016.

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
AT	0	0	0	0	1	53	0	0	939	0	0	0	0	0	22	0	6 433	0	0	0	0	0	723	0	0	0	0	0	8,171
BE	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	6 221	0	0	0	0	0	0	0	0	0	0	0	6,223
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	24 642	0	0	0	56	0	0	13 952	0	14 377	0	0	0	0	0	1 17	0	0	0	0	11 361	0	0	0	0	0	0	65,558
DE	0	3 554	0	0	238	0	0	0	48 491	0	4 083	168	0	0	27	0	1 834	0	0	0	0	26 138	8 805	0	0	0	0	0	93,338
DK	0	8 412	0	0	1	29	0	0	295	0	214	20	3	0	0	3	0	0	0	0	0	20 926	97	0	0	0	0	0	30
EE	0	16 875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97	0	0	0	5 694	1 506	0	0	0	69	0	24,241
ES	0	391	0	0	0	0	0	0	0	0	70	0	0	0	0	0	6 459	0	0	0	0	135	0	0	0	0	0	0	7,055
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	0	0	0	100	592	0	0	85 994	0	0	0	0	0	0	0	5 915	0	0	0	0	4 628	0	0	0	0	0	0	97,229
GB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	15
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	0	0	0	168
IE	0	267	0	0	0	0	0	0	32 382	0	1 523	675	0	0	0	0	7 945	0	0	0	0	25 045	0	0	0	0	0	0	67,837
IT	0	25	0	0	136	0	0	0	17 893	0	0	0	0	0	0	0	0	0	0	0	0	29	7 278	0	11	0	0	125	25,497
LT	0	0	0	0	0	0	0	0	5 38	0	0	0	0	0	759	0	1 718	0	0	0	0	74	19	0	0	0	0	0	7,95
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
LV	0	0	0	0	0	0	0	0	490	0	0	0	0	0	0	0	0	0	0	0	0	25 735	0	0	0	0	0	0	26,225
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	227	0	0	9 243	0	0	604	0	537	5 821	527	9 315	0	0	0	0	0	6 527	0	31	0	0	0	32,832
PL	0	0	0	0	0	0	0	0	4 232	0	0	0	0	0	1	0	2 947	0	0	0	0	943	0	0	0	0	0	0	8,123
PT	0	0	0	0	0	0	0	0	472	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	472
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94	0	0	0	0	0	0	0	0	0	0	0	94
Total	0	54 166	0	0	476	957	0	0	219 763	0	20 269	1 467	3	537	6 63	530	50 066	97	0	0	0	120 708	24 955	0	210	0	69	125	501,028

Table A4.3: Estimated annual number of non-replacement calves transported on long journeys (> 8 hours) within the EU in 2017.

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
AT	0	0	0	0	0	53	0	0	2 89	0	0	0	0	0	0	0	7 003	0	0	0	0	0	1 469	0	0	0	0	0	11 415
BE	0	0	0	0	0	0	0	0	21 499	0	20	0	0	0	0	60	5 342	0	0	0	0	0	0	0	0	0	0	0	26 921
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	25 16	0	0	0	72	0	0	17 247	0	476	0	0	0	0	0	403	0	0	0	0	4 816	0	0	0	0	0	0	48 174
DE	0	3 473	0	0	246	0	0	0	60 381	0	1	63	0	0	0	0	1 256	0	0	0	0	23 707	6 928	0	0	0	0	0	96 055
DK	28	10 528	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	17 335	42	0	0	22	0	0	27 966
EE	0	15 523	0	0	0	0	0	0	425	0	0	0	0	0	531	0	1 658	28	0	0	0	8 409	4 296	0	0	0	0	0	30 87
ES	0	156	0	0	404	0	0	0	0	0	104	0	0	0	0	0	6 648	0	0	0	0	132	0	0	0	0	0	0	7 444
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	176	0	0	0	0	0	0	93 219	0	0	0	0	0	0	0	9 364	0	0	0	0	4 785	0	0	0	0	0	0	107 544
GB	0	0	0	0	0	0	0	0	19 525	0	0	0	0	0	0	0	194	0	0	0	0	0	0	0	0	0	0	0	19 719
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	631	0	0	0	631
IE	0	11 981	0	0	0	0	0	0	46 418	0	571	553	0	0	0	0	10 802	0	0	0	0	33 86	0	0	0	0	0	0	104 185
IT	0	4	0	0	17	0	0	0	3 378	0	0	0	0	0	0	0	0	0	0	0	0	27	3 074	0	0	0	41	61	6 602
LT	0	0	0	0	0	0	0	0	7 31	0	0	0	0	25	0	0	3 776	0	0	0	0	8 362	4 41	0	747	0	0	0	24 63
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	0	0	0	0	0	178	0	0	0	0	0	254

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
LV	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23 779	4 778	0	0	0	0	0	28 619
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	310	0	30	20 02	0	0	1 205	0	56	1 509	281	3 047	0	0	0	0	0	10 546	0	0	0	96	151	37 251
PL	0	0	0	0	0	0	0	0	122	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1 122
PT	0	0	0	0	0	0	0	0	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203
RO	0	0	0	0	0	21	0	0	0	0	0	0	0	11	151	0	0	0	0	0	0	0	0	0	0	0	0	0	183
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	2 633	0	0	0	0	0	0	0	119	0	0	0	0	0	0	0	0	0	0	0	2 752
Total	28	67 063	0	0	667	456	0	30	29 527	0	1 172	1 821	0	92	2 191	352	50 688	28	0	0	0	125 212	35 721	0	1 378	22	137	212	582 54

Table A4.4: Estimated annual number of non-replacement calves transported on long journeys (> 8 hours) within the EU in 2018.

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	UK	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
AT	0	0	0	0	2	3	0	0	12 89	0	0	0	0	0	0	0	7 104	0	0	0	0	0	5 263	0	0	0	0	0	25 263
BE	0	0	0	0	2 484	0	0	0	61 61	0	0	0	0	0	0	0	7 182	0	0	0	0	0	0	0	0	0	0	0	71 274
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	27 554	0	0	0	173	0	0	17 05	0	0	0	0	0	0	0	700	0	0	0	0	5 011	5	0	0	0	0	0	50 489
DE	1	2 988	0	0	20	0	0	0	61 58	0	1 007	0	0	0	0	0	1 138	0	0	0	0	23 77	3 989	0	0	0	0	0	94 484
DK	0	10 938	0	0	0	0	0	0	35	0	0	4	3	0	0	0	0	106	0	0	0	20 45	4	0	47	37	0	0	31 623
EE	0	16 696	0	0	0	0	0	0	0	0	0	0	0	0	0	0	533	38	0	0	0	8 979	104	0	0	0	0	0	26 35
ES	0	126	0	0	1 288	0	0	0	0	0	135	0	0	0	12	0	7 738	0	0	0	0	234	0	0	0	0	0	0	9 533
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	262	0	0	0	39	0	0	97 28	0	0	0	0	0	0	0	10 63	0	0	0	0	3 995	0	0	0	0	0	0	112 199
UK	0	0	0	0	0	0	0	0	20 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20 181
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	196	0	0	0	0	0	0	0	0	0	0	0	196
HU	0	0	0	0	0	0	0	0	597	0	0	0	0	19	0	0	3 52	0	0	0	0	0	0	0	0	0	0	0	4 136
IE	0	16 602	0	0	0	0	0	0	82 46	0	8 26	469	0	0	0	0	16 98	0	0	0	0	43 6	0	0	0	0	0	0	168 362
IT	0	0	0	0	0	0	0	0	2 305	0	0	0	100	0	0	0	0	0	0	0	0	37	486	0	0	0	0	0	2 928
LT	0	719	0	0	0	0	0	0	7 671	0	0	0	0	0	0	0	3 986	0	0	0	0	8 373	8 934	0	200	0	0	0	29 883
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	UK	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
LV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9 422	1 007	0	0	0	0	0	10 429
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	179	0	99	20 63	0	44	0	0	31	717	0	2 672	0	0	0	0	0	9 914	0	0	0	129	0	34 41
PL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	369	0	0	0	0	0	0	0	0	0	0	0	369
PT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	364	0	0	0	0	0	0	0	0	0	0	0	364
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	4 214	0	0	0	0	0	0	0	530	0	0	0	0	86	0	0	0	0	0	0	4 83
Total	1	75 885	0	0	3 794	394	0	99	388 5	0	9 446	473	103	50	729	0	63 63	144	0	0	0	123 9	29 71	0	247	37	129	0	697 303

Table A4.5: Estimated annual number of non-replacement calves transported on long journeys (> 8 hours) within the EU in 2019.

	Destination																												
Origin	**AT**	**BE**	**BG**	**CY**	**CZ**	**DE**	**DK**	**EE**	**ES**	**FI**	**FR**	**UK**	**GR**	**HR**	**HU**	**IE**	**IT**	**LT**	**LU**	**LV**	**MT**	**NL**	**PL**	**PT**	**RO**	**SE**	**SI**	**SK**	**Total**
AT	0	0	0	0	0	0	0	0	14 651	0	0	0	0	0	0	0	8 553	0	0	0	0	0	4 789	0	0	0	0	0	27 993
BE	0	0	0	0	0	0	0	0	28 267	0	129	0	0	0	0	0	1 661	0	0	0	0	0	0	0	0	0	0	0	30 057
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	7 123	0	0	0	13 3	0	0	38 684	0	24	0	0	0	0	0	1 358	0	10 5	0	0	11 943	0	0	0	0	0	0	59 37
DE	0	1 92	0	0	1 5	0	0	0	15 6	0	1	0	0	0	0	0	1 847	0	0	0	0	24 371	5 416	0	50	0	0	0	49 22
DK	0	8 01	0	0	0	24	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	34 56	0	0	0	7	0	0	42 633
EE	0	4 244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	358	65	0	0	0	20 037	1 225	0	0	0	0	0	25 929
ES	0	405	0	0	0	0	0	0	0	0	4	0	0	0	79	0	8 972	48	0	0	0	436	329	0	0	0	0	6 2	10 335
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	103	0	0	0	9	0	0	129 71	0	0	0	0	0	0	0	14 055	0	0	0	0	5 585	0	0	0	0	0	0	149 462
UK	0	0	0	0	0	0	0	0	9 243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9 243
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HU	0	0	0	0	0	0	0	0	1 134	0	0	0	0	0	0	0	2 588	0	0	0	0	0	0	0	621	0	0	0	4 343
IE	0	0	0	0	0	0	0	0	59 239	0	6 519	38 8	0	0	0	0	19 324	0	0	0	0	67 213	6 414	12 2	0	0	0	0	159 219
IT	0	0	0	0	0	0	0	0	743	0	0	0	0	5	70 1	0	0	0	0	0	0	19	0	0	7	0	0	0	1 475
LT	0	0	0	0	0	0	0	0	5 88	0	0	0	0	0	0	0	3 58	0	0	0	0	3 982	3 184	0	214	0	0	0	16 84
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7 405	1 6	0	0	0	0	0	9 005
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Destination																												
Origin	**AT**	**BE**	**BG**	**CY**	**CZ**	**DE**	**DK**	**EE**	**ES**	**FI**	**FR**	**UK**	**GR**	**HR**	**HU**	**IE**	**IT**	**LT**	**LU**	**LV**	**MT**	**NL**	**PL**	**PT**	**RO**	**SE**	**SI**	**SK**	**Total**
NL	0	0	0	0	0	0	0	0	28 204	0	0	13 6	0	28	11 3	0	3 845	0	0	0	0	0	9 329	0	152	0	9 9	0	41 906
PL	0	0	0	0	0	0	0	0	630	0	0	0	0	0	0	0	1 141	0	0	0	0	0	0	0	0	0	0	0	1 771
PT	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3 059	0	0	0	0	0	0	0	0	0	0	0	3 06
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	3 136	0	0	0	0	0	0	0	271	0	0	0	0	942	0	0	0	0	0	0	4 349
Total	0	21 805	0	0	1 5	16 6	0	0	335 13	0	6 677	55 6	0	34	89 3	0	70 612	11 3	10 5	0	0	176 493	32 286	12 2	1 044	7	9 9	6 2	646 219

Table A4.6: Estimated annual number of non-replacement calves transported on long journeys (> 8 hours) within the EU in 2020.

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	UK[1]	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
AT	0	0	0	0	0	3	0	0	12 841	0	0	0	0	0	0	0	4 977	0	0	0	0	0	6 142	0	0	0	0	0	23 963
BE	0	0	0	0	0	0	0	0	0	0	18 062	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18 067
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	0	0	0	0	0	0	0	68 666	0	58	0	0	438	32	0	1 518	0	0	0	0	4 419	0	0	0	0	0	0	75 131
DE	2	76	96	0	0	0	0	0	19 119	0	0	0	0	0	106	2	1 47	0	0	0	0	186	1 765	0	0	0	0	0	22 822
DK	0	1 717	0	0	0	0	0	0	0	0	0	156	0	0	4	0	0	2	0	0	0	36 056	896	0	0	0	0	0	38 831
EE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23 65	1 01	0	0	0	0	0	24 66
ES	0	5	0	0	0	1	0	0	0	0	14	0	0	0	0	0	10 638	128	0	0	0	172	303	0	0	0	61	0	11 322
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	162	0	0	0	0	0	0	122 797	0	0	0	4	0	0	0	16 661	0	0	0	0	4 318	0	0	0	0	0	0	143 942
UK[1]	0	0	0	0	0	0	0	0	3 735	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 735
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HU	0	0	0	0	0	0	0	0	1 625	0	0	0	0	0	0	0	1 267	0	0	0	0	0	0	0	239	0	0	0	3 131
IE	0	0	0	0	0	0	0	0	71 671	0	2 227	436	0	0	0	0	7 168	0	0	0	0	47 282	2 145	0	0	0	0	0	130 929
IT	0	0	0	0	0	0	0	0	1 7	0	0	0	0	0	301	0	0	29	0	0	0	0	0	0	0	0	0	0	2 03
LT	0	0	0	0	0	0	0	0	3 452	0	0	0	0	0	3 506	0	2 68	0	0	0	0	0	5 035	0	3 399	0	0	0	18 072
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	UK[1]	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	Total
LV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 489	2 218	0	0	0	0	0	3 707
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	0	0	0	19 318	0	77	128	0	490	351	121	10 25	0	0	0	0	0	8 666	0	741	0	4	990	41 136
PL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	633	0	0	0	0	0	0	0	0	0	0	1	634
PT	0	0	0	0	0	0	0	0	486	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	486
RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	335	0	0	0	0	0	0	0	0	0	0	0	335
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	5 654	0	0	0	0	0	0	0	563	0	0	0	0	0	0	0	0	0	0	0	6 217
Total	2	1 96	96	0	0	4	0	0	331 064	0	20 438	725	4	928	4 3	123	58 16	159	0	0	0	117 572	28 18	0	4 379	0	65	991	569 15

[1] in 2020, the UK was no member of EU anymore, but the numbers have been included in the table to be able to compare with the data from 2015 to 2019.

Table A 4.7: Estimated annual number of non-replacement calves transported on long journeys (> 8 hours) within the EU and the UK (average 2015 to 2020).

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK[1]	Total
AT	0	0	0	0	1	34	0	0	7 369	0	0	0	0	4	0	6 843	0	0	0	0	0	3 104	0	0	0	0	0	0	17 355
BE	0	0	0	0	414	0	0	0	18 562	0	3 036	0	0	0	10	3 434	0	0	0	0	0	0	0	0	0	0	0	1	25 457
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	18 094	0	0	0	72	0	0	28 433	0	4 192	0	73	5	0	1 231	0	18	0	0	8 022	13	0	0	0	0	0	0	60 153
DE	1	2 945	16	0	87	0	0	0	40 577	0	849	0	0	49	0	1 349	1	0	0	0	22 547	6 214	0	8	0	0	0	44	74 687
DK	5	6 793	0	0	0	17	0	0	55	0	35	1	0	1	2	0	18	0	0	0	25 329	173	0	8	11	0	0	36	32 484
EE	0	11 726	0	0	0	6	0	0	71	0	0	0	0	469	0	425	38	0	0	0	12 595	1 711	0	0	0	12	0	0	27 053
ES	0	215	0	0	282	0	0	0	0	0	999	0	0	15	0	8 152	29	0	0	0	185	161	0	0	0	10	10	0	10 058
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	118	0	0	16	107	0	0	99 995	0	0	1	0	0	14	10 248	0	0	0	0	4 546	0	0	0	0	0	0	0	115 045
UK[1]	0	0	0	0	0	0	0	0	8 781	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	8 816
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	33
HU	0	0	0	0	0	0	0	0	559	0	0	23	3	0	0	1 230	0	0	0	0	0	0	0	306	0	0	1	0	2 122
IE	0	4 893	0	0	0	0	0	0	52 206	0	3 183	0	0	0	0	11 592	0	0	0	0	40 594	1 427	20	0	0	0	0	583	114 498
IT	0	5	0	0	26	0	0	0	8 288	0	0	17	41	167	0	0	5	0	0	0	183	2 715	0	6	0	7	31	0	11 491
LT	0	120	0	0	0	0	0	0	4 975	0	0	0	4	877	0	2 721	0	0	0	0	3 511	3 625	0	760	0	0	0	0	16 593

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK[1]	Total
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	29	0	0	0	0	0	0	42
LV	0	288	0	0	0	0	0	0	82	0	0	0	0	0	0	0	0	0	0	0	15 547	2 837	0	0	0	0	0	0	18 754
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	119	0	22	16 443	0	292	0	191	1 419	155	5 168	0	0	0	0	0	8 304	0	154	0	55	190	345	32 857
PL	0	0	0	0	0	0	0	0	2 282	0	0	0	0	0	0	2 393	0	0	0	0	1 066	0	0	0	0	0	0	0	5 741
PT	0	0	0	0	0	0	0	0	463	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	463
RO	0	0	0	0	0	4	0	0	0	0	0	0	2	25	0	626	0	0	0	0	0	0	0	0	0	0	0	0	657
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	2 606	0	0	0	0	0	0	393	0	0	0	0	171	0	0	0	0	0	0	0	3 170
Total	6	45 197	16	0	826	359	0	22	291 747	0	12 586	42	314	3 031	181	55 886	91	18	0	0	134 296	30 313	20	1 242	11	84	232	1 009	577 529

[1] In 2020, the UK was no member of EU anymore, but the numbers have been included in the table to be able to compare with the data from 2015 to 2019.

Table A4.8: Estimated annual number of unweaned non-replacement calves transported to other MS and the percentage on long journeys (> 8 hours) within the EU and the UK from 2015 to 2020.

	2015		2016		2017		2018		2019		2020		average 2015-2020	
MS of origin	**total**	**> 8 hours**	**total**	**> 8 hours**	**total**	**> 8 hours**	**total**	**> 8 hours**	**total**	**> 8 hours**	**total**	**> 8 hours**	**total**	**> 8 hours**
AT	41 181	17.8%	36 069	22.7%	35 799	31.9%	46 205	54.7%	50 478	55.5%	38 154	62.8%	41 315	42.0%
BE	51 048	0.4%	40 482	15.4%	102 392	26.3%	179 379	39.7%	78 117	38.5%	47 262	38.2%	83 114	30.6%
BG	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CY	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CZ	66 461	93.6%	68 569	95.6%	50 753	94.9%	53 289	94.8%	61 130	97.1%	76 489	98.2%	62 783	95.8%
DE	589 148	15.6%	595 922	15.7%	627 709	15.3%	676 918	14.0%	672 284	7.3%	637 761	3.6%	633 291	11.8%
DK	33 327	71.6%	34 515	86.9%	30 817	90.7%	35 231	89.8%	44 433	95.9%	39 582	98.1%	36 319	89.4%
EE	30 541	99.1%	24 912	97.3%	31 511	98.0%	29 216	90.2%	26 982	96.1%	24 786	99.5%	27 993	96.6%
ES	18 182	80.6%	10 237	68.9%	11 866	62.7%	13 197	72.2%	14 170	72.9%	12 984	87.2%	13 439	74.8%
FI	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
FR	172 231	46.4%	202 477	48.0%	248 922	43.2%	250 965	44.7%	297 384	50.3%	332 132	43.3%	250 685	45.9%
UK	0	0.0%	15	100.0%	27 593	71.5%	24 143	83.6%	14 919	62.0%	5 116	73.0%	11 965	73.7%
GR	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
HR	2	0.0%	1	0.0%	0	0.0%	196	100.0%	1	0.0%	0	0.0%	34	97.1%
HU	331	95.2%	1 052	16.1%	2 397	26.3%	6 051	68.4%	6 617	65.6%	5 459	57.4%	3 653	58.1%
IE	61 332	92.1%	72 522	93.5%	110 379	94.4%	177 152	95.0%	170 691	93.3%	149 647	87.5%	123 620	92.6%
IT	30 786	98.8%	25 589	99.6%	6 646	99.3%	2 928	100.0%	1 635	90.2%	2 075	97.9%	11 609	98.9%
LT	4 187	52.1%	13 822	57.5%	28 689	85.9%	35 121	85.1%	21 603	77.9%	22 245	81.2%	20 944	79.2%
LU	10 085	0.0%	11 574	0.0%	10 718	2.4%	12 632	0.0%	17 486	0.0%	21 595	0.0%	14 016	0.3%
LV	37 666	91.7%	26 226	100.0%	29 802	96.0%	10 564	98.7%	9 919	90.8%	6 975	53.2%	20 193	92.9%
MT	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NL	18 817	51.0%	42 033	78.1%	44 648	83.4%	40 508	84.9%	44 495	94.2%	42 795	96.1%	38 884	84.5%

MS of origin	2015 total	2015 > 8 hours	2016 total	2016 > 8 hours	2017 total	2017 > 8 hours	2018 total	2018 > 8 hours	2019 total	2019 > 8 hours	2020 total	2020 > 8 hours	average 2015-2020 total	average 2015-2020 > 8 hours
PL	22 447	99.9%	8 152	99.6%	1 122	100.0%	380	97.1%	1 771	100.0%	634	100.0%	5 751	99.8%
PT	7 937	20.2%	4 684	10.1%	5 009	4.1%	3	0.0%	123	7.3%	4 744	10.2%	3 750	12.3%
RO	1	100.0%	0	0.0%	1 033	17.8%	2 492	14.6%	6 705	45.6%	1 249	26.8%	1 914	34.4%
SE	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
SI	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
SK	2 603	30.0%	2 016	4.7%	7 202	38.2%	13 696	35.3%	14 048	31.0%	15 338	40.5%	9 150	34.6%
Total	1 198 313	39.1%	1 220 869	41.0%	1 415 007	41.2%	1 610 266	43.3%	1 554 991	41.6%	1 487 022	38.3%	1 414 422	40.8%

Table A4.9: Estimated annual number of unweaned non-replacement calves arriving from other MS and the percentage on long journeys (> 8 hours) within the EU and the UK from 2015 to 2020.

MS of arrival	2015		2016		2017		2018		2019		2020		average 2015-2020	
	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours
AT	18	0.0%	47	0.0%	47	59.6%	6	0.0%	2	0.0%	5	40.0%	22	22.7%
BE	75 946	66.2%	76 931	70.4%	115 643	58.0%	152 522	49.8%	57 907	37.7%	45 726	4.3%	87 446	51.7%
BG	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	96	100.0%	16	100.0%
CY	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CZ	71	0.0%	911	52.3%	843	78.9%	3 799	99.9%	16	93.8%	0	0.0%	940	87.8%
DE	9 622	1.9%	13 613	7.0%	6 706	6.8%	3 826	10.4%	1 750	9.5%	355	1.1%	5 980	6.0%
DK	3	0.0%	0	0.0%	0	0.0%	3	0.0%	0	0.0%	0	0.0%	2	0.0%
EE	0	0.0%	1	0.0%	30	100.0%	99	100.0%	43	0.0%	0	0.0%	29	75.9%
ES	277 402	65.2%	323 173	68.0%	445 446	66.3%	525 965	73.9%	483 921	69.3%	519 255	63.8%	429 195	68.0%
FI	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
FR	24 926	70.3%	28 917	70.1%	6 731	17.4%	14 074	67.1%	15 668	42.6%	24 330	84.0%	19 108	65.9%
UK	5 947	17.1%	5 834	25.1%	8 024	22.7%	9 262	5.1%	11 866	4.7%	19 443	3.7%	10 063	10.0%
GR	136	100.0%	3	100.0%	0	0.0%	103	100.0%	0	0.0%	4	100.0%	42	100.0%
HR	555	42.9%	684	78.5%	125	73.6%	684	7.3%	116	29.3%	1 571	59.0%	622	50.2%
HU	3 691	93.3%	7 324	90.5%	4 141	52.9%	3 164	23.0%	5 410	16.5%	5 890	73.1%	4 938	61.4%
IE	86	100.0%	530	100.0%	353	100.0%	0	0.0%	0	0.0%	123	100.0%	181	100.0%
IT	82 060	51.4%	81 816	61.2%	79 244	64.0%	92 746	68.6%	98 898	71.4%	80 882	71.9%	85 944	65.0%
LT	1 470	0.2%	222	43.7%	387	7.0%	2 856	5.1%	1 643	6.9%	1 631	9.7%	1 368	6.7%
LU	218	0.0%	10	0.0%	50	0.0%	36	0.0%	147	71.4%	36	0.0%	83	21.7%
LV	0	0.0%	44	0.0%	50	0.0%	186	0.0%	111	0.0%	82	0.0%	79	0.0%
MT	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

MS of arrival	2015		2016		2017		2018		2019		2020		average 2015-2020	
	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours	total	> 8 hours
NL	678 587	20.9%	646 293	18.7%	697 250	18.0%	754 956	16.4%	826 931	21.3%	734 051	16.0%	723 012	18.6%
PL	37 321	83.1%	33 380	74.8%	46 447	76.9%	44 535	66.7%	46 933	68.8%	46 241	60.9%	42 477	71.4%
PT	1	0.0%	0	0.0%	0	0.0%	0	0.0%	122	100.0%	0	0.0%	20	100.0%
RO	195	100.0%	521	40.3%	3 109	44.3%	1 266	19.5%	3 056	34.2%	6 085	72.0%	2 372	52.4%
SE	0	0.0%	0	0.0%	22	100.0%	37	100.0%	7	100.0%	0	0.0%	11	100.0%
SI	14	21.4%	69	100.0%	140	98.6%	129	100.0%	166	59.6%	65	100.0%	97	85.6%
SK	44	13.6%	546	22.9%	219	96.8%	12	0.0%	278	22.3%	1 151	86.0%	375	61.9%
Total	1 198 313	39.1%	1 220 869	41.0%	1 415 007	41.2%	1 610 266	43.3%	1 554 991	41.6%	1 487 022	38.3%	1 414 422	40.8%

Table A4.10: Estimated annual number of non-replacement calves transported on long journeys between 8 and 19 hours within the EU and the UK (average 2015 to 2020).

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK[1]	Total
AT	0	0	0	0	1	34	0	0	4 584	0	0	0	0	4	0	6 843	0	0	0	0	0	3 104	0	0	0	0	0	0	14 570
BE	0	0	0	0	414	0	0	0	18 121	0	3 036	0	0	0	9	3 376	0	0	0	0	0	0	0	0	0	0	0	1	24 957
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	18 094	0	0	0	72	0	0	245	0	4 188	0	73	5	0	1 086	0	18	0	0	7 988	13	0	0	0	0	0	0	31 782
DE	1	2 945	0	0	87	0	0	0	22 490	0	849	0	0	42	0	1 259	1	0	0	0	22 547	6 199	0	8	0	0	0	6	56 434
DK	3	6 767	0	0	0	17	0	0	0	0	6	0	0	0	0	0	0	0	0	0	25 315	30	0	0	11	0	0	0	32 149
EE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	40	1 332	0	0	0	0	0	0	1 410
ES	0	202	0	0	0	0	0	0	0	0	999	0	0	0	0	4 141	0	0	0	0	160	0	0	0	0	0	0	0	5 502
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	118	0	0	14	107	0	0	98 406	0	0	0	0	0	14	9 972	0	0	0	0	4 511	0	0	0	0	0	0	0	113 142
UK[1]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	33
HU	0	0	0	0	0	0	0	0	0	0	0	7	3	0	0	1 090	0	0	0	0	0	0	0	306	0	0	0	0	1 406
IE	0	88	0	0	0	0	0	0	276	0	173	0	0	0	0	0	0	0	0	0	2 164	0	0	0	0	0	0	483	3 184
IT	0	5	0	0	26	0	0	0	8 044	0	0	0	41	167	0	0	0	0	0	0	183	1 748	0	5	0	7	30	0	10 256
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	828	0	0	0	0	0	0	40	3 588	0	15	0	0	0	0	4 471

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK[1]	Total
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	17	0	0	0	0	0	0	30
LV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	867	2 783	0	0	0	0	0	0	3 650
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	119	0	0	1 527	0	292	0	60	1 195	23	4 051	0	0	0	0	0	7 732	0	0	0	28	173	145	15 345
PL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 876	0	0	0	0	1 066	0	0	0	0	0	0	0	2 942
PT	0	0	0	0	0	0	0	0	392	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	392
RO	0	0	0	0	0	2	0	0	0	0	0	0	2	25	0	589	0	0	0	0	0	0	0	0	0	0	0	0	618
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	291	0	0	0	0	157	0	0	0	0	0	0	0	448
Total	4	28 219	0	0	542	351	0	0	154 085	0	9 543	7	179	2 266	46	34 620	39	18	0	0	65 038	26 546	0	334	11	35	203	635	322 721

[1] In 2020, the UK was no member of EU anymore, but the numbers have been included in the table to be able to compare with the data from 2015 to 2019.

Table A4.11: Estimated annual number of non-replacement calves transported on long journeys of more than 19 hours within the EU and the UK (average 2015 to 2020).

	Destination																											
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK[1]	Total
AT	0	0	0	0	0	0	0	0	2 785	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 785
BE	0	0	0	0	0	0	0	0	441	0	0	0	0	0	1	58	0	0	0	0	0	0	0	0	0	0	0	0	500
BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZ	0	0	0	0	0	0	0	0	28 188	0	4	0	0	0	0	145	0	0	0	0	34	0	0	0	0	0	0	0	28 371
DE	0	0	16	0	0	0	0	0	18 087	0	0	0	0	7	0	90	0	0	0	0	0	15	0	0	0	0	0	38	18 253
DK	2	26	0	0	0	0	0	0	55	0	29	1	0	1	2	0	18	0	0	0	14	143	0	8	0	0	0	36	335
EE	0	11 726	0	0	0	6	0	0	71	0	0	0	0	469	0	425	0	0	0	0	12 555	379	0	0	0	12	0	0	25 643
ES	0	13	0	0	282	0	0	0	0	0	0	0	0	15	0	4 011	29	0	0	0	25	161	0	0	0	10	10	0	4 556
FI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FR	0	0	0	0	2	0	0	0	1 589	0	0	1	0	0	0	276	0	0	0	0	35	0	0	0	0	0	0	0	1 903
UK[1]	0	0	0	0	0	0	0	0	8 781	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	8 816
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HU	0	0	0	0	0	0	0	0	559	0	0	16	0	0	0	140	0	0	0	0	0	0	0	0	0	0	1	0	716
IE	0	4 805	0	0	0	0	0	0	51 930	0	3 010	0	0	0	0	11 592	0	0	0	0	38 430	1 427	20	0	0	0	0	100	111 314
IT	0	0	0	0	0	0	0	0	244	0	0	17	0	0	0	0	5	0	0	0	0	967	0	1	0	0	1	0	1 235

	Destination																												
Origin	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK[1]	Total
LT	0	120	0	0	0	0	0	0	4 975	0	0	0	4	49	0	2 721	0	0	0	0	3 471	37	0	745	0	0	0	0	12 122
LU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	12
LV	0	288	0	0	0	0	0	0	82	0	0	0	0	0	0	0	0	0	0	0	14 680	54	0	0	0	0	0	0	15 104
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NL	0	0	0	0	0	0	0	22	14 916	0	0	0	131	224	132	1 117	0	0	0	0	0	572	0	154	0	27	17	200	17 512
PL	0	0	0	0	0	0	0	0	2 282	0	0	0	0	0	0	517	0	0	0	0	0	0	0	0	0	0	0	0	2 799
PT	0	0	0	0	0	0	0	0	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71
RO	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	37	0	0	0	0	0	0	0	0	0	0	0	0	39
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SK	0	0	0	0	0	0	0	0	2 606	0	0	0	0	0	0	102	0	0	0	0	14	0	0	0	0	0	0	0	2 722
Total	2	16 978	16	0	284	8	0	22	137 662	0	3 043	35	135	765	135	21 266	52	0	0	0	69 258	3 767	20	908	0	49	29	374	254 808

[1] In 2020, the UK was no member of EU anymore, but the numbers have been included in the table to be able to compare with the data from 2015 to 2019.

Annex 5 Mortality data after transport

Table A5.1 Mortality rates of claves after arrival at Dutch veal calves per MS of origin in 2017

year	MS code	total calves entered	Day 1		Day 2		Week 1		before week 2		Before 56 days		Rest		Total	
2017	BE	26 041	2	0.008%	33	0.13%	78	0.30%	221	0.85%	556	2.14%	497	1.91%	1 053	4.04%
2017	CZ	20 534	0	0.000%	3	0.01%	28	0.14%	71	0.35%	219	1.07%	321	1.56%	540	2.63%
2017	DE	522 543	4	0.001%	45	0.01%	897	0.17%	3 234	0.62%	9 271	1.77%	8 523	1.63%	17 794	3.41%
2017	DK	23 518	0	0.000%	0	0.00%	29	0.12%	72	0.31%	300	1.28%	328	1.39%	628	2.67%
2017	EE	15 312	3	0.020%	2	0.01%	38	0.25%	76	0.50%	214	1.40%	281	1.84%	495	3.23%
2017	IE	45 766	1	0.002%	10	0.02%	124	0.27%	235	0.51%	563	1.23%	534	1.17%	1 097	2.40%
2017	LT	10 014	0	0.000%	6	0.06%	52	0.52%	111	1.11%	300	3.00%	212	2.12%	512	5.11%
2017	LU	18 101	0	0.000%	2	0.01%	18	0.10%	78	0.43%	239	1.32%	342	1.89%	581	3.21%
2017	LV	25 438	1	0.004%	0	0.00%	116	0.46%	267	1.05%	586	2.30%	496	1.95%	1 082	4.25%
2017	NL	949 211	14	0.001%	68	0.01%	1 236	0.13%	4 929	0.52%	15 485	1.63%	16 272	1.71%	31 757	3.35%
2017	PL	2 438	0	0.000%	0	0.00%	16	0.66%	36	1.48%	93	3.81%	74	3.04%	167	6.85%
2017	SK	3 686	0	0.000%	0	0.00%	4	0.11%	15	0.41%	65	1.76%	68	1.84%	133	3.61%
	Total	**1 662 602**	**25**	**0.002%**	**169**	**0.01%**	**2 636**	**0.16%**	**9 345**	**0.56%**	**27 891**	**1.68%**	**27 948**	**1.68%**	**55 839**	**3.36%**

Table A5.2 Mortality rates of claves after arrival at Dutch veal calves per MS of origin in 2018

year	MS Code	total calves entered	Day 1		Day 2		Week 1		before week 2		Before 56 days		Rest		Total	
2018	BE	28 242	0	0.000%	0	0.00%	42	0.15%	217	0.77%	542	1.92%	377	1.33%	919	3.25%
2018	CZ	26 943	0	0.000%	1	0.00%	31	0.12%	78	0.29%	282	1.05%	419	1.56%	701	2.60%
2018	DE	548 841	8	0.001%	48	0.01%	1 077	0.20%	3 882	0.71%	10 657	1.94%	9 260	1.69%	19 917	3.63%
2018	DK	27 055	0	0.000%	0	0.00%	39	0.14%	100	0.37%	371	1.37%	402	1.49%	773	2.86%
2018	EE	23 884	2	0.008%	4	0.02%	58	0.24%	120	0.50%	365	1.53%	379	1.59%	744	3.12%
2018	IE	55 072	0	0.000%	3	0.01%	119	0.22%	279	0.51%	760	1.38%	645	1.17%	1 405	2.55%
2018	LT	12 657	0	0.000%	2	0.02%	33	0.26%	77	0.61%	208	1.64%	191	1.51%	399	3.15%

2018	LU	18 324	0	0.000%	3	0.02%	33	0.18%	85	0.46%	257	1.40%	296	1.62%	553	3.02%
2018	LV	28 809	0	0.000%	3	0.01%	127	0.44%	240	0.83%	606	2.10%	507	1.76%	1 113	3.86%
2018	NL	935 359	6	0.001%	39	0.00%	1 029	0.11%	4 202	0.45%	13 601	1.45%	13 885	1.48%	27 486	2.94%
2018	SK	1 405	0	0.000%	0	0.00%	1	0.07%	5	0.36%	17	1.21%	24	1.71%	41	2.92%
	Total	**1 706 591**	**16**	**0.001%**	**103**	**0.01%**	**2 589**	**0.15%**	**9 285**	**0.54%**	**27 666**	**1.62%**	**26 385**	**1.55%**	**54 051**	**3.17%**

Table A5.3 Mortality rates of claves after arrival at Dutch veal calves per MS of origin in 2019

year	MS Code	total calves entered	Day 1		Day 2		Week 1		before week 2		Before 56 days		Rest		Total	
2019	BE	14 925	0	0.000%	0	0.00%	28	0.19%	117	0.78%	289	1.94%	222	1.49%	511	3.42%
2019	CZ	19 823	0	0.000%	6	0.03%	37	0.19%	60	0.30%	210	1.06%	318	1.60%	528	2.66%
2019	DE	604 832	2	0.000%	59	0.01%	1 177	0.19%	3 814	0.63%	10 163	1.68%	9 589	1.59%	19 752	3.27%
2019	DK	34 898	0	0.000%	0	0.00%	33	0.09%	97	0.28%	431	1.24%	437	1.25%	868	2.49%
2019	EE	24 296	0	0.000%	4	0.02%	74	0.30%	134	0.55%	354	1.46%	474	1.95%	828	3.41%
2019	IE	83 191	0	0.000%	5	0.01%	142	0.17%	328	0.39%	874	1.05%	967	1.16%	1 841	2.21%
2019	IT	109	0	0.000%	0	0.00%	0	0.00%	1	0.92%	1	0.92%	1	0.92%	2	1.83%
2019	LT	5 720	0	0.000%	0	0.00%	18	0.31%	44	0.77%	114	1.99%	69	1.21%	183	3.20%
2019	LU	19 246	0	0.000%	3	0.02%	28	0.15%	104	0.54%	331	1.72%	327	1.70%	658	3.42%
2019	LV	21 117	0	0.000%	1	0.00%	74	0.35%	158	0.75%	396	1.88%	376	1.78%	772	3.66%
2019	NL	903 726	13	0.001%	78	0.01%	889	0.10%	3 380	0.37%	11 432	1.26%	13 801	1.53%	25 233	2.79%
2019	SK	2 688	0	0.000%	1	0.04%	8	0.30%	10	0.37%	26	0.97%	24	0.89%	50	1.86%
	Total	**1 734 571**	**15**	**0.001%**	**157**	**0.01%**	**2 508**	**0.14%**	**8 247**	**0.48%**	**24 621**	**1.42%**	**26 605**	**1.53%**	**51 226**	**2.95%**

Table A5.3 Mortality rates of claves after arrival at Dutch veal calves per MS of origin in 2020

year	MS Code	total calves entered	Day 1		Day 2		Week 1		before week 2		Before 56 days		Rest		Total	
2020	BE	20 526	0	0.000%	0	0.00%	33	0.16%	105	0.51%	265	1.29%	334	1.63%	599	2.92%
2020	CZ	3 551	0	0.000%	0	0.00%	6	0.17%	10	0.28%	52	1.46%	36	1.01%	88	2.48%
2020	DE	504 694	0	0.000%	62	0.01%	977	0.19%	3 015	0.60%	8 081	1.60%	7 756	1.54%	15 837	3.14%
2020	DK	40 220	0	0.000%	0	0.00%	21	0.05%	83	0.21%	443	1.10%	526	1.31%	969	2.41%
2020	EE	23 103	0	0.000%	3	0.01%	55	0.24%	90	0.39%	238	1.03%	321	1.39%	559	2.42%
2020	IE	47 711	0	0.000%	4	0.01%	67	0.14%	142	0.30%	397	0.83%	578	1.21%	975	2.04%
2020	IT	302	0	0.000%	0	0.00%	0	0.00%	0	0.00%	3	0.99%	5	1.66%	8	2.65%
2020	LU	19 582	0	0.000%	3	0.02%	29	0.15%	107	0.55%	324	1.65%	340	1.74%	664	3.39%
2020	LV	15 068	0	0.000%	0	0.00%	12	0.08%	41	0.27%	191	1.27%	265	1.76%	456	3.03%
2020	NL	893 837	33	0.004%	158	0.02%	1 162	0.13%	3 442	0.39%	10 481	1.17%	13 080	1.46%	23 561	2.64%
2020	RO	264	0	0.000%	0	0.00%	0	0.00%	1	0.38%	14	5.30%	3	1.14%	17	6.44%
2020	SK	657	0	0.000%	0	0.00%	0	0.00%	0	0.00%	5	0.76%	11	1.67%	16	2.44%
	Total	**1 569 515**	**33**	**0.002%**	**230**	**0.01%**	**2 362**	**0.15%**	**7 036**	**0.45%**	**20 494**	**1.31%**	**23 255**	**1.48%**	**43 749**	**2.79%**

Annex 6 Cost and Benefits of using sexed semen.

Economic effects of using sexed and beef semen in the Netherlands

To get insights into the economic effects of using sexed semen to reduce the number of non-replacement dairy-type calves, analysis was performed using a typical Dutch dairy farm with 100 dairy cows as example. Analysis shows how insemination with sexed semen can reduce the number of male non-replacement dairy calves (Figure 19). Further details on the calculations are in Annex 6.

Basic scenario: use of non-sexed dairy semen and beef semen

If every cow is inseminated with normal dairy type semen, so non-sexed semen, for every 100 cows around 50 female dairy calves and 50 male dairy calves are born. Considering a 12% still-born and peripartum mortality rate of calves, this results in around 44 female and 44 male dairy calves. Approximately 30% of the calves born are needed to replace cows. Thus, per 100 cows, 58 dairy calves are born (14 female and 44 male) that are not needed for replacement (Figure 19).

Alternative Scenario 1: use of non-sexed dairy semen and non-sexed beef semen

To reduce the number of non-replacement typical dairy calves, a farmer can also use beef type semen to inseminate the cows that are not used to produce replacement female dairy cows. In this situation, considering calf mortality, 68 out of every 100 cows need to be inseminated with dairy type semen. This results in 30 female replacement dairy calves and 30 non-replacement male dairy calves. The remaining 32 cows can be inseminated with beef type semen to produce 28 crossbred calves, half of them female and half male. Thus, per 100 cows, 30 dairy calves (all male) and 28 crossbred calves are born that are not needed for replacement (Figure 19).

Text box: cost and benefits of using sexed semen

Additional insemination costs of sexed semen were around €21[163] (minimum €14, maximum €27, depending on the bull) per inseminated cow compared to non-sexed semen. Prices of beef semen were about €5 lower[164] than not-sexed dairy semen. Per 100 cows, total insemination costs with dairy and beef semen are about €290 per year lower than those for insemination with only dairy semen. Total insemination costs per 100 cows using sexed dairy semen and beef semen are about €1,090 per year higher than those of insemination with only dairy semen. Revenues of crossbred calves (male €180, female €95)[165] are higher than for dairy calves (male €75, female €20)[166].

Alternative Scenario 2: use of sexed dairy semen and non-sexed beef semen

Using sexed dairy type semen reduces the number of male dairy calves born by 90%. Instead of 1 male calf born per female calf, with sexed dairy type semen only 1 male calf is born per 10 female

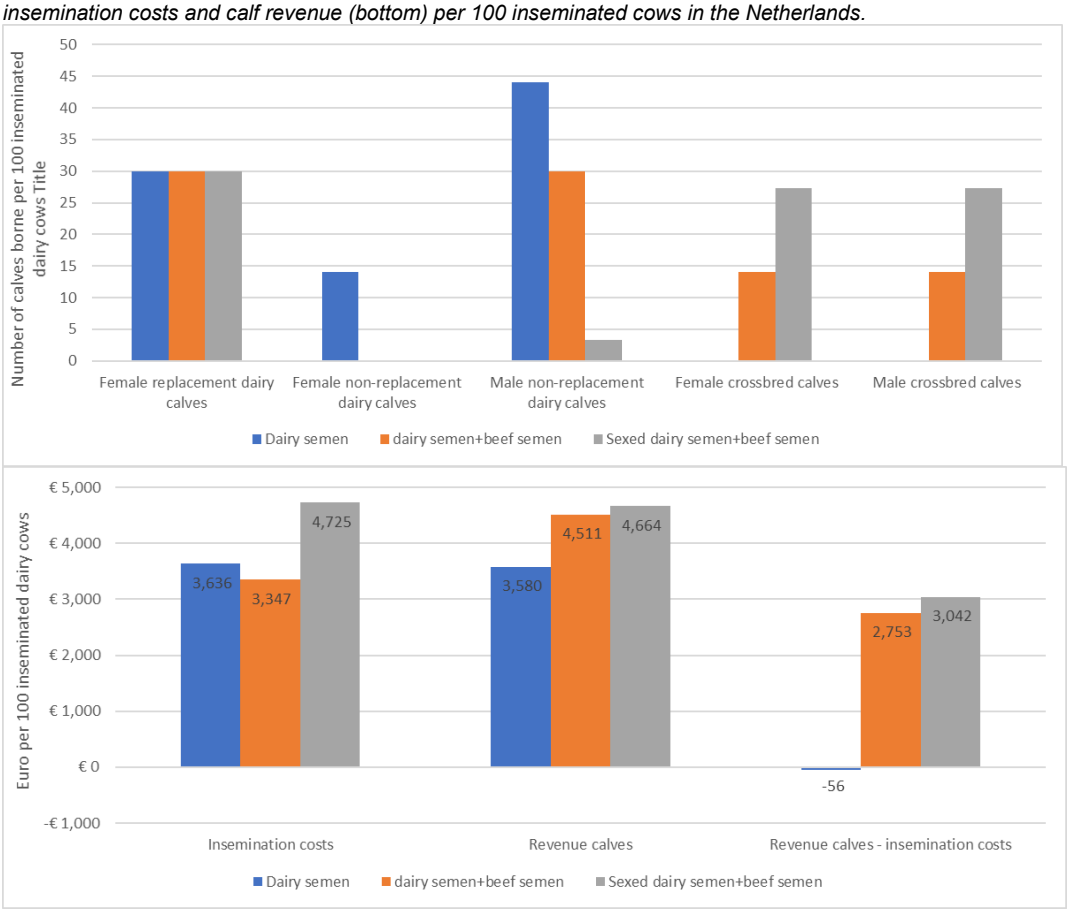
[163] Prices CRV, dairy Holstein black and white, published on 8 December 2021.
[164] Prices CRV February 2022, beef cattle, Belgium Blue.
[165] Male and female calves 50% Belgian Blue, average 2015-2021, www.agrimatie.nl.
[166] Male and female calves, black/red and white, average 2015-2021, www.agrimatie.nl.

calves. To get 30 replacement female dairy calves with sexed semen, only 38 cows need to be inseminated with dairy semen. This results in 30 female replacement dairy calves and 3 non-replacement male dairy calves. The remaining 62 cows can be inseminated with beef type semen resulting in 55 crossbred calves, half of them female and half male. Thus, per 100 cows, 3 dairy calves (all male) and 55 crossbred calves are born that are not needed for replacement (Figure 19).

Figure 19 also provides the economic impact of using sexed dairy semen and beef semen per 100 cows in the Netherlands. Using non-sexed dairy semen and beef semen can increase revenues with over €2,500 per 100 cows compared to only using dairy semen. Using sexed dairy semen and beef semen can increase revenues by almost €4,200 per 100 cows compared to using only non-sexed dairy semen.

At the revenue prices presented, using sexed dairy and beef semen results in the highest revenue minus insemination costs. However, the additional beef on the market could have an impact on the market price of beef. For a farmer using only dairy semen, changing to sexed dairy semen and beef semen is economically more favourable if the revenue price of a crossbred calf is about €33 higher than that of a non-replacement dairy calf. For a farmer already using dairy and beef semen, it is economically more favourable to change to using sexed dairy semen when the revenue price of a crossbred calf is about €80 higher than for a non-replacement dairy calf.

Figure 19. *Estimate of the impact of using beef semen and sexed dairy semen on number of calves born (top), insemination costs and calf revenue (bottom) per 100 inseminated cows in the Netherlands.*



Economic effects of using sexed and beef semen in the Netherlands

To get insights into the economic effects of using sexed semen to reduce the number of non-replacement dairy-type calves, analysis was performed using a typical Dutch dairy farm with 100 dairy cows as example. Analysis shows how insemination with sexed semen can reduce the

number of male non-replacement dairy calves (Figure 19). Further details on the calculations are in Annex 6.

Basic scenario: use of non-sexed dairy semen and beef semen

If every cow is inseminated with normal dairy type semen, so non-sexed semen, for every 100 cows around 50 female dairy calves and 50 male dairy calves are born. Considering 12% still-born and peripartum mortality of calves, this results in around 44 female and 44 male dairy calves. Approximately 30% of the calves born are needed to replace cows. Thus, per 100 cows, 58 dairy calves are born (14 female and 44 male) that are not needed for replacement (Figure 19).

Alternative Scenario 1: use of non-sexed dairy semen and non-sexed beef semen

To reduce the number of non-replacement typical dairy calves, a farmer can also use beef type semen to inseminate the cows that are not used to produce replacement female dairy cows. In this situation, considering calf mortality, 68 out of every 100 cows need to be inseminated with dairy type semen. This results in 30 female replacement dairy calves and 30 non-replacement male dairy calves. The remaining 32 cows can be inseminated with beef type semen to produce 28 crossbred calves, half of them female and half male. Thus, per 100 cows, 30 dairy calves (all male) and 28 crossbred calves are born that are not needed for replacement (Figure 19).

Text box: Cost and benefits of using sexed semen

Additional insemination costs of sexed semen were around €21 [167] (minimum €14, maximum €27, depending on the bull) per inseminated cow compared to non-sexed semen. Prices of beef semen were about €5 lower [168] than not-sexed dairy semen. Per 100 cows, total insemination costs with dairy and beef semen are about €290 per year lower than those for insemination with only dairy semen. Total insemination costs per 100 cows using sexed dairy semen and beef semen are about €1,090 per year higher than those of insemination with only dairy semen. Revenues of crossbred calves (male €180, female €95) [169] are higher than for dairy calves (male €75, female €20) [170].

Alternative Scenario 2: use of sexed dairy semen and non-sexed beef semen

Using sexed dairy type semen reduces the number of male dairy calves born by 90%. Instead of 1 male calf born per female calf, with sexed dairy type semen only 1 male calf is born per 10 female calves. To get 30 replacement female dairy calves with sexed semen, only 38 cows need to be inseminated with dairy semen. This results in 30 female replacement dairy calves and 3 non-replacement male dairy calves. The remaining 62 cows can be inseminated with beef type semen resulting in 55 crossbred calves, half of them female and half male. Thus, per 100 cows, 3 dairy calves (all male) and 55 crossbred calves are born that are not needed for replacement (Figure 19).

Figure 19 also provides the economic impact of using sexed dairy semen and beef semen per 100 cows in the Netherlands. Using non-sexed dairy semen and beef semen can increase revenues with over €2 500 per 100 cows compared to only using dairy semen. Using sexed dairy semen and beef semen can increase revenues with almost €4 200 per 100 cows over using only non-sexed dairy semen.

At the presented revenue prices, using sexed dairy and beef semen results in the highest revenue minus insemination costs. However, the additional beef on the market could have an impact on the

[167] Prices CRV, dairy Holstein black and white, published on 8 December 2021.
[168] Prices CRV February 2022, beef cattle, Belgium Blue.
[169] Male and female calves 50% Belgian Blue, average 2015-2021, www.agrimatie.nl.
[170] Male and female calves, black/red and white, average 2015-2021, www.agrimatie.nl.

market price of beef. For a farmer using only dairy semen, changing to using sexed dairy semen and beef semen is economically more favourable if the revenue price of a crossbred calf is about €33 higher than that of a non-replacement dairy calf. For a farmer already using dairy and beef semen, it is economically more favourable to change to using sexed dairy semen when the revenue price of a crossbred calf is about €80 higher than for a non-replacement dairy calf.

Figure 20. Estimate of the impact of using beef semen and sexed dairy semen on number of calves born (top), insemination costs and calf revenue (bottom) per 100 inseminated cows in the Netherlands.

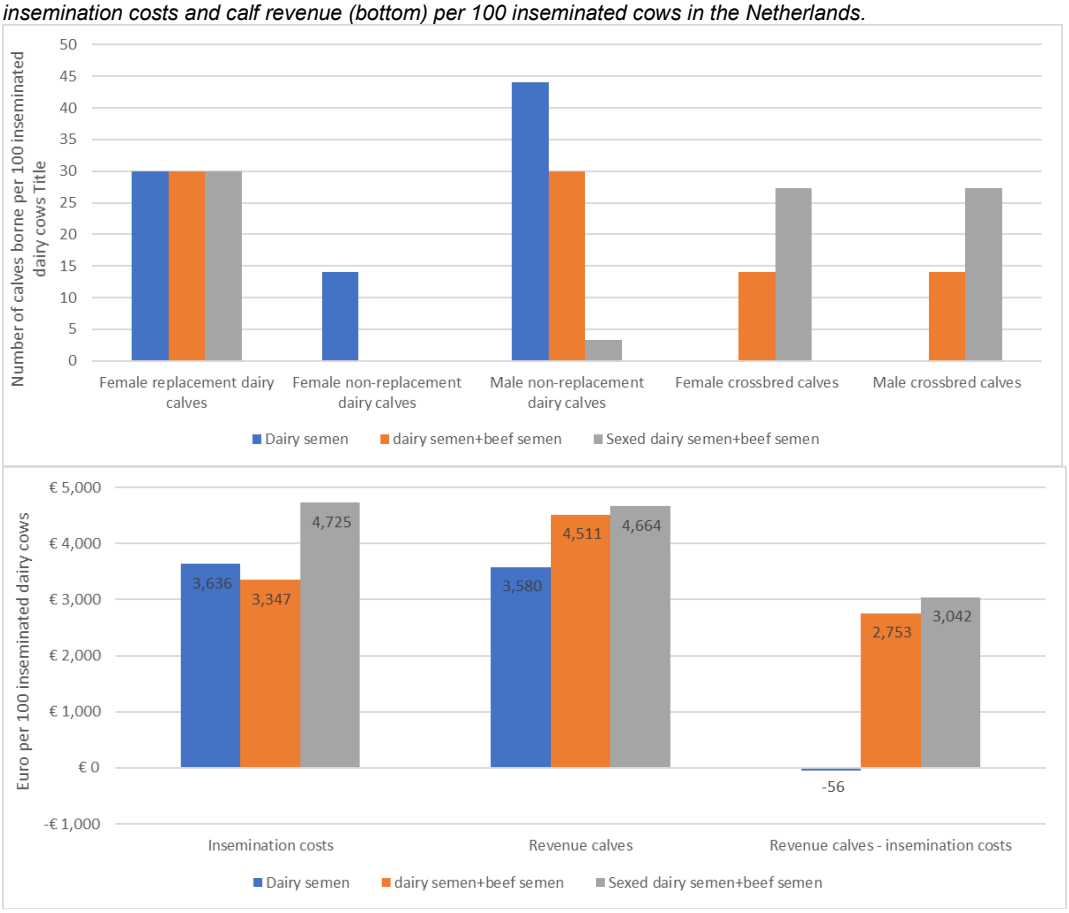


Table A6.1 cost calculation of the cost and benefits of using sexed semen of a standard farm of 100 dairy cows

	Dairy semen	Dairy + beef semen	Sexed dairy + beef semen
number of calves			
number of dairy cows	100	100	100
number of calves per cow per year	1	1	1
Replacement percentage	30%	30%	30%
% born dairy calves female	50%	50%	90%
Mortality calves up to 2 years of age	12%	12%	12%
Number of dairy cows with dairy calf semen	100.00	68.18	37.88
Number of female dairy calves for replacement	30	30	30
Number of female dairy calves to beef	14	0	0
Number of male dairy calves to beef	44	30	3.33
Number of dairy cows with beef calf semen	0	31.82	62.12
% born crossbred calves female	50%	50%	50%

Number of female crossbred calves to beef	0	14	27.33
Number of male crossbred calves to beef	0	14	27.33
Comparison to dairy semen scenario			
Avoided dairy calves to beef per 100 cows	0	28	54.67
% non-replacement calves that are dairy calves	100%	52%	6%
Costs insemination			
Price insemination dairy calf semen	€20.00	€20.00	€40.00
Conception rate dairy calf semen	55%	55%	50%
Number of inseminations dairy calf semen	181.82	123.97	75.76
Costs of insemination dairy calf semen	€3 636	€2 479	€3 030
Price insemination beef calf semen	€15.00	€15.00	€15.00
Conception rate beef calf semen	55%	55%	55%
Number of inseminations beef calf semen	0.00	57.85	112.95
Costs of insemination beef calf semen	€0	€868	€1,694
Total costs insemination	**€3 636**	**€3 347**	**€4 725**
Delta compared to dairy semen scenario	**€0**	**- €289**	**€1 088**
Revenue calves			
Price male dairy calves to beef	€75	€75	€75
Price female dairy calves to beef	€20	€20	€20
Price male crossbred calves to beef	€180	€180	€180
Price female crossbred calves to beef	€95	€95	€95
Revenue male dairy calves	€3 300	€2 250	€250
Revenue female dairy calves	€280	€0	€0
Revenue male crossbred calves	€0	€2 520	€4 920
Revenue female crossbred calves	€0	€1 330	€2 597
Total revenue	**€3 580**	**€6 100**	**€7 767**
Delta compared to dairy semen scenario	**€0**	**€2 520**	**€4 187**
Revenue calves - insemination costs	**- €56**	**€2 753**	**€3 042**
Delta compared to dairy semen scenario	**€0**	**€2 809**	**€3 099**

EW-01-22-217-EN-N

Publications Office
of the European Union

doi: 10.2875/072915
ISBN: 978-92-76-50118-3