

SMALL RUMINANTS NETWORK REPORT



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The Small Ruminants Network is mandated to monitor the health of sheep and goat herds in order to gather and distribute the information required for actions to protect both animal and public health. For more information about the Small Ruminants Network, please visit this Web page (in French only): <https://www.mapaq.gouv.qc.ca/fr/Productions/santeanimale/maladies/RAIZO/Pages/reseauruminants.aspx>.

Highlights

Since this report covers an eight-year period (2013-2020), it discusses only some of the small ruminant surveillance activities in which MAPAQ participated during this period.

PISAQ campaigns¹

The goal of the Quebec's Integrated Animal Health Program (PISAQ) is to inform livestock producers about good prevention and control practices and assist them in implementing them. It raises awareness through campaigns with themes that have been selected by a working group, which includes and represents various actors from the industry. In the small ruminants sector, three campaigns on the following themes have been created since PISAQ's inception: abortions, integrated gastrointestinal parasite management in herds with access to pasture, milk quality and mammary health in small dairy ruminants. In addition to educational activities, which consist of animal health visits from the farm's veterinary practitioner, these campaigns include surveillance activities that encourage producers to submit samples to the laboratory in order to promote a more judicious use of drugs and better management of health problems. More information about PISAQ and its various campaigns is available in French at www.mapaq.gouv.qc.ca/PISAQ.

Abortions in small ruminants

Abortions often occur in waves and can greatly affect the profitability of the goat and sheep farming facilities concerned. In addition, most of the pathogens that cause these abortions are zoonotic, which means that they are not only capable of being spread to humans, but can also be harmful to their health. Launched in 2017, this PISAQ campaign informs livestock producers about the causes of abortions and the zoonotic risks, and provides them with tools to better prevent and control them. As of May 20, 2021, more than 370 sheep and goat farming facilities had received an animal health visit as part of an awareness activity. During the same period, surveillance activities resulted in 149 aborted fetuses and placentas being submitted for a necropsy, whose costs were covered by MAPAQ. The main pathogens identified to date are *Chlamydia* spp, *Toxoplasma gondii* and *Coxiella burnetii* in sheep, and *C. burnetii* in goats. More details are available in French at <https://www.mapaq.gouv.qc.ca/fr/Productions/md/programmesliste/santeanimale/PISAQ/Pages/PISAQ-Campagne-1.aspx>. The results of these surveillance activities can also be consulted in French in the publication entitled [Le Vétérinaire du printemps 2021](#). It should be noted that the *C. burnetii* infection was the subject of multiple research, surveillance and communication activities during the period covered by this report. These activities, which were carried out by the Faculty of Veterinary Medicine (FMV) with assistance from MAPAQ, made it possible to detect its prevalence in ruminant² herds and farm cats and inform producers and farm service providers about strategies to prevent and manage the risk of transmission. Some of these included the use of vaccinations, which turns out to be the preferred approach. Due to various issues, the use of vaccinations is limited for the time being, but developments are expected in the coming years.

¹ Program title and description in French: [Programme intégré en santé animale du Québec](#)

² Turcotte, M. É., Buczinski, S., Leboeuf, A., Harel, J., Bélanger, D., Tremblay, D., Gagnon, C. A. and Arsenault, J. Epidemiological study of *Coxiella burnetii* in dairy cattle and small ruminants in Quebec, Canada. *Prev Vet Med.* 2021 Apr 25;191:105365.

Integrated gastrointestinal parasite management in small ruminants with access to pasture

A joint research project between Quebec's sheep farming centre of expertise (CEPOQ), the FMV, McGill University and MAPAQ from 2013 to 2018 documented a higher rate of nematode resistance to fenbendazole and ivermectin in Quebec sheep herds with access to pasture (in the process of being published). Since these are the two most commonly used anthelmintics, the resistance observed raised serious concern, and both a paradigm shift and a change in practices appear to be necessary to ensure lasting control of parasitism. In the interest of migrating to an integrated approach, the partners developed numerous information tools designed to promote the use of refugia and selected treatments rather than deworming the entire herd according to a schedule.

It was with this in mind that the PISAQ campaign for integrated gastrointestinal parasite management in small ruminants with access to pasture was launched in 2019. Animal health visits are carried out as part of the campaign's awareness-raising activities to encourage the acquisition of new knowledge and support changes in practices. Its surveillance activities encourage the use of stool tests as a decision-making tool prior to deworming. The aim is to promote a more judicious use of anthelmintics with a view to extending their therapeutic efficacy by reducing the risk of resistance being developed. From the start of the campaign on June 1, 2019 to December 31, 2020, 175 producers were visited at least once by one of the 37 veterinarians who participated in the campaign. In total, 460 visits were made, including 181 awareness and prevention visits, 177 planning visits, and 102 assistance visits. The latter visits led to 265 laboratory submissions for a total of 311 stool samples for testing. More details are available in French at <https://www.mapaq.gouv.qc.ca/fr/Productions/md/programmesliste/santeanimale/PISAQ/Pages/PISAQ-Campagne7.aspx>.

Udder health and milk quality

Since the goat and sheep milk sectors have been grappling with milk quality standards compliance issues for a number of years, educational tools have been developed by the main actors in this sector³. A training course was also given in 2019 to professionals and producers. The same actors contributed to the 2020 launch of a PISAQ udder health and milk quality-themed campaign. Like the other campaigns, this one has two series of activities. The first series of activities is aimed at making producers more aware of good practices and the second encourages them to resort to bacteriological analyses in order to solve problems in collaboration with their veterinary practitioner. From the start of the campaign on June 29, 2020 to December 31, 2020, 12 producers were visited at least once by one of the 10 veterinarians who participated in the campaign. In total, 19 visits were made, including 12 milking visits, 4 sampling visits, and 3 follow-up and assistance visits. The sampling visits resulted in the culture of 51 milk samples. More details are available in French at <https://www.mapaq.gouv.qc.ca/fr/Productions/md/programmesliste/santeanimale/PISAQ/Pages/campagne6.aspx>.



3 CEPOQ, Lactanet, FMV, MAPAQ and Association des médecins vétérinaires praticiens du Québec

Climate change and vector-borne diseases

In the last decade, climate change and associated issues have become aggravating factors. Agriculture, animal health and public health are unfortunately directly affected by the repercussions of these changes. Some of the issues that have been raised and observed include vector-borne diseases caused by infectious agents that can only be spread by living vectors, often insects or ticks. Although the vector itself does not cause the disease, it is necessary to spread the infection. This is where climate change comes into play, because climate warming and certain types of extreme events can partially modify the geographical distribution of vector populations. As a result, diseases that were previously kept south of the Canadian-U.S. border are now increasingly appearing and gaining a foothold in our territory.

A good example of these new diseases was revealed in 2013 when the first cases of congenital malformations caused by the Cache Valley virus appeared in a herd of sheep in the eastern part of Quebec. This disease is caused by a virus of the genus *Orthobunyavirus*, which is spread to sheep by mosquitos. From 2013 to 2020, eight submissions including this first case resulted in a diagnosis of an aborted fetus or congenital malformations caused by this virus in sheep. Another submission resulted in the same diagnosis in a goat herd. Serological tests have also shown that the virus should now be considered endemic in most of Quebec's agricultural regions⁴.

Another example of these vector-borne diseases, whose geographical distribution seems to evolve in response to climate change, is bluetongue (BT). This viral infection is spread by gnats or biting midges of the genus

Culicoides. Numerous serotypes of the virus are endemic in the United States, but their presence had not been reported in central and eastern Canada prior to 2015, i.e. before cattle infected with serotype 13 were serologically discovered in Ontario. The evolution of herds at risk of BT, especially in Europe and North America, shows the potential repercussions of climate change⁵. Although no cases have been detected yet in Quebec, the situation should be monitored.



⁴ Unpublished MAPAQ data.

⁵ For a more in-depth analysis of the issue, see: Mayo, C., McDermott, E., Kopanke, J. and collab. Ecological Dynamics Impacting Bluetongue Virus Transmission in North America. Front Vet Sci. 2020;7:186. Published 2020 Apr 17. doi:10.3389/fvets.2020.00186

Decontamination program for herds affected by lentiviruses

(with assistance from Simon Tremblay, molecular biologist at MAPAQ's Animal Health Laboratory)

MAPAQ has contributed to control programs for herds affected by lentiviruses (maedi-visna in sheep herds and caprine arthritis encephalitis (CAE) in goat herds) by carrying out serological testing. In addition to reducing the prevalence of lentiviruses, these programs aim to identify herds at very low risk of being infected by the virus with a view to raising health standards during the animal purchasing process. Both of these programs are run by CEPOQ, and all related documents as well as various educational tools are available in French on its website:

[Maedi-visna program \(sheep herds\)](#)

[CAE program \(goat herds\)](#)

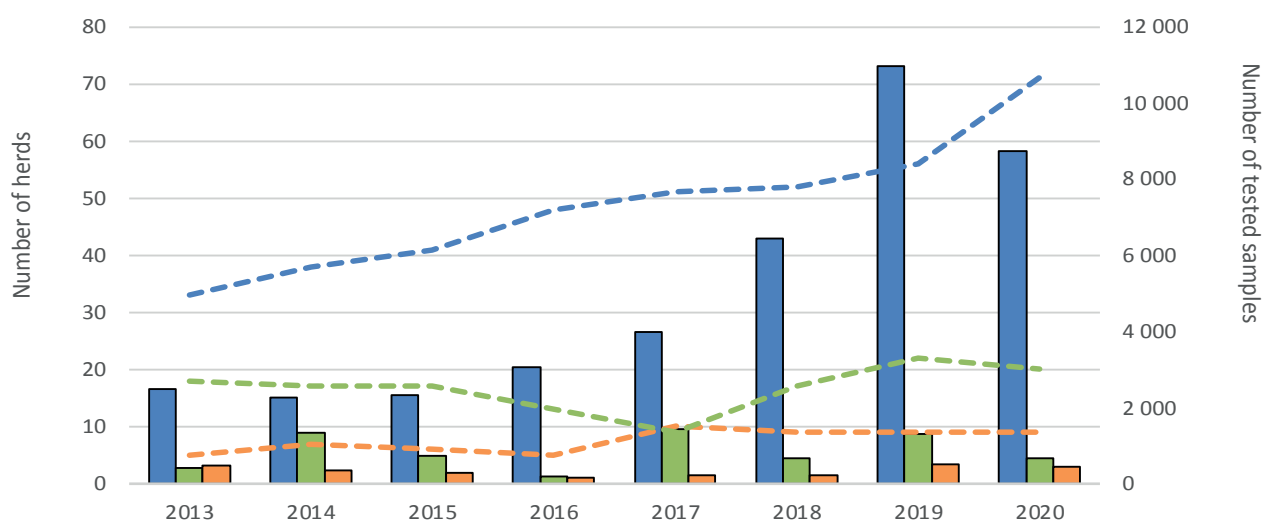
As part of these programs, serological testing is performed at the Animal Health Laboratory in Quebec City. The tests are carried out with Hyphen BioMed's Elitest MVV-CAEV ELISA Kit, which detects the presence of antibodies directed against the GAG p25 capsid antigen and the gp46 transmembrane protein. According to the program's rules, testing is done on individual serum samples or composite samples of three to five individual samples.

From 2013 to the end of 2020, the number of sheep herds participating in the maedi-visna control program and the number of sheep samples tested increased significantly (Figure 1). This major increase reflects CEPOQ's effective promotion of the program and a more mature sector. Quebec sheep farmers are increasingly convinced of the potential benefits associated with the decontamination of their herd and, by extension, with program participation.

For goats, dairy farm data is presented separately from meat herd data. We should also mention that the program's coordination changed hands in 2017, when CEPOQ took over and renewed promotional efforts for the program. From 2013 to the end of 2020, the number of serum samples tested for the presence of CAE virus antibodies remained relatively stable, both on dairy farms and meat farms. Furthermore, it appears that a slight increase in the number of participating herds has occurred since 2017, which could be related to CEPOQ's arrival and management of the program for this species (Figure 1).

Figure 1

Participation in the maedi-visna control program by sheep farmers (in blue) and the caprine arthritis encephalitis control program by dairy goat farmers (in green) and meat goat farmers (in orange).



The dotted lines represent the participating herds, whose numbers are indicated on the left side of the chart. The bars in the chart represent the tested samples, whose numbers are indicated on the right side of the chart.

Summary results of necropsies and biopsies

The data presented in this section refers to submissions (necropsies or biopsies) sent to MAPAQ's Animal Health Laboratory for goat and sheep species. A submission consists of one or more tissues or animals from the same origin that were collected on the same date. The submissions are made by veterinary practitioners who observe health problems in herds. It should be noted that this summary does not factor in samples from slaughterhouses or necropsies performed on goats and sheep by the FMV's pathologists.

Sheep

The total number of herds in Quebec with more than 20 sheep aged one year or older has fallen since 2013. The number of adult sheep went from 144,261 in 2013 to 118,594 in 2020. They were distributed over 825 herds in 2013 and 615 herds in 2020 (Table 1⁶). During the same period, the number of submissions to MAPAQ's Animal Health Laboratory fluctuated quite significantly, peaking in 2018 when the program began to promote the submission of necropsies during abortions (Figure 2). Appendix 1 goes into more detail about the geographical distribution of herds and origin of the submissions since 2013.

Table 1

Geographical distribution of sheep herds with more than 20 sheep aged one year or older and origin of sheep submissions to MAPAQ's Animal Health Laboratory and the FMV laboratory in 2020.

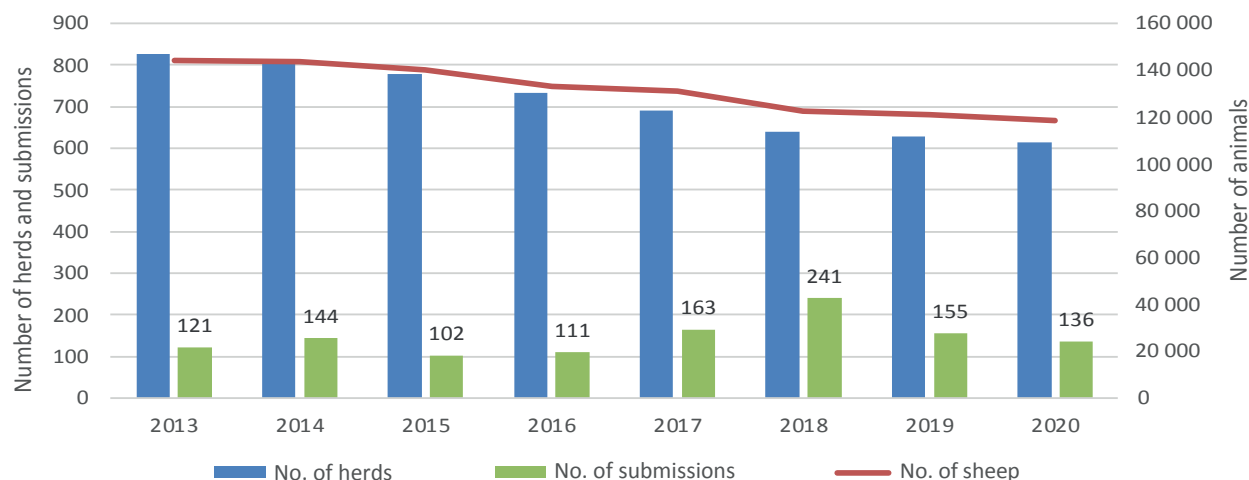
	Bas-Saint-Laurent	Saguenay-Lac-Saint-Jean	Capitale-Nationale	Mauricie	Estrie	Montreal	Outaouais	Abitibi-Témiscamingue	Côte-Nord	Gaspésie-Îles-de-la-Madeleine	Chaudière-Appalaches	Laval	Lanaudière	Laurentides	Montréal	Centre-du-Québec	TOTAL
No. of herds	131	15	17	23	84	0	34	13	1	14	72	1	35	26	85	64	615
No. of submissions	35	5	11	2	13	0	5	0	0	2	16	0	4	3	34	6	136
No. of sheep	39,725	3,201	2,472	2,610	18,790	0	4,297	2,542	45	3,134	9,443	35	5,515	2,674	12,164	11,947	118,594



6 See appendix 1 for the data source.

Figure 2

Changes in the number of herds, sheep and submissions from 2013 to 2020.



The bars in the chart represent the herds and submissions, whose numbers are indicated on the left of the chart. The red line represents the animals, whose numbers are indicated on the right of the scale.

Table 2 shows a compilation of etiological sheep diagnoses following a necropsy or biopsy performed at MAPAQ's animal pathology laboratories from 2013 to 2020. However, it should be remembered that in 2020, MAPAQ's laboratory operations were heavily affected by the COVID-19 pandemic, which caused the number of submissions to decrease. During the period covered by this report, four types of conditions dominate: abortions, respiratory system diseases, parasitic diseases, and digestive system diseases.

Abortions definitely top the list. However, this is very likely due to the surveillance program associated with the PISAQ 1 abortion campaign that began at the end of 2017. The main infectious causes of abortion identified during these years were *Chlamydia* spp, *T. gondii* and *C. burnetii*. It must be noted that in many of the cases that fall under the «other or undetermined etiology» category, the presence of an agent (especially *C. burnetii*) was detected by PCR, but none of the lesions confirmed that this agent caused the abortion.

Respiratory system diseases are still one of the main diagnoses resulting from necropsies of sheep. The number of diagnoses linked to this system has remained relatively constant over the years, except in 2018, when the total number of submissions rose considerably. Every year, *Mannheimia haemolytica* continues to be the most often detected agent and is considered the cause of lesions in the affected pulmonary tissues.

Coccidiosis is the most frequently diagnosed digestive system disease in the animals submitted for a necropsy, which corroborates the clinical observations of veterinarians who practice on sheep farms. Diarrhea in young sheep, especially when it caused by *Escherichia coli*, and cases of enterotoxemia caused by *Clostridium perfringens* type D are the other most frequent diagnoses for this system.

Furthermore, necropsies resulting in a diagnosis of a chronic sheep disease (particularly maedi-visna, caseous lymphadenitis and paratuberculosis) are not very frequent even though these diseases are considered endemic in Quebec and Canadian sheep herds⁷. With an annual culling rate of 15% in this case, it is possible that the producers cull the sheep before or as soon as the animals begin to show clinical signs, without trying to determine the cause of the infection. Finally, the nervous form of listeriosis is regularly detected during sheep necropsies at MAPAQ's laboratories, which is a reminder that *Listeria monocytogenes* is omnipresent and it is important for each and every farm to implement risk management practices.

⁷ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4712996/>

Table 2

Etiological diagnoses established in sheep following a necropsy or a biopsy performed in MAPAQ's laboratories from 2013 to 2020.

	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Number of submissions	121	144	102	111	163	241	155	136	1,173
Digestive system diseases	38	53	25	31	48	53	42	31	328
Coccidiosis	8	9	8	7	10	13	11	9	75
Enterotoxemia	4	4	4	5	3	3	7	2	32
Hepatic conditions	4	6	1	3	5	3	4	2	28
Cryptosporidiosis	4	4	2		5	4	3	6	28
Diarrhea/enteropathy/enteritis of uncertain origin	5	3	4	1	3	1	4		21
Enteric colibacillosis	2			3	4	5	2	2	18
Nematode disease	6	4	1	1	1	2	2	1	18
Mixed gastro-intestinal parasitism	1	8		3	1	2		2	17
Haemonchosis	1	6		3	5				15
Abomasitis	1	1	2	2	2	1	2	2	13
Giardiasis		2	2	1		6	1	1	13
Intestinal injury (hemorrhage, strain, torsion, etc.)	1	2			1	5		2	10
Viral diarrhea					2	4	3		9
Stomatitis/reticulitis/rumenitis/peritonitis		1	1	1	3	1	1	1	9
Tympanitis (bloating)					2		1	1	4
Ulcers	1	2				1			4
Paratuberculosis		1			1	1			3
Abortions	23	22	31	23	36	89	51	50	325
Abortion due to another or undetermined etiology	=7	14	10	5	8	29	6	12	91
Abortion caused by <i>Chlamydia</i> spp.	2	2	4	1	10	15	12	9	55
Abortion caused by <i>T. gondii</i>	5	1	10	7	5	9	10	8	55
ABacterial abortion/placentitis	1	3	1	2	6	18	4	2	37
Abortion caused by <i>C. burnetii</i>	1	1	2	2	4	8	11	6	35
Abortion caused by <i>E. coli</i>	1		2	1	1		1	8	14
Congenital malformations of undetermined etiology	3	1	2	1	1			2	10
Abortion caused by the Cache Valley virus	2					4	2		8
Goiter				1	1	1	4	1	8
Abortion caused by <i>Campylobacter</i> spp.				2		3		2	7
Abortion caused by <i>L. monocytogenes</i>	1			1		2	1		5
Respiratory system diseases	28	22	20	15	29	41	24	30	209
Bronchopneumonia caused by <i>M. haemolytica</i> +/- other infectious agents	12	7	12	6	8	20	7	8	80
Bacterial bronchopneumonia of other or unspecified etiology	9	10	6	4	8	13	10	9	69
Aspiration bronchopneumonia		3	1		5	1	1		11
Infection caused by <i>Mycoplasma</i> spp.	1			2	2	2		4	11
Interstitial pneumonia					1			1	2
Verminous bronchopneumonia							1		1
Nervous system diseases	6	11	11	10	6	13	11	9	77
Listeriosis	5	4	3	2	2	6	6	4	32
Encephalitis and/or meningitis other than listeriosis or unspecified	1	3	1	2	3	5	2	1	18
Encephalopathy, myelopathy		1	1	4		1	1	2	10
Polioencephalomalacia		1	3					1	5
Tetanus			1				1		2
Multisystem diseases	9	10	3	9	13	12	8	2	66
Caseous lymphadenitis	2	4		4	3	4	3		20
Cachexia, emaciation	5	4	1	4	1	1	1		17
Septicemia	1	2	1	1	3	1	2	1	12
Maedi-visna					5	2			7
Various tumors	1		1		1	1	1		6
Myoarthroskeletal system diseases	1	7	3	11	7	6	6	3	41
Eosinophilic myositis				3					3
Cardiovascular diseases	7	4	3	1	6	5	2	2	30
Nutritional deficiencies	4	2	2	1	8	7	3	2	29
Integumentary system diseases	2	1	2	4	4	6	5	1	25
External parasites				1	1				2
Urinary system diseases	1	6	1	1	2	4		1	16
Reproductive system diseases other than abortion	1	2		2	2	2	1	2	12
Metabolic diseases		3		3	2	1	2	1	12
Poisoning	1	1	1	1		2		2	8

All diagnoses are compiled in the table according to the system concerned, but only frequent or important conditions for the sector are specified. The number of submissions is lower than the total number of diagnoses, all conditions considered, because a submission can be subject to more than one diagnosis.

Goats

In 2020, 171 herds reported that they had more than 20 adult goats. Quebec had a total of 4,595 meat goats and 16,302 dairy goats (Table 3⁸). Figure 3 shows the changes in Quebec's total number of goats and the number of goats submitted for necropsies to MAPAQ's laboratories between 2013 and 2020. During this period, the total number of goats tended to increase in meat herds, but decrease in dairy herds. During the same period, the number of goat submissions to MAPAQ's Animal Health Laboratory fluctuated between 25 and 58 submissions per year, which is still lower than the number of sheep submissions. Appendix 2 goes into more detail about the geographical distribution of herds and origin of the submissions since 2013.

Table 3

Geographical distribution of goat herds with more than 20 goats aged one year or older and origin of goat submissions to MAPAQ's Animal Health Laboratory and the FMV laboratory in 2020.

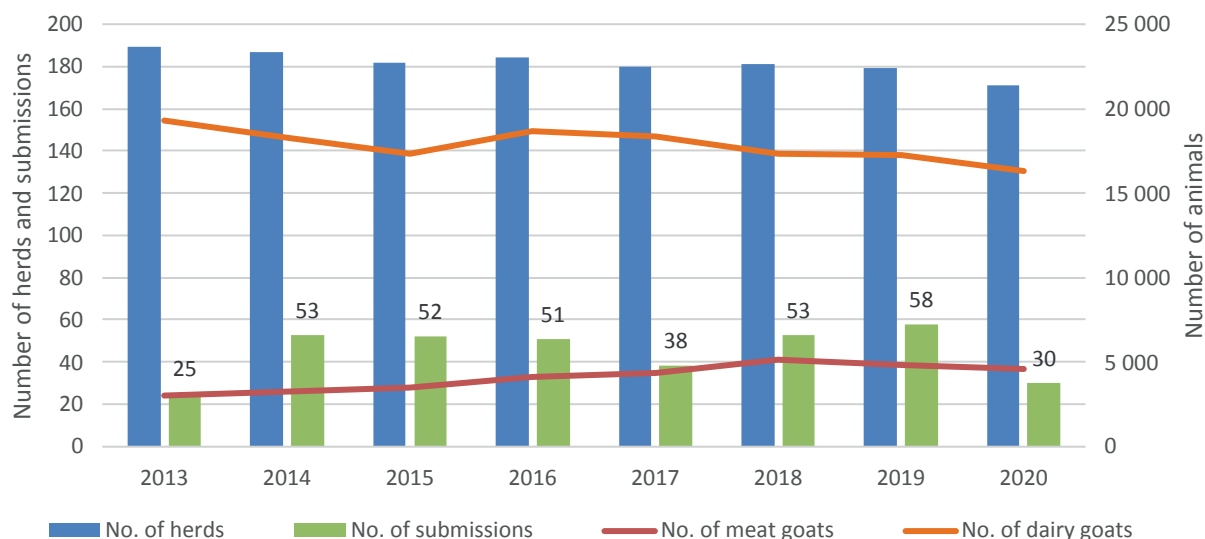
	Bas-Saint-Laurent	Saguenay–Lac-Saint-Jean	Capitale-Nationale	Mauricie	Estrie	Outaouais	Abitibi-Témiscamingue	Gaspésie-Îles-de-la-Madeleine	Chaudière-Appalaches	Laval	Lanaudière	Laurentides	Montréal	Centre-du-Québec		TOTAL
No. of herds	16	3	11	4	18	8	5	2	19	1	7	5	40	32		171
No. of submissions	0	2	0	1	0	0	0	0	5	0	0	0	12	10		30
No. of meat goats	696	241	490	176	285	348	57	0	430	10	273	188	1,342	59	4,595	20,897
No. of dairy goats	1,554	12	834	177	1,086	30	465	137	1,675	50	338	130	3,302	6,512	16,302	



8 See appendix 2 for the data source.

Figure 3

Changes in the number of herds, submissions, meat goats and dairy goats from 2013 to 2020.



The bars in the chart represent the number of herds and submissions, whose numbers are indicated on the left side of the chart. The red and orange lines represent the animals, whose numbers are indicated on the right side of the chart.

Table 4 shows a compilation of etiological diagnoses that were established for goats following a necropsy or biopsy completed at MAPAQ's animal pathology laboratories from 2013 to 2020. However, it must be remembered that in 2020, MAPAQ's laboratory operations were significantly affected by the COVID-19 pandemic, which caused the number of submissions to decrease. During the period covered by this report, five types of conditions dominate: abortions, respiratory system diseases, parasitic diseases, and digestive system diseases and chronic diseases.

As in sheep, necropsies for respiratory problems in goats most often determined that *M. haemolytica* was the agent that caused them. Inadequate living conditions and high animal density in buildings could explain the high incidence of these problems in these two species.

As for abortive diseases, the bacteria *C. burnetii* is the most frequent cause of abortions in goat herds. Goiter is also frequently diagnosed, which suggests that it might be in the producers' interest to make certain nutritional changes.

Bacterial enteric (*E. coli*, *C. perfringens*), viral and parasitic (coccidiosis, cryptosporidiosis and mixed gastrointestinal parasitosis) diseases are frequently diagnosed during necropsies of goats. They are probably, just like respiratory diseases, associated with inadequate living and housing conditions.

Finally, the high number of chronic disease diagnoses, especially paratuberculosis, corroborates the results of a study conducted in 2010-2011 on the principle causes of mortality in goats over two months old⁹. Other studies have also confirmed the high incidence of this infectious disease in Canadian goat herds¹⁰.

⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3659454/>

¹⁰ https://www.mapaq.gouv.qc.ca/SiteCollectionDocuments/Regions/CentreduQuebec/INPACQ2018/Conferences_Caprins/laparatu-berculose.pdf et <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4712996/>

Table 4

Etiological diagnoses established in goats following a necropsy or a biopsy performed at MAPAQ's laboratories from 2013 to 2020.

	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Submissions	25	53	52	51	38	53	58	30	360
Digestive system diseases	9	20	25	16	10	13	19	11	123
Coccidiosis	1	3	2	5		3	5	4	23
Diarrhea/enteropathy/enteritis of uncertain origin		1	5		4	1	4	2	17
Mixed gastro-intestinal parasitism	1	5	4	2		3		2	17
Paratuberculosis	1	5	5	1	1	2	1		16
Enterotoxemia	2	4	1	2			1	1	11
Cryptosporidiosis	1		1	2	1	1	2		8
Haemonchosis			1	2	1	1	2		7
Hepatic conditions	1		2		1	1	1		6
Nematode disease	1	1		1	1			1	5
Tympanitis (bloating)	1		1		1	1			4
Intestinal injury (hemorrhage, strain, torsion, etc.)		1	1						2
Enteric colibacillosis				1				1	2
Stomatitis/reticulitis/rumenitis/peritonitis			1				1		2
Giardiasis							1		1
Abomasitis							1		1
Respiratory system diseases	4	11	9	9	6	10	9	8	66
Bacterial bronchopneumonia of other or unspecified etiology	2	5	3	3	2	3	4	1	23
Bronchopneumonia caused by <i>M. haemolytica</i> +/- other infectious agents	2	3	3	5	2		2	3	20
<i>Mycoplasma</i> spp. infection		2		1			2	1	6
Verminous bronchopneumonia		1				3			4
Aspiration bronchopneumonia			1		1			1	3
Abortion	7	5	9	4	10	17	11	2	65
Abortion due to another or undetermined etiology	2	2	4	2	5	3	4		22
Abortion caused by <i>C. burnetii</i>		2	1			5	4	1	13
Abortion caused by <i>Chlamydia</i> spp.	4					1	1		6
Goiter		1		1		3		1	6
Bacterial abortion/placentitis	1		1	1	1		1		5
Abortion caused by <i>L. monocytogenes</i>			1			3			4
Abortion caused by <i>T. gondii</i>					3	1			4
Congenital malformations of undetermined etiology			1			1			2
Abortion caused by <i>E. coli</i>			1		1				2
Abortion caused by the Cache Valley virus							1		1
Multisystem diseases	1	3	1	4	3	6	6	4	28
Caseous lymphadenitis			1	2	3	2	2	1	11
Cachexia, emaciation		2		1		2	2	3	10
Various tumors	1	1				1	1		4
Caprine arthritis encephalitis				1		1	1		3
Nervous system diseases	1	4	1	7	2	2	1	2	20
Listeriosis		1	1	7	2	1	1	1	14
Encephalitis and/or meningitis other than listeriosis or unspecified	1	1						1	3
Polioencephalomalacia						1			1
Nutritional deficiencies		2		4	2		4		12
Integumentary system diseases			3	4	1	2	1	1	12
External parasites			1	1		1		1	4
Myoarthroskeletal system diseases		2	1		1	1	3	1	9
Reproductive system diseases	1	2		2			2		7
Cardiovascular diseases		2	1		2	1	1		7
Urinary system diseases		2	2			1	1		6
Metabolic diseases (4) or poisoning (1)	2			1	1			1	5

All diagnoses are compiled in the table according to the system concerned, but only the frequent or important conditions for the sector are specified. The number of submissions is lower than the total number of diagnoses, all conditions considered, because a submission can be subject to more than one diagnosis.

Conclusion

The PISAQ campaigns have reached a large number of sheep and goat farmers. In doing so, they have succeeded not only in obtaining relevant information about infectious conditions on farms, but also improving practices and distributing information.

The most often diagnosed conditions in both sheep and goats are bacterial bronchopneumonia, particularly those involving *M. haemolytica*, abortions and coccidiosis. These multifactor conditions emphasize the importance of discussions about the overall health of small ruminants that take into account risk factors and farm management practices.

Despite a reduction in the total number of sheep and goats in Quebec, the number of necropsy submissions has remained steady over the years. This situation suggests that the tool is being used more, thanks perhaps to its promotion by the PISAQ campaigns. Nevertheless, necropsy services are still used a lot less by sheep and goat farmers than by farmers of other species like dairy cattle, perhaps because of the cost. Furthermore, we notice that there are fewer submissions per herd head in regions far away from the laboratories. These two situations are therefore factors that limit the available information and surveillance capabilities.



APPENDIX 1

GEOGRAPHICAL DISTRIBUTION OF SHEEP HERDS WITH MORE THAN 20 SHEEP AGED ONE YEAR OR OLDER AND ORIGIN OF SHEEP SUBMISSIONS TO MAPAQ'S ANIMAL HEALTH LABORATORY AND THE FMV LABORATORY FROM 2013 TO 2020

Administrative region	2013			2014			2015			2016			2017			2018			2019			2020		
	No. of herds	No. of sheep	No. of submissions	No. of herds	No. of sheep	No. of submissions	No. of herds	No. of sheep	No. of submissions	No. of herds	No. of sheep	No. of submissions	No. of herds	No. of sheep	No. of submissions	No. of herds	No. of sheep	No. of submissions	No. of herds	No. of sheep	No. of submissions	No. of herds	No. of sheep	No. of submissions
Bas-Saint-Laurent	163	44,754	34	155	43,512	29	155	43,718	33	152	42,565	21	144	43,096	40	130	39,053	61	132	41,015	20	131	39,725	35
Saguenay—Lac-Saint-Jean	31	5,057	12	29	4,866	8	28	4,326	5	24	3,819	8	21	3,594	11	15	2,972	8	13	2,922	8	15	3,201	5
Capitale-Nationale	25	3,947	8	24	3,825	8	21	3,195	7	18	3,008	21	19	3,039	19	21	3,001		19	2,802	15	17	2,472	11
Mauricie	23	3,869	1	25	3,972	4	25	3,405	4	24	2,332	2	24	2,627	2	22	2,525	10	23	2,690	9	23	2,610	2
Estrie	106	20,328	11	100	19,810	5	96	18,852	1	85	18,187	14	77	17,458	19	83	16,789	17	84	18,681	11	84	18,790	13
Montréal	0	0	2	0	0	3	0	0		0	0		0	0	1	0	0		0	0		0	0	
Outaouais	49	4,971	11	52	5,135	12	50	4,795	4	49	4,641	4	49	4,789	5	33	4,268	11	34	4,309	3	34	4,297	5
Abitibi-Témiscamingue	35	6,930		31	6,161		30	6,073	1	27	5,774		25	5,642		19	4,922		13	2,542		13	2,542	
Côte-Nord	2	97		3	133		3	121		3	121		2	85		2	85		2	85		1	45	
Gaspésie—Îles-de-la-Madeleine	17	3,486	1	17	3,201		17	3,200		18	3,370		14	3,017		15	3,317	14	14	3,134	1	14	3,134	2
Chaudière-Appalaches	80	9,489	4	82	9,595	18	80	10,373	28	67	8,265	15	63	8,320	24	66	8,844	44	70	9,284	30	72	9,443	16
Laval	0	0							3	1	35		1	35		1	35		1	35		1	35	
Lanaudière	51	6,408	15	52	6,576	9	46	6,108	2	41	5,750	10	35	5,520	1	37	5,600	6	36	5,562	10	35	5,515	4
Laurentides	38	3,753		36	3,498	18	33	3,401	1	34	3,481		34	3,459	6	34	3,427	2	29	2,960	4	26	2,674	3
Montréal	123	15,516	18	126	18,201	22	120	17,614	12	118	16,885	15	106	15,023	21	90	13,487	49	88	12,359	28	85	12,164	34
Centre-du-Québec	82	15,656	4	78	15,306	8	75	15,084	1	73	14,750	1	76	15,272	14	72	14,392	17	70	12,499	16	64	11,947	6
	825	144,261	121	810	143,791	144	779	140,265	102	734	132,983	111	690	130,976	163	640	122,717	239	628	120,879	155	615	118,594	136
	EDM 2013 12			EDM 2014 12			EDM 2015 12			EDM 2016 12			EDM 2017 12			EDM 2018 12			EDM 2019 12			EDM 2020 12		

* The number of herds and the number of animals are established on the basis of the ministerial data warehouse (EDM). The number of sheep includes adult sheep.

APPENDIX 2

GEOGRAPHICAL DISTRIBUTION OF GOAT HERDS WITH MORE THAN 20 GOATS AGED ONE YEAR OR OLDER AND ORIGIN OF GOAT SUBMISSIONS TO MAPAQ'S ANIMAL HEALTH LABORATORY AND THE FMV LABORATORY FROM 2013 TO 2020

	2013				2014				2015				2016				2017				2018				2019				2020				
Administrative region	No. of herds	Meat goats	Dairy goats	No. of submissions	No. of herds	Meat goats	Dairy goats	No. of submissions	No. of herds	Meat goats	Dairy goats	No. of submissions	No. of herds	Meat goats	Dairy goats	No. of submissions	No. of herds	Meat goats	Dairy goats	No. of submissions	No. of herds	Meat goats	Dairy goats	No. of submissions	No. of herds	Meat goats	Dairy goats	No. of submissions	No. of herds	Meat goats	Dairy goats	No. of submissions	
Bas-Saint-Laurent	13	198	1,505	5	12	300	1,505	2	13	420	1,505	4	15	525	1,505	6	14	665	1,420	3	16	750	1,554	2	15	670	1,554	4	16	696	1,554		
Saguenay–Lac-Saint-Jean	2	24	60		2	24	60		2	52	12	1	2	52	12		2	148	12	3	2	205	12		3	241	12	7	3	241	12	2	
Capitale-Nationale	15	228	938	1	14	248	728	7	10	196	444	2	12	495	1,017	13	13	490	1,077	4	12	490	995		11	490	834	12	11	490	834		
Mauricie	5	141	255		6	163	255		7	201	255	1	4	176	177	4	5	276	177		5	276	177		5	276	177	6	4	176	177	1	
Estrie	14	174	1,233	1	14	154	996	3	13	154	811	4	14	192	1,027	2	15	192	1,077	1	14	133	1,080		16	180	1,086		18	285	1,086		
Montréal	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		
Outaouais	7	119	330		8	179	213	3	7	239	112	1	7	239	112		7	289	112	4	7	337	30	8	8	384	30	2	8	348	30		
Abitibi-Témiscamingue	4	30	470	1	3		470		2		290		4	100	540		4	100	540		5	130	540		5	57	465		5	57	465		
Côte-Nord	0	0	0		1	0	340		1	0	340	1	1	0	340		1	0	340		1	0	340		1	0	340			0			
Gaspésie–Îles-de-la-Madeleine	0	0	0		0	0	0			0		1		0			2	0	137		2	0	137		2	0	137		2	0	137		
Chaudière-Appalaches	26	529	2,694	1	21	423	2181	11	19	398	2121	7	20	414	2177	8	17	381	1,630	5	18	409	1,630	7	19	427	1,675	4	19	430	1,675	5	
Laval	1	0	60	4	1		60	4	1		60	2					1	10	50		1	10	50		1	10	50		1	10	50		
Lanaudière	7	99	336	1	9	235	296	3	9	235	296	4	10	400	296	3	7	278	338	2	7	278	338	4	8	308	338	2	7	273	338		
Laurentides	7	152	190	2	7	152	190		6	127	190		6	127	190	1	6	127	190	4	6	127	190		5	188	130		5	188	130		
Montréal	48	1,109	3,732	2	48	1,104	3,547	6	49	1,207	3,393	16	44	1,130	3,405	2	42	1,217	3,455	9	42	1,469	2,822	25	42	1,499	3,212	20	40	1,342	3,302	12	
Centre-du-Québec	40	207	7,466	7	41	272	7,466	14	43	244	7,516	8	45	244	7,837	12	44	159	7,818	3	43	509	7,448	7	38	134	7,245	1	32	59	6,512	10	
Sous-total		3,010	19,269			3,254	18,307			3,473	17,345			4,094	18,635			4,332	18,373			5,123	17,343			4,864	17,285			4,595	16,302		
TOTAL	189	22,279		25	187	21,561	53	182	20,818	52	184	22,729	51	180	22,705	38	181	22,466	53	179	22,149	58	171	20,897	30								
	EDM 2013 12				EDM 2014 12				EDM 2015 12				EDM 2016 12				EDM 2017 12				EDM 2018 12					EDM 2019 12				EDM 2020 12			

* The number of herds and the number of animals are established on the basis of the ministerial data warehouse (EDM). The number of goats includes adult goats.

