

Brucellosis in small ruminants in 2014: 95 départements of metropolitan France are now officially disease-free

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Abstract

No outbreak of sheep or goat brucellosis has been reported in France since 2003. Sixty-four départements have been declared officially free of sheep and goat brucellosis by the European Commission since 2006, and 31 new départements obtained this status on 9 December 2014. Only one metropolitan département, the Pyrénées-Atlantiques, is not officially recognised as disease-free, due to a vaccination programme against ovine epididymitis caused by *Brucella ovis*. Vaccination against the disease was stopped in early 2008 in all other parts of the country. In order to detect any possible reintroductions of the infection, surveillance is based both on repeated serological controls of flocks (programmed surveillance) and on abortion notification (outbreak surveillance). This contributes to maintain disease-free status in the concerned départements. No outbreak of small ruminant brucellosis were reported in 2014. While some positive serological reactions were observed, the investigations conducted on these cases all demonstrated that brucellosis was not the cause.

Keywords

Notifiable disease, Regulated disease, Sheep and goat brucellosis, Programmed surveillance, Outbreak surveillance, France, 2014

Résumé

Brucellose des petits ruminants en 2014 : 95 départements de France métropolitaine sont désormais indemnes

La France n'a connu aucun foyer de brucellose ovine ou caprine depuis 2003. Soixante-quatre départements étaient reconnus officiellement indemnes par la Commission européenne depuis 2006. Le 9 décembre 2014, 31 départements supplémentaires ont obtenu ce statut. Seul un département métropolitain (Pyrénées-Atlantiques) n'a ainsi pas été reconnu officiellement indemne en raison d'un programme de vaccination contre l'épididymite contagieuse à *Brucella ovis* (la vaccination contre la maladie n'est plus pratiquée sur le reste du territoire depuis début 2008). La surveillance, fondée sur un dépistage sérologique régulier dans les troupeaux (surveillance programmée) et sur la surveillance des avortements (surveillance événementielle), vise à détecter une réintroduction de l'infection, maintenir le statut indemne (pour les départements reconnus comme tels). Aucun foyer de brucellose n'a été détecté chez les petits ruminants en 2014. Des réactions sérologiques positives ont été obtenues, mais les investigations menées ont infirmé l'origine brucellique dans chacun des cas.

Mots-clés

Danger sanitaire de 1^{ère} catégorie, maladie réglementée, brucellose ovine et caprine, surveillance programmée, surveillance événementielle, France, 2014

Infection of any domestic animal by any *Brucella* other than *Brucella ovis* and *Brucella suis* biovar 2 is classified as a Category 1 health hazard (Ministerial Order of 29 July 2013). Small ruminants are the preferred hosts and primary reservoir of *Brucella melitensis*.

Surveillance and control measures for sheep and goat brucellosis are described in [Box 1](#). These are the new measures introduced by the publication of technical and financial ministerial orders on 10 October 2013.

Surveillance system

The data presented below were extracted from the national information system, SIGAL, and also include information collected by Departmental Directorates for Protection of the Population (DDecPPs) as part of the annual survey on animal health. Given the difficulties in consolidating data from SIGAL, certain information concerning herd surveillance is incomplete. Caution should therefore be exercised when interpreting the presented data.

Nation-wide data are given in the text, while [Table 1](#) shows data by region.

Qualification of départements and herds

Since December 2014, 95 of the 101 départements in France have been recognised as officially sheep and goat brucellosis-free (Commission

Decision 2014/892/EC). All metropolitan départements, including the Pyrénées-Atlantiques département (due to a vaccination programme against contagious epididymitis), are now recognised as officially free of sheep and goat brucellosis.

According to the data in SIGAL, 123 herds of small ruminants (out of 118,421 registered in SIGAL for all of France) were disqualified for administrative or health reasons⁽¹⁾ on 31 December 2014.

Programmed surveillance: serological surveys

The data recorded in SIGAL and those collected from the départements ([Table 1](#)) show that in 2014, 36,226 herds and 1,361,339 animals underwent serological screening, out of a total of 118,421 herds registered in SIGAL accounting for 7,001,465 animals more than six months old, according to the annual census, or 30.6% of herds and 19.5% of small ruminants more than six months old.

Note that to maintain an officially disease-free status, a département must test at least 5% of all animals over the age of six months (see [Box 1](#)).

1. Disqualification is different from placing a herd under Prefectural monitoring order (APMS), even though both cases lead to restrictions on animal movements. In the first case, the conditions have not been satisfied to qualify the herd as "officially brucellosis-free" (e.g. due to failure to undertake mandatory serological testing). In the second case, there is a suspicion of brucellosis in the herd, for example due to a non-negative serological result obtained from an aborting female.

Box 1. Surveillance and health control measures for sheep and goat brucellosis in 2014

The Ministerial Order of 10 October 2013 establishing the technical and administrative framework for collective prophylaxis and control measures for sheep and goat brucellosis amended the provisions of 13 October 1998 and introduced new surveillance methods, which are described in this box.

Objectives of the surveillance programme

- Detect as early as possible the emergence of any new outbreak in domestic sheep and goats.
- Provide evidence on the status of the 95 *départements* considered officially sheep and goat brucellosis-free.

The population monitored

Domestic sheep and goats throughout France.

Surveillance procedures

Programmed surveillance

Programmed surveillance is based on mandatory serological screening performed at a rate that can vary between *départements*.

The maintenance of herd qualification is based on the screening, at a predefined rate, of a representative fraction of animals, defined as follows:

- all non-castrated males over the age of six months,
- all animals introduced (excluding by birth) into the holding since the previous test,
- 25% of females of reproductive age (sexually mature) or in lactation, with no fewer than 50 per farm. On farms where there are fewer than 50, all these females must be tested.

Since the implementation of the new decree, the representative fraction of animals to be screened in herds has been the same for sheep and goats (whereas previously 100% of goats had to be screened), irrespective of the type of production (raw milk products or any other).

By default, the fraction of animals defined above is tested annually. The control interval can, however, be relaxed depending on the *département* where the herd is located (Table 1), except for producers of raw milk, for which the rate is still annual.

In *départements* that are officially brucellosis-free, officially brucellosis-free herds retain their status if the departmental screening programme is carried out correctly.

In addition, the Prefect may impose stricter measures, including the maintenance of annual testing for herds deemed at risk (for example, farms with an epidemiological link to an outbreak, or because of practices related to transhumance).

Before the entry into force of the new provisions for surveillance, the relaxed screening rate could be as infrequent as every ten years. Currently, the maximum applicable attenuation is five-year programmed screening (Memorandum DGAL/SDSPA/2014-157 published on 27-02-2014 relative to sheep and goat brucellosis: programmed and outbreak surveillance).

Table 1. Minimum testing rate for a herd to retain its qualification as officially brucellosis-free, depending on the qualification of the *département* in which it is located*

Qualification of the <i>département</i> in which the officially brucellosis-free herd is located	Testing rate to apply to the herd
<i>Département</i> not officially brucellosis-free, with fewer than 99% of herds officially free	Annual
<i>Département</i> not officially brucellosis-free, with more than 99% of herds officially free	At least every three years
<i>Département</i> officially brucellosis-free	Determined by the <i>département's</i> programmed screening plan. The latter must screen at least 5% of the <i>département's</i> eligible animals every year (which is equivalent to a five-year screening rate: annual screening of 25% of eligible animals in 20% of farms)

* Excluding farms producing raw milk, for which the rate is always annual

Outbreak surveillance

The rules governing the reporting of abortions have been modified, so as to revive the awareness of breeders and veterinarians regarding this procedure and adapt to situations frequently encountered on farms.

All abortions (even isolated cases) must be recorded in the farm register, but now only the reporting of abortive episodes (defined as three or more abortions, over a period of seven days or less) is mandatory. If this threshold is reached, the farm's veterinarian must be informed of the episode, so that investigations may be initiated. However, if the veterinarian considers that an abortion in a herd of small ruminants is suggestive of brucellosis, especially in small herds, then the veterinarian may report the suspicion, which triggers investigations under the same technical and financial conditions (operations financed by the State) as a suspicion based on three successive abortions.

The definition of abortion in small ruminants has also been revised in order to improve the positive predictive value of reports of abortions regarding brucellosis. Abortion is now defined as follows: "An infectious abortion is defined as the expulsion of a foetus or a stillborn animal or one that dies within twelve hours of birth, excluding abortions that are clearly of accidental origin" (Article 2 of the Ministerial Order of 10 October 2013). Therefore, clearly accidental abortions and animals dying after twelve hours of birth are no longer taken into account.

Health control measures

Diagnostic protocols and health control measures are set out in Memorandum DGAL/SDSPA/2014-157 published on 27-02-2014 relative to sheep and goat brucellosis: management of suspicions. Application of the Ministerial Order of 10 October 2013.

Investigation of non-negative results in programmed surveillance

The screening test used for programmed surveillance campaigns is a Rose Bengal Test (RBT). The complement fixation (CF) test is only used in the event the RBT proves positive. A result is considered unfavourable when both tests are positive (a negative CF can refute a positive RBT).

Suspicions (*i.e.* giving rise to an APMS) with programmed surveillance are only issued after two rounds of unfavourable tests (unfavourable initial serological screening, then a repeat test six to eight weeks later again unfavourable for RBT and CF). A brucellin test⁽¹⁾ is then performed for a group of animals (20 individuals) including the animals that reacted positively to the previous individual serological tests and seronegative contact animals (if brucellin testing is not possible, the positive animals are again tested serologically individually).

If the brucellin tests (or, in their absence, a renewed individual serological control) are positive, then diagnostic slaughter is performed to search for *Brucella* on the lymph nodes. The herd is considered infected and placed under Prefectural declaration of infection (APDI) if a *Brucella* strain is detected on culture, or if the suspected farm has a direct epidemiological link to an infected farm, through animal movements, for example.

Investigation of non-negative results in outbreak surveillance

Abortions are investigated by serological testing. A swab sample from the uterine cervix of aborting females is also taken for bacteriological analysis if the serological analysis proves positive (both RBT and CF positive); failing that, diagnostic slaughter is performed.

A farm is placed under APMS following an abortion if serological testing is unfavourable (RBT and then CF if the RBT is positive). The farm is placed under APDI if the bacteriological analysis of the swab is positive.

Measures taken in herds under APDI

The whole herd is slaughtered if *Brucella abortus* or *melitensis* is isolated.

Regulations

Council Directive 91/68/EEC of 28 January 1991, as amended, on animal health conditions governing intra-Community trade in ovine and caprine animals

Ministerial Order of 10 October 2013 establishing the technical and administrative framework for collective prophylaxis and control measures for ovine and caprine brucellosis

1. Except when the animals on the farm have been vaccinated for brucellosis

Outbreak surveillance: reporting and investigation of abortions

In 2014, 2,541 holdings of small ruminants reported a total of 4,891 abortions, distributed over 67 départements (Table 1). It is difficult to compare the number of reports in 2014 with the number of reports in previous years, due to changes in the regulations governing the reporting of abortions (see Box 1). Currently, only abortive episodes (three abortions or more within seven days or less) are subject to mandatory reporting; isolated abortions no longer have to be reported but do need to be recorded in the farm register. Therefore, the slight decrease in the number of reported abortions and reporting herds does not necessarily indicate a decline in the reporting system.

The 2,541 reporting herds account for 2.1% of the 118,421 herds of small ruminants recorded in SIGAL. It should be noted that approximately 30% of the herds of small ruminants recorded in SIGAL are herds with less than five adults, in which there are likely few breeding animals and therefore few animals likely to abort.

There are substantial variations between départements. Thus in four départements (Lot, Tarn, Indre-et-Loire, Pyrénées-Atlantiques) more than 10% of herds reported an abortive episode, while in 30 others no abortions of small ruminants were reported.

Overall, the proportions of herds reporting abortions remain lower than the expected values, given the frequency of abortion in small ruminants, as has already been pointed out in previous years. This

under-declaration could prevent the system from being sufficiently sensitive and responsive, reducing its effectiveness for the early detection of brucellosis in the event of re-emergence of the disease. This is why the reporting procedures have changed, in order to bring them closer into line with the risk of infection for brucellosis. Additional work still in the test phase is currently being undertaken in collaboration with professional managers. Its aim is to assist farmers in identifying causes of abortion, in order to encourage them to more readily report infectious abortions and thus improve the early detection of brucellosis in the event of reintroduction.

Enhanced surveillance in the Barge Massif, département of Haute-Savoie

In 2012, following an outbreak in cattle of *B. melitensis* biovar 3 (Rautureau *et al.*, 2013), enhanced screening was introduced on the return from summer pasturing in the Barge Massif. Since the autumn of 2014, the system implemented on the return from summer pasturing has involved only a fraction of each herd (25% of small ruminants over the age of six months with no less than 50 animals), and no longer all animal adults, with priority given to animals that have been kept in the Barge Massif and in particular gestating females and females that have given birth since their return from summer pasturing. In this context, 1,484 animals from 20 herds were tested (six goat herds and 14 sheep herds), including 14 herds from the Haute-Savoie département and the other six herds from the Rhône and Hautes-Alpes départements. Special vigilance was applied to dairy goat herds

Table 1. Surveillance and health control measures for sheep and goat brucellosis by region of metropolitan France for 2014

Region	Number of small ruminants		Programmed surveillance			Outbreak surveillance		Investigations of suspected cases				Herd qualification
	Number of herds	Number of animals over the age of six months	Number of tested herds	Number of tested animals	Number of non-negative animals with screening	Number of herds reporting at least one abortion	Number of reported abortions	Number of animals with serological test	Number of animals with positive serological test	Number of animals with bacteriological culture	Number of animals with brucellin skin test	Number of herds placed under APMS
Alsace	1,396	35,729	485	8,508	0	16	22	22	0	0	0	0
Aquitaine	9,624	705,899	4,744	183,693	4	449	1,099	1,103	1	25	1	1
Auvergne	6,224	425,001	1,492	46,492	0	140	208	208	1	1	0	1
Basse-Normandie	8,575	107,409	2,601	27,626	1	15	15	16	0	15	0	1
Bourgogne	4,974	217,155	1,378	40,683	2	155	169	171	1	28	0	3
Bretagne	9,978	110,377	1,371	17,586	0	23	57	57	0	0	0	0
Centre	5,148	263,741	1,408	55,021	0	183	316	316	0	0	0	0
Champagne-Ardenne	1,963	111,281	310	9,343	0	32	56	56	0	0	0	0
Corse	872	113,680	555	42,693	0	8	33	33	1	1	0	1
Franche-Comté	2,414	57,915	219	6,954	0	16	16	16	1	3	0	2
Haute-Normandie	4,844	71,522	542	7,117	0	7	14	14	0	0	0	0
Île-de-France	912	15,946	180	4,866	0	6	7	7	1	0	10	1
Languedoc-Roussillon	3,490	320,312	1,284	63,206	5	61	129	134	5	39	30	5
Limousin	5,443	398,688	1,103	30,880	0	66	95	95	0	0	0	0
Lorraine	2,842	176,922	757	15,755	0	7	8	8	0	0	0	0
Midi-Pyrénées	12,531	1,615,592	7,860	345,554	7	549	836	843	4	4	0	4
Nord-Pas-de-Calais	2,345	47,810	494	7,678	0	21	22	22	0	0	0	0
Pays de la Loire	8,771	251,895	989	21,281	0	96	117	117	0	0	0	0
Picardie	2,493	78,005	751	12,627	0	25	55	55	7	8	0	2
Poitou-Charentes	6,849	771,749	978	54,878	0	203	574	574	2	133	10	2
Provence-Alpes-Côte D'Azur	3,854	643,655	2,342	202,717	2	111	447	449	2	5	60	3
Rhône-Alpes	9,919	445,327	4,350	155,481	3	343	586	589	2	7	42	4
Outre-mer	2,960	15,855	33	700	0	9	10	10	0	0	0	0
Total	118,421	7,001,465	36,226	1,361,339	24	2,541	4,891	4,915	28	269	153	30

by preceding these tests with screening of milk during the summer pasturing period (an experimental protocol followed by the NRL). All of the test results were favourable. Only one sheep had results that were positive for RBT and negative for CF, which gave rise to a repeat test which proved favourable (unlike the general screening scheme, this enhanced surveillance protocol provides for a repeat test whenever an RBT result is positive, despite a negative CF result).

Suspected and confirmed cases

Out of the 4,891 abortions reported in 2014 in small ruminants in France, seven provided a positive serological result (RBT+ and CF+), i.e. 0.13% of seropositive females among those having aborted.

Among the animals undergoing serological screening (1.4 million), 24 still had a non-negative result in the second repeat test (the number of positive animals for the first test could not be estimated due to differences in recording procedures between *départements*), causing a suspicion of brucellosis to be reported.

Overall, 153 brucellin skin tests following positive serological results with programmed surveillance, 250 bacteriological analyses of swabs, and 12 bacteriological analyses after diagnostic slaughter were required to refute these suspect results, which caused 30 herds to be placed under surveillance (APMS). Note that the number of bacteriological swab analyses undertaken was much higher than the number of non-negative serological results after abortion (which is the only case requiring such analyses). The *départements* in which these analyses were undertaken will be contacted to identify the source of this deviation.

A goat herd in the Ardèche *département* had a large number of positive serological results not attributed to brucellosis (Box 2).

Costs (amounts expressed before VAT)

For brucellosis in small ruminants, the State reimburses the costs of animal health measures, i.e.:

- all expenses relating to outbreak surveillance (veterinary visits, sampling and analyses performed for the investigation of abortions);
- costs relating to the investigation of suspicions arising as a result of programmed surveillance (veterinary visits, sampling and analyses performed when an APMS is issued).

Visits and initial screening analyses as part of programmed surveillance are paid for by the owners of the animals, with possible subsidies (especially by the Departmental Councils) which vary between

Box 2. Particular case of a suspicion in goats in the Ardèche *département*

In the context of programmed surveillance, 25 goats from a dairy herd of 191 animals (100% of the animals were tested) had a positive RBT result, including 22 that also had a positive CF result. Brucellosis was immediately ruled out by a brucellin skin test in this group.

The epidemiological investigation did not find any evidence in favour of a brucellosis suspicion. However, the drinking water analysis showed non-compliant results (flora and total coliforms); it did not, on the other hand, find any agents such as *Yersinia enterocolitica* O:9, *Salmonella urbana* or *Escherichia coli* O157:H7, which have antigenic cross-reactions with *Brucella*.

Serological follow-up of the herd was proposed so as to ensure that, with such a high intra-holding incidence of false-positive serological reactions (FPSRs), these would disappear over time, as is usually the case when FPSRs involve only one or two animals per herd. Some of the animals had high titres in the CF (six above 100 CFU/ml) and were monitored for four months with the traditional RBT and CF tests as well as with indirect ELISA tests undertaken by the NRL. Far fewer animals had a serological response after two months (n=9); however, this response was still significant for eight animals after four months (including one that became positive again at four months after having shown negative results at two months). For these animals, it was above all the RBT that remained positive. There were far fewer positive results with ELISA, and the CF was negative for all the animals at four months. Such a trend does not at all correspond to what occurs during outbreaks of brucellosis. At the beginning of 2015, programmed surveillance of this holding did not show any positive reactions.

départements. For small ruminants, the State may also participate in the financing of programmed surveillance in herds excluded from relaxed screening (and accordingly subject to annual screening) because they are deemed to be at risk (due to transhumance or other factors).

The French government allocated around €590,000 to surveillance and control of brucellosis in small ruminants in 2014 (compared with €937,000 in 2013). Veterinary costs accounted for approximately €217,230 (37%), laboratories fees for around €186,500 (32%), subsidies for herds kept under annual testing because deemed at risk for €181,000 (31%) (715,608 animals in 6,139 herds benefited from this assistance, in 21 *départements*), and compensation relating to suspicions plus miscellaneous expenses for €5,600.

These sums do not take into account the cost of running and managing the technical and financial aspects of the scheme, particularly in terms of human resources delegated by the administration.

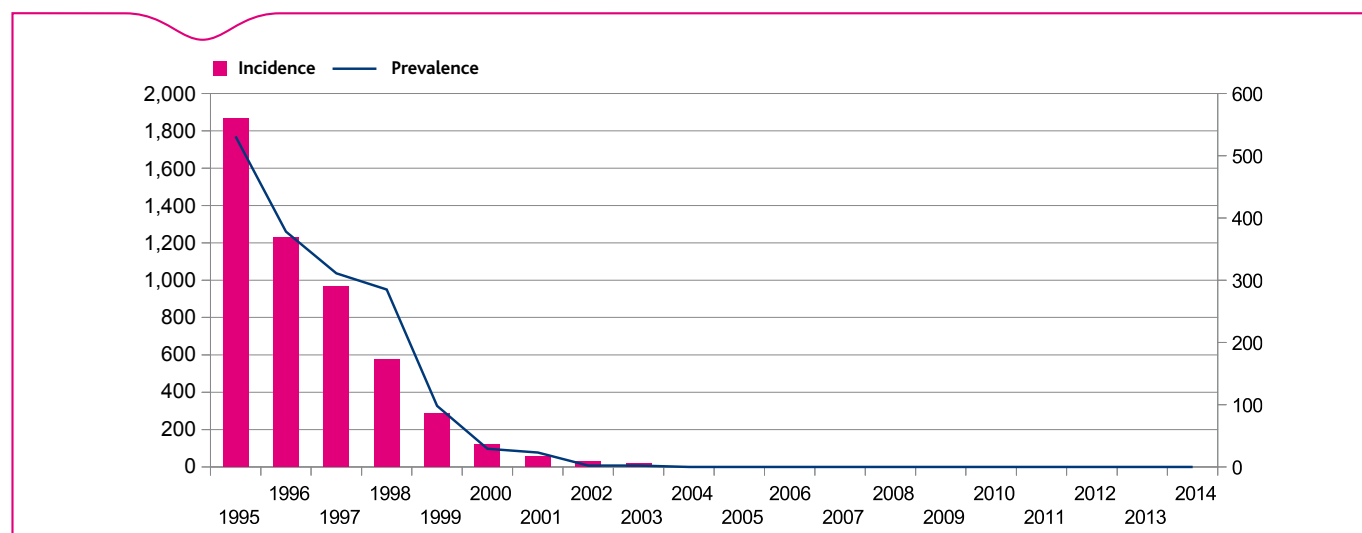


Figure 1. Annual figures for incidence and prevalence of herds infected with sheep and goat brucellosis in France from 1995 to 2014

Discussion

The health status of France concerning sheep and goat brucellosis for 2014 has therefore remained highly satisfactory. No new outbreaks have been detected for over ten years (Figure 1).

However, the two episodes of bovine brucellosis in 2012 are a reminder of the importance of maintaining high levels of vigilance (Rautureau *et al.*, 2013). Like the system in place for cattle farming, brucellosis surveillance in small ruminants is implemented by two complementary systems: periodic large-scale screening, and clinical surveillance based on the reporting of abortions. However, the abortion surveillance system is clearly not yet fully optimal, given the low number of abortions reported.

The new procedures relating to collective screening and health control measures for sheep and goat brucellosis introduced by the ministerial orders published at the end of 2013 (Perrin *et al.*, 2014) take into account the current epidemiological context and are intended to make the system more efficient.

With programmed surveillance, amendments to the decision-making rules applied since 2013 in the event of non-negative results, by combining the various serological tests available, have limited the number of herds placed under surveillance (and restrictions) due to false-positive results.

With outbreak surveillance, the new rules for mandatory reporting (see Box 1), which now require the reporting of abortive episodes only and not isolated abortions, are intended to improve the system's

specificity and acceptability. The slight decrease in the number of reporting herds and reported abortions between 2013 and 2014 (respectively 5,186 animals and 3,253 herds in 2013) may be due to these new procedures.

For herds under APMS, the brucellin skin test (available since 2013) is an effective alternative to the diagnostic slaughter of suspect animals.

These new measures are making it possible to refute unfavourable surveillance results more quickly and minimise the constraints for farmers, which is expected to improve the system's acceptance by the various stakeholders and instil it with new momentum.

In parallel with these developments, the gradual introduction, at the request of professionals, of a protocol for differential diagnosis of abortion-related diseases could contribute to strengthening the system for the reporting of abortions. Whenever an abortion is reported, the veterinarian's visit is paid for by the State under the brucellosis scheme. The farmer only pays for samples and analyses unrelated to brucellosis. This protocol is currently being studied in the Midi-Pyrénées region.

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"Erratum in BE 59" Box

There was an error in the data given in the article entitled "No brucellosis outbreak detected in sheep and goats in France in 2012, but vigilance must be maintained" in No 59 of the special 2012 *Bulletin Épidémiologique* on regulated and emerging diseases: the total number of reported abortions and the total number of herds reporting at least one abortion in France were incorrect (however, the values given by *département* in Table 1 of the article were correct). The electronic version of this article has been corrected. Likewise, the conclusions regarding the change in the number of reported abortions from 2012 to 2013 published in the article entitled "Sheep and goat brucellosis in 2013: epidemiological situation and changes to surveillance measures" in No 64 of the special 2013 *Bulletin Épidémiologique* on regulated and emerging diseases have been modified.