

Final report on the Assessment of the Geographical BSE-Risk (GBR) of the REPUBLIC OF SAN MARINO - 2002

27 June 2002

NOTE TO THE READER

Independent experts have produced this report, applying an innovative methodology by a complex process to data that were supplied by the responsible country authorities. Both, the methodology and the process, are described in detail in the final opinion of the SSC on "the Geographical Risk of Bovine Spongiform Encephalopathy (GBR)", 6 July 2000 and its update of 11 January 2002. These opinions are available at the following Internet address:

<http://europa.eu.int/comm/food/fs/sc/ssc/outcome_en.html>

This report, and the opinion of the SSC based on it, is now serving as the risk assessment required by the TSE-Regulation EU/999/2001 for the categorisation of countries with regard to their BSE-status. The final BSE-status categorisation depends also on other conditions as stipulated in annex II to that TSE-Regulation.

1. DATA

- The available information was sufficient to carry out the qualitative assessment of the GBR. This report, however, depends on some reasonable worst case assumptions adopted in cases where the available information is not adequate.

Sources of data

- Country Dossier (CD) consisting of the information provided to respond to the requirement of Regulation (EC) 999/2001 Annex II Chapters A and B and additional information sent on the 9th of May 2002.

Other sources:

- EUROSTAT data on export of "live bovine animals" and on "flour, meal and pellets of meat or offal, unfit for human consumption; greaves" (customs code 230110), covering the period 1988 to 2001.
- UK-export data on "live bovine animals" (1980-1996) and on "Mammalian Flours, Meals and Pellets", 1980-1996. As it was illegal to export mammalian meat meal, bone meal and MBM from UK since 27/03/1996, exports indicated after that date under customs code 230110 should only have included non-mammalian MBM.
- Opinion of the SSC on the GBR of Italy, July 2000, and report on the GBR-assessment of Italy, July 2000.
- Export data from Cyprus, the Czech Republic, Estonia, Hungary, Lithuania, Slovenia and Switzerland.

2. EXTERNAL CHALLENGES

2.1 Import of cattle from BSE-Risk¹ countries

According to the CD, information on cattle imports is available only from 1992 onward, but San Marino has never imported live cattle from the UK. This is confirmed by the UK export statistics. In addition, importation from UK was banned on 26 March 1996

According to the CD, in the period 1992-2001 San Marino has imported 5.800 animals from BSE-risk countries: Italy, France, Germany and Austria. Animals for fattening, breeding and reproduction (milk and meat production) have always been purchased mainly from Italy (2.209). To a lesser extent, some animals have also been imported from Germany (81 breeding animals for milk production), while a considerable number of animals (3.429) have always been imported from France for fattening and subsequent slaughtering. These cattle imported for fattening are usually slaughtered at an age of around 24 months. According to Eurostat data, in addition 42 pure-bred breeding bovines were imported from Netherlands in 1999 but the Authorities of San Marino verified it and are certain that this import never took place.

¹ BSE-Risk countries are all countries already assessed as GBR III or IV or with at least one confirmed domestic BSE case.

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Country	data	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	0	1	Total
Austria	CD													39	19			4		3	12	4		81
	other																							0
France	CD													288	363	453	420	337	332	244	327	402	263	3429
	other																							0
Germany	CD																			39	17	25		81
	other																							0
Italy	CD													262	199	226	214	291	247	273	209	184	104	2209
	other																							0
UK	CD																							
	other																							
ALL TOTALS																								
non UK	CD	0	0	0	0	0	0	0	0	0	0	0	0	589	581	679	634	632	579	559	565	615	367	5800
	other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UK	CD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1: Live cattle imports into San Marino (CD) and corresponding exports from BSE-Risk countries. Source for export data: Eurostat and UK export statistics and, where available, export statistics from other BSE-Risk countries. Note: Only imports in Risk periods (grey shaded) are taken into account for assessing the external challenge. Risk periods are defined according to the SSC opinion of January 2002.

2.2 Import of MBM² or MBM-containing feedstuffs from BSE-Risk countries

According to the CD there are no feed-producing industries in San Marino. All feeding stuffs (compound feeds) for livestock are purchased either directly from Italian producing companies or from specialised shops in San Marino but originating from Italy.

The following import data were provided:

Year	Feeding stuffs [tons]	Feed supplements [tons]	Total [tons]
1992	729.7	4.3	734.0
1993	724.5	0.4	724.9
1994	1,025.6	0.7	1,026.3
1995	1,361.6	0.8	1,362.4
1996	1,512.2	0.3	1,512.6
1997	1,463.7	2.4	1,466.1
1998	1,097.3	3.7	1,101.0
1999	871.6	14.9	886.5
2000	836.5	39.3	875.8
2001	359.2	53.6	412.8
Total	9,981.9	120.4	10,102.4

Table 2: Feed imports into San Marino from Italy.

The Italian authorities are expected to carry out controls of the presence of MBM, but no data are available on the feeding stuffs exported to San Marino. Moreover, 18 tests for MBM have been carried out in San Marino in 2001 and all were negative.

2.3 Overall assessment of the external challenge

The level of the external challenge that has to be met by the BSE/cattle system is estimated according to the guidance given by the SSC in its final opinion on the GBR of July 2000 (as updated in January 2002).

- Live cattle imports:

In total the country imported 5.800 live cattle from BSE-risk countries, of which none came from the UK. As in San Marino there is no rendering industry, no animals could be rendered and enter the feed chain. Therefore, these animals do not represent any challenge to San Marino.

- MBM imports:

The country imported no MBM as such from BSE-risk countries but it imported between 1992 and 2001 about 10,000 tons of feeding stuffs and feed supplements, all from Italy

² For the purpose of the GBR assessment the abbreviation “MBM” refers to rendering products, in particular the commodities Meat and Bone Meal as such; Meat Meal; Bone Meal; and Greaves. With regard to imports it refers to the customs code 230110 “flours, meals and pellets, made from meat or offal, not fit for human consumption; greaves”.

(GBR III with about 60 cases). Assuming that a certain fraction of these feeding stuffs and feed supplements was contaminated with 1-3% processed ruminant proteins, the equivalent of 100 to 300 tons of MBM probably reached the BSE/cattle system of San Marino, representing a low to moderate external challenge. Broken down to 5-years periods the resulting external challenge is as given in table 3. Although, in absolute terms, the amount of MBM imported yearly in the period 1980-2000 might be perceived as a small one, it would be sufficient to expose a large proportion of the small cattle population in San Marino, thus representing a “significant” challenge.

Imports to San Marino of MBM-contaminated feeding stuff should have finished at the end of 2000, as the feed-ban was published in December 2000 and Italian feeding stuffs should have become void of MBM.

External Challenge experienced by SAN MARINO				
<i>External challenge</i>		<i>Reason for this external challenge</i>		
Period	Overall Level	Cattle imports	MBM imports	Comment
1980 to 2000	Significant*	Negligible	Low to Moderate	According to reasonable worst case hypothesis.
2001	Negligible		Negligible	Introduction of the feed-ban in December 2000.

Table 3: External Challenge resulting from live cattle and/or MBM imports from the UK and other BSE-Risk countries. The Challenge level is determined according to the SSC-opinion on the GBR of July 2000 (as updated in January 2002).

* A reasonable worst case assumption is that before 1992 the challenge level was about the same as in the period 1992-2000 and that the amount of MBM imported yearly, although small, could have been sufficient to expose a large proportion of the cattle population in San Marino.

Conclusion: The overall external challenge of San Marino was significant, indicating that it is regarded likely that the BSE-agent was introduced into the country by import of contaminated feeding stuff or feed supplements.

3. STABILITY

3.1 Overall appreciation of the ability to avoid recycling of BSE infectivity, should it enter processing

Feeding

According to the country dossier, livestock is fed with farm produced forage (hay of first and second mowing) and with cereal flour (barley and maize) partly produced on farm and partly purchased. Proteins are added, if needed, by soy-bean flour, dried Spanish clover and field beans. Cotton seed is used to increase the fat content of the milk. Wheat bran is used to add raw fibre. Minerals and vitamins are added via industrial supplements. In some cases

minerals and vitamins are provided by supplementing feeding stuffs that provide the right quantity of proteins and energy.

It is stated that, with regard to the needs of bovines, the use of concentrated feed has always been marginal. Mainly farms producing milk and, to a lesser extent, producing meat, resort to it.

In absence of data on the issue it is assumed, as a reasonable worst case assumption that most of the cattle in San Marino receive at least sporadically in their live feeding stuff or feed supplements that could contain or be contaminated with MBM, at least until end 2000.

In San Marino there are no feed-producing industries.

In December 2000, a decree banned the feeding to livestock of animal proteins derived from mammals (Decree n. 47 of 5 December 2000). The feed ban is controlled by inspections on farm and feed sampling. The feed samples taken from the 6 specialised shops selling animal feed were all negative.

In March 2001, a Regulation on the feeding to animals of animal proteins was published, in conformity with EC Decision 2000/766 (Decree n.40 of 15 March 2001).

Potential for cross-contamination and measures taken against

There are no feed-producing industries. Cross-contamination in feed mills is therefore no issue in San Marino.

Of the 55 cattle breeders in San Marino many have poultry for their own use and 15 have 2-3 pigs for their own consumption. Cross feeding and on-farm cross-contamination could therefore be a problem in San Marino.

However, the imported feed does and did always carry the same risk of being contaminated with the BSE-agent as any feed produced in the exporting country, i.e. Italy.

Rendering

In San Marino there are no rendering plants. By-products or waste from the slaughterhouse and/or animals that died/were killed on the farm have always been either buried or sent to authorised Italian rendering plants.

In some years, when there was no demand for meat from older cattle, these animals were sold to Italy where they were presumably slaughtered and their remains rendered in the Italian rendering plants.

Next to the only slaughterhouse existing in San Marino there is an incinerator for animal waste (including SRM) that is operational since 1982. Since October 2000 also the incineration of all animal that died on farm (fallen stock) is compulsory.

SRM and fallen stock

Provisions adopted over the years:

- 6 March 1997: brain, spinal cord, spleen, tonsils, thymus and intestines of bovines aged over 6 months, born in France, Portugal and Ireland must be seized and incinerated.
- 9 September 1998: skull, including brain and eyes, spinal cord and tonsils of bovines aged over 12 months must be removed during slaughtering and considered as risk

material. This provision concerns only bovines from Belgium, France, Ireland, Luxembourg, the Netherlands and Portugal.

- 4 October 2000: SRM must be seized during slaughtering and destroyed under incineration.
- 12 January 2001: intestines from the duodenum to the rectum of bovines of all ages must be considered as SRM and removed and destroyed.

Since March 1997 all SRMs (as defined in the respective regulations) of slaughtered animals are incinerated in the incinerator next to the slaughterhouse.

Since October 2000 all fallen stock in San Marino is also incinerated. Before it could have been buried or been sent to an authorised Italian plant.

Conclusion on the ability to avoid recycling

In light of the above-discussed information it is assumed that the BSE-agent, should it have entered the territory of San Marino, would have not been recycled and amplified within San Marino. However, as older cattle might have been sold to Italy, and fallen stock might have been sent to authorised Italian rendering plants, some infectivity could have been recycled into the Italian BSE/cattle system. It was possibly partly re-imported into San Marino in the form of Italian feeding stuff that might have again reached cattle in San Marino.

However, the country clarifies that never any SRM, as identified in the above-mentioned regulations, have been sent to Italy. It is not clear if any slaughterhouse offal or fallen stock were rendered in Italy. From the information that the incinerator is working since 1982 when the slaughterhouse was opened, it is also possible that slaughter waste was not sent to rendering in Italy. Whether San Marino was a dead end for BSE infectivity possibly imported from Italy is not completely clear and the possibility of infectivity recycling through the Italian rendering system cannot be excluded.

3.2 Overall appreciation of the ability to identify BSE-cases and to eliminate animals at risk of being infected before they are processed

Cattle population structure

San Marino is a small country (64 sq. Km) with a small number of cattle (1304) distributed in 55 farms. The farms are characterised by limited dimensions, traditional cattle-breeding and milk and meat production.

The age structure of the cattle population is as follows:

Year of birth	N° of cattle
1988	2
1989	3
1990	2
1991	5
1992	10
1993	12
1994	36
1995	56
1996	76
1997	66
1998	94
1999	101
2000	239
2001	633
2002	91
Total on 31/3/2002	1426

Table 4: Age structure of the cattle population in San Marino on 31/3/2002.

Of the 55 cattle breeders in San Marino many have poultry for their own use and 15 have 2-3 pigs for their own consumption.

The age distribution at slaughter is described as follows: 75% of the slaughtered cattle are 22-24 months (beef breeds). About 20% of all slaughtered cattle are calves of less than 12 months at slaughter. About 5% of the slaughtered animals is older than 24 months. In some years, when there was no demand for meat from older cattle, these animals were sold to Italy.

BSE surveillance

Compensation is provided in accordance with the Law n.7 of 1 February 1977, "Creation of a fund for livestock mortality". Whenever animals die on the farm or are slaughtered in an emergency for traumas or infectious diseases, 80% of the value is refunded to the owners. Such value is estimated by a Commission including also two members of the State Veterinary Service. Because of this measure, the CD states, farmers should not have reasons to hide any pathology in their livestock. In addition, the limited size of the territory and the small number of cattle and cattle holdings facilitate the supervision of farms.

Notification of any disease is compulsory since Decree n.87 of 4 October 1984, "Veterinary Regulation on Hygiene". It established that the owners of any kind of animals are obliged to notify the person responsible for the Veterinary Service of any animal having died or suspected of being infected by a disease.

According to the Law n.42 of 12 March 1991, "Reorganisation of the Veterinary Service", San Marino breeders are obliged to resort to State veterinarians for the diagnosis and

treatment of animals bred for human consumption. Therefore, the State Service intervenes in all animal pathologies. The Veterinary Service is also responsible for the Health Directorate of the San Marino Slaughterhouse.

Following the Interim Agreement on Trade and Customs Union between the European Economic Community and the Republic of San Marino, in particular article 5, paragraph 4 and article 6, paragraph 1, San Marino undertook to adopt Community veterinary regulations. On 28 June 1994, the EC-San Marino Co-operation Committee issued Decision n. 1/94, encompassing all legislative measures adopted by San Marino mutatis mutandis. On 24 August 1994 a decree was published by the Republic of San Marino reflecting this Decision (Decree of 28 August 2001, n. 75).

Decree of 20 May 1996, n. 60, "Rules on the notification of animal diseases between the Republic of San Marino and EC countries", provides for the compulsory notification to the Commission and to each EC member State on the onset of various infectious diseases, including BSE.

Decree of 14 February 2001, n. 23, "Rules on health policing including general measures to combat some animal diseases", sets the measures to be taken whenever a BSE case is found.

Contrary to other infectious diseases, if a positive BSE case is found, animals living together with the animal are slaughtered in a limited and selected way according to a plan established by the Veterinary Service to which no exceptions are possible (Decree of 8 May 2001, n. 64)

The surveillance and monitoring measures already described are supplemented by Decree of 8 May 2001, n. 63, "Measures concerning voluntary slaughtering according to a programme for the replacement of bovine livestock, within BSE prophylactic plans". The purpose of this provision is to eliminate animals being at risk to carry the BSE-agent from farms and excluding them also from human consumption and/or transformation into feed. This refers to those animals which, according to their age and origin, might be infected. The Veterinary Service is responsible for determining the animals to be slaughtered. A test for BSE is carried out on all animals culled in this context. All these animals are then incinerated.

Training: The responsible for the animal health unit of the State Veterinary Service of San Marino attended the following seminars, held by different specialised institutions in Italy:

- "TSEs: national surveillance system and guarantees for consumers" (30/10/2000).
- "Guidelines on sample taking for rapid BSE tests" (15/12/2000).
- "Monitoring of animals having died on the farm" 1/2/2001)
- "Prion diseases in animals and human" (11/6/2001).

Diagnosis: Decree of 15 March 2001, n. 39 "Diagnostic tests for spongiform encephalopathies," provides for compulsory tests on the encephala of bovine, caprine and ovine animals. Such tests have already been carried out from 1 January 2001 and are compulsory on:

- all bovine aged over 24 months normally slaughtered for human consumption;
- all bovine, irrespective of their age, which have died/were killed on the farm or during the transport or that have been slaughtered in an emergency;
- all bovines slaughtered according to the voluntary slaughtering plan envisaged by Decree of 8 May 2001, n. 63;

- all ovine and caprine slaughtered in an emergency and/or having died/were killed on farm or during their transport.

Between 1 January 2001 and 31 March 2002, 282 tests were carried out according to the following break down. No BSE cases were detected.

Type and age of the tested animal	No. tested
Bovine of more than 24 months slaughtered for human consumption	94
Bovine of less than 24 months slaughtered for human consumption	23
Bovines having died on the farm or during the transport	32
Bovine animals slaughtered in an emergency	60
Bovines slaughtered according to the voluntary slaughtering plan envisaged by Decree 63 of 8 May 2001	71
Total bovines tested:	280
Total bovines over 24 months tested:	257
Total n° of “at-risk” cattle tested:	92
Ovine having died on the farm	2

Table 5: Number of laboratory tests for BSE. Note: Given the small number of cattle in San Marino the probability to find a case within the small n° of samples that can be taken is very low, even if the risk is at the same level as, for example, in Italy³.

Tests are carried out by the Microbiological Laboratory of San Marino Environmental Hygiene Service. Staff of this laboratory was trained at the Brescia Unit of the Italian Zooprohylactic Institute

The three tests validated by the UE can be used, but until now only the ‘Prionics’ Western Blot was applied.

In case of a “non-negative” result in a BSE test, the sample would be sent to the Turin Unit of the Italian Zooprohylactic Institute, which is the Reference Laboratory for San Marino as far as the diagnosis of infectious diseases is concerned

3.3 Overall assessment of the stability

For the overall assessment of the stability, the impact of the three main stability factors and of the additional stability factor, surveillance has to be estimated. Again, the guidance provided by the SSC in its opinion on the GBR of July 2000 is applied.

Feeding

Feeding (R)MBM to cattle was legally possible until December 2000 and even if it was probably not widespread, supplementary feed, imported from Italy, was given to domestic cattle or could have reached them via (accidental) cross feeding of non-ruminant feed on farms. Feeding was, therefore, **“not OK”** until December 2000. Theoretically the feedstuffs

³ For an estimate of the necessary sampling size please see the SSC opinion on requirements for statistically authoritative BSE/TSE surveys (adopted on 29-30 November 2001); http://europa.eu.int/comm/food/fs/sc/ssc/outcome_en.html#opinions.

from Italy should have been void of mammalian MBM since 1994 (MMBM-ban) but apparently they were not, as demonstrated by the BSE cases found in Italy born after 1994. Control of the December 2000 feed ban is carried out in San Marino by on site controls (at farms, dealer) and feed sampling. No positive samples were found so far and feeding is regarded to be ‘OK’ since January 2001. This is also supported by the assumption that Italian feed should anyway be void of any MBM since January 2001.

Rendering

As in Italy.

SRM-removal

As in Italy.

BSE surveillance

Until end 2000 the surveillance of BSE was only passive and therefore unlikely to detect low levels of incidence. Since the beginning of 2001 the surveillance system is considered to be quite good, now including active sampling of animals without clinical signs of BSE. However, the small sample size that is only possible will continue making it difficult to recognise low incidence levels.

Stability of the BSE/cattle system in SAN MARINO over time					
Stability		Reasons			
Period	Level	Feeding	Rendering	SRM removal	BSE surveillance
1980-1999	Extremely unstable	Not OK	Not OK	Not OK	↓
2000	Neutrally stable		OK		→
2001-	Optimally stable	OK		OK	

Table 6 Stability resulting from the interaction of the three main stability factors and the BSE surveillance. The stability level is determined according to the SSC-opinion on the GBR of July 2000. As the BSE/cattle system of San Marino is closely interlinked with the Italian BSE/cattle system the stability factors “rendering” and “SRM-removal” are as in Italy.

The interlinkage of the BSE/cattle system of San Marino with the Italian system is mainly due to the fact that all industrial feed used in San Marino came from Italy, carrying the same risk as any other Italian feed.

The feedstuffs imported from Italy were potentially contaminated with MBM and could have lead to a wide exposure of the cattle population in San Marino to the BSE-agent, which was apparently present in Italy since some time.

Due to the improvement of the rendering system in Italy the risk of receiving contaminated feed from Italy should have somewhat decreased in late 1999 and the system became neutrally stable. It then became “optimally stable” in January 2001 because of the feed-ban preventing the introduction of the BSE-agent via Italian feed, which in turn should anyway be void of any MBM since January 2001.

4. CONCLUSION ON THE RESULTING RISKS

4.1 Interaction of stability and challenges

In conclusion, the stability of the BSE/cattle system of San Marino/Italy in the past and the external challenges the system of San Marino has coped with are summarised in the table below.

From the interaction of the two parameters “stability” and “external challenge” a conclusion is drawn on the level of “internal challenge” that emerged and had to be met by the system, in addition to external challenges that occurred.

From the above presented information it is concluded that imports and feeding to cattle of contaminated MBM-containing feedingstuff, mainly from Italy, is the route by which the BSE-agent could have reached cattle in San Marino. It is as likely as in any other part of Italy that this feed carried the BSE-agent and therefore induced BSE in domestic cattle of San Marino. However, no recycling and amplification of the BSE-agent could take place within the San Marino itself.

INTERACTION OF STABILITY AND EXTERNAL CHALLENGE IN THE REPUBLIC OF SAN MARINO			
Period	Stability	External Challenge	Internal challenge [#]
1980 to 1982	Extremely unstable	Significant*	Unlikely
1983-1989			Possible and growing if existing
1990-1999			Likely and growing
2000	Neutrally stable	Negligible	Likely and stable
2001-	Optimally stable		Likely but decreasing

Table 7: Internal challenge resulting from the interaction of the external challenge and stability. The internal challenge level is determined according to guidance given in the SSC-opinion on the GBR of July 2000.

* Reasonable worst case hypothesis, assuming that feed imports from Italy were potentially BSE-contaminated – see GBR-report- for Italy by the SSC (July 2000).

[#] Internal challenge as for Italy - see GBR-update by the SSC (January 2002).

4.2 Risk that BSE infectivity entered processing

Potentially BSE-contaminated MBM was most likely imported from Italy before 1992 and could have reached domestic cattle. Therefore, BSE-incubating cattle could have been slaughtered in San Marino already in the late 80s, as it was becoming possible that Italian feed could have been contaminated with the BSE-agent since 1983. This risk continued to exist as long as cattle were slaughtered that received Italian feed that was potentially contaminated with the BSE-agent. It grew around 1995 because the risk of Italian feed being BSE-contaminated is considered being higher since 1990. Given the fact that Italian feed should be void of MBM since January 2001, and that this is controlled in San Marino, the risk that BSE-incubating cattle are processed (slaughtered) in San Marino is now decreasing in line with the rate at which cattle born before 1/1/2001 leave the system.

4.3 Risk that BSE infectivity was recycled and propagated

As there is no rendering in San Marino, recycling and amplification within the country is not an issue. However, a certain recycling might have happened via Italian based rendering plants and feedmills that processed old cows from San Marino and fallen stock and produced feed from it.

5. CONCLUSION ON THE GEOGRAPHICAL BSE-RISK

5.1 The current GBR as function of the past stability and challenge

The current geographical BSE risk (GBR) level is *III*, *i.e. it is likely* that domestic cattle are infected with the BSE-agent but it is not confirmed.

- It should be noted that the very small cattle/BSE system of San Marino is most appropriately regarded to be a sub-system to the Italian BSE/cattle system, which is known to have been incorporating and recycling the BSE-agent.
- In view of the very small cattle population in San Marino and of the level of BSE-prevalence registered in Italy and most other European countries, it may take several years before a single BSE-case is identified in San Marino, even with a very efficient surveillance system.

5.2 The expected development of the GBR as a function of the past and present stability and challenge

- As in Italy the GBR of San Marino will decrease over time as the possibility of new BSE cases born after the ban of December 2000/January 2001 is regarded to be very small.
- The GBR of San Marino should be decreasing at the rate by which cattle born before the total feed ban leave the national system (slaughter, cull).

5.3 Recommendations for influencing the future GBR

The careful control of the feed ban ensures that no new exposure can occur and that the GBR decreases as rapid as possible.

Culling of all cattle born before it became highly unlikely that contaminated feed could have been present in San Marino could be an option to speed-up this decrease. San Marino has already started a voluntary culling programme.