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# Review of Badger (*Meles meles*) Research Licences in 2002

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#### Introduction

The National Bovine Tuberculosis Eradication Scheme includes a research programme involving diagnostic, epidemiological and wildlife investigation projects. As part of this research programme badgers (*Meles meles*) are caught under licence and examined for evidence of tuberculosis. Data relating to licences used and badgers removed are described in this review.

#### **Materials and Methods**

A Veterinary Inspector, in the course of the epidemiological investigation of a tuberculosis breakdown in a herd, may make an application for a licence if wildlife involvement is suspected. Licences to remove and examine badgers are issued by the National Parks and Wildlife Service of the Department of the Environment and Local Government. Each licence is valid for one year from the date of issue and is operated by or under the direct supervision of staff of the Department of Agriculture and Food.

These local research licences are operated within a two-kilometre radius of the index farm, to assist in the epidemiological investigation of the breakdown. Other research licences, such as those granted for the Four Area Badger Study and the East Offaly Project, cover a larger area and are operated with the aim of quantifying the contribution of badgers to the spread of tuberculosis in cattle.

All badgers removed under licence undergo gross *post-mortem* examination at the Regional Veterinary Laboratories of the Department of Agriculture and Food or under contract at the laboratory of the Irish Equine Centre. In addition, a number of road casualties are submitted each year, which are also examined for evidence of tuberculosis.

A proportion of badgers also had tissues submitted for further pathological tests. For example, where visible lesions of tuberculosis were found in a badger carcass this was taken as significant, and histopathological examination and culture were used as confirmatory tests in most cases. However, this was not done in all cases. Data relating to both confirmed and unconfirmed cases are presented. These extra tests were also carried out on a proportion of gross lesion negative badgers.

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#### Results

#### Origin of cases

This review presents results from 5,945 badgers submitted under local licences and the East Offaly Project. It also includes data from 450 badgers submitted as casualties. Badgers were also submitted as part of the Four Area Badger Study. A summary of the origin of all cases is given in Table 1. Detailed analysis of data from badgers removed in the Four Area Badger Study is reported separately (Griffin *et al.*, 2003). A small number of badgers were submitted but were not examined for various reasons, such as carcass decomposition.

#### Table 1. Origin of cases.

2002	Offaly	Local	Total excl.	Four	Total
	-	Licence	Four Area	Area	
Licence	168	5327		188	5683
Road Casualty	4	446		0	450
Total	172	5773	(5945)	188	6133

A total of 638 local licences were used in 2002. The average number of badgers removed per licence was 8.3 and the range was one to 66. Every county, except Dublin, submitted badger carcasses under local licences in 2002.

#### Sex Ratio

Of the 5,906 cases where sex was recorded (Table 2), the sex ratio was almost even. However, significantly more males had confirmed tuberculosis (P<0.001). The sex was not recorded in two confirmed cases. There was no significant difference in sexes between those removed under licence and those submitted as casualties.

#### Table 2. Sex ratio of cases.

Sex	All Badgers (%)	Tb confirmed badgers (?	
Female	3025 (51.2)	328 (44.3)	
Male 2881 (48.8)		413 (55.7)	
Total	5906	741	

#### Weight

Weight was recorded in 4,776 cases and average weights are shown in Table 3. The range was 1.4 kg. to 16.5 kg. for males and 2.2 kg. to 16.4 kg. for females.

#### Table 3. Weight distribution (average, in kg.) Year 2002.

Sex	
Males	9.6
Females	8.9
All cases	9.3

No significant weight difference was found between badgers positive and negative for tuberculosis, or between those removed under licence and those submitted as casualties.

#### Disease Profile

All badgers underwent gross *post-mortem* examination. In addition, further laboratory tests were carried out on a number of badgers. Results of the gross *post-mortem* examination of badgers are presented in Table 4. Some 6.2% of cases were found to be positive for tuberculosis and a further 25.2% were inconclusive.

Result	Local Licence (%)	Casualty (%)	Total (%)
Positive	325 (5.9)	41 (9.1)	366 (6.2)
Inconclusive	1373 (25.0)	126 (28.0)	1499 (25.2)
Negative	3797 (69.1)	283 (62.9)	4080 (68.6)
Total	5495	450	5945

Table 4. Results of gross <i>post-mortem</i> examination, 20
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The additional laboratory tests consisted of histpathological examination and culture of selected lymph nodes or other tissues. The application of these tests was not uniform due to different resources at different laboratories. Thus, there is a geographical bias towards particular cases. There is also a disease bias, as the "inconclusive" cases received a disproportionate number of additional tests compared with those cases that were deemed to be negative for tuberculosis on gross *post-mortem* result, that underwent additional tests, together with the results of the latter tests, are shown in Table 5.

Result of gross examination	Results of additional diagnostic tests	No. of Badgers
Positive	Positive	190
Positive	Inconclusive	8
Positive	Negative	70
Positive	Not done	98
1999 - 1999 Sa	sub-total	366
Inconclusive	Positive	360
Inconclusive	Inconclusive	5
Inconclusive	Negative	1091
Inconclusive	Not done	43
	sub-total	1499
Negative	Positive	193
Negative	Inconclusive	8
Negative	Negative	820
Negative	Not done	3059
-	sub-total	4080
	Totals	5945

 Table 5. Numbers and results of additional laboratory diagnostic tests, 2002.

Of the 366 gross lesion positive cases, 268 (73.2%) had additional tests; 190 (70.9%) of these were confirmed. Of 1,499 gross lesion inconclusive cases, 1,456 (97.1%) had additional tests and 360 (24.7%) of these were confirmed as positive for tuberculosis. Of 4,080 gross lesion negative cases, 1,021 (25%) had additional tests and 193 (18.9%) of these were also confirmed. Overall, tuberculosis was confirmed in 743 (12.5%) badgers. A comparison of rates of confirmed infection over the past five years is given in Table 6.

Year	No. examined (gross <i>post-</i> <i>mortem</i> )	No. confirmed positive (by addit- ional tests)	% confirmed positive
1998	1,997	258	12.9
1999	3,457	458	13.2
2000	4,757	580	12.2
2001	3,542	463	13.1
2002	5,945	743	12.5

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\*limited sampling in 2000 -2001

In addition 52 (11.6%) of the 450 road casualty cases were confirmed with tuberculosis.

#### Lesion Location – confirmed tuberculosis

The locations of lesions in 377 badgers in which a single location was recorded are presented in Table 7. In a further 352 cases, lesions were recorded in more than one location; their distribution is shown in Table 8. No location was recorded for 14 cases that were initially found to be gross lesion negative.

Table 7. Location of lesions in 37	7 confirmed cases showin	g a single lesion, 2002.
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Lesion location	
Axillary lymph node	5
Bronchial/Mediastinal lymph nodes	69
Hepatic lymph node	13
Kidney	17
Inguinal lymph node	2
Liver	4
Lung	47
Mesenteric lymph node	4
Pharyngeal, parotid or submandibular lymph node	118
Popliteal lymph node	57
Prescapular lymph node	32
Skin	9
Total	377

## Table 8. Distribution of lesions in 352 cases showing multiple lesions,2002.

Lesion location	
Axillary lymph node	20
Bronchial/Mediastinal lymph nodes	197
Hepatic lymph node	50
Kidney	36
Inguinal	2
Liver	34
Lung	134
Mesenteric lymph nodes	38
Pharyngeal, parotid or submandibular lymph node	194
Popliteal lymph node	89
Prescapular lymph node	123
Skin	16
Spleen	7
Other location *	4

\* "Other locations" were omentum, pleura, pericardium and mammary gland

In 216 cases there were two locations, in 76 cases three locations, in 35 cases four locations and in 14 cases five locations. Six cases had lesions recorded in six locations; two cases had lesions in seven locations and three in eight locations.

#### Licences with confirmed cases

Overall in 2002, of the 638 licences issued, 303 (47.5%) yielded tuberculous badgers. Again it should be stated that many badgers that had gross evidence of tuberculosis had not been subjected to any further confirmatory tests; these cases are not reflected in the data presented in Table 9.

No. of badgers removed	No. of licences	No. of "confirmed Tb" licences	% of "confirmed Tb" licences
1-5	304	93	30.6
6 – 10	165	82	49.7
11 - 15	84	58	69.0
16 - 20	39	27	69.2
> 20	46	43	93.5
Total	638	303	47.5

Table 9. Badgers removed per licence and "confirmed Tb" licences, 2002.

As the number of badgers removed under a licence increased, the greater the likelihood of finding one with tuberculosis. Density of setts in areas will vary depending on habitat type (Smal, 1995) and this is reflected in the number of badgers removed under individual licences. Interference at setts by blocking, digging etc. continues to be reported. This also results in lower numbers being captured at these setts. In other situations, the number of positive cases may have been reduced because of the prior death of affected badgers.

#### Discussion

These data demonstrate that the badger population examined here had a minimum rate of infection of 12.5% in 2002 (Table 6). This is remarkably similar to the rate of infection in badgers disclosed in previous years. The population studied was biased towards infected groups, as the initial selection was in areas of cattle herd breakdowns. Nevertheless, the presence of tuberculosis in 11.6% of the 450 road casualties examined, i.e. a more representative sample, and the fact that positive badgers were found in every county (except Dublin) in 2002, supports the view that tuberculosis is endemic in the Irish badger population.

The respiratory route appears to be an important route of infection. Of the positive cases, 47% had lesions in the lungs or pulmonary lymph nodes. Fagan (1993) reported respiratory disease in 13 (46%) of 28 badgers with gross evidence of tuberculosis.

The fact that significantly more males than females were found to be tuberculous is attributed to the extra contact and fighting which occurs in the breeding season. Similar findings were reported in badgers in 1997 (O'Boyle, 1997), 1999 (O'Boyle 1999) and 2000/2001 (O'Boyle 2001) but not in 1998 (O'Boyle 1998).

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