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Short Communication

Managing Public Demand For Badger Rehabilitation In An Area Of England With Endemic Tuberculosis.

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Abstract: Badgers are a popular and protected species in England, despite their association with tuberculosis (*M. bovis* infection) in cattle. Casualty badgers are commonly presented to veterinarians and wildlife rescue centres following injury, as a result of disease, or as orphans. Strict policies are adopted for their rehabilitation and release, with respect to the prevention of spread of tuberculosis, these policies differ between adult badgers and badger cubs. Adult badger casualties are not normally tested for *M. bovis* infection prior to release, but are instead kept in isolation and released back where found. A study of casualty adult badgers found 10% to be positive on a single serological test. These animals had a variety of clinical signs that had resulted in none of them being released back to the wild. Badger cubs are serologically tested for evidence of *M. bovis* infection on three occasions during rearing; 13% were found to test positive. Positive animals were examined at post-mortem and cultures made for *M. bovis*; 12.5% of serologically positive animals were found to be culture positive. Alternative test methods and zoonotic risks are considered.

Public attitudes to badgers in England are generally positive despite the association between badgers and *M. bovis* infection in cattle having been made as long ago as the 1970s (Muirhead *et al.*, 1974). The Badger Trust, an umbrella group for regional groups concerned with badger protection, has approximately 1,000 individual members with representatives in 80 local groups throughout the country (Badger Trust, 2009). The trust campaigns for the protection of badgers through the protection of badger environments (damage to sets, building developments and roads), protection against persecution (snaring, baiting), representation on political issues and rehabilitation of orphaned and injured animals. There are strong public attitudes towards the issues associated with *M. bovis* infection in cattle and badgers. Public opposition to badger culling to control tuberculosis (TB) in cattle is very significant with 96% of respondents in opposition to a recent proposal (Defra, 2006). Even in farming areas with a TB problem methods of controlling disease that avoid culling badgers are favoured (Bennett and Willis, 2007).

There are approximately eighty British wildlife rescue centers in England with varying levels of charitable funding, and a wide range of facilities and levels of care. There is currently no statutory control of such facilities. Secret World Wildlife Rescue (SWWR), based in the South West of England, cares for approximately 4,000

casualties per annum including most British wildlife species. Badgers are found in their greatest numbers in this part of the country, where population densities of 1.2 animals per square kilometer have been estimated (Wilson *et al.*, 1997; Delahay *et al.*, 2008). SWWR treats approximately 70 adult badger casualties and 50 badger cubs per annum.

The reasons for veterinary involvement in treating indigenous wildlife include; the welfare of individual animals, conservation, disease monitoring, ‘addressing the balance’ of mankind’s actions, and professional satisfaction. Potential negative consequences include the welfare of the individual casualties while in captivity, the social and disease influences their release may have on other animals, cost, and health and safety issues. In the England there are few species endangered to the point where conservation can be used as a reason for the individual care of indigenous wildlife species and such treatment is consequently driven by welfare and a demand for this service from the general public.

The veterinary professional associations in the UK broadly support the care of wildlife; the Royal College of Veterinary Surgeons (RCVS) ‘Guide to Professional Conduct’ provides the veterinary surgeon with a legal obligation to provide emergency care ‘*at least first aid and pain relief*’, to all species of animal including indigenous wildlife (Royal College of Veterinary Surgeons, 2008). The British Veterinary Association (BVA) and Royal Society for the Prevention of Cruelty to Animals (RSPCA) ‘*Memorandum of agreement*’ further suggests that emergency care or euthanasia of small mammals and all wild birds brought to practices during normal surgery hours will be provided free of charge. The RSPCA contributes to the cost of out of hours fees and visits to large mammals such as deer (British Veterinary Association, 2008) but this agreement is not legally binding. Despite their enthusiasm for wildlife care, there is limited information for veterinarians and rehabilitators working in rescue centres.

Most animals are presented by members of the general public or by a wildlife rescue group. A decision may be made during triage to euthanase those individuals unlikely to make a full recovery and return to the wild (Best and Mullineaux, 2003). Wildlife casualties are often anaesthetised to allow further examination, diagnostic tests and treatment. A period of ‘rehabilitation’ then follows, usually at a specialist wildlife centre, where animals are prepared for their released back to the wild. Most individuals are ‘hard’ released (just put back in a free-ranging situation without any external support) exactly at the geographical position where they were found.

Adult badgers are usually presented to veterinary practitioners and wildlife centres as a result of injury or disease. In contrast, presented cubs have usually been abandoned (by disturbed sows) and are healthy.

Of the adult badgers brought into captivity, 37% were as a result of road traffic accidents and 54% due to injuries from territorial disputes. Admissions peak in the spring and autumn coinciding with adult badger reproductive activity, but there is no sex difference. Adult badgers frequently present with evidence of badger to badger ‘territorial wounding’ which may account for 55% of admissions mostly in boars taking refuge in buildings. Wounding affected the rump area in 82% of cases (Mullineaux, unpublished data).

One third (36%) of badgers were successfully rehabilitated and released (Mullineaux, unpublished data). 50% of badgers were euthanased for welfare reasons, with 78% of these humanely destroyed during the initial veterinary examination. 14% of cases died in captivity, usually within the first few days.

Badger cubs required little veterinary attention but needed specialist care with bottle feeding for at least 8 weeks before weaning. Cubs are identified on admission (micro-chipped, then tattooed at a later date) and reared in social groups of 6-8 animals of both sexes. Once weaned the cubs are kept in their social groups in secure pens until over 6 months old. The cubs are then 'Soft' released into a fenced area containing an artificial sett where food and water is initially provided, with full local landowner consent.

There is a variable level of acceptance by wildlife charities' personnel of the potential risk to cattle from *M.bovis* infection in badgers. In some situations individual staff members will neither acknowledge the *M.bovis* risk from the wild animals they treat nor accept current scientific evidence for disease transmission. The more responsible charities/groups do however accept that there is a zoonotic disease risk and a potential risk to livestock and other animals after release. Additionally there is a risk to the whole process of rehabilitation and release if public perception is damaged and funding subsequently reduces. The three main charities involved in badger rehabilitation and release; SWWR, the Badger Trust (formerly the National Federation of Badger Groups, NFBG) and the RSPCA have always taken the risk seriously and badger cubs in their care have been tested for *M.bovis* infection since 1992. The UK regulatory authority in 2000 (Ministry for Agriculture Fisheries and Food) formed a subgroup of its TB panel comprising ecologists, farmers' representatives, scientists and the interested charities to discuss badger rehabilitation and the risk of *M.bovis* being transmitted to cattle from released badgers. An agreed policy was published in 2003 (Secret World Wildlife Rescue *et. al*, 2003; Mullineaux, 2003b) but it is not legally binding on rehabilitators and veterinarians. The policy differentiates between adult badger casualties and badger cubs in the way that they are treated and rehabilitated with respect to *M.bovis* infection.

Adult badger casualties are never mixed when in captivity and are released exactly where they were found because of their territorial behaviour. Adult badger casualties are not tested for TB because the risk of disease transfer as a result of the rehabilitation process is considered very low and the practicalities of testing are difficult to achieve in rehabilitation centres. Until April 2009 the only serological test available to rehabilitators in the UK was the indirect 'Brock' Elisa test (Goodger *et al.*, 1994; Chambers *et al.*, 2002) with a sensitivity value of 40.7% for a single test (Clifton-Hadley *et al.*, 1995), which is too low to detect *M.bovis* infection in individual animals. The costs of multiple testing, as described for cubs below, is considered too high to be financially viable and the time required for multiple testing would delay the release of the casualty with consequent welfare concerns. Clinical testing of urine, faeces or sputum is limited by intermittent shedding of *M.bovis* (Little *et al.*, 1982; Clifton-Hadley *et al.*, 1993; Gallagher and Clifton-Hadley, 2000; Chambers *et al.*, 2002), and time required for culture (Crawshaw *et al.*, 2008).

Badger cubs are grouped for behavioural and social reasons during rearing and are released in these groups into areas geographically remote from where they were found and therefore present a risk for potential translocation of *M.bovis*. Consequently, badger cubs are tested on three occasions prior to release using the Brock test. Multiple applications of the test are employed to increase the sensitivity to 79.5% (Forrester *et al.*, 2001) but specificity falls from 94.3% to 83.1% (Forrester *et al.*, 2001). Badger cubs testing positive on any one of the three occasions are euthanased and sent for standard post mortem examination and culture at an approved laboratory (Gallagher and Horwill, 1977, Pritchard *et al.*, 1986, Clifton-Hadley *et al.*, 1993). The sensitivity of such methods have however, been questioned when compared to alternative techniques (Corner, 2006; Crawshaw *et al.*, 2008) and attempts are being made to investigate and improve the techniques employed

The TB testing policy was reviewed for badger cubs and adults. Under the policy adult badgers are not normally tested. However in 2006, as part of a wider study, 40 consecutive cases of badger casualties were tested retrospectively for *M.bovis* using a single indirect Elisa test. Where there was evidence of wounds from territorial biting swabs were taken. Based on these tests 10% (4/40) of adult badger casualties were considered positive for TB; three badgers were seropositive on a single indirect Elisa test and two animals had positive wound swabs. None of these casualties had been released as they had either died shortly after admission or had been euthanased following clinical assessment. No animals testing positive had been released back to the wild. Clinical data was available for the four cases (Table 1).

Case number	Sex	Condition	Wound swab culture	Serology (single Brock Elisa)	Clinical findings	Outcome
EM60	M	Poor	No wounds	Positive	Osteomyelitis Renal failure	Euthanased
EM61	M	Poor	Positive	Positive	Chronic infection Moderate wounding	Died
EM65	M	Poor	Positive	Negative	Chronic infection Severe wounding	Euthanased
EM82	F	Poor	No wounds	Positive	Old fractures Osteomyelitis	Euthanased

Table 1: Clinical details of TB positive adult badgers

The study shows that badgers brought into captivity do test positive for *M.bovis* infection, although standard clinical triage protocol are likely to result in these animals being euthanased rather than considered suitable for release. The potential zoonotic disease risk associated with *M.bovis* infections in adult badgers is a situation often overlooked by wildlife rescue centres in their Health and Safety assessments for their staff. Casualty badgers are by definition likely to have an increased injury and disease risk compared to the general population. Additionally, many casualty adult badgers are found in buildings and it has been suggested that such animals may carry an increased risk of TB (Cheesman and Mallinson, 1981). Education is necessary to

ensure that those involved in the care of badgers limit risk to themselves, their employees, volunteers and members of the public. There have been no studies to investigate the success of adult badger releases; the social impacts on badger populations; or the risks of disease transmission associated with such releases.

Over a 12 years period (1996-2008) 360 cubs were tested at SWWR using the protocol described above. This represents an estimated 90% of cubs successfully reared and released in the UK during this period. Animals testing positive to any of the three indirect Elisa tests were euthanased and standardised post mortem and culture procedures undertaken at an approved laboratory. Thirteen percent (48/360) of cubs were positive to at least one of the three indirect Elisa tests. However only 12.5% (6/48) of the Elisa positive cubs were culture positive on standard post mortem and culture techniques. Overall only 1.7% (6/360) cubs tested and subsequently euthanased were culture positive.

Despite multiple testing, the true prevalence of infection in badger cubs remains unknown and complete assurance that cubs released are TB negative is not possible. The triple testing methods employed are currently under review, but are likely to remain the best opportunity available to badger rehabilitators of ensuring cubs that are released are disease free. Improved post mortem techniques may help further understanding of the limitations of the testing regimes employed and the apparently high numbers of serologically positive but post mortem and culture negative animals. New testing methods such as the Brock TB Stat-Pak®, which replaced the Brock Elisa test as the only commercially available serological test in April 2009, are being made available and it is hoped that a badger γ -interferon test may soon be commercially available. A commercial badger bacille Calmette-Guérin (BCG) vaccine is likely to be available for use in wild badgers in 2010 and it may be possible to incorporate this into the testing policy. As with adult badgers, the social and ecological consequences of cub releases on badger populations and disease transmission require further investigation. Any changes in testing regimes must however fully consider the welfare of the badger cubs involved, as well as the financial and emotional issues testing policies may cause for the rehabilitators involved in the care of these animals. Above all it should be remembered that there is a public enthusiasm for badgers in England and the proper care of casualty and orphan badgers is likely to remain an emotive issue.

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Conflict of Interest Statement

The authors have no conflict of interest.

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