Institution: University of Derby
Unit of Assessment: Biological Sciences
Title of case study: Public Engagement with Science

1. Summary of the impact (indicative maximum 100 words)

Research conducted by the Biological Sciences Research group on sexual selection, using bushcrickets as model organisms, has attracted a very high level of media interest and has contributed to public engagement with science. Evidence for this is provided by a considerable number of review articles on the research in the media. There is also evidence of public debate through social media such as twitter, blogs, sharing of articles and individual comments on web articles about the research.

2. Underpinning research (indicative maximum 500 words)

The research that underpins the impact in this case study used crickets and bushcrickets as model organisms to study the process of sexual selection, specifically the evolution of testes size.

The size of testes relative to male body mass varies greatly across species. In numerous taxa, relative testes size correlates positively with the extent to which females of the species engage in polyandrous mating. There are at least two hypotheses that could account for this pattern. The sperm competition hypothesis, which has won broad acceptance, proposes that larger testes allow males to produce larger ejaculates per mating, thereby enabling the male to out-compete rival sperm. The male mating rate hypothesis, on the other hand, proposes that larger testes allow males to produce a greater number of (potentially smaller) ejaculates. The latter hypothesis has been almost completely neglected over the last two decades (reviewed in Vahed & Parker 2012).

Karim Vahed, D.J. Parker and J.D.J. Gilbert conducted a comparative study of European bushcrickets to test the predictions of these competing hypotheses (Vahed *et al.* 2011). The data on testes mass, ejaculate mass, sperm number and the degree of polyandry for each species collected from 2008 to 2009. The research was led by Dr K. Vahed, who at the time was a Reader in Behavioural Ecology at the University of Derby (where he had been employed since 1993). The results revealed that like virtually all other taxa, relative testes size increased with the degree of polyandry. Larger testes, however, were associated with smaller ejaculates. The study therefore provided some of the first comparative evidence to support the male mating rate hypothesis. The study also revealed that one of the species studied, the Tuberous bushcricket, *Platycleis affinis*, has the largest testes relative to male body mass so far recorded in any animal.

3. References to the research (indicative maximum of six references)

The evolution of testes size

Vahed, K. & Parker, D. J. (2012) The evolution of large testes: sperm competition or male mating rate? *Ethology*, **118**: 107 – 117.

Vahed, K., Parker, D. J. & Gilbert, J. D. J. (2011) Larger testes are associated with a higher level of polyandry, but a smaller ejaculate volume, across bushcricket species (Tettigoniidae). *Biology Letters*, **7** (2): 261 – 264. (Output listed in REF2).

4. Details of the impact (indicative maximum 750 words)

The contribution of the submitted unit to the research

The research was led by K.Vahed, who planned the study, collected the majority of the data and wrote the majority of the manuscript. D.J. Parker, who was at the time an undergraduate Zoology student at the University of Derby, assisted with the dissection of the specimens, while J.D.J. Gilbert, who at the time was an Associate lecturer at the University of Derby (and also a research fellow at the University of Cambridge) was involved with the statistical analysis of the data.

Critical reviews in the media.

The University of Derby produced a press release based on research on the evolution of testes size in bushcrickets (Vahed *et al.* 2011, published online in *Biology Letters* on 10th November 2010). This resulted in very high levels of global media coverage.

The story was reported on BBC.co.uk/news on 10th November 2010 and all over the world in both print and online media; from Canada to Brazil, Tazmania, to India, Bulgaria to Kuwait, Ireland and the USA. This was in a range of media, from science specific, such as *National Geographic* and *Science Centric*, to the science pages of national daily papers including the *New York Times* and *Daily India, The Arab Times, The Bancock post, The Daily Express (Borneo)* to tabloid media such as *Yahoo News* and *MSN*. The story was reported in national daily newspapers in the UK such as *The Sun, the Daily Mail, Metro*, and *The Independent* and *The Guardian online* and *The Week magazine*. As the story was carried by news wires including Press Association and AFP it was picked up by many smaller local newspapers such as *The Northern Echo* and *The Stoke Sentinel*.

Because the story was reported so widely, and in so many languages, the exact number of web reports is hard to pin down – but it is safe to say that it was in the hundreds, with reports on Chinese language, Taiwanese, Portuguese and Spanish websites.

K.Vahed was interviewed about this research by the BBC World Service Radio, who carried the story throughout November 10th and by Radio West Midlands and BBC Radio Derby. Westdeutcher Rundfunk, the biggest public radio station in Germany, also broadcast an interview with K. Vahed relating to his research on crickets on 14th February 2013.

In February and 6th May 2013, K. Vahed was involved in the filming of a 3-D documentary on Insects, filmed by Atlantic Produtions for Sky and iMax cinemas, entitled "Micromonsters 3-D". This series was released in June 2013. The documentary, which was narrated by Sir David Attenborough, featured mating in crickets, which K. Vahed supplied. He advised on material for inclusion in the script and helped with the filming of the mating sequences.

Evidence of public engagement with the science and public debate:

The online press release (in The University of Derby's *Connected* magazine) was visited a total of 1,116 times on 10th November 2010, by visitors from at least 40 countries including Brazil, Japan, Spain, Australia, Hungary and the USA.

BBC World Service Radio, who carried the story throughout November 10th , has typical listening figures of 130 million.

The story was very popular on social media – for the morning of 10th November 2010, it was the most shared story on BBC.co.uk/news, which indicates that it was being shared by people on their social networking pages such as Twitter, Facebook and Bebo. According to the figures displayed on BBC.co.uk/news, the BBC's article on this research on testes size in bushcrickets has been shared 12,144 times.

A quick twitter search on 10th November 2010 showed that it was a popular thread of discussion: there were over 50 tweets for "Vahed". With "crickets" added into the search and the results were too many to record.

The story also featured on popular websites such as "D-Listed" and the women's online magazine "Jezebel" and numerous blogs. An animated article about the research features on "You Tube": where it has attracted 1,446 views.

In May 2011, K. Vahed delivered an invited public lecture on mating behaviour in crickets entitled "The sex lives of crickets" at Natural History Museum, London. This event was part of the museum's "Live Science" programme, based in their Attenborough studio.

5. Sources to corroborate the impact (indicative maximum of 10 references)

National Geographic
http://news.nationalgeographic.com/news/2010/11/101110-biggest-testicles-size-bushcrickets-biology-vahed-science-animals/

Guardian
http://www.guardian.co.uk/science/2010/nov/10/largest-testicles-species-bush-cricket

BBC
http://www.bbc.co.uk/news/science-environment-11718029

CBC (Canada)

http://www.cbc.ca/technology/story/2010/11/10/big-testicles-bushcricket.html

FOX NEWS

http://www.foxnews.com/scitech/2010/11/10/animal-biggest-testicles/

MS NBC

http://www.msnbc.msn.com/id/40109803/ns/technology_and_science-science/

YAHOO NEWS

http://uk.news.yahoo.com/18/20101110/tsc-gonad-greatness-bushcricket-has-reco-718400e.html

CBS NEWS

http://www.cbsnews.com/8300-501465_162-501465.html?keyword=tuberous+bushcricket

YouTube

http://www.youtube.com/watch?v=Ty5urm3O9qk