Institution: The Open University

Unit of Assessment: B7 Earth Systems and Environment Sciences

Title of case study: Public debate, engagement and participation associated with the BBC documentary series, Frozen Planet

1. Summary of the impact

The Open University (OU) co-produced the highest rating television natural history science programme in the UK since 2001. Input from Dr Mark Brandon's research over the last 15 years shaped the subjects to be filmed, the science portrayed, and the narrative used in the series. The impact had reach and significance: 263,000 A0 polar maps containing research-level science were requested by the UK public, and the series provided a focal point that changed the public debate on polar climate change. This debate influenced the passage of the UK Antarctic Bill through the Houses of Parliament.

2. Underpinning research

Open University researcher Dr Mark Brandon (with 21 years' polar research experience) led the project. His cross-disciplinary publication record and previous career at the British Antarctic Survey put him in a perfect position to advise the BBC on the Frozen Planet series. A key theme of the series was the apparent contradiction between the complete isolation yet strong climate connections of the high latitudes and the temperate regions. In the Antarctic both are provided by the ocean. Brandon's oceanographic research on the Antarctic Circumpolar Current led to a landmark paper (Cunningham et al., 2003) that was a key theme of Frozen Planet Episode 1 ('To the Ends of the Earth').

Brandon's work with OU research student D.P. Walker close to the Antarctic continent has shown how the global ocean is responsible for a significant proportion of the current observed ocean-driven decay of the West Antarctic Ice Sheet. The paper by Walker et al. (2007) measured the heat flowing towards the continent, and demonstrated how inefficient the process of the ocean melting the ice actually is. Walker et al. (2013) describes the features of the regional oceanography that allow warm water to reach the ice. This underpinning science became key themes of two Frozen Planet episodes, 6 and 7 ('The Last frontier' and 'On Thin Ice'). These insights also led Brandon to become the Co-Chair of the UK Experts group on Ice Sheet Stability and write the 'Announcement of Opportunity' for the NERC Ice Sheet Stability programme.

Brandon's published work on polar ecosystems became the key elements of the Frozen Planet 'story'. For example, in Atkinson et al. (2001) he showed how the ocean controlled the ecosystem around an important island noted as a 'biological hotspot'. He also led the oceanographic work on a four-nation international experiment called the 'Bo Survey' to determine the amount of krill in the Atlantic Sector of the Antarctic waters. This research provided key management data which fulfilled the UK statutory requirement under the auspices of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Brandon wrote and contributed to many research articles based around these experiments, and Hewitt et al. (2004), in which he provided the oceanographic analysis, summarises the key research points. This research was used implicitly throughout the seven hours of the series and was an underlying theme of Frozen Planet Episodes 2, 3 and 4 ('Spring', 'Summer' and 'Autumn').

Finally, Brandon had the insight to develop a proposal to take the NERC autonomous underwater vehicle Autosub to sample the physical and biological environment beneath the sea ice of Antarctica. This work provided the first knowledge about the larger environment beneath the sea ice and his published work (Brierley et al., 2002) led to the development of a key storyline in Frozen Planet Episode 5, 'Winter'.

3. References to the research

In order of the discussion above. All the research articles were written while Brandon has been a member of staff at The Open University:

Atkinson, A., Whitehouse, M.J., Priddle, J., Cripps, G.C., Ward, P. and Brandon, M.A. (2001) South Georgia, Antarctica: a productive, cold water, pelagic ecosystem', *Marine Ecology Progress Series*, vol. 216, pp. 279–308.

Brierley, A.S., Fernandes, P.G., Brandon, M.A., Armstrong, F., Millard, N.W., McPhail, S.D., Stevenson, P., Pebody, M., Perrett, J., Squires, M., Bone, D.G. and Griffiths, G. (2002) 'Antarctic krill under sea ice: elevated abundance in a narrow band just south of ice edge', *Science*, vol. 295, no. 5561, pp. 1890–2.

Cunningham, S.A.; Alderson, S.G.; King, B.A. and Brandon, M.A. (2003) 'Transport and variability of the Antarctic Circumpolar Current in Drake Passage', *Journal of Geophysical Research: Oceans*, vol. 108(C5), pp. 1–17. DOI: 10.1029/2001JC001147.

Hewitt, R.P., Watkins, J., Naganobu, M., Sushin, V., Brierley, A.S., Demer, D., Kasatkina, S., Takao, Y., Goss, C., Malyshko, A., Brandon, M., Kawaguchi, S., Siegel, V., Trathan, P., Emery, J., Everson, I. and Miller, D. (2004) 'Biomass of Antarctic krill in the Scotia Sea in January/February 2000 and its use in revising an estimate of precautionary yield', *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 51, nos. 12–13, pp. 1215–36.

Walker, D.P., Brandon, M.A., Jenkins, A., Allen, J.T., Dowdeswell, J.A. and Evans, J. (2007) 'Oceanic heat transport onto the Amundsen Sea shelf through a submarine glacial trough', *Geophysical Research Letters*, vol. 34 (L02602), pp. 1–4.

Walker, D.P., Jenkins, A., Assmann, K.M., Shoosmith, D.R. and Brandon, M.A. (2013) 'Oceanographic observations at the shelf break of the Amundsen Sea, Antarctica', *Journal of Geophysical Research: Oceans,* vol. 118, no. 6), pp. 2906–18.

Grants supporting the research:
1999-2001 £123,883 awarded by NERC (under the thematic programme Autosub Science Missions) to Dr Mark Brandon for project entitled 'Under Sea Ice and Pelagic Surveys (USIPS): Fisheries and Plankton Acoustics, and Oceanographic Investigations of Otherwise Impenetrable Environments'.

2003-2007 £119,685 awarded by NERC to Dr Mark Brandon for project entitled 'Evolution and impacts of circumpolar deep water on the Antarctic continental shelf.'

4. Details of the impact

The Open University co-produced Frozen Planet – a seven-hour BBC One television series that was the highest rating natural history series in the UK since 2001. It was scientifically coherent and was the first prime-time BBC natural history programme to devote an entire hour to how the poles are changing through climate change. It carried a high profile environmental science message, and the public, society at large, the media and the UK government benefited from the impact through timely accurate presentation of polar science.

As a co-producer, The Open University was intimately involved in the production of Frozen Planet and our input throughout the REF period shaped the science portrayed, subjects to be filmed, and the scripts. Brandon's research expertise became a key underpinning element and it raised areas of polar-related science previously unknown in the public sphere. These included physical science based on his own research and leadership, and animal behaviour through his cross-disciplinary collaborative publications.

The first five episodes were devoted to the environment and animals, building on Brandon's basic research and expertise. The sixth episode portrayed the place of people in the polar regions and showed the place of scientists at both poles. Episode 7 was crucial and was called 'Thin Ice'.

'Thin Ice' was devoted to the science of how the poles are changing. It was a tour of the best evidence we have for why and how the polar regions are changing, and the potential impact on the rest of the planet. Clearly, the science behind the episode and the narration by Sir David Attenborough were to be profoundly important. Relating to our published research, the science issues portrayed included, for example, krill stocks in the southern ocean, the fate of the Antarctic ice sheet and the state of the Arctic sea ice cover. Where the science did not directly link to our research publications, such on the melting of the Greenland ice sheet, we determined the importance and the narration.

In The Open University we used our experience of communicating climate science to the public and were prepared for the inevitable debate. This in fact started more than six months before the first broadcast, when the House of Lords Communications Committee questioned Sir David Attenborough. Baroness Fookes directly asked:

"Sir David, we have heard a report, which may or may not be true, that at the end of your latest series 'Frozen Planet' there is a big statement by you on environmental issues, which could be regarded as controversial... Can we ask if it's true or not?"

Sir David responded that he was the narrator of the series and he was sure it was solid science. Just before 'Thin Ice' was broadcast it was attacked in print by Lord Lawson and others in the Daily Telegraph and other publications for being a biased exaggeration. Brandon led media discussion pointing to both his and the communities' research which supported the science portrayed.

Part of our relationship with the BBC is educational and at the end of several Frozen Planet episodes David Attenborough advertised a free double-sided A0 map of the polar regions with the Arctic on one side and the Antarctic on the other. Brandon prepared this in collaboration with the British Antarctic Survey, and around the map edges were several thousand words of research-level information and scientific images of the poles. The Open University sent out 263,000 of these maps on request to the general public, raising the profile of polar research.

The series was watched by an average of 10.8 million people per episode with a further 12 million views on the BBC iPlayer. In the United States the average per episode was over 20 million. This made it the highest rating natural history series in the UK since 2001 and the largest environmental science message in the UK of 2011. The impact extended into government policy and influenced the passage of the Antarctic Bill into UK law in 2012–13.

Subsequently, over 2500 people paid to take an Open University short course called Frozen Planet, consisting of a 260-page book and various online film and activities based on the filmed material and the science behind it. Brandon also prepared a wide variety of extremely popular open educational resources with tens of thousands of downloads. His work on and around the series led to him being awarded the Times Higher Education 'Most Innovative Teacher of the Year, 2012'.

5. Sources to corroborate the impact

External sources corroborating impact:

1. British Antarctic Survey Impact Case Studies: available at http://www.nerc.ac.uk/about/perform/documents/casestudies-bas.pdf
2. http://www.huffingtonpost.co.uk/rod-downie/frozen-planet-final-episode-climate-change_b_1131680.html
3. Parlimentary journal Hansard report on the Antartic bill mentioning the impact of Frozen http://www.publications.parliament.uk/pa/cm201213/cmpublic/antarctic/121121/pm/121121s01.htm#12112159000057

4. Baroness Fookes questioning the science of Frozen Planet. HoL Communications Committee: inquiry into the governance and regulation of the BBC 17th May 2011. http://www.parliamentlive.tv/Main/Player.aspx?meetingId=8404&st=16:40:10
5. Caroline Tomson CEO of the BBC commenting on the strategic importance of the Frozen Planet series http://www.bbc.co.uk/mediacentre/speeches/2011/thomson-voice-of-the-listener-and-viewer.html

Beneficiaries who could be contacted to corroborate impact:

6. Deputy Head, Polar Regions Department, Foreign and Commonwealth Office (testimonial available on request).

7. BAS management board member and head of Operations & Engineering, British Antarctic Survey (testimonial available on request).

8. Head of UK EU Marine Policy Programme and Polar Programme Manager, WWF-UK (testimonial available on request).

9. Head of Communications, British Antarctic Survey.

10. Operations Manager, British Antarctic Survey (testimonial available on request).