

Institution: University of Kent		
Unit of Assessment: 14: Geography and Environmental Studies		
Title of case study: Advancing New Assessment and Mitigation Approaches to Resolve Conflict between Protected Species and Infrastructure Development in the UK		
Period when the underpinning research was undertaken: 2008-2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Prof. Richard Griffiths Dr Joseph Tzanopoulos Dr Dimitrios Bormpoudakis Prof. Jim Groombridge Dr Andrew Buxton	Role(s) (e.g. job title): Professor Reader Research Associate Professor Research Associate	Period(s) employed by HEI: 1995-present 2011-present 2016-2019 2003-present 2019-present
Period when the claimed impact occurred: 2014-2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact (indicative maximum 100 words)		
<p>After demonstrating that traditional approaches to reduce development impacts on newts often fail, Professor Griffiths' team developed a new approach combining eDNA surveys for newts with 'risk map' modelling. The approach has been adopted by Defra/Natural England, leading to a new landscape-level approach for mitigation that combines eDNA data and modelling – District Level Licensing. Additionally, both the eDNA and modelling protocols have been rapidly adopted by businesses, planning authorities, and commercial laboratories. This has resulted in conservation benefits for newts, while cutting the delays and costs that hindered traditional approaches. By March 2020, this scheme had been implemented in 69 planning authorities across England, with 386 ponds created or restored for newts.</p>		
2. Underpinning research (indicative maximum 500 words)		
<p>In a speech on 30 June 2020, the Prime Minister declared that 'Newt counting delays are a massive drag on the prosperity of this country'. The great crested newt has been declining across its European range and receives full legal protection in the UK. However, the widespread distribution of the species means that it frequently comes into conflict with infrastructure development. Traditional approaches to mitigate the impacts of such development are both expensive and often ineffective. Griffiths and his team at the Durrell Institute of Conservation and Ecology (DICE) at Kent have created and validated new approaches to mitigating the impacts of commercial and residential development in the UK. These new approaches have significant implications for wider scientific and policy efforts, specifically with respect to protected species and habitats, and are capturing the interest of other countries experiencing similar issues [R1]. The underpinning research, which has been published from 2014 onwards, was undertaken in three stages:</p>		
1. Demonstrating the shortcomings of traditional mitigation measures		
<p>Although mitigation of development impacts on protected species and habitats is often required by law, the outcomes of mitigation actions are rarely rigorously assessed. Combining field surveys with systematic evidence review and analysis of unpublished post-development reports, work by Griffiths' team found no conclusive evidence that mitigation for great crested newts is effective. Where data were available, there was little evidence that the mitigation actions benefited the populations, with overall declines occurring at about 60% of sites (2014-17). This was followed by further research in partnership with Amphibian and Reptile Conservation, commissioned by Defra and Natural England, analysing the impact of traditional actions to mitigate development impacts on great crested newts [R2].</p>		

2. A new eDNA method for assessing great crested newt populations

Recent advances in DNA technology have enabled the detection of species through the DNA that has been shed into the environment, known as environmental or eDNA. In collaboration with partner organisations (Freshwater Habitats Trust, Amphibian and Reptile Conservation Trust, SPYGEN, Natural England, and Defra), Griffiths' team have taken the lead in developing and validating the technique to assess the distribution of great crested newts (2014-15). In 2014, the team published a technical report describing the method for government agencies to use as a protocol [R3]. A subsequent paper for a more general scientific audience was published in 2015 [R4] which has received over 260 citations in the last four years. Further refinement of the techniques has been conducted at Kent [R5] and has led to several training workshops for Natural England staff and other research users (2017-20).

3. New models for predicting the distribution of great crested newts

After showing that traditional development mitigation practice was often ineffective, Griffiths' team utilised data gathered using the new eDNA survey protocols to develop models that produced 'risk maps' for land-use planners to predict the occurrence and distribution of great crested newts (2016). The risk maps were used to identify important areas for great crested newts, and highlighted how the design and implementation of mitigation measures could be improved [R6]. Following training at DICE, this approach was subsequently adopted by Natural England and Defra.

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

Kent was the UK academic lead institution for this research with other authors being collaborators from Freshwater Habitats Trust, Amphibian and Reptile Conservation Trust, SPYGEN, Natural England, and Defra.

1. Demonstrating the shortcomings of traditional mitigation measures

[R1] Germano, J., Field, K., **Griffiths, R. A.**, Clulow, S., Foster, J., Harding, G., and Swaisgood, R. (2015). 'Mitigation-driven translocations: are we moving wildlife in the right direction?' *Frontiers in Ecology and the Environment* 13: 100-105.

[R2] Lewis, B., **Griffiths, R. A.**, Wilkinson, J. W., and Arnell, A. (2014). 'Examining the fate of local great crested newt populations following licensed developments'. Department for Environment, Food and Rural Affairs, Report WM031.

2. New eDNA method for assessing great crested newt populations

[R3] Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., **Griffiths, R. A.**, Foster, J., Wilkinson, J., Arnell, A., Williams, P., and Dunn, F. (2014). 'Analytical and methodological development for improved surveillance of the great crested newt'. Defra Project WC1067.

[R4] Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., Dejean, T., **Griffiths, R. A.**, Foster, J., Wilkinson, J. W., Arnell, A., Brotherton, P., Williams, P., and Dunn, F. (2015). 'Using eDNA to develop a national citizen science-based monitoring programme for the great crested newt (*Triturus cristatus*)'. *Biological Conservation* 183: 19-28.

[R5] Buxton, A. S., **Groombridge, J. J.**, Zakaria, N. B, and **Griffiths, R. A.** (2017). 'Seasonal variation in environmental DNA in relation to population size and environmental factors'. *Scientific Reports* 7: 46294.

3. New models for predicting the distribution of great crested newts

[R6] **Bormpoudakis, D.**, Foster, J., Gent, T., **Griffiths, R. A.**, Russell, L., Starnes, T., **Tzanopoulos, J.**, and Wilkinson, J. (2016). 'Developing models to estimate the occurrence in the English countryside of great crested newts, a protected species under the Habitats Directive'. Defra Project WC1108.

Grants

[G1] Defra/NRW (2014). 'Development of Models to Predict the Distribution of Great Crested Newts'. Value: £146k.

[G2] Amphibian and Reptile Conservation Trust (2017, 2018). 'Greater Crested Newt Pilot Project Modelling for the Midlands', value: £24k; 'Great Crested Newts Modelling for the South Midlands', value: £25k.

[G3] NERC (2020-22). 'Integrating New Statistical Frameworks into eDNA Survey and Analysis at the Landscape Scale, Following Up on Earlier Developments'. PI: Matechou (Kent); co-I: Griffiths co-I. Value: £303k.

[G4] NatureSpace Partnership (2020). 'Modelling Great Crested Newt Distribution to Support an Organisational Licence for Network Rail (St Pancras – Kettering Section)'. Value: £9,600.

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

The new methodologies devised by Griffiths and the team at DICE have revolutionised the way in which great crested newt sites are assessed, and shifted mitigation measures away from inefficient site-based protocols to a landscape-level approach. Their work has led directly to changes in government policy at national level (Defra, Natural England), and acted as a catalyst for innovation and new business creation. The replacement of the previous piecemeal, fragmented approach to mitigation with strategic, district-level schemes has benefited local authorities and developers throughout England. The impact on diversity has been significant, with high-quality, better-protected habitats for great crested newts than under the previous system, and improvements to the methods of surveillance of protected species by conservation bodies. The research on great crested newts also has wider implications, not only for other protected species, but also for other countries balancing conservation with infrastructure development **[R1]**. Moreover, the DICE team are informing the rollout and future adoption of these new approaches through training and knowledge-sharing, and via appointments to the committee advising Natural England on licensing and implementation.

Adoption of eDNA methodology by statutory agencies and across national programmes

Whereas developers were traditionally required to undertake surveys using onerous and seasonally restrictive protocols to ascertain the presence of great crested newts, the eDNA methodology developed by Griffiths et al. **[R3, R4]** is a rapid occupancy assessment tool that requires a single visit to a site. Since 2014, the technique outlined in the report **[R3]** has been adopted by Natural England as a licensable protocol in England and Wales, and has fundamentally changed the way in which newt surveys are carried out **[a, b]**. The technology has led to at least nine commercial laboratories setting up to provide a great crested newt eDNA analysis service **[c]**. Nature Metrics – a technology start-up using cutting-edge genetic techniques to monitor biodiversity – is one such laboratory that has been working with the partnership since 2018 to develop new biodiversity footprint and impact assessment tools based primarily on freshwater communities. As the Co-founder and Technical Director of Nature Metrics highlights: 'The DICE team at the University of Kent, led by Prof. Griffiths, have been pivotal in developing and applying survey protocols that combine emerging DNA technologies with spatial and statistical modelling. In turn, since 2018 this has driven new approaches to assessing development impacts' **[c]**. NatureSpace, a partner of Nature Metrics, has been 'utilising these new protocols within their new district level licensing scheme that has been expanding over England these last three years' **[c]**.

In addition to revolutionising approaches to identifying great crested newts at individual sites, the further refinement of the eDNA method by Griffiths' team – which involves combining large-scale eDNA surveys with species distribution modelling – has enabled distribution assessments on a scale that would have been prohibitive using previous protocols (2016-20; **[R6]**). This methodology has been adopted for national species surveillance programmes by the Freshwater Habitats Trust, whose PondNET scheme is the largest-ever eDNA-based citizen science survey of freshwater habitats. The Director of the Trust explains: 'It has been quite extraordinary how quickly the eDNA method has been developed and applied for broader freshwater sampling [...]. The data emerging from PondNet indicate freshwater biodiversity at a scale and cost that could not have been considered possible just a few years ago. We are therefore continuing to work closely with the University of Kent team so that we can continue to capitalize on new developments in this area as they emerge' **[d]**. The Trust are also applying the eDNA method to other aquatic animals – for example, to identify sites with alien American Bullfrogs.

Implementing District Level Licensing in local authorities and major infrastructure projects

The work by Griffiths et al. is used as the basis of District Level Licensing schemes, which use 'risk maps' for great crested newts based on the team's methodology of combining large-scale eDNA surveys with species distribution modelling. Following their development of the initial risk maps, the DICE team trained Natural England and NatureSpace staff to apply the protocol within their own schemes. Instead of commissioning inefficient surveys and paying for mitigation methods that often fail, developers pay into a district-level compensation scheme that funds large-scale habitat creation in advance of any development. This approach was adopted as Government policy in England in **2016**, with detailed guidance for developers now provided by Natural England/Defra [e]. It is already being implemented across 80 planning authorities in England [g].

In **2018**, the NatureSpace Partnership started implementing the District Level Licensing scheme in the South Midlands under licence from Natural England [f, h]. Since then, the Partnership has been granted further licences to deliver the scheme across 21 Local Planning Authorities spanning the breadth of England, and is awaiting licensing for a further 40 LPAs [f]. The work of the Partnership is highlighted as a case study in the UK Government's 25-Year Environment Plan (p. 142). The Chief Executive of NatureSpace explained: 'The District Licensing scheme for great crested newts emerged from the long-term frustration of all parties (including Government) at the cost and ineffectiveness of traditional methods to mitigate the impact of development on newts. Professor Griffiths and his team were instrumental in gathering and publishing the scientific evidence that has driven the need for change' [f]. He adds: 'The University of Kent team were involved with the development and testing of the original eDNA survey protocol and spatial modelling on which the risk maps are based. They have been instrumental in ensuring that the scheme is strongly evidence-based and continue to work with us to undertake valuable applied R&D to improve the protocols further. With continued University of Kent assistance, we have recently developed further risk maps for the UK's major rail infrastructure provider, who are now adopting this novel approach to mitigating engineering impacts within their own planning' [f].

DLL is reducing risk, uncertainty, delays, and costs within the construction and planning sectors, and developers has responded positively to the new approach [f, j]. For example, Duncan Chadwick, Partner, David Lock Associates, said: 'Using the NatureSpace district licensing scheme helped speed up the planning process for us. If we'd have gone down the traditional route, we would have had to wait at least another two months before we could even survey the site for great crested newts. This way, we could get the ball rolling much quicker, and we found the process to provide a lot more certainty for us and for our client' [j].

Impact on conservation of District Level Licensing

As part of the NatureSpace initiative the Newt Conservation Partnership was formed as a not-for-profit community-interest organisation to carry out habitat creation and monitoring. It was initially formed as the South Midlands Newt Conservation Partnership, but 'South Midlands' was dropped as it rapidly expanded nationally. Griffiths is a Director and Buxton a project officer of the Newt Conservation Partnership. Its purpose is to create and manage high-quality habitat for great crested newts and other species, using funds from developers. Locations of compensation sites are also informed by the risk maps, and require a clean water source, a high chance of population viability, and a location within range of an existing newt population to maximise the chance of natural colonisation. This will result in better conservation outcomes, as newt populations can remain healthy and expand across the countryside, rather than trying to retain populations with poor long-term viability in urbanised, heavily managed environments. As the Chief Executive of NatureSpace states: 'the work of the DICE team is clearly contributing to better conservation outcomes for this species' [f].

To date, District Level Licensing has resulted in the creation or restoration of 386 such ponds to compensate for potential development impacts [k]. This has benefited nature conservation and provided net gain for the species within the landscape.

Impact on future policy development

The DICE team are helping to shape long-term policy development through the appointment of Griffiths and Buxton to Natural England's Great Crested Newt Expert Licensing Panel in **2018**.

This is an advisory committee to help implement new great crested newt licensing policies and thereby contribute to delivering the Government's 25-Year Environment Plan (2017) and Natural England's Conservation Strategy 'Conservation 21' (2016) [a]. These appointments are influencing both the technical and the strategic direction of District Level Licensing.

The Director of Specialist Services and Programmes at Natural England stated: 'Both Professor Griffiths and Dr Buxton from DICE have been appointed to this panel on the strength of their research in this area. The panel has been instrumental in helping to develop GCN [great crested newt] conservation partnerships, and informing, refining and reviewing monitoring strategies to ensure that our new licensing policies deliver better conservation outcomes for GCN at a landscape scale. This represents a significant step-change in the way Natural England now mitigates the impact of development activities on biodiversity' [e].

Training in e-DNA methods and data analysis

To consolidate the impact, the research team has engaged strongly with professionals, volunteers, and statutory agencies. As the research was emerging, Griffiths was asked by Natural England to serve as an expert on a 'Science and the Law' panel in 2016. Workshops relating to the use of environmental DNA for professional surveys were subsequently run at the Herpetofauna Workers' Meeting – a national conference for professionals and volunteers – in 2017, 2019, and 2020 to present the research; analyse the perceived advantages and disadvantages of the eDNA method; and answer questions from research users. An additional workshop was run in February 2017 for Natural England licensing advisers on the interpretation of environmental DNA results, so they are now providing informed advice to licence applicants [i]. This has resulted in over 300 practitioners who are now better-equipped to deliver and interpret the results of eDNA-based surveys.

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

[a] Letter from the Director of Specialist Services and Programmes, Natural England, detailing the impact of DICE in informing policy development and conservation outcomes.

[b] Evidence of adoption of eDNA methods and findings from the report [R3] (listed as Defra investigation in sources) by statutory agencies and commercial laboratories.

[c] Letter from Nature Metrics and links to company websites, evidencing commercial impact.

[d] Letter from the Director, Freshwater Habitats Trust, describing the impact of the DICE team in developing new conservation practices and the resulting conservation benefits.

[e] Evidence of adoption by Natural England of the new approach for mitigating the impact of development.

<https://www.gov.uk/government/publications/great-crested-newts-district-level-licensing-schemes>.

[f] Letter from the Chief Executive Officer, NatureSpace Partnership, highlighting Kent's involvement in the Digital Level Licensing scheme.

[g] Letter from the Chief Executive Officer, Amphibian and Reptile Conservation Trust, detailing the role of DICE in informing survey design, modelling, and conservation assessment practice.

[h] Letter from Warwickshire County Council, describing the rollout of District Level Licensing, highlighting that DICE work facilitated the exchange of important science to local authorities.

[i] Evidence of Training in eDNA methods and analysis (workshop programmes available).

[j] Nature Space LPA Bulletin (August 2020) and Aylesbury Vale District Council video, both detailing the benefits of the Digital Level Licensing scheme.

<https://www.youtube.com/watch?v=rG8II00gdSQ>

[k] Natural England blog, detailing the number of ponds that had been created or restored by December 2020. <https://naturalengland.blog.gov.uk/2020/12/11/district-level-licensing-for-great-crested-newts-by-numbers/>