Spatial Action Plan for Great Crested Newts in Anglesey

A Manual for Achieving Favourable Conservation Status

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Amphibian & Reptile Conservation

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Mae'r adroddiad hwn yn gwneud defnydd o adroddiadau ymchwil blaenorol a gomisiynwyd gan Cyfoeth Naturiol Cymru (CNC) a'i ragflaenwyr yn ymwneud â phennu statws cadwraethol madfallod dŵr cribog Triturus cristatus yng ngogledd Cymru. Mae Llywodraeth Cymru yn rhwym i gynnal neu adfer statws cadwraethol ffafriol madfallod dŵr cribog yng Nghymru, a nod yr adroddiad hwn yw rhoi canllawiau ymarferol ynghylch sut y gellir cyflawni hyn ym Sir Ynys Môn. Mae'n un o blith cyfres o dri adroddiad o'r fath, gyda'r ddau arall yn ymdrin â Sir y Fflint ac Mwrdeistref Sirol Wrecsam.

Oherwydd ei statws cyfreithiol, mae'r fadfall ddŵr gribog yn ganolbwynt i ymdrechion cadwraethol sylweddol gan amrywiaeth o wahanol gyrff. Nod y ddogfen hon yw cynnig strategaeth gyffredinol er mwyn rhoi arweiniad i ddatblygwyr, Sefydliadau Anllywodraethol cadwraethol a llywodraethau lleol a chenedlaethol yn eu hymdrechion er mwyn sicrhau'r budd cadwraethol mwyaf i fadfallod dŵr cribog. I'r perwyl hwn, ategir yr adroddiad gan nifer o haenau SGDd (GIS) a fydd o ddefnydd ymarferol neilltuol i'r rheini sy'n gysylltiedig â gwarchod y fadfall ddŵr gribog ar draws Ynys Môn.

Mae'r adroddiad yn cyflwyno dull sgorio lle y gellir pennu Statws Cadwraethol Presennol (SCP) madfallod dŵr cribog ar amryfal raddfeydd daearyddol, o un pwll dŵr i sir gyfan. Yna, mae'n defnyddio model rhagfynegi sy'n seiliedig ar ddata daearyddol, dosbarthiadol, hinsoddol a hanesyddol i lunio mapiau addasrwydd cynefinoedd ar gyfer y sir. Caiff y rhain eu defnyddio i ddiffinio SCP madfallod dŵr cribog ar draws Ynys Môn a nodi nifer o ddewisiadau ar gyfer diffinio Statws Cadwraethol Ffafriol (SCF) o fewn y sir. Yna, caiff yr wybodaeth hon ei defnyddio i bennu ardaloedd sy'n arbennig o bwysig i fadfallod dŵr cribog, i gael targedau arolygu a thargedau creu pyllau fel y gellir sicrhau SCF o fewn y sir.

Gellir rhoi'r technegau hyn ar waith mewn gwahanol senarios yn ymwneud â defnydd tir a chynllunio, ac mae'r adroddiad yn cynnig canllawiau ymarferol ynghylch pennu ardaloedd sydd o werth arbennig o uchel neu isel i fadfallod dŵr cribog, gan asesu effeithiau datblygiadau arfaethedig, cynllunio dulliau lliniaru effeithiol a goblygiadau cynlluniau amaeth-amgylcheddol ar gyfer madfallod dŵr cribog.

Caiff pob sefydliad neu unigolyn sy'n gysylltiedig â rheoli madfallod dŵr cribog yn Ynys Môn, boed hynny o safbwynt cadwraeth neu ddatblygu, eu hannog i ddarllen yr adroddiad hwn er mwyn sicrhau y gellir rhoi dull unedig ar waith i gyflawni SCF ar draws y sir.

Yn ystod y broses fodelu, gwelwyd bod cyfanswm o 2,146 o byllau i'w cael yn Sir Ynys Môn. Gyda golwg ar wneud yn iawn am golledion hanesyddol (collwyd 37% o byllau ers data mapio 1843), ystyriwyd SCF yng ngoleuni'r nifer o byllau â madfallod ynddynt a fyddai wedi bodoli pan fapiwyd y data'n wreiddiol mewn perthynas â nifer y pyllau presennol â madfallod ynddynt ac Addasrwydd Cynefin pyllau ar gyfer y rhywogaeth (sgoriau HSI). Yn hanesyddol, amcangyfrifwn y byddai 2,983 o byllau wedi bod yn Ynys Môn, gyda 464 o byllau â madfallod dŵr cribog ynddynt a 716 o byllau gyda sgôr HSI >0.7. Cynigiwn y dylid defnyddio'r 464 pwll â madfallod dŵr cribog ynddynt i ddarparu lefel darged ar gyfer y rhywogaeth (Gwerth Cyfeirio Ffafriol, GCF, ar gyfer helaethrwydd Tiriogaeth a Chynefin). Caiff hyn ei gymhwyso ymhellach trwy ei gwneud yn ofynnol i'r pyllau gael HSI >0.7 er mwyn sicrhau ansawdd y cynefin, bod â phoblogaeth ganolig ei maint o leiaf, bod ar ddwysedd o 4 fesul km^2 o leiaf (er mwyn sicrhau hyfywedd y boblogaeth) a bod â lefel fygythiad isel (neu lai) (er mwyn ymdrin â rhagolygon y rhywogaeth yn y dyfodol). Amcangyfrifir bod gan Statws Presennol y rhywogaeth ar Ynys Môn 334 o byllau â madfallod dŵr cribog ynddynt.

Gan ddefnyddio'r system sgorio arfaethedig, mae SCF yn Ynys Môn angen 464 o byllau â madfallod ynddynt sy'n ffurfio rhan o boblogaethau canolig, mewn ardaloedd â dwysedd uchel o byllau ac sydd â HSI o >0.7: y sgôr isaf ar gyfer cyflawni'r meini prawf hyn fydd 16 ar gyfer pob pwll. Er mwyn cyflawni SCF byddai'n rhaid i'r sgôr fod yn uwch na 464 x 16 = 8,352. Gydag amcangyfrif o 334 o byllau â madfallod dŵr cribog ynddynt, a phe bai'r holl byllau mewn cyflwr ffafriol (h.y. yn sgorio 16), yna fe fyddai'r sgôr SCP = 5344.

Mae'r dull o nodi SCP a SCF gosod allan yn y ddogfen hon yn un o nifer sydd yn y broses o gael eu datblygu ar draws y DU ac Ewrop. Er nad oes dull safonol sengl y gellir eu cymhwyso'n gyson ar draws amrywiaeth o rywogaethau a chynefinoedd ar hyn o bryd, gall un ddod i'r amlwg yn y dyfodol. Gyda'r cynnydd diweddar mewn astudiaethau sy'n edrych ar Rhywogaethau Gwarchodedig Ewropeaidd ac â datblygu technolegau (megis synhwyro o bell a dadansoddiad DNA amgylcheddol) efallai y byddwn yn disgwyl y bydd dulliau newydd o asesu statws y madfall gribog fwyaf yn datblygu yn y dyfodol agos. Byddem yn annog ymdrechion i ddysgu oddi wrth y gwaith hwn i ddatblygu offer ymarferol a mesurau polisi angenrheidiol i helpu cadwraeth ddau ar gyfer hyn a rhywogaethau eraill ymhellach. Fodd bynnag, nid yw hyn yn tynnu oddi wrth y dull a argymhellir yma fel dull pragmataidd i feintioli statws a mesur effeithiau.

2. Executive Summary

This report draws on a series of previous research reports commissioned by Natural Resources Wales (NRW) and its predecessor body on determining the conservation status of great crested newts *Triturus cristatus* in north Wales. The Welsh Government is obligated to maintain or restore the favourable conservation status of great crested newts within Wales and this report aims to provide practical guidance on how this can be achieved within the County of Anglesey. It is one of a series of three such reports, the other two covering the counties of Flintshire and Wrexham.

Due to its legal status, the great crested newt is the focus of considerable conservation effort from a variety of bodies. This document aims to provide an overarching strategy to guide developers, conservation NGO's and local and national government in their efforts in order to achieve the greatest conservation benefit for great crested newts. To this end, the report is accompanied by a number of GIS layers which will be of particular practical use to those engaged in great crested newt conservation across Anglesey.

The report presents a scoring method by which the Current Conservation Status (CCS) of great crested newts can be determined at multiple geographical scales from a single pond to the entire county. It then uses predictive modelling based on geographical, distributional, climatic and historical data to produce habitat suitability maps for the county. These are used to define the CCS of great crested newts across Anglesey and identify a number of options for defining Favourable Conservation Status (FCS) within the county. This information is then used to identify areas which are particularly important for great crested newts, to derive survey targets and pond creation targets to enable FCS to be achieved within the county.

These techniques can be applied in various land use and planning scenarios and the report provides practical guidance on identifying areas of particularly high or low value for great crested newts, assessing the impacts of proposed developments, designing effective mitigation and the implications of agri-environment schemes for great crested newts.

Any organisations or individuals involved in the management of great crested newts in Anglesey, whether that be from a conservation or development-related angle, are encouraged to consult this report to ensure a unified approach to achieving FCS across the county.

During the modelling process, a total of 2,146 extant ponds were identified within the County of Anglesey. With a view to redressing historic loss (37% of ponds having been lost since the 1843 mapping data), FCS was considered in the light of the level of occupancy that would have occurred at the time of the original mapping relative to current levels of occupancy and Habitat Suitability of ponds to the species (HSI scores). Historically we estimate there would have been 2,983 ponds in Anglesey and a corresponding 464 ponds occupied by great crested newts and 716 ponds with an HSI score >0.7. We propose that the 464 occupied ponds should be used to provide a target level for great crested newts (FRV for Range and Habitat sufficiency). This is further qualified by requiring these ponds have an HSI >0.7 to ensure habitat quality, has at least a medium population, are found at a density of at least 4 per km^2 (to ensure population viability) and has a minor (or lower) level of threat (to address the species' future prospects). The Current Status of the species in Anglesey is estimated as having 334 ponds occupied by great crested newts.

Using the propose scoring system, FCS in Anglesey requires 464 occupied ponds which form part of medium populations, in high pond density areas and that have an HSI of >0.7: the minimum score to achieve these criteria will be 16 for each pond. To achieve FCS the score would need to exceed is 464 x 16 = 8,352. With an estimated 334 ponds being occupied and if all of the ponds are in favourable condition (i.e. would score 16), then the Current Conservation Status score = 5344.

The approach to identifying CCS and FCS laid out within this document is one of a number which are in the process of being developed across the UK and Europe. Whilst there is currently no single standard approach which can be applied uniformly across a range of species and habitats, one may emerge in the future. With the recent increase in studies looking at European Protected Species and with developing technologies (such as remote sensing and environmental DNA analysis) we may expect that new approaches to status assessment of great crested newts will develop in the near future. We would encourage efforts to learn from this work to further develop practical tools and necessary policy measures to aid the conservation of both for this and other species. However, this does not detract from the approach being advocated here as a pragmatic means for quantifying status and measuring impacts.

3. INTRODUCTION

3.1. Background

The conservation status of a species is defined as the sum of all the differing influences acting upon it, but can be usefully understood through considering its range, population, the quantity and quality of its habitats and its future long-term prospects. It is affected by a variety of environmental and genetic factors which may be natural or anthropogenic. The ability to define conservation status for a species is a vital tool for the effective conservation of that species as it enables the determination of the current condition of the species as a whole (i.e. whether it is favourable), the assessment of the likely effects of a variety of external influences on the species (such as climate change or development) and the setting of targets for conservation action to achieve a favourable status for the species.

Favourable Conservation Status (FCS) is defined for species in Article 1 of the European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the **"**Habitats Directive"). According to the Directive, the conservation status of a species is "favourable" when the following criteria are met:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- the natural range of the species is not being reduced for the foreseeable future; and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Achieving FCS for habitats and species is the central aim of the Habitats Directive. The great crested newt *Triturus cristatus* is listed within Annexes II and IV of the Directive and therefore this places an obligation on the Governments of EU member states to maintain or restore the species at favourable conservation status. This requires the designation of Special Areas of Conservation (SACs), provision of a strict protection regime, managing habitat linkage, preventing incidental capture and killing and promotion of appropriate research and defines the derogation regimes; the Directive requires that these measures are implemented at a level proportionate to the achievement of FCS. This legislation is implemented in Wales through the Conservation (Natural Habitats, etc) Regulations 2010.

The concept of FCS is defined within the Habitats Directive, however determining values for this for different species and habitats and the setting of appropriate spatial scales for doing this is more problematic. The European Commission has provided guidelines in the context of the six yearly reporting round, indicating how national Favourable References Values (FRVs) should be set for each of the different parameters used to measure conservation status (Evans & Arvela, 2011; update being planned for 2018 reporting round). While the EC advocates that the favourable level should not be below that when the Directive came into force (1994 in the UK) this does not indicate necessarily that the 1994 level should be considered favourable, nor necessarily used as a base date for evaluation. Work is currently being undertaken both within the UK and elsewhere in Europe and through the European Commission to further explore both the definition and valuation of this term and this may influence future versions of this handbook.

Determining the conservation status of a species (both current and favourable) can be difficult, particularly if the species is widespread or distribution and/or population data is sparse, as is the case with great crested newts in north Wales. One approach to filling such gaps in our knowledge of great crested newts in north Wales has been the use of predictive modelling. Over recent years, Amphibian and Reptile Conservation (ARC) and NRW (and its predecessor body CCW) have developed a Geographical Information System (GIS) based model to aid in the conservation of great crested newts in north Wales (ARC, *et al* 2010; Arnell & Wilkinson 2011a, 2011b, 2013). This document uses the GIS model to describe the Current Conservation Status (CCS), determine FCS, and provide an over-arching spatial strategy for achieving FCS for great crested newts within Anglesey.

3.2. Aims of the Spatial Action Plan

Due to their documented decline and their legally protected status, great crested newts are subject to a considerable degree of conservation effort. Their inclusion within the Annexes of the Habitats Directive requires national governments to monitor the species and restore/maintain it at FCS. The Habitats Directive is implemented in UK law via the Conservation (Natural Habitats, etc) Regulations 2010 (Conservation Regulations 2010) and the strict protection measures for great crested newts that are required by the Directive being achieved through listing the species on Schedule 2. A few species protection provisions of the Wildlife & Countryside Act 1981 remain in force though the majority of these have been repealed as they are covered by the Conservation Regulations. These pieces of legislation also provide mechanisms for designating sites (European sites as Special Areas of Conservation, SACs) and national level sites as Sites of Special Scientific Interest, SSSIs). Due to concern over its decline, it was included as a Priority Species within the UK Biodiversity Action Plan (BAP) in 1994, and subsequently numerous Local BAPs, including for Anglesey. It is listed under Section 7 of the Environment (Wales) Act 2016 as a species of principal importance for the conservation of biological diversity in Wales (this status was originally conferred through Section 42 of the Natural Environment and Rural Communities Act 2006). This has led to numerous different organisations being involved in great crested newt conservation including government agencies undertaking surveillance at a national level, identifying and designating nationally important sites for the protection of the species and granting derogation licences; Local Authorities assessing the impacts of development on great crested newts, identifying, designating and managing locally important sites and carrying out conservation measures in line with targets within Local BAPs; developers through the need to mitigate the impacts of their developments, and conservation NGOs involved in the direct conservation of the species. In many cases there is limited interaction between these organisations, resulting in a piecemeal conservation effort at a landscape level.

The primary aim of this plan is to provide an overarching framework for the conservation of great crested newts in the County of Anglesey with the objective of attaining FCS for the species at the County level. Specifically, the plan will

- define Favourable Conservation Status and Favourable Reference Values (FRV) for great crested newts in Anglesey
- estimate Current Conservation Status for great crested newts within Anglesey
- determine pond creation targets to achieve FCS in a spatial context
- provide targets for survey and monitoring
- provide a framework for valuing great crested newt populations at any spatial scale from a single pond to the entire county
- provide an integrated framework assessing potential effects of actual or proposed developments, forestry operations or other land management activities at local

and wider geographic scales, including applications that inform forward planning and development control

- provide a robust basis and context for applying derogation licensing criteria 'tests'
- provide a framework for assessing the effectiveness of conservation effort, including agri-environment scheme and development mitigation
- provide a context for evaluating purpose, sufficiency and ecological functionality of designated sites, including conservation objectives.

3.3. Great Crested Newts in Anglesey

Anglesey lies at the western edge of the great crested newt's range. Northeast Wales, particularly parts of Flintshire and Wrexham, is one of the strongholds of the great crested newt within the UK (Jehle *et al* 2011), however Anglesey has some important populations and is considered important for the species within Wales. Due to the soil type, underlying geology and historical land use, parts of Anglesey have a number of suitable ponds and particularly in the west of the island. Anglesey contains an internationally significant site for the species: Glan-traeth Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI).

The decline of great crested newts within Anglesey has been acknowledged and the species was included within the Anglesey Local Biodiversity Action Plan in 2002.

4. USE OF PREDICTIVE MODELLING

It is practically impossible to achieve complete survey coverage of great crested newts within Anglesey and this presents difficulties when making informed decisions regarding their conservation, such as how FCS can be achieved. One approach to filling the significant gaps in our knowledge of great crested newts within the area is to use a predictive model. Over recent years, Amphibian and Reptile Conservation (ARC), in conjunction with Natural Resources Wales (NRW) and its predecessor body, have developed such a model for great crested newts in north Wales, including Anglesey. Previous versions of the model are documented by Amphibian & Reptile Conservation *et al* (2010) and Arnell & Wilkinson (2011; 2013).

The model underpinning this spatial plan is based on Arnell & Wilkinson (2013). They compiled high resolution, recent (1990-2011) great crested newt records and then used the distribution modelling software, MaxEnt (Elith *et al* 2006), along with environmental layers to produce an estimated probability of presence output for great crested newts in northeast Wales at a 25m resolution across the study area. The model used 19 bioclimatic variables, the effect of land cover was incorporated using the Land Cover Map 2007, pond density was extracted from Ordnance Survey Mastermap and Slope and Aspect layers were derived from elevation data using GIS software. Full methodological details of the model construction are provided within Arnell & Wilkinson (2013). This model has subsequently been modified to include flood risk data as although floodplains often contain many ponds, these are typically unsuitable for great crested newts as they often contain predatory fish. This had caused the earlier versions to overestimate the suitability of floodplains.

The model contains a lot of information and has many potential applications. However, it has been used to create a number of GIS layers which will be of particular practical use to those engaged in great crested newt conservation across Anglesey:

- Habitat Suitability: This maps the suitability of habitat for great crested newts across the county (Map 1)
- Habitat Value: This maps the value of particular areas for great crested newts across Anglesey in a landscape context, based on the core habitat of the species within the county (Map 2)

- Survey Target Areas: This maps priorities for great crested newt surveys, highlighting particular areas where knowledge is lacking (Map 3)
- Pond Creation Target Areas: This maps areas where the creation of new ponds would provide the most conservation benefit (Map 4)

These GIS spatial layers are made available through a file geodatabase supplied as part of the fulfilment of this contract. The data are viewable through the ArcGIS platform ArcMap simply by opening the MXD map document, also supplied.

Within the map document, layers can be turned 'on' and 'off' independently or in groups. Map layers are grouped by Unitary Authority, then by survey target areas and 'points' layers including habitat suitability and core areas. The pond creation target areas are contained within a single map layer.

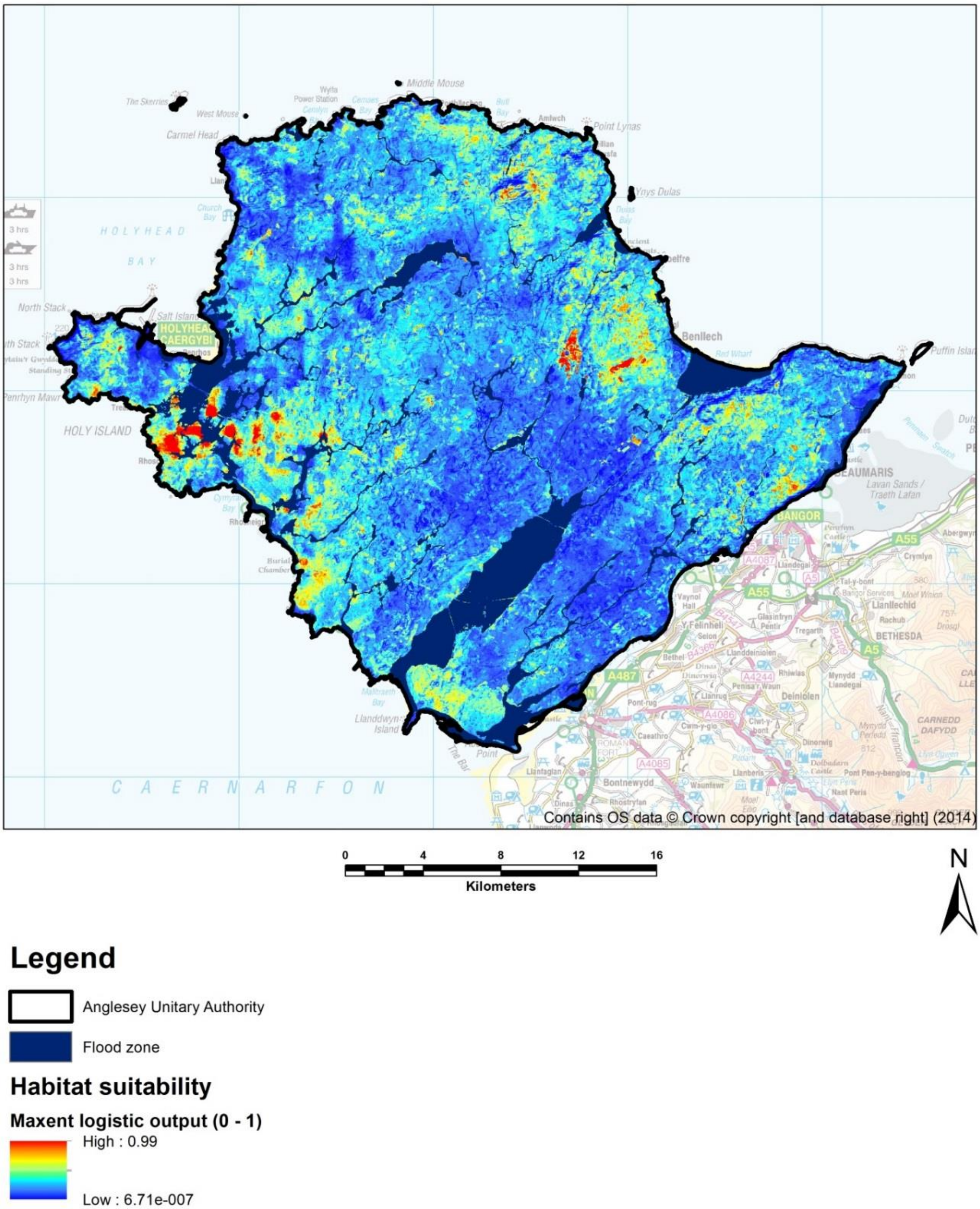
The individual map layers are stored as File Geodatabase Raster Datasets (FGDBR) with a predefined filing taxonomy. The file nomenclature should be intuitive but in addition each raster dataset contains a unique description and thumbnail image embedded in the metadata and viewable in ArcCatalog.

The Unitary Authority boundaries are also contained within the geodatabase as File Geodatabase Feature Classes beginning with the prefix 'UA'. For added interpretation, two 1:250:000 scale Ordnance Survey map tiles are included named simply 'SH' and 'SJ' which cover the study areas. Published maps containing these Ordnance Survey data should include the caption 'Contains OS data © Crown copyright (year). These layers open automatically in the map document and may also be toggled on and off.

Other modelling approaches are available and their application for newt conservation has been explored in England (Bormpoudakis *et al* 2015). This work demonstrates that different approaches can provide information that can be valuable in different ways. This report advocates the use of MaxEnt modelling as this is based on 'presence only' data that are readily available in north Wales. Other approaches using 'presence: absence' data may, over time, offer more robust analyses. Greater availability and precision of environmental data, for example provided through remote sensing, are expected to offer opportunities to further develop predictive modelling in the near future.

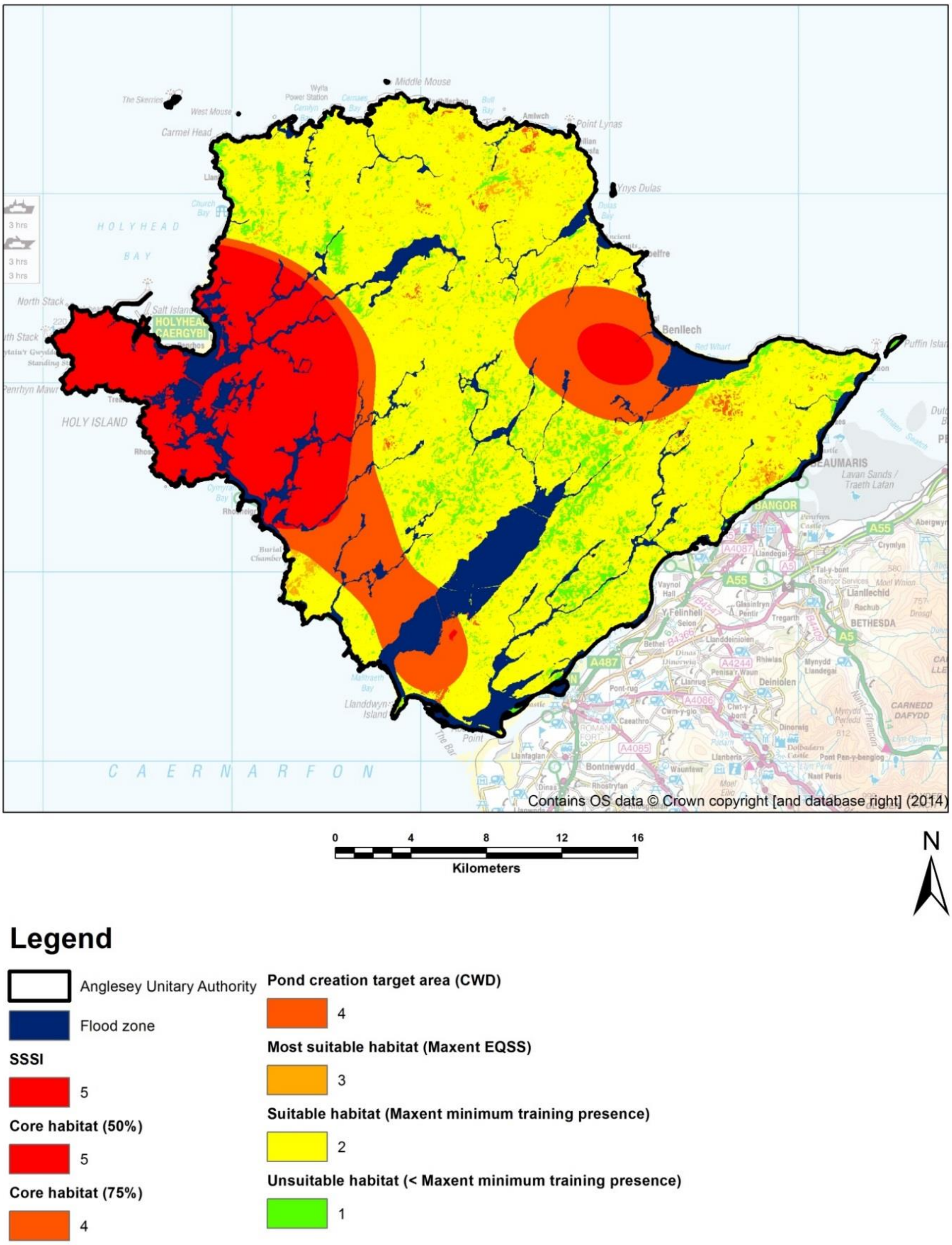
Map 1

Habitat Suitability for Great Crested Newts across Anglesey



Map 2

Habitat Value for Great Crested Newts across Anglesey



5. DEFINING CURRENT AND FAVOURABLE CONSERVATION STATUS

5.1. Introduction

The Current Conservation Status (CCS) of a species is considered to be the sum of all elements of its biological condition and all influences acting upon it, and can be described by the status of its:

- range/area of occupancy within the range (CCS-R)
- viability and abundance of populations (CCS-P)
- amount of habitat (CCS-H)
- future prospects (CCS-F)

The conservation status of a species can be considered favourable when the species is prospering (in both quality and extent/ population) and with good prospects to do so in the future (Evans & Arvela 2011). In the context of the Habitats Directive this is seen as a positive outcome of a condition that is greater than just avoiding extinction. The fact a species is not threatened does not necessarily mean that it has a favourable conservation status. There are no hard and fast rules for determining exactly the level needed to establish a favourable population level, though guiding principles indicate that this needs to be informed by ecological principles and the functioning of healthy ecosystems, consider historical changes (and especially those resulting from anthropogenic factors) and should not be lower than the level when the Habitats Directive came into force (1994 in the UK). Some principles for assessing Favourable Conservation Status for Great Crested Newts have been develop elsewhere (ARC, Cofnod & CCW 2010; Bormpoudakis *et al* 2015) though further work is continuing towards developing guidance around a consensus opinion.

In order to establish whether the status of the species is favourable, it is necessary to establish Favourable Reference Values (FRV) for each of the four components of status (termed FRV-R, FRV-P, FRV-H and FRV-F). This concept can be applied at various spatial scales from that of an individual population through an entire landscape to national and international levels. Conservation status at a landscape level is in effect, the sum of the conservation status of all of the individual populations within it (see Figure 5.1).

Due to their requirement for water to breed in and their fidelity to ponds, great crested newt populations are relatively easy to define. Based on published estimates of terrestrial movements and pond fidelity in adults, and maximum dispersal distances of metamorphs, Grayson (1994) defined great crested newt populations on three levels:

Breeding pond: the number of newts within a single pond

Population: the number of newts within ponds within 250m of each other

Metapopulation: the number of newts within ponds within 500m of each other

Therefore, in cases where a population is spread across multiple ponds, each pond contributes to the overall CCS of the population. Ponds present an ideal base unit for the assessment of CCS and FCS in great crested newts as they are easy to define and measure. They also allow for extrapolations to be made to look at CCS and FCS at a landscape scale. For example, if the proportion of ponds likely to be occupied by great crested newts within a landscape is known, a count of the total number of ponds can be used to derive a likely total number of occupied ponds within that area.

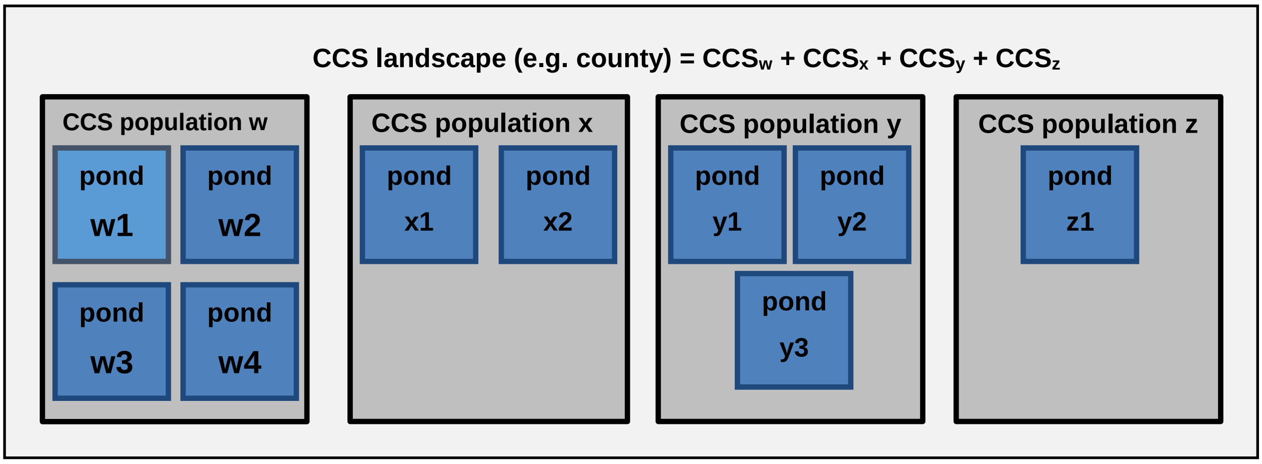


Figure 5.1. Current conservation status (CCS) at a landscape level is the sum of the CCS of the each of its component populations. This approach can be applied at whatever spatial scale is desired.

5.2. CCS at an Individual Population Level

The CCS of an individual population of great crested newts is dependent on the viability of the population; the number of ponds (i.e. subpopulations); the quality of aquatic and terrestrial habitat; and the future prospects of the population. A method of assessing the CCS and deriving FRVs for each of these factors is provided below. These have been used to derive a method for scoring the current conservation status of individual great crested newt populations. There is a precedent for the use of similar scoring systems to determine the value of amphibian populations and assemblages (e.g. Beebee & Grayson 2003; JNCC 2013).

5.2.1. Number/density of ponds

Great crested newt populations spread across several ponds have a much lower extinction risk than those in single ponds. There are two primary reasons for this: 1) subdivided populations are at lower risk from environmental stochasticity (e.g. pond drying or the introduction of fish); and, 2) dispersal between ponds reduces the effects of genetic drift and erosion and allow for the recolonisation of ponds where breeding has failed should conditions become suitable again. Using Population Viability Analysis (PVA), Griffiths & Williams (2000) found that for a <5% extinction risk after 50 years, at least five subpopulations (i.e. ponds) are required (assuming at least some dispersal between ponds). Therefore a "favourable" population would require at least five ponds within 500m of each other. For populations in single ponds, extinction risk was 0.461, whereas for two ponds extinction risk was 0.237 to 0.136 depending on the dispersal rate. This concurs with Oldham *et al.* (2000) who cited an optimal pond density of >4 per km^2.

5.2.2. Habitat quality

The quality of great crested newt ponds can be assessed using a Habitat Suitability Index (HSI, Oldham *et al.* 2000). This uses ten characteristics of a breeding pond to derive a score between 0 and 1 (with 1 being the highest) which corresponds to the quality of a pond for great crested newts. Surveys carried out in Kent were used to derive categories of pond suitability which relate to the likelihood of the pond being occupied (ARG UK, 2010, see Table 5.1). An "average" pond would have an approximately 50% likelihood of being occupied. Using this method of assessment, a pond would be considered "favourable" if it had an HSI score of 0.7 or higher.
The HSI uses the pond as a unit of habitat, however this definition also includes associated terrestrial habitat. Terrestrial habitat is an important component of great crested newt habitat as a whole. Scrub, woodland, rough grassland and gardens are considered suitable habitat types (Langton *et al*, 2001; Oldham *et al,* 2000), whereas improved grassland and arable are considered less suitable (Swan & Oldham,

1993). Oldham (1994) suggested a lower limit of 0.4ha of suitable habitat in order for a pond to support great crested newts, whereas Beebee (1977) found that significant populations were only found in ponds with a minimum of 5ha of scrub associated. The HSI contains a measure of terrestrial habitat which, in the most widely used version (ARG UK 2010), entails categorising terrestrial habitat (all connected habitat within 250m of a pond) as either “none” (no suitable habitat), “poor” (<25% suitable habitat), “moderate” (25%-75%) or “good” (>75%). Total available habitat within 250m is ca.20ha and therefore 25% = 5ha.

Table 5.1 Interpretation of HSI scores (based on data from Kent (ARG UK 2010))

HSI Score	**Suitability**	**Proportion of ponds occupied**
<0.5	Poor	0.03
0.5 – 0.59	Below average	0.20
0.6 – 0.69	Average	0.55
0.7 – 0.79	Good	0.79
>0.8	Excellent	0.93

5.2.3. Population size

Small populations are at greater risk of extinction as their long-term survival is dependent on the ability of relatively few individuals to survive and successfully reproduce; isolation exacerbates this situation by preventing recruitment and the introduction of new genetic material from surrounding populations. This leaves them much more vulnerable to stochastic events, from which larger populations are better able to recover (Lande 1995). It is difficult to establish accurate estimates of minimum viable population sizes; however Population Viability Analysis (PVA) can be used to estimate the extinction risk for populations of various sizes. For great crested newts Halley *et al* (1996) found that populations of great crested newts numbering less than 40 individuals have a low likelihood of persisting more than 20 generations if they were more than 0.5km from a source pond and Griffiths & Williams (2000) found that a population size of at least 100 was required for the extinction risk to be <0.05% in an isolated population.

For great crested newts, standard survey methods only detect a proportion of the population and there is a large variation in the proportion detected. For torching and bottle trapping it is estimated that between 6%-23% and 2%-28% are detected respectively (Cooke 1986; Griffiths & Raper 1994). Given the difficulty of getting accurate population sizes, previous guidance on great crested newt survey has used class sizes which can be used to compare populations. The *Great crested newt mitigation guidelines* (English Nature, 2001) use the following definitions, derived from JNCC (2013) and based on counts summed across all ponds within 250m of each other using standard torch counting or bottle trapping methodology (English Nature, 2001):

- Count <10: Small/low
- Count 10-100: medium/good
- Count >100: large/exceptional

It is worth noting that counts of more than 30 individuals are considered important at a county level and could be designated as County Wildlife Sites.

5.2.4. Prospects

The primary determinant of the future prospects of a great crested newt population is the long-term persistence of its habitat, particularly breeding ponds. Loss of breeding ponds is considered the primary reason for the decline of great crested newts in the UK (Beebee & Griffiths, 2000). Breeding ponds may be lost or rendered unsuitable for great crested newts for a variety of reasons. Most obviously, physical loss may occur due to development, agricultural improvements or landscaping works. Ponds can also be rendered unsuitable for great crested newts and therefore effectively lost due to pollution (e.g. road run-off, agricultural run-off, chemical pollution, pollution caused by excessive numbers of waterfowl) or the introduction of predators (and notably many fish species) or competitors or invasive plant species. In addition, typical great crested newt breeding ponds are a plagioclimax habitat and therefore would naturally be lost to succession without human intervention. Terrestrial habitat is also vital for the long-term persistence of great crested newt populations and can be lost or isolated due to development and land use changes.

5.2.5. Scoring system for CCS

5.2.5.1 Overview: The close association between great crested newts and breeding ponds allows the application of scoring methods that are based around the pond unit, for example the Habitat Suitability Index (Oldham *et al* 2000, ARG UK 2010).

The approach advocated here provides a scoring system that combines the different factors used to describe Conservation Status (namely population, habitat and future prospects). We consider this approach as a valuable step for developing assessments of FCS at different spatial scales, but recommend that this approach is trialled to ascertain its genial application and possible value for other taxa.

The scoring system developed works at two levels. Assessments are made for individual ponds that are then aggregated to provide a value for each population (where this is based on multi-pond systems) and a value can be obtained for these to determine how favourable these are in terms of their long term viability. The approach developed for determining population scores can then be applied to measuring Conservation Status at the Landscape/ County level. The underlying rationale for determining a Favourable Conservation Status relates to maintaining a distribution of viable population units.

The system uses a score between 1 and 5 for each of these factors to give a total maximum score of 20. If a population scores 4 or more for an individual factor, then that factor can be considered to be in favourable condition, for example because there will be a sufficient quantity and quality of habitat to support the population and/ or the population is likely to be large enough to cope with stochastic events. In these cases the measured values can be considered to be 'favourable' for those parameters (i.e. meeting FRV-H or FRV-P). Therefore, excepting unpredictable catastrophic events and considering other known factors that may affect the population, a favourable assessment of the 'prospects' would indicate the population is likely to persist into the future (i.e. meet the favourable level FRV-F). Each pond is scored individually for each of the four parameters. When all the factors are considered together, a pond scoring 16 or more would be considered favourable. Such a scoring system has a particular value for quantifying impacts in the context of development or assessing the value of conservation work, with high scoring ponds contributing more to the viability of populations than those with lower values. Simply adding scores for ponds together in a population can be instructive, and can be useful for providing a numeric measure for evaluating populations and for quantifying impacts, but has proved difficult to use for setting threshold levels – for example for defining population level conservation statuses. This is because a number of low scoring and non-viable ponds might provide a sufficient aggregated score to suggest a good population when this was not in fact the case e.g. while two ponds scoring 16 each would score 32 and represent a good population, the same score could be achieved from four ponds only achieving a score of 8. Conversely, when looking at approaches to generate a single population statistic that 'averages' overall pond status, i.e. where a population comprises more than one pond, the total score of all the ponds within the population are divided by the number of ponds to give a score for the population as a whole, we can generate a valuable measure that indicates the overall condition of the existing ponds and, where scores of less than 15 are obtained, it would show that some ponds could benefit from management. However this approach has the shortcoming that where there are sub-optimal ponds in amongst a number of good ponds they would reduce the population score and may provide a misleadingly low score compared to the actual overall viability and strength of the population.

Therefore we advocate that for multiple pond systems, totals of pond scores should be measured but that assessments of favourable conservation status should be based on an assessment of the scores for individual ponds and their distribution. Any population with single ponds scoring 16 or more, or two ponds scoring 15 are likely to be viable - however considering the geographic spread of any population for it to be considered favourable these high scores should be replicated in each 500m extent of the population. For this assessment a population is considered to occupy an area based on one or more ponds, with any ponds occurring within 250m of their nearest neighbours being considered to be part of the same population. Consequently, where distances exceed 250m or where there is a break in the continuity of suitable habitat that is considered sufficient to impede the movement of newts (e.g. by a break created by a barrier such as river, wide road, large areas of development without 'corridors' of habitat), the ponds are in separate populations. Consequently a population may occupy a small parcel of land or range extensively over a landscape.

5.2.5.2 Population size: Assigning a score for population size presents a difficulty due to the wide variation in the proportion of the population detected by standard survey methods. However, PVA suggests that only relatively low numbers are necessary for a reasonably low extinction risk and the "medium" size class is likely to indicate sufficient numbers are present. For example, using Cooke's (1986) estimate of the proportion of the population seen, a “medium” population where between 10 and 100 newts are counted, represents an actual population size of between 43 and 1,667 individuals and therefore exceeds the minimum population size of 40 estimated by Halley et al (1996), and is likely to exceed the Griffiths & Williams’ (2000) estimate of the 100 individuals required for a <0.05% extinction risk. The rating of a population based on a count should follow the approach set out in section 5.2.3 above.

5.2.5.3 Number/ density of ponds: Breeding ponds are defined as those that can be considered as being at all likely to be used by newts based on direct observation of animals or ‘expert opinion’. Ponds considered unsuitable for newts, including late successional/ permanently dry features should not be counted as breeding ponds, nor should any considered unsuitable due to presence of many fish or extreme pollution. If only ‘non-breeding’ ponds are present then this would score 1.

5.2.5.4 Habitat quality: It is noted that the HSI includes an individual index for the number of ponds and this could lead to double counting of this value within the scoring system. However the purpose of the HSI differs slightly from the purpose of this system in that it seeks to determine the suitability of individual ponds, whereas the purpose here is to determine the conservation status of whole populations.

5.2.5.5 Future prospects: Calculating a score for the future prospects of a population presents some problems as it is difficult to quantitatively assess threats to a pond. Therefore deriving a score for threats to a pond is necessarily a more subjective process. Table 5.2 presents a number of factors (both positive and negative) which should be considered when assessing threats to a pond. Influences to both the pond and surrounding terrestrial habitat should be considered.

	Negative factors	Positive factors
Site protection and surrounding land use	Pond is located within or adjacent to urban areas and may be at risk from development. Pond is located within an area of intensive agriculture and at risk of being infilled. Pond is located within high density grazing land and is at risk from damage by livestock. Pond is located within a flood risk area.	Pond is within a protected site (such as SPA/SAC/SSSI, local wildlife site, National Nature Reserve, local or NGO nature reserve). Pond is located within common land. Pond is located within low intensity or organic agricultural land.
Pollution risk	Pond is located within an area of intensive agriculture and is at risk from eutrophication. Pond receives road run-off. Pond has excessive numbers of wildfowl. Pond appears to be affected by other kinds of pollution.	Pond is in a protected site without potential pollution sources. Pond is on common land. Pond is within low intensity/organic agricultural land.
Human disturbance	Pond is located close to urban or suburban areas. Pond is publically accessible. Pond is in an area of high recreational use, particularly by dog walkers. Pond has evidence of introduced species including amphibians, fish and invasive aquatic plants. Pond has evidence of fly-tipping/litter. Water table impacted by abstraction	Pond is on private land and is inaccessible. Pond is far from human settlements Pond is on a nature reserve or other area where it is actively managed to mitigate for human disturbance (such as the introduction of alien species).

Natural Succession	Pond appears to be in the later stages if succession (some signs include heavy shading by willows, significant cover by reedmace, silting or infilling by leaves, frequent drying). Pond has an input from a ditch or stream which is introducing quantities of silt. Pond is located within woodland or scrub habitats. Pond at risk of inundation (e.g. in flood plain) which risks causing introduction of fish.	Pond is in the early stages of succession. Pond is in habitat where succession is slower (typically oligotrophic habitats such as uplands). Pond is on a protected site or nature reserve (and is actively managed).
Environmental change	Pond is vulnerable to changes in the water table. Pond is at risk from drying out which may be exacerbated by climate change.	
Other	Any other factors which have not been mentioned above.	Any other factors which have not been mentioned above.

Table 5.2. Identifying and assessing a pond's prospects.

Score	**1**	**2**	**3**	**4**	**5**
Population size Class size: peak count of 6 visits using standard methods summed across all ponds within 250m.	None recorded	Few individuals, non-breeding Count <4	Small Count 4-10:	Medium Count 10-100	Exceptional Count >100
Number/density of ponds Include the surveyed pond and all other ponds within 500m.	Non-breeding pond	1 breeding pond	2-3 breeding ponds	4 breeding ponds	5+ breeding ponds
Habitat quality HSI following ARG UK (2010).	<0.5	0.5-0.59	0.6-0.69	0.7-0.79	>0.79
Prospects Identify threats to the pond and assess the likelihood of the pond persisting.	Significant threats identified: pond unlikely to remain suitable for great crested newts within the near future.	Significant threats identified: pond unlikely to remain suitable in the long term.	Moderate threat level: pond is likely to remain suitable for some time, but condition is likely to decline.	Minor threats: pond likely to remain suitable in the long-term.	No significant threats identified: pond certain (>95% likelihood) to remain suitable for foreseeable future.

Table 5.3. Scoring system to asses value and Current Conservation Status of great crested newt ponds and populations

5.2.2.6 Calculating Current Conservation Status: Where a population is made up of more than one pond, each pond should be assessed individually and then the total score for all the ponds summed. When assessing population size, each pond should be scored for the whole population summed across all ponds.

Example 1: if a population is made up of two ponds, the first with an HSI score of 0.55, a moderate threat level and a peak survey count of 5 and the second with an

HSI score of 0.62, a moderate threat level and a peak count of 7, the score of the population should be calculated as follows:

Pond 1: population size = medium (score 4), number of ponds = 2 (score 3), habitat quality = 0.55 (score 2), threats = moderate (score 3). Total score for the pond = 12

Pond 2: population size = medium (score 4), number of ponds = 2 (score 3), habitat quality = 0.62 (score 3), threats = moderate (score 3). Total score for the pond = 13

<u>Total CCS score for the population = 12+ 13 = 25</u>

Example 2: Similarly if a population is made up of four ponds, the first with an HSI score of 0.55, a moderate threat level and a peak survey count of 5 and the second with an HSI score of 0.62, a moderate threat level and a peak count of 7, the first with an HSI score of 0.75, a low threat level and a peak survey count of 15 and the second with an HSI score of 0.70, a low threat level and a peak count of 8 the score of the population should be calculated as follows:

Pond 1: population size = small (score 3), number of ponds = 4 (score 4), habitat quality = 0.55 (score 2), threats = moderate (score 3). Total score for the pond = 12

Pond 2: population size = small (score 3), number of ponds = 4 (score 4), habitat quality = 0.62 (score 3), threats = moderate (score 3). Total score for the pond = 13

Pond 3: population size = medium (score 4), number of ponds = 4 (score 4), habitat quality = 0.75 (score 4), threats = low (score 4). Total score for the pond = 16

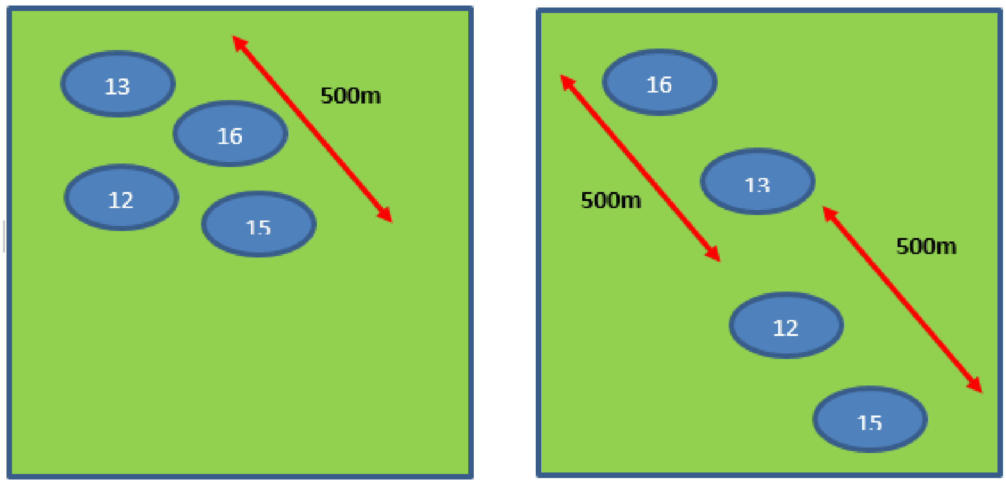
Pond 2: population size = small (score 3), number of ponds = 4 (score 4), habitat quality = 0.70 (score 4), threats = low (score 4). Total score for the pond = 15

<u>Total CCS score for the population = 12 + 13 + 16 + 15 = 56</u>

The score for the <u>population</u> is a measure of the overall value of the population and, as such, is directly comparable to the scores of other populations. However, it does not tell us whether the population is in favourable condition or not as it does not account for size (i.e. relative to the number of ponds). For example, a population comprising one pond in favourable condition scores at least 16 (from section 5.2.5), but a population comprising three ponds in unfavourable condition may also score 16. It also does not provide a measure as to whether any of the ponds were in favourable condition. In Example 1 above the score of 25 could have been obtained from two sub-optimal ponds as shown, or from 1 pond scoring 16 and another very poor quality pond scoring 9 (e.g. through two ponds (score 3) an HSI score of 0.59 (score 2), a moderate threat level (score 2) and a peak count of 2 (score 2). Therefore the assessment of favourable should be based around the best ponds and not result in a lower rating due to the presence of poor ponds. In example 1, therefore, the population would be considered unfavourable – though if the second scenario for a score of 25 (i.e. with one pond scoring 16 was applied) then it would be favourable. It would also be considered favourable if it had two ponds scoring 15 or more.

In Example 2 one pond scores 16 and another 15, hence the total score of 56 is based on a population that should be considered favourable. However we suggest that the distribution of pond quality across the whole population should be considered. If ponds are clustered close together (in Fig 5.2 (a)) the full extent of that population would be considered favourable.

Figure 5.2. Distribution of four ponds (a) within 500m such that the full extent of the population can be considered in Favourable Conservation Status and (b) where the distribution of quality ponds is such that part of the range, and hence the population in its entirety, can be considered unfavourable.



a b

However if the ponds are over a larger area, such that in any 500 m stretch there are no ponds scoring 16 or no pairs of ponds each scoring 15 (see Fig 5.2 (b)) then that element of the population is unfavourable. In this case, overall the population would be considered unfavourable as improvement would be needed to maintain the range into the future.

As this approach to assessing CCS uses the pond as its base unit, provided there is sufficient information available, it can be applied at any spatial scale from a single pond, a specific site, a landscape or an entire county. It can also be applied to a population comprising several ponds, or a site containing part of a population.

5.3. FRVs at a County Borough Level

The conservation status of great crested newts at a landscape level (in this case within the County of Anglesey) is determined by the range of the species within that landscape and the sum of the conservation status of the individual component populations present within it. It is not feasible to obtain detailed population and habitat data for every population within such a large geographical area and therefore the predictive model has been used to estimate probability of presence across the landscape. The modelling approach differs from the specific approach in that it does rely on predictions based on available data, whereas the site specific approach uses (as far as is possible "complete" data collected in the field. However, modelling allows FCS and FRVs to be assessed at a much larger scale and therefore is of much greater use in assessing overall population trends.

When applied to data covering Anglesey, the model can be used to estimate three of the four aspects of the CCS of great crested newts within Anglesey: the current number of populations (CCS-P); the area of suitable habitat (CCS-H); and, the predicted range of great crested newts within the County (CCS-R). However, it is not able to explicitly account for future prospects.

The model is extremely useful in estimating the CCS of great crested newts in Anglesey, however CCS does not necessarily equate to FCS (and the corresponding Favourable Reference Values, FRV-P, FRV-H or FRV-R) and given the documented decline in great crested newts across Britain, including northeast Wales, it is likely that this only represents a proportion of the historical status. This presents a problem in that it is difficult to assess at what point in history the great crested newt population in Anglesey was at FCS and therefore any point selected is likely to be arbitrary to a certain degree. The difficulty is further increased by the lack of data on historical great crested newt conservation status.

Due to its close association with breeding ponds, the number of suitable ponds within the landscape can provide an immediate guide to great crested newt conservation status in any given area (notwithstanding the importance of other factors such as terrestrial habitat and connectivity). Potential options for establishing a "baseline" for the determining FRVs are:

Ecological assessment of functioning populations within the landscape, looking at the overall distribution of species within the different habitats balanced with needs of other species, and supported by Population Viability Analyses. Whilst ecologically robust this can be complex and need a lot of data.

Historic Status, looking at historical landscapes to assess the number of ponds present and using this as a guide to previous status. There are potentially serious shortcomings in using a baseline date for determining FRVs, however the availability of data does allow an understanding of how the species status has changes over recent time and so can provide a rational basis for this exercise.

Although there are difficulties in using an arbitrary date as a baseline for deriving FRVs, not least that there is no guarantee that the population present at the time selected is indeed "favourable", it is possible to assess this for different time periods, providing sufficiently detailed historical mapping is available. Potential options for establishing a "baseline" for determining FRVs are:

- **1843**: This is the earliest date where good data on the number of ponds in the countryside exists, based on historical mapping from the time (see Gleed-Owen 2007).
- 1**965**: A base date that can be extrapolated from the published studies by Trevor Beebee (Beebee 1975) that documented a decade of significant loss of great crested newt populations in Great Britain – it is reasonable to assume that post WWII farming practices are associated with significant recent anthropogenic declines of the species
- **1979**: this is the date when the Bern Convention was signed (or 1981 could be used since this is when it came into effect in the UK); this being the first

legislative instrument to recognise the need to conserve great crested newt across Europe.

1994: This is when the Habitats Directive, and therefore the requirement to restore great crested newts to FCS, came into effect in the UK (European Habitats Forum 2006), and EC guidance indicates that FRVs should not fall below the level of 1994.

Modified 1994 baseline: evaluating whether the populations present in 1994 were viable and adapting these to take account of recent historic losses and the degree to which restoration is possible, practical and feasible.

Using historical mapping, Oldham & Swan (1997) estimated that amphibians would have reached peak abundance in Britain approximately 100 years ago as this coincided with a peak in the number of farm ponds within the countryside. By 1994, significant declines in the conservation status of great crested newts had been established across Britain (Beebee 1975; Cooke & Scorgie 1983; Nicholson & Oldham 1986; Swan & Oldham 1989, 1993; Hilton-Brown & Oldham 1991) and therefore it is unlikely to have been considered favourable at this point in time. Additionally, The Countryside Survey 2007 (Williams *et al*., 2010), suggests that, since the early 1990s, pond numbers in Wales have actually increased and so FRVs attached to any date since then would actually be lower than present day figures (although there is some indication that the quality of ponds has declined – see Anon. 2009). Therefore, the use of 1843 pond data as a baseline is more appropriate as it better reflects the status of great crested newts prior to the significant decline recorded in the 20th Century.

Gleed-Owen (2007) estimated a 37% decline in the number of ponds in northeast Wales between 1843 and 2007. Therefore an FRV based on 1843 pond numbers can be calculated by extrapolating the current number of ponds (as of 2007) by 37% in areas identified as suitable habitat within the model. However, not all ponds are suitable for great crested newts and therefore the FRV can be assessed in a number of different ways. Arnell & Wilkinson (2011) presented three potential options for assessing the FRV based on 1843 pond numbers:

- Option 1: The total number of ponds in 1843

- Option 2: The number of ponds theoretically occupied by great crested newts in 1843. This is based on an overall percentage of the number of ponds occupied by great crested newts in Wales (15.55%).
- Option 3: The number of suitable ponds (with an HSI of >0.7) theoretically lost since 1843.This was calculated using the overall percentage of ponds (24%) with an HSI of >0.7 (see Wilkinson *et al*., 2011).

During the modelling process, a total of 2,146 extant ponds were identified within the County of Anglesey. This is a slight increase in the 1,879 identified by Gleed-Owen (2007). Therefore, assuming a 37% pond loss rate, the number of ponds within the county in 1843 = 1879/(1 – 0.37) = 2,983. This allows the calculation of the number of ponds required for each of the three options for the FRV as:

- Option 1: A total of 2,983 ponds
- Option 2: 464 ponds occupied by great crested newts (15.55% of 2,983)
- Option 3: 716 ponds with an HSI score >0.7 (24% of 2,983)

5.4. Assessing FCS of Great Crested Newts in Anglesey

5.4.1. Determining the conditions for FCS

Based on this rationale, FCS in Anglesey will be met when there is either the equivalent number of ponds in total or the (estimated) equivalent number of ponds occupied by crested great newts or the (estimated) same number of high quality ponds (i.e. with HSIs >0.7) as there would have been in 1843. For clarity we advocate only one of these is used and the most appropriate is number of occupied ponds. This provides the metric for the range (FRV-R) and habitat sufficiency (FRV-H) criteria.

In addition, though, the way in which these ponds are distributed relative to each other, the quality of ponds occupied by newts and newt population sizes within each population need to be considered in terms of habitat quality and population viability (these address the metrics for populations (FRV-P) and long-term demographic prospects (FRV-F)). The prospect for any population will also be affected by threat levels and the likelihood of continuing positive management into the future.

In accordance with this information, great crested newts in Anglesey would be considered to be at FCS when the following criteria are met:

1) **There are at least 2,983 ponds within the county,**

OR

There are at least 716 ponds with an HSI score >0.7 within the county

OR

There are at least 464 ponds occupied by great crested newts within the county

This accounts for FRV-R as it ensures that all of the potential range within the county is occupied; and for FRV-H as it ensures sufficient quantity of habitat is present across the county.

2) **In occupied areas, pond density is at least 4/km^2 (each occupied pond is within 500m of at least three other ponds)**

   This accounts for FRV-F as ponds within a network have a much lower extinction risk and therefore are more likely to persist in the long term.

3) **Each occupied pond has an HSI score >0.7**

   This accounts for FRV-H as it ensures habitat is of sufficient quality.

4) **Each occupied pond has at least a "medium" population (or a proportion of a "medium" population distributed across neighbouring ponds)**

   This accounts for FRV-P and FRV-F as it ensures each individual population (and therefore the population across the county as a whole) is large enough to have a high likelihood of withstanding stochastic events.

5) **The threat level for each occupied pond is minor or less**

   This accounts for FRV-F as it ensures each occupied pond has a high likelihood of persistence in the long-term.

5.5. Estimating Whether the CCS of Great Crested Newts is Favourable in Anglesey

Once FCS is defined, this can be used to determine whether the CCS of great crested newts is favourable within Anglesey as a whole. The model identified 2,146 extant ponds within Anglesey (in 2011), and therefore, assuming a 15.55 % occupancy rate, 334 ponds occupied by great crested newts. If all of the ponds are in favourable condition (i.e. would score 16), the total CCS = 5,344 which is less than

the theoretical value for FCS 8,352 (section 5.4.2 above) and therefore is unfavourable. It is acknowledged that this is an optimistic estimate as it assumes that all occupied ponds are in favourable condition, which is unlikely to be the case.
It should be noted that using these figures alone does provide a good indication of FCS/CCS in terms of numbers (ponds, population size etc.). However, when considered in isolation it does not explicitly account for range. The numbers are based on all areas assessed by the model as suitable being occupied, however it could be possible to reach FCS as described above with an exceptionally high density of ponds in one area, but low numbers or absence in another suitable area. The distribution model indicates the extent of suitable habitat (see Map 1 and Map 2), and therefore FCS would only be achieved once all suitable areas are occupied.

5.6. Estimating the Contribution of Individual Populations/Sites to County Level CCS/FCS

The estimated total CCS and FCS values for Anglesey can be used to determine the contribution of individual sites towards these figures. For example, targets for FCS for the Glantraeth SAC (CCW 2008) include the following:

- There will be a viable breeding great crested newt population present on the site.
- Ample display/breeding ponds will be found on site.
- Great crested newt larvae will be found in most of the breeding ponds.
- Most of the display/breeding ponds on the site will have standing water during the average summer months.
- The breeding ponds will dry out by mid summer occasionally (>5year intervals).
- There will be adequate native water plants (macrophytes) for egg laying and adequate areas of bare pond bottom for displaying newts.
- Surrounding vegetation will not heavily shade breeding and display ponds.
- Algal blooms and surface sheens will be absent from display/breeding ponds.
- Fish will be absent or rare in breeding/display ponds that support great crested newts.
- Only small numbers of wildfowl will occur on the ponds.
- The terrestrial habitat surrounding breeding ponds will comprise of refuge areas for newts, foraging areas, areas of hibernacula and corridors that will aid the movement of great crested newts back and forth with the neighbouring

Newborough Warren – Ynys Llanddwyn SSSI (for migration, dispersal, foraging and genetic exchange purposes).

- There will be no significant loss of great crested newts as a result of road engineering such as gully-pots.
- Non-native aquatic species will be absent or if present, not at more than “occasional” frequency.
- All factors affecting the achievement of the above conditions will be under control.

If these criteria are satisfied, the site would contain a large population of great crested newts, containing at least three main ponds (plus a number of other smaller ponds), each with an HSI of at least 0.7 and only minor threats identified. Therefore, a typical pond on the site would have a total CCS score of 18 (population size = large (score 5), number of ponds = >5 (score 5), habitat quality = >0.7 (score 4), threat level = minor (score 4)). This equates to a total CCS score for the site (the three main breeding ponds) of 3 x 18 = 54.

Therefore, at FCS, Glantraeth SAC would contribute:

- (54/5,344) x 100 = 1.01% of the total CCS for Anglesey
- (54/8,352) x 100 = 0.65% of the target total FCS for Anglesey

6. TOWARDS ACHIEVING FAVOURABLE CONSERVATION STATUS

6.1. Introduction

A model is only as good as the data used to build it. One of the aims of this plan is to improve and update the model by identifying areas of data deficiency and setting targets to fill these gaps. To this end, geographic survey targets have been identified as well as a programme of surveys to improve the resolution of the model.

The primary practical way in which the CCS of great crested newts can be increased is by creating new ponds (including associated terrestrial habitat for foraging and sheltering, as well as dispersal to other areas and populations). This chapter explores various methods of setting pond creation targets with the aim of achieving FCS. It also identifies locations where pond creation would have the most benefit.

6.2. Survey Targets

6.2.1. Filling gaps in geographic knowledge

Although the quantity and quality of data on great crested newts in Anglesey is relatively good when compared to other areas within the UK, there are still some gaps in our knowledge. Filling in these gaps would give better understanding of range and population size, would allow for refinements to improve the reliability of the model, would enable more effective targeting of habitat improvement measures and would facilitate a more accurate assessment of CCS. There are a variety of different techniques which can be used to survey great crested newts, including HSI assessment, environmental DNA (eDNA) and population counts. However, each of these is relatively time-consuming and potentially costly and therefore achieving blanket survey coverage is not practically possible. Therefore the model was used to identify target survey areas which would provide the most useful information for the resources invested.

In order to identify geographic survey targets, a 250m buffer was added to all known great crested newt ponds. Any areas within the 75% core habitat or pond creation areas, but falling outside of a 250m buffer around an existing pond are considered a survey target (see Map 3). The rationale for selecting these areas is that the status of great crested newts is unknown within them and they are sufficiently distant from known sites that occupation cannot be assumed. However, they do contain suitable habitat and therefore survey effort is unlikely to be wasted due to the area being unsuitable.

6.2.2. Surveillance to improve the model and refine FCS targets

The predictive model and the targets derived from it are to a certain degree based on extrapolations of data from Anglesey or other areas. For example, the targets for pond creation are based on HSI and occupancy data for the whole of Wales. Surveys of ponds within Anglesey would provide occupancy rates and HSI data that better reflect local conditions. The estimate of CCS calculated in Chapter 5 assumed that all occupied ponds were in favourable condition. This is unlikely to be realistic and therefore the CCS is probably overestimated.

In order to refine these estimates, a random sample of 107 ponds (5% of the total number in Anglesey) should be surveyed with an HSI score calculated and population size class estimated. This would enable the CCS to be calculated for each one. This survey should specifically allow the following to be estimated:

- Proportion of ponds occupied by great crested newts
- Proportion of ponds with an HSI of >0.7
- Average CCS for ponds in Anglesey

A number of organisations area currently involved in undertaking amphibian surveys within Anglesey, including voluntary surveys such as NARRS (co-ordinated by Amphibian & Reptile Conservation) and PondNet (co-ordinated by the Freshwater Habitats Trust) and commercial ecologists working on development projects. These should be strongly encouraged to collect and submit this data as part of their protocols.

6.3. Pond Creation

6.3.1. *Location of Pond Creation Areas*

In order to provide the most benefit, conservation effort, such as the creation of new ponds, should be carefully targeted. To this end, the predictive model has been used to identify areas where the creation of ponds would make a significant contribution to enhancing the conservation status of great crested newts at a landscape level within Anglesey.

MaxEnt was used to model habitat suitability for great crested newts across Anglesey, but omitting pond density as a factor (see Arnell & Wilkinson (2013) for the full methodology). Using this model, areas which fulfilled the following criteria were identified: a) suitable habitat for great crested newts; b) low pond density, and c) areas where it is practical to build ponds (such as outside built up areas and within areas with existing conservation designations). From this, areas with a pond density of less than 4 per km^2 were selected, as pond densities lower than this are sub-optimal for great crested newts (Oldham *et al.* 2000). The selected areas were then compared with the Anglesey Unitary Development Plan and any which conflicted with land designated for development were removed. Flood zone maps were obtained from Natural Resources Wales and incorporated into the model. Any potential pond creation areas overlapping with flood zones were then excluded from the model. Pond creation areas fall into two categories, each of which has a slightly different function. Corridors are areas which could potentially link two or more existing populations (Map 4a). Cost weighted buffers are buffers around existing populations based on typical dispersal distances, although adjusted for the resistance of the surrounding habitat (Map 4b). For example, where the habitat surrounding a pond is suitable for great crested newts, it is easy to disperse through and therefore the cost weighted buffer will be relatively large, whereas if the habitat is unsuitable, it will be difficult to disperse through and consequently, the buffer will be smaller. Pond creation in these two types of areas has different advantages and disadvantages. Ponds created in corridors may facilitate connectivity between populations, however they may also be further from existing populations and therefore there is a lower chance they will be colonised. Ponds created in cost weighted buffers are more likely to be colonised and will allow existing populations to expand. However, they will not necessarily facilitate movement between populations. There is overlap between these two categories and therefore it is possible for a single pond creation area to fall within both a corridor and a cost weighted buffer.

6.3.2. Number of Ponds

During the modelling process, a total of 2,146 ponds were identified within in the County of Anglesey. Using typical occupancy rates and HSI Scores (Wilkinson *et al* 2011), this equates to a total of 515 (24%) with an HSI >0.7, and 334 (15.5%)

occupied by great crested newts, which fall short of the FRV established within this report.

Arnell & Wilkinson (2013) investigated the options for meeting this FRV by:

- Option 1: Restoring the total number of ponds to 1843 levels
- Option 2: Restoring the number of ponds occupied by great crested newts to 1843 levels
- Option 3: Restoring the number of ponds with an HSI >0.7 to 1843 levels

Of these three options, Option 1 was rejected on the basis that the total number of ponds required was very high and therefore unlikely to be practically achievable. In addition, the FRV could still be achieved without many of the new ponds actually being suitable for great crested newts, and therefore this would be an inefficient use of resources. Option 2 was rejected as it relies on every new pond created actually being occupied by great crested newts. Even if a new pond is designed to fulfil all the habitat requirements of great crested newts, there is still no guarantee it would be occupied and therefore this option means there is a high risk of the FRV not being achieved if even a few of the new ponds are not colonised. Therefore, Option 3 was selected on the basis of it requiring the creation of the lowest number of ponds whilst still being likely to achieve the FRV.

In addition, to Arnell & Wilkinson's (2013) options, two additional options are considered within this report:

- Option 4: increasing the current number of ponds by 20%
- Option 5: an "ecological option" to bring up the number of ponds to a density of at least 4 per km^2 in all areas of suitable habitat

The great crested newt was a Priority Species within the UK Biodiversity Action Plan and therefore has been included in many local BAPs across the UK, including Wales and specifically, Anglesey. Many of these local BAPs contained targets for the conservation of the species including pond creation. In many cases these targets were not set objectively based on conservation status, but on achievable, although often arbitrary, numbers. Option 4, examines the effect of such a target on the conservation status of great crested newts.

Option 5 is designed to bring pond density up to a theoretical threshold level known to support great crested newts (see Oldham *et al*. 2000). A pond density layer within the model was used to identify those extents within pond creation areas that have a pond density of <4 per km^2. The number of ponds within these areas were counted and compared with the count of ponds within the wider pond creation target area. The difference between these two numbers was taken to be the number of ponds needed to bring the entire pond creation target area up to a minimum density of 4 ponds per km^2. This target for the total number of ponds was then divided by the area where pond density was lower than 4 per km^2 to calculate the pond creation targets (see Table 6.1).

Table 6.1: Pond creation targets for corridors and cost weighted buffers for each of Options 3-5. Options 1 and 2 are disregarded.

Option	Pond creation targets					
	Corridors			Cost weighted buffers		
	Target number of ponds	Area (km^2)	Ponds created per km^2	Target number of ponds	Area (km^2)	Ponds created per km^2
Option 3	201	3.42	58.78	201	10.94	18.36
Option 4	429	3.42	125.66	429	10.94	39.24
Option 5	5	5.68	2.41	43	14.44	2.96

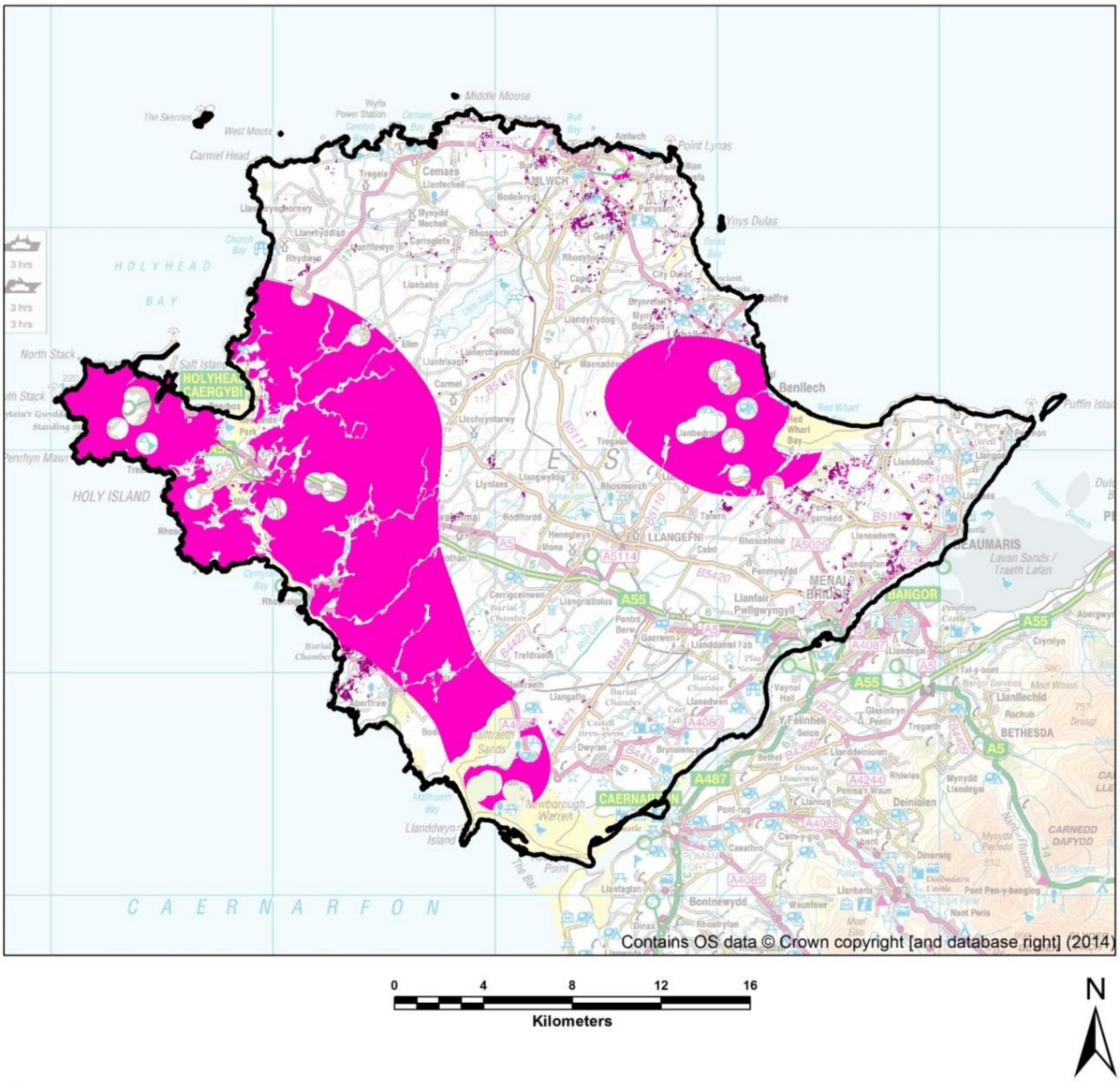
Of these three remaining options, Option 3 is preferred as it would be the most efficient option by which FCS could be achieved for great crested newts within Anglesey. It would ensure that there is suitable habitat present for great crested newts to occupy all of their potential range within Anglesey (and therefore FRV-H and FRV-R are satisfied) and the number of ponds are likely to result in a significant increase in population (potentially satisfying FRV-P).

Option 4 would also achieve FCS, however it is less efficient, necessitating the creation of 228 more ponds than Option 3.

Option 5 would ensure that the entire suitable range within Anglesey could be occupied (therefore satisfying FRV-R), but the number of ponds created would be well below the number required to achieve FRV-H and therefore FRV-P is also unlikely to achieved. In addition, populations at low density are at higher risk of extinction, which makes it difficult to ensure FRV-F is achieved. Although this option would create a sustainable population it would be extremely vulnerable to factors such as future environmental or climatic change, and habitat change such as pond loss. In effect this would mean that very small changes (e.g. the loss of a single pond) could have large effects on the populations across the wider landscape. By increasing pond density (as per Option 3), a considerably more robust population structure is built which would therefore achieve FRV-P due to the increased numbers and FRV-F due to the high likelihood of long-term persistence.

Map 3

Anglesey Survey Target Areas

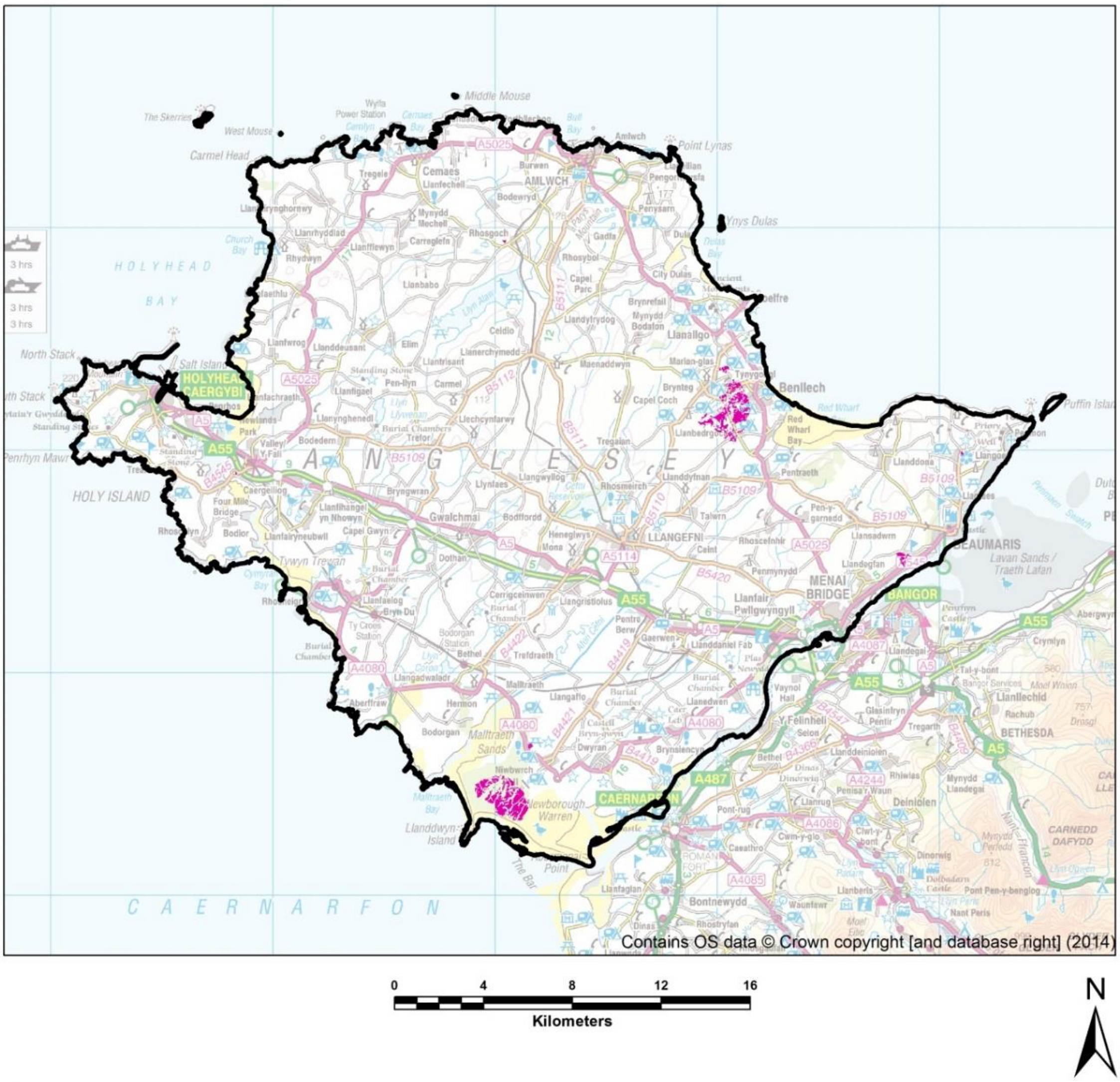


Legend

- Anglesey Unitary Authority
- High priority survey target area
- Low priority survey target area

Map 4a

Anglesey Pond Creation Target Areas in Corridors



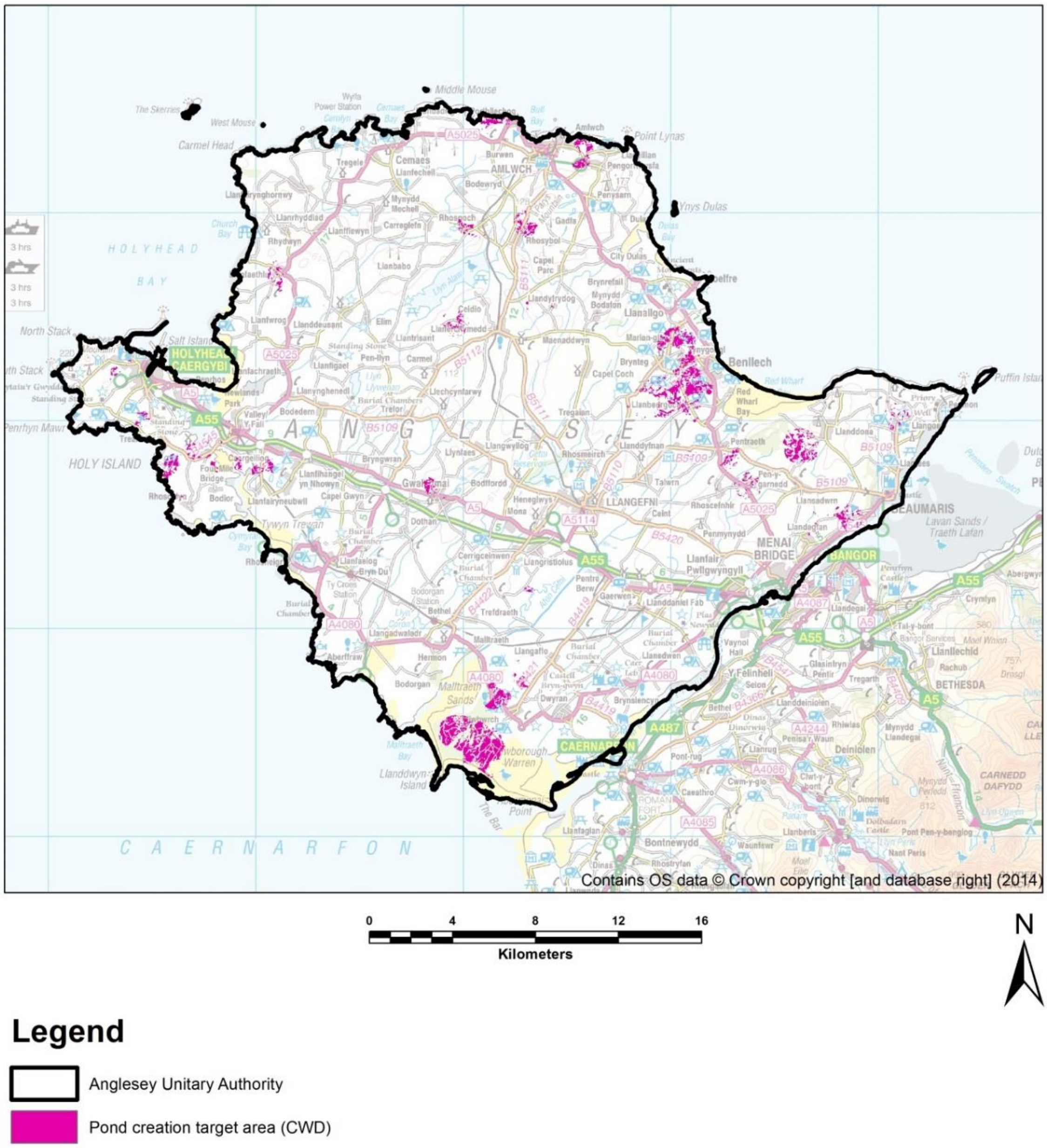
Legend

Anglesey Unitary Authority

Pond creation target area (in corridor)

Map 4b

Anglesey Pond Creation Target Areas in Cost Weighted Buffers



7. INCORPORATING FCS CONCEPTS INTO LAND USE PLANNING, IMPACT ASSESSMENT AND MITIGATION

7.1. Introduction

The legal protection of great crested newts means that the potential impacts of any activity, primarily (but not exclusively) development, must be considered. In the context of development, frequently this occurs at three stages:

- The developer (often in conjunction with an ecological consultant) will undertake an impact assessment of the project or plan upon great crested newts
- The Local Planning Authority will consider the potential impacts of the project or plan as part of the process of determining the planning application.
- Natural Resources Wales (NRW) will consider the impacts of the project or plan as part of the process of determining whether a derogation licence to allow the activity to take place can be issued.

For sites which are allocated within Local Development Plans, the Local Authority may also consider great crested newts whilst developing the plan.

When a project or plan might impact on great crested newts, any activity that would normally result in an offence under the Habitats Regulations can be made lawful by issue of a licence. When considering whether to grant a licence, NRW will consider whether it complies with the “three tests”:

- Purpose: licence is issued for the purpose of “preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment.”
- Alternative: the appropriate authority shall not grant a licence unless they are satisfied “that there is no satisfactory alternative.”
- FCS: the appropriate authority shall not grant a licence unless they are satisfied “that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.”

This puts the concept of CCS and FCS at the heart of the decision making process.

Typically, developments are considered on a case-by-case basis and there is limited communication between teams working on different developments. This can mean that the impacts of a development are only assessed at a site level and wider landscape scale impacts are only given superficial consideration. Where a development (or other scheme) is considered likely to have adverse impacts on great crested newts, a programme of mitigation will often be implemented in order to maintain the status of the affected population(s). The lack of co-ordination between developments can mean that mitigation is piecemeal and inefficient at a landscape scale.

This chapter provides an objective method by which the potential impacts of a project or plan on the conservation status of great crested newts can be assessed. It is a useful tool for the statutory agency responsible for assessing the project and issuing a licence, however it can also be applied by Local Authorities when considering planning applications, and developers when carrying out Environmental or Ecological Impact Assessments. Although this method is of particular use when assessing the impacts of development, it can be applied to any activity likely to affect great crested newts including agriculture, forestry and other land management. Alternative approaches have been used to quantify impacts of development on great crested newts, for example the use of graph theory based connectivity analyses that allow relative impacts of development to be quantified (Fletcher and Wilkinson, 2013) and use of conservation status impact matrices (Bormpoudakis et al, 2015).

7.2. Land Use Planning

When allocating land within Local Development Plans, the Local Authority must be mindful of the potential impacts on great crested newts. However, due to the large geographic coverage of such plans and their strategic nature, detailed information on the status of great crested newts within land allocations may be unavailable and is often too costly to obtain. The predictive model can be particularly useful in this application as it enables a rapid assessment of the risk of great crested newts being affected by the plan.

The model has produced a 'probability of presence' layer which covers the whole of Anglesey. This can be used to quickly assess whether great crested newts are likely to be present in any given land allocation and therefore the risk that they will be adversely affected as a result. However this does not necessarily consider the full effects of the plan on FCS. Given the distribution of great crested newts in Anglesey and the demand for land for development, some conflict between great crested newts and development is inevitable. Therefore, in order to ensure there is no loss in the CCS of great crested newts (i.e. avoids impacts) and does not compromise the future attainment of FCS, the plan must allow for conservation measures to mitigate the impacts of development and enhance the status of great crested newts.

To assist with this process, the predictive model has been used to create a *habitat value layer.* This categorises all the land within Anglesey in terms of its relative contribution to the target for FCS for great crested newts within the County. Some of the categories may overlap, e.g. a site within the 75% core range may also fall within Pond Creation Areas. Where this happens, the highest value should be used.

This not only considers current habitat quality (FRV-H) and likelihood of occupancy (FRV-P), but also the value of the land in attaining FCS in the future (FRV-F). Categorisations are shown in Table 7.1 and on Map 2.

Table 7.1: Relative value of different land categories within Anglesey

Category	**Value**
Designated sites This includes all SSSIs/SACs designated in part due to the presence of great crested newts	Very high
50% core range This area encompasses 50% of known populations at the highest possible density	
75% core range outside the 50% core range This area encompasses 75% of known populations at the highest possible density	High
Pond creation target area Areas in which pond creation would achieve the greatest benefit for great crested newts	
Most suitable habitat outside core range Areas outside the 75% core range which are likely to contain suitable habitat for great crested newts	Moderate
Suitable habitat outside core range Areas outside the 75% core range which may possibly contain suitable habitat for great crested newts	Low
Unlikely/very unlikely habitat Areas unlikely or very unlikely to contain suitable habitat for great crested newts, including flood zones.	Negligible

Land with “very high” value is unlikely to be suitable for development. It may be already designated for the presence of great crested newts and therefore development would be strongly opposed through policy and without appropriate consents would be illegal. If it is not designated, it contains a very high density of known great crested newt ponds and makes a significant contribution to achieving FCS at a county level. Therefore development in these areas would have a significant effect on the CCS of the species. It also may be less economically efficient to develop as it is likely to require extensive mitigation in order to allow the statutory agency to issue a licence under the Habitats Regulations.

Land with “high” value is likely to contain a high density of known great crested newt populations and each km^2 contributes a significant amount to the FCS target for Anglesey. Development within these areas is likely to have a significant impact on the CCS of great crested newts and consequently require appropriate mitigation. It may also include pond creation target areas, the development of which would impair the likelihood of FCS being achieved for great crested newts within Anglesey.

Land with “Moderate” value is outside the core range, although the habitat may be suitable and there is a possibility of great crested newts being present. If great crested newt populations are present, they may have some intrinsic value although are less likely to be of significant value at a landscape level. They may, however, be important in contributing to the maintenance of the overall range of the species. The lower density of ponds within these areas means there is less chance of populations with a high CCS occurring and therefore significantly contributing to achieving FCS at the county level. Consequently, development within these areas is less likely to be constrained by the presence of great crested newts and where it is, mitigation is likely to be less complex.

Land with “Low” and “Negligible” value is outside the core range and the habitat is of low suitability for great crested newts. Therefore there is a low likelihood of great crested newts being present within these areas and they are unlikely to make a significant contribution to FCS at a county level.

Each area of land to be allocated within a Local Plan should be considered against these criteria. It should be noted that any great crested newt population will have some value regardless of the area in which it is located. All populations are legally protected and will require the same impact assessment and mitigation process.

7.3. Impact Assessment

The impact of a project or plan upon a great crested newt population can be assessed as the predicted change in CCS as a result of the activity. When assessing an impact, the following steps should be undertaken:

1. The total CCS for the population should be calculated in absence of the proposed activity. This is calculated as detailed in Chapter 5 where each pond comprising the population is scored in terms of its population size, HSI score and number of ponds within the vicinity. The total CCS can be used to establish a baseline metric for assessing the population prior to the activity. Individual pond scores should be assessed to see if the population is in a favourable conservation status.
2. The CCS should be calculated for the population after the proposed activity, in the absence of any mitigation.
3. The difference between the total CCS before and after should be calculated in order to quantify the loss of conservation status.
4. Individual pond scores should be used to assess whether the population is favourable after the activity.

An accurate impact assessment relies on being able to accurately predict CCS after the activity. Some aspects of this are relatively straightforward, whereas others are more difficult. Of the three factors considered when assessing CCS, the number of ponds is the easiest to predict as pond losses or gains can be discerned at the project design stage and impacts can also be examined in the context of effects on FCS. Isolation and fragmentation effects should also be considered (this is relatively easy to determine at a local scale, however modelling provides a much greater insight at a landscape level).

The change in habitat quality is more difficult to assess as it requires predicting changes to the HSI. Of the ten individual indices, some are unlikely to change (e.g. location, pond size, etc), whereas others will be significantly affected. Many potential impacts may not be certain, for example ponds retained near to new housing developments have an increased risk of fish being introduced. In situations such as this, any areas of uncertainty should be identified during the assessment process and the plausible worst case scenario should be used to calculate the post development CCS. Advice on assessing the impacts of a project on HSI scores is provided in Table 7.2. For more general advice on assessing the impacts of development on great crested newts, the reader should consult the *Great crested newt mitigation guidelines* (English Nature 2001) or discuss with Natural Resources Wales.

Changes in population size are also difficult to accurately predict as population size is influenced by many external factors. Research has shown that population counts can fluctuate widely from year to year and actual trends may not become apparent for several years. As time passes, it becomes increasingly difficult to separate the impacts of a development on a great crested newt population from natural process such as pond succession (notwithstanding positive factors such as pond management). Therefore, the aim of the impact assessment is to calculate the difference between population size immediately before and after the development. To this end, the effect on population size should be assessed in terms of pond loss. For example, if a population comprises two ponds: Pond A with a peak survey count of 25 and Pond B with a peak survey count of 6; the peak count for the whole population is 31 and therefore it is classified as “medium”. If Pond A was lost as a result of a development, the peak count for the entire population would be 6 and therefore it would be classified as “small”. If Pond B was lost, the peak count would be 25, and as this is greater than 10, the population would still be classified as “medium”.

A worked example of how to assess the impacts of two development scenarios on the conservation status of a great crested newt population is shown in Box 7.1.

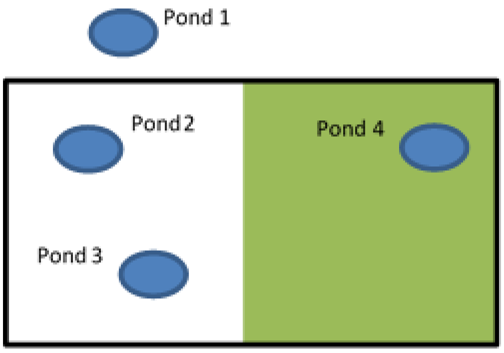
It should be noted that for many projects the total CCS after the development will be the same as it was before. This does not necessarily mean there is no impact, only that the impact is unlikely to affect the conservation status, or is of short duration. Such low impact schemes will still often require mitigation to some degree.

Table 7.2: Advice for predicting the impacts of development on pond HSI scores.

Individual SI		**Advice for predicting impact**
SI1	**Location**	In the context of the HSI, provided mitigation is carried out within the same county, this would not change.

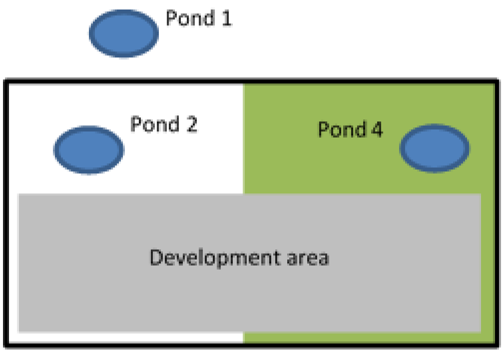
SI2	**Pond size**	If a pond is retained this is unlikely to change. However, any possible changes in the size should be identified at the design stage.
SI3	**Pond drying**	For most developments this is unlikely to change. However, for some large projects the hydrology of an area may be affected. Such projects are likely to be subject to EIA and therefore this may be a source of information.
SI4	**Water quality**	Water quality may be affected as a result of development due to contaminated run-off from new areas of hardstanding, roads etc. Ponds in public open space can also be affected by people feeding waterfowl introducing nutrients to the pond, and by dogs swimming which stirs up the bottom sediments and causes bank erosion. The risk of invasive plant species being introduced, some of which can form mats, blocking sunlight, is also increased. Consequently, unless it can be guaranteed that such impacts would not occur, the SI score for water quality for the pond post-development should be downgraded by at least one level.
SI5	**Shade**	Shade is unlikely to change as a result of development, however increased shading could occur if new buildings or landscape planting are located close to ponds.
SI6	**Waterfowl**	This is difficult to predict as the number of waterfowl can increase on ponds in public open space due to public feeding, conversely swimming dogs can scare them off. Therefore, unless there is evidence to the contrary, the SI score for waterfowl is likely to remain the same.
SI7	**Fish**	Ponds in public open space have an increased risk of fish introduction. Therefore, unless it can be guaranteed that fish would not be introduced, it is recommended that for residential developments, any pond in public open space is categorised as at least “possible” (SI score of 0.67) for the presence of fish when calculating the post-development HSI.
SI8	**Number of ponds**	Pond losses or gains should be easy to quantify once the layout of a development is known.
SI9	**Terrestrial habitat**	Terrestrial habitat losses or gains should be easy to quantify once the layout of a development is known.
SI10	**Macrophyte cover**	This is difficult to predict as it is dependent on a number of factors. An increase in waterfowl and fish number can result in a decrease in cover, as can decreases in water quality. However, the introduction of a non-native species could result in an increase in cover (although a drop in diversity). In the absence of detailed knowledge it is recommended that the SI score is not changed.

Box 7.1 Example of impact assessment considering the effect on CCS

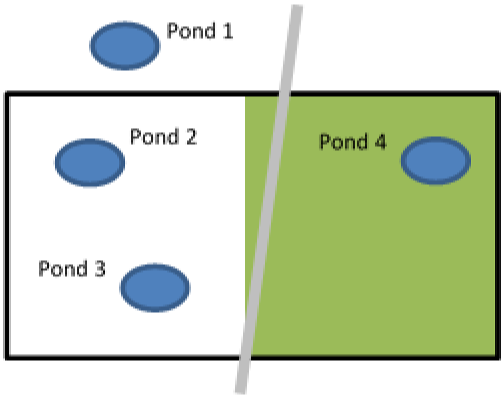


In this example of impact assessment, Pond 1 has an HSI score of 0.65 and a peak survey count of 20, pond 2 has an HSI score of 0.65 and a peak survey count of 20, pond 3 has an HSI score of 0.65 and a peak survey count of 20, pond 4 has an HSI score of 0.75 and peak survey count of 120. Suitable terrestrial habitat is shown in green. Pond 1 is outside the development site, however it will be affected by the development and therefore should be part of the assessment. In Scenario A, a housing development results in the loss of terrestrial and aquatic habitat. In Scenario B, the construction of a new road causes fragmentation.

Scenario A



Scenario B



In this example the value of the site and the CCS of the population prior to the development are calculated as follows:
Pond 1: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.65 (score 3), threats = minor (score 4). Total = 16
Pond 2: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.65 (score 3), threats = minor (score 4). Total = 16
Pond 3: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.65 (score 3), threats = minor (score 4). Total = 16
Pond 4: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.75 (score 4), threats = minor (score 4). Total = 17
Total CCS for the site = 16 + 16 + 16 + 17 = 65. Pods scoring over 16 indicate viability and therefore the population is favourable

In Scenario A the development results in the loss of pond 3 and the loss of terrestrial habitat which reduces the HSI score for all the remaining ponds by 0.1. Ponds 2 and 4 are retained within public open space, however they are adversely affected by the feeding of waterfowl which reduces water quality and reduces the HSI score by a further 0.1.
Pond 1: Pop. size = large (score 5), no. of ponds = 3 (score 3), HSI = 0.55 (score 2), threats = minor (score 4). Total = 14
Pond 2: Pop. size = large (score 5), no. of ponds = 3 (score 3), HSI = 0.45 (score 1), threats = mod. (score 3). Total = 12
Pond 4: Pop. size = large (score 5), no. of ponds = 3 (score 3), HSI = 0.55 (score 2), threats = mod. (score 3). Total = 13
Total CCS for the site = 14 + 12 + 13 = 39, a decline in CCS of 26.
No single pond scores 16 or more, nor are there two ponds scoring 15 and therefore the population is unfavourable

In Scenario B the new road isolates pond 4 from the other ponds, it also isolates ponds 1, 2 and 3 from terrestrial habitat causing a reduction of the HSI score by 0.1
Pond 1: Pop. size = medium (score 4), no. of ponds = 3 (score 3), HSI = 0.55 (score 2), threats = minor (score 4). Total = 13
Pond 2: Pop. size = medium (score 4), no. of ponds = 3 (score 3), HSI = 0.55 (score 2), threats = minor (score 4). Total = 13
Pond 3: Pop. size = medium (score 4), no. of ponds = 3 (score 3), HSI = 0.55 (score 2), threats = minor (score 4). Total = 13
Pond 4: Pop. size = large (score 5), no. of ponds = 1 (score 2), HSI = 0.75 (score 4), threats = minor (score 4). Total = 15
Total CCS for the site = 13 + 13 + 13 + 15 = 54, a decline in CCS of 11 points. The isolation effectively creates two separate populations. The first comprising ponds 1, 2 and 3 and with a CCS of (13 + 13 + 13)= 39. The second comprising pond 4 only, which has a CCS of 15. Therefore both populations are unfavourable.

7.4. Valuing Sites and Assessing Impacts at the County Level

When dealing with conflicts between great crested newts and development, the plan aims to discourage development which would affect valuable populations in important areas whilst encouraging development in less important areas which are less likely to affect valuable populations. This should also maintain the overall distribution of the species across the county, and keep representative species in typical habitats.

There are two methods by which the potential impact of a development can be assessed and the appropriateness of either method will depend on the data available and the reason for the assessment.

In situations where there is no detailed information on great crested newt status on the site in question, the relative effect of the project on the CCS and FCS target for the whole county can be assessed by the value category in which the site falls (see Table 7.1). Developments within higher value areas are more likely to have a significant adverse impact than those in areas with lower value.

Where more detailed knowledge of the site is available, the change in CCS before and after the development can be calculated as per the example in Box 7.1. This allows both assessments of viability of each component population but also a measure on impacts overall across the county, i.e. they can then be related to the countywide estimate of CCS of 5,344 and the target FCS of 8,352, enabling the effect of the development on the CCS and FCS target at a county level to be quantified and expressed as a percentage change in status.

7.5. Assessing the Effectiveness of Mitigation

The aim of great crested newt mitigation is to maintain the conservation status of great crested newts in the long term and therefore as a bare minimum should ensure there is no long-term loss of status. However, given that it is impossible to guarantee the success of any mitigation programme, and particularly where high impacts are likely, mitigation should seek to provide additional resources to the affected population in order to increase the likelihood of long-term success. Therefore the mitigation targets should be proportional to the value of the population (i.e. the contribution of the population to overall FCS) and the severity of the predicted impact.

The likely effectiveness of a mitigation scheme can be assessed using the same method as the impact assessment. Once the mitigation has been designed, the predicted total and relative CCS for the affected population post mitigation can be calculated and compared to that prior to the development. The aims of any mitigation scheme should be:

1. To ensure that there is no net loss in CCS as a result of the development
2. To maintain affected populations at FCS
3. Dependent on the level of impact, to enhance the CCS of affected populations

For high impact schemes (any project involving the loss of ponds or core terrestrial habitat) the mitigation should aim to increase the total CCS by at least 1.3x the pre-development level, and ensure all affected populations are at FCS, regardless of their CCS before the development. For a moderate impact project, the mitigation should aim to increase the CCS of the affected populations. For low impact schemes, the CCS is not predicted to decline as a result of the development and therefore the mitigation will be would be focussed on the protection of individual animals in order to ensure legal compliance.

7.6. In-situ Versus Ex-situ Mitigation

In most situations, in-situ mitigation is preferred over ex-situ mitigation. However, there may be circumstances where it is not possible to maintain a viable population on the site and therefore ex-situ mitigation would be more appropriate. Additionally, there may be examples when ex-situ mitigation may provide additional benefits for FCS over in-situ mitigation (e.g. where impacts occur to a small isolated population with limited long-term prospects). When ex-situ mitigation is proposed, it should contribute to the overall aim of achieving FCS for great crested newts in Anglesey.

Mitigation schemes are often devised and implemented on a case-by-case basis and this may not be the most efficient approach in terms of maximising value. For example, if two developments implement separate mitigation schemes which result in two small populations being maintained on two separate sites, the CCS of the two separate populations is likely to be lower than if they were both maintained on the same site where more ponds were created as a result. The effect of overall FCS would be greater still if the habitat works were undertaken within a pond creation area.

Due to the greater risk of failure, ex-situ mitigation schemes should seek to double the CCS of the affected population, and ensure that the affected population is at FCS post development. In order to double the CCS of the affected population it is likely to be necessary to replace any lost ponds at a 2:1 ratio. However, it is easier to create ponds with a relatively high HSI (and therefore with a greater contribution to the CCS of great crested newt populations) in high value areas, such as the core range areas and the pond creation areas. These areas have more suitable habitat, a higher density of ponds and potentially already contain great crested newt populations, all of which would contribute to a higher potential CCS. Therefore, selecting a site for an ex-situ mitigation project in a high value area may mean fewer ponds need to be created, saving costs for the developer. This has a number of potential positive implications:

1. It discourages development in areas of high value for the countywide FCS target as populations within these areas are likely to have a higher CCS. This means that in order to double the CCS, a greater number of ponds would need to be created. Therefore, if there is a choice of potential development sites, this would encourage the selection of the site in the lower value area with a lower CCS.
2. It discourages ex-situ mitigation in inappropriate or lower value locations as meeting the requirement to double the CCS would be much more onerous in a lower value area, with a lower pond density. This would have the effect of either: encouraging the selection of a receptor site within a higher value area such as a pond creation area, or necessitating the creation of a significant number of new ponds in lower value areas, which would increase the value of that area.
3. It encourages developers to select mitigation sites in high value areas where new ponds can be added to existing ponds to form a robust pond network at a landscape scale as it is easier to create a pond which would make a high contribution to the CCS of a newt population in an area where there already a number of existing ponds.

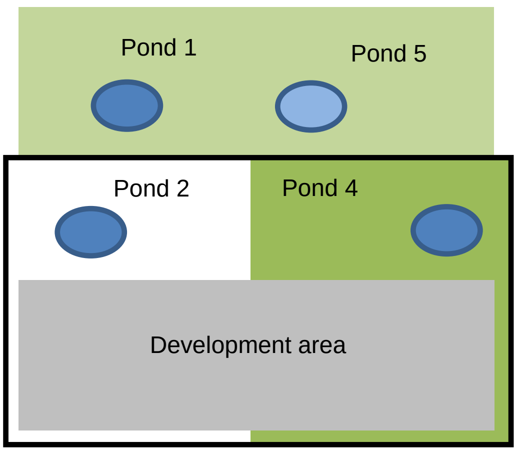
Once the CCS of the affected population/site is calculated, it can either be used to guide habitat creation which would double the CCS, or it can be directly translated to a financial contribution for the creation and management of ponds by the Local Authority (through a section 106 agreement), or to a third party land manager.

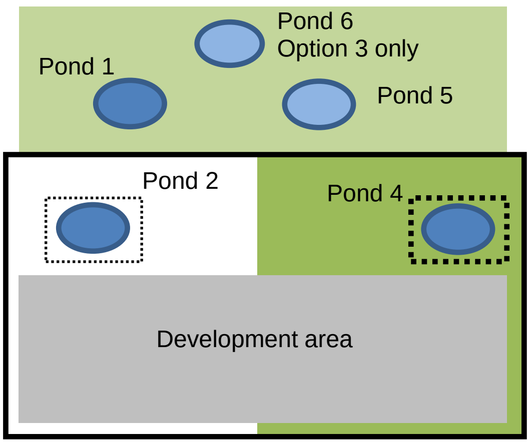
7.7. Pond Creation through Agri-environment Schemes

The Welsh Government agri-environment scheme, Glastir, includes options for creating wildlife ponds and buffering habitat around existing ponds. This has the potential to contribute towards achieving FCS for great crested newts in Anglesey. Where farms within Glastir occur within pond creation areas the creation of ponds which contribute at least 16 to the CCS of great crested newt populations should be encouraged. Where pond creation is proposed as part of Glastir, their CCS should be calculated using the method demonstrated within Chapter 5. This will enable their contribution to the overall FCS target for Anglesey to be quantified.

Box 7.2. Using CCS to design and assess mitigation

This box explores various mitigation options for the housing development scenario (Scenario A) discussed in the impact assessment example in Box 7.1. Prior to the development, the total CCS for the population was 65 with ponds scoring 16 or more, indicating that the population was favourable. The impact assessment predicted that after the development, the total CCS would be 39, a decline of 26 and without any remaining ponds of having high enough scores, indicating that the population would now be in unfavourable condition. Three options for mitigating the impacts of the project are assessed below. As a minimum, all of the options involve like-for-like replacement of lost habitats. Existing ponds are shown in dark blue whilst newly created ponds are shown in light blue. Existing terrestrial habitat is dark green and newly created habitat is lighter green. When new ponds are created it is assumed that they will be designed to be suitable for great crested newts and have an HSI score of at least 0.7.





Option 1 entails the like-for-like replacement of the lost aquatic and terrestrial habitat.

Pond 1: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.65 (score 3), threats = minor (score 4). Total = 16

Pond 2: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.55 (score 2), threats = mod. (score 3). Total = 15

Pond 4: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.65 (score 3), threats = mod. (score 3). Total = 15

Pond 5: Pop. size = large (score 5), no. of ponds = 4 (score 4), HSI = 0.70 (score 4), threats = mod. (score 3). Total = 16

Total CCS for the population = 16 + 15 + 15 + 16 = 62, a decline of 3 from the CCS before the development. There are both one or more ponds scoring 16 and two or more ponds scoring 15 and therefore is favourable. Although the remaining population would be favourable, this mitigation scheme fails to maintain the CCS of the population prior to the development.

8. CONCLUSIONS

This document provides a practical manual on how Favourable Conservation Status for great crested newts can be achieved within the County of Anglesey. It will, for the first time, allow the Current Conservation Status of the species to be assessed at a landscape level and lays out the actions required to reach FCS. Any organisation engaged in the management of great crested newts within the county should follow the guidance within in order to enable a unified approach to great crested newt conservation and ensure their actions provide the most benefit possible and contribute towards FCS targets.

As actions within this plan are implemented more survey data will become available and this information should be incorporated into the model in order to refine it and improve its accuracy. Therefore it is recommended that it is reviewed after five years. Any new ponds created within this period should also be considered within the model and pond creation targets revised accordingly.

It should also be noted that there are a number of projects in progress across the UK and Europe investigating the application of FCS to conservation scenarios. Consequently, a unified approach which can be applied to a variety of habitats and species may emerge in the future. Therefore, future revisions of this plan should reflect any changes in approach to the assessment of FCS. Until such a unified approach is widely advocated, the document provides a practical working method.

Spatial Action Plans have also been produced for Flintshire and Wrexham, and it is recommended that similar reports are prepared for other areas of Wales. If universal coverage is achieved it would enable the Welsh Government to accurately assess the conservation status of great crested newts across Wales and derive targets to achieve nationwide FCS. This would allow the accurate reporting of FCS of great crested newts as required by the European Commission.

9. REFERENCES

Amphibian and Reptile Conservation Cofnod and Countryside Council for Wales. 2010. *Determination and application of the concept of favourable conservation status to address conservation of great crested newts in north Wales.* CCW Contract Science Report No: 939, 94pp, CCW, Bangor.

Anon. 2009. *Wrexham Industrial Estate, Wrexham - Historical Review of Great Crested Newt Survey Data and Aerial Photography.* CCW, Bangor.

Arnell AP Wilkinson JW. 2011a. *Pilot modelling to inform determination of Favourable Conservation Status for the great crested newt.* CCW Contract Science Report No 961, 30pp, CCW, Bangor.

Arnell AP Wilkinson JW. 2011b. *Predictive Modelling of Key Herpetofauna Species in North Wales.* CCW Contract Science Report No 976, 27pp, CCW, Bangor.

Arnell AP Wilkinson JW. 2013. *Spatial Conservation Status Modelling of the Great Crested Newt in Anglesey and North-East Wales.* CCW Contract Science Report No 1044, 54pp, CCW, Bangor.

ARG UK. 2010. *ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index*. Amphibian and Reptile Groups of the United Kingdom. Unpublished.

Beebee TJC. 1975. Changes in the status of the great crested newt *Triturus cristatus* in the British Isles, 1. *British Journal of Herpetology,* **5**, 481-486.

Beebee TJC. 1977. Habitats of the British Amphibians, 1. Chalk uplands. *Biological Conservation,* **12**, 279-293.

Beebee TJC Griffiths RA. 2000. *Amphibians and Reptiles: A Natural History of the British. Herpetofauna.* HarperCollins Publishers, London.

Beebee T Grayson R. 2003. Site assessment and protection. In, Gent, T. & Gibson, S. *Herpetofauna Workers Manual.* Joint Nature Conservation Committee, Peterborough.

Bormpoudakis D Foster J Gent T Griffiths RA Russell L Starnes T Tzanopoulos J and Wilkinson J. 2015. *Developing models to estimate the occurrence in the English countryside of Great Crested Newts, a protected species under the Habitats Directive* Department of Environment, Food and Rural Affairs commissioned research *[Defra Project Code WC1108]* http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=19272

Cooke AS. 1986. Studies of the crested newt at Shillow Hill. *Herpetofauna News,* **6,** 45-47.

Cooke AS Scorgie HRA. 1983. *The status of the commoner amphibians and reptiles in Britain.* Focus on nature conservation 3. Nature Conservancy Council, Huntingdon.

Countryside Council for Wales. 2008. *Core management plan including conservation objective for Johnstown Newt Sites Special Area of Conservation (SAC) EU SAC Code UK0030173*. CCW, Bangor.

Elith J Graham CH Anderson RP Dudı´k M Ferrier S Guisan A Hijmans RJ Huettmann F Leathwick JR Lehmann A Li J Lohmann LG Loiselle BA Manion G Moritz C Nakamura M Nakazawa Y Overton J McC Peterson AT Phillips S J Richardson K S Scachetti-Pereira R Schapire RE Sobero´n J Williams S Wisz MS and Zimmermann NE. 2006. Novel methods improve prediction of species' distributions from occurrence data. *Ecography*, 29, 129-151.

English Nature. 2001. *Great crested newt mitigation guidelines*. English Nature, Peterborough.

European Habitats Forum. 2006. *Towards European Biodiversity Monitoring. Assessment, monitoring and reporting of conservation status of European habitats and species*. Wien, Cambridge, Bruxelles. 80 pp.

Evans, D Arvela M. 2011. *Assessment and reporting under Article 17 of the Habitats Directive Explanatory Notes & Guidelines for the period 2007-2012 Final version. July 2011* European Topic Centre on Biological Diversity https://circabc.europa.eu/sd/d/2c12cea2-f827-4bdb-bb56-3731c9fd8b40/Art17%20-%20Guidelines-final.pdf, http://www.sopsr.sk/natura/dokumenty/reporting/art17_guidelines.pdf

Fletcher DH Wilkinson JW. 2013. Options for GCNs in Wrexham: Comparative impact modelling to inform planning. Amphibian & Reptile Conservation Report. November 2013 ARC, Bournemouth

Griffiths RA Raper SJ. 1994. A review of current techniques for sampling amphibian communities. JNCC report no. 210*.* Joint Nature Conservation Committee, Peterborough.

Griffiths RA Williams C. 2000. Modelling population dynamics of great crested newts (*Triturus cristatus*): a Population Viability Analysis. *Herpetological Journal.* **10,** (4), 157-163.

Jehle R Thiesmeier B and Foster J. 2011. *The Crested Newt – A Dwindling Pond Dweller.* Laurenti-Verlag, Bielefeld, Germany.

JNCC. 2013. *Guidelines for the Selection of Biological SSSIs*. Joint Nature Conservation Committee, Peterborough.

Gleed-Owen C. 2007. *Development of a National Amphibian and Reptile Recording Scheme (NARRS), Phase 2 - Historic, current and future conservation status of the great crested newt (*Triturus cristatus*) in northeast Wales*". CCW Contract Science Report No. 789, CCW, Bangor.

Grayson RF. 1994. Surveying and monitoring great crested newts. In Gent, T. & Bray, R. (eds). *Conservation and management of great crested newts: Proceedings of a symposium held on 11 January 1994 at Kew Gardens, Richmond, Surrey.* English Nature, Peterborough.

Halley J.M Oldham RS and Arntzen, J.W. 1996. Predicting the persistence of amphibian populations with the help of a spatial model. *Journal of Applied Ecology,* **33**, 455-470.

Hilton-Brown D Oldham RS. 1991. *The status of the widespread amphibians and reptile in Britain, 1990, and changes during the 1980's.* Nature Conservancy Council Contract Surveys 131. Nature Conservancy Council, Peterborough.

Lande R. 1995. Mutation and Conservation. *Conservation Biology.* **9**, 782-791.

Langton T Beckett C and Foster J. 2001. *Great Crested Newt Conservation Handbook.* Froglife, Halesworth.

Nicholson M Oldham RS. 1986. *Status of the warty newt* Triturus cristatus. Nature Conservancy Council CSD Report no. 703. Nature Conservancy Council, Peterborough.

Nicolet P Weatherby A Biggs J Williams P and Hatton-Ellis T. 2007. *A preliminary assessment of Important Pond Areas (IAPs) in Wales.* Pond Conservation: Policy and Research, Oxford.

Oldham RS 1994. Habitat assessment and population ecology. . In Gent T & Bray R (eds). *Conservation and management of great crested newts: Proceedings of a symposium held on 11 January 1994 at Kew Gardens, Richmond, Surrey.* English Nature, Peterborough.

Oldham RS Swan MJS. 1997. Pond loss and amphibians, a historical perspective. In Boothby, J. (ed): *British Pond Landscapes: Action for Protection and Enhancement: 3-16.Proceedings of the UK Conference of the PondLife Project held at University College, Chester, 7th-9th September 1997.* The PondLife Project, Liverpool.

Oldham RS Keeble J Swan MJS and Jeffcote M. 2000. Evaluating the suitability of habitat for the great crested newt. *Herpetological Journal.* **10**. 137-143.

Swan MJS Oldham RS. 1989. *Amphibian communities. Final report.* Contract number HF3-03-332. Nature Conservancy Council, Peterborough.

Swan MJS Oldham RS. 1993. Herptile sites, Volume 1: National Amphibian Survey. *English Nature Research Report Number 38*. English Nature, Peterborough.

Wilkinson JW Wright D Arnell AP and Driver B. 2011. *Assessing population status of the great crested newt in Great Britain.* Natural England Commissioned Reports, Number 080. Natural England, Peterborough.

Williams P Biggs J Crowe A Murphy J Nicolet P Weatherby A and Dunbar M. 2010. *Countryside Survey: Ponds Report from 2007*. Technical Report No. 7/07 Pond

Conservation and NERC/Centre for Ecology and Hydrology, 77pp. (CEH Project Number: C03259).

Data Archive Appendix

Data outputs associated with this project are archived on server–based storage at Natural Resources Wales.

The data archive contains:

The final report in Microsoft Word and Adobe PDF formats.

A series of GIS layers on which the maps in the report are based with a series of word documents detailing the data processing and structure of the GIS layers

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue https://libcat.naturalresources.wales (English Version) and https://catllyfr.cyfoethnaturiol.cymru (Welsh Version) by searching 'Dataset Titles'. The metadata is held as record no 118712

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