Great Crested Newt

Conservation Handbook

Acknowledgements

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Great Crested Newt
Conservation Handbook

by Tom Langton, Catherine Beckett and Jim Foster

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Contents

Abbreviated names in this text

CCW	Countryside Council for Wales
DEFRA	Department for Environment Food and Rural Affairs
EA	Environment Agency
EN	English Nature
FWAG	Farming and Wildlife Advisory Group
JNCC	Joint Nature Conservation Committee
NAW	National Assembly for Wales
SE	Scottish Executive
SEERAD	Scottish Executive Environmental Rural Affairs Department
SEPA	Scottish Environment Protection Agency
SNCO	Statutory Nature Conservation Organisation
SNH	Scottish National Heritage

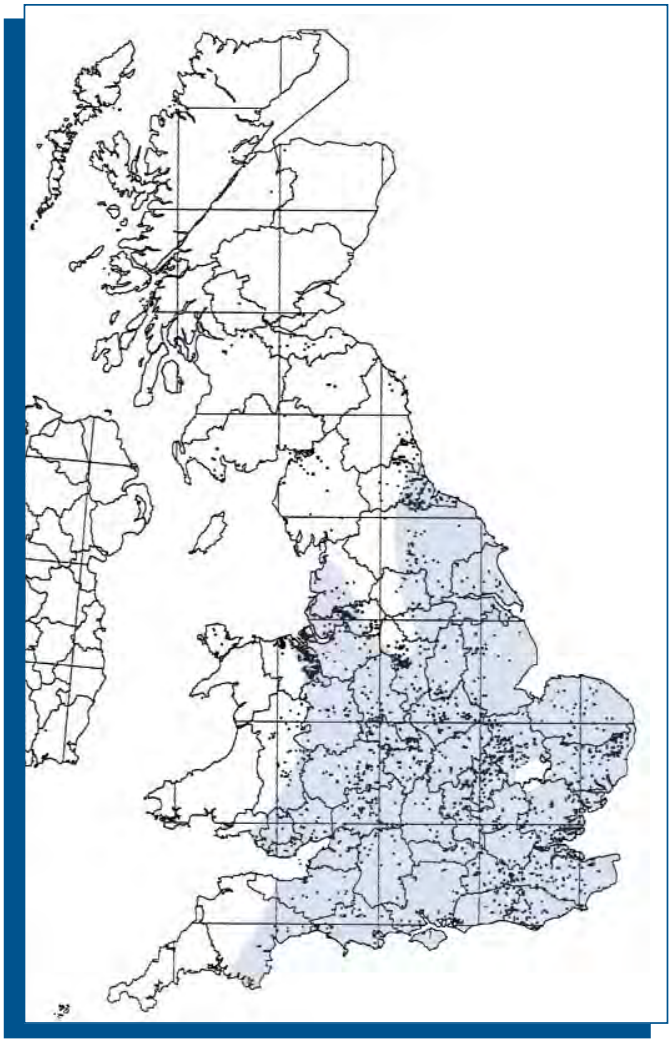
Preface

Great crested newts share a particularly unfortunate history with many other animals in Britain. They declined very markedly during the latter part of the twentieth century, primarily as a result of agricultural intensification. Like the other amphibians, great crested newts need suitable ponds surrounded by good quality terrestrial habitat if they are to prosper. Changes in farming practices have had seriously adverse effects on both of these essential requirements. Ponds have disappeared through a combination of neglect and deliberate destruction. They have become increasingly redundant from the agricultural point of view, reducing the extent (and thus crop yield) of arable fields, and often superfluous to requirements for livestock since the advent of piped water systems. Intensive ploughing, spraying and until recently stubble burning in arable areas has also made the landscape around many ponds increasingly inhospitable to amphibians. All too many of our remaining countryside ponds are almost lifeless, polluted puddles isolated in agricultural prairies.

Great crested newts are rather more fastidious in their habitat requirements than our other widespread amphibian species, and as a result, have declined more severely. Nevertheless, their needs are now quite well known and the possibility to reverse recent declines lies clearly before us. Ponds suitable for great crested newts can be restored and new ones created. Terrestrial habitat between ponds can be managed in newt-friendly ways to strengthen metapopulation structures. The methods for achieving these objectives are tried and tested; we know they can work. New words such as **pondscapes** and **pondways** are entering the conservation vocabulary as we become increasingly aware of the importance of habitat continuity.

The UK's great crested newt Species Action Plan (SAP) sets out how effective conservation can be achieved. Together with an associated Work Programme (WP) these documents should pave the way for a major reversal in the great crested newt's unenviable recent fate. This handbook is intended to supplement the SAP and WP, with the detailed procedures essential for putting them into action on the ground. At last there is cause for optimism that great crested newts are on the way back.

Trevor Beebee
University of Sussex.



Great crested newt breeding sites (dots) and the area (blue) where early 20th century pond numbers exceeded about 1 per square km in the species known range in lowland England and Wales. Map adapted from Oliver Rackham (Ref 72). Great crested newt data from Froglife Great Crested Newt Sites Register (Froglife 1998).

Introduction

The great crested newt *Triturus cristatus* is Britain's most strictly protected amphibian. It is included in Annexes II and IV of the Habitats Directive due to the considerable decline that it underwent during the last century. Like nearly all amphibians, the great crested newt is dependent on water-bodies for breeding but usually spends most of its life on land. Despite a widespread distribution, the status of the great crested newt is considered to be of concern because populations are still being lost or damaged. The main factors in the decline of this species are:

- The deliberate filling in or destruction of ponds
- Pond loss through natural succession
- Introduction of fish
- Chemical pollution and nutrification of breeding sites
- Loss of terrestrial habitat
- Habitat fragmentation
- Habitat management which renders sites unsuitable for great crested newts
- Deterioration of ponds through neglect or misuse

To counter these factors, and therefore to conserve and enhance great crested newt populations, the application of a wide range of measures is necessary.

- **Survey:** It is estimated that only around one sixth of breeding ponds have been identified, and in some geographic areas the knowledge of distributions is very much poorer than this. Further field survey is required to improve this situation.
- **Habitat management:** Favourable habitat management, restoration and creation need to be encouraged by ensuring that clear and concise practical advice is available, and by offering incentives to landowners for co-operation.
- **Formalising newt interest in planning procedures:** Great crested newts are threatened by a wide range of land uses, including agriculture, forestry and development. The recognition of great crested newt sites by Local Planning Authorities in terms of both development control and strategic planning is vital to protect them from land use threats. In most areas this is still a long way from being put into practice adequately.
- **Implementation of legislation:** The legislation protecting great crested newts is often not interpreted in a way that most benefits conservation, nor is it effectively enforced, so these areas require further attention.

This publication aims to assist those undertaking practical conservation work for the great crested newt. It provides guidance so that the conservation objectives can be achieved most effectively. In particular, it focuses on habitat management and survey to locate great crested newts, with supporting information on ecology, legislation and site protection.

It has been designed to be used primarily by the following groups: volunteer surveyors; wardens, rangers, landowners and others who manage sites; local authority staff involved in protecting sites; statutory nature conservation agencies and voluntary conservation organisations involved with great crested newt sites. Although it cannot be exhaustive, it should provide enough detail to assist many of the practical tasks outlined in the great crested newt Species Action Plan and in the national Work Programme.

This handbook is a guide to proactive conservation, and not mitigation measures such as habitat and newt translocation at sites subject to a change in land use. These cases are likely to require application of expert knowledge specific to each circumstance. The generalised account of great crested newt ecology has been put together using a range of published and unpublished sources, which are listed in the references.

Ecology

Identifying great crested newts

The great crested newt is the UK's largest newt, reaching a maximum adult overall length of up to about 170mm, although size varies between populations. Mature female length ranges from 90 - 170mm, typically reaching 110-130mm. Male newts may mature at a length of only 85mm (normally more), and grow to an adult maximum of about 150mm, though more typically 110-120mm. Adults are easily distinguished from the two other native newt species, the smooth and palmate newts, by size and colouring; these two smaller species reach a maximum of around 100mm. The skin of adult crested newts is granular in appearance. It has a black or dark brown background colour with darker spots, that in males extend onto the crest. It has very fine white spots on the lower flanks.

The male (above) has a jagged crest along the back that dips at the rear of the abdomen, and a smoother edged crest above and below the tail. The crest decreases in size outside the breeding season. There is a white, silver or grey stripe running from the tail tip along the central, fleshy section of the tail that fades as it approaches the abdomen. Females (below) lack a crest and white tail stripe, but have a yellow-orange stripe running along the bottom edge of the tail. Both sexes have a vivid orange or yellow belly with an irregular pattern of dark black spots or blotches. On land, the great crested newt appears virtually black, and in males the crest shrinks back against the body. Males of all newts have a relatively more swollen cloaca (vent).

The adult male smooth newt (above) has a crest that is wavy rather than jagged, and it does not dip at the start of the top of the tail. It lacks obvious granules in the skin, and is generally lighter in overall coloration, often with roundish black spots. The belly may be superficially similar in appearance to that of the great crested newt, but the dark markings tend to be more rounded and usually fewer in number in adults.

Male palmate newts (above) have a protruding filament at the tail tip, with a low ridge along the back rather than a crest. Female smooth (below) and palmate newt (bottom) are very similar in colour and pattern, usually with a beige or brown background colour, with lighter undersides.

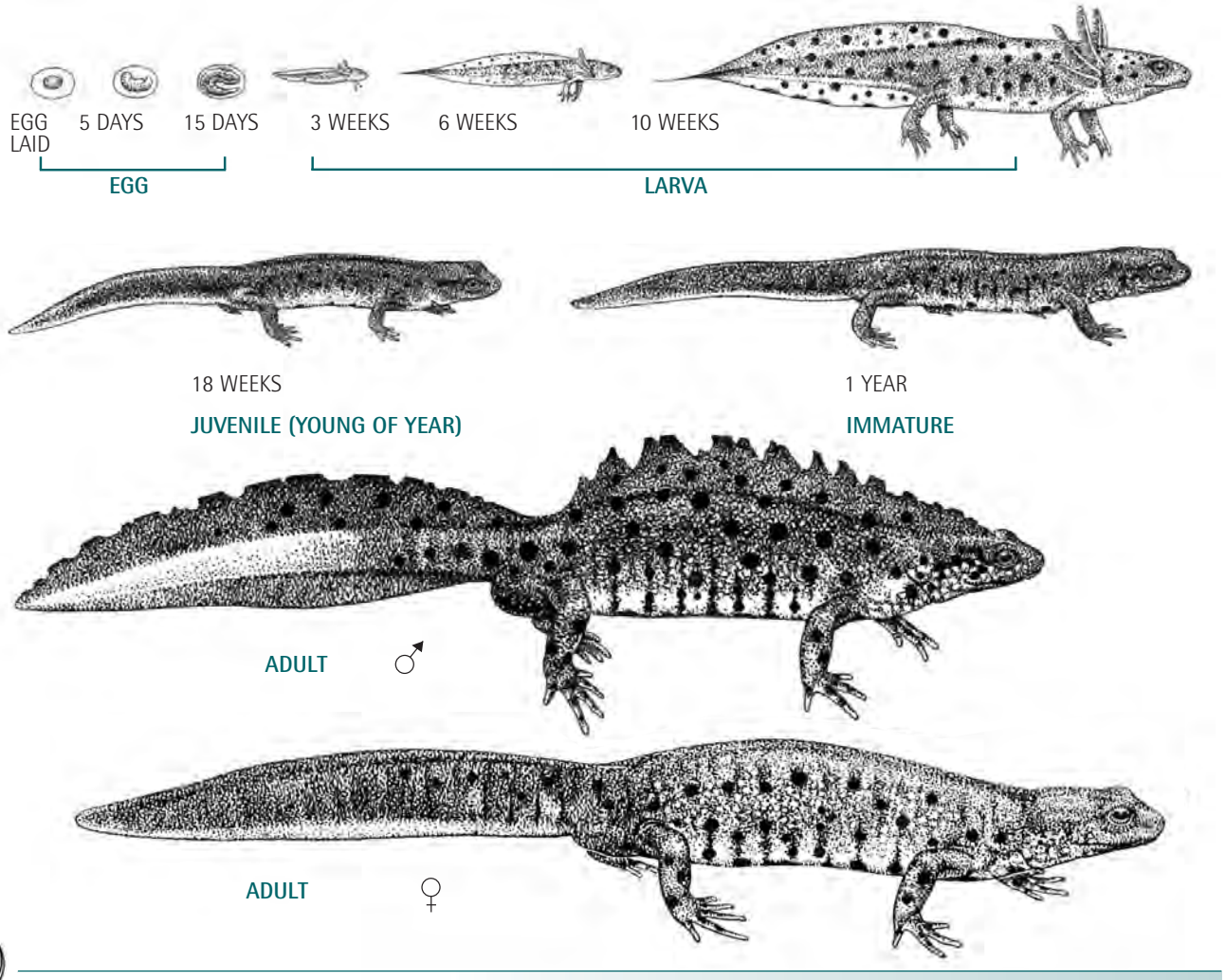
Great crested newt eggs have a jelly capsule around 4.5 - 6mm long, with a light yellowish centre, while smooth and palmate newts lay greyish-brown or dirty white coloured eggs, surrounded by a transparent jelly capsule that is about 3mm across. The larvae of great crested newts can be distinguished from the other species by the presence of a filament at the tail tip and black blotches over the body, tail and crest. They can be very hard to tell apart when they are under 20mm in length. The smooth and palmate newt larvae (which cannot be distinguished by eye) are light beige or brown, sometimes with fine black speckling. Great crested newt larvae are considerably larger, reaching a length of 50 - 90mm before metamorphosis (compared to 30 - 40mm for the smaller species).

Newt larvae (tadpoles) - mid-term, approx life size

Metamorphosis of great crested newt (life size)

On leaving the water, great crested newt juveniles are similar in appearance to adults, apart from lacking the black spots/patterns that develop on the orange belly as they grow. The pattern becomes 'fixed' as the adults approach maximum size. Males start to develop the secondary sexual characteristics in their second or third season. This is marked by the appearance of the whitish tail stripe and the crest, and normally occurs when newts reach 90 - 120mm in total length. It is impossible to sex great crested newt juveniles externally, as the crest and tail stripe are absent.

Fig. 1 Typical growth and development of great crested newt shown at approximately life size



Exotic (introduced) European newt species can be encountered occasionally as the result of past release by universities, biological supply companies and hobbyists. Continental forms of crested newt are very difficult to tell apart from native British great crested newt without expert help and analysis. Crested newt species are known to hybridise and the spread of non-native species and their hybrids is a cause for concern. Other species such as alpine newt and marbled newt may also have life stages that are, to some extent, similar to those of great crested newts and have been mistaken for them in the past. If you are suspicious about the identity of newts, get them checked by an expert. The release of exotic newts in the wild is undesirable and unlawful and they have an effect on native species. Prompt removal of exotics can help prevent their spread.

Crested newts from outside Britain look very similar to our own. Those from more distant locations in central, southern and eastern Europe vary slightly in body/limb length ratios, in colour patterns and other subtle ways

Male alpine newt adult

Male alpine newt (belly lacks spots)

The breeding migration

As the newt breeding season immediately follows winter dormancy, adult great crested newts mature the eggs and sperm they will need for the next year in the previous summer and autumn. Adult newts may feed from the start of the breeding season in order to replenish reserves. Newts that have bred for at least one season may emerge from hibernation with their eggs and sperm ready for the new spring breeding season. Adult great crested newts normally begin moving from their over-wintering land sites between February and April. The timing of this movement is governed by a number of factors, particularly temperature and rainfall. The first of the newt emergence nights are normally wet or damp, with air temperatures above 4 - 5°C, following several days when the temperature has been just below this level. This makes it less likely that newts will be stimulated to emerge too early by a single unseasonably warm winter's day, only to then find themselves above ground or in the water when freezing conditions return. Movement over land occurs almost exclusively at night.

The migration of newt populations to breeding ponds is normally staggered, with some adults not reaching the pond until May. The earliest arrivals tend to be males. Migration dates are often later to the north and east of Britain, as they are for frogs and other amphibians. There is considerable variation between individuals in the amount of time spent in breeding ponds. Having entered in early spring, adult newts may spend anything from one day to seven months or more in a pond. At one well-monitored site in England, a third of the population occupied the pond for less than ten days. Therefore, shortly after the main movement into ponds, there may be a period of emigration when newts leave to forage or disperse on land. Newts may also repeatedly move in and out of the breeding pond, as well as between ponds, over the spring and summer.

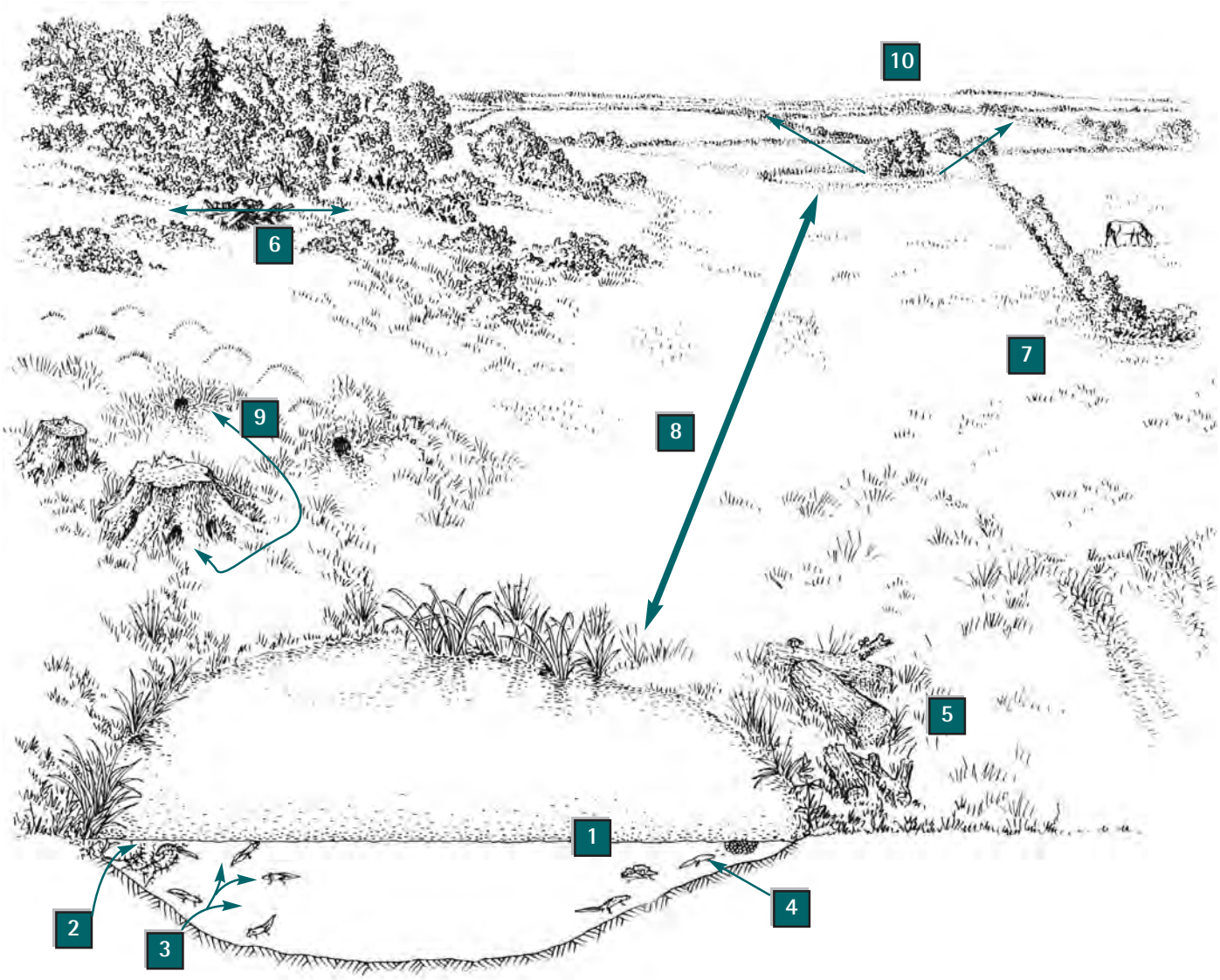
The main period when breeding adults generally leave the pond is between late May and July. This movement occurs gradually, with most newts having left by August. A proportion however may stay on until October and even, in some ponds, over winter amongst pond sediment and debris. Emigration from the pond usually coincides with periods of rainfall, and there is evidence that newts may leave a pond at or around the same point they entered it, indicating that they return to favoured parts of the terrestrial habitat that they somehow recognise. After leaving the pond, newts generally seek underground crevices or concealed above ground refuges.

Adult activity on land

On land, great crested newts generally engage in searching for food or dispersing and resting. In summer and autumn when conditions can be very dry for many weeks or in winter when conditions are too cold, they are not seen above ground.

Foraging above ground occurs mostly at night, and newts feed over a range of habitat types that support invertebrate prey. Newts may also forage for food underground in mammal

Fig. 2 Habitat use by great crested newts at a two-pond site



1 Display and courtship in the open pond margins
2 Egg laying on floating and submerged marginal vegetation
3 Larvae forage for invertebrates in all zones of ponds
4 Adults feed on other amphibians and invertebrates
5 Adults, immatures and juveniles under refuges during day
6 Foraging and over-wintering in undergrowth and litter layer
7 Foraging in rough grassland, pasture and hedgerow
8 Movement of adults between ponds
9 Refuge in mammal burrow and tree stump voids
10 Dispersal of some adults and immatures to distant sites

burrows during the day. They have two strategies: active searching for food and 'sit and wait'. 'Sit and wait' tends to be used at the edge of a refuge, burrow or crack and is more prevalent when the temperature and dampness suitable for foraging are borderline. Rough grassland, scrubland and woodland appear to be favoured foraging habitat. Newts are generally more active on warm, wet evenings or those following rain. They feed on a range of invertebrates, such as earthworms, insects, spiders and slugs. They seem to be rather unselective and their diet at a given place will probably reflect the availability of small, slow-moving invertebrates in the area. Great crested newts often take daily refuge under rocks, logs and discarded debris, where invertebrates collect, and so sheltering in these locations provides food as well as protection from predators and the extremes of weather. When in ponds, newts can be active during the day, especially when cold nights are punctuated by warm sunny days. In general, however, there seems to be more activity at night when newts move up from the centre of pond bases into the shallows.

In winter, when night temperatures fall below about 5°C, great crested newts enter a period of low activity. The point in the year at which this occurs will vary with annual variations in weather, but generally begins in late September to mid October and most animals are dormant by the end of November. An overwintering site for a great crested newt may, like day refuges, be an underground crevice or crack, such as a void in a tree stump or bank, or under refugia such as rock piles or dead wood. It may be just deep in loose soil at, or close to, their summer resting places. At many sites, great crested newts

overwinter in woodland, where the tree canopy, undergrowth and litter layer help buffer the ground from exposure and freezing. A proportion of adult and immature great crested newts are more likely to over-winter in or close to the pond edge at sites with dense pond edge vegetation and nearby features such as mammal burrows or old tree stumps.

Young male great crested newt

Smooth newt adult female (left), male (right) and juvenile showing comparatively pale colouration.

Adult activity in water

Great crested newts have an elaborate courtship. This is made all the more spectacular by the male secondary sexual characters, which are the high, jagged crest and light-coloured tail-stripe. Sexual characteristics reach their maximum size and intensity during the breeding season (normally April - May). The male often chooses a temporary display area, which tends to be a more open, less vegetated part of the pond bottom. This is normally near the shallow margins of a water-body, but can be at a depth of up to about one metre. Areas suitable to perform courtship display may be defended by males, especially in ponds where such places are in short supply, as they are important to breeding success. An individual male may use one or more display areas in a given night. Male newts sometimes mimic females and lure other males away from display areas, in order to take over favoured spots.

The male employs a range of display behaviours, including rocking, leaning, tail-whipping and fanning. These latter two behaviours waft sexual attractants (pheromones) towards the female. Courtship movements take place in a particular order but may vary with the receptiveness of the female. If the female exhibits an interest in the full display, the male then leads her away, quivering his tail. The female follows and touches the male's tail with her nose, signalling readiness for his deposition of a small white mass of sperm and jelly (spermatophore) on the pond bottom. The pair then move so that the female is in position to collect the spermatophore in her vent, after which fertilisation of her eggs takes place internally.

Great crested newts in courtship

Adult great crested newts also feed in their breeding ponds, which can offer a rich and varied supply of prey. Most obvious in the early season are frog tadpoles, which in some cases can be eradicated completely by newt predation. The adults and

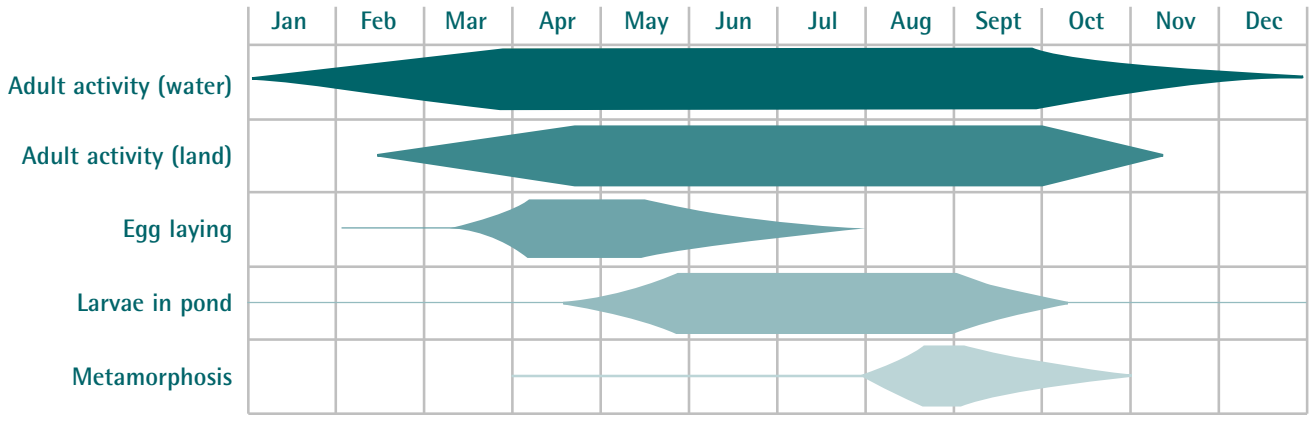


Fig 3 General timing and level of great crested newt activities over a calendar year

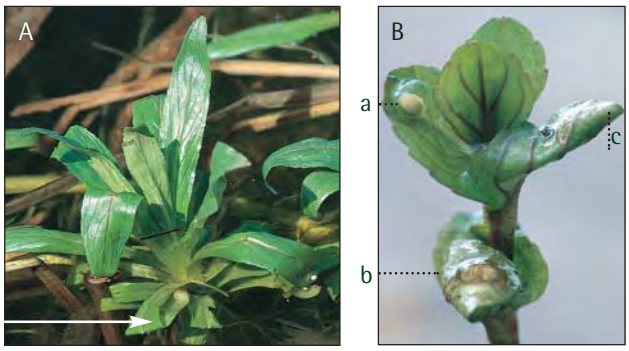
young of smooth and palmate newts and their tadpoles, and even a few toad tadpoles can also be taken. A range of invertebrates such as water lice *Asellus* spp., water shrimps, small snails, lesser water boatmen *Corixa* spp. and fly larvae (especially phantom midge *Chaoborus* spp). may be eaten. Zooplankton such as water fleas *Daphnia* spp., are a very important part of the diet because of the large biomass that builds up and becomes available as food for newts of all sizes.

Egg-laying

Female, noticeably plump with eggs at the start of her breeding season. Note the orange-brown colouration when seen at night by torch light

A breeding female will lay about 250 eggs per season, each egg individually deposited, typically on the submerged leaf of a marginal plant, under water and often close to the surface. The hind legs and feet are used to wrap the leaf around the egg, which is surrounded by an adhesive substance ensuring that the leaf encloses and protects it. A wide range of plants with thin and easily folded leaves are used for egg-laying (see *Planting new ponds* section page 28). Great crested newts may preferentially lay eggs on grasses (e.g. sweet or flote grasses *Glyceria* spp.), small wide-leaved plants (e.g. water mint *Mentha aquatica*), or narrow-leaved plants (e.g. water forget-me-not *Myosotis scorpioides*). Eggs are sometimes laid in folded dead or decomposing leaves, from the previous year's growth such as those of *Typha* sp. As well as aquatic plant species, terrestrial plants whose leaves dip into the water (or are submerged in

Female newt folding an egg into a water plant leaf



A Typical leaf folding in submerged leaf of great hairy willow herb

B Great crested newt eggs deposited on water mint a) freshly laid on surface, b) developing c) hidden in folded leaf

heavy rain) may occasionally be used; terrestrial grasses, bramble *Rubus fruticosus* and nettles *Urtica dioica* are examples. Sometimes eggs are left on the surface of leaves, on stalks, algae, old logs, roots and stones and debris such as plastic bags.

At the start of the breeding season females may lay just a few eggs per night, but as air and then water temperatures rise, by April they may lay ten or so eggs each day, with consecutively laid eggs often deposited on the same plant. On grasses and narrow leaved plants, several eggs can be laid on the same blade, leading to a repeatedly folded, concertina-like appearance. The main egg-laying season is mid-April to mid-June in most areas. However, eggs can sometimes be found in small numbers from February and into late July.

For more information on egg identification, refer to the *Survey Techniques* section on page 44.

Egg and larval development

Hatching rates of great crested newt eggs are dependent on temperature. Development varies according to the date of egg-laying and the type of pond. For example, it may take two weeks for an egg to hatch out in a warm, unshaded, shallow pond in June, while it could take three times as long if laid earlier in February or in a cool, heavily tree shaded pond. The timings given in the next paragraph are consequently typical values for eggs laid in mid-season in average pond conditions but they can be greatly slowed in cold weather.

Soon after being deposited, the spherical egg differentiates to form distinct head, torso and tail-bud regions. Due to a chromosome abnormality, 50% of great crested newt eggs die within a week or two at the early tail-bud stage. For the survivors, gills and balancers emerge during the second week, and striping starts to form over the cream background body colour. The eyes develop, body movement increases and hatching from the thin, clear egg-case surrounding occurs at around the 3rd-4th week. At first the newly hatched larva is a poor swimmer, and remains immobile, attached to the egg capsule or vegetation by the balancers. The forelimbs develop, followed by the hind limbs, and swimming ability increases

Great crested newt egg after a few days development in warm water

with short bursts of movement between resting. The larvae are a yellow colour with two grey stripes. At the same time, the gills increase in size and the mouth develops. By the sixth week from egg laying, the stripes have receded and black blotches become more visible on the tail fins. Larvae are tiny and hard to find until June. In July they are much bigger and easier to see, swimming in open water or resting on the pond base.

Larval great crested newts are highly predatory, feeding almost exclusively on aquatic invertebrates and small larval amphibians. Larval growth is greatly influenced by prey availability. There appears to be little selection, with prey being taken in relation to its availability in the pond. After the first few weeks, the larvae either swim and rest in mid-water, catch prey, or lie on the bottom of the pond in colder weather.

Great crested newt larva, just after hatching

Larvae can be seen in the water column in daylight although they are generally more active at night. Towards the end of the larval development period, when swimming ability decreases, great crested newt larvae become more benthic (living on the pond bottom), moving more into the margins of the pond. Known prey items include water fleas *Daphnia*, copepods, fly larvae, water lice *Asellus* spp., water shrimps, mayfly nymphs, young newt larvae (including great crested), and small common frog and common toad tadpoles.

Over the larval period, the overall body colouring becomes gradually darker, with black blotches spreading over the tail and body. The orange and black belly pattern starts to form between the forelimbs about mid way through the summer. Around this time, the gills and tail 'fins' gradually resorb into the body, and the previously smooth skin texture becomes more granular. The limbs and tail become more robust. After around 16 weeks, metamorphosis is completed when the gills and tail fins are totally resorbed, and the juvenile newt emerges from the pond onto land. Sizes of newly metamorphosed juvenile great crested newts vary greatly from around 45-90mm, more typically 60-75mm total length. Juvenile newts are known to emerge from ponds in a directional (i.e. non-random) manner. There is some evidence that they can recognise and follow the scent trails of other great crested newts. This might assist in finding high quality foraging habitat and refuges upon first emergence. For successful emergence, breeding ponds must normally retain water until the end of August.

Great crested newts normally reach sexual maturity aged between two and four years. During the intervening period, the immatures forage on land and sometimes in water, with some animals dispersing to the vicinity of new ponds. Growth and development again depends largely on prey availability, with maturity normally occurring sooner in more food-rich sites.

Males tend to mature sooner than females. Great crested newts can be relatively long-lived and have been recorded living up to fourteen years in the wild.

Population size and structure

Newts can fluctuate in number considerably from year to year for natural reasons. The drying out of ponds, a high number of predators, cannibalism and competition can all lead to major reductions in recruitment of young newts. These important factors may interact to affect different stages of the newt life cycle in different ways. For example, if fish colonise a temporary pond one spring, they may eradicate the whole larval cohort of that year but then suffer a local extinction themselves when the pond dries out in September. The result will be that there is no recruitment to the adult newt population from that year. If the pond refills as normal in winter and fish do not subsequently recolonise the pond, this incident may have little or no bearing on the overall viability of the population in the long term, due to the fact that newts can live for ten years or more.

Great crested newts suffer their heaviest predation during the egg and larval stages of their life cycle. Eggs are taken by water beetles, snails, newts, fish, waterfowl (indirectly with vegetation) and a few wading and diving birds. Eggs that become unwrapped from the leaf in which they were laid are likely to be more vulnerable. Fungi can also attack newt eggs. Larvae are prey to invertebrates such as water beetles and dragonfly larvae, as well as fish and even other great crested newts. During metamorphosis, the young newt's skin develops

glands containing toxins that make them unpalatable to most predators. Once individual newts reach the immature and adult life stages, their chance of survival on an annual basis increases dramatically. Even so, some birds (such as herons) as well as grass snakes have been known to take adults. It seems likely that some nocturnal mammals (rats, hedgehogs, foxes and badgers) may also prey on them occasionally.

Competition

Great crested newts may compete for food (on land and in ponds), space (particularly male display areas during the breeding season), and for egg-laying substrates in poorly vegetated ponds. The intensity of competition, and the effect that it has can vary enormously. Competition for food at the larval stage for example, may result in a smaller sized individual at metamorphosis, delayed emergence from the pond, or increased aggressive encounters between larvae. Even in established, nutrient rich ponds the supply of invertebrate food may be limiting. Other animal species may also compete with great crested newts for resources.

Metapopulations

Great crested newts often exist in metapopulations. A metapopulation is a group of associated populations. That is, a metapopulation is made up from newts which breed in, and live around, a cluster of ponds. There will be some interchange of newts between ponds, even though most adults consistently return to the same pond to breed. Metapopulations are much less vulnerable to habitat changes than populations based on single breeding ponds. For example, the early drying up of one pond in a cluster of, say four ponds, will not threaten the breeding success of all animals in the locality. As great crested newts can be relatively long-lived, populations can survive several years without successful breeding. Ponds will vary in their suitability for egg survival and larval development. Productive or 'source' ponds produce lots of young newts while unproductive or 'sink' ponds may not contribute to recruitment. Sometimes, ponds where surveys have shown lots of newts to be present are not productive, while those that are less obviously occupied by adults in the spring can produce many young.

Movement on land and colonisation of new ponds

Newts disperse over land to forage for food, and move between ponds. The distances moved during dispersal vary widely according to habitat quality and availability. At most sites, the majority of adults probably stay within around 250m of the breeding pond, so the density of individuals gradually decreases away from the pond. However, newts may well travel further if there are areas of high quality foraging and refuge habitat extending beyond this range. Disused railway lines and woodland patches in an intensive arable landscape are examples of such habitat. The rate of movement has been little studied, but some newts have been found to move 120m in one night. Like many amphibians, small numbers of individuals disperse as colonisers to distances of 1000 m or more.

Adult male great crested newt on land

Great crested newts are able to colonise a newly created or restored pond if, firstly it provides a suitable breeding habitat, secondly it is sufficiently close to the existing population, and thirdly, if the intervening habitat is conducive to dispersal and there are no significant barriers to movement. Newts may encounter ponds during their normal terrestrial activities, or may seek out new ponds, possibly using smell. In some cases, colonisation can be rapid, whilst in others it may take several years. Successful colonisation can be achieved by a small number of newts, with juveniles being the main dispersers. If breeding is successful the population may increase rapidly.

The distances over which newts have been known to colonise new ponds varies, but in general, nearer ponds are colonised more readily and quickly. Newts have been known to colonise newly dug ponds 300m away from existing ponds in the first year. The colonisation by newts of new ponds over 1000m distant from occupied ponds may take several years.

Habitat requirements

Great crested newts need both aquatic and terrestrial habitat. They prefer small to medium sized breeding ponds, around 50-250m^2, with smaller ponds being used more successfully where they occur in clusters. Very small ponds (e.g. garden ponds, small bog ponds) and larger lakes are usually not used. Breeding ponds should support aquatic vegetation for egg-laying. It appears that great crested newts prefer extensively vegetated ponds with a submerged plant cover of about two thirds of the pond and emergent/floating vegetation cover of one quarter to one half of a pond; in other words a well established, mid-succession pond. Ideally there should be open, less vegetated areas within the pond to allow adult males to display in clear view of females. Ponds that lack shade on the southern margin seem to be preferred.

Although great crested newts have been found in both acid and alkaline ponds (pH 4.4-9.5), they tend to be found more frequently in close to neutral or slightly alkaline water. They do not necessarily require permanent ponds. Temporary ponds which dry out every so often, can support very good populations, partly because periodic drying out reduces the

abundance of some of the most efficient newt predators such as dragonfly larvae and fish. Ponds also need to support a healthy (mainly invertebrate) fauna to provide food for developing larvae. Adult newts also feed in the water, so the presence of other amphibian spawn and larvae and invertebrates is beneficial. Great crested newts have been found to do particularly well where there are several suitable breeding sites in close proximity.

The primary requirements for great crested newt terrestrial habitats are that they should provide (1) permanent areas of refuge habitat for shelter in the more extreme weather conditions (i.e. drought in summer and freezing in winter), (2) daytime refuges, (3) foraging opportunities, and (4) dispersal opportunities. Permanent refuge habitat can be accommodated by ground cover of various kinds. Rough (especially tussocky) grassland, scrub and woodland may be used by newts as a shady refuge from hot, dry conditions. Broad-leaved woodland appears to be able to support higher densities of newts than coniferous woodland. With their permeable skins, newts are vulnerable to desiccation and need to be in contact with some form of moisture during the active season. For hibernation, newts seek out a location that affords them protection from winter conditions. Such places include underground crevices, tree root systems, mammal burrows, rubble piles or old walls. During the active season, immature newts and some of the breeding population may spend the daytime resting in thick ground cover, under shelters such as fallen trees trunks or in mammal burrows.

Foraging appears to take place in a range of habitats, but those where invertebrate prey are abundant, such as grassland and woodland, are particularly good. Movement between hibernation sites and breeding ponds, and also between neighbouring sites, can help to maintain populations (see below), and to allow this to happen there should be areas of suitable land habitat between breeding areas. Again, sufficient ground cover such as that provided by rough grassland is preferable, but great crested newts are able to cross stretches of bare open ground. Barriers to regulate migration and dispersal include roads with high traffic volume, built-up areas, large or fast-flowing rivers, and large expanses of intensively farmed land.

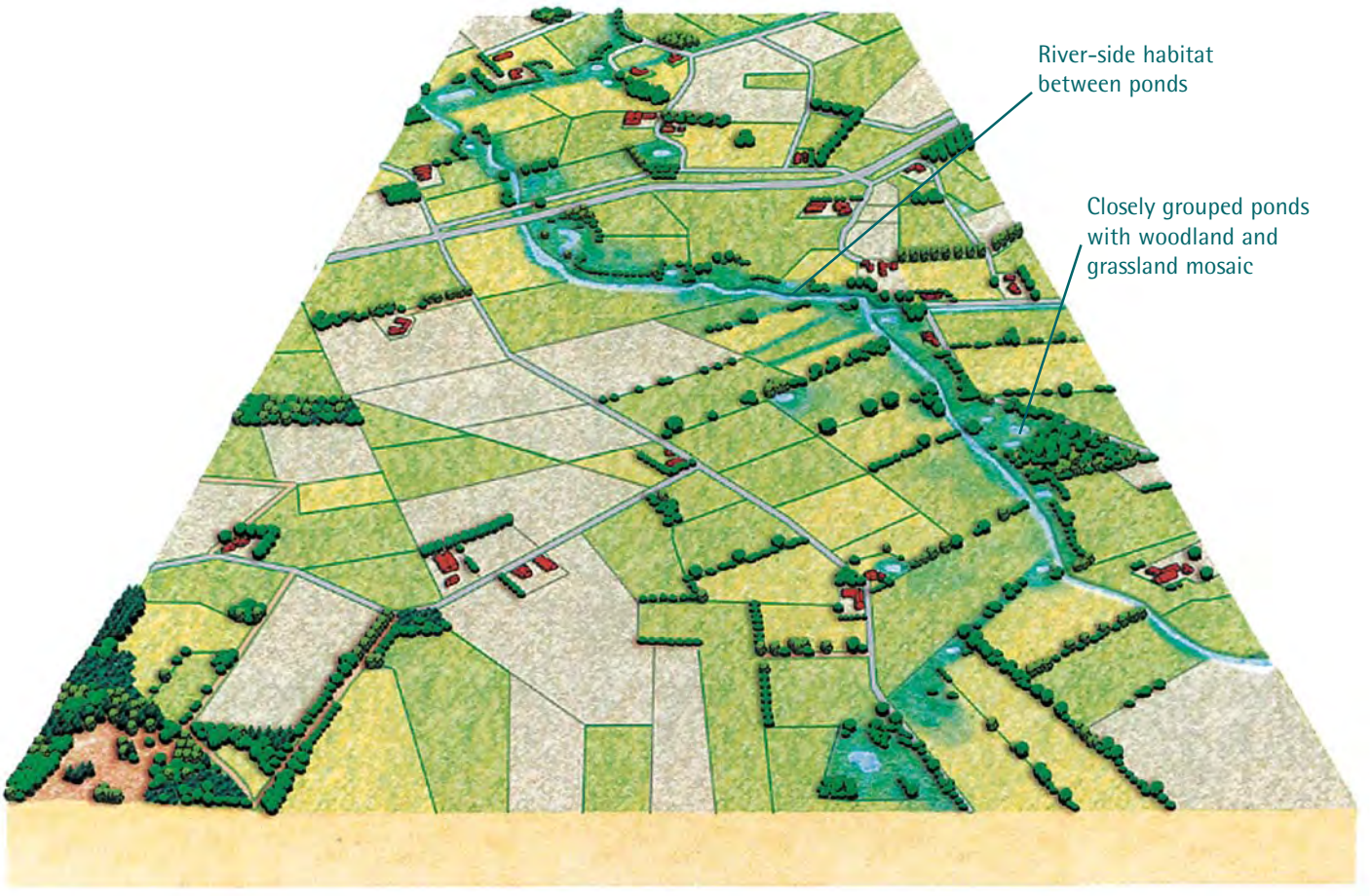
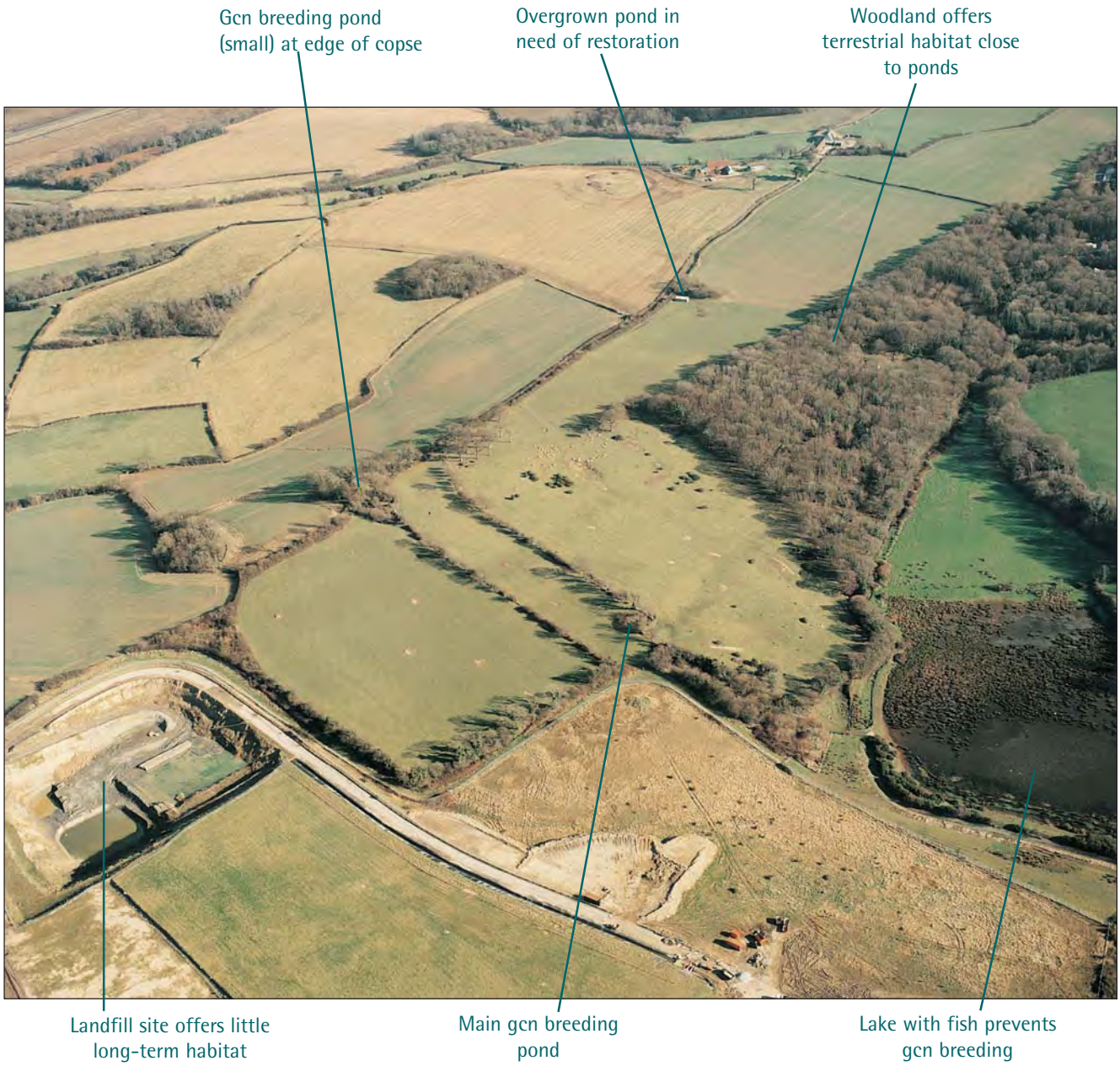


Fig. 4. Great crested newts in the landscape. Ponds act as stepping stones for newt dispersal in the landscape. In this example, features such as hedgerows and woodlands, ditches and river banks act as habitat corridors between the ponds and prevent the newt metapopulations from being isolated. Adapted from Alterra/The Pond Life Eco Project.



Typical great crested newt (gcn) distribution showing existing and potential breeding ponds in a metapopulation within mixed arable and livestock farming. The influence of urban land use (landfill site) encroaches from one side

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Habitat Types

GREAT CRESTED NEWT HABITATS IN THE UK

Great crested newts live in a wide range of mainly lowland habitats, and are by no means restricted to 'natural' environments. They are found primarily in artificially created ponds and terrestrial habitats, or at least those that have been greatly modified by human activities. The farmed landscape provides the most extensive broad habitat type. They appear able to colonise modified habitats relatively quickly if the conditions are favourable and there is a colonising source in the vicinity.

Natural and semi-natural aquatic habitats in which great crested newts occur include marshes, reed beds, spring fed ponds, pingos, bog pools, sand dune pools and ox-bow lakes. As these habitats have become reduced through human activities, overall they contribute less today to great crested newt survival than newer, man-made habitats. However, as these settings represent the "natural state" of the species they are of conservation significance. Some semi-natural locations support very large and regionally significant populations.

In some areas of high pond density, such as north-west England and north Wales, populations are distributed across a dense network of farm ponds within extensive metapopulations. Populations in this situation are considerably more robust than those where landscapes are fragmented by urbanisation or industry, or where populations are centred on small numbers of isolated breeding ponds. Here, metapopulation structure is poorly developed, with great crested newt colonies being more vulnerable to long-term declines and local extinctions.

Marl pits are typical farm ponds in Cheshire, England

Great crested newts occupy a slightly narrower range of habitat types than do the smaller native newts. Both palmate newts and smooth newts may breed in very small ponds (e.g. garden ponds) through to large lakes, while great crested newts tend to be found in ponds in the middle of this range. In addition, great crested newts seem to be more susceptible to the effects of silting and shading. This means that in most landscape types, they may be found in fewer ponds than their smaller relatives.

The lowland farmed landscape

Pastoral (stock grazing) farming is practiced on just under half of agricultural land in lowland Britain, and is a major land use in Wales and south-west, west and north England. The key features of pastoral farmland for great crested newts are that inter-pond distances are low, that grazing pasture can provide good quality foraging habitat which also permits dispersal, and that associated hedgerows, dry stone walls and copses provide additional habitats.

Pond with a fence to form a drinking bay for livestock, Flintshire, Wales

Sheep, horse and cattle grazed pasture are all used by great crested newts. Very short pasture is easily traversed by newts, and provides night time foraging, but little in the way of shelter. Ponds used to be dug out in large numbers on pasture to water stock and sometimes, where soil conditions were suitable, to provide marl, a form of lime rich fertilizer and soil

conditioner. These ponds were often dug in clusters of ten or more. Most were dug during the period from the mid 1700s to the mid 1800s. Average pond density at that time was 15-20 ponds per km^2 but could even reach around 40 ponds per km^2 in certain pond-rich areas. The average present day figure is usually very much lower.

Pond losses have been due to natural succession, agricultural intensification, and influences of increased housing, industry, commerce, recreation and road building. One of the main causes of pond loss has been their general neglect. Without management, many farm ponds have become over-shaded or silted up and have dried out permanently; around half of ponds in many areas are known to be in the late stages of succession.

As ponds reach late successional stages, their value to amphibians is greatly reduced or completely lost although their value to invertebrates can still be high

Although some small samples of the countryside suggest a local slowing of pond loss, relatively few new wildlife ponds have been created. New ponds are mainly dug for fishing or other amenity purposes, which limit their value for great crested newts. However, the total stock of ponds in some areas such as Cheshire, Lancashire and north-east Wales and parts of East Anglia still result in valuable pond-rich landscapes. In such places great crested newt occupancy reaches 30% and rarely even 50% of ponds on a localised basis, although 5% occupancy is perhaps more typical.

Arable (crop) farming is concentrated in eastern and south-central England and lowland Scotland, and is the predominant agricultural land use in just over half of farmed lowland Britain. Crop growing imposes a variety of restrictions on the landscape for great crested newts. For example, the use of pesticides can reduce terrestrial prey density, and fertilisers may run off into ponds causing eutrophication. In addition, ploughing, rolling, harrowing and similar farming practices may inhibit dispersal. However, the planting of hedges and retention or planting of woodland can provide dispersal, foraging and hibernation opportunities. Ditches may also provide extra breeding sites and dispersal routes. Ponds in arable areas have tended to be lost at a similar, if not slightly higher rate than that in pastoral areas.

Semi-natural grassland and woodland

Unimproved semi-natural grassland and woodland both provide excellent terrestrial habitat for great crested newts, and where there are ponds within colonisation range, good populations can result. Great crested newts may be found in acid, neutral or calcareous grassland. Deciduous, coniferous or mixed woodland may support newts, though extensive tracts of closed conifer plantation with little understorey and low pH ponds generally provide poor habitat. Great crested newts prefer deciduous woodland with vegetated ground cover and a considerable amount of dead wood on the ground. Areas recently subject to large-scale clear-felling may be of less value. This is perhaps due to greater exposure caused by temporary loss of ground cover, and ground compaction due to machinery, especially if natural regeneration is suppressed. The value of grassland and woodland is maximised when they occur together as a mosaic, in association with a number of ponds.

Small pond in intensive arable farmland, once used to provide a water supply for livestock

Mineral extraction sites

Most of the largest known great crested newt populations in Britain occupy disused (or partially disused) mineral extraction sites. The most common types are clay or chalk pits and stone quarries. Coal and sand pits are also used by newts. Typically, these activities leave behind large pits that fill with water, and disturbed surrounding land that becomes vegetated to some degree. Such sites may consist of a few large, deep excavations, or an extensive series of smaller, shallower workings. Great crested newts seem to be able to colonise these relatively quickly, and can reach large population sizes. The value of such sites decreases with age, particularly if fish are introduced or colonise naturally and spread causing newt populations to suffer heavy predation. Some types of workings have shallow temporary ponds in which fish populations cannot develop.

Chalk pit in north Kent, England: flooded following chalk extraction for the cement manufacturing industry. These are often warm, sheltered places with a rapid (aquifer) water supply in spring and late summer drying out

Stone quarry pond, Lothians, Scotland. Some suitable habitats within the species' range are not occupied because they are now too isolated to be re/colonised

Orton Pit cSAC Cambridgeshire, England. Showing linear ridges and furrow waterbodies that are occupied by great crested newts at very high densities

Extensive areas of ridge and furrow habitat were created following large-scale clay extraction for brick making in the 20th century. 'Brownfield' sites may provide excellent great crested newt habitat because of their abandoned state, but may be highly transient due to their use as landfill sites or for urban developments. Mineral sites may be included in conservation strategy under Habitat Action Plans (HAPs) and significant opportunities may exist for amphibian conservation

Urban and suburban sites

Great crested newt breeding sites occasionally occur within urban settings. Some of the best examples are in urban nature reserves, disused industrial land, golf courses, land next to rail tracks, large gardens or estates (especially moated sites), common land and parkland. Often, urban sites support only small numbers of great crested newts, due to one or more of the following factors: low pond density (normally just one or a few ponds per site), small area of good quality terrestrial habitat, habitat fragmentation, public disturbance, unsympathetic management, or the presence of fish and ducks or geese. There has been a large-scale loss of urban great crested newt populations in recent decades, largely due to the destruction of ponds through development, and the factors listed above. Where they do occur, urban great crested newt populations are of local importance as evidence of a formerly more extensive distribution at the edges of towns and cities.

Pond formed between two railway embankments, Carlisle, Cumbria, England

Dew ponds

On land with a permeable soil, ponds normally need to be artificially lined to retain water. Dew ponds are a special example of this, being lined with puddled clay, normally over a chalk substrate. These ponds were once built as drinking ponds for cattle and other stock and sometimes have a surface dressing of stone to protect the clay lining. The most well known examples are on the Sussex Downs, normally being constructed in natural hollows, fairly high up in the hills, fed by rainfall and run-off from the surrounding area. Dew ponds tend to be fairly shallow (around one metre maximum depth), and most were built in the 19th Century. Dew ponds also occur elsewhere on chalk, for example in Kent and Dorset, and on limestone in Derbyshire. Great crested newts seem to thrive in areas where dew ponds are still numerous and where the surrounding terrestrial habitat is also suitable for them. In many areas these ponds are being lost through lack of management and disrepair.

Other habitat types

Great crested newts can also be found in a range of other habitats and situations, though typically only in scattered, smaller distributions. Lowland heathland, which normally occurs on sandy soils, supports low densities of ponds, and these tend to be acidic and nutrient poor except where the heathland abuts land of a different geology; some heathland and mire pond sites are occupied by great crested newt. Mosaics of heathland, acid grassland and conifer plantations, especially at favoured upland sites in Scotland and Wales, occasionally support great crested newt. Breeding sites in such situations may be fire ponds or natural depressions. Other habitats offering habitat for great crested newts include natural sand dune slacks, and wet ditches, which are often overlooked as newt habitat.

Fixed sand dune pools at Glantraeth SSSI/cSAC, Anglesey, Wales

Mesotrophic basin mire, Pitmedden Forest cSAC, Fife/Tayside borders, Scotland

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Breeding Pond Management and Restoration

STRATEGIES FOR MANAGING AND RESTORING WATERBODIES

Practical conservation for great crested newts combines 'emergency' work, aimed at preventing local extinction, and ongoing habitat improvement work aimed at providing a sustainable network of good quality breeding sites that are protected and managed.

How you choose to go about managing pond-dependent wildlife will be influenced by existing levels of local interest and the potential to carry out practical activities on the ground. Once surveys have assessed the importance of existing wetland areas, the need for protecting, restoring, or creating them can be considered.

Decisions on whether or not to manage must take into account factual information on the presence or likely absence of species, and identify and interpret the wildlife communities that use each area. The potential for ponds to be managed in the long term is a major factor. Nineteenth century ponds became abandoned, for example, largely because of the time and costs needed for their upkeep. 'Imposing' short-term management alone does not necessarily provide the long-term solution, as the new work will itself need to be managed in time.

As the understanding of ponds has improved, the importance of old and shaded ponds to rare aquatic invertebrate species has become clear. Creating new ponds, adjacent to existing ones has sometimes become preferable to restoration, in places where this is possible.

Scale of approach

As has been indicated, there is considerable regional variation in pond density; heavy claylands have high densities of ponds and low densities are usually found on sands and rocky terrain. The proximity of ponds and other wetlands to each other can be vital in the consideration of the dispersal of animals and plants between them over time, in order to avoid the isolation of, and inbreeding in, populations. A **pondscape** plan for a region or parish is, like a woodland inventory, a way in which the quality of wildlife habitats in and between ponds (and their management and protection) may be considered. Over larger areas, local and regional **pondways** can be defined for the purpose of safeguarding such ecological networks. At a finer scale, animals may exist as metapopulations where the ponds in a **pond cluster** vary from year to year in their ability to support different species. Here, the presence of species and their numbers fluctuate as a function of changes within the pond environment and their ability to move within a group of ponds.

The scale at which any action is taken is an important factor to consider. For this reason, while it is clearly worth, for example, restoring a pond within a nature reserve, the fact that the ponds around the reserve have been filled in should not be forgotten. Consideration of the link between the reserve and the wider countryside should be the next step, without which the original work may be substantially devalued by the effects of isolation.

Best use of resources

It is often difficult to decide how best to approach spending a fixed allocation at a local scale. It may be best in the short term to restore one pond in or between each metapopulation, thus preventing or at least delaying local extinction. It may be possible to concentrate on a complete metapopulation by working on a series of ponds that are located close to each other. The strategy chosen for a given situation will be the result of a wide range of constraints. It may vary according to whether the public has access to the pond as an amenity or the likelihood of the pond being managed in a sympathetic way for wildlife in the foreseeable future.

Choice of ponds to work on might take into consideration logistical constraints, such as the ease of access for machinery, and details of survey information available. Seek the advice of conservationists who have experience of doing this type of work. It is also worth remembering that although commercial operators may have the practical experience necessary to ensure work is carried out efficiently, they will not necessarily know how to minimise the impact on all types of wildlife, archaeology or other specialist aspects.

Importance of monitoring

Monitoring should be an integral part of any management or restoration scheme. The careful recording of information is necessary before, during and after any work. Information that should be recorded includes the origin and history of ponds, details of water catchment and water supply, soil type/s, the shape or profile throughout each pond, the location of significant features and the presence of animal and plant species. Adequate time should be allocated for planning initiatives. Monitoring newts (egg laying, tadpole development and adult breeding numbers) before and after work may give some indication of the effectiveness of management, and will also identify any need to remedy problems that could develop. Photographic records will be a useful future reference.

POND RESTORATION

In recent years, increasing concern has been expressed about the need to find out as much about a pond as possible, before considering its management. It is not always possible to know the history and wildlife use of old ponds, but research and survey at the earliest opportunity are essential for restoration schemes. With newly constructed ponds, the same principles apply. The table below lists some of the factors to be considered before restoring or constructing ponds for great crested newts.

Management plans: managing for wildlife communities

In restoring or creating a wildlife pond community that can support great crested newts, design decisions will influence the capacity to support other species. Other amphibian species, for example, are likely to benefit from work principally carried out for great crested newts. While great crested newts benefit from ponds of a larger size, small bays or separated shallows at pond edges provide the smaller newts and frogs with breeding sites where their tadpoles may not be completely predated by the great crested newt adults. It is often a feature of larger great crested newt ponds that smooth and palmate newt and frog numbers are depressed. Shallow ponds and ditches will add to the range of wetland conditions in a given area and help increase the numbers of amphibians and the carrying capacity of the site for the amphibian (and invertebrate) community. Avoid the introduction of fish and wildfowl, which exclude or limit amphibian populations. To sum up, it is vital to consider the structure of food chains and predator-prey relationships when designing management plans.

Bear in mind that carrying out pond restoration specifically aimed at improving habitat for great crested newts, may mean that the scope for use by some other wildlife species is limited. Not creating islands for example, will limit the suitability of a pond for water birds. There is no harm in replacing one type of habitat which has wildlife interests with another, in principle, as long as you know that is what you are doing and the losses are considered to be acceptable.

Table 1 Pond restoration and construction: some common factors to consider

Factors to check	Restoration	Construction
Safeguard of other species from disturbance	Pond should take all wildlife interest into account	Check wildlife value of area to be excavated
Planning consent from Council	Unlikely to need planning permission	May need planning permission if non-agricultural
Licensing	For existing great crested newt sites consult SNCO	For existing great crested newt sites consult SNCO
Siting	Fixed	Choice of most appropriate place for pond
Safeguards for archaeological interest	Check with local historian and/or County Council archaeologist	Check with local historian and/or County Council archaeologist
Protection of services; e.g. electricity, telephone, water, gas and sewer pipes	Check buried and overhead services with providers	Check buried and overhead services with providers
Water supply	Usually existing and adequate or repairable	Requires careful investigation to ensure adequate run-off, ditch, drain, spring, or flood supply
Soil permeability/water levels	Pond base usually well defined and intact/ impermeable	Some soils may be permeable and require lining to retain water
Plants/silt/invertebrates	Some may be left in situ or rescued for repositioning	Site may need stocking from nearby sources
Excavation	Silt may be disposed of to controlled site or spread and ploughed in on arable fields	Topsoil and sub-soil may need to be landscaped on-site or removed in road licensed vehicles
Pollution	Some silt and debris may need to be removed to a controlled disposal site	Usually no pollution detected. Check local records/archives
Pond shape and size	Usually defined. May be altered	Shape can be determined
Timing of work	Best done in autumn/early winter.	Anytime of year (subject to other constraints)
Changes to existing wildlife communities	Surveys needed to establish type/level of change	May reduce terrestrial habitat. Best if on former arable/disturbed land

Working with landowners

Thousands of pond owners have great crested newts on their land and many hundreds of ponds change ownership every year, so clear and readily available advice on good management practice is essential. To many owners, economic considerations will be the overriding basis on which ponds are managed, so the cost efficiency of proposed activities should be well thought through. Fostering good working relationships with and between neighbouring landowners is important. Groups of landowners may share different parts of a newt metapopulation and so a strategic approach should be taken. In some cases, work may not be possible in the short term, irrespective of the ecological benefits. It may be easier to include newt conservation work within exisitng schemes when they are reviewed.

Planning pond restoration

The most common reason for the necessity of pond restoration for newts is silting-up. Typically, silted-up ponds (containing up to two metres or more of sediment) are dry for all or most of the year. They are not always obvious in the landscape and in many cases, scrub or trees have grown up within and around them. In other cases ponds have a base of thick, black, anaerobic sediment with just a few inches of water, often with an accumulated leaf litter layer and dead tree limbs throughout. Restoring or re-creating ponds that have dried out as a result of accumulated sediment and leaf fall must be done with great care to ensure that general nature conservation interests are served, as well as those of amphibians.

The main objective for restoration work is the establishment of deep water for newts to breed in, with a 1.0 - 3.5m maximum central depth being optimal. One important consideration is the ease with which the pond can be drained for fish removal should this become necessary; a single deep point close to the pond edge may make this easier in the long term.

Farm ponds may still have the original access ramp that was used to remove soil during the initial excavation and this can provide a useful access for machinery. Access may be restricted by mounds of original spoil around the pond if it was not carted away, to be spread elsewhere (as was the case with marl pits). It is important to minimise the disturbance caused by heavy excavation machinery and dumper trucks, by restricting them to a single (preferably taped off) track. Using the excavator to form a ramp down into the pond is often the only way to avoid excessive bank edge disturbance.

The timing of work will be determined by ground conditions. Dry autumn and early winter conditions (August - October) are most frequently chosen, while 'drought' years offer the greatest scope. Depending on the year, the ground is normally wet and soft during much of the winter, which may result in machinery getting stuck, and damage to access tracks. In spring, the potential for disturbance to wildlife may prohibit work. Dry hot summers, when they occur, may be exploited for pond restoration as pond silt dries out and is easier to excavate and spread. In some circumstances manual labour may be needed where there are problems with access to the site.

The use of machinery is a job for the experts, and experienced operators should be used. Choosing the correct method and machinery will minimise costs and enable projects to be completed to a budget. Distances, work rates and quantities should be calculated carefully. The checklist on the next page suggests things to consider when contemplating the restoration of ponds. Some ponds, particularly older ponds or those associated with old buildings or workings, may require advice from specialist biologists and archaeologists. This in turn may lead to taking actions to protect and safeguard particular areas of a pond or the carrying out of work in a particular way, sometimes with inspections, as the work progresses.

A 19th century origin Cheshire farm pond, used as a rubbish dump for thirty years, has been excavated in autumn, to its original shape

Winter rain has refilled the pond

Checklist for planning the restoration of ponds

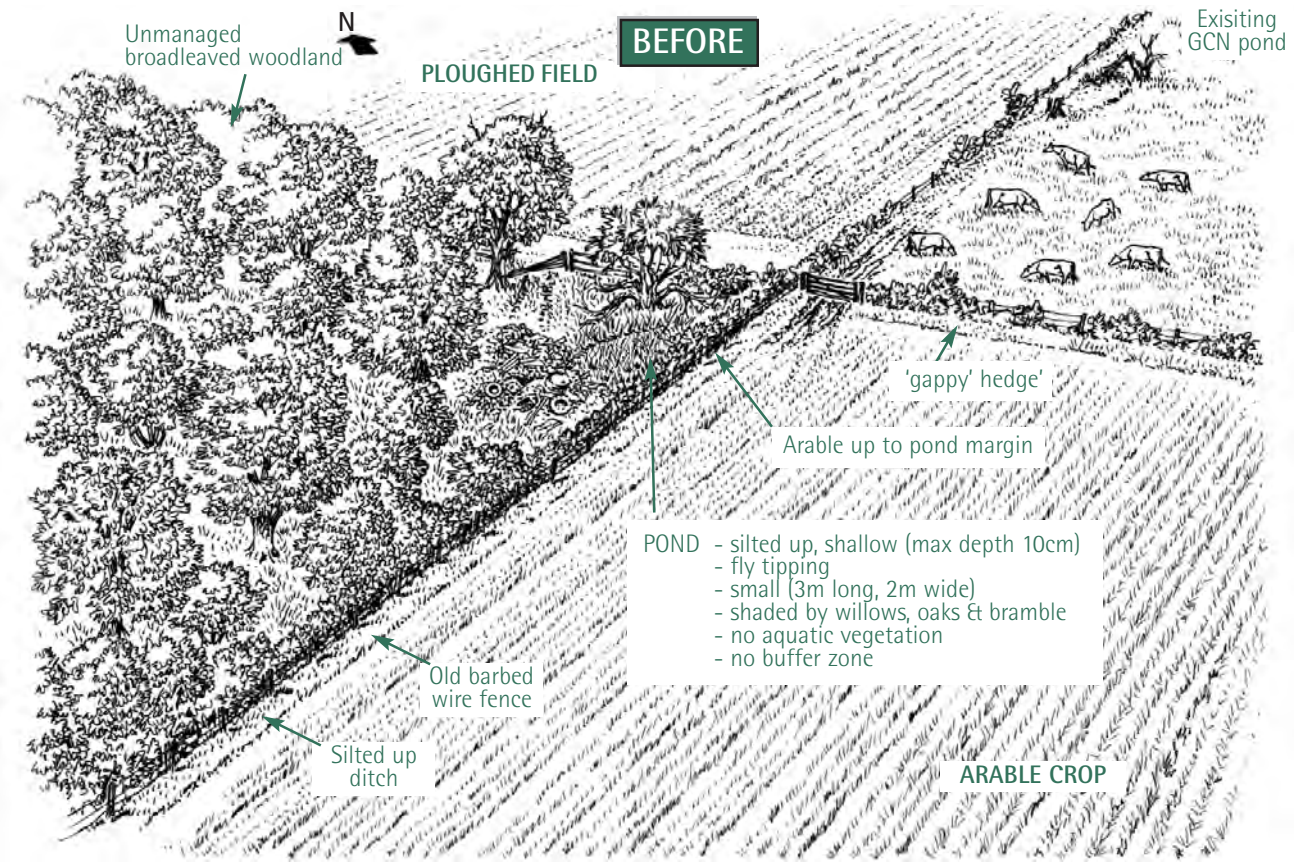
Aspect	Notes
Owner interest and permissions	Best if owner is involved at all stages as much as practicable.
Statutory requirements for planning permission	Check with District/Borough Council.
Nature conservation interest (including presence of great crested newt)	Survey the pond. Check with local SNCO and others for designations/recorded interest and any licensing requirements
Archaeological interest	If unsure check with Local Authority archaeologist.
Plant survey	Checks between May and September.
Invertebrate survey/s	Checks over at least one year prior to management work.
Management plan	Draw up detailed plans to describe work.
Silt deposition site	Avoid removal to landfill site unless silt is polluted. Best put on arable land after harvest. Consult with EA/SEPA.
Machine/labour needs	Seek advice on methods from experienced plant operators Get a range of quotes. Ask local wildlife organisations for recommended contractors.
Funding source/s	Check grant aid schemes available (see page 53/54).
Timetable for work	Assess all factors to determine options. Plan well in advance.
Remove/relocate plants in areas to be disturbed Ensure no plants are needlessly damaged	Replant when machine work is complete.
Tree surgery/felling	Discuss tree/shade reduction with tree officer/owner according to management plan requirements.
Water level monitoring	Monitor winter rain/water level control/outlet pipe/ditching.

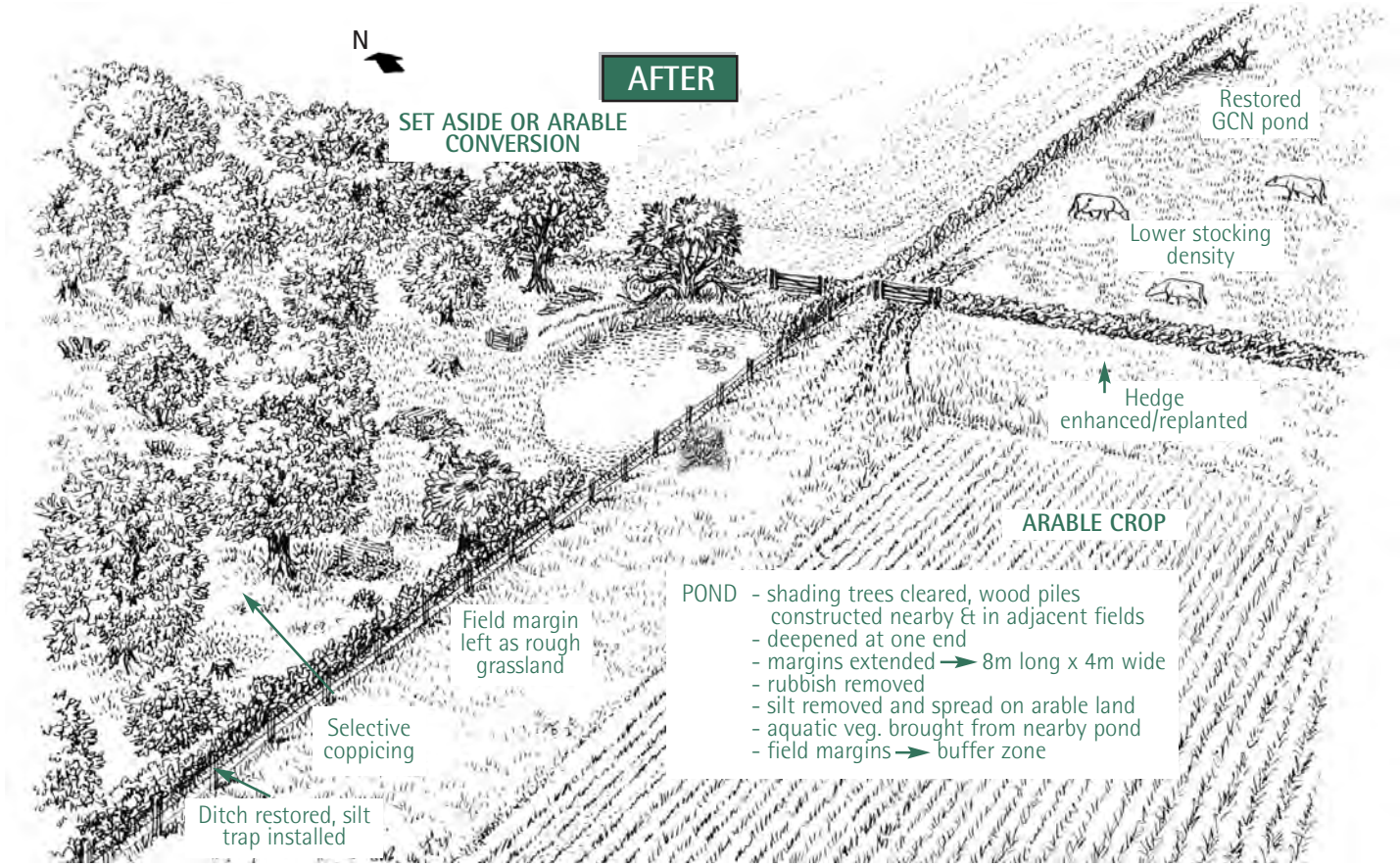
Carrying out habitat management work

The shape of a restored pond is usually dictated by its original design, although repairs may be needed where pond banks have slumped in, or been dug away, or where clay linings have been punctured. In some cases, ponds may be extended or modified to create larger areas. This may create a need for the removal of sub-soil, which tends to be more difficult to dispose of and is often less suitable for spreading on the surface.

The most commonly employed method for digging out silt involves the use of an excavator. This is a tracked vehicle with a hinged arm that can swivel around 360° in order to load a dumper truck or lorry without having to manoeuvre. The smaller of these come in sizes of 1, $1^1/_2$ or 3 tons. For bigger ponds requiring removal of 100-1,000 cubic metres of silt, a machine of between 10 and 18 tons is commonly used. The size of the digger bucket will determine how quickly a dumper truck will be filled. The size and number of dumpers needed will be determined by the digger size and the distance they will travel to tip the spoil i.e. the turnaround time. Estimating the size and number of excavators and dumper trucks required for a specific job is the key to keeping costs to a minimum, as hourly rates for machinery and labour can be considerable.

Fig. 5 'Neglected' pond before and after idealised restoration





Understanding how to instruct drivers, the hire rules of plant hire companies, and the time required for difficult operations is essential for efficiency. Sensitive 'no-go' areas should be marked with hazard tape on poles and on simple clear plans for the reference of drivers. It is important to oversee the work carefully, ideally with at least one supervisor present at all times.

Tree surgery may be needed in advance of the work and log piles may be left as deadwood refuges. In places with public access, log piles are better covered with a layer of soil or wired together to prevent them from being thrown into the pond or taken for fire wood. Keeping logs in large heavy pieces and moving them with the help of the excavator may also reduce interference.

Disposal of excavated silt is always an important consideration and waste disposal regulatory authorities (EA/SEPA) should be consulted. Silt contaminated with debris may need to be deposited wet or broken up, spread and allowed to dry. It can then be picked over for debris by hand before ploughing in. Allow time for this to be done and ensure that the silt is not deposited too thickly on the ground. Dumpers can tip while still moving and help spread material as they deposit. Ensure that there is no risk of contaminating watercourses with run-off from wet sediment.

Re-filling ponds with water can be done from boreholes, mains supplies and clean low nutrient streams and rivers, but is clearly most easily achieved with rainwater. Smaller ponds will refill over winter but larger ponds can take two winters' rain.

Protecting pond edge plants from drying out needs consideration, and re-planting may need to be delayed until water levels are high enough. Pumping water from watercourses requires consents (from EA/SEPA) and should be done with the use of screens at the inlet and delivery end of the pump hoses, in order to prevent unwanted movement of plants and animals such as fish.

Removal of shading and aquatic vegetation

When deciding on appropriate management of vegetation in and around a waterbody, it is important to have a clear idea of the end result that you are hoping to achieve. The more survey data you have available, the better informed your decisions will be. You need to have decided the following:

• How much overall shade of the water's surface is desirable?

The shadier a pond is, the lower the water temperature is likely to be throughout much of the year. A pond surrounded by overhanging trees will not let summer sunlight penetrate to the water surface, and therefore it will not be warmed. In addition, overhanging vegetation will shed dead material into the water, accelerating the build up of nutrients and probably leading to a requirement for more frequent de-silting. On the other hand, trees and scrub near the pond can provide good terrestrial habitat for wildlife species, including great crested newts. A compromise could involve retaining tree and scrub vegetation on the north side of a pond where it will cast little or no shade on the water surface, and removing shading vegetation on at least the south side.

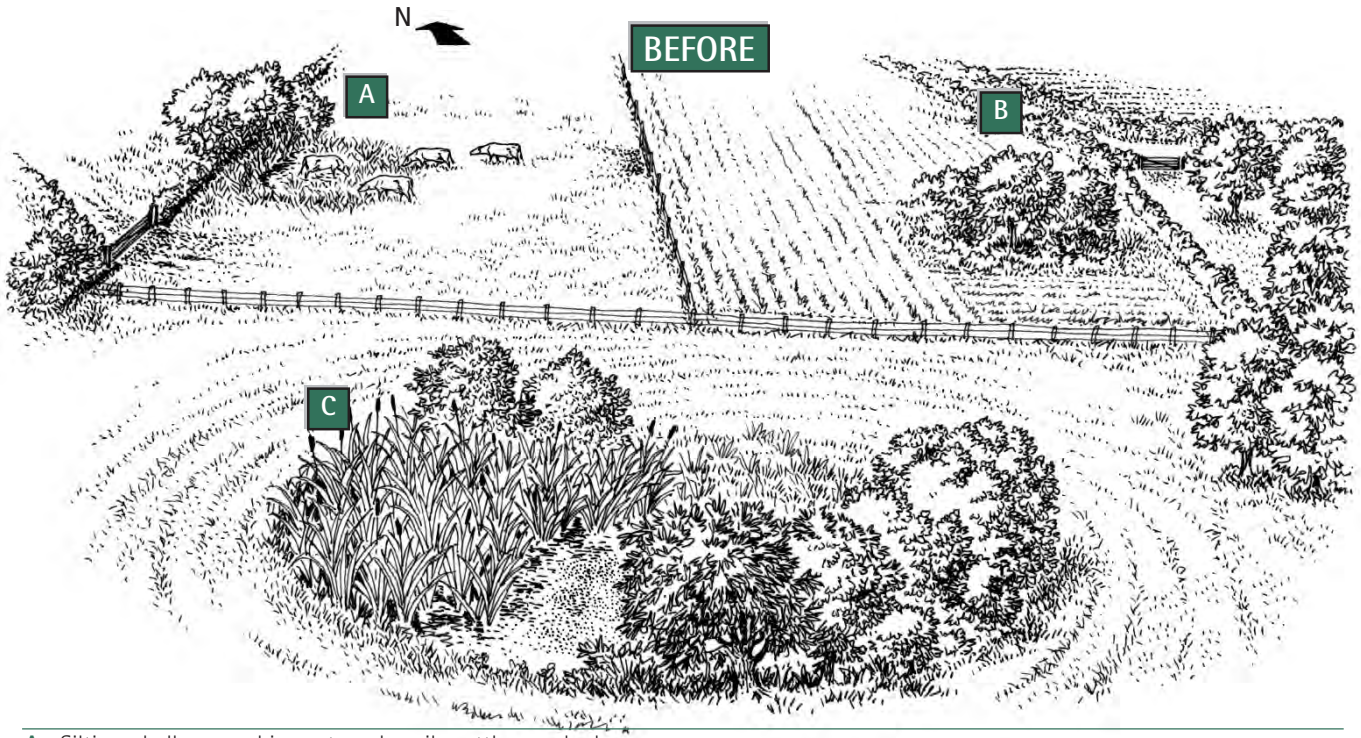
• How much marginal vegetation is desirable?

Marginal and emergent vegetation are important components of a great crested newt pond as they provide excellent egg-laying sites. Good plants for this purpose include water forget-me-not *Myosotis scorpioides*, flote/sweet grass *Glyceria fluitans* and great hairy willowherb *Epilobium hirsutum*. Marginals and emergents are also important habitat for other species groups, notably damselflies, dragonflies, water voles and birds. They are, however, an integral part of the natural successional change of a waterbody to a marshy area, and finally dry land. Therefore whilst it is preferable to have a good range and area of marginal plants, if they have reached the stage where they extend across the entire water surface, it may be time to consider their partial removal. In most circumstances it will be desirable to retain a fringe of marginal and emergent vegetation around at least half of a pond's edge. Where the marginal vegetation is particularly invasive, and provides no specific benefit to crested newts, it may be decided that its complete removal is necessary. This could be argued for greater reedmace *Typha latifolia* in small, shallow ponds, for example.

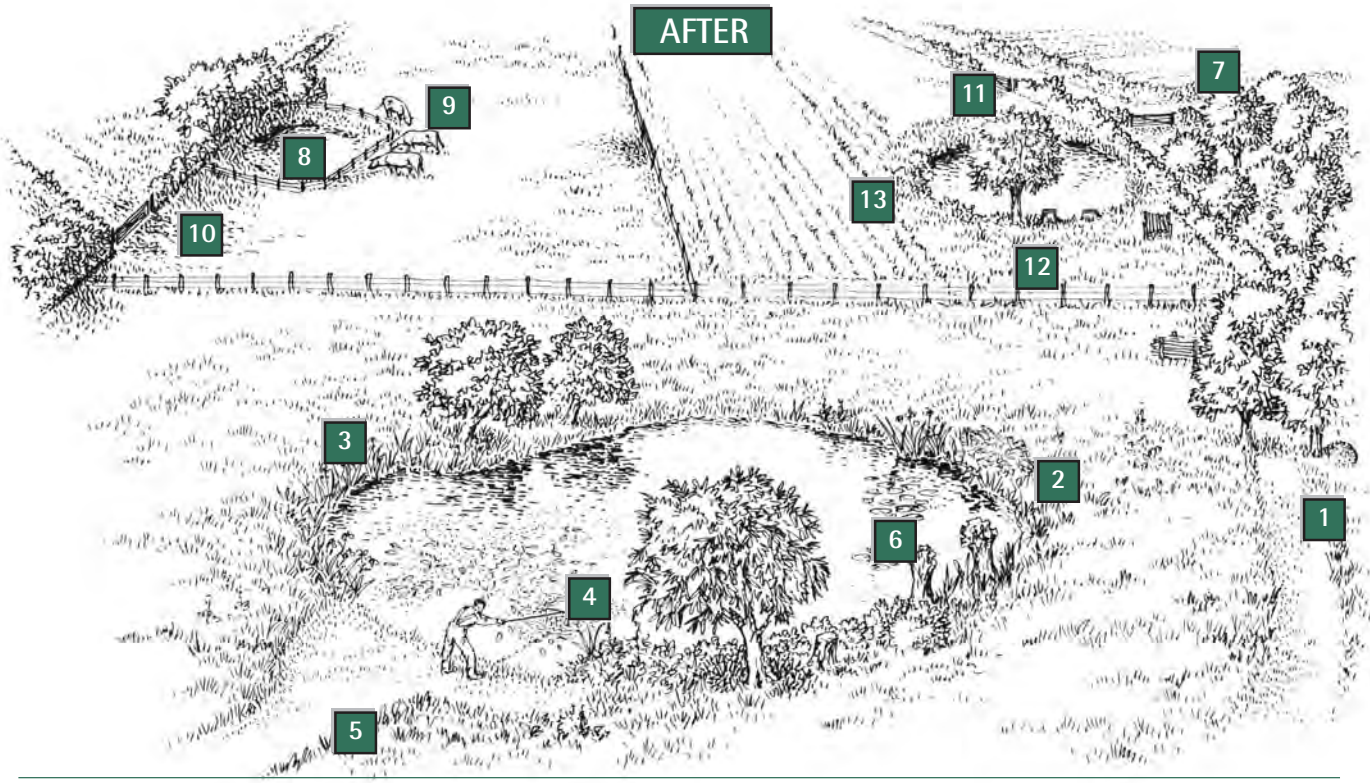
• How much submerged vegetation is desirable?

Submerged vegetation is an important component of the pond ecosystem, making it habitable to a wide range of animals. Too many plants can occasionally be undesirable for newts however, if the water column becomes completely shaded and choked. Pioneer (early successional) submerged vegetation like stoneworts (e.g. *Chara* spp.) is unlikely to cause a problem. In time, stoneworts are normally replaced by higher plants like curled pondweed *Potamogeton crispus* or water crowfoot *Ranunculus aquatilis*. Introduced or 'alien' submerged plants can grow very vigorously and dominate more beneficial native species. New Zealand stonecrop *Crassula helmsii* and Canadian pondweed *Elodea canadensis* are two examples to be avoided. In most instances the complete removal of such species is recommended. The autumn/winter die-off of large amounts of submerged plant material (e.g. hornwort *Ceratophyllum demersum*) can sometimes lead to temporary pond stagnation. Raking out pond weed may help to prevent stagnation and slow the process of natural succession.

Fig. 6 Summary of pond management activities for great crested newts



A Silting, shallow pond in pasture; heavily cattle-poached
B Entirely shaded, dried up pond - willows and scrub growing in pond and around margins, arable up to pond edge
C Very shallow pond in amenity grassland (frequently mowed). Shaded on south side. Surface dominated by *Typha* and floating vegetation



1 Build hibernacula in woodland (summer)
2 Place refugia near pond (winter)
3 Dig out *Typha* (autumn-winter)
4 Remove excess floating and submerged veg. (autumn)
5 Cut grass in hot dry conditions. Paths are cut regularly
6 Cut back/pollard trees to reduce shade (autumn-winter)
7 Increase wooded area and tree planting
8 De-silt pond **A** (autumn-winter)
9 Install fence to control access to pond **A** (autumn-winter)
10 Install silt trap (summer)
11 Remove encroaching scrub and trees (autumn-winter)
12 Re-profile pond (autumn-winter)
13 Buffer zone of rough grass around pond

• How much floating vegetation is desirable?

Floating vegetation provides habitat but also blocks out sunlight by shading. Therefore it is generally preferable to keep at least one third of a pond's surface free from floating plants. Introduced or 'alien' species of floating plants like water fern *Azolla* spp. can be extremely vigorous and cover ponds completely within one growing season. These are best eliminated where possible and should never be introduced to a new pond. Removal of the ponds source of nutrients (by excavation of silt) may be necessary. The native duckweeds *Lemna* spp. can also be a problem in this way, although their growth seems to fluctuate from year to year, and complete cover one year may be followed by just slight cover the following year without any intervention.

• Methods of vegetation removal

It is recommended that vegetation removal is carried out by hand in ponds where great crested newts are present. Chemical control is only recommended as an essential last resort, as contamination of the water system is difficult to safeguard against completely. The removal of greater reedmace *Typha latifolia* or the invasive non-native New Zealand Stonecrop *Crassula helmsii* may, in addition to digging out, require careful treatment of any remaining areas with glyphosate (e.g. Roundup Biactive). The large size and water-resistent exterior of some plant stems and leaves make it difficult to spray stands of plants, however. Other treatments are being developed and it is worth checking to get the most recent advice. Consent from the Environment Agency/SEPA is required for the use of any chemical in or near water.

Water lilies can smother a small pond over long periods.

Water fern (*Azolla*) can form a dense green/pink coloured carpet across a ponds surface, blocking out light and smothering out other plant and animal species

To be effective, marginal and emergent plant removal must be 'roots and all', or rapid regrowth will occur. This may mean digging out 'turfs' or 'clumps' of plants. For small areas, hand digging with spades is advisable. For larger areas, the careful use of a mechanical excavator may be effective.

Reduction of floating and submerged plants can be done, using a long-handled rake or a grapple on a rope to drag vegetation from the pond. Species such as Canadian pondweed, *Elodea canadensis*, can recover after dragging within a year or two.

• Timing of removal

Aquatic vegetation is most abundant during the summer months, particularly the floating and submerged plants. Where these need to be removed, plant material should be hand sorted to extract any newts or other animals caught up in it. Submerged and floating plants in the deeper sections of a pond are less likely to be used for egg-laying than those at the margin, but removing plants during the egg laying period should be avoided. Note that any methods involving capture of or disturbance to great crested newts will require a licence. If in doubt, consult the office of your SNCO.

The removal of marginal and emergent vegetation from ponds should take place at the time of minimum newt activity. It should obviously avoid the breeding season, when newts are active in the pond, and vegetation has newt eggs laid on it. Depending on weather conditions within the year, September to November are likely to be the most suitable months to undertake this work, when most animals have bred and are dispersed within or out of the pond or are dormant. Dry or frozen ground conditions may be beneficial where the use of heavy machinery is necessary.

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Construction of Breeding Ponds

Constructing new ponds offers exciting opportunities to enhance the wildlife interest of an area. The pond type and its position in the landscape will be determined by a variety of factors and careful advance preparation is necessary. The cost of each stage in the process, including time for adequate research and supervision must be an early consideration. Tests may be needed to determine the suitability of ground conditions. Checking the development of the new pond should take place after construction to detect any adjustments that are needed to ensure its successful establishment.

SITING CONSIDERATIONS

New ponds should ideally be sited within 500m of a known great crested newt breeding pond. The position of purpose-built great crested newt ponds within surrounding terrestrial habitat is important as young newts may disperse for the first time in any direction. There are no fixed rules on minimum inter-pond distances. Two ponds close together can be more practical than two distant ones for some management purposes.

Local climate, soil type and catchment area will determine the amount of water collecting at a given place. This can be relatively easy to predict in heavy clay but quite difficult in more permeable soils and surface drifts, where pockets of mixed soils can cause seepage and reduced pond depth.

In some arable land on less permeable soils such as clay, land drains (perforated plastic or pottery pipes and gravel trenches set below the ploughing depth) have been installed to increase the rate of land drainage and so help to promote crop growth. Land drains cross fields at regular intervals and can be tapped to increase the water supply to a pond. On gradients, these can act like springs, rapidly filling ponds after heavy rain; many existing ponds have field drains feeding into them. The quality of water being collected is a consideration; it will not always be desirable to tap into drains that take water from land that is being fertilised, as this is likely to lead to nutrification of the pond. Surface run-off and road drains feeding into ponds in urban areas may rapidly affect water quality by introducing pollutants and can also produce dramatic water level increase.

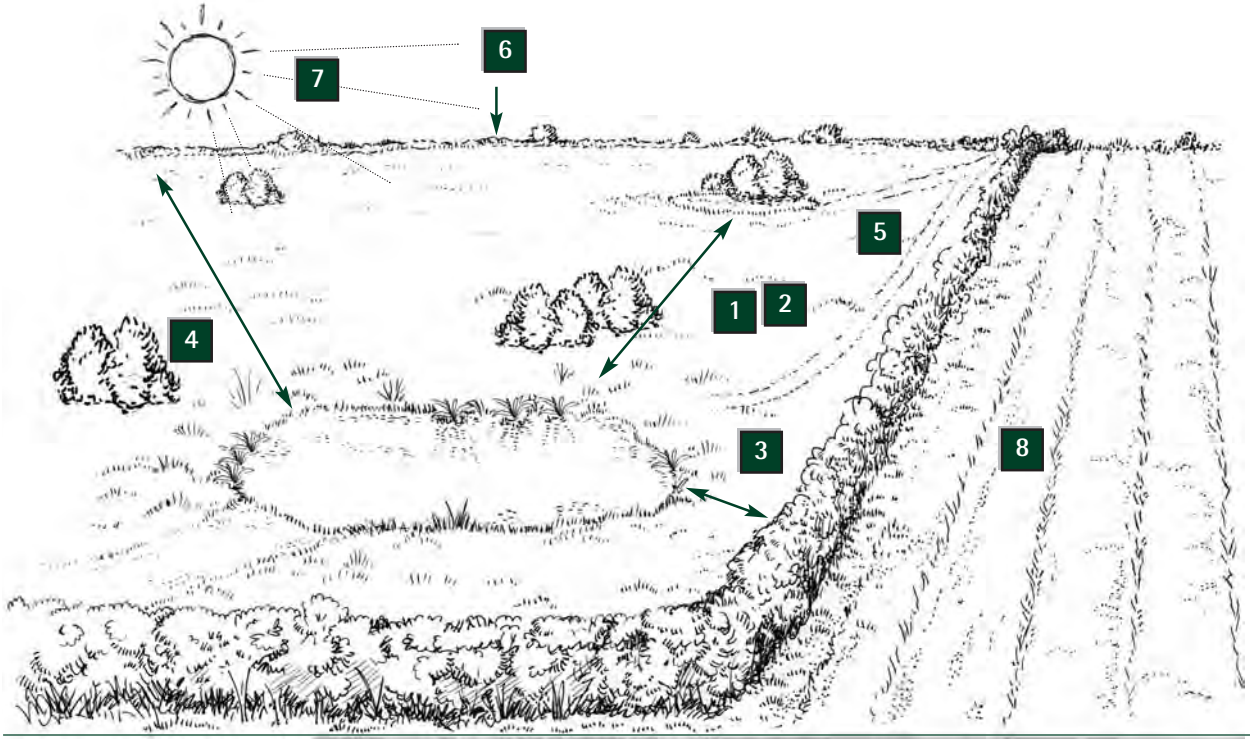
Siting ponds in existing habitat such as woodland or grassland will require care to minimise damage to existing wildlife interest. It is important not to site new small ponds too close to trees, as they may become over-shaded and rapidly silted up. The amount of direct sunlight that a pond receives is very important as water temperature and light greatly influence the rate of growth and development of invertebrates, plants and amphibians. When creating ponds in the floodplain consult EA/SEPA.

A newly excavated pond in heavy boulder clay

An agricultural field drain is intercepted and brought to the pond edge with pipework as a water supply

The pond, now established, is flushed with plenty of water in rainfalls of above 12mm and has an overflow at its edge that runs to a nearby ditch

Fig. 7 Factors influencing the siting of new great crested newt ponds



1 Proximity to occupied great crested newt pond/s
2 Suitability of habitat linking existing pond/s to new site
3 Buffer zone habitat (20m radius)
4 Surrounding terrestrial habitat (500m radius)
5 Access for machinery
6 Location of spoil disposal area
7 Aspect to direct sunlight
8 Geology, landform and drainage

DESIGNING PONDS FOR GREAT CRESTED NEWTS

Decisions about the depth and overall shape of new ponds will be influenced by the purpose for which the pond is being built. For example, dew ponds that are also to be used as a livestock drinking supply may be shallower than those on heavy clay soils in arable farmland. The size of a permanent pond (i.e. one that does not or very rarely dries out) will influence both its capacity to sustain adult newts throughout the year and the number of young that can be produced.

In deeper, larger ponds, the water is more buffered from cold air cooling or freezing the upper layers of water than in shallow ponds, especially in spring and autumn. Temperature influences newt metabolism; ponds in excess of one metre depth are most likely to maintain water temperatures at the bottom that are high enough for newt activity throughout the year.

Ponds of less than about 25 square metres surface area tend to have insufficient depth and volume to allow many great crested newt larvae to survive. This may be because of competition, with larvae preying on each other, and bottom dwelling predators being able to find them more easily. Small ponds that are 'topped up' or that receive water from natural sources in late summer may have a better prospect of recruiting young than those that progressively dry out. In conditions where the water table fluctuates greatly, occasional drying out may sometimes favour newts in the long run, as this can result in a large drop in predator numbers, especially fish.

Predicting the variation in pond water levels may require prior survey and testing so that the likely result of high rainfall, and of dry or drought conditions is understood. Altering the profile of a pond after construction may be difficult, although inlet/outlet pipes or ditches can be adjusted.

EXCAVATING AND LINING NEW PONDS

Marking out

Design drawings should show the pond shape and levels, both above and below the proposed average summer and winter water lines. Once the outer edge that is to be dug away has been marked on the ground, any topsoil present can be removed. Topsoil and sub-soil can either be used creatively on-site, for example to make a raised hedge base, or removed from site. The first marginal shelf can then be marked out to assist the excavator driver. Survey equipment may be needed during the excavation, to help check that the levels are correct and that the pond fills as closely as possible to the desired extent.

Excavation and soil disposal

As in pond restoration, an excavator with a large bucket will normally be able to load dumper trucks or lorries with soil. The 'turn around' time for moving soil away will need to be matched to the rate of excavation. The tipping rate can vary, from a few minutes for 'on-site' tipping to an hour or more for disposal some distance off-site. Matching the excavator with appropriate size and number of soil removal vehicles is

essential for greatest cost efficiency. An experienced plant operator will be able to suggest appropriate machinery, and provide an estimate for the job to include hourly or daily rates for each machine and costs for driver, fuel and haulage to and from site. If there is local demand, selling topsoil and sometimes sub-soil may offset some of the cost of machinery hire. The demand for soil varies greatly however. The time of year when material can best be disposed of may influence the most cost effective time for you to do the work. Checking all of these details in advance of work starting will pay dividends. EA/SEPA should also be able to offer advice.

Favourable weather conditions are extremely important when using heavy machinery to move soil, as wet weather can slow progress or stop work for days or even weeks until the ground dries out.

Pond linings

In general, artificial pond liners should be avoided for a range of reasons, the most important being that they are costly to renew. In addition, rubber, plastic, concrete and puddled clay linings can all be damaged by the effects of extreme weather conditions, puncturing by sharp objects, plant roots and animal hooves/teeth and other general wear and tear. Problems may also be experienced if surface water cannot all be channelled into the pond (on top of the liner), but instead collects underneath. Nevertheless, artificial liners may be essential on free-draining soils or made-up (disturbed) ground.

If pond linings are to be used, it is important to consider which of the several types available is the most suitable. Consideration must also be given to picking the most appropriate materials to protect the liner from damage. Lining large ponds is best done by specialist firms. Larger ponds are usually lined with heavy-duty plastic liners of a type used at landfill sites, sometimes joined using hot-welding techniques. Small ponds up to about ten metres radius can be lined with a single piece of liner. The pond base will probably have to be 'picked-over' by hand to ensure that there are no sharp stones that could puncture the overlying liner. A 'blinding' of sand or other stone-free soil can be used above and below linings to help prevent puncture. Such blinding may be used in conjunction with matting made from polyester or natural materials. Machinery used for excavation can often be used to help lift into place and spread lining materials, before they leave site.

Clay-based matting or puddled clay and cast concrete provide alternatives to plastic and butyl, but advice from experienced pond builders and managers is advised due to the differing constraints and risks in using these linings.

Filling with water

Ponds dug in late autumn may fill with rain over their first winter, although larger, deep ponds may need two winters to fill naturally. Test filling ponds may sometimes be possible as a check for leakage. Until fully established with plant cover, evaporation from the pond edge can be relatively high, especially

Lining a small (40m^2) pond on made-up ground. The pond has been dug and protective matting (centre) is unrolled to protect the underside of the heavy-duty butyl liner from below

The butyl is put in place, and a further layer of protective matting (polyester) is placed on top. Topsoil is then spread over the pond base to a depth of 50-100mm

The pond is left to fill over the winter

The completed pond in the following summer

in dry summer conditions. Once the final water levels have been established, deep rooting plants can then be placed at the best depth for their development as the water levels rise. Many plants will die or do very poorly if they are planted too deep or subsequently become too deeply submerged.

Planting new ponds

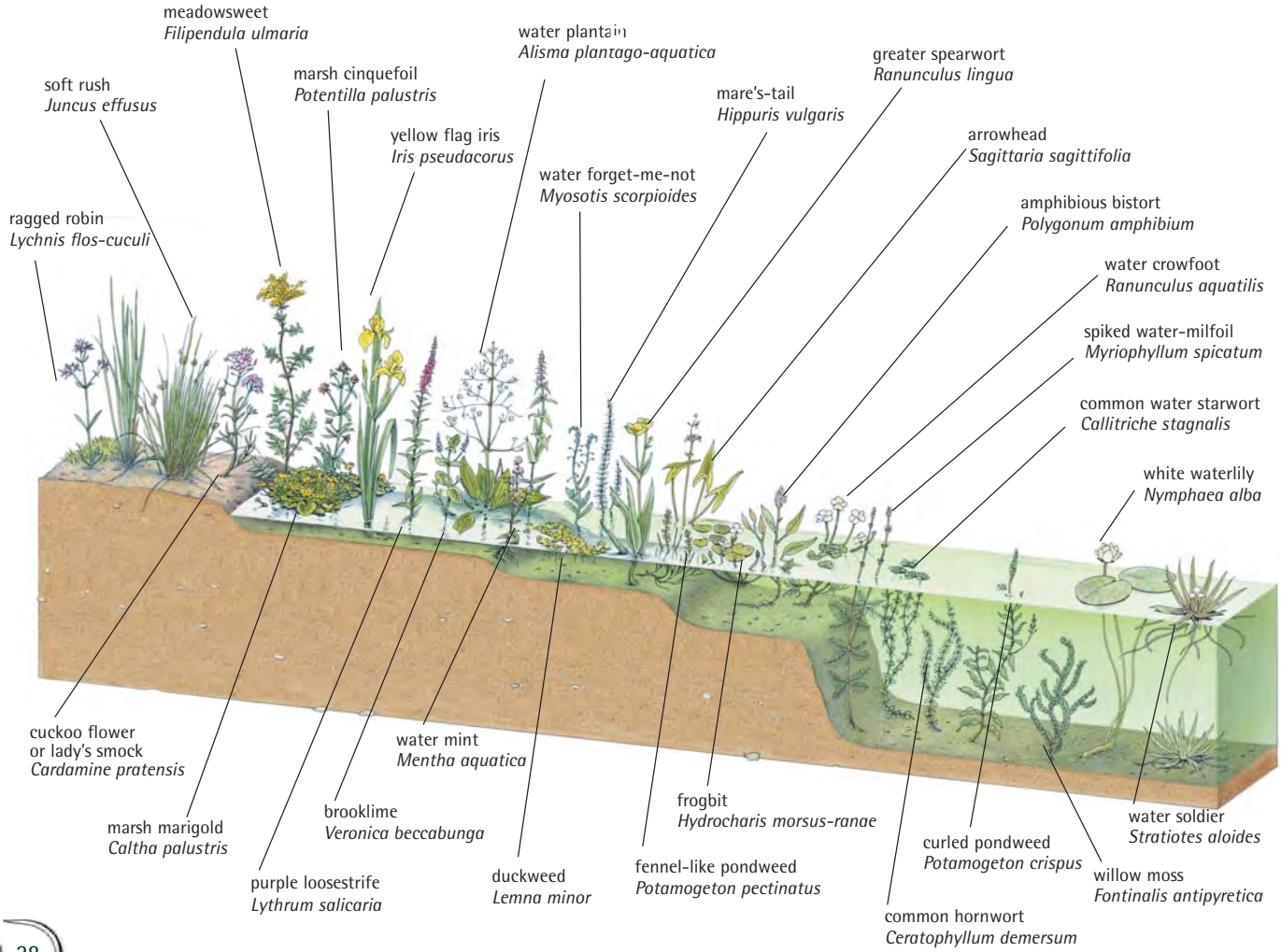
Approaches to planting newly created ponds vary. In many instances, letting the pond colonise naturally, by chance, with no deliberate planting is the recommended option. The rate of plant arrival is related to the distance from the nearest sources together with other plant dispersal variables. Permitting natural colonisation in this way may mean that it can take many years for ponds to reach their maximum plant species richness, and remote ponds are more likely to have low plant species richness.

For great crested newt projects that involve the recovery of very small populations, or at introduction sites where animals may be released, some planting may be necessary, but must be carried out only with careful planning and rigorous checks throughout. Planting helps to ensure that cover is established relatively quickly, and invertebrate food to sustain the newt population is available (see above photo opposite). Where planting is advised, aquatic plants should be appropriate for the habitat concerned and sourced from nearby ponds, not from outside the local region. Very careful checks are needed to avoid the transferral of fish, or the seeds or fragments of undesirable invasive or exotic plants.

All planting undertaken should be recorded on a planting map that is kept as a part of the pond management records. Most valuable are plants used for egg-laying and cover for newts and invertebrates. It may take up to ten years or more for plants to spread within a small pond and their position and dominance will fluctuate. Planting at the correct depths and with spacing to allow growth and spread will speed establishment.

Once settled in, pond vegetation can be left to develop undisturbed. There are a few exceptions to this. The removal of introduced, exotic or highly invasive species before they take hold is one such exception. Such work should be timed to minimise disturbance to pond life. While the presence of livestock (e.g. cattle and ducks) in low numbers can help keep ponds 'open', over stocking can cause the disappearance of plant, invertebrate and amphibian species. Where livestock is present at a high density, excessive trampling of pond margins can be avoided by fencing or screening off sections of pond edge on a temporary or permanent basis.

Typical aquatic plant species at great crested newt ponds



Terrestrial Habitat Creation and Managment

cont.

Planting at the edge of the pond provides cover

Ponds dug in open woodland may have vegetation growth suppressed by reduced light levels and leaf fall

See next page for Key References

THE IMPORTANCE OF LAND HABITAT

Terrestrial (or land) habitat around a pond provides feeding and sheltering places for newts when they are out of water. The type of habitat around a pond will influence the movement of newts and their long distance dispersal. Dense, heavily structured habitats (like scrub), provide many places where newts can overwinter and take refuge from desiccation or bad weather. Rough grassland with dense tussocks will also provide areas with food and cover.

Studies show that land habitats with a well developed litter layer and dead wood component are favoured by newts. Rocks, logs and gaps in the ground, especially in moist, shaded places or under dense ground cover provide ideal places for newts to rest during the day or to remain during cold or very dry weather. Ditch and hedge banks increase the surface area of land, provide a sheltered microclimate, and often have mammal burrows that newts may share. Networks of burrows made by voles, moles, rabbits and shrews, may be quite extensively adopted by newts.

Great crested newt densities have been measured at a range of sites. They have rarely been found to exceed 400 adult newts per hectare, but 100-300 per hectare is perhaps more typical. A small pond may need at least half a hectare of suitable habitat around it to support a viable population of great crested newts. Newt numbers may be greatly reduced and the population left vulnerable to local extinction when the amount of land habitat is too small or when connections to other ponds are lost. The ratio of water to good quality land habitat for optimum newt numbers is not known, but a 1:20 ratio may not be excessive. On this basis, a pond with a 20 metre span will be supported by a little over one hectare of good quality land habitat. A ten hectare habitat creation area might support between five and ten ponds of such a size.

Newly created and enhanced land habitats will take time to mature and become valuable for newts, although a lot can be achieved in a single year, if planting seasons are carefully observed. For bare sites such as reversion from agriculture, however, longer may be needed before habitat that will support newts is established. Adding log, rock or turf stacks to newt habitat will provide immediate cover, and the selected planting density of trees or sowing rates of seed will influence the time it takes suitable ground cover to develop and for invertebrates and small mammals to increase their numbers. Rock or log heaps should be located in areas where they will not get in the way of machinery needed to manage other habitats. The deep mulching of tree-planted areas mimics a litter layer and can be very beneficial. (See 'Provision of refuges/over-wintering sites' page 31, for more detail).

Grassland swards can be established by either sowing seed or by leaving the ground to colonise naturally and imposing a mowing regime. Wherever possible, good quality habitat should surround a new pond, so that newts have a choice of direction when leaving the water.

Planting and seeding

Habitat creation for great crested newts should take account of local conditions and habitat types; these will indicate species that are appropriate to the soils and climate of the location.

Arable field before creation of a 15m wide grassland strip with hedge and ditch to link newt ponds

Newly created habitat: Ditch, hedge planting and grassy strip

Hedge and grassland are well established after three years. Dew's ponds SSSI/cSAC Suffolk, England

Seeding of grassland and planting of scrub and woodland should use local stock and seed sources. In general, a variety of species should be sown or planted to provide a structurally diverse habitat, and to encourage the development of a species rich animal and plant community.

Managing grasslands

Grassland around great crested newt breeding ponds should be managed in a way that is sensitive to the maintenance of both newts and the grassland sward. The aims of management should be to provide floristically-rich, invertebrate-rich and structurally varied habitat with a minimum of disturbance to newts in the process.

To maintain grassland as grassland, the sward will require cutting or grazing at least annually at a time when newts are less likely to be harmed. A 'traditional' hay cut during hot dry weather in June or July is unlikely to interfere greatly with newt activity. This involves cutting, drying and baling the hay over a period of about a week. Grazing by sheep, horses or cattle may also benefit the grassland sward, although over-grazing must be avoided. Where possible it is beneficial to leave a margin of uncut vegetation up to five metres or so in width around some of the pond margins and alongside hedges, streams or other boundaries to ensure the presence of some dense cover throughout the year.

Scrub and woodland management

To maximise the potential of scrub and woodland for newts, such areas should be divided into compartments for management purposes, and felled or coppiced on a small scale rotational basis to ensure that disturbance at any one time is minimised. Where coppicing is taking place, cut timber can be stacked to provide useful refuge areas for newts. Haul routes should be minimised to reduce ground disturbance.

Use of chemicals

Like all amphibians, great crested newts have a permeable skin, and are at risk from any chemicals they may encounter. With this in mind, it is recommended that a precautionary approach to exposing newts to chemicals (e.g. landfill leachate, fertilisers and herbicides) is adopted. This means avoid the use of, or prevent access by newts to chemicals wherever possible. Those chemicals that break down quickly to harmless substances are preferred when use is required. Where pernicious weeds are a problem in terrestrial habitat, or invasive or alien water plants are threatening a breeding pond, mechanical control where practicable is always recommended before considering the use of herbicide. Careful treatment of invasive vegetation with approved chemicals may be considered in some limited situations, although success is not guaranteed. Use of chemicals almost always requires a consent and/or licence if the waterbody is connected to groundwater and/or has an inflow and outflow (where it is required by EA or SEPA) or if it has some informal or formal level of site designation (e.g. Site of Special Scientific Interest (SSSI).

Key References (pages 25 - 30)

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Special Newt Conservation Measures

PROVISION OF REFUGES/OVER-WINTERING SITES

Providing wood and rock piles for shelter and over-wintering is important in management for great crested newts. Dead wood and the thick litter layer of old woodland and scrub provides the moist stable environment that they need.

Mulching

Providing a deep litter layer (100mm or preferably more) of deciduous or mainly deciduous bark mulch artificially creates a litter layer. Composted bark mulch is even better as it compacts well and holds moisture more effectively. Used in association with new tree plantations it can be immediately successful in providing habitat for newts. Mulch also reduces growth of ground flora that competes with newly planted tree stock. As plantations grow and are thinned, the cut poles and branches can be left on the surface between trees as further dead wood. By 10-15 years the plantation should provide good quality newt habitat, as an understorey of bramble, ivy or other plant cover develops.

Logs

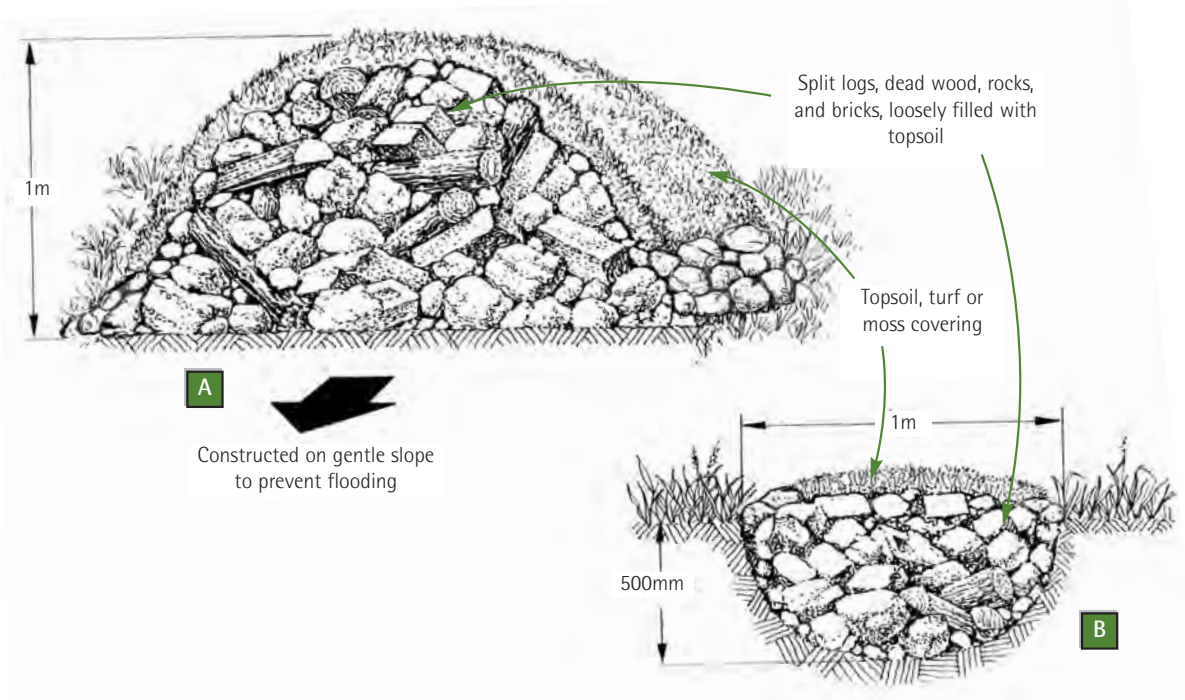
Fallen dead wood under which newts can shelter and feed may be supplemented with cut logs. These can be placed directly on the ground or in a shallow excavation with spoil and turf in between and on top of the logs. Where possible, log piles should be positioned in shady places where sunlight will not dry them out too much.

Stones and rocks

Stone, rock, clean brick rubble (without cement residues) and old or misfired bricks can be used in a similar way to logs to provide shelter and feeding areas. Building successful rock and log piles can be time consuming and requires careful attention to the timing of delivery and spreading of materials. As with log piles, stone can be placed in shallow excavations made by taking spoil to spread amongst and over the logs or stones. On clay or slow-draining soils, great care must be taken to ensure drainage is adequate and the refuge is not in a flood zone, as the lower part could become waterlogged in heavy rain.

The position for rubble heaps can be anywhere within 200 metres of a pond, but in general, the closer they are to the ponds, the better. Refuges that blend into the environment are best. Avoid unattractive, messy heaps which have the appearance of fly-tipping as these may generate complaints. Encouraging moss and grass to grow on wood/stone piles by adding soil to the top and inside of heaps may increase the humidity and stability of the environment.

Fig. 8 Great crested newt refuges on (A) impermeable and (B) free-draining soils



FISH REMOVAL

The introduction of fish to a pond can be so detrimental that their total removal is essential to protect any great crested newt population present. The selection and careful application of appropriate methods and timing for fish removal are important in order to minimise the impact of work on pond wildlife. All methods of fish removal are subject to licensing and/or consents.

Netting

Netting is usually done with the lowering of water levels, using a pump or siphon. Netting alone will not usually remove the entire fish population; it will only be a temporary measure and fish stocks may recover in a few years. Netting may be combined with additional methods of fish removal like electrofishing or the application of a chemical narcotising solution. Aquatic plant life dies back in winter, making netting easier, although fish tend to move towards the bottom of ponds in cold weather. Consideration should also be given to fish breeding seasons. Sticklebacks for example place fertilised eggs in nests that cannot easily be located between March and October.

A small former farm pond in a rural town garden is netted to remove large numbers of recently introduced carp from a great crested newt breeding pond

The netted fish are removed. The adult newt in the catch is released back to the pond

Draining down

Draining down and drying out a pond is the only way to guarantee total fish removal but it can cause massive disruption and local extinction of plant and invertebrate life, especially if the pond base is left to dry out to ensure that small fish fry (and egg nests of sticklebacks) are no longer present. Pond bases may be uneven, causing fish to be trapped in pockets of water or silt, sometimes in the middle of ponds and without easy access for netting. Fish are most easily removed from those ponds that are not heavily vegetated and that readily drain to a single point at the pond edge.

Electrofishing

This method does not require the complete draining of a pond, but does require an experienced team of trained workers, a boat and specialised equipment. Electrofishing tends to stun fish over 120mm total length, leaving most smaller fish unaffected.

Chemicals

Where draining is not practical or poses unacceptable risks to wildlife the removal of sticklebacks and the young of other small fish may only be achieved with the authorised use of a piscicide. Rotenone is a biodegradable, non-residual, and naturally occurring chemical that, diluted in pond water, immobilises fish causing them to float to the surface where they may be netted. Permissions and consents for the use of rotenone are necessary, and the relevant Agency (EA or SEERAD) should be consulted, as regulations governing their use are under constant review. Piscicide use is managed by the Control of Pesticides Regulations (1986). The use of noxious substances for the use of taking or destroying fish is regulated under Section 2 of The Salmon and Freshwater Fisheries Act (1975) and is managed by the Environment Agency in England and Wales and SEERAD (see next page) in Scotland. Consultation with and an application to the local area consenting officer is needed. However, rotenone is approved only as an insecticide by the Pesticide Safety Directorate so approval for use on fish will not be given other than in exceptional cases, with rigorous checks to show there is no alternative and that the work is essential. Where great crested newts are present, the relevant SNCO should also be consulted.

Use of chemicals requires stringent planning, trained operators and careful monitoring. It may not be allowed at some locations

Any applications will require a range of detailed assessments, a method statement, a report demonstrating the difficulties in achieving effective fish removal using other methods and details of consultation with all relevant bodies. Basic information on the land and water areas concerned and potential pollution control information are also required. The effect of rotenone is at first reversible, but in prolonged contact it acts as a piscicide and will kill unless fish are transferred to clean water and/or solutions that stop its effects. Following the application of rotenone, fish should be netted from the surface and revived in clean water. This process is time-consuming, and may include some working at night as the chemical has a differential effect on fish of a different size and species over a period of up to 48 hours.

The use of these methods will cause some fish mortality. They are specialist activities that require trained and experienced operators to be successful, and to ensure adequate welfare provision for the fish. Preliminary trials at one site suggest that if carried out in winter, the mortality from use of rotenone on most invertebrate species is minimal, and far less than that of the draining down method.

In Scotland the Scottish Executive for Environmental and Rural Affairs Department (SEERAD) issues licenses for electrofishing. It has ultimate authority with respect to rotenone use in fishery management. (Tel: 0131 244 6227).

CONTROL OF PUBLIC ACCESS

A number of methods may be deployed to minimise the likelihood of fish introductions and to reduce excessive public disturbance. It is important that positive messages are given out rather than a list of 'do not' rules. Leaflets and display boards can help to reinforce local bylaws and management plans. Information may be supplied to school teachers and others who may take and release back to the wild small numbers of plants and animals as a part of their work or pastime. The particular danger of releasing carnivorous fish such as sticklebacks, perch and pike should be highlighted, as some wildlife guides and gardening books do not warn of the effect that these very common predators can have in limiting species richness in many types of small pond communities.

A fence and stile with hedge planting along a right of way, with a notice giving information on access to the ponds and grassland areas. Wymondham, Norfolk

In general, the more visitors a pond has, the greater the chance of unauthorised release of unwanted animals and plants and other damage. In urban areas it may be difficult to limit the disturbance of ponds. To protect newts at such places may mean keeping the main breeding site in a secluded or inaccessible area. Deeper ponds, however, may prove irresistible to those who move freshwater fish without permission. Although it is illegal, the release of fish for angling purposes without a Consent from the Environment Agency has, like habitat destruction and neglect, been one of the biggest threats to newts.

The degree of acceptable disturbance will vary according to each site. Ultimately, outside nature reserve areas, a successful strategy to keep one or more newt breeding sites viable will depend upon managing the demands of the public so that these important ponds are kept primarily for wildlife use. Creating new ponds in an appropriate area may in some cases be the only way of achieving this.

Ways to improve the seclusion of ponds include:

- Diversion of footpaths away from pond edges.
- Planting of hedges or narrow tree belts to screen ponds from being noticed and approached. Note: do not plant too close to ponds with trees that may grow and shade or take excessive water from the pond.
- Fencing or railings (in urban areas) to prevent complete access around a pond edge. It may be possible to protect a proportion of pond edge from disturbance.

RE-ESTABLISHING NEWT DISTRIBUTION

If great crested newts cannot colonise suitable habitat through their natural dispersal, then there is the potential to establish or renew populations by transferring them artificially. The process of moving newts from one site to another is more often associated with translocation from threatened sites, but there is potential for it to be used for proactive conservation purposes. Normally, it is preferable to allow newts to colonise naturally, since then there is more confidence that the new (or newly restored) habitat is acceptable to them. Transfer to a new site may be appropriate **only** when a number of criteria are met and usually where newt distribution has been all but lost over a wide area. Firstly, the new habitat must be capable of supporting a population, and therefore should be:

- Safe from threat of unfavourable land use change
- Subject to an agreement for its sympathetic future management
- Have at least four suitable ponds in close proximity
- Have at least one hectare and preferably more, of suitable terrestrial habitat
- Lack fish or stocked waterfowl

The following should also apply:

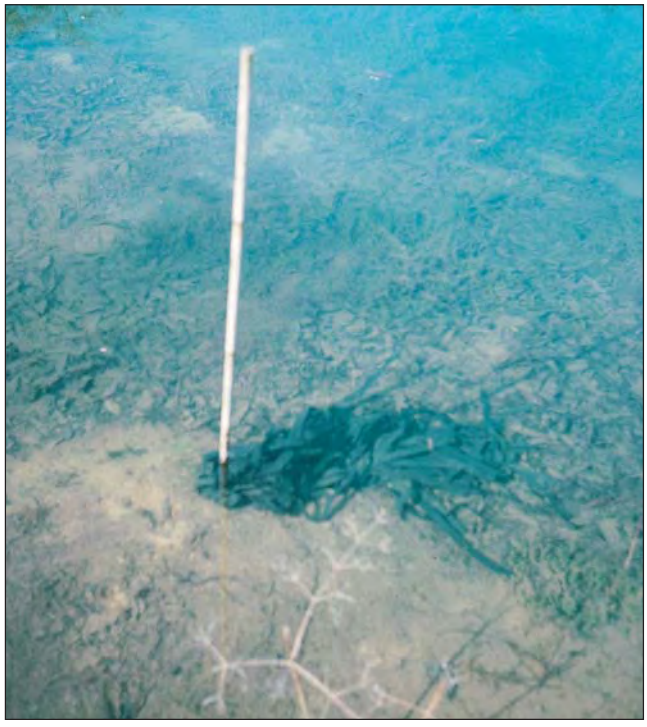
- The site should not currently support great crested newt
- The site should be within the natural range of the species, and ideally known to have supported great crested newts in the past
- The reason why great crested newts are not currently present should be understood (often, this might be because of the lack of a suitable pond), and this should have been rectified
- The great crested newts should not have a deleterious impact on communities in the new habitat (normally this is not a problem as new habitat will be created)
- The site should be separated by at least 1 km, or by barriers to dispersal, from other great crested newt ponds, yet capable of being linked up to it by future habitat creation
- Land owners and managers should be agreeable
- Monitoring of the transferred newts should be arranged
- The statutory nature conservation organisation should be consulted (licences will be required)

Methods for newt translocation

The source of the newts should be a collection of ponds located 30 km or so from each other within the same geographic zone, and therefore adapted to local conditions. They should be ponds at which there are viable, large populations of great crested newts, well linked to other populations and not subject to major threats. This helps ensure that the animals taken for translocation are genetically and physically healthy, and that the donor populations will not be harmed in the long-term by the depletion of numbers for the translocation.

Newts should not be transferred into newly created or restored ponds immediately after their construction; there should be time to allow for the aquatic plant and invertebrate community to develop.

The recommended life-stage for great crested newt translocation is the egg stage. Although moving adults is more tempting because they can be monitored immediately, the numbers needed to ensure a good genetic range is prohibitive in most circumstances. The transfer can be achieved over a spring period by placing artificial egg laying strips in the ponds selected for donation. Egg laying strips should be placed in several locations around the edge of a pond for several days before collecting. When abundant, plants with eggs laid on them can also be transferred, but only when the pond owner has given permission. At least 600 eggs should be used each year for three years. Egg laying strips should be transferred carefully and anchored in the warm shallows of the receptor pond. Checks to ensure that they have not been disturbed may be worthwhile. Larvae may become visible towards the middle of June onwards and in mid to late August, large larvae with fully developed legs can be counted by the pond edge at night by torchlight.



Artificial egg laying strips can be used to transfer newt eggs

Captive rearing of newt larvae is time consuming and not recommended; given a well-planned project incorporating suitable donor and receptor sites, it should not, in any case be required. Larvae are delicate and sensitive to shock and are prone to cannibalism when confined.

Monitoring of the receptor pond should concentrate on establishing:

- Successful larval development and metamorphosis from the transferred eggs
- The presence of newly-matured (small) adults, two to four years from the release
- Courtship and egg-laying by returning adults
- The presence of juveniles and immatures on land (under refugia) or in the pond

Key References

38. GENT, T. & GIBSON, S. (Eds) (1998). The Herpetofauna Workers' Manual. JNCC, Peterborough. Contains references to legislation and more details on a wide range of practical details such as handling and survey techniques.

65. ENGLISH NATURE (1996). Species Conservation Handbook. A series of advice notes, including the following advice notes relating to great crested newts: 1.1 Amphibians and reptiles in England: The species and their status, protection and distribution. 1.2 Amphibians and reptiles: Bibliography and reading list.1.3 Amphibians and reptiles and the law: an introduction. 1.4 Amphibian and reptile recording schemes. 1.5 Sales controls on British species of amphibian and reptile. 2.1 Survey and monitoring of amphibians. 2.3 Management of great crested newt habitats. 2.5 Licence guidance notes on trapping and on translocating great crested newts.

Legal Protection and Licensing

MAIN LEGISLATION

This chapter is concerned with the use of the law to assist conservation work, but it is not designed to address the range of issues arising from situations where habitats are being altered or destroyed. Anyone in doubt over any legal issue relating to great crested newts should contact the relevant Statutory Nature Conservation Organisation (SNCO) in the first instance. What follows is a summary of the main provisions of the law but is not a complete guide.

Great crested newts are safeguarded by both British and European laws. Together these provide strict protection of the species and its habitat, and a means by which sites can be protected from undesirable change. The Wildlife and Countryside Act 1981 is the main nature conservation legislation in Britain. Section 9 of this law provides protection to species listed on Schedule 5 of the Act, which includes the great crested newt. This was enacted to implement the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) to which the UK is a signatory. The Act has been amended several times since it was passed.

The European Union's 'Habitats Directive' (Council Directive 92/43/EEC (a) on the Conservation of Natural Habitats and of Wild Fauna and Flora) requires that areas are designated as Special Areas for Conservation (SACs) for the great crested newt (as it is listed on Annex II) and that the species is given strict protection (as it is listed on Annex IV). The Directive is implemented in Great Britain by the Conservation (Natural Habitats, etc) Regulations 1994 (also known as The Habitats Regulations) and strict protection is given via Regulation 39 (the species is listed here on Schedule 2). The Countryside and Rights of Way Act 2000 "CROW Act", which applies only to England and Wales, makes further minor amendments to the species protection measures provided by the Wildlife & Countryside Act.

The wording in the 1981 Act and 1994 Regulations is slightly different and these differences are summarised in Table 1. Taken together the Act and the Regulations (following the CROW Act 2000) make it illegal to:

- Intentionally or deliberately capture or kill, or intentionally injure great crested newts
- Deliberately disturb great crested newts or intentionally or recklessly* disturb them in a place used for shelter or protection
- Damage or destroy a breeding site or resting place
- Intentionally or recklessly damage, destroy or obstruct access to a place used for shelter or protection
- Possess a great crested newt, or any part of it, unless acquired lawfully
- Sell, barter, exchange or transport or offer for sale great crested newts or parts of them.

Table 2: Comparison of provisions in the Wildlife and Countryside Act 1981 (as amended) and the Conservation (Natural Habitats) Regulations 1994.

Actions prohibited under: Wildlife and Countryside Act 1981	Actions prohibited under: Conservation (Natural Habitats & c) Regulations 1994
Intentional killing	Deliberate killing
Intentional injuring	-
Intentional taking	Deliberate taking/destruction of eggs
Possession/control	Keeping
Intentional or reckless* damage to/destruction of/obstruction of any structure/place used for shelter/protection	Damage to/destruction of breeding site/resting place
Intentional or reckless* disturbance at occupied structure/place	Deliberate disturbance
Sale offering/advertising for sale (includes any part or derivative) or transport for sale	Sale/exchange, offering for sale (includes any part or derivative) and transport

* "Reckless" offences were added by the Countryside and Rights of Way Act 2000, which applies only to England and Wales.

The legislation covers all life stages; eggs, tadpoles and adult newts are all equally covered.

There are cases where the law allows these actions to occur. These include acts carried out for humane reasons, for example tending injured animals and releasing them when they are fit, or the euthanasing of severely injured animals. Protection relating to obstructing access or damage to breeding or resting places, or places used for shelter and protection does not apply within dwelling houses. The law also allows actions that would otherwise be illegal provided these are "the incidental result of a lawful operation and could not reasonably have been avoided" (Section 10(3)c and Regulation 40 (3)c).

The Wildlife and Countryside Act 1981 provides a mechanism for the designation of Sites of Special Scientific Interest (SSSIs), and the mechanisms and level of protection for these sites has been further strengthened via the CROW Act (2000 see below). The Conservation Regulations 1994 identifies ways in which Special Areas of Conservation (SACs) are designated and protected. Both SSSIs and cSACs have been designated specifically for great crested newts.

Legislation is very important in the conservation of great crested newts because it helps Local Planning Authorities (LPAs) to control the way in which land use is determined. LPAs effectively have two major roles: development control (i.e. determining applications for changes in land use), and strategic development planning (i.e. preparing development plans which set out the policies for local land use). Government provides advice on nature conservation issues to LPAs primarily through a series of advice notes. These are: Planning Policy Guidance note 9: Nature Conservation (PPG 9) [England], National Planning Policy Guideline NPPG 14 - 'Natural Heritage' [Scotland], Technical Advice Note 5 [Wales]. These notes provide advice to local authorities on domestic and international legislation, and outline their responsibilities with respect to planning matters on other designated sites and sites where protected species such as the great crested newt occurs. LPAs are advised that the presence of great crested newts is a material consideration in the planning process, and that the refusal of permissions and the imposition of planning conditions are options when newts are present. In addition, development plans should take into account landscape features such as ponds, and encourage their protection. It is useful to read Local Plans and Unitary Development Plans in order to get acquainted with the ways in which LPAs set out their nature conservation objectives in policy form. Some of these plans now list great crested newt sites and state that development on these sites will not normally be permitted. There are also some requirements that are fairly specific, for example PPG9 requires LPAs to ensure that Local Plans are based on adequate information about local species and habitats and for linear habitat features such as hedges and ditches to be protected to counter the effect of habitat fragmentation.

Other legislation

Protection of Animals Act 1911 (1912 in Scotland) (and amendments) Prohibits cruelty and ill-treatment. Applies to captive vertebrate animals only (including captured animals which were previously living wild).

Abandonment of Animals Act 1960 Prohibits abandonment of captive vertebrate animals if it is likely to cause or causes them unnecessary suffering.

Animals (Scientific Procedures) Act 1986 Certain activities such as tail and toe-clipping and other invasive sampling or marking procedures, are controlled by this Act. Some recognised procedures can, however, be licensed by the Home Office.

Countryside and Rights of Way Act 2000 Introduces 'reckless' offences in addition to those that are carried out with intent.

In general, legislation sets out what people or organisations are not permitted to do, rather than placing a duty on them to be proactive. The main exceptions to this are the designation of SSSIs and SACs, and Section 74 of The Countryside and Rights of Way Act 2000, which placed a general duty on Government Departments in England and Wales to further the conservation of biodiversity, which can help conservation if species and habitats are properly selected, protected, managed and monitored. On the whole though, conservation objectives are not usually progressed by legislation alone. However, laws do assist conservation by providing a framework for legal protection and encouraging organisations and individuals whose functions impinge on great crested newts to take their interests seriously. Section 25 of The Wildlife and Countryside Act 1981 places a duty on local authorities to promote education concerning nature conservation to the public and Statutory Nature Conservation Organisations can advise on this. Other statutory bodies, such as the Environment Agency (Environment Act 1995, Section 7 England and Wales, Section 34, Scotland) are also given explicit duties to further nature conservation.

Licensing

Actions that are prohibited by the Wildlife and Countryside Act 1981 and the Conservation (Natural Habitats & c.) Regulations 1994 can be made lawful on the granting of a licence by the appropriate statutory authority. For most conservation purposes, this will be English Nature (EN), the Countryside Council for Wales (CCW) or Scottish Natural Heritage (SNH).

In practice, those working directly on promoting the conservation of great crested newts are most likely to require a licence when undertaking surveys using techniques which involve disturbance or capture of the newts. Licences would therefore certainly be required for netting, bottle trapping, pitfall trapping and refuge searching. For torch surveying, if a degree of disturbance is considered likely, a licence is required. Egg searching may also entail disturbance, and if in doubt a licence should be obtained. Habitat management may require a licence and this should be discussed with the SNCO in

Site Protection

Legal Protection and Licensing (cont.)

advance. Licences may be granted by all SNCOs for the capture of newts for their introduction or reintroduction, so long as this is part of a properly planned conservation project. For further advice on licensing, contact the relevant SNCO (see contact details at the end of this handbook well in advance of any work).

Licences for habitat management are only required when an activity which otherwise may be an offence (e.g. disturbance) is likely. Hence, for the majority of pond, woodland and grassland management, no licence is required so long as the work is done using appropriate methods and is timed to avoid unlawful activities. In some very limited circumstances, where there is no alternative, habitat management activities involving deliberate disturbance, capture and confinement of great crested newts may be authorised with a licence from the appropriate SNCO.
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Cutting and mowing of grassland in summer is generally not advised against so long as it is a part of maintaining suitable habitat for great crested newts. In dry weather these activities are highly unlikely to lead to killing or injuring, as most newts spend daylight hours below the ground surface or under refuges. The only problem that might be encountered is where dense grass swards are subject to low cuts, especially when this is undertaken close to breeding ponds during the active season (a particularly sensitive period being wet weather in August - September, when metamorphs are emerging). However, in most cases, if management activities are undertaken in hot, dry conditions and machine cutting blades are set high, then there is unlikely to be any contact with newts above ground. Areas that are to be maintained as a short sward (e.g. paths) should be regularly mown to discourage animals from resting there.

Key Web addresses

Conservation (Natural Habitats & c.) Regulations 1994:
http://www.hmso.gov.uk/si/si1994/Uksi_19942716_en_1.htm
Countryside and Rights of Way Act 2000:
http://www.legislation.hmso.gov.uk/acts2000/20000037.htm
Habitats Directive:
http://wwweuropa.eu.int/eur-lex/en/lif/dat/1992/en_392L0043.html
Bern Convention
http://www.nature.coe.int/english/cadres/bern.htm

Key References

49. DETR (1995). Biodiversity: The UK Steering Group Report Volume 1: Meeting the Rio challenge. HMSO London ISBN 0117532185.
50. DETR (1995). Biodiversity: The UK Steering Group Report Volume 2: Action Plans (Great crested newt pages 112-113) HMSO London ISBN 0117532282.

THE ROLE OF SITE PROTECTION SYSTEMS

The decline of great crested newts is largely due to loss, damage/modification and fragmentation of their habitat. This can occur, for example, when a site supporting newts is destroyed to build a new road or housing development. Although great crested newts receive protection under wildlife legislation and it is illegal to damage certain parts of their habitat, this does not always prevent a development. This is often either because their presence is not known, or because a licence to remove newts according to an approved scheme may be issued by the appropriate government department. Various statutory and non-statutory designations (see Table 3) may provide differing levels of protection against development.

Many great crested newt breeding sites are threatened by housing developments

Some day-to-day practices such as ploughing of arable fields and woodland management may cause only temporary disturbance to newts and their habitat. Statutory site protection systems are not designed to hinder rural land management so long as it is consistent with nature conservation. However, cases need to be considered individually and in some instances, site protection is needed when change occurs or is threatened outside the local authority (Council) development control process. One example, the infilling of ponds and ditches is likely to require consent from the EA/SEPA. Site protection systems may be complex, as different Government agencies have separate but sometimes overlapping functions. Some organisations offer leaflets explaining how you should respond for greatest effect (see ref 37).

In order to give sites a better chance of long-term protection from threats, they need to be identified by survey work, and reported. In some cases they can also be given extra protection through designation (see the table on page 39). At the simplest level, sites that have been surveyed and for which the results have been made available to the landowner should be listed, and maps kept by local authority planning officials, voluntary bodies and Government agencies. Individuals who are experienced and who can carry out checks by virtue of their general interest or duties (e.g. amphibian group members and pond wardens) have an important role to play in helping to locate breeding sites, updating existing records when they are ten years or so old and reporting site threats to appropriate organisations.

Such breeding site lists help in raising the profile of the newt interest on a site when a significant land use change or development is proposed. The great crested newt UK Species Action Plan calls for all known breeding sites to be identified in Local Plans or Unitary Development Plans. Sites may be designated on a non-statutory basis or through stronger, statutory mechanisms.

Representations concerning planning applications that may, as a side effect of their being approved, cause decrease in a newt population size or obstruct its dispersal, are normally made formally in writing to a Local Planning Authority (LPA) by the Statutory Nature Conservation Organisation. The SNCO will advise both the LPA (and the relevant Government Department) on the effect of any proposals and upon the viability of any Method Statements that describe mitigation proposals to minimise or ameliorate such threats to the conservation status of the species. Voluntary bodies may also comment. Planning conditions requiring special safeguards and measures to protect newts and their habitat (including connectivity to adjoining ponds/colonies) are often placed in planning permissions as a result.

Local planning authorities have responsibilities under the Conservation Regulations 1994 and will only grant planning permissions that involve disturbance to great crested newt populations under certain strict conditions. Invariably, measures to maintain the conservation status of newts are required. Further guidance can be obtained from SNCOs (and DEFRA/NAW/SE). Planning policy guidance in England, Scotland and Wales, encourages local government to protect wildlife, and the preparation of landscape (or pondscape) zones and linkages on a strategic level is also advised.

Both local authorities (Council officials from relevant departments) and the Police (Police Wildlife Liaison Officers) have duties to assist when it is suspected that unlawful actions have been or are about to be undertaken.

All of these systems are designed to prevent site damage and loss and to maintain the conservation status of the species. Without long-term work to maintain distributions and habitats in favourable conditions, and monitoring to ensure that the newt population is sustained or enhanced, site protection is of much less value. This is because newt populations can be eroded or lost by processes other than total site destruction.

Some areas such as landfill sites may be colonised by newts but offer little security for their long term survival

Drift fencing may be required to keep newts in agreed areas or to help in their capture and nearby release as a part of licenced mitigation schemes

Some threats such as overstocking of livestock may require expert advice and research to identify and address them

Drawing boundaries

Drawing boundaries on maps to show adequately the extent of sites for designation requires a consistent approach. Lists of breeding sites often indicate the location of the aquatic habitat but not that of the land habitat. It is important to consider the pond cluster in which breeding sites occur, and the likely movements between a known breeding site and any others nearby or, in the absence of that information, on any ponds that could be potential breeding sites.

Ideally, local 'pondscape' maps should be produced (1:25,000 scale is useful), showing the position of all ponds and other suitable habitat to a distance of 1.2 km. Those ponds and land habitats with known protected species interests should be highlighted and important pond clusters with good numbers of newts and particularly rare or diverse habitat should also be given prominence.

Normally, when identifying a site for County Wildlife Site or SSSI designation, local officials will consider a range of factors. A CWS or SSSI may encompass the great crested newt breeding ponds and most semi-natural habitat (including hedges, embankments, ditches and verges) within the relevant distance in any direction and between known breeding ponds. Ponds not known to be occupied by newts, that may be occupied in the future should be included if they are within natural dispersal distance of a known great crested newt breeding pond.

Non-statutory local nature conservation designations (often called County Wildlife Sites (CWS), Sites of Nature Conservation Interest (SNCIs), Sites of Importance for Nature Conservation (SINCs) and by other abbreviations) vary greatly from place to place. Some county systems recognise a proportion of great crested newt sites for CWS designation, usually when they are combined with other species or habitat interests. In other areas all great crested newt sites are considered to have equivalent status to County Wildlife Sites.

Special Areas of Conservation (SACs) protect examples of typical habitats and the biggest populations of great crested newts in Britain. Peters Pit SSSI/cSAC, Kent England

The 'Sites of Special Scientific Interest' (SSSI) designation offers a degree of protection to a small number of sites. Newt populations can be designated because of their large size or because they occupy part of an area designated for other species or habitat interests. SSSIs may also be designated by SNCOs when they cover an important assemblage of amphibian species. Notification of an SSSI means that owners and occupiers are required to consult the SNCO before carrying out potentially damaging operations. Sites designated as Special Areas of Conservation (SAC) carry an even higher level of protection.

Table 3 Major statutory and non-statutory site designations, with designating authority

Designation Type	Authority	Comments
LOCAL Non statutory local wildlife site (many different official terms, e.g. County Wildlife Site).	Local Planning Authority, and/or County Wildlife Trust often in consultation with SNCO (England and Wales) Wildlife Trust (Scotland)	Usually updated on an annual basis
NATIONAL SSSI (Site of Special Scientific Interest)	Statutory Nature Conservation Organisation	Designated by the SNCO following site survey, consultation and notification process. Can be designated at any time.
EUROPEAN SAC (Special Area of Conservation)	Statutory Nature Conservation Organisation and Government	Designated by the UK Government following submission the European Union by DEFRA, National Assembly for Wales or Scottish Executive. Normally an SSSI and selected by SNCO following a similar consultation and notification process to that for an SSSI.

What to do when a site is threatened

Great crested newt populations are frequently threatened by actions that may be classed as unlawful. A proportion of these threats are observed and reported, and an appropriate response is made to ensure the most efficient action to minimise damage. In most areas, a good level of communication between Amphibian and Reptile Groups, Wildlife Trusts, individuals and officials enables the reporting of concerns to the relevant authority. In some cases, lists of planning applications or notices displaying intent to carry out work may draw attention to the activity before it begins, giving time for more measured considerations and response.

If a known or suspected great crested newt site is threatened by development, the local planning authority and the local office of the SNCO should be informed as far in advance as possible. For activities not subject to planning permission, it is best to contact the landowner well before any work is due to start. The local SNCO office may be able to assist. Advice can then be given to ensure the conservation of the population. Where there is evidence that an offence has been committed, or is about to be committed, the police should be informed (Police Wildlife Liaison Officers are good contacts). For offences involving pond draining, infilling or fish stocking, it is also worth contacting the EA (England/Wales) or SEPA (Scotland) or SEERAD (fish stocking in Scotland). For potential offences at places where work is being undertaken, the licensing or consenting authority should be contacted in the first instance, as follows.

- Threats from development activities that require planning permission; *Local planning authority and local office of SNCO.*
- Threats from non-development related activities, Landowner, then if offence occurs; *Statutory Nature Conservation Agency (local office) and Police Wildlife Liaison Officer.*

Without well recorded and reported surveys of great crested newts and their habitats it is difficult or impossible for site designation and law enforcement agencies to act.

- Threats where the case involves damage or infilling [in Scotland only, infilling as part of a waste disposal operation] of ditch or pond supplied by/feeding ditch, pipe or watercourse; *Environment Agency/Scottish Environment Protection Agency.*
- Threats caused by stocking with fish; *Environment Agency (England and Wales)/Scottish Executive Environment and Rural Affairs Dept. (SEERAD) in Scotland (and SNCO if on a SSSI).*

Mitigation projects for great crested newts often require habitat creation and special fencing to keep newts and other wildlife away from hazardous areas

Key References

37. FROGLIFE (1998) The planning system and site defence. Advice sheet 9. Froglife, Halesworth.

53. ENGLISH NATURE (2001). Great crested newt mitigation guidelines. English Nature, Peterborough - ISBN 1857165683.

54. FROGLIFE (2001) Local Species Action Plans for Great Crested Newts. [Suggested template for LSAPs] Available from Froglife.

55. HERPETOFAUNA GROUPS OF BRITAIN AND IRELAND (1998). Evaluating local mitigation/translocation programmes: Maintaining best practice and lawful standards. HGBI advisory notes. HGBI c/o Froglife, Halesworth.

56. MACKAY, J.M. (1997) Legislative and tenancy mechanisms for pond protection and management. In Boothby, J. British Pond Landscapes (see ref 32).

57. NATURE CONSERVANCY COUNCIL (1989). Guidelines for the selection of biological SSSIs. NCC, Peterborough.

58. SCOTTISH WILDLIFE TRUST (1993). A manual on the survey, assessment and processing of Wildlife Sites. SWT Edinburgh.

65. ENGLISH NATURE (1996). Species Conservation Handbook. A series of advice notes, including the following advice notes relating to great crested newts: 1.1 Amphibians and reptiles in England: The species and their status, protection and distribution. 1.2 Amphibians and reptiles: Bibliography and reading list.1.3 Amphibians and reptiles and the law: an introduction. 1.4 Amphibian and reptile recording schemes. 1.5 Sales controls on British species of amphibian and reptile. 2.1 Survey and monitoring of amphibians. 2.3 Management of great crested newt habitats. 2.5 Licence guidance notes on trapping and on translocating great crested newts.

Surveying and Monitoring

Why survey for great crested newts?

While the habitats occupied by great crested newts are legally protected, there are an estimated 18,000 or so breeding sites, and the majority (perhaps as many as 80%) remain unrecorded. Hence many sites are lost in spite of the presence of great crested newts.

On the other hand, if ponds are surveyed, great crested newt records can be passed to regional recorders and record centres, and then relayed to the appropriate authorities. Important sites can be designated as Sites of Special Scientific Interest (SSSI) or County Wildlife Sites. If records are made available to local authorities, great crested newt habitats can be protected during the strategic planning and development control processes. As sites are identified, their locations and assessment of their management needs can be used to produce plans for local pond restoration and creation. Landowners can be informed of the presence of this species and provided with advice on favourable habitat management.

Although the primary focus of these guidelines is the great crested newt, survey methods are generally applicable to the other two native newt species, palmate newt and smooth newt (collectively referred to as smaller newts). These guidelines will help in considering a range of survey strategies, and in selecting from a variety of survey techniques. The techniques considered are refuge searching, egg searching, netting, torching and bottle trapping.

Guidelines and standards for survey as part of licensed mitigation, resulting from development threats, are provided in *Great Crested Newt Mitigation Guidelines* available from English Nature (see reference no. 53).

Planning a survey

All survey records are useful. However, with a little planning, the benefits from a survey can be maximised. Surveyors should consider the aims of the survey. Are they to locate new site records for great crested newts, to measure the number and density of ponds occupied by newts in a locality, or to consider the apparent change in status of newts in a given area, or within a single pond?

Surveyors should also do some research to establish previous or even ongoing surveys in the same geographic area. This could avoid replication of effort and may allow collaboration with others. Local Amphibian and Reptile Groups (ARGs), Wildlife Trusts or natural history societies may be able to provide information on past surveys and active surveyors. Froglife can also help you to make local contacts.

Before survey work is carried out, the permission of landowners should always be obtained. Most types of great crested newt survey work will also require licensing.

Survey strategy

For the purposes of this handbook, survey strategy refers to the way in which ponds are selected for survey. The choice of strategy will depend on the aims of the survey.

Incidental survey
This refers to surveying ponds on an opportunistic or casual basis. Incidental surveys may cover hundreds of records gathered over a long period or a single record generated for any purpose, such as someone looking for newts in their garden pond, the field pond nearby, or at a site threatened by development.

Targeted survey
Targeted surveys focus effort on ponds that are purposefully, rather than opportunistically, selected. For example a recorder trying to maximise the number of great crested newt site records that can be made in a limited time, could focus on ponds thought most likely to support this species. Clues as to the likely presence or absence of great crested newts can be obtained by inspecting the habitat and on the basis of other species present. For example, a pond that supports large numbers of fish and ducks is an unlikely great crested newt site.

Great crested newts may occupy clusters of ponds (as metapopulations), so a search aimed solely at locating new site records could concentrate on ponds close to sites where populations are known to exist. 1:25,000, or finer scale Ordnance Survey maps are useful for locating ponds. If re-surveying an area in which the information on distribution of great crested newts is old and very patchy, it is best to concentrate on checking known historical sites, then spread out effort to look at ponds within 500 m or so. This will check whether 'old' sites are still occupied, and give an idea of whether they are part of metapopulations.

Targeted surveys are the best strategy to produce a large number of new records, but are limited in providing a complete picture. For example, they cannot be used to provide precise information on average local pond occupancies (the proportion of ponds occupied by newts) because they are based on a sample of ponds chosen because they are thought to have a higher than average likelihood of containing newts.

Blanket survey

Blanket surveys cover all ponds within a given area, for example a parish, district or grid square of an Ordnance Survey map. The size of the area will depend on the resources available and pond density. Undertaking these detailed surveys can provide complete information on newt distribution and density of breeding sites along with other information relating to their conservation. Such information can be useful even beyond the area surveyed. For example if a blanket survey in one area reveals that about one third of local ponds can be expected to support great crested newts, then this can influence planning and land management decisions in areas of similar habitat, even if their ponds have not actually been surveyed.

What data should be collected?

Presence/likely absence

For most conservation surveys, the key information to gather is whether newts are present or absent. Theoretically, it is impossible to prove that newts are absent from a site; not finding newts does not mean that they are not there. But in practice it is useful to be able to record animals as absent, or strictly speaking, likely to be absent. Several visits and a variety of survey techniques will be required before it can be concluded that newts are likely to be absent from a site.

Relative abundance

Although presence/likely absence surveys are the basis of much great crested newt conservation work, there are situations when it is helpful or necessary to obtain some measure of population size. However, establishing the true size of a newt population is very time-consuming, and is an activity more appropriate to research projects than to conservation work. Relative abundance is an index or measure of newt numbers seen or captured at a site each year using repeatable methods, and is a more practical option for conservation surveys. It provides a measure of numbers so that, even though actual population size is not known, trends and comparisons can be made between ponds or over time. Relative abundance can be used to:

- assess sites for conservation designation
- compare sites when developing and prioritising conservation strategies
- consider population changes over time.

Counts

The use of counts of newt numbers to assess populations has evolved from guidelines for the selection of biological SSSIs published by the Nature Conservancy Council in 1989. Guidance relevant to great crested newts and other herpetofauna is also summarised in the *Herpetofauna Workers' Manual* (see references). Newt populations are scored as low, good or exceptional (see below). To be eligible for SSSI designation, a great crested newt population normally has to be scored as exceptional over at least three years.

The surveyor should be aware of the limitations of counts. They can vary dramatically for a single population from one day to the next, and in particular, are affected by temperature fluctuations. Also, the variable nature of ponds affects the ease with which newts can be counted. For example, they may be less easily observed in turbid or weedy ponds. Repeating the counting process can go some way towards compensating for variation in newt visibility in ponds where water clarity varies. At least three, and preferably six, counts per year are recommended. These should be carried out over the course of the main breeding season, under suitable weather conditions. The highest count obtained should be used to score the population. If comparisons between population are being made, or if changes in population size over time are being considered, then ideally the average of the same number of counts for each year is used. When assessing populations in a closely-spaced group of ponds (within 250 m of each other) counts can be added together to give a cumulative site score.

If monitoring (measuring population size changes over time) is being undertaken, it should be noted that newt population size can fluctuate between years, sometimes quite considerably. This is not necessarily a cause for concern, but may be part of a normal process. Long-term monitoring, ideally over many years, is needed to reveal any meaningful trends in newt populations (see later).

Licensing

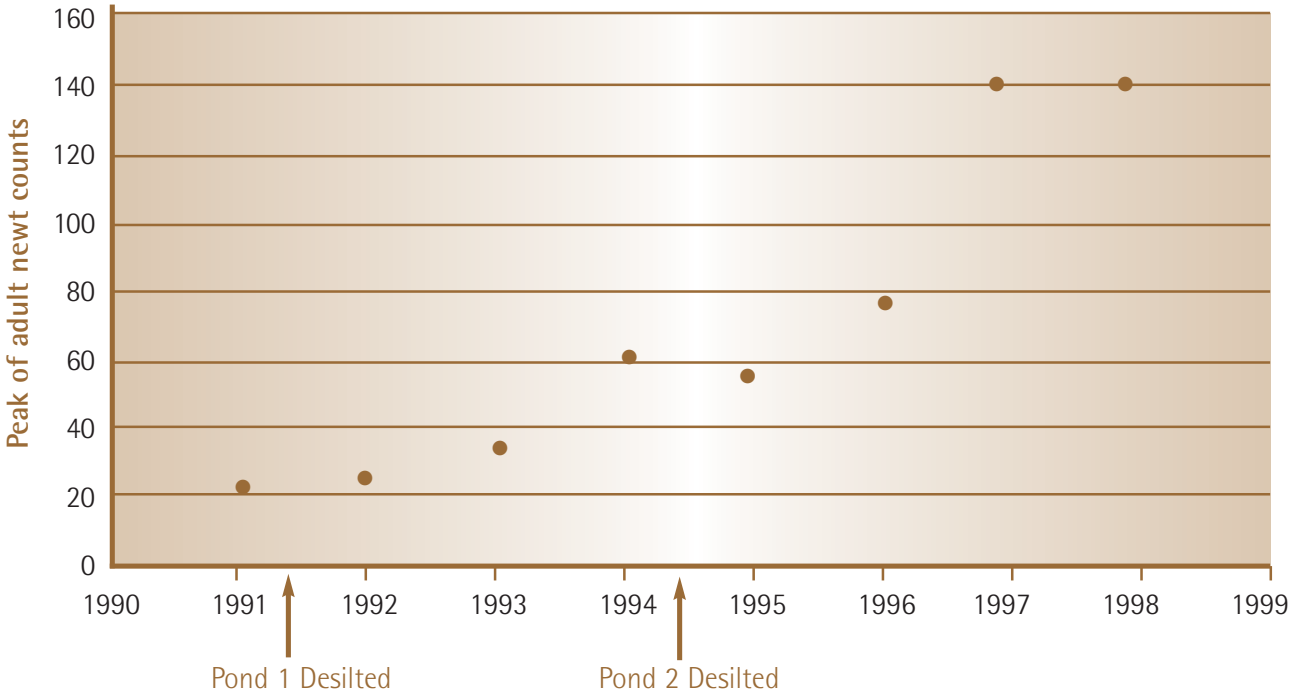
As described in the previous chapters, the great crested newt is strictly protected in Britain through the Wildlife and Countryside Act 1981 (as amended) and the Conservation (Natural Habitats etc.) Regulations 1994. This legislation not only protects great crested newt habitat, but also makes it an

Newt Species	Survey Method	Population Score		
		Low	Good	Exceptional
Great crested newt	Seen or netted (day) Counted at night	< 5 < 10	5-50 10-100	> 50 > 100
Smooth newt and Palmate newt	Netted (day)/counted (night)	< 10	10-100	> 100

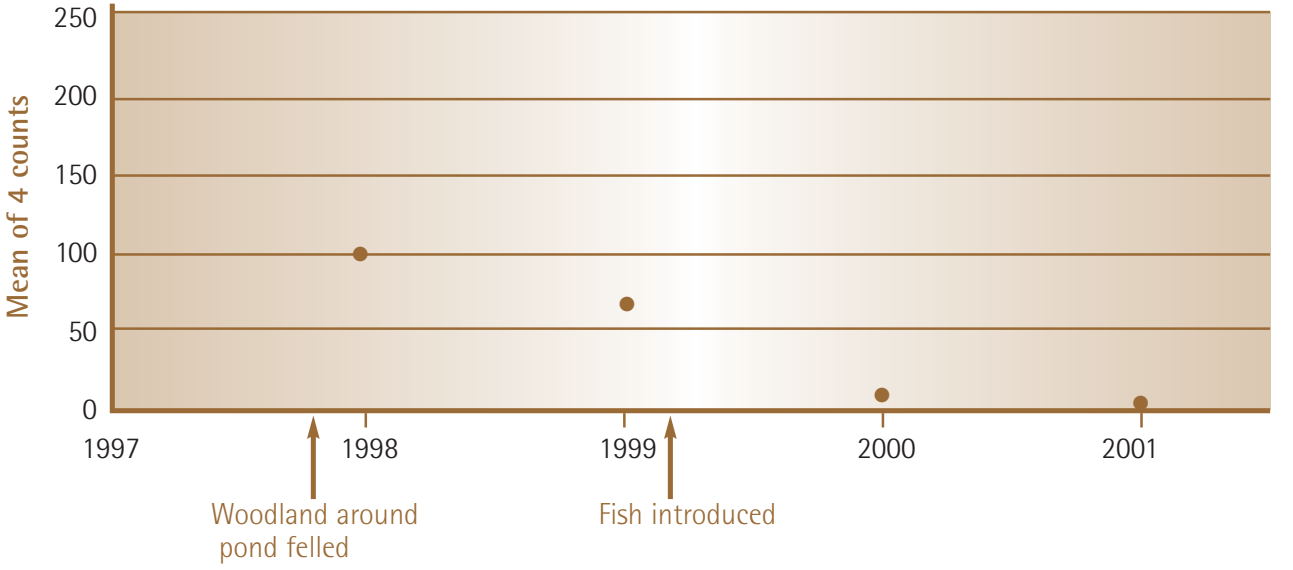
Table 4 System for assigning population status based on newt counts. Extracted from the Nature Conservancy Council's guidelines on the selection of biological SSSIs (NCC 1989).

offence to capture or disturb the species. A licence allows an otherwise unlawful activity to occur for a certain reason, such as conservation. If it is anticipated that great crested newts will be encountered during a survey, then generally it is advisable to obtain a licence first, and certainly if you are going to use methods which involve capture or disturbance (licences are issued by the relevant Statutory Nature Conservation Organisation).

Example A. Monitoring of pond restoration on nature reserve; peak of six counts (three ponds)



Example B. Monitoring effects of damaging activities in forestry plantation; mean of four counts (single pond)



Site owners and managers may wish to assess the status of a resident newt population over time, by keeping a record of survey data. It is recommended that night torch surveys or bottle-trapping be used for this purpose. Regular counts, of at least three, and preferably six per season, may help develop a picture of the state of the great crested newt population. The graphs show examples of monitoring over a period of years. The peak counts (if the number of counts remains constant year to year) or the mean counts may be used to monitor the effects of management techniques or other changes.

Survey techniques

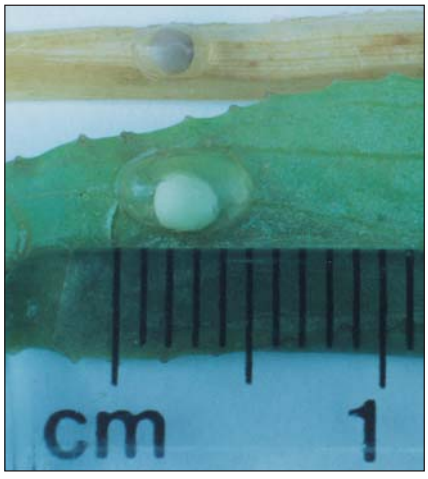
The techniques used will depend on both the level of information needed and the nature of the pond. If the aim of a survey is to provide results that will be compared with other surveys, then the techniques used must be the same in all cases. For example if a survey aims to look at changes in local populations by re-visiting sites of old records, then the survey techniques should be the same as used in the original work.

Refuge searching

On land, newts take refuge beneath objects such as rocks, logs, moss, and discarded debris, particularly if they are flat and retain moisture. Looking underneath such objects, especially in the vicinity of ponds, can sometimes reveal newts. Juvenile and adult newts may be found under refuges from March to October. However, refuge searching is often not very reliable; newts may be present at a site, but simply not found under refuges. This method is best used as an additional technique when undertaking other survey methods. Anything moved during a refuge search should be replaced in its original position.

Egg searching

Examining submerged vegetation for newt eggs is a speedy, effective survey method for detecting the presence of great crested newts. Newts lay eggs singly and fold pliable material, usually the leaves of aquatic plants, around them (see page 8). The surveyor should search for folded leaves, and then gently open them to check for eggs. Great crested newt eggs can be distinguished readily from those of the smaller newts by their size, shape and colour, but it is not possible to distinguish smooth newt from palmate newt eggs. The jelly capsule of a great crested newt egg is oval and approximately 5 mm long, whereas that of the smaller newts is more rounded and approximately 3 mm long. The newly laid egg inside the jelly coat is round in shape in all of the newt species.



Newt egg colours may vary slightly. The eggs of the smaller newt species (above) are off-white, shades of grey and brown. Below, the larger great crested newt eggs are pale yellow. Eggs may sometimes reflect colour from the enveloping leaf.

In the absence of the leaves of suitable live plants, great crested newts will also lay eggs on dead leaves, including leaves that have fallen into the pond, or on the surface of non-pliable objects, such as fallen twigs. In a situation like this it can be more difficult for a surveyor to detect the eggs, but artificial materials can be used to the surveyor's advantage. A plastic bag cut into strips approximately 10 to 15 mm wide can be used to provide newts with an egg-laying substrate. The strips should be held together in a bunch with a length of wire, a twist-tie or similar, weighted or staked in a shallow area near the pond margin, and left for a few nights. The strips can then be checked for eggs at the convenience of the surveyor, and should be removed from the pond after the eggs have hatched.

Once unfolded, leaves or plastic strips will not re-adhere to eggs, so a surveyor should unwrap only the minimum needed to confirm newts' presence. Unwrapped eggs may suffer higher rates of predation. There is no benefit to be gained from unwrapping large numbers of eggs to count them, as there is no way to relate egg counts to any meaningful measure of population size or viability. Egg searching is best done from April to June, although eggs can sometimes be found in March and July in smaller numbers.

Netting

Using a sturdy dip-net with a 2-4 mm mesh can be a useful survey technique, although in general it is not as likely to reveal the presence of newts as are egg searching, torching or bottle trapping. This technique is not very efficient in detecting adult great crested newts, as during the day they tend to stay in the deeper areas on the pond base. It is useful in capturing the larvae and adults of the smaller species however. Netting can cause a great deal of disturbance to a pond, and so should be employed with care to minimise this impact. Invasive exotic plants, particularly New Zealand stonecrop (*Crassula helmsii*) and water fern (*Azolla filiculoides*) can easily be transferred between ponds via nets. If these plants are present, then the pond should not be netted.

The best time for netting is generally from March to May, when most adults are in the pond, and mid July to August when larvae are bigger. Care should be taken not to damage larvae, which need to be handled very carefully (because of their delicate external gills).

Netting can be standardised, to produce relative abundance scores. Fifteen minutes of netting per 50 m of pond shoreline is consistent with guidelines on SSSI selection (see table 4, page 42).

Netting for newts in an open shallow pond

Netting can be restricted by tree debris

Night-time torch counting

Torching

Searching a pond by torchlight between shortly after dusk and midnight is an effective means of detecting adult newts. The surveyor should walk slowly around the pond, checking for newts in the torch beam, paying particular attention to marginal vegetation and potential display areas on the pond bottom, and scanning every 2-3 metres or so as gaps in pond bank vegetation allows. March to June is the best time, and warm, still evenings without rain are most productive. Although newts are active in rainy and windy conditions, the water surface can become too disrupted for clear viewing. Larvae can also be detected by torching during late summer and autumn. The activity of newts, and hence their visibility during torch surveys, is heavily influenced by temperature.

In days following frozen or very cold conditions, newts can be so inactive in ponds that they go undetected. The air temperature below which torching becomes less reliable has not been established but 5°C can be taken as a working guide. A powerful torch is needed and waterproof rechargeable ones are most suitable. For most ponds, a torch with 100,000 candle power is adequate but when viewing water from greater distance (e.g. from 5-10 metres away at the edge of a flooded quarry), spot lamps of up to 1,000,000 candlepower can be used. Care must be taken with high power spot lamps as, at close range, these may cause extensive disturbance and possibly damage to animals.

Torching is a suitable technique for measuring relative abundance. Perhaps the most important issue regarding the choice of torch for those counting newts rather than recording presence/likely absence, is that of consistency. To compare counts between ponds or over time, the same type of torch, bulb and battery strength should be used in each case.

Torchlight counts are prone to showing apparent 'declines' in adult numbers over the summer as vegetation cover increases and breeding activity ends, reducing the visibility of newts. In very turbid or densely vegetated ponds, torch surveys are unsuitable.

To gain a population score the surveyor should make a single circuit of the pond and count the total number of adult newts seen by torchlight (see page 42).

Bottle trapping

Bottle traps are an effective way of detecting and assessing a population, but they do have several drawbacks. Bottle trapping can be logistically onerous and there is a risk of harming newts and small aquatic mammals. Due to the problematic nature of bottle trapping it is recommended only in limited cases. It could be used for checking weedy or turbid ponds where torching is not reliable for example, or for ponds at which night-time access (for torching) is restricted.

Bottle trapping normally requires two visits to a pond for each trapping session; an evening visit to set the traps, followed by an early morning visit to check them. It can take a long time to set, collect and transport a large number of traps to and from a pond (see reference 38). The use of bottle traps demands considerable care and should be carried out only by thoroughly trained persons. If traps are fully submerged and prevent newts rising to the surface of the water to breathe, then the newts may eventually suffocate. Warmer water holds less oxygen, so this risk increases in hot weather and also in small, well-weeded and heavily silted ponds. For information on bottle trapping, see reference no. 62

Drift fence and pitfall traps

Drift fences and pitfall traps are commonly used in studies of amphibian ecology. As a conservation survey tool they can be used to show the direction of arrival at, and departure from a pond, or to detect occurrence and movements on land.

Pitfall trapping is time consuming and labour intensive and can, like bottle trapping hold risks to amphibians, mammals and other wildlife.

Method	Time of year (months)									Licence recommended?*
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
Refuge searching										Yes
Egg searching										Yes, in Scotland and Wales No in England
Netting						L	L	L		Yes
Torching						L	L	L		Yes (see licensing text)
Bottle trapping										Yes

Table 5 Summary of survey methods for great crested newts, showing the months when techniques are most likely to be effective. Peak season (dark shading), other months when techniques may be effective (light shading) and times when they are generally much less likely to find newts (blank). L = technique likely to find larvae. * For guidance only. Check with your SNCO before undertaking survey work.

Recommended procedures

These recommended procedures are to guide conservation surveys. Mitigation work may demand more stringent standards (See reference no. 53).

Presence/likely absence survey

If carrying out a survey to determine whether newts are present or (likely to be) absent, then a surveyor should use a variety of techniques. A combination of egg searching, netting and torching is recommended. This can be expected to detect almost 90% of great crested newt populations. However, not all techniques will need to be deployed at each site, because once newts are detected then no further survey methods need be applied. A proposed procedure for a presence/likely absence survey is offered as a guide:

1. Obtain licence from statutory body, if required.
2. Obtain permission of landowner to survey pond.
3. Make first visit to pond during daylight.
   3.1. Carry out egg search and netting.
   3.2. Familiarise self with the site in preparation for a night-time visit.
4. Make second visit to pond (if needed) after dark for night-time torching survey.

During the daytime visit to the pond the surveyor should walk around the edge of the pond, scanning weeds for evidence of newt eggs. A second circuit of the pond should be made, netting for up to 15 minutes per 50 m of shoreline. This daytime visit is also a good opportunity to reconnoitre the site in preparation for a second visit, after dark, to carry out a torch survey. If the pond is visited immediately prior to dusk, then the daytime and night-time surveys can be carried out during a single visit. However, if netting has increased water turbidity then it may be necessary to delay the night-time survey to allow visibility to improve.

Relative abundance survey

Netting, torching and bottle trapping can be used to measure relative abundance of newts in different ponds. However, the logistical and welfare problems associated with bottle trapping and the inefficiency of netting in the capture of great crested newts means that torching is the most suitable technique to measure relative abundance for this species. If a surveyor wishes to monitor a population (repeat surveys over many years), then bottle trapping can also be used.

A proposed procedure for a relative abundance survey, using torching, is given as guidance:

1. Obtain licence from statutory body, if required.
2. Obtain permission of landowner to survey pond.
3. Make first visit to pond during daylight to familiarise yourself with terrain.
4. Revisit pond from three to six times during peak season for torch surveys or six to twelve visits for overnight bottle trapping.
5. Use highest count as a measure of population status and average count (same number each year) to compare between sites or years.

Collecting survey data

In addition to the species found or not found, at minimum, a record should include:

- date
- location (six-figure Ordnance Survey grid reference)
- recorder's name
- name and address of the pond owner.

Additional information could include a habitat description, threats to the site and a sketch map. A simple record form is provided on page 48. Please photocopy this for use.

Using survey data

All survey data, irrespective of the survey strategy employed, are valuable to conservation. Negative records (ponds surveyed where newts were not found) can be just as useful as positives. They help to identify survey 'gaps' by making a distinction between areas where newts have not been found and areas that have not been surveyed. All records, including 'negatives' should be sent to your local recorder and biological records centre. Building up a distribution map allows the information to be used for conservation planning purposes to protect sites. Landowners should also be informed of the presence of great crested newts on their land, given advice on how they can manage the area, and informed of what assistance is available and what the legal restrictions are. Ensure they are aware that you have reported your findings.

Exceptional populations of great crested newts are eligible for designation as Sites of Special Scientific Interest (SSSI) (see section *What data should be collected?* on page 42) and should be reported to the relevant Statutory Nature Conservation Organisation.

For larger targeted and blanket surveys, surveyors should also consider preparing a report. A suggested format is given below:

1. **Summary**
   A one page synopsis of the type of survey and results.

2. **Introduction**
   Information on habitat types and land use within the survey area, and distribution of newts known prior to the current survey.

3. **Methods**
   When the work was carried out, by whom, which survey methods were used, number of ponds visited.

4. **Results**
   - Number of ponds in which newts were found,
   - relative abundance data,
   - habitat information including pond density and condition,
   - map of positive and negative results,
   - list of all sites visited with results,
   - indication of best sites; other species recorded.
   - six-figure grid references of all ponds surveyed.

5. **Discussion**
   - Any limitations to the survey,
   - habitat associations; geographical associations,
   - protected status of newt sites,
   - conservation status of newts (comparison with old records),
   - number of new sites found,
   - number of sites lost or retained,
   - prevalent threats and likely causes of losses,
   - opportunities and suggestions for further work,
   - conclusions.

Such reports should be widely circulated. The following are suggested recipients: local amphibian and reptile groups, Froglife, local planning departments, the local office of the Statutory Nature Conservation Organisation, the local Environment Agency or Scottish Environment Protection Agency office, local and national records centres, local museums and natural history societies.

Health and safety

Surveying for newts involves working close to water bodies, often after dark. Surveyors should be aware of two types of potential health and safety issues: hazards associated with water bodies (e.g. drowning and disease) and possible dangers associated with working outside at night, particularly in urban or suburban areas (e.g. theft or assault). Danger can be minimised by visiting all sites during daylight, prior to night-time surveys, carrying a mobile phone and avoiding working alone. Surveying for newts can usually be carried out without getting wet. However, where bankside vegetation is dense this may necessitate wading through some areas, and egg searching may involve immersing hands in pond water.

Three main diseases to be aware of are Tetanus, Weil's disease (leptospirosis) and Hepatitis A. Weil's disease and Hepatitis A can be contracted through ingesting infected water and Weil's disease can also enter the body through mucous membranes and broken skin. To protect against disease:

- ensure that Tetanus boosters are adequate
- do not expose open wounds to pond water
- do not ingest pond water
- in case of injury, or if illness follows working near water, seek immediate medical advice.

Key References

38. GENT, T. & GIBSON, S. (Eds) (1998). The Herpetofauna Workers' Manual. JNCC, Peterborough. Contains references to legislation and more details on a wide range of practical details such as handling and survey techniques.

39. GIBB, R. & FOSTER, J. (2000). The Herpetofauna Workers Guide 2000. Froglife, Halesworth. Contains extended reference list.

53. ENGLISH NATURE (2001). Great crested newt mitigation guidelines. English Nature, Peterborough - ISBN 1857165683.

62. GRIFFITHS, R.A., RAPER, S.J., BRADY, L.D. (1996). Evaluation of a standard method for surveying common frogs (*Rana temporaria*) and newts (*Triturus cristatus, T. helveticus, and T. vulgaris*). Joint Nature Conservation Committee Report No. 259.

64. BEEBEE, T.J.C., & GRIFFITHS, R.A. (2000). Amphibians and Reptiles. Collins, London. New Naturalist Series.

66. FROGLIFE "Frogs, toads and newts in garden ponds". Advice Sheet 1. General advice on amphibians in gardens, spawn translocation etc.

GREAT CRESTED NEWT SHORT SURVEY FORM

This is a short form, particularly suitable for those recording newts for the first time. Similar forms are available from ARGs (see HWG/listing at www.froglife.org website to find nearest contact). Your help with organised surveys is needed in most areas.

Recorder details	**Pond ownership details**	
Name:	Name:	
Address:	Address:	
	Copy of record sent to owner	**Yes / No**
	Owner's permission to release record	**Yes / No**
	Owner's signature	
Tel/email	Tel/email	

Date	_ _ / _ _ / _ _ _ _	Grid reference	_ _ : _ _ _ _ _ _ _
Arrival / departure time		Site name	
Nearest town / village		Site status	
County		Site ref. no. or new	

Species records: Are these records of species on **water** or on **land**? **(circle)**

Species	**Adult**		**Adult Total**	**Imm.**	**Count Method**	**Tadpole**	**Count Method**	**Eggs/ Spawn**	**Count Method**	**Dead**	**Dead on Road**
	Male	**Female**									
Great Crested Newt											
Smooth Newt											
Palmate Newt											
Common Frog											
Common Toad											
Natterjack Toad											
Water Vole						-	-	-			
Grass Snake						-	-				

Count methods: Visual count (V), Netting (N), Bottle Trap (B), Pitfall Trap (P), Refuges/Debris Search (R)

Other Species

Pond size during visit (please circle appropriate depth)

Max. pond span (approx)		Max. pond depth (approx)	<0.5 m	0.5 - 1m	>1m

Site Description: Attach an A4 sketch map of the location marking its boundary, noting adjacent land-use features, north etc. If possible, add additional information, noting threats e.g. pollution, succession, in-filling, fish etc.

Please circle habitat / location categories that apply to site being surveyed:

Habitat: Woodland, Grassland, Parkland, Scrub, Heathland, Garden, Arable, Pasture, Quarry, Sand-dune, Wetland, Other
Setting: Rural, Suburban, Urban
Linear features: Bank, Ditch, Gully, Fence, Wall, Road / Rail verge, Road / Rail embankment or cutting
Waterbodies: Garden pond, Pond (up to 0.25 ha), Pond (0.26-2.0 ha), Lake (>2.0 ha)

Records should be sent to your Amphibian and Reptile Group/County recorder/local record centre who will forward records to national record centres. Any records sent to Froglife will be forwarded to local recorders/ record centres. Further information on recording schemes can be found on the Froglife website at www.froglife.org.

☐ Site visits must only be conducted with the landowner's permission. These records are returned with the understanding that, with the landowner's permission, they are entered onto a computer database and made freely available. If this is not the case please tick the box and the records will not be used without prior consent.

References

Identification, Ecology and Habitats

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Great Crested Newt Species Action Plan

The following is the text of the GCN SAP, extracted from the UK Biodiversity Action Plan (DETR 1995). Note: For DETR/MAFF, now read as DEFRA, WOAD read NAW, SOAEFD read SEERAD, NRA read Environment Agency, RPBs read SEPA.

1. Current status

1.1 The great crested newt is still quite widespread in Britain. It is widespread but local in Scotland, where there are fewer than 1000 individuals. The species may be numerous locally in parts of lowland England and Wales but is absent or rare in Cornwall and Devon. It is absent from Northern Ireland.

1.2 The species has suffered a decline in recent years with studies in the 1980s indicating a national rate of colony loss of approximately 2% over five years. It is estimated that there are a total of 18,000 ponds within Britain, although only 3,000 of these have been identified. The British population is amongst the largest in Europe, where it is threatened in several countries.

1.3 The great crested newt is listed on Annexes II and IV of the EC Habitats Directive and Appendix II of the Bern Convention. It is protected under Schedule 2 of the Conservation (Natural Habitats, etc.) Regulations, 1994, (Regulation 38) and Schedule 5 of the WCA 1981.

2. Current factors causing loss or decline

2.1 Loss of suitable breeding ponds caused by water table reduction, in-filling for development, farming, waste disposal, neglect or fish stocking and the degradation, loss and fragmentation of terrestrial habitats.

2.2 Pollution and toxic effects of agrochemicals.

3. Current action

3.1 JNCC have published a five-year framework (1994 - 1999) for the conservation of amphibians and reptiles in the UK, in collaboration with the statutory nature conservation agencies and voluntary bodies.

3.2 SNH commissioned a study on the distribution and status of this species in Scotland in 1994 and followed up with site surveys in 1995.

3.3 CCW, EN and SNH support a post within the NGOs to develop further local Amphibian and Reptile Groups, and support surveys and conservation initiatives. EN recently published the results of a symposium on the species, and leaflets have been published by EN and CCW, and by British Coal.

4. Action plan objectives and targets

4.1 Work in the early 1980s documented a 2% decline in the number of ponds every five years. A more recent report suggests that 42% of great crested newt populations in the London area have been lost in 20 years. Assuming a 0.4-2% annual loss of ponds, and assuming 18,000 populations, then between 72-360 populations are being lost each year. A target of 100 re-colonisations will offset these losses. This represents new ponds required to offset losses due to neglect and should be in addition to preventing site loss through development.

4.2 Where feasible, restore populations to 100 unoccupied sites each year for the next five years, creating new ponds and managing habitat where necessary.

4.3 Maintain the range, distribution and viability of existing great crested newt populations.

5. Proposed actions with lead agencies

5.1 Policy and legislation

5.1.1 Seek to ensure all ponds known to hold viable populations are identified in Local plans or Part II of unitary development plans, and that the protection and enhancement of the ponds is taken into account in accordance with paragraph 24 of DOE's Planning Policy Guidance note: PPG9. (ACTION: CCW, DoE, EN, LAs, SNH)

5.1.2 Consider expanding incentives for pond creation and management on farmland under the Countryside Stewardship and agri-environment schemes.(ACTION: MAFF, SOAEFD, WOAD)

5.1.3 Seek to create new pond protection measures to prevent deterioration and loss of great crested newt habitats. (ACTION: DoE, SOAEFD, WO)

5.2 Site safeguard and management

5.2.1 Seek to ensure that key sites for the great crested newt in Wales are safeguarded, considering SSSI notification where necessary to secure appropriate management. (ACTION: CCW)

5.2.2 Promote favourable management on all key sites where this species is known to occur. (ACTION: CCW, EN, FA, FE, LAs, SNH)

5.2.3 Seek to maintain the number and distribution of occupied sites through habitat restoration or creation of sufficient new sites near existing ones to compensate for local losses. (ACTION: CCW, EN, FA, FE, LAs, SNH)

5.3 Species management and protection

5.3.1 Encourage the natural dispersal of the species to new sites through habitat management and re-creation and, if necessary, consider establishing a translocation or re-introduction programme to restore populations to previously occupied or appropriate new sites. (ACTION: CCW, EN, SNH)

5.4 Advisory

5.4.1 Publish guidance for LAs, developers, land managers and others on legal obligations for the species, local management and, where appropriate, translocation techniques for the species. (ACTION: CCW, EN, JNCC, NRA, RPBs, SNH)

5.4.2 Promote training of professional and volunteer surveyors and those involved in the management and conservation of the great crested newt. (ACTION: CCW, EN, SNH)

5.5 Future research and monitoring

5.5.1 Develop further survey methods, recording, updating and data retrieval systems and surveillance systems to monitor the changes in status and the means of disseminating information. (ACTION: BRC, JNCC)

5.5.2 Encourage further surveys to identify important breeding sites. (ACTION: BRC, CCW, EN, JNCC, SNH)

5.5.3 Support research on habitat requirements, habitat use, population dynamics and species genetics to determine the favourable conservation status and underpin management advice. (ACTION: JNCC)

5.5.4 Expand the National Recording Scheme to ensure regular monitoring of known and potential sites. (ACTION: BRC, JNCC)

5.5.5 Pass information gathered during survey and monitoring of this species to JNCC or BRC in order that it can be incorporated in a national database and contribute to the maintenance of an up-to-date Red List. (ACTION: CCW, EN, SNH)

5.6 Communications and publicity

5.6.1 Further develop communications between statutory authorities and local conservation groups. (ACTION: CCW, EN, SNH)

5.6.2 Promote, through publicity and media opportunities, a wider and more sympathetic understanding of amphibian conservation. (ACTION: CCW, EN, SNH)

Advice & Assistance

GOVERNMENT BODIES

The Department of the Environment Food and Rural Affairs (DEFRA) is responsible for advising the government and for implementing policy and legislation. They also administer grants schemes for Countryside Stewardship and Environmentally Sensitive Areas. DEFRA Helpline, Department for Environment, Food and Rural Affairs 3-8 Whitehall Place, London SW1A 2HH, Tel: 08459 335577. Email: helpline@defra.gsi.gov.uk

The Scottish Executive Environment and Rural Affairs Department (SEERAD) is responsible for advising Ministers on policy relating to agriculture, rural development, food, the environment and fisheries, and for ensuring the implementation of those policies in Scotland. Tel. 0131 244 6023. E-mail: ceu@scotland.gsi.gov.uk

The National Assembly for Wales develops and implements policy for agriculture, the environment and the promotion of agri-environment schemes. Cardiff Bay, Cardiff CF99 1NA. Tel: 029 20 825111.
Website: www.wales.gov.uk. Email through website

STATUTORY NATURE CONSERVATION ORGANISATIONS (SNCO'S)

These are the Government's statutory advisors on nature conservation, and are responsible for identifying and notifying SSSIs, providing advice on nature conservation and wildlife legislation, issuing licences for conservation and education purposes, and supporting relevant research. They also manage grant schemes for nature conservation projects.

The Joint Nature Conservation Committee is the government's wildlife division undertaking international coordination of conservation work on behalf of nature conservation agencies, including English Nature, Scottish Natural Heritage and the Countryside Council for Wales. JNCC, Monkstone House, City Road, Peterborough, PE1 1JF. Website: www.jncc.fgov.uk Tel. 01733 362626

English Nature, Northminster House, Peterborough PE1 1UA. Tel. 01733 455000. Website: www.english-nature.org.uk. Email: enquiries@english-nature.org.uk

Countryside Council for Wales, Plas Penrhos, Ffordd Penrhos, Bangor, Gwynedd LL57 2LQ. Tel. 01248 385500. Website: www.ccw.gov.uk. Email direct from this site.

Scottish Natural Heritage, 2 Anderson Place, Edinburgh EH6 5NP. Tel. 0131 447 4784. Website: www.snh.org.uk. Email: enquiries@snh.gov.uk.

OTHER STATUTORY BODIES

Local authorities have a key role in great crested newt conservation, as owners and managers of land and as grant giving bodies. They also have a substantial involvement in planning matters. Some own and manage great crested newt sites, and countryside sections may become involved with survey initiatives.

The Environment Agency is responsible for controlling air, land and water pollution in England and Wales, has a statutory duty to promote the conservation of wetland wildlife, and is the licensing agency for fish transfers. The Environment Agency is involved in a number of management and survey projects for great crested newts. The equivalent body in Scotland is the Scottish Environment Protection Agency, which has a similar remit but has no statutory control over fish transfer. The Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS12 4UD. Tel. 01454 624400. Website: www.environment-agency.gov.uk Email direct from this site.

Scottish Environment Protection Agency, Erskine Court, Castle Business Park, Stirling FK9 4TR. Tel 01786 457700. Website: www.sepa.org.uk Email direct from this site.

The Forestry Commission is the statutory agency responsible for forestry, and it provides grants for woodland planting and management. It also owns and manages a number of sites with great crested newt populations. The Forestry Commission, 231 Corstorphine Rd, Edinburgh EH12 7AT. Tel. 0131 334 0303.
Website: www.forest.gsi.gov.uk
Email: enquiries@forestry.gsi.gov.uk

The Countryside Agency is a statutory body that works to conserve and enhance the countryside; to promote social equity and economic opportunity for the people who live there and to improve access to the countryside. They support research and lead a number of initiatives, including administrating grant schemes that involve communities in countryside projects. The Countryside Agency, John Dower House, Crescent Place, Cheltenham GL50 3RA. Tel: 01242 521381;
Fax: 01242 584270.
Website:http://www.countryside.gov.uk
www.countryside.gov.uk Email direct from website.

A wide range of other government bodies, such as the **Ministry of Defence**, control access to and manage large areas of wildlife habitat and may welcome your interest and involvement.

VOLUNTARY ORGANISATIONS: GREAT CRESTED NEWT SPECIES ACTION PLAN LEAD PARTNERS

These non-governmental organisations have the responsibility of guiding the implementation of the UK Species Action Plan and reporting on progress. As well as giving advice on great crested newt conservation they are also able to give advice on general amphibian conservation matters.

Froglife, Mansion House, 27/28 Market Place, Halesworth, Suffolk IP19 8AY. Tel. 01986 873733.
Email: enquiries@froglife.org.
Website: www.froglife.org

The Herpetological Conservation Trust, 655a Christchurch Rd, Boscombe, Bournemouth, Dorset BH1 4AP. Tel 01202 391319. Email: enquiries@HerpConsTrust.org.uk
Website: www.HerpConsTrust.org.uk

British Herpetological Society, c/o Zoological Society of London, Regent's Park, London NW1 4RY.
Website: www.thebhs.org

OTHER VOLUNTARY ORGANISATIONS

The Farming and Wildlife Advisory Group (FWAG) provides conservation advice to farmers and landowners, including a grant aid advice service. FWAG has a network of locally based Conservation Advisers in the UK. For contact details Tel: 024 7669 6699 Website: www.fwag.org.uk.
Email direct from this site.

Police Wildlife Liaison Officers are now appointed throughout Britain, and most police stations can advise on their local representatives.

The British Trust for Conservation Volunteers (BTCV) achieve conservation action through working with a network of local groups. BTCV, 36 St Mary's Street, Wallingford, Oxfordshire OX10 0EU. Tel: 01491 821600.
Website: www.btcv.org. Email: Information@btcv.org.uk

Groundwork UK is a charity with a network of over 40 local Trusts, working in partnerships to promote economic and social regeneration by improvements to the local environment. Groundwork UK, 85-87 Cornwall Street, Birmingham, B3 3BY. Tel: 0121 236 8565.
Website: www.groundwork.org.uk

The National Trust cares for over 248,000 hectares (612,000 acres) of countryside in England, Wales and Northern Ireland, including almost 600 miles of coastline and more than 200 buildings and gardens of outstanding interest and importance. 36 Queen Anne's Gate, London, SW1H 9AS. Tel. 0207 222 9251. Website: www.national trust.org.uk.

The National Trust for Scotland also cares for countryside buildings and gardens. Wemyss House, 28 Charlotte Square, Edinburgh, EH2 4ET. Tel: 0131 243 9300.
E-mail: information@nts.org.uk

The Ponds Conservation Trust promotes the long term restoration and management of ponds and aquatic habitats. They provide grants and technical assistance to community groups to carry out information-based pond restoration. The Ponds Conservation Trust, Oxford Brookes University, Gipsy Lane, Headington, Oxford, OX3 OBP. Tel. 01865 483 199.
Website: www.brookes.ac.uk/pondaction/PCT.
Email: rsnow@brookes.ac.uk

The Pond*life* Project is a programme to promote sustaining of ponds and other small water bodies in the landscape through building volunteer networks in partnerships with a wide range of government and non-government organisations. Pond*life* Project 15 - 21 Webster Street Liverpool L3 2ET.
Tel. 0151 231 4044.

Royal Society for the Protection of Birds. A main role of the RSPB is the creation and management of nature reserves to help birds, and other wildlife. They also debate with and advise the government on a range of issues. RSPB UK Headquarters, The Lodge, Sandy, Bedfordshire, SG19 2DL. Tel: 01767 680551 Website www.rspb.org.
Email bird@rspb.org.uk.

The Wildlife Trust's partnership of 47 local wildlife trusts work across the UK to protect wildlife in towns and countryside and they own and manage many reserves with ponds. The Kiln, Waterside, Mather Road, Newark, Nottinghamshire, NG24 1WT Tel: 0870 036 7711.
Website: www.wildlifetrusts.org.
Email: info@wildlifetrusts.cix.co.uk.

The Scottish Wildlife Trust, Cramond House, off Cramond Glebe Road, Edinburgh EH4 6NS. Tel : 0131 312 7765
Fax : 0131 312 8705
Website:www.swt.org.uk. Email: enquiries@swt.org.uk

A number of other voluntary bodies own and manage great crested newt habitats and can offer opportunities to help promote great crested newt conservation.

SOURCES OF GRANT-AID FOR SURVEY AND MANAGEMENT

Major sources of grant-aid for pond and terrestrial management on agricultural land are: Countryside Stewardship (England), Rural Stewardship Scheme (Scotland) and Tir Gofal (Wales). Applications are required well in advance due to the grant allocation cycles. Local county and district authorities may also offer a proportion of costs as grant aid for pond restoration and creation schemes that are in or close to areas within public ownership or view. Grant schemes are operated by other Government bodies (e.g. the SEPA Habitat Enhancement Plus Initiative in Scotland).

Non-government organisations such as The British Herpetological Society and The Herpetological Conservation Trust may allocate sums annually that are distributed as small grants for great crested newt survey and habitat creation and

restoration projects. Applications are received by the Froglife Great Crested Newt Conservation Coordinator at the Froglife main office, and are normally requested before the end of each calendar year for projects in the following year. Habitat creation proposals are assessed at the beginning of the year to which they apply.

Several areas have established (e.g. Cheshire, Worcestershire) are developing (e.g. Sussex, Kent, Hampshire) Pond Warden schemes where volunteers are trained and assisted to undertake a wide range of duties concerning pond protection and management. Such ventures have been promoted by a range of universities, voluntary bodies, corporate sponsors and government agencies and may be able to advise and assist local projects.

A number of corporate bodies dealing with energy and water supply such as Shell Better Britain, National Grid, Southern Water and Transco have promoted pond projects and may assist if a clear project proposal is prepared.

For Advice and information, contact the Froglife Great Crested Newt Conservation Coordinator
Tel: 01986 873733 Email: froglife@froglife.org
Website: www.froglife.org

Great Crested Newt Species Action Plan Work Programme

This document, updated every two years with the assistance of the great crested newt Species Action Plan (SAP) steering group, gives details on the implementation of the SAP. This includes the organisations responsible for each action in the SAP, priorities and timing, as well as a geographical breakdown of re-colonisation targets. A free copy of the Work Programme can be obtained from Froglife. For matters of national and general importance to great crested newt conservation, the great crested newt SAP Steering Group can be contacted via Froglife.

Local Biodiversity Action Plans (LBAP)

An LBAP is one way in which national BAP objectives may be planned and achieved locally. They are operated in a wide variety of ways, often led by the local authority or Wildlife Trust. Local great crested newt conservation projects should take account of LBAP targets and contribute to LBAP reporting. A list of LBAPs and contacts is available on the www.ukbap.org.uk

Amphibian and Reptile Groups (ARGs)

ARGs are local voluntary groups that progress herpetofauna conservation within their local area, often working closely with Wildlife Trusts. In many areas, great crested newt conservation will be a priority, and ARGs are often heavly involved in LBAPs. Herpetofauna Groups of Britain and Ireland (HGBI) is the independent federation of ARGs, giving advice, providing policy guidance and acting as a national forum for the exchange of information. Regular regional meetings and an annual conference are held. Details can be found on the Froglife web pages.

Other Species Conservation Handbooks

A.C. Entwistle, S. Harris, A. M. Hutson, P. A. Racey, A. Walsh, S.D. Gibson, I. Hepburn and J. Johnson. (2001) **Habitat management for bats**, a guide for land managers, land owners and their advisors. Joint Nature Conservation Committee, Peterborough ISBN1861075286

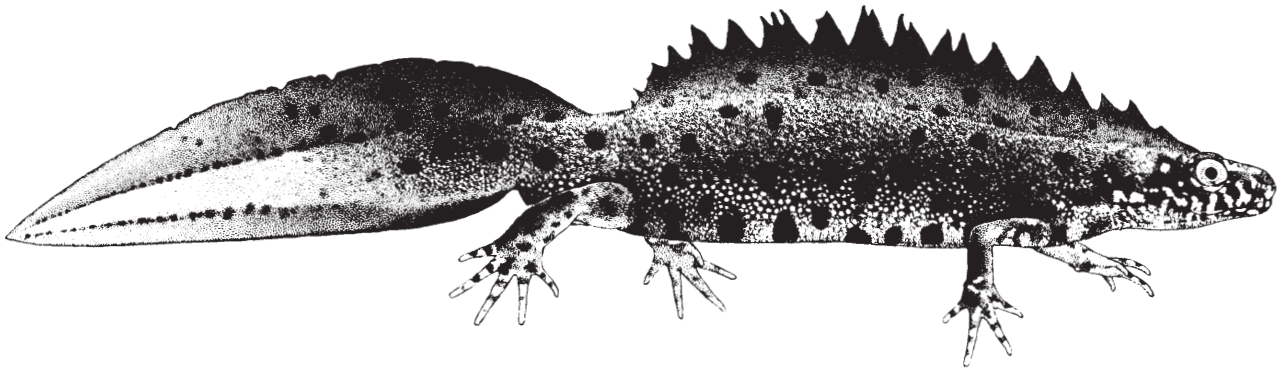
N. Moulton and K. Corbett (1999) **The Sand Lizard Conservation Handbook.** English Nature, Peterborough ISBN 1857164601

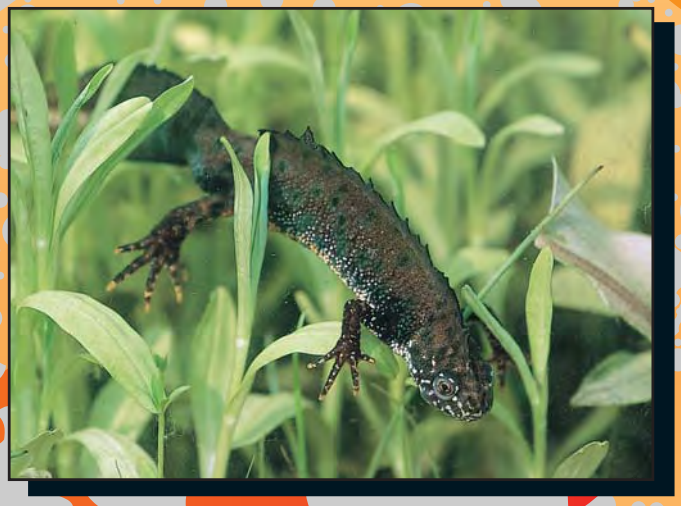
Environment Agency (1999) **Otters and River Habitat Management**. 2nd Edition. Environment Agency. Bristol

R. Strachan (1998) **Water Vole Conservation Handbook**. Wildlife Conservation Research Unit. Oxford

T. Beebee and J. Denton (1996) **The Natterjack Toad Conservation Handbook.** English Nature, Peterborough. ISBN 185716220

P. Bright, P. Morris and T. Mitchell-Jones (1996) **The Dormouse Conservation Handbook.** English Nature, Peterborough ISBN 1857162196





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