ENGLISH NATURE

The distribution and abundance of ponds in Suffolk

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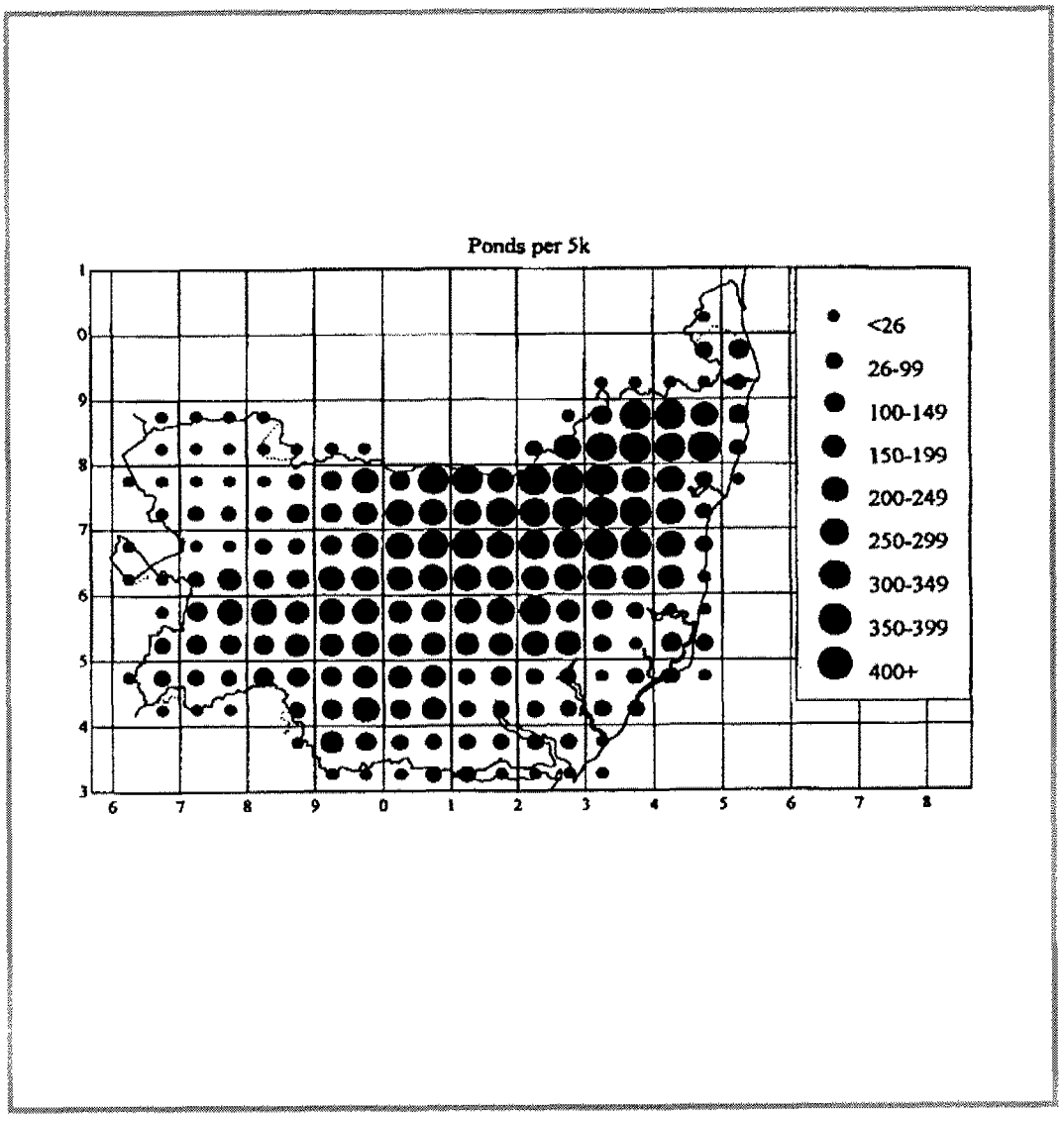

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The distribution and abundance of ponds in Suffolk

Nicholas Sibbett

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Summary

Ordnance Survey extracted from its computer database a list of every feature in Suffolk labelled 'pond', together with its name, grid reference and the name of the parish in which it is situated. This list represents every mapped pond in Suffolk and is the basis of this report.Ordnance Survey has no standard definition of a pond, so some features on the limits of a 'normal' definition of a pond may or may not have been labelled as a pond according to the surveyor's judgement. Ponds that have been filled in or new ponds that have been dug since the last round of survey will also be misrepresented on the list of ponds. Generally, however, the list is believed to be a good approximation of the extent of the rural pond resource but is not an exact representation

Suffolk contains 471 parishes and 4 non-parished areas. In the 3848.6km^2 of Suffolk covered by the 475 parishes / non-parished areas there are 22635 ponds according to the Ordnance Survey, at a mean density of 5.9 ponds per square kilometre. The overall range of pond densities in parishes is great. Across Suffolk, the average density of ponds is 5.9 ponds per square kilometre. Twenty-one parishes have a density of fifteen or more ponds per square kilometre, but thirty-seven have a density of one pond or less per square kilometre.

The Breckland and East Anglian Chalk Natural Areas have pond densities less than the Lowland Pond Survey's British average for lowlands of 1.7 ponds per km^2. The Suffolk Coast and Heaths has twice the British average, Broadland has over two-and-a half times the British average, and the East Anglian Plain Natural Area has four-and-a half times the average British lowland pond density. 'The Saints' of north-east Suffolk has a pond density more than seven times the British average, and the adjacent parishes have a density nearly ten times the British average. The parishes of Cratfield, Thrandeston, Linstead Parva, Heveningham, Sotterley, and Redlingfield each have a pond density more than ten times the British average.

A nature conservation aim is to increase the number of ponds proportional to current density, and improve the management of existing ponds. Future conservation effort should therefore be in proportion to the density of ponds across Suffolk.

Acknowledgements

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Environment Agency	Contact: Merle Leeds, Conservation Officer
St Edmundsbury Borough Council	Contact: John Smithson, Park Ranger Service
Mid Suffolk District Council	Contact: Richard Thurlow, Community Services
Babergh District Council	Contact: Peter Berry, Planning Policy and Economic Development
Suffolk County Council	Contact: Sue Hooton, Environment and Transport
Ipswich Borough Council	Contact: Gary Lowe, Park Ranger Service
Suffolk Association of Local Councils	Contact: John Dunnett
Suffolk Coastal District Council	Contact: John Davies, Planning and Leisure

In addition, Suffolk Association of Local Councils has also agreed to distribute copies this report to the several hundred Parish Councils who form its membership - a logistical challenge indeed!

Martin Sanford of Ipswich Borough Council's Suffolk Biological Records Centre produced the maps which form figure 1.

English Nature is grateful for all the financial and practical help so readily given. Without such help, this report could not have been given and our knowledge about Suffolk's ponds would have been so much poorer.

1 Methods

Ordnance Survey produce paper and digital maps of the United Kingdom, based on very detailed surveys carried out on the ground and from aerial photographs. All their survey data are stored on a computer. Ordnance Survey extracted from this database a list of every feature in Suffolk labeled 'pond', together with its name, grid reference and the name of the parish in which it is situated. This list represents every mapped pond in Suffolk and was sent to English Nature to be the basis of this report.

Ordnance Survey has no standard definition of a pond, so some features on the limits of a 'normal' definition of a pond may or may not have been labelled as a pond according to the surveyor's judgement. For example, ponds which hold water only during certain times of the year may have been identified or not identified depending on the time of year surveyed. Large ponds may or may not have been labelled as 'lakes' and so were not extracted from the database for analysis in this report. Other water features which ecologically act as ponds but have different functions are labelled differently, such as 'moat' or 'ditch', and these too were not extracted from the database for analysis in this report. Urban ponds are generally not surveyed by the Ordnance Survey as their surveyors do not enter gardens, and often they do not enter woodland, so some woodland ponds may not have been mapped.

Ponds that have been filled in or new ponds that have been dug since the last round of survey will also be misrepresented on the list of ponds. Revision of water features is in Ordnance Survey's change category 3 as due for revision every three years. The cyclic revision published in July 1998 (Ordnance Survey 1998) shows parts of Suffolk recently revised, and the remainder to be revised by May 1999 or October 1999. However, unpublished work by Jim Foster and Rosie Norton in Sibton and Peasenhall parishes has shown that some ponds listed by the Ordnance Survey were infilled over a decade ago (Pers comm.) and so the Ordnance Survey's gradual revision programme is not fully recording changes to ponds.

Generally, however, the list is believed to be a good approximation of the extent of the rural pond resource but is not an exact representation. Rural ponds are most likely to be of most value to nature conservation, but the resource of urban and suburban ponds which is under-represented here also has some nature conservation interest.

The list of ponds and their name, grid reference and parish are currently stored at English Nature's Bury St Edmunds office. It is not easy to draw conclusions from a long continuous list, so the list has been summarised in a number of ways. For clarity, the following sections group together the method of summary and the results for each of the topics. The list of all ponds in Suffolk will be referred to in the remainder of this report as 'the comprehensive Ordnance Survey list of ponds in Suffolk'.

The quality of the pond resource is of great importance in evaluating the nature conservation value of the resource. This report looks only at the size of the resource and does not attempt to assess the quality of individual ponds or the quality of the whole resource.

2 The number of ponds in Suffolk

The comprehensive Ordnance Survey list of ponds in Suffolk was summarised by counting the number of pond records for each parish. The administrative District or Borough was attached to each parish record, as was the Natural Area in which the parish fell. See chapter 4 for the difficulties in deciding in which Natural Area each parish falls. The list of pond names and grid references for each individual parish is available from English Nature's Suffolk Team.

Suffolk contains 471 parishes and 4 non-parished areas which were used in the summaries for this report. The non-parished areas are Newmarket, Bury St Edmunds, Ipswich, and Lowestoft. In the 3848.6km^2 of Suffolk covered by the 475 parishes / non-parished areas there are 22635 ponds, at a mean density of 5.9 ponds per square kilometre.

All this information is presented in Table 1, with the parishes in alphabetical order, which is the basis for all the other data summaries in this report. Each pond is mapped as a dot in Figure 1a, which clearly shows the distribution of ponds in Suffolk. Figures 1b and 1c show the distribution by tetrad (2x2km square) and by 5x5km square of the National Grid.

Table 2 shows that the number of mapped ponds in parishes is very varied, with one parish having no pond, nineteen parishes having 1-5 ponds, and four parishes having more than two hundred ponds. The number of ponds in each parish is shown graphically in Figure 2. As no two parishes are the same size, it may be more useful to compare the density of ponds (expressed as the number of ponds per square kilometre) between parishes. This forms the next section of this report.

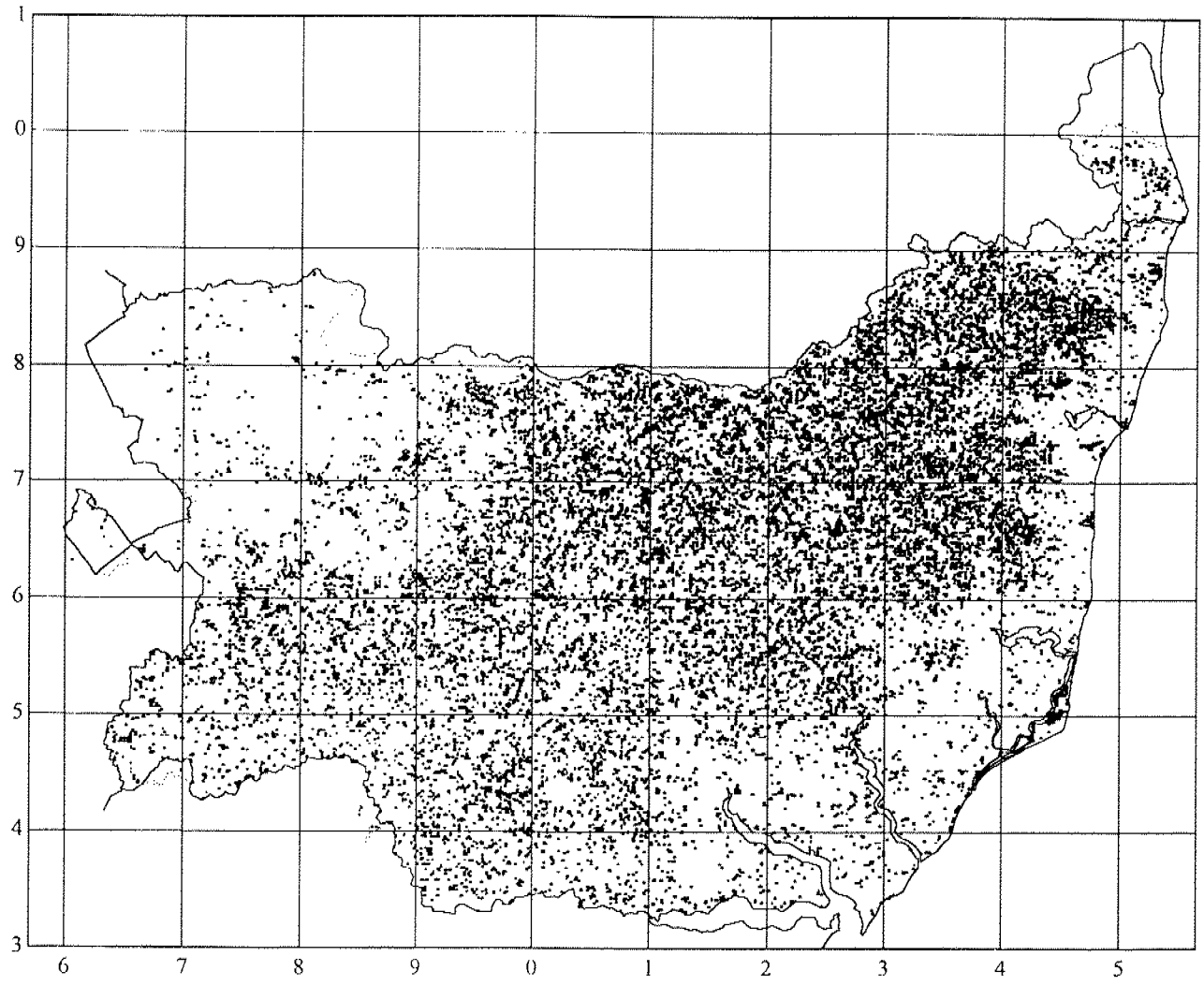


Figure 1a The distribution of ponds in Suffolk. Each dot represents one pond and is as representative of its grid referenced position as printing will allow.

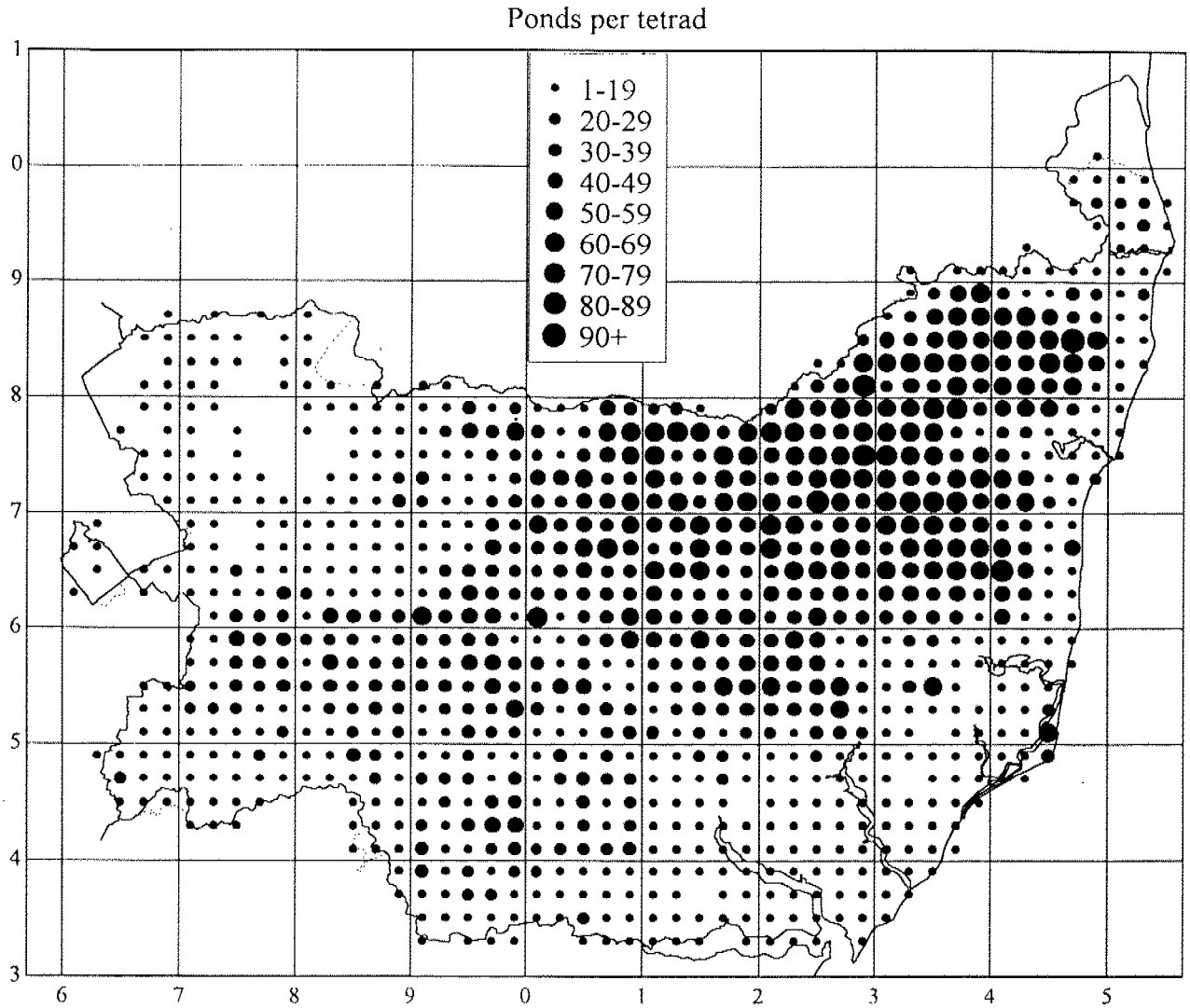


Figure 1b. The distribution of ponds in Suffolk. The number of ponds in each tetrad (2x2km square)

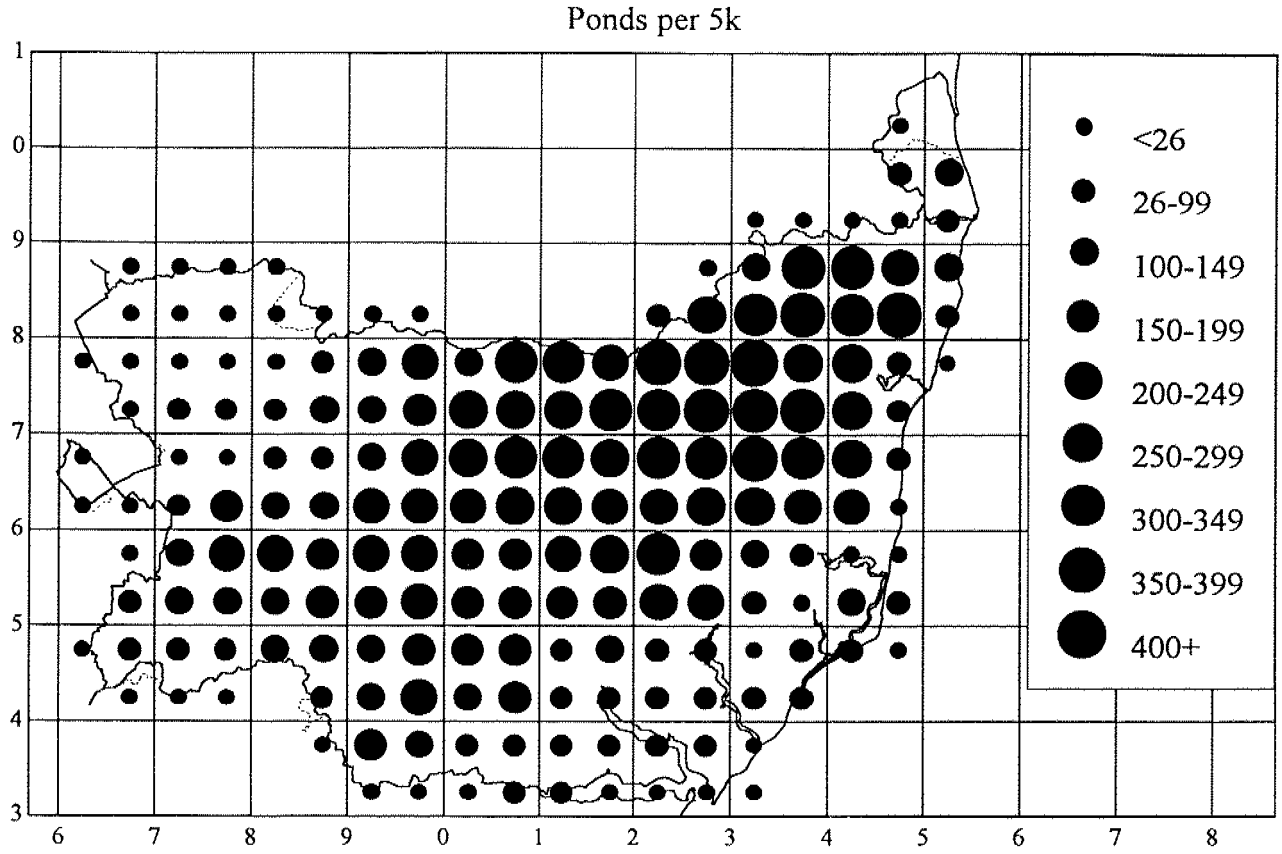
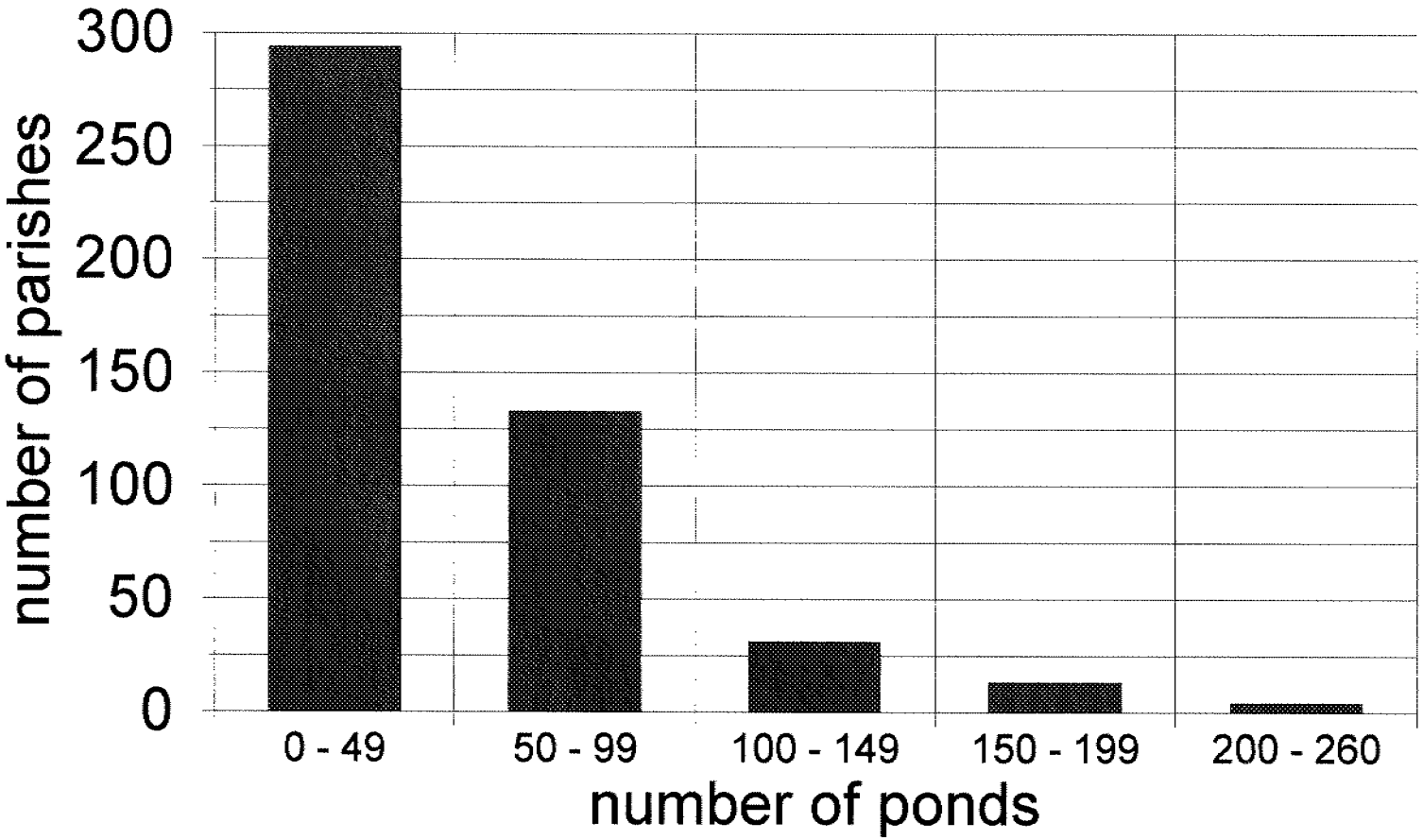


Figure 1c. The distribution of ponds in Suffolk. The number of ponds in each 5km x 5km square

Figure 2
pond numbers in Suffolk parishes



3 The density of ponds in Suffolk

The area of each parish in hectares enables the density of ponds in each parish to be calculated using the formula

$$\text{Density in ponds per km}^2 = \frac{\text{number of ponds} \times 100}{\text{area in hectares}}$$

Table 3 shows the density of ponds in Suffolk parishes, according to the list of ponds supplied by the Ordnance Survey. The parishes with high density are not necessarily the same as the parishes with the most ponds. For example, Fressingfield parish has most ponds but it is a big parish and there are thirty-seven parishes with a greater density of ponds. St Margaret South Elmham and Tunstall parishes both have 39 ponds; St Margaret South Elmham has an overall density of 16.2 ponds per square kilometre, whereas Tunstall has only 3.3 ponds per square kilometre.

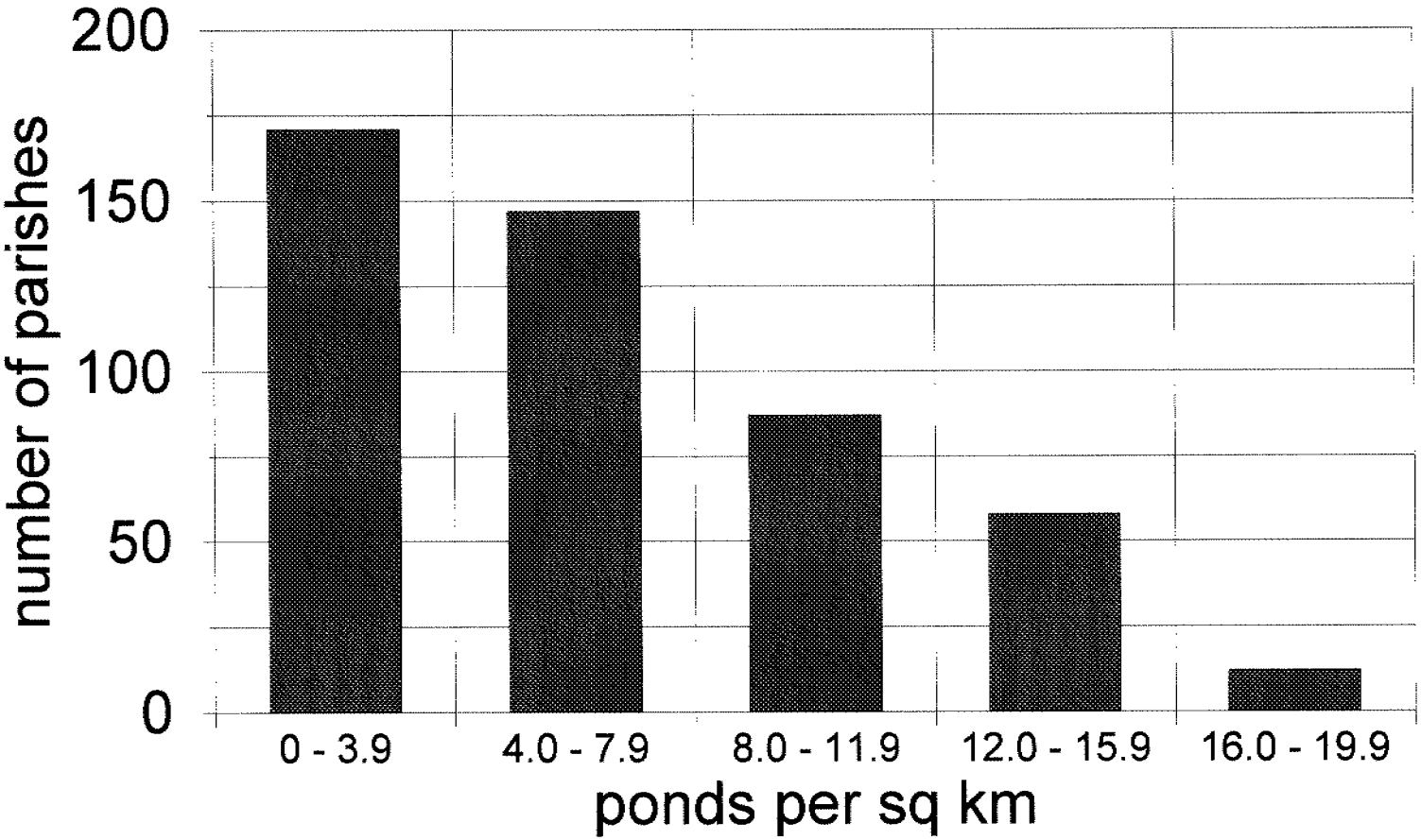
The overall range of pond densities is great. Across Suffolk, the average density of ponds is 5.9 ponds per square kilometre. Twenty-one parishes have a density of fifteen or more ponds per square kilometre, with the highest density in Cratfield (Mid Suffolk) with 19.5 ponds per square kilopmetre. Thirty-seven have a density of one pond or less per square kilometre, with no ponds at all on the Ordnance Survey's maps in Knettishall (St Edmundsbury). The range of densities in each parish is shown in Figure 3.

There is an administrative unit in between parish and whole-county scale. There are seven District and Borough Councils in Suffolk, many of which contributed to this study. These Councils have the ability to influence pond conservation, and so the data has been summarised for each District and Borough in tables 4-10 and figure 4. Councils can control development which might affect ponds, conserve the pond resource on their own land, and through their Countryside Management Projects encourage landowners to conserve their ponds. There is even the potential for more pro-active pond work as special projects or for Local Agenda 21.

Figure 4. The density of ponds in each District/Borough in Suffolk

District/Borough	**number of ponds**	**area of District or Borough (ha)**	**ponds per sq. km**
Babergh	2805	61,771	4.5
Forest Heath	235	37,403	0.6
Ipswich	79	4,094	1.9
Mid Suffolk	8240	85,947	9.6
St Edmundsbury	2574	65,663	3.9
Suffolk Coastal	5781	93,076	6.2
Waveney	2921	36,904	7.9
All Suffolk	**22635**	**384,858**	**5.9**

Figure 3
Pond density in Suffolk parishes



For many years, there has been an anecdotal belief that the part of Suffolk with the highest pond density is 'The Saints', comprising eleven contiguous parishes covering 5267ha in Waveney District each with 'St' in their name. This analysis shows that their pond density is 12.4 ponds per square kilometre. However, an adjacent group of nine parishes covering 5308ha has a pond density 30% higher. The density of ponds in Chediston, Cratfield, Heveningham, Laxfield, Linstead Magna, Linstead Parva, and Ubbeston is 16.4 ponds per square kilometre.

Figure 1 shows the distribution of ponds across Suffolk, but how does this reflect the differences between the Natural Areas of Suffolk? Are some Natural Areas more important than others for pond conservation? The next section looks at the differences between the Natural Areas.

4 Ponds in the Natural Areas of Suffolk

Natural Areas are parts of the country that have a unique combination of natural features and land-use, mainly influenced by landform, climate and soils. The Natural Area concept includes local people's recognition of the area, with wildlife and natural features having developed within the local culture and history. Natural Areas provide a framework for nature conservation in Britain. Administrative boundaries, such as County boundaries, are irrelevant to wildlife and natural features. Using Natural Areas, we can more easily identify processes and trends affecting each aspect of the natural resource and decide how we want to conserve it. The Natural Areas in Suffolk are

- The East Anglian Plain, the claylands of central and southern Suffolk
- Breckland, the chalky and sandy heaths, farms and forest of north-west Suffolk
- The Suffolk Coast and Heaths, with its sandy soils and superb coastline
- The Fens, in the extreme north-west of the county
- The East Anglian Chalk, the flat open chalkland around Newmarket
- Broadland, alongside the lower reaches of the Waveney in north-east Suffolk

Natural Area boundaries do not follow parish boundaries, but the summarised data on pond densities is summarised by parish. Each parish was therefore allocated a Natural Area for the purposes of this analysis. There were some discrepancies caused by this, where some parishes fall into two Natural Areas. The most obvious examples were in the peripheral Natural Areas. For example, Mildenhall and Lakenheath parishes were allocated as Breckland, although parts of their parishes are beyond the fen edge and are clearly Fenland. This anomaly meant that no ponds were identified for the Fenland Natural Area. The parishes alongside the river Waveney downstream of Bungay were allocated either to Broadland or to the Suffolk Coast and Heaths. In reality parts of those parishes contain Broadland grazing marshes by the river but their higher drier soils are of the Suffolk Coast and Heaths. Ipswich is dissected by a natural boundary but its urban character partly hides the change. Ipswich was therefore included in the analysis for both the East Anglian Plain and the Suffolk Coast and Heaths. The Natural Area boundaries as used for this report are shown on figure 5. The pond density in each Natural Area is shown in figure 6 and tables 11-15.

Figure 6. The density of ponds in each Natural Area

Natural Area	**Average pond density** (ponds per km^2)
East Anglian Plain	7.7
Broadland	4.6
Suffolk Coast and Heaths	3.3
Breckland	1.0
East Anglian Chalk	0.4

Figure 5 The Natural Areas of Suffolk, as used in this report. See text for more information

1 East Anglian Chalk
2 Breckland
3 East Anglian Plain
4 Suffolk Coast and Heaths
5 Broadland

The East Anglian Plain has the highest average pond density in Suffolk, 67% greater than Broadland. Broadland as a whole may have more rivers, Broads and water-filled ditches than the East Anglian Plain but is far less important within Suffolk for pond conservation. The Suffolk Coast and Heaths has fewer ponds, but still has a reasonable density which are mostly found on the river floodplains rather than on the higher sandy soils. The flat, free draining soils of Breckland and the East Anglian Chalk have very few ponds indeed.

The historical scarcity of ponds in the Breckland Natural Area is illustrated by the pond named 'Rymer'. It was so vital to the livestock economies of surrounding parishes that the parish boundaries were drawn to meet at the pond, sharing its water between them. Even today, the parishes of Barnham, Culford, Ingham, Ampton, Little Livermere, Great Livermere, Troston, Honington, Fakenham Magna, and Euston still all converge at 'Rymer'. The farming of sheep and cattle in Breckland and on the dry heaths of the Suffolk Coasts and Heaths were extensive, with animals being grazed over vast open heaths as a way of coping with a low density of ponds.

Why does the East Anglian Plain have so many ponds? The reasons are both physical and cultural. The clay soils are slow to drain, and it is easy to compact the clay to make an impermeable layer to hold water. This physical reason is one of many which enabled so many ponds to be created in past years and centuries. In the nineteenth century the rural economy depended upon livestock farming, intensive by contemporary standards but extensive by today's standards, with arable land being scarce in comparison. Fields were no larger than one or two hectares, and livestock were rotated between fields regularly. Every field needed a water supply for the animals, and every village green and farmyard needed a water supply for horses and driven livestock. The needs were supplied by ponds, which were extremely abundant, and were maintained because they were important. In the twentieth century, but particularly after the inception of the Second World War, agriculture changed. Fields have become ten or twenty times larger, arable now dominates and there is no longer an agricultural need for ponds. A great many ponds have been lost, but some have survived by default, by fulfilling a much-reduced need, or by appreciation of farmers and/or communities. The 'high density' of 7.7 ponds per km^2 is but a fraction of a previous density but is still of importance to nature conservation today.

Other studies have been carried out which allow comparison of this Ordnance Survey data; are the results of this survey meaningful in relation to other work? The next section looks at this.

5 Comparison with other pond density data

5.1 Previous Suffolk estimates

In 1988, an estimate of pond distribution and abundance was carried out by Suffolk Wildlife Trust (Beckett, Langton and Dunmore, 1990). More than one thousand hours was spent looking at 1:10,000 Ordnance Survey maps of Suffolk, dated between 1950 and 1979. The number of ponds and other water bodies such as lakes, reservoirs and moats were recorded for each 5kmx5km map.

The number of ponds and other water bodies found was 15,584, which is much less than the data from Ordnance Survey's computer as reported here. The 1:10,000 maps used by the Suffolk Wildlife Trust may have not included all ponds known to Ordnance Survey, due to their small size, difficulties of plotting clusters of ponds, or insufficient space. It is likely that the information about ponds on the digital database is more accurate than the information on paper maps produced from it.

The Suffolk Wildlife Trust study found a highest pond density of 13.6 ponds per km^2, lower than forty-three parishes found in this report. However, the general pattern of pond density was similar, with highest density in north-east and north-central Suffolk, and lowest density in the Breckland Natural Area and Suffolk Coast and Heaths Natural Area.

5.2 The lowland pond survey

The Lowland Pond Survey (Williams *et al.* 1998) was undertaken by Pond Action and the Institute of Terrestrial Ecology on behalf of the Department of Environment, Transport and the Regions. A stratified random sample of 150 1km squares in lowland Britain were surveyed to identify all ponds and survey their ecological, physical and chemical characteristics. Ponds were defined as 'a body of standing water $25m^2$ to 2ha in area which usually holds water for at least four months of the year'. Water bodies in golf courses, in school grounds, gardens, farmyards, or in urban areas were not recorded.

The lowland pond survey found an average density of 1.7 ponds per km^2 in England, which was higher than the corresponding densities for Wales and Scotland. Nearly two-thirds of the ponds were in the smallest size class, between $25m^2$ and $400m^2$. Over half the ponds recorded were in farmland, with about one-fifth recorded in woodland. In comparison with 1990 data, about 7% of ponds were lost between 1990 and 1996 but in the same period nearly the same number of new ponds had been created.

Five 1km squares in Suffolk were surveyed in 1996 in the Lowland Pond Survey. The locations of these are confidential, so that future changes are not influenced by land management reacting to repeated surveys. It is possible, however, to compare the number of ponds identified by surveyors on the ground, with the number of ponds known to the Ordnance Survey which form the basis of this report. The number of ponds identified during the Lowland Pond survey was supplied by Pond Action, who carried out the surveys (letter dated 12 October 1998). The

number of ponds in each 1km square in this study was extracted from the Ordnance Survey list (see chapter 1) using the grid references supplied with the data.

Figure 7. Comparison of data with Lowland Pond Survey 1996 findings, in surveyed 1km squares

1km square	no. of ponds - lowland pond survey 1996	no. of ponds - Ordnance Survey database (this study)
A	0	0
B	5	3
C	2	3
D	12	20
E	14	11
total	**33**	**37**

In two of the squares, the surveyors found more ponds than the Ordnance Survey had mapped but in two squares the surveyors found fewer than the Ordnance Survey had mapped. Overall, the Lowland Pond Survey surveyors found four fewer ponds than the Ordnance Survey had mapped. There are many possibilities for the discrepancies. For example, the Lowland Pond Survey used a strict definition of 'pond', based on size and location, whereas the Ordnance Survey has no definition of a pond and their surveyors use their judgement as to whether a water body is labelled as pond or as something else. Certainly, the confidence in their own data is greater from the Lowland Pond Survey than from the Ordnance Survey. It is possible that differences in the number of ponds may result, at least in part, from ponds being lost or created since the area was mapped by the Ordnance Survey. The Lowland Pond Survey may be more accurate; the rate of pond loss and creation is much higher than anecdotal evidence suggests if both sets of data are assumed to be accurate at the time of survey.

The Breckland and East Anglian Chalk Natural Areas (see chapter 4) have pond densities less than the Lowland Pond Survey's British average for lowlands of 1.7 ponds per km^2. The Suffolk Coast and Heaths has twice the British average, Broadland has over two-and-a half times the British average, and the East Anglian Plain Natural Area has four-and-a half times the average British lowland pond density. 'The Saints' of north-east Suffolk (see chapter 3) has a pond density more than seven times the British average, and the adjacent parishes have a density nearly ten times the British average. Table 3 shows that the parishes of Cratfield, Thrandeston, Linstead Parva, Heveningham, Sotterley, and Redlingfield each have a pond density more than ten times the British average.

5.3 Ponds in Cheshire

Cheshire has a distinctive pond landscape, and is believed to have one of the highest pond densities in Britain. It covers an area of 2328km^2, about the size of the East Anglian Plain in Suffolk. The number and density of ponds has been assessed by Boothby and Hull (1997) as part of a European Union-funded Pond Life project. All the ponds were counted on paper Ordnance Survey maps of 1:10000 or 1:10560 scale, dated between 1965-1975. Twenty-three thousand ponds were identified, making an average density of 9.9 ponds per km^2, which is 30% more than the current density as mapped in this report in the Suffolk's East Anglian Plain.

As well as a paper study, the Pond Life project also studied 1992 & 1993 aerial photographs of Cheshire, to identify changes from their mapping exercise. Of the mapped 23,000 ponds only 16,728 remained, at a density of 7.2 ponds per km^2, slightly less than the mapped figure for Suffolk's East Anglian Plain. The next step in Suffolk is surely to carry out a similar aerial photograph analysis and ground surveys for comparable results.

It is interesting to know the pond densities, but we must not forget that the aim of this study is to facilitate nature conservation. How do these pond densities help us to conserve ponds and the species dependent on them? The next section has some examples.

6 Examples of nature conservation applications

6.1 Increasing pond numbers in Suffolk

For many conservationists, digging new ponds is an aim. For example, English Nature (1997) advocates replacing unavoidable pond losses with new ponds, and Mendel (1992) states that pond creation can have an important part to play in dragonfly conservation.

Where are these ponds best situated? In the absence of any data related to pond losses across Suffolk, it is reasonable to assume that ponds have been lost proportionally in all parishes and Natural Areas. It is therefore logical to maintain the historical distribution of ponds across Suffolk, by increasing pond numbers proportionally in each parish. For example, if 10% increase in Suffolk ponds were to be a target, they should be shared out as a 10% increase in each parish. In this scenario, Fressingfield will be due to gain twenty-six new ponds, but the Breckland parishes of Knettishall, Kentford, Red Lodge, Wangford, Westley and Wordwell would be due to gain just one pond between them (see section 3 for current densities). Most effort will be needed in north-central and north-east Suffolk to encourage pond creation, because greater number of ponds will be needed to create a proportionate increase compared to the remainder of the county.

6.2 Encouraging pond management to increase pond quality

Pond management to maintain or increase the nature conservation value of ponds is widespread in the conservation literature, for example Biggs *et al* (1994) or Andrews & Rebane (1994). A whole range of pond types, from early succession ponds available for those species which are early colonisers, the classic mid-successional pond, and the later stages of natural infilling and drying, are important to nature conservation. The Ordnance Survey data does not, of course, tell us anything about the quality of any of the ponds. Anecdotal evidence from the Suffolk Ponds Working Party (Davies, pers comm) is that many ponds are not in favourable condition. Encouraging public and private landowners to manage their ponds to enhance quality is therefore needed to optimise the nature conservation value of the whole resource.

To ensure that pond management effort is distributed equally across the whole resource, the effort should be in proportion to the density of ponds. Advocacy and grant-aid for pond management should be targetted in proportion to the number of ponds in a parish. In practice, some pond management advice/advocacy is common throughout the county or within District/Borough, such as leaflet distribution, newspaper articles and availability of reactive advice from bodies such as FWAG. This therefore means that the areas of highest pond density require extra measures if the advice is to be proportionate to the number of ponds.

It is implicit that ponds under favourable management for conservation are unlikely to be lost and so favourable management has the added benefit of maintaining pond distribution.

6.3 Great crested newt conservation

Great crested newts are legally protected amphibians (see Gent and Howarth 1998) that breed in ponds and need several different habitats around to complete the terrestrial part of their lifecycle (English Nature 1994). The detailed habitat requirements and how to achieve them by land management is described in Bullock, Oldham and Corbett (1998). The mapping study does not indicate the habitat quality of the ponds, but it does enable comparison of parishes against the pond densities required by great crested newts as they disperse from pond to pond. Below a density of 0.7 ponds per km^2, great crested newts are unlikely to persist (Oldham 1994); if a pond becomes unsuitable it is too far to the next pond for them to travel. At a density of 3 ponds per km^2, ponds are within a more reasonable travelling distance and as ponds become unsuitable or suitable from year to year so the newts can move around and persist. However, an optimal density of suitable ponds is 5 - 10 ponds per km^2 (Bullock, Oldham and Corbett 1998).

Assuming that the ponds in the Suffolk parishes are distributed more-or-less evenly, it is possible to work out which parishes are suitable for great crested newts. In Table 3 256 parishes have the optimum density of 5 ponds per km^2 or greater, 96 more parishes have the 'comfort' threshold of 3 ponds per km^2, and only 20 parishes are below the minimum threshold of 0.7 ponds per km^2.

In fact, ponds are not spread evenly throughout parishes, and there are some great crested newt populations in the Breckland parishes where the overall pond density is apparently too low. Presumably the ponds are not equally spaced, and the great crested newts are found where some ponds are clustered in a small part of the parish. No great crested newts have been found in some parishes where pond density is apparently suitable, and this may reflect quality of habitat or inadequate search effort. The distribution of great crested newts in Suffolk is very similar to that of ponds (Suffolk Biological Records Centre, pers comm). Future great crested newt survey and conservation effort could therefore to be distributed throughout the county in proportion to the distribution of ponds.

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