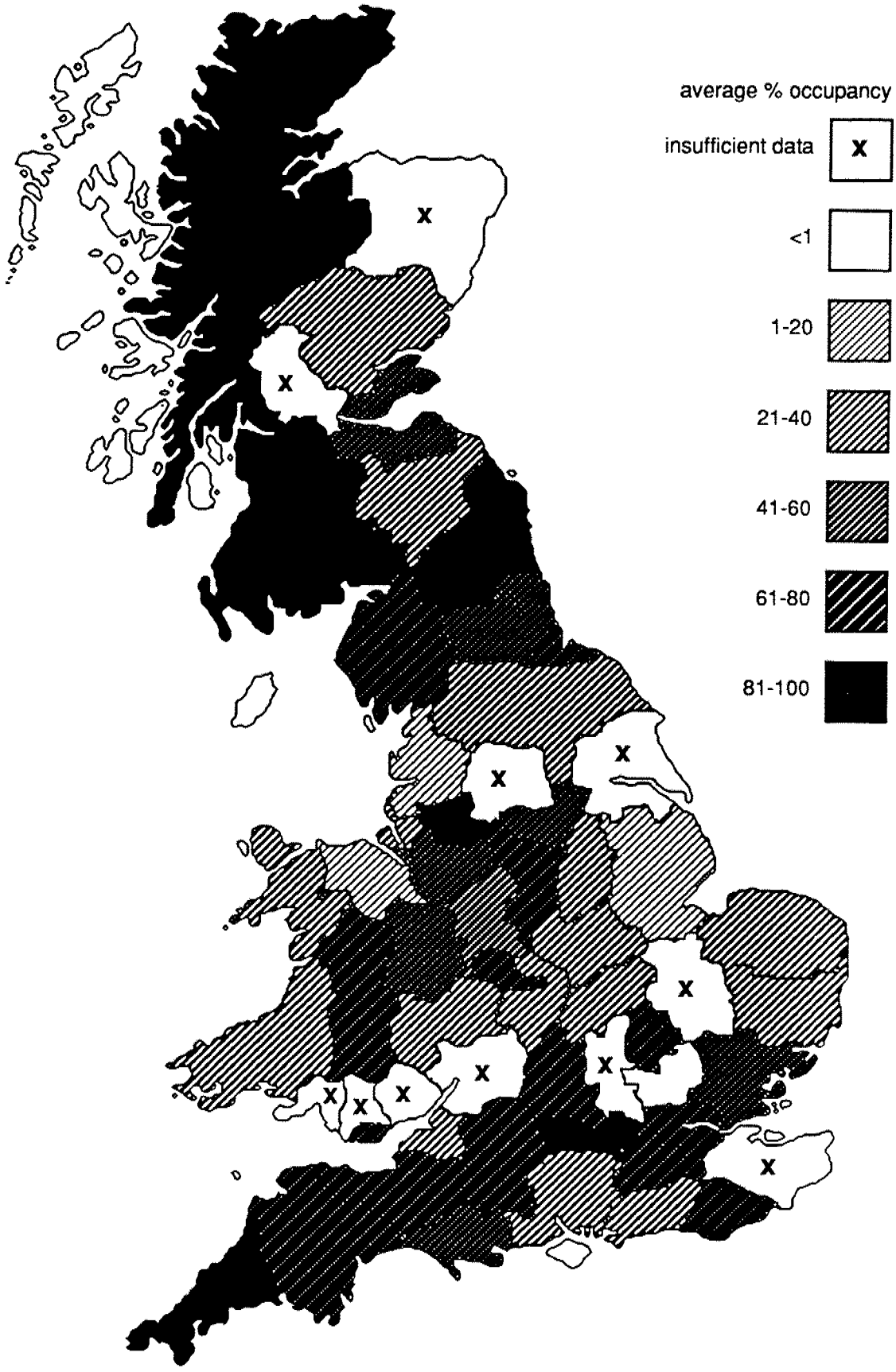
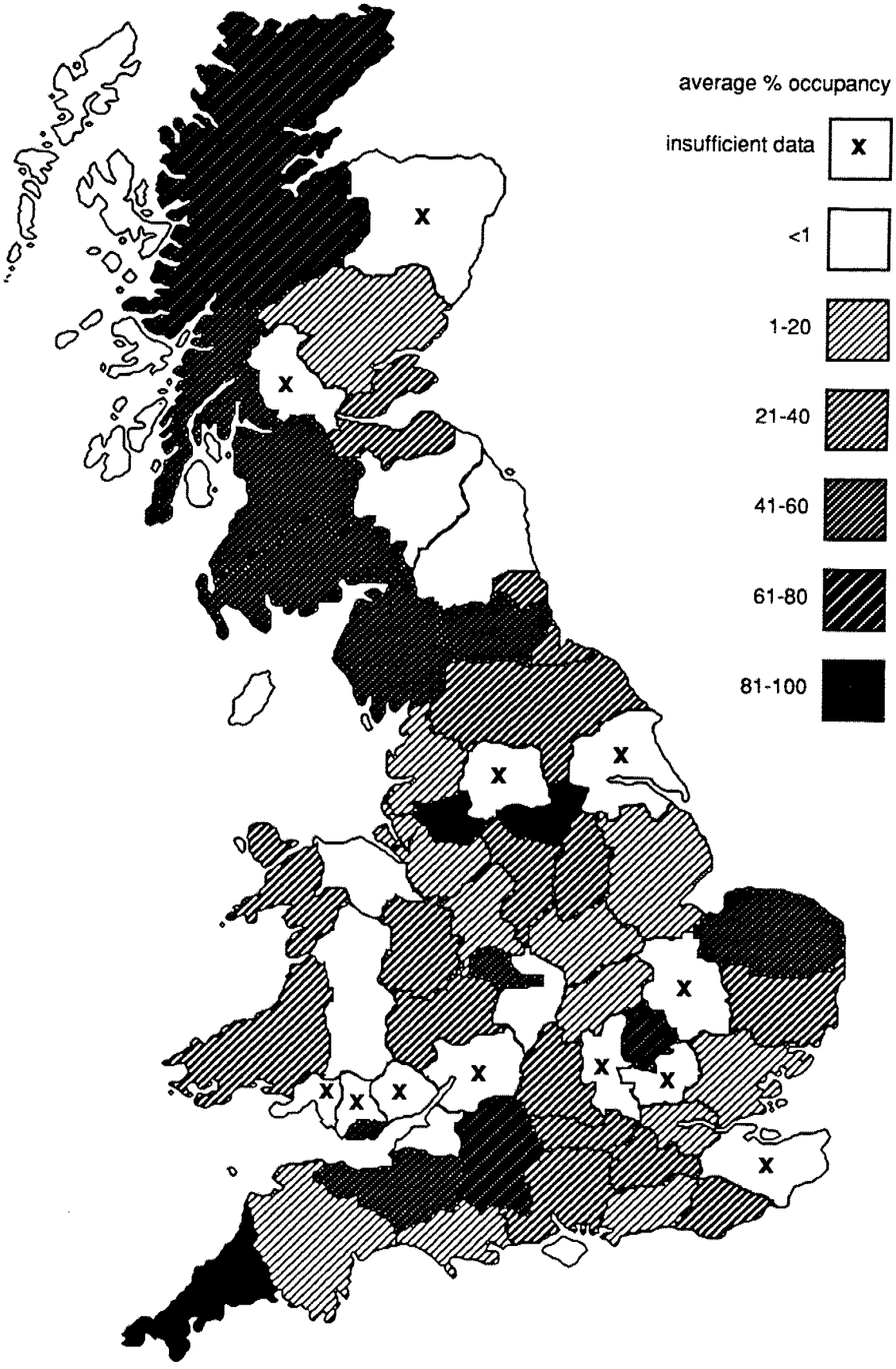
Fig 4.5
Average percentage of ponds occupied by each species, by county.

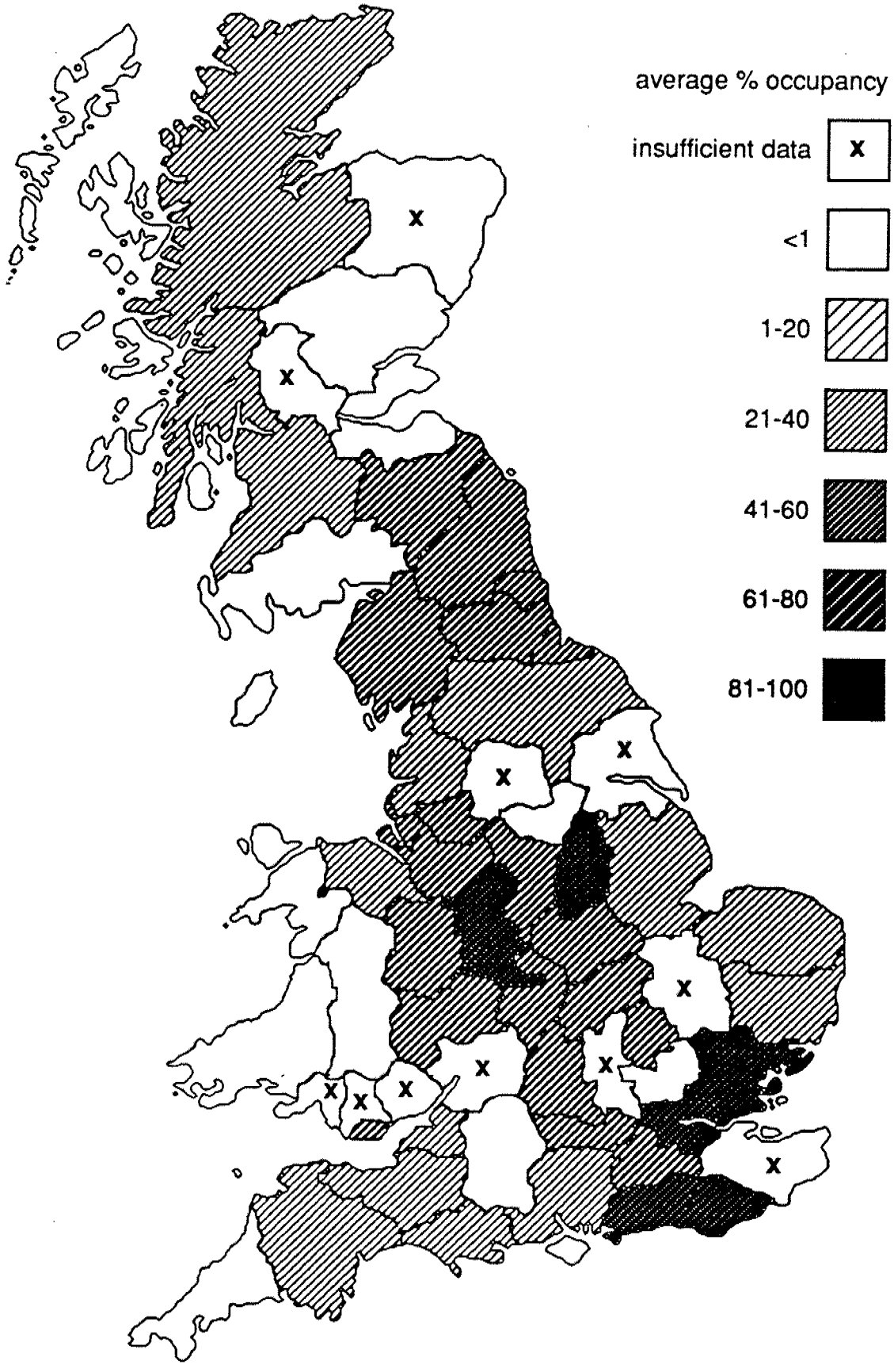
(a) Frog



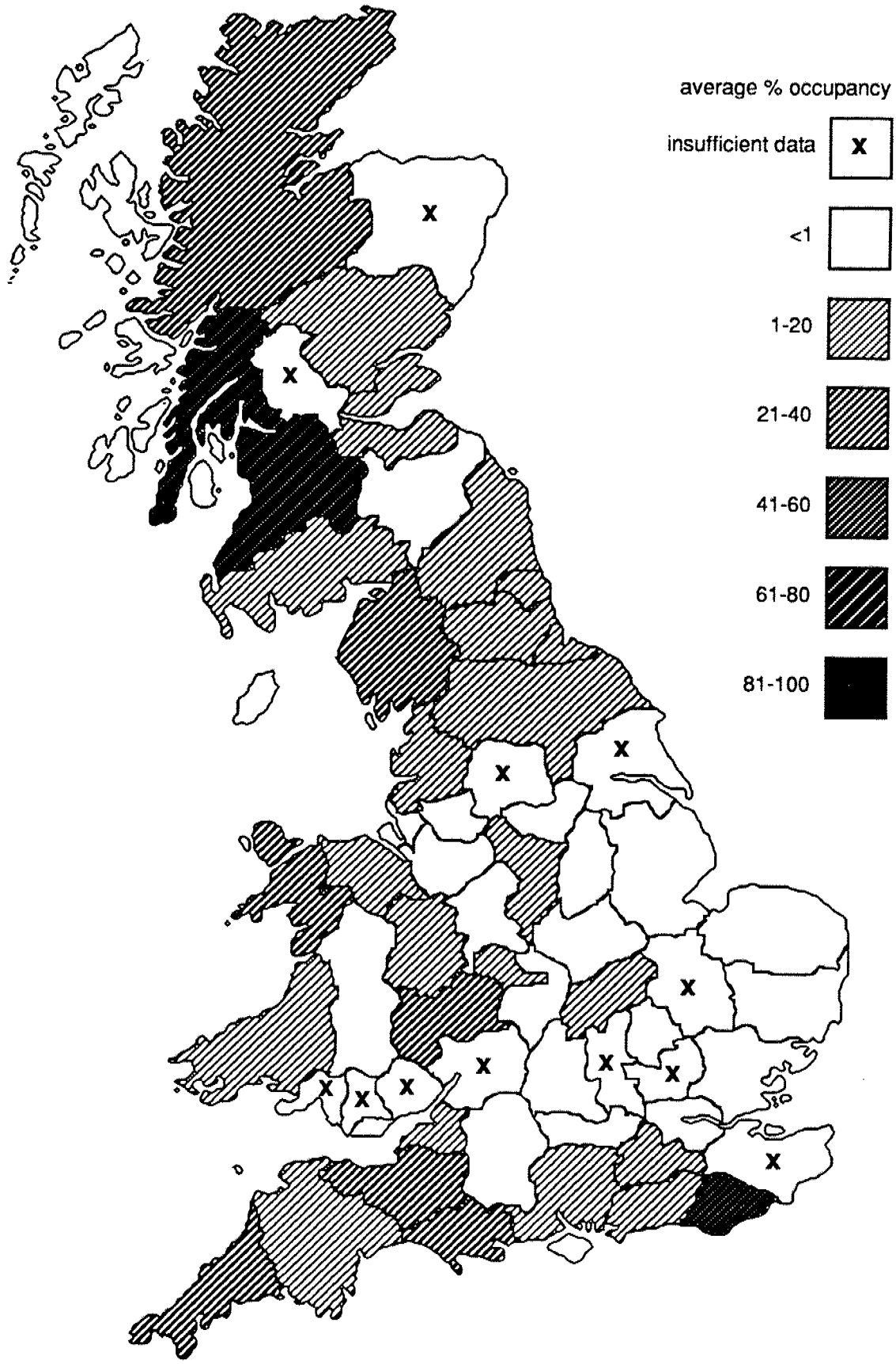
(b) Toad


average % occupancy
insufficient data
X
<1
1-20
21-40
41-60
61-80
81-100

(c) Smooth Newt



(d) Palmate Newt



(e) Crested Newt

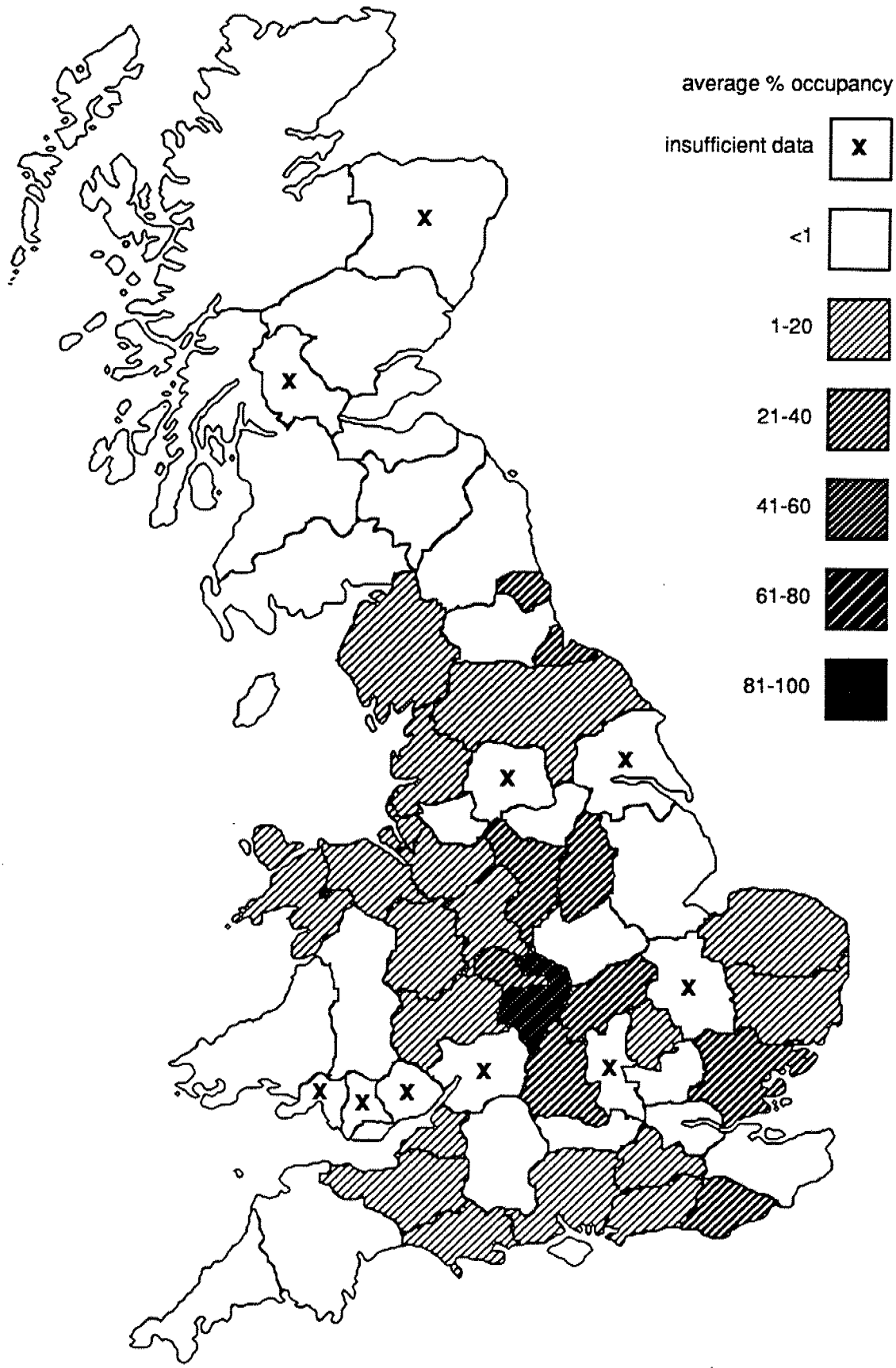


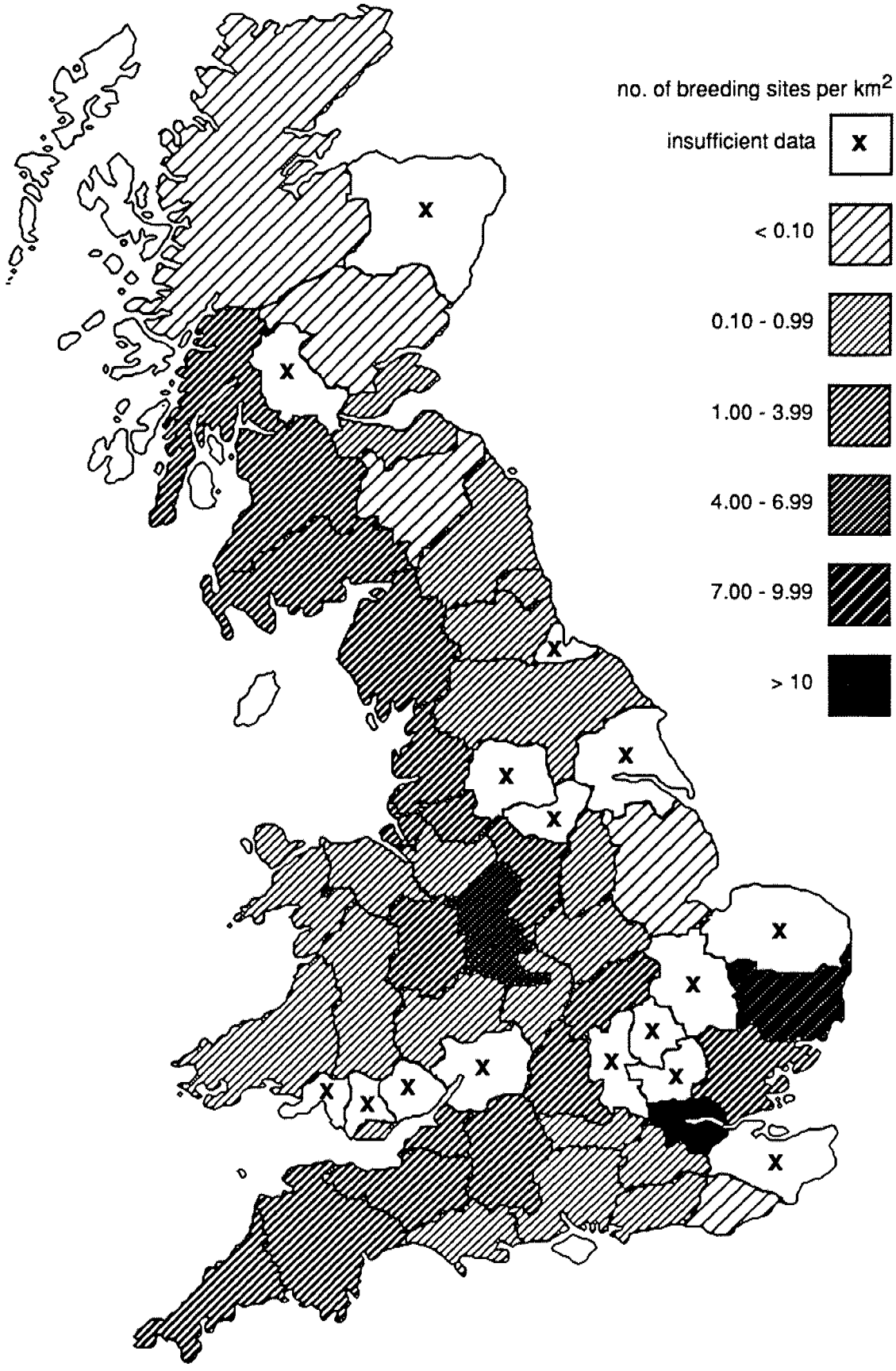
Table 4.6

Density of breeding sites of each species in 75 blanket surveys.

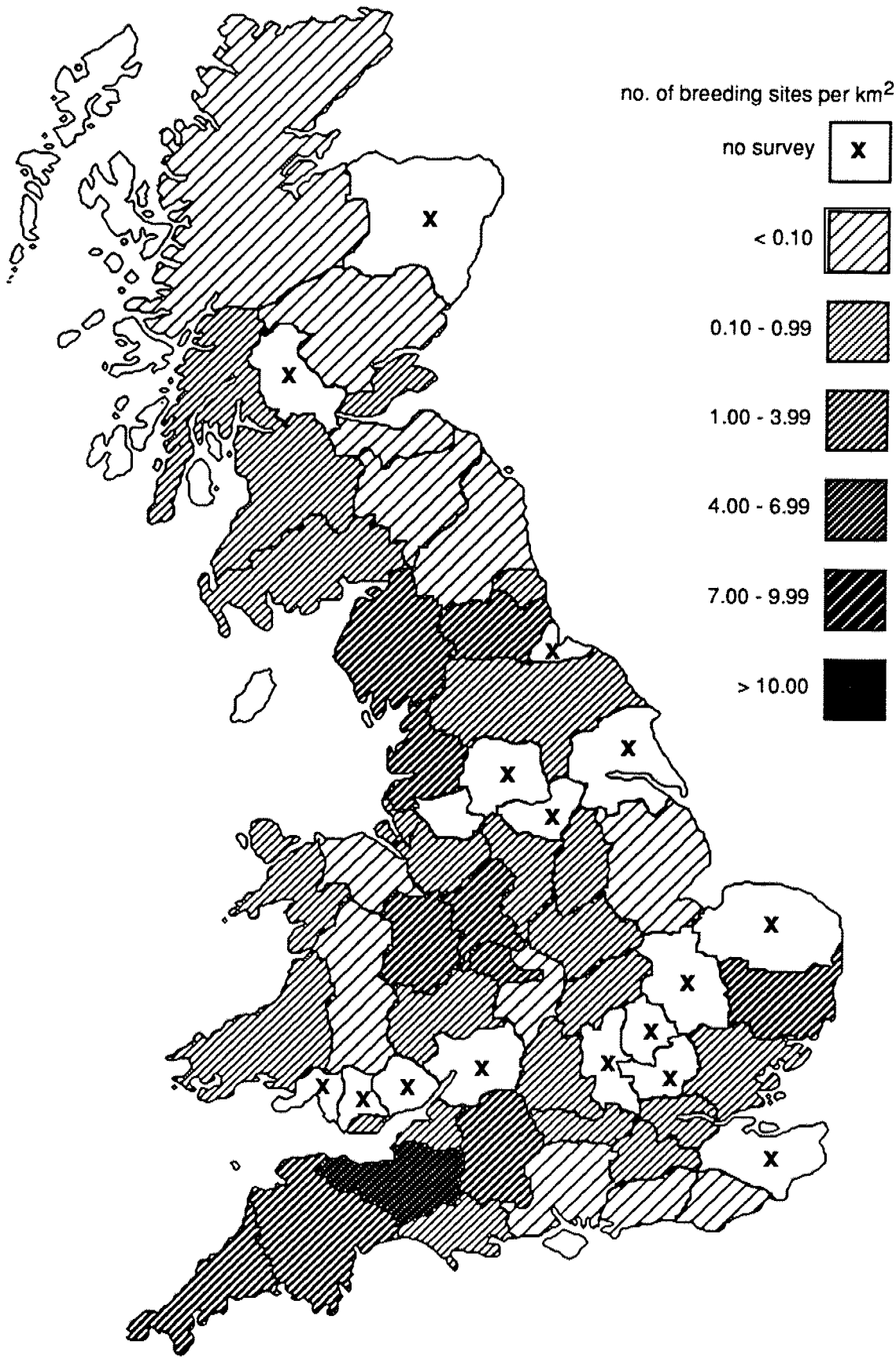
	frog	toad	smooth newt	palmate newt	crested newt
no.of surveys in which sp present	74	60	59	31	35
% surveys in which sp present	99	80	79	41	49
density of breeding sites (no per km^2) :-					
within all areas:					
median	0.7	0.2	0.2	0	0
mean	1.4	0.6	0.8	0.2	0.3
max	15.5	4.0	11.7	2.2	2.9
min	0	0	0	0	0
within areas in which sp occurs:					
median	0.7	0.4	0.4	0.2	0.4
mean	1.4	0.7	0.9	0.4	0.7
max	15.5	4.0	11.7	2.2	2.9
min	0.02	0.01	0.002	0.004	0.004

Fig 4.6
Average densities of amphibian populations (numbers of breeding sites per km^2), by county. Number of surveys = 77.

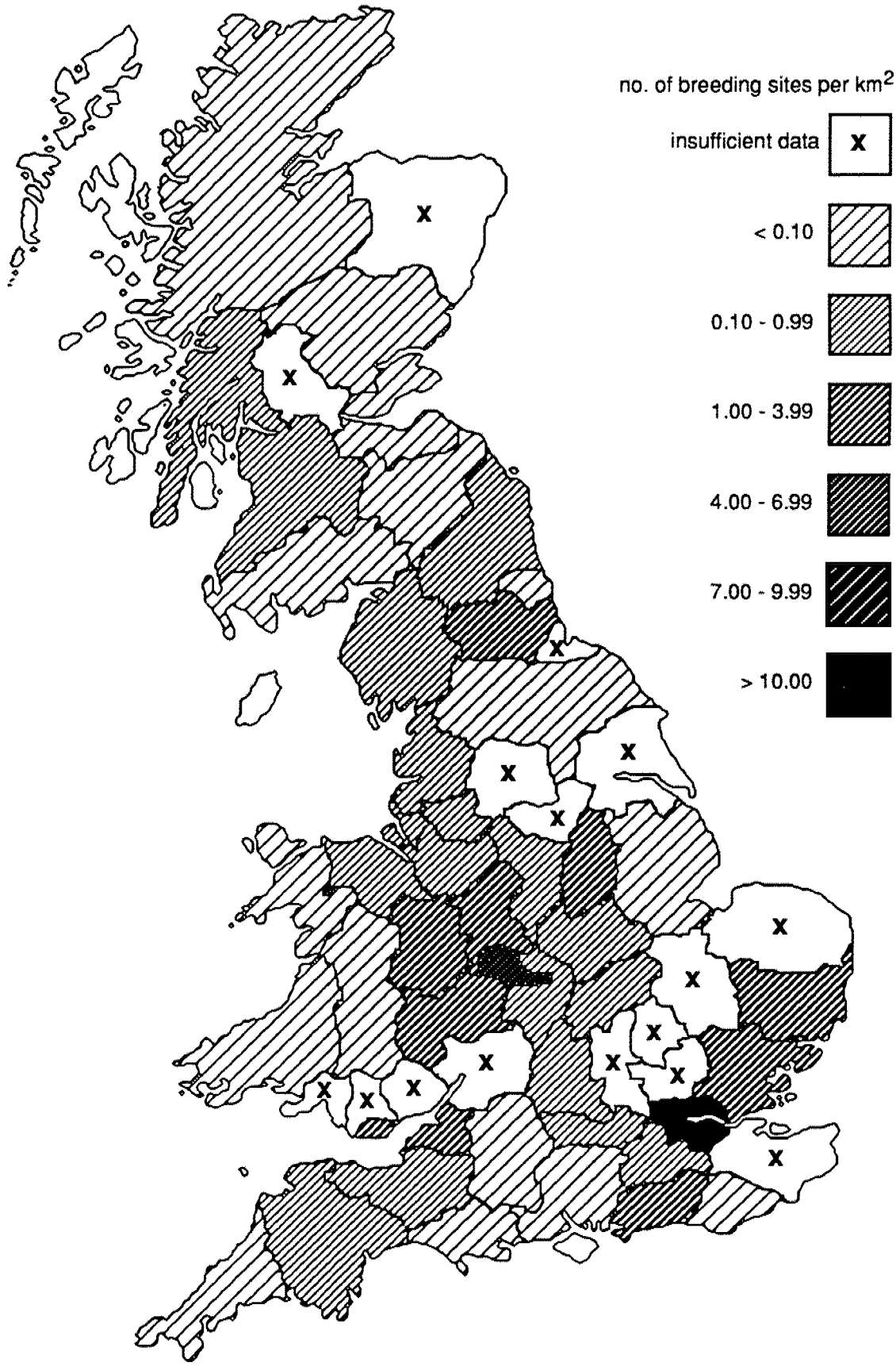
(a) Frog



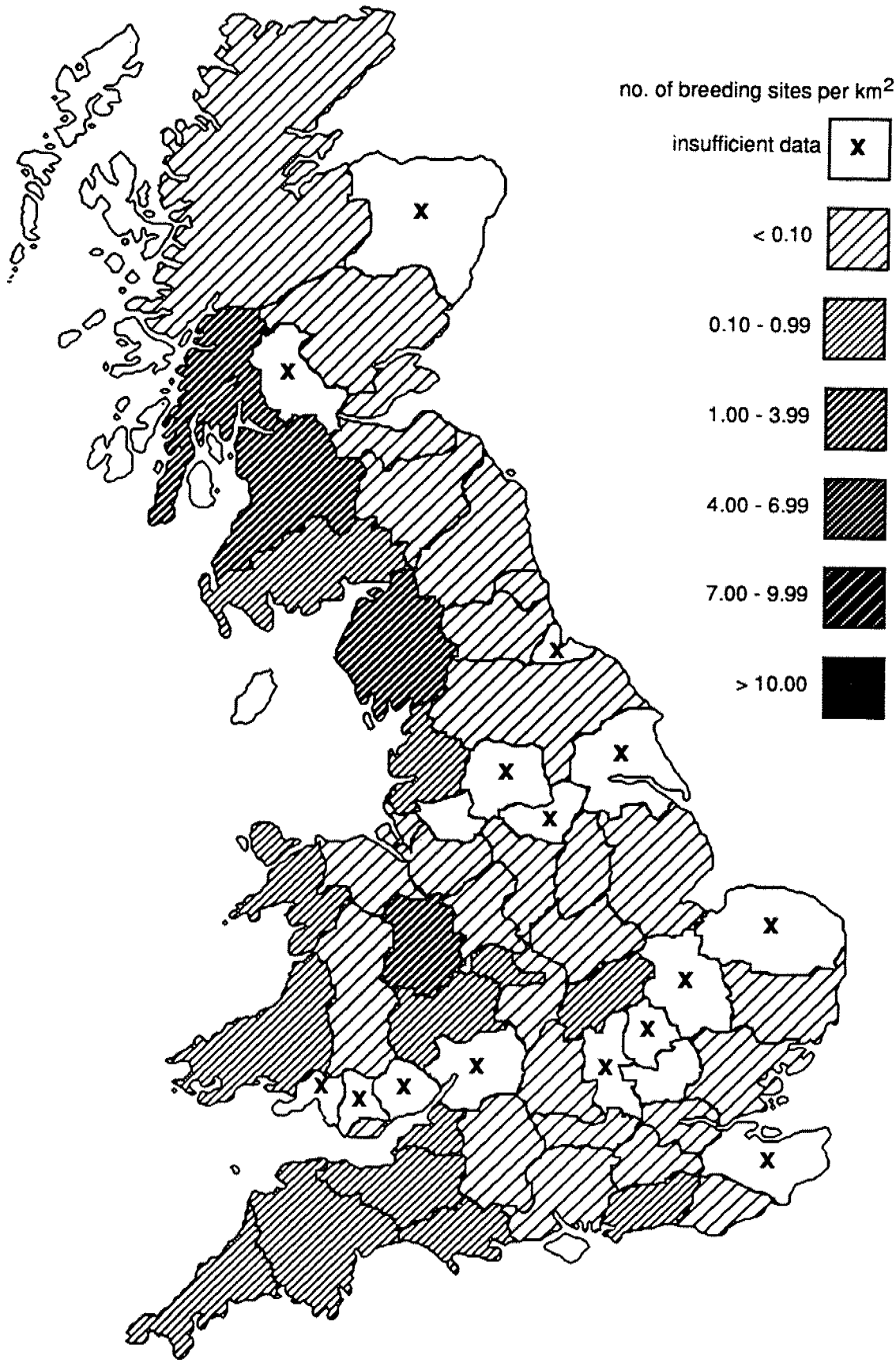
(b) Toad


no. of breeding sites per km2
no survey
X
< 0.10
0.10 - 0.99
1.00 - 3.99
4.00 - 6.99
7.00 - 9.99
> 10.00

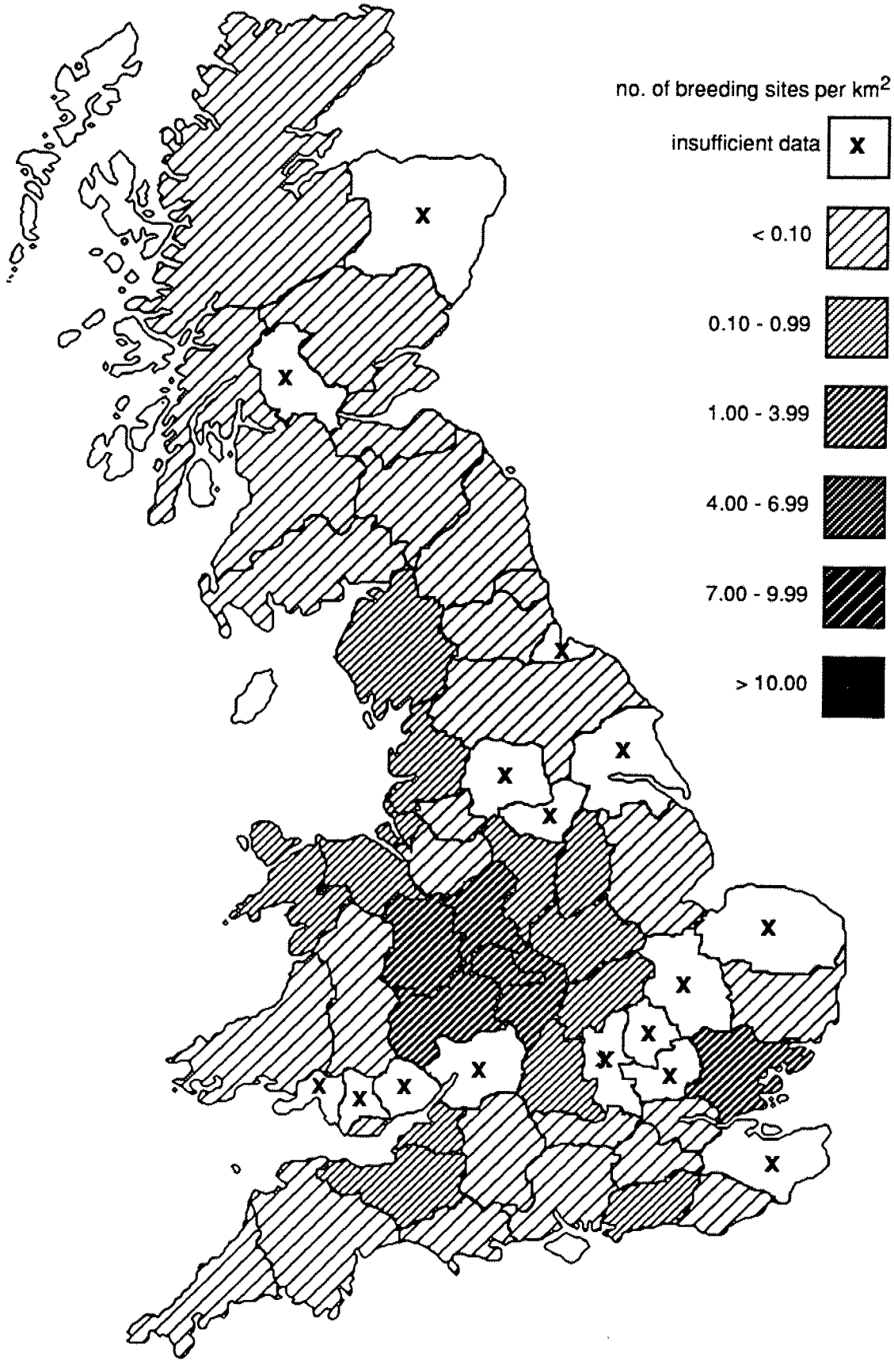
(c) Smooth Newt



(d) Palmate Newt



(e) Crested Newt



ranged from 100% in three small surveys of Cumbria (five ponds searched), Greater Manchester (three ponds) and Cornwall (three ponds) to zero in 18 surveys from throughout the country. The species' median percentage occupancy in areas in which the toad was found was 33%, the minimum being two percent (a survey of 43 ponds in Worcestershire), Table 4.5.

From the county mean values illustrated in Fig. 4.5(b), the highest relative site occupancy by toads was found in the west of Britain - the west of Scotland, Cumbria and some south western counties. It was found in considerably fewer ponds than frogs, however, in most surveys, occurring in over 60% in only six counties and in less than 20% in 14. The species was not present at all in systematic surveys within five counties (Borders Region, Northumberland, Clwyd, Powys and W Midlands).

Toads were present in 60 of the surveys from which densities could be calculated, occurring at an overall median density of 0.2 per km^2 (ranging from zero in 15 surveys to four per km^2 in a $2km^2$ survey of 14 ponds in Somerset). In blanket surveys in which toads were recorded, the median density was 0.7 per km^2, with a minimum of 0.03 per km^2 ($250km^2$ of Hampshire and $30km^2$ of Highland Region), Table 4.6.

Combining and averaging toad densities by county, the species was found to occur at relatively low densities throughout Britain, ie in less than one pond per km^2 in 26 counties (46% of those in which it was recorded at all in systematic surveys). Breeding pond densities were slightly higher in the south west and in the southern west midlands (Fig. 4.6(b)).

4.3.3.4 Smooth newt status

The smooth newt was reported in 74 of the 99 blanket surveys undertaken (75%). Overall, it was found in a median of 17% of ponds (it was absent from 25 of the surveyed areas), but within areas in which it was present it was recorded in a median 27%. Where the smooth newt was found, its percentage

occurrence range was from 0.5% (Fife) to 100% (surveys of three ponds each in Nottinghamshire and Staffordshire), Table 4.5.

Smooth newts were found in the greatest proportion of ponds in northern and south east England and the Midlands (Figure 4.5(c)). It was absent from the blanket surveys conducted in eight counties, principally those outside its normal distribution range in the north and west of Britain, (see Chapter 3). Its average percentage occupancy did not exceed 60% in any county, and was above 40% in only six.

Smooth newts were encountered in 59 of the 75 surveys from which population densities were calculable. Their overall median density was 0.2 populations per km^2, but including only those areas in which they were recorded, their median density was 0.4 per km^2. The minimum density at which they were present was 0.002 per km^2 recorded in a 423km^2 survey of Fife, and the maximum, 11.7 populations per km^2, found in the one km^2 urban park survey in Greater London (Table 4.6).

In the "density" data set, smooth newts were not found in 16 of the counties surveyed systematically (Figure 4.6 (c)). Its average density was less than one per km^2 in 25 of the counties in which it was recorded. In only 11 counties did the average density exceed one population per km^2. Most of the counties in which densities were highest were within the western midlands, East Anglia and south east England.

4.3.3.5 Palmate newt status

The palmate newt was found in only 42 of the 99 blanket surveys, which is probably a reflection of its restricted distribution range (see Chapter 3). Overall, it occupied a median of 11% of ponds nationally, but 17% of those within the survey areas in which it was present. Its percentage occupancy ranged from 0.5% (a survey of 224 Derbyshire ponds in which 18% of ponds contained smooth newts), to 87.5% (Gwynedd), Table 4.5.

The palmate newt was not found in systematic surveys within 19 counties - nearly one third of mainland Britain. However, in much of north western Britain it occupied a higher proportion of ponds than the smooth newt, and in both of the surveys of Strathclyde Region it was found in over 60% of water-bodies (Figure 4.5 (d)). The species was very scarce or absent from East Anglia, the East Midlands and the non-coastal counties of southern England. A relatively high proportion of water-bodies in coastal southern England were occupied, probably reflecting the presence of heathland habitats in these regions.

The median density of palmate newt ponds nationally was zero, but within the areas in which it has been recorded (31 out of 75 surveys) a median density of 0.2 ponds per km^2 was occupied. The species' density ranged from 0.004 (250 km^2 survey of Hampshire) to 2.2 per km^2 (14 km^2 survey of duneslack on the Cumbrian coast), Table 4.6.

The highest recorded average county densities of palmate newts, all below three per km^2, occured in the west of Scotland, northern England, the western midlands, west Wales and the south west peninsula (Figure 4.6(d)). The palmate newt was present in blanket surveys in 44 counties, but recorded at a density of less than one per km^2 in 22.

4.3.3.6 crested newt status

Ninety-three surveys fell within the distribution range of the crested newt, in 53 of which the species was recorded. Its median percentage occurrence was 2.4% overall, but 18% in the areas in which it was found. The range extended from 2.4% (a survey of 41 ponds in Avon) to 78% (nine ponds in Warwickshire), Table 4.5.

The crested newt was reported to be absent from survey areas in 22 systematically surveyed counties within the UK, mainly in Scotland, west Wales and south west England (Figure 4.5(e)). In ten counties the mean percentage of ponds occupied exceeded 20% - five counties within the west and east

midlands, Cleveland, Tyne and Wear, Essex, Oxfordshire and E Sussex. The highest county mean was for Warwickshire (78%) and the lowest, 2.4% was recorded in Avon (survey of 41 ponds).

Density information was available for 71 surveys, in 35 of which the species was present. The crested newt's median density overall was zero, as it was absent from over 50% of the surveys carried out. Within the set of areas in which it was recorded, the median population density was 0.4 per km^2, values ranging from 0.004 (250 km^2 survey of Hampshire) to 2.9 per km^2 (4km^2 survey of Hereford and Worcester), Table 4.6.

The mean county density values indicate highest concentrations of populations in central England. (Fig 4.6 (e)). The species was present at average densities of less than one population per km^2 in 19 of the counties in which it was systematically recorded. Mean densities of over one per km^2 occurred in only nine counties.

4.3.3.7 Water-body density and occupancy by amphibians

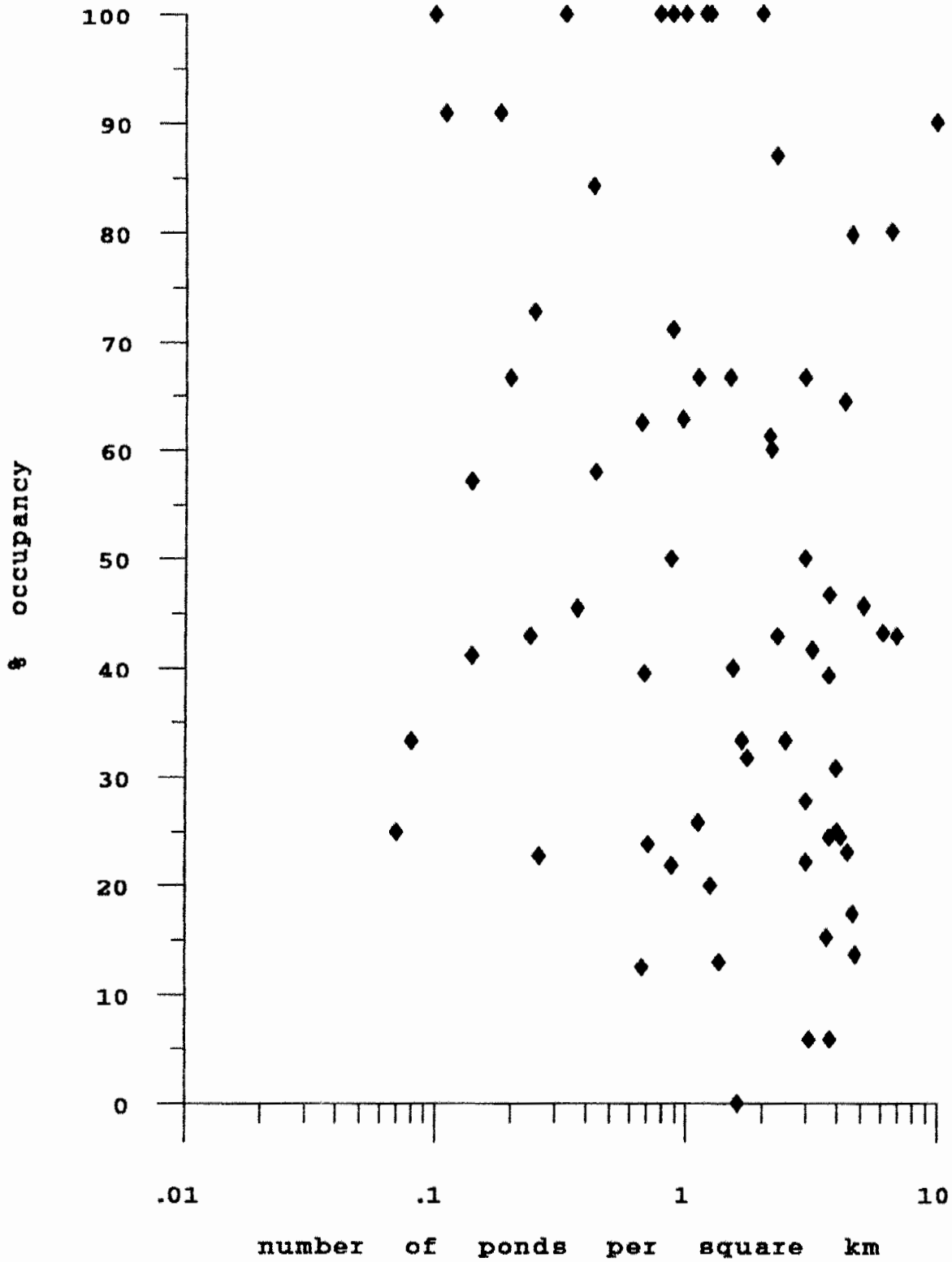
Figures 4.7(a) to (e) illustrate the relationships between each of the species and pond densities within the blanket survey areas. No obvious clear-cut relationships are apparent, but no account has been taken of pond "quality" or of the surrounding land-use.

Overall, frogs exhibited the only significant correlation between pond density and species percentage occurrence ($p<0.008$, Spearman Rank Correlation), the latter increasing with decreasing pond density. This relationship is probably dependant on the high percentage of low density upland sites supporting frog populations. (Within the lowland areas, pond quality and surrounding terrestrial habitat availability may assume greater importance - see Chapter 5). Toads and smooth newts were present in fewer of the low pond density areas than frogs.

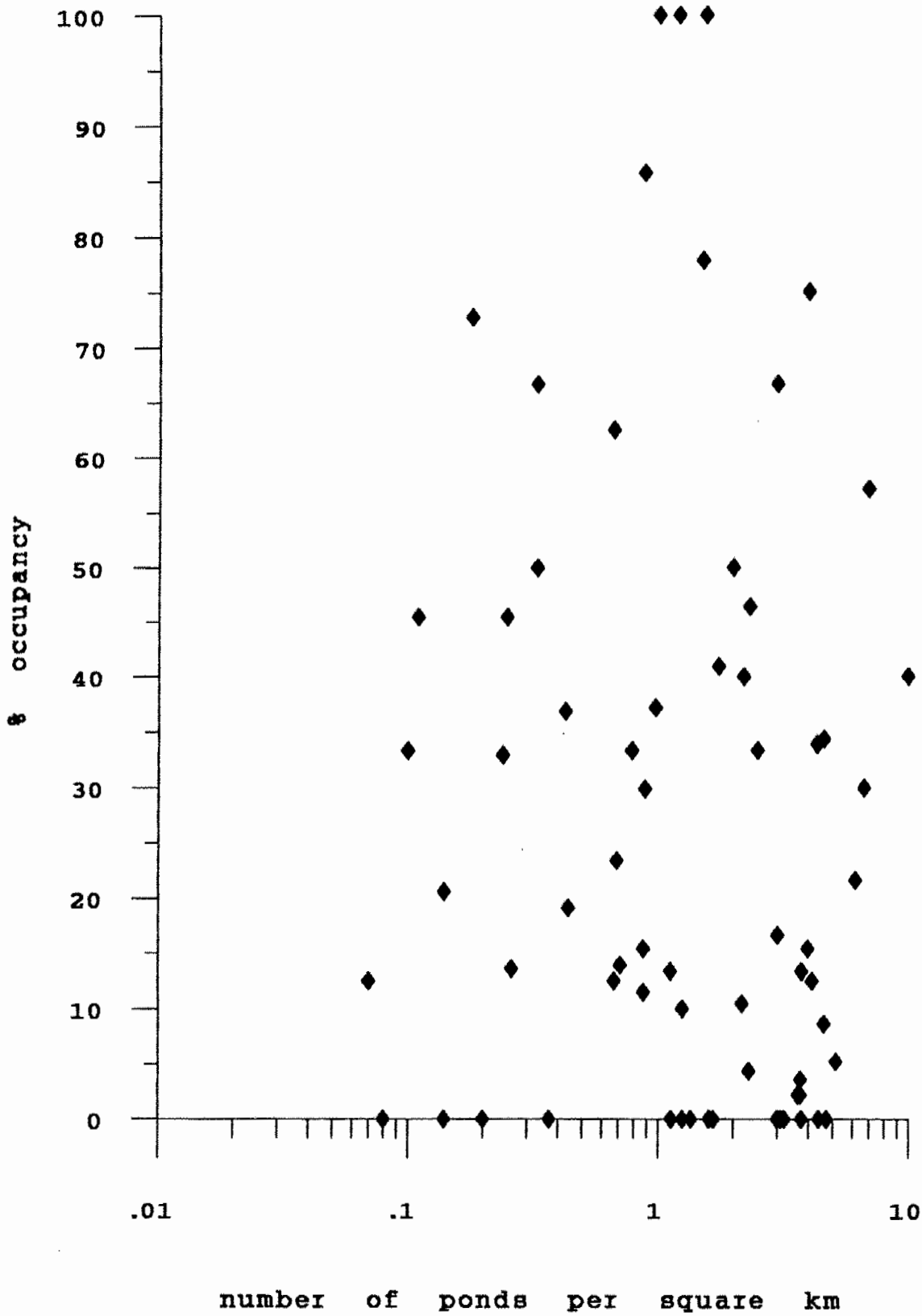
Fig 4.7

Percentage of water-bodies occupied by amphibians at different levels of pond density.

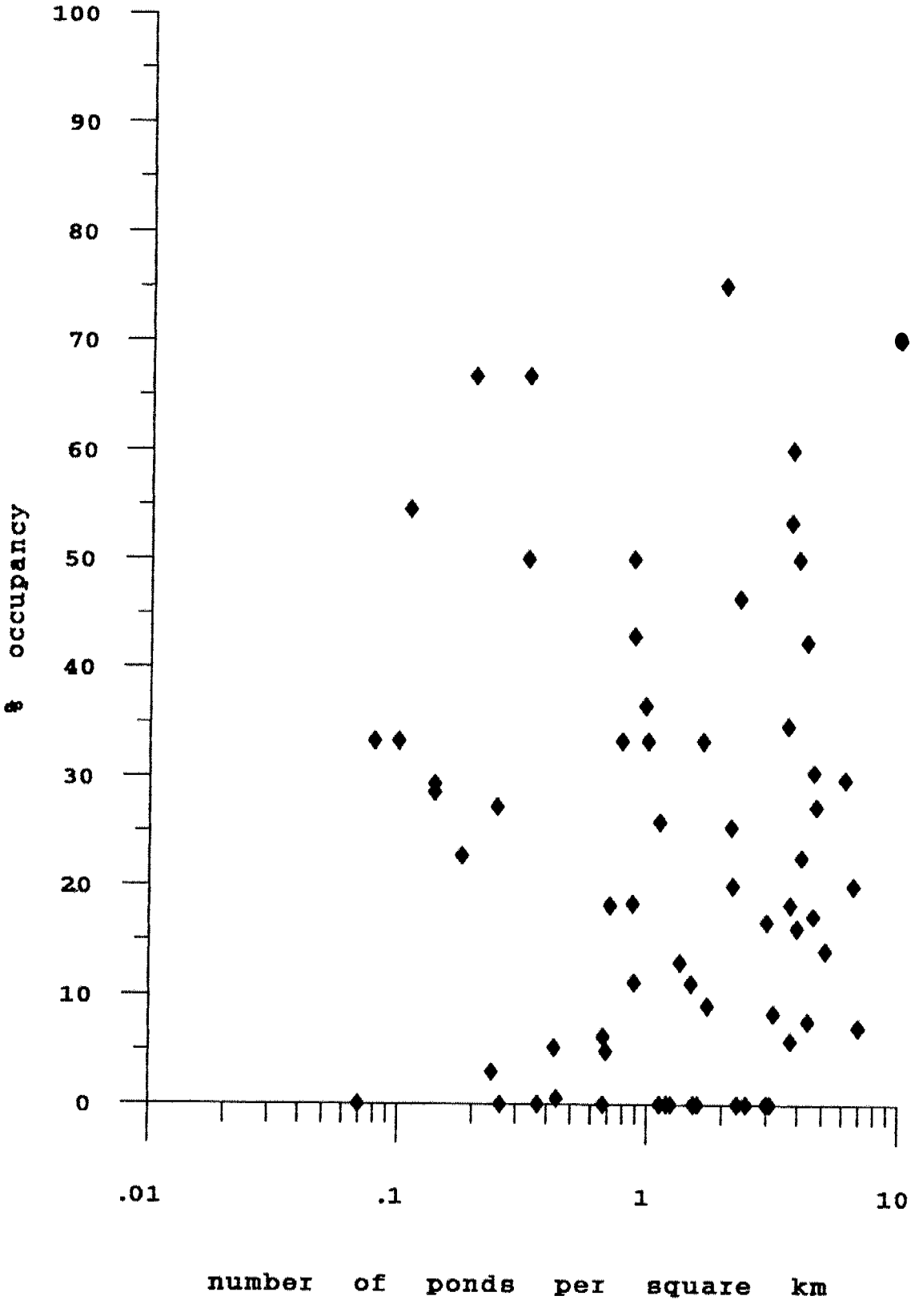
(a) frog



(b) toad


100
90
80
70
60
50
40
30
20
10
0
% occupancy
.01
.1
1
10
number of ponds per square km

(c) smooth newt



Palmate newts were recorded in a higher percentage of low (less than one per km^2) than high (greater than one per km^2) pond density areas (53 compared to 40% respectively), although the relationship did not produce a significant negative correlation. Like the frog, the palmate newt was found in a relatively high proportion of upland, low density water-bodies. It is probable though that, unlike the frog, many of the high pond density areas were outside the newt's distribution range.

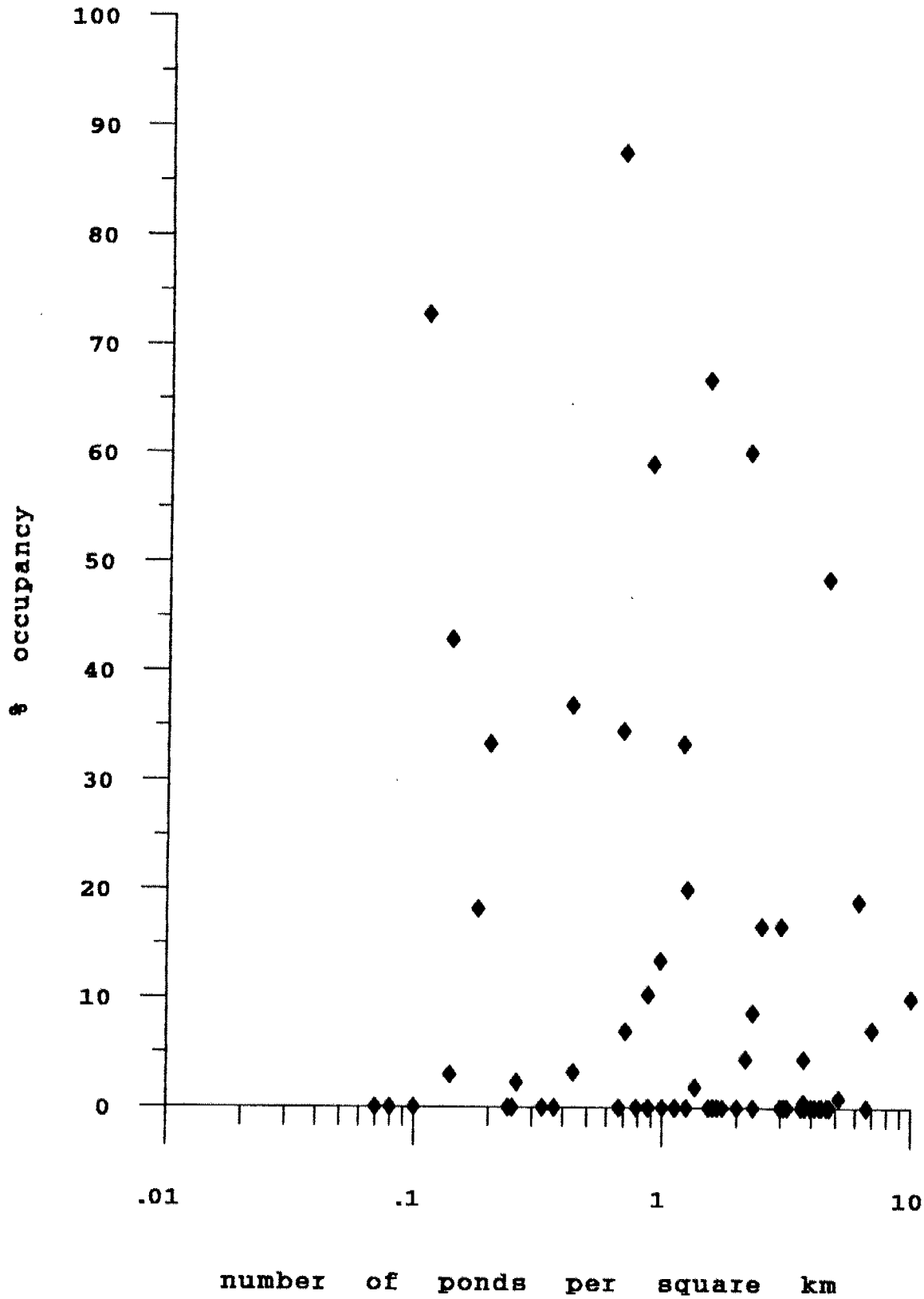
The crested newt is the only species for which a minimum pond density threshold is suggested by the data. Figure 4.7(e) indicates that only about one third of areas where pond densities were less than 0.7 ponds per km^2 supported the species; newts were present in only 42% of the survey areas containing fewer than one pond per km^2. The percentage occurrence of crested newt populations did increase with pond density, but the probability value exceeded 0.05 ($p<0.08$).

Figure 4.8 indicates that although the percentage of sites which desiccated was fairly constant throughout the density range, a relatively high proportion of ponds within the denser ranges were in an advanced stage of succession. Thus, within apparently high pond density areas, the actual densities of "usable" sites may be relatively low. Chapter five will explore the effects of pond and surrounding habitat characteristics on the frequency of amphibian populations in more detail.

4.4 Conclusions

Conducting systematic surveys on a national scale on a voluntary basis has met with varying success. More useful data have been collected regarding water-body than amphibian status, indicating that it would be worthwhile promoting and encouraging further such pond survey initiatives. Systematic amphibian surveys on the other hand are probably best conducted on a professional contract basis.

(d) palmate newt



(e) crested newt

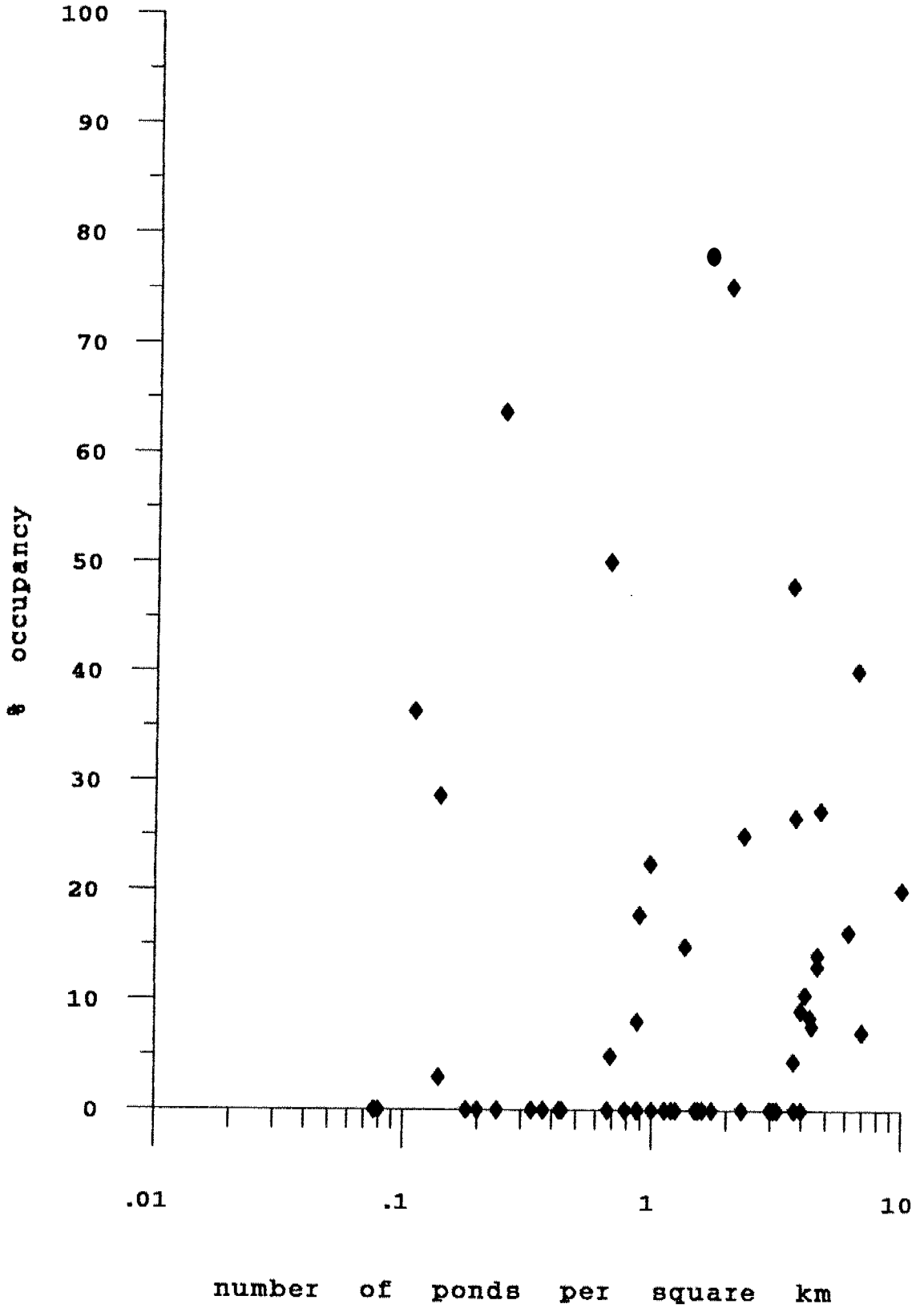
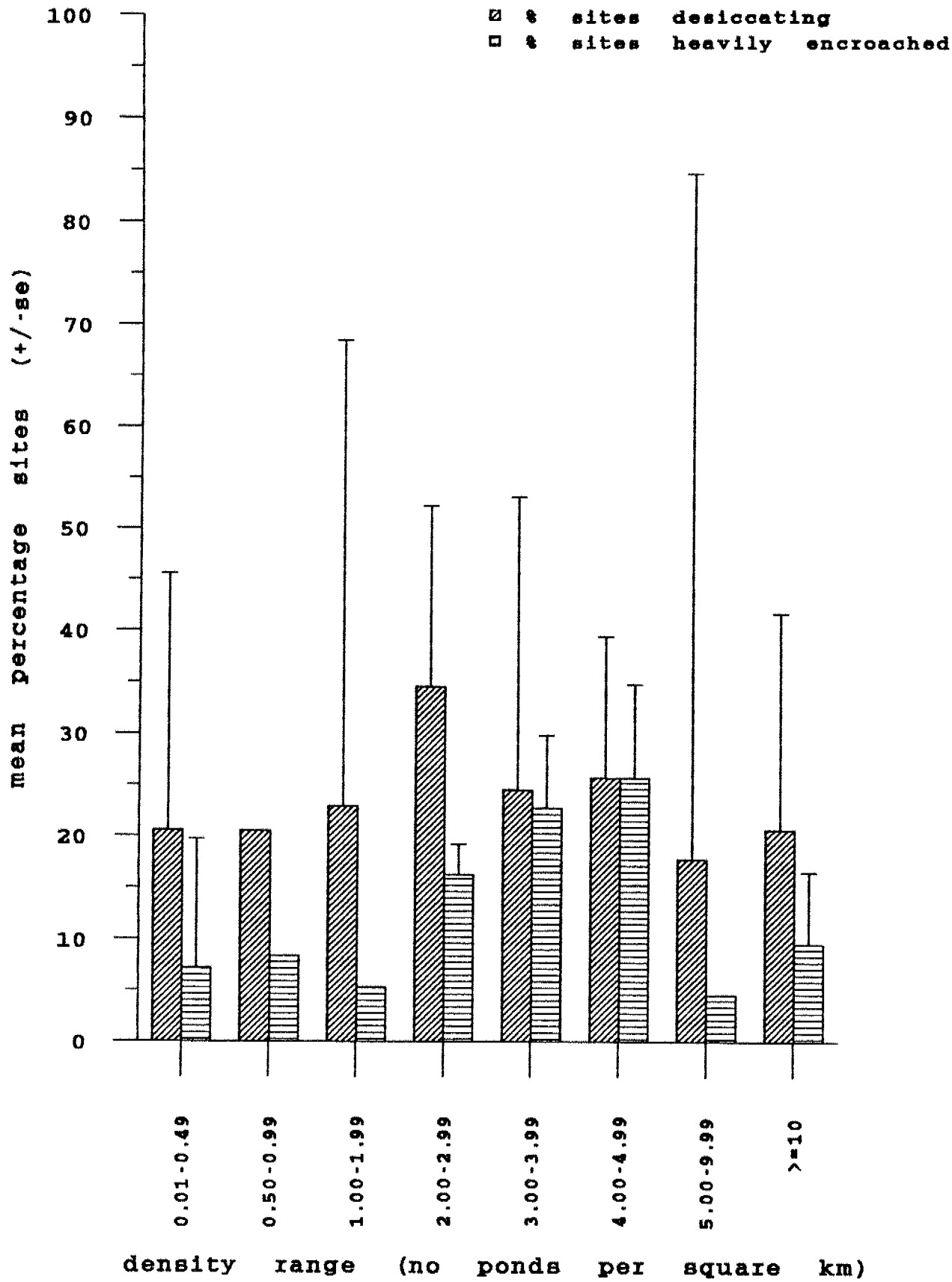


Fig 4.8

Percentage of ponds heavily encroached with emergent vegetation or desiccating regularly, with respect to site density.



Water-body densities varied considerably throughout Britain, being generally higher in lowland than upland areas and western rather than eastern counties (with the exceptions of Kent and Suffolk). The presence of mineral extraction sites or built-up areas within agricultural landscapes was associated with elevated pond density values.

Approximately one tenth of surveyed ponds were in an advanced stage of succession, high pond density areas containing the greatest proportions of neglected water-bodies. Around 20% were reported to desiccate.

Most surveys showed a net loss of ponds since the 1950's, the median loss overall being 17%. However, without the mitigating effect of recent pond construction or restoration, this national figure would have been increased to 30%. Pond losses were higher in lowland agricultural areas then in those with mineral extraction sites present, or in the uplands.

Almost half of systematically surveyed ponds contained frogs, the species occurring most frequently in the west of Britain; population densities largely reflected pond densities. The median density of frog populations overall, in areas where it was present at all, was 0.7 populations per km^2.

Around one quarter of ponds contained toads, which were also found in the greatest frequency to the west of the country. The species was however less common than the frog, being absent from approximately one in five of the areas in which the latter was recorded. Median toad density where it occurred was, however, the same as for the frog, breeding ponds per km^2.

Smooth newts, found in about one fifth of ponds, were encountered most frequently in eastern and central England. Where present, their median density overall was 0.4 populations per km^2.

Palmate newts were only found in 42% of the survey areas, but nevertheless were recorded in 11% of all systematically

surveyed ponds. Within the species' distribution range, (albeit smaller than the other amphibians), it occupied nearly one fifth of ponds. Within these areas, its median density was (0.2 ponds per km^2).

It should be noted, however, that due to their small size and cryptic coloration, the two small newt species (*Triturus vulgaris* and *T. helveticus*) are probably the most difficult of the five widespread amphibians to find, and are therefore the most likely to be under-represented. They are also the most similar in appearance and thus the most likely to be mis-identified.

The crested newt was found in only two percent of ponds within its distribution range, being recorded most frequently in central and eastern England. Its median population density (where the species was present) was 0.4 populations per km^2, twice the median density of or *T. helveticus*. Perhaps therefore a minimum threshold population density is required for the species to be present at all. Indeed, few areas containing less than 0.7 ponds per km^2 were reported to support *T. cristatus*. In the light of this, as a working rule of thumb, a minimum of one pond per km^2 should be aimed for in respect of crested newt conservation habitat management.

The potential "amphibian capacity" of high pond density areas is probably currently not being realized due to the neglected state of a relatively high proportion of those water-bodies.

4.5 Conservation implications

Pond numbers and densities continue to decrease. However, evidence from this chapter suggests that in non-intensively farmed areas, low pond-densities do not preclude high percentage water-body occupancy by amphibians. On the other hand, in the agricultural lowlands (which comprise most of the distribution range of the crested newt) where terrestrial environments may not provide adequate cover, relatively low pond-pond distances may be essential for amphibians.

Although pond densities are higher in the agricultural lowlands, many of the water-bodies are probably unsuitable for amphibians due to neglect and consequent vegetation overgrowth. In these areas we therefore suggest the provision of one "suitable" pond per km^2 as a conservation target, in consideration particularly of the crested newt. "Suitability" will be discussed in Chapter five.