

CHAPTER 4

AMPHIBIAN AND WATER-BODY STATUS

4.1 Introduction

In the previous chapter we reported the distribution ranges of the five species, and the extent to which each could be considered ubiquitous within the counties in which it was found. However, these data gave little indication of species status on a local scale. For example, amphibians may be present throughout each of two counties, but in the first in only 10% of available ponds, while in the second, 50%. Only through systematic or blanket surveys, in which every pond within a given area is investigated, can local status be adequately compared.

This chapter reports the results of pond status and blanket amphibian surveys throughout mainland Britain. Pond, and species population densities are illustrated by county, as are the proportions of water-bodies which support amphibians. The extent to which Britain's ponds are in a neglected state - an advanced stage of natural succession - is also indicated by the data.

4.2 Methods

4.2.1 Pond status

Pond status information comprised data on current pond densities, loss of mapped ponds, and the presence of unmapped ponds. Numbers of ponds heavily encroached by emergent vegetation or known to desiccate regularly were also recorded, and brief surrounding habitat descriptions were available for some of the survey areas. The "Pond Status" recording form can be found in Appendix 16.

4.2.2 Amphibian blanket survey

Appendix 7 contains the amphibian survey "Pond Questionnaire" form, on which most of the blanket survey data were recorded. As well as species density and percentage occurrence data, the systematic amphibian surveys also provided water-body density information additional to the pond status survey. For each separate survey, information on the number of ponds in which over 75% of the water surface was encroached by emergent vegetation, or which desiccated regularly, was also extracted from the questionnaire forms.

4.3 Results

4.3.1 Data sets

Combining the Pond Status (PS) and Blanket Amphibian surveys (BA), a total of 263 separate systematic surveys were returned to the National Amphibian Survey between 1987 and 1992. However, these included 49 pre-1980 survey reports; in the remaining 214, observations had been made since 1979. The number of PS surveys alone (no amphibian data included) was 159, BA surveys numbered 83, and 21 included both amphibian and pond status data; the data were returned by 59, 72 and 16 recorders respectively. The number of surveys from which vegetation encroachment and desiccation data could be extracted was 142, land-use descriptions were provided in 102 and pond status change information calculable from 93 surveys. The total number of ponds visited and assessed since 1979 was 16,973.

One hundred and seventy five surveys provided area estimations from which water-body densities could be calculated. The total known area included in the surveys amounted to 13,657 km², 4.2% of the area of mainland Britain, approximately five times the area covered for the 1989 national survey report (Swan and Oldham 1989). However, areas of coverage varied greatly, from 0.05km² (urban survey within Leicester) to 3,547km² (a survey of the whole of Cornwall). The mean area surveyed per county

was 78km², but a more realistic indication of county coverage is given by the median - 13km².

One hundred and nineteen separate areas were surveyed for pond status, the maximum area of survey being 3,547km² (the whole of Cornwall) and the minimum 0.14km² (one of six Cheshire surveys). Forty-one counties were surveyed with a mean coverage per county of 122km². The median county total however provides a more realistic figure of 26km². The total national coverage amounts to 14,532km², approximately 4.5% of the area of mainland Britain - about five times the area reported in 1989 (Swan and Oldham 1989).

Surveys providing amphibian status data were returned from 48 counties; the mean coverage per county was 68km², and the median, 9km². Areas ranged from 0.05 (urban Leicester) to 1,980km² (most of Lothian region); the total country coverage was 5,688km², approximately 1.7% of the land area of mainland Britain (an increase of about 100% of that reported in 1989). The maximum number of surveys per county was 10, (Leicestershire), but only one systematic amphibian survey was undertaken in each of 27 counties. The mean per county was four and the median, two.

Comparisons between the numbers of ponds present on maps and those found on the ground were made in order to quantify recent changes in water-body status. Ninety-six percent of surveys in which such comparisons were made reported change since 1950, and 88%, change since 1960. Thus, the data presented illustrate change mainly within the 20-30 years prior to the present (Table 4.1).

4.3.2 Pond status

4.3.2.1 Current densities

Unless otherwise stated, only data from surveys where the most recent observations were made since 1979 are included. The data therefore illustrate the situation pertaining in the

Table 4.1

Period spanned between years of initial map survey and final field survey for ponds. In each case the year of final survey was not prior to 1980.

	----- decade of initial map survey -----					
	pre-1950	1950-59	1960-69	1970-79	post-1979	total
number of surveys	4	8	14	64	9	99

1980's. Also, surveys of areas of less than 1km², or in which fewer than three water-bodies were investigated, were excluded from the following analyses.

The median pond density for the whole of mainland Britain is calculated to be 1.4 ponds per km², ranging from 0.04 (Strathclyde Region) to 30 per km² (Kent). Extrapolating this to the whole area of mainland Britain gives a crude estimate of the total number of still water-bodies (excluding garden ponds) of 438,780. However, if the mean density for the whole country (2.8 per km²) is used as the basis of the calculation, the water-body estimate is increased to 916,276.

With the exceptions of Kent and Suffolk, the highest densities (above four ponds per km²) were recorded in western lowland counties; ie the west midlands, Clwyd, Lancashire and Merseyside and the south west of England excluding Cornwall (Figure 4.1). Pond densities were less than one per km² over most of Scotland and south east England. Much of the eastern and northern midlands, and most of northern England (21 counties) recorded county medians between one and four ponds per km². Densities of over 10 per km² were recorded in only four counties - Avon, Devon, Essex and Suffolk.

However, pond distributions within counties were not even, and median values belie sometimes considerable intra-county variation. For example, the two Devon surveys, one of a lowland farming area and the second of part of Dartmoor, gave density estimates of 19 and one pond per km² respectively. On the other hand, the eastern midlands counties of Leicestershire, Northamptonshire and Nottinghamshire together provided a range of densities between 0.5 and 9.23 for 42 separate surveys, their individual county medians being 2.4, 3.3 and 1.2. Thus, for these areas, with similar mixed lowland agricultural regimes, variation was less. County boundaries, used in this report for administrative convenience, are therefore not the most appropriate classification categories in respect of land-use. The survey coverage and range of densities observed for each county are listed in Appendix 17.

4.3.2.2 Water-body condition

An average of 10.7% (median value of 6.5%) of ponds in each survey were in an advanced stage of succession (over 75% encroachment by emergent vegetation). Individual survey percentages ranged from zero (41% of the surveys) to 100% (Central Region, Scotland). In 13% of the surveys, 25% or more ponds were in this condition. However, in eight counties, mainly in the north of England and southern Scotland, but also Devon, Essex, Powys and Wiltshire, no heavily encroached ponds were recorded.

Less than 20% of ponds in 36 counties (65% of the 55 counties for which adequate information was available) were heavily encroached; median values of over 30% were reported in only four counties (Gloucestershire, Leicestershire, W Midlands and Central Region). Figure 4.2 indicates a slight trend towards lower percentages of ponds in an advanced stage of succession in Scotland and Northern England.

Due to variations in precipitation rates between the years of the survey, desiccation figures between surveys undertaken in different years cannot reliably be compared. Nevertheless, overall, the average percentage of ponds known to dry up was 18% (median, 11%) ranging from none in 61 surveys to 100% in two (surveys in Wiltshire and Dumfries and Galloway).

4.3.2.3 Change in pond status

By subtracting the numbers of ponds found on the ground from those marked on the map or listed in previous surveys, it is possible to estimate pond losses or gains; ie net changes in status. The data presented are used to estimate changes in status between the 1950's and the 1980's. Of 93 separate surveys, 65 showed a net loss of ponds on the ground since the maps were compiled, five exhibited no change and 23 recorded a net gain. The median percentage change was a net loss of 17% per survey, the maxima ranging from a loss of 88% of ponds

(rural Leicestershire) to a gain of 380% (an urban park within Greater London).

Figure 4.3 illustrates national trends in pond loss by county. However, where there were insufficient data or intra-county variation was so extreme that median values were not representative of the county as a whole, the data are not presented. For the purpose of this presentation, changes between plus and minus 1% are regarded as "no change". The percentage change in 35 counties is shown on the map. Losses of over 25% have occurred in nine counties (26%) and equivalent gains in three (9%); negligible change (plus or minus 1%) was found in only two (6%). The ranges, median and mean values for each county are listed in Appendix 18.

Changes in numbers of ponds result in changes in density. Pond densities have been reduced by one or more ponds per square km in 26 surveys (29%), but have increased by a similar level in only six (7%). If an arbitrary figure of a 500m radius for crested newt ranging around breeding ponds is assumed, then the loss of one pond within a square km may be a significant determinant of newt status within an area. The median density change for all surveys combined was a net reduction of 0.2 ponds per km², ranging from a loss of nine ponds per km² (Greater Manchester - loss to "recreation" land development) to gains of 18 and 19 (farm pond creation in Devon and urban park pond restoration and creation in Greater London respectively).

Figure 4.4 illustrates median county density changes for Britain; the same qualifications regarding extreme values apply as for the loss map (Figure 4.3). Relatively small changes of plus or minus 0.5 ponds per km² were recorded in 17 counties; most of Scotland and south east England comes into this category. Losses of more than one pond per km² were observed in eight counties, some, such as Suffolk, Clwyd or Lancashire in counties currently still containing high pond densities. Buckinghamshire, Durham and Shropshire were the

Fig 4.3

Percentage change in numbers of ponds since 1950, by county; current surveys all undertaken since 1980. Number of surveys = 93.

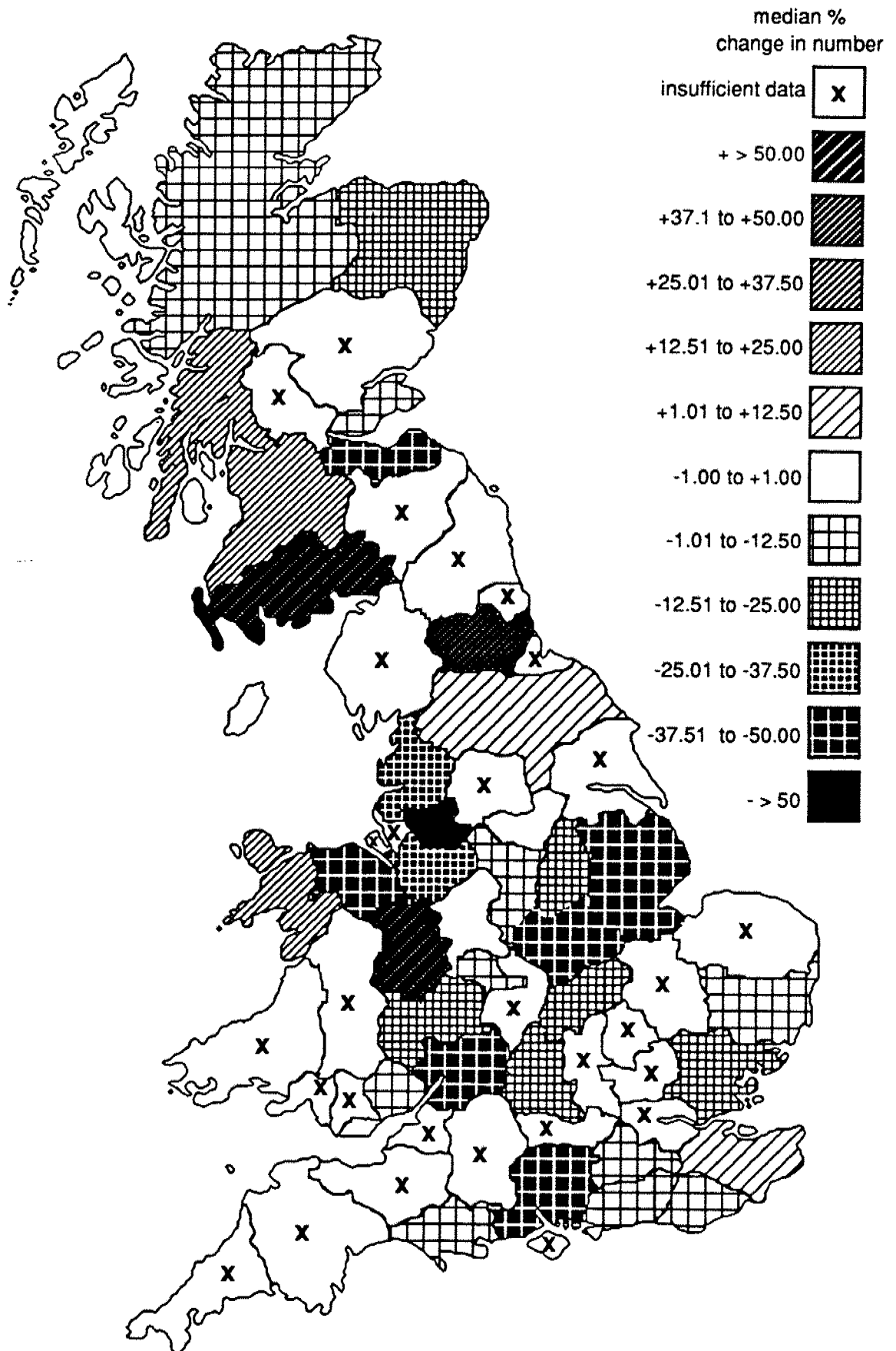
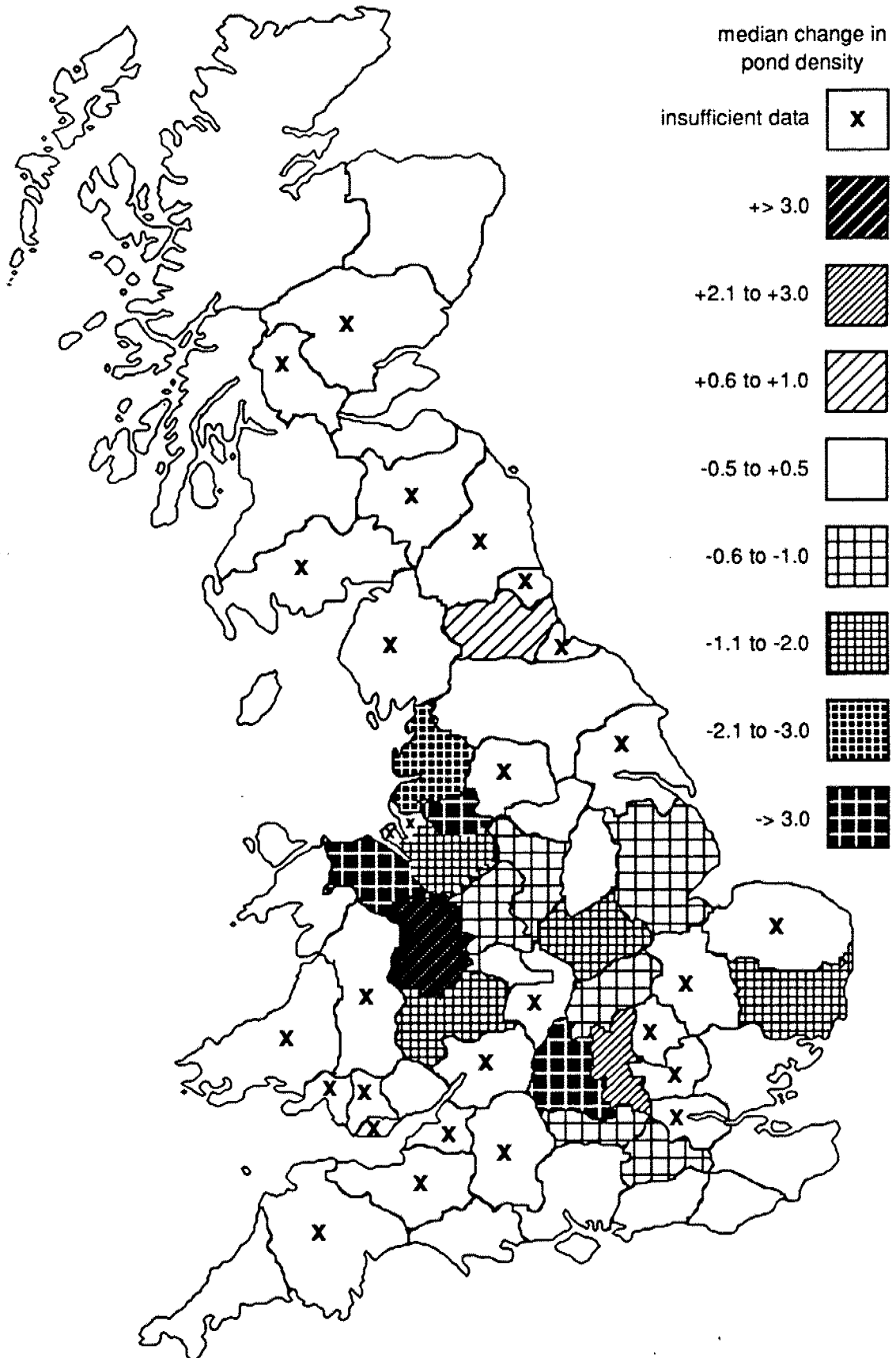


Fig 4.4

Change in pond density (number of ponds per km²) since 1950, by county; current surveys all undertaken since 1980. Number of surveys = 93



only counties in which median pond density changes amounted to net gains above 0.5 per km².

The above reports net pond number and density changes, ie combines numbers of mapped ponds lost with numbers of unmapped water-bodies to assess overall trends in the small water-body resource. In 53 out of 93 surveys (57%) ponds were found on the ground which were not marked on maps. As a percentage of the total number of ponds found on the ground, these unmapped sites constituted between two and 100 percent, the median percentage of unmapped ponds found being seven. Although mapping inaccuracies do occur, for the purposes of this analysis unmarked ponds are assumed to have been constructed during the period between the initial and final surveys. Nevertheless, the figures presented must be regarded as indicating broad trends rather than precise estimates.

Estimating percentage loss of mapped ponds by subtracting the number of mapped ponds found on the ground from the number originally marked on the maps indicates the extent of losses which would have been suffered without the creation of new ponds. Nationally, the percentage of mapped ponds lost ranges from none (15 separate surveys) to 90% (rural Leicestershire), with a median loss of 30%. The median net loss however was just 17% (section 4.3.2.3). Thus, pond construction and restoration projects throughout Britain have had a significant ameliorating effect on habitat losses nationally as well as locally.

Using the initial survey dates or years of map revision, changes in water-body status accruing since particular decades have been calculated. Table 4.2 indicates an increase in percentage pond loss with an increase in the time elapsed since the initial survey since 1950. Ie, as the time during which losses could have occurred decreases, not surprisingly, so also does the level of the loss. However, as newer maps are more likely to take account of previous losses, they might be expected to show fewer ponds, therefore each pond lost should represent a higher percentage of the total. In other words, as

Table 4.2

Percentage change in pond number between 1980's and previous map survey. All final surveys undertaken since 1979.

	number of years since initial survey			
	1 - 10	11 - 20	21 - 30	>30
median % change	-15	-20	-45	-12
mean % change (+/-sd)	-13+/-16	-11+/-64	-44+/-43	-1+/-77
max % loss	-38	-75	-86	-88
max % gain	+19	+380	0	+211
% showing increase	18	23	0	33
n	11	73	3	12

the proportional loss is decreasing with succeeding decades, so also must be the absolute numbers disappearing. However, there are now considerably fewer ponds left to "disappear" than in the 1950's.

4.3.2.4 Pond status and land-use

Predominant land-use summaries were provided for 60 of the Pond Status surveys. These were divided into five main types - lowland agricultural - with and without gardens and built-up areas, upland (most of which included coniferous plantations), areas which included sites of mineral extraction, and dune-slack. Table 4.3 shows that pond density was highest in the one survey of dune-slack habitats - 4.6 ponds per km². Within the other four categories the presence of quarries, gravel pits and other sites of mineral extraction were associated with relatively high pond densities (3.3 ponds per km²). Upland area water-body densities were generally low, ranging from 0.04 to 2.3 per km² with a median value per survey of 0.1 per km². Agricultural lowland values were also comparatively low, ranging from 0.2 to 5.5 per km² (median of 1.1) in the absence of gardens and built-up areas. However, densities were significantly higher where gardens and built-up areas were present ($p < 0.05$), ranging from 0.3 to 10.9 per km² (median of 2.0). No differences in lowland agricultural densities were observed where woodland was recorded within the landscape, nor between arable, pasture or mixed farming areas.

However, with the exception of the dune-slack survey, the habitats supporting the higher densities were also recorded as containing greater percentages of ponds suffering both heavy vegetation encroachment and desiccation. The dune-slack ponds were recorded as being free from excessive vegetation cover, but a high proportion of them desiccated regularly.

Higher net losses of water-bodies were recorded for the lowland agricultural landscapes than for those containing areas of mineral extraction ($p < 0.05$), and the median change reported for the upland areas was positive, indicating a net

Table 4.3

Pond density associated with different land-use types in 60 survey areas.

land-use type	----- density -----				
	median	mean(+/-sd)	max	min	n
lowland agricultural					
- b'up area/garden absent	1.2	1.8+/-1.6	5.5	0.2	33
- b'up area/garden present	2.0	3.3+/-3.4	10.9	0.3	14
sites of mineral extraction within area	3.3	3.5+/-2.2	6.2	1.2	4
upland areas	0.1	0.5+/-0.8	2.3	0.04	8
dune-slack	4.6	-	-	-	1

gain (Table 4.4). Within the agricultural lowland sample, habitats containing built-up areas or gardens had apparently suffered lower levels of net water-body loss than those more remote from human habitation ($p < 0.01$).

4.3.3 Species status

4.3.3.1 Survey limitations

Because the national survey was conducted on a voluntary basis, there has been limited control over the extent and types of areas covered. Generally, individuals investigated ponds within their own locality with which they were familiar. It is also probable that they will have recorded areas which they considered likely to contain amphibians. In some cases the areas surveyed represented particular features, such as Forestry Commission plantations (particularly in Scotland and North Yorkshire) or nature reserves. Of those which could reasonably be said to comprise "typical farmland", nearly one quarter (23%) contained residential or built-up areas. A great deal of time and difficulty are involved in systematically surveying representative patches of the wider countryside outside the potential influence of human settlement. Thus, in order to ensure adequate, even and representative national coverage the task is probably unsuited to the amateur, and best undertaken under paid contract. Nevertheless, useful data have been produced and are presented below. The current analysis includes data only from surveys in which at least one km² and a minimum of three ponds have been surveyed.

The second major shortcoming concerns the map illustrations of pond occupancy by each species, derived from blanket survey. The two rarest species, *T. helveticus* and *T. cristatus*, have not always been found in blanket surveys in the counties in which they are known to occur. For example, crested newts were absent from the blanket survey areas in N Yorkshire, although Figure 3.3 confirms their presence within the county. Figures in this section should not, therefore, be taken to indicate

Table 4.4

Change in pond numbers associated with different land-use types in 80 areas.

land-use type	----percentage change in number----				n
	median	mean	max loss	max gain	
lowland agricultural					
- b'up areas/gardens abs	-24.1	-25.8	-75.0	+50.0	49
- b'up areas/gardens pres	-50.0	-10.0	-50.0	+100.0	19
sites of mineral extraction within area	-6.7	+41.2	-39.3	+184.0	5
upland areas	+4.1	+1.9	-57.1	+76.9	7

species distribution range or presence within each county, but as an indication of the probability of encountering the species therein. To illustrate the point, in Leicestershire, the small newt species relatively frequently encountered in field ponds is the smooth newt. However, the palmate newt is also found within the county but in a small area of regionally atypical upland geology. The latter species was not found in any Leicestershire blanket survey, but because one would not expect to find it in areas of mixed agricultural land-use typical of most of the county, the maps are not entirely unrepresentative of its status.

Figures in this section show mean values rather than medians in an attempt to overcome the problem of under-representation of species with patchy distributions within counties. The problem associated with using median values can be explained using, as an example, the toad in Leicestershire. The animal was found in only three of the nine blanket surveys within the county, therefore both its median percentage occurrence and density for the whole county were zero. The fact that so few areas contained the species is itself significant, but for "zero" to represent toad status in Leicestershire would imply a rarity comparable to that of the palmate newt, which would be misleading. To some extent therefore, the choice of methods of data representation have been influenced by the project coordinators' prior knowledge. However, the representative value of the figures can be assessed by reference to Appendices 19 and 20 which list the range, median and mean percentage occurrence and density of each species by county.

Adequate percentage occupancy data were returned in 99 surveys from 53 counties, and density information in 75 surveys from 47 counties.

4.3.3.2 Frog status

From the 99 systematic ("blanket") amphibian surveys throughout mainland Britain, frogs were reported to breed in a median percentage of 47% of ponds. The percentage occupancy

however varied considerably between surveys, ranging from none at all in two (small surveys in Leicestershire and Staffordshire comprising of only five and three ponds respectively) to 100% in 12 surveys (six of which were from Scotland). In the surveys in which it was found, the frog was present in a minimum of 2% of ponds, Table 4.5.

Comparing county mean percentage values, the highest percentage occupancies were recorded in the west of Britain, particularly in Scotland and northern and south west England (Figure 4.5(a)). In nearly a third of counties (19) the mean percentage was over 60, and in only three were mean percentage occupancy values less than 20 (Clwyd, Lancashire and Lincolnshire).

The total number of surveys from which population densities could be calculated was 75, in 74 of which frogs were present. Where present, frog median density was 0.7 per km² ranging from 0.02 (38km² of Borders Region) to 15 (Suffolk), Table 4.6.

Frog population densities, however, did not entirely reflect percentage occupancies, being relatively highest in East Anglia, and the west midlands counties as well as the south west peninsula and south west Scotland (Figure 4.6(a)). Frog population densities were frequently fairly low, averaging less than one per km² in 24 counties (51%) and greater than four in only seven. The highest recorded densities of fifteen and seven populations per km² were for two one km² surveys of a Greater London urban park and of agricultural land adjoining a Suffolk village respectively.

In general frog densities reflected pond densities, but in upland habitats a high percentage of water-bodies contained them, despite low pond densities.

4.3.3.3 Toad status

Toads were found in 81 of the 99 blanket surveys their overall median percentage occupancy of ponds being 23%. The percentage

Table 4.5

Percentage occurrence of each species in 99 blanket surveys.

	frog	toad	smooth newt	palmate newt	crested newt
no.of surveys in which sp present	97	81	74	42	53
% surveys in which sp present	98	82	75	42	57
% occurrence of each species:-					
within all areas:					
median	47	23	17	0	2
mean	52	30	22	11	11
max	100	100	100	88	78
min	0	0	0	0	0
within areas in which sp occurs:					
median	47	33	27	17	18
mean	53	37	30	26	20
max	100	100	100	88	78
min	2	2	0.5	0.5	2