BTO Research Report No. 27

THE SEASONAL USE OF GARDENS BY BIRDS WITH SPECIAL REFERENCE TO SUPPLEMENTARY FEEDING

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A report from the British Trust For Ornithology to Pedigree Petfoods

OCTOBER 1987

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GENERAL INTRODUCTION

Gardens are a rich habitat for wildlife and in particular for birds. In 1980, it was estimated that gardens comprised twice the area of our National Nature Reserves (Glue 1982), and this importance is likely to grow with increasing urbanisation. Gardens of all shapes and sizes offer birds and other wildlife a diverse refuge in the heart of the country, in suburbia or in the centre of our largest cities. For many years it has been known that some bird species use gardens extensively for nesting and overwintering. Many other species are less reliant on gardens except for feeding during severe winter weather. Garden bird feeding has for a long time been widespread, and in recent years has been encouraged by organisations like the RSPB. Thus there has been an increase in public awareness of garden birds and an urge to help them survive during the winter months.

There has been much speculation as to the benefits accrued by garden birds from supplementary feeding. The RSPB have always encouraged householders to feed birds in winter but have been equally forceful in their condemnation of feeding birds during the breeding season. It is generally believed that many birds and tits in particular will feed their young on unsuitable foods where these are provided. The editors of the RSPB's Birds magazine regularly advise that birds should not be fed during the breeding season because the foods provided are unsuitable for nestling birds and feeding stations may increase the likelihood of disease. In an information leaflet, the RSPB recommend that there is no need to feed birds between April and September. They state that during these months, natural food should be 'superabundant' and that if it is not, birds should not be allowed to become dependent on the provider. The same document also advises that nestlings may be killed when fed with indigestible foodstuffs such as peanuts. The BTO also produce an information leaflet titled 'Feeding Garden Birds', in which it is recommended that birds can be fed from August to mid-May after which date young tits are in the nest being fed. Factual evidence to support these recommendations is extremely fragmentary, due to the lack of studies of birds carried

out in garden habitat. The main aims of this study were as follows: a) to review the available literature concerning the effects on birds of providing supplementary food in gardens; b) to describe the seasonal patterns of usage of gardens by birds, from the results of a national survey; c) to carry out field studies to examine the extent to which nesting Blue and Great Tits use supplementary foods during the breeding season. The first three sections of this report relate specifically to each of these aims in turn.

PART 1

THE EFFECTS OF SUPPLEMENTARY FEEDING ON BIRDS: A LITERATURE REVIEW.

General Introduction.

Few ornithologists have chosen to study birds in garden habitats despite the logistical advantages of working in such an area. Hartley (1954) first outlined the sorts of research questions which could be tackled by studying birds in gardens. In his brief review, he stressed the ease with which garden birds could be monitored as opposed to watching them in natural habitats such as woodlands. Whilst many people have enjoyed watching the birds in their gardens, little has been published about the birds themselves except in the popular literature (Glue 1982, Soper 1965, Thornton 1981). For quantitative information, we must turn to the scientific literature. Bird feeding has never been well represented and, in the case of garden birds this is particularly so.

Many of the species which nest and overwinter in gardens have been the subject of detailed studies but usually in other habitats. Books have been published on several groups of birds which occur in gardens, most notably finches (Newton 1972), tits (Perrins 1979), thrushes (Simms 1978), warblers (Simms 1986) and crows (Coombs 1978). In addition, there are monographs (species-specific publications) on the Blackbird* (Snow 1958), the Starling (Feare 1984), the House Sparrow (Summers-Smith 1963, 1987), the Robin (Lack 1943, Mead 1984), the Wren (Armstrong 1955) and the Woodpigeon (Murton 1965). Whilst these birds all use gardens, few of the authors actually studied their birds in gardens. There are also many published scientific papers on bird species which visit gardens, although most are outside the scope of this study.

Effects of supplementary feeding on winter survival.

Few researchers have examined the effect of providing supplementary food over the winter period. In the Netherlands, van Balen (1980) examined Great Tit numbers and survival over a

thirteen year period. During the winters of 1966/67, sunflower and hemp seeds were provided throughout the study area. The Great Tits normally fed on beechmast during the winter but, in years when beechmast was scarce, they relied on the supplied seeds. As a direct result of the food provided, the survival of the tits increased at a time when the beechmast was scarce. Thus, at a time when survival and population density may have been expected to decrease it actually increased.

A German study of Great and Blue Tits also indicated that survival decreased negligibly after a severe winter in a fed population whilst there was a significant decrease in survival in the unfed area (Berndt and Frantzen 1964). Hilden and Koskimies (1969) point out that several species of birds wintering in Finland did not decrease markedly after the severe winter of 1965/66. The species in question were the Great Tit, House Sparrow, some finches and crows which were entirely dependent on food provided or thrown out by humans. The authors speculated that these species would not have survived had it not been for this food source. Van Balen (1980) also speculated that in the northern part of their range Great Tits were solely reliant on non-natural foods to survive during adverse winter conditions.

In a study carried out in Sweden, Kallander (1981) provided sunflower seeds and fat for Great and Blue Tits in two study areas. In control areas, Great Tit populations decreased dramatically whereas in the two study areas where food was provided, the populations actually increased. In the following winter, the populations of Great Tits increased in both the fed and unfed study areas. In the second winter it seems likely that the presence of a good crop of beechmast was responsible for the increase in Great Tit populations. In years of low beechmast production the artificial food is used thereby ensuring a high overwintering survival. When beechmast is present and available, the effect of provided food on survival is minimised. Where both mast and provided foods were absent then the overwintering survival and the size of the breeding population the following year were reduced. The results of Kallander's study agree with the

findings of Van Balen. Strangely, there was no effect of food provision on Blue Tit survival.

The results from an Oxford study of Blue and Great Tit survival were quite different. In this case, it was concluded that the availability of winter food had no obvious effect on Great Tit survival or spring breeding density, whilst Blue Tits significantly increased in the area where sunflower seeds were provided (Krebs 1971 in Kallander). Other studies have been less conclusive but for completeness are recorded here. Berndt (1941) suggested that the provision of food benefitted the survival of populations of Nuthatch and Treecreeper. A similar paper (Berndt & Frantzen 1964) suggested that food provision maintained Great Tits at stable numbers after a severe winter whilst the population declined markedly in unfed areas. Unfortunately, the authors could not determine if survival had increased as a result of food provision or if birds had moved into the area where supplementary food was available. Other studies were even less conclusive. In a Scottish pine plantation, winter populations of Coal Tits were increased in the immediate vicinty of a feeding station but the breeding populations were unaffected (Deadman 1973). Hogstad (in Kallander 1981) concluded that the provision of food in winter had a positive effect on Willow Tit overwintering survival.

Effects of supplementary feeding on timing of breeding and mating systems.

Since the work of Lack (1954) there has been considerable interest as to how food supply influences timing of breeding in birds. Ewald and Rohwer (1982) published a paper describing the effects of food supplementation on laying date in Red-winged Blackbirds. They also reviewed research that had been carried out on other species and cited examples where it was known that food appeared to affect timing of laying. In the cases cited, laying date was advanced by the provision of supplementary food. In Britain, several workers have studied the timing of breeding in garden birds but in non-garden habitats.

In a long term study of Dunnocks in Cambridge University Botanic Gardens, Davies and Lundberg (1984, 1985) studied how food supply influenced mating system and timing of breeding. Dunnocks varied their mating system in accordance with their food supply. Where food was abundant, females limited themselves to small areas. In areas with rich food patches there were therefore several female Dunnocks in close confines. Where this occurred, females tended to be monopolized by one or two males. Thus in areas where food was abundant, males frequently had several mates (polygyny). In areas where food was sparse, females had larger territories and were then more commonly monogamous or even sometimes polyandrous (each female had several mates). Thus, the mating system differed in accordance with the amount of food present in the area. The provision of food to areas low in natural foods led to the contraction of female territories and to a shift in mating system with polygyny becoming more prominent. The timing of laying was also influenced by the availability of food. In two years when food was provided in certain areas, female Dunnocks in fed areas laid earlier than females in unfed territories. In year one, the females laid 10 days earlier whilst in year two the females laid 22 days earlier. The extra food had no effect on the clutch size with both groups of birds (fed and unfed) laying clutches of the same size (Davies & Lundberg 1985).

In a study of Great Tits, Kallander (1974) demonstrated that laying date could be influenced by the provision of food. In his study area in Lund (Sweden), Kallander was able to advance laying date in Great Tits by supplying extra food in the birds' territories (1974). There have been studies of a similar nature in other species. In Magpies, Hogstedt (1981) discovered that experimental pairs (which were provided with food) laid earlier, had larger clutches, heavier eggs and greater hatching and fledging sucess than pairs in territories in which extra food was not supplied. In Nuthatches, Enoksson and Nilsson (1983) found that population densities in the autumn were positively correlated with the abundance of natural food (beechmast). They also demonstrated that territory size decreased when sunflower seeds were provided. A Swedish study of Willow Tits and Crested Tits

(von Bromssen & Jansson 1980) also showed that laying date could be advanced when extra food was made available to the birds. They also discovered that the clutch size was not significantly larger in the fed birds than in unfed birds. Nestling Crested Tits were however, significantly heavier in the fed territories than the unfed. Willow Tit nestlings did not differ significantly in weight between fed and unfed areas. A later publication (Jansson et al. 1981) indicated that both winter survival and immigration were influenced by the provision of extra food. Populations were denser in fed areas than unfed areas suggesting that winter food supply at least partly determines breeding density the following spring.

Effects of supplementary feeding on breeding success.

A study in Cardiff (Cowie and Hinsley 1987) monitored timing of laying, clutch size and breeding success in Blue and Great Tits nesting in suburban and natural habitats. Whilst Great Tits nested earlier in urban habitats than natural woodlands, Blue Tits did not. Both species laid smaller clutches and fledged fewer young than they did in deciduous woodland. A similar study in West Germany (Schmidt & Steinbach 1983 and Schmidt & Einloft-Achenbach 1984) found that Great and Blue Tit clutch size and fledging success was lower in suburban habitat than in natural woodlands. The authors speculated that the food supply was poorer in these habitats than in surrounding natural woodlands. Whilst the garden habitats in Cowie and Hinsley's study area were well supplied with bird table foods, the authors stress that much of this food was unsuitable for the nestlings with the result that many were starving to death (Cowie & Hinsley 1987). This was a very important finding in that the authors stressed that even though food was available it was unsuitable as a nestling foodstuff. Although Cowie has found some chicks which have died as a result of consuming unsuitable foods, he stresses that that in the majority of cases dead chicks were emaciated and had obviously died of starvation (Dr. R. Cowie pers. comm.).

Effect of supplementary feeding on distribution.

Several studies have suggested that the provision of food has led to the expansion of the ranges of several species. In recent

years, the Magpie has expanded its range considerably. Tatner (1982) and Clarkson & Birkhead (1987) consider that this can partly be attributed to the increasing use of domestic waste made by Magpies. Tatner (1983) documents the food of both adult and nestling Magpies. Whilst other factors such as a decrease in the level of shooting may be important, the use of human waste foods by Magpies is strongly suspected as being one of the main reasons why this bird has colonised the urban environment so rapidly (Clarkson & Birkhead 1987). Starlings have been equally successful in their invasion of the urban environment. During the winter, the majority of food consumed by Starlings are the products of man's agriculture and household waste disposal. Tait (1973) suggests that the Starlings success is, in part, due to it's exploitation of these feeding facilities at a time when natural food is scarce or not readily available. The utilisation of these food sources has allowed Starlings to overwinter more successfully thereby increasing their survival and population. Another species which has exploited the urban environment most successfully is the House Sparrow. Much of this success is attributable to the House Sparrow's use of non-natural foodstuffs either presented in gardens for birds or thrown out as waste. Whilst natural foods are the most important, non-natural foods become more important when invertebrates and vegetable material are scarce. In particular, Seel (1969) found grain and bread were important in the diet of nestlings in rural and urban areas respectively. Summers-Smith (1963) also attributed the success of the House Sparrow in urban environments to it's ability to adapt it's diet. These birds have very catholic tastes allowing them to utilise almost anything available.

Feral Pigeons (relatives of the Rock Dove) inhabit urban areas and thus have a near continuous food supply with the result that half the birds are able to stay in breeding condition continuously. Woodpigeons are found breeding both in rural habitats and in more urban areas. The urban birds are able to nest earlier as a result of the abundant food supplied by humans (Cramp 1972). Cramp also stated that the diet of these Woodpigeons consisted mainly of bread as opposed to the grain-based diets of the rural pigeons.

Food supplied at the bird table is also thought to have had a major effect on over-wintering habits of some birds. Since 1945, the number of Blackcaps wintering in Britain has steadily increased. The Blackcap is a summer visitor to Britain returning south at the end of each breeding season along with many other migrants which visit Britain to breed. The wintering birds are immigrants to Britain from northern and eastern Europe and are increasingly to be found during the winter months in suburban gardens. Whilst these birds are typically found in woodlands, during cold weather they move into gardens where bird table food is available. Their ability to survive very cold winters may be partly due to the supplied food. At least one study has shown that Blackcaps are able to maintain and even increase their body weight throughout severe weather (Leach 1981). In contrast to the Blackcap, the Chiffchaff maintains an entirely insectivorous diet throughout the winter and, as a result, it is susceptible during very cold weather with the result that many individuals which attempt to overwinter in Britain are killed (Lack 1986).

Another species whose distribution is thought to have been affected by bird table feeding is the Siskin. Primarily a bird of the coniferous forests of north western and central Europe, Siskins normally prefer to feed on alder and birch seeds during the winter months. Since 1961, Siskins have increasingly been recorded entering gardens to feed, particularly on peanuts (Spencer and Gush 1973). Garden feeding is chiefly typical of the latter stages of winter after the more natural food such as alder and birch seeds have been exhausted. Although these birds are typically irruptive, tending to move great distances in search of food, it is likely that the recently acquired habit of feeding in gardens has meant that many birds are now able to remain more sedentary throughout the winter.

In a study of the feeding ecology of finches, Newton (1967) documented the feeding habitats finches occupied throughout the year. Chaffinches were considered to feed mainly in farmland and woodland except during snowfall when they moved into gardens.

Greenfinches visited gardens to feed during January, February and March and also during periods of snow cover. Bramblings and Siskins were not considered to feed for a significant amount of time in gardens during any period. In a later study (Newton 1972) documented the use of man-made habitats by finches. The Greenfinch, Chaffinch and Siskin were all known to visit feeding stations at the time of publication whilst the Brambling was a rare visitor and the Bullfinch thought to visit feeding stations only on the continent. The same study also stated that Bramblings were rare winter visitors to gardens and that Siskins may only be found in rural gardens. Finches such as the Greenfinch, Brambling and Siskin now regularly visit gardens during the winter and spring to feed on provided food (Glue 1982). It would seem that the feeding habits are still changing and that habits can change over a very short period of time.

Conclusions

The provision of food can have an effect on survival, timing of breeding and reproductive success. Very few of the studies documented above have actually been carried out in garden habitat. Therefore, whilst there is good evidence that food supply is important in determining the timing of breeding, we can only hypothesise that this would hold true for birds nesting in gardens where food is provided. There is also a strong suggestion that some species have expanded their ranges and become more abundant as a result human foods being discarded as waste.

Because so little research has been carried out in gardens we do not know how commonly birds use bird table foods to supplement their own diet or to feed to their nestlings. Whilst a great deal of work has beeen carried out on those species which are easier to study, we still know very little about how finches and thrushes might use these foods during the breeding season. The literature study also indicates that we know very little about what birds are doing in gardens during the late summer and early autumn. At this time many garden bird populations are probably at their highest levels. Finally, there are very few published accounts on the

possible nutritional advantages or disadvantages accruing to birds which regularly feed on bird table foods.

PART 2

THE GARDEN BIRD FEEDING SURVEY

2.1 Introduction

The BTO's Garden Bird Feeding Survey (GBFS) began in 1970 and is now entering it's eighteenth year. The aims of the survey are threefold: a) to assess the importance of gardens as a bird habitat; b) to determine garden bird feeding preferences and c) to record feeding behaviour patterns. The survey runs over a six month period from the beginning of October to the end of March with data recorded on a weekly basis, from approximately 200 gardens. To encourage birds to use their garden, all participants provide food and water throughout the period of the survey. All birds which come into gardens to drink or eat are recorded.

As part of a special contract to the BTO from Pedigree Petfoods to study the seasonal use of gardens by birds and to determine garden bird feeding preferences, the BTO organised a special spring extension to the GBFS in 1987. The Spring GBFS aimed to compare bird feeding numbers in the spring with feeding numbers in winter in both rural and suburban habitats and to determine which species use bird table foods during the breeding season.

2.2 Methods

On registration to the survey, each participant is given a site number and data recording sheets. On each recording sheet (see appendix 2 and 3) a list of the twenty most frequently recorded species is displayed along with a data box for each week of the survey. At the end of each survey week the observer records the peak count for each species feeding or drinking in their garden. The peak count is the maximum number of individuals of each species which is seen in the garden feeding or drinking at any particular time. Peak counts are probably the most repeatable measure of bird feeding activity that can easily be recorded by amateurs. Other counting methods are unsatisfactory because

without individually marked birds it is impossible to know if the birds in the garden one day are the same ones as the day before. There are no restrictions on the duration or timing for making observations within each week.

This report is confined to the analysis of seasonal trends only, which have been described by two measures: (a) the proportion of gardens in which the different species were recorded each week, and (b) the mean weekly peak counts of each species. Because substantial differences in the results for suburban and rural gardens have been recorded for many species, the results are presented separately for the two garden types. The results which cover the period October 5th 1986 to June 30th 1987 are presented in a series of graphs in the appendices.

During the winter GBFS a total of 181 participants took part covering 101 suburban and 80 rural gardens. The spring GBFS which ran from 1st April to 30th June covered 69 suburban and 45 rural gardens.

2.3 Results

At the end of each GBFS, the BTO has produced a 'top twelve list' to indicate those species most frequently recorded in gardens. To produce this list for the latest survey, the 1986-87 data was analysed to determine the percentage of gardens that an individual species was recorded in. The results of this analysis are shown for the winter GBFS in (Table 2.1) and the spring GBFS (Table 2.2)

TABLE 2.1 The percentage of gardens (N = 181) recording each species during the winter survey.

SPECIES	GARDENS RECORDED IN.	%
Blackbird	181	100
Robin	180	99
Blue Tit	179	99
Starling	177	98
Chaffinch	176	97
Great Tit	176	97
House Sparrow	175	97
Greenfinch	173	96
Dunnock	166	92
Song Thrush	156	86
Coal Tit	128	71
Collared Dove	122	67
Magpie	105	58
Pied Wagtail	85	47
Wren	83	46
Mistle Thrush	74	41
Black-headed Gull	71	39
Jackdaw	64	35
Brambling	64	35
Wood Pigeon	59	33
Siskin	57	31
Great Spotted Woodpecker	56	31
Carrion Crow	52	29
Sparrowhawk	49	27
Fieldfare	47	26
Jay	46	25
Reed Bunting	40	22
Redwing	40	22
Nuthatch	40	22
Bullfinch	36	20
Rook	31	17
Blackcap	31	17
Pheasant	27	15
Marsh / Willow Tit	23	13
Common Gull	23	13
Yellowhammer	22	12
Long Tailed Tit	20	11
Tree Sparrow	20	11
Goldfinch	19	10
Feral Pigeon	15	8
Kestrel	15	8
Herring Gull	14	8
Moorhen	9	5
Treecreeper	8	4
Lesser Redpoll	8	4
Marsh Tit	8	4
Chiffchaff	7	4
Goldcrest	7	4
Grey Wagtail	6	3
Willow Tit	5	3
Linnet	5	3
Lesser Spotted Woodpecker	5	3
Meadow Pipit	4	2
Mallard	4	2
Skylark	4	2
Lesser Black-backed Gull	4	2
Green Woodpecker	3	2
Tawny Owl	3	2
Merlin	3	2
Grey Partridge	2	1
Great Black-backed Gull	2	1
Waxwing	2	1
Red Legged Partridge	2	1
Hawfinch	2	1
Buzzard	2	1
Hooded Crow	2	1
Willow Warbler	1	*
Stock Dove	1	*
Little Owl	1	*
Woodcock	1	*
Redshank	1	*
Water Rail	1	*
Firecrest	1	*
Black Redstart	1	*
Ring Necked Parakeet	1	*
Snipe	1	*
Corn Bunting	1	*
Peregrine	1	*
Mealy Redpoll	1	*
Serin	1	*
Twite	1	*
Great Grey Shrike	1	*
Lapwing	1	*
Barbary Dove	1	*
Hen Harrier	1	*
Red Grouse +	1	*
Zebra Finch +	1	*

TABLE 2.2 The percentage of gardens (N = 114) recording each species during the spring survey.

SPECIES	GARDENS RECORDED IN.	%
Blue Tit	113	99
Blackbird	111	97
House Sparrow	107	94
Starling	106	93
Chaffinch	103	90
Great Tit	102	89
Greenfinch	101	89
Dunnock	100	88
Robin	99	87
Collared Dove	85	75
Song Thrush	75	66
Coal Tit	69	60
Magpie	62	54
Jackdaw	47	41
Wood Pigeon	37	32
Siskin	37	32
Carrion Crow	33	29
Mistle Thrush	26	23
Great Spotted Woodpecker	22	19
Jay	22	19
Brambling	19	17
Rook	19	17
Reed Bunting	18	16
Nuthatch	17	15
Pied Wagtail	15	13
Wren	13	11
Black-headed Gull	13	11
Sparrowhawk	13	11
Bullfinch	12	10
Feral Pigeon	12	10
Tree Sparrow	10	9
Willow Warbler	9	8
Long Tailed Tit	8	7
Pheasant	8	7
Marsh / Willow Tit	7	6
Yellowhammer	7	6
Blackcap	6	5
Goldfinch	5	4
Herring Gull	5	4
Turtle Dove	5	4
Kestrel	4	3
Chiffchaff	4	3
Garden Warbler	4	3
Lesser Black-backed Gull	4	3
Spotted Flycatcher	3	3
Willow Tit	3	3
Tree Creeper	2	2
Linnet	2	2
Hooded Crow	2	2
Stock Dove	2	2
Marsh Tit	2	2
Common Gull	2	2
Moorhen	1	*
Mallard	1	*
Lesser Redpoll	1	*
Waxwing	1	*
Raven	1	*
Barbary Dove	1	*
Pied Flycatcher	1	*
Wheatear	1	*
Crossbill	1	*
Tree Pipit	1	*
Yellow Wagtail	1	*
Hen Harrier	1	*
Redstart	1	*
Lesser Spotted Woodpecker	1	*
Grey Partridge	1	*
Tawny Owl	1	*

* Denotes less than 1%
Other species recorded but not feeding were:
Swallow, Swift, House Martin and Shelduck.

Fewer species were recorded in the spring GBFS than in the winter GBFS (68 species as opposed to 87). Whilst the same species are in the top twelve for both periods, the order of percentage occurrence is slightly different, the most notable changes being the increased frequency of occurrence of the Collared Dove in spring and the decreased frequency of the Song Thrush from it's winter position. These results are interesting, but they do not give a true assessment of the frequency with which birds are recorded in gardens or the actual numbers of birds feeding in gardens on a weekly basis.

TABLE 2.3 The 12 most frequently recorded species in rural and suburban gardens. (data from the GBFS, (Oct.1986 - June 1987).

THE MEAN PERCENTAGE OF GARDENS IN WHICH EACH SPECIES WAS RECORDED PER WEEK.*

SPECIES	RURAL	SPECIES	SUBURBAN
Blackbird	88	House Sparrow	93
Blue Tit	86	Blue Tit	86
Great Tit	83	Blackbird	86
Robin	83	Starling	86
House Sparrow	80	Great Tit	68
Chaffinch	78	Dunnock	67
Dunnock	74	Robin	66
Starling	70	Chaffinch	64
Greenfinch	62	Greenfinch	60
Magpie	41	Collared Dove	56
Collared Dove	39	Song Thrush	35
Coal Tit	36	Coal Tit	26

* denotes that the survey ran for 39 weeks.
The figures in the table have been calculated from the weekly means. For example: Blackbirds were recorded each week in an average of 88% of rural gardens and an average of 86% of suburban gardens.

TABLE 2.4 The 12 most abundant species in rural and suburban gardens. (data from the GBFS, Oct.1986 - June 1987).

THE MEAN PEAK COUNT OF BIRDS RECORDED IN EACH GBFS PLOT PER WEEK.*

SPECIES	RURAL		SUBURBAN
House Sparrow	11.0	Starling	12.8
Starling	9.1	House Sparrow	11.7
Chaffinch	6.2	Chaffinch	2.6
Blue Tit	4.6	Blue Tit	2.6
Greenfinch	4.0	Greenfinch	2.4
Blackbird	3.3	Blackbird	2.3
Great Tit	3.0	Great Tit	1.4
Collared Dove	1.6	Collared Dove	1.3
Dunnock	1.6	Dunnock	1.1
Robin	1.4	Robin	0.9
Magpie	0.9	Black-headed Gull	0.8
Coal Tit	0.7	Wood Pigeon	0.5

In Table 2.3 the data from both surveys is combined. The mean weekly percentage of gardens recording individual species is displayed for both rural and suburban gardens. With the exception of the Magpie and Song Thrush, the top twelve species occurring in rural and suburban gardens are the same. The House Sparrow, Starling and Collared Dove were more frequently recorded in suburban gardens than rural gardens. Great Tits, Robin, Chaffinch, Magpie and Coat Tit were all more frequently encountered in rural than suburban gardens.

Whilst Blackbirds were recorded in most weeks in at least 86% of all the survey gardens, they were not the most numerous garden bird.

To determine which birds were the most numerous users of gardens, the GBFS peak count data was utilised. The weekly peak counts were used to calculate a mean weekly peak count for each species. The results in Table 2.4 represent the mean number of birds one could expect to see feeding at any instance in a garden and therefore give an impression of the relative abundance of each species. The results have been separated for rural and suburban gardens to highlight differences in relative abundance. Whilst this is not entirely satisfactory (the difference in actual mean garden size is not known) it does allow a comparison to be made of the abundance of species within garden types.

In both garden types, the House Sparrow and Starling were the most numerous. In fact, the rank order of abundance was the same in both garden types for the first 10 species. Interestingly, of the first ten species, the House Sparrow and the Starling were more abundant in suburban gardens whilst the remaining 8 species were all more numerous in rural gardens. However, I suspect that rural gardens are on average much larger than suburban gardens so these results should be used with some caution.

The GBFS data have been used to determine which species were most frequently recorded (per week) and those birds which were present at feeding stations in highest numbers.

SPECIES DESCRIPTIONS

The mean peak counts and the mean percentage of gardens occupied by each species per week are shown in Figures 2.1 - 2.38 in the Appendices. In the species descriptions, the overall mean peak counts and the percentage of gardens occupied are presented where necessary along with their respective ranges. The species are presented in order of their frequency of occurrence in gardens (see table 1.1). All population estimates are for Britain and Ireland and are largely based on the BTO's Atlas of Winter Birds (Lack 1986).

BLACKBIRD (Fig.2.1)

Blackbird peak counts were higher in rural than suburban gardens. During the period of the survey, the mean peak count in rural gardens was 3.3 birds (range 1.2 - 9.7) and 2.3 birds in suburban gardens (range 1.1 - 4.4). The highest peak counts were recorded in week 15 of the survey. The Blackbird was the most frequently recorded garden bird being present in a mean of 88% of rural and 86% of suburban gardens. Percentage occupancy ranged from 65 - 100% of rural gardens and 63 - 97% of suburban gardens. During the spring, Blackbirds were recorded in 97% of all gardens at least once during the survey. The graphs suggest that there was no difference in the usage of rural and suburban gardens as a spring feeding area. Gardens are clearly important to Blackbirds during the spring as they are recorded from more gardens at this time than in the early autumn.

Whilst the Blackbirds from southern England are generally non-migratory, birds from other regions tend to migrate. During the winter months, there is normally a huge influx of Blackbirds into Britain from Scandinavia, Germany and the Low Countries. Such an influx may explain the gradual early winter increase in garden occupancy. This species does not normally undertake hard-weather movements except in the most extreme weather conditons, although it does appear that in week 15 of the survey some birds moved into gardens as a result of severe weather. It is probable that this may be partly explained by birds undertaking local movements from woodland to gardens thereby explaining the large increase in rural

peak counts. Throughout the winter period Blackbirds maintain a feeding territory except during severe weather when the territory boundaries break up and the birds forage as a flock (Lack 1986). The winter population is estimated in the BTO Winter Atlas as in the range of 14 - 20 million birds (Lack 1986).

ROBIN (Fig.2.2)

The mean weekly peak count for Robins was 1.4 birds (range 0.7 - 2.7) in rural gardens and 0.9 birds in suburban gardens (range 0.2 - 1.5). Robin peak counts were at their highest in week 15 with a mean of 2.7 birds in rural and 1.5 birds in suburban gardens. Robins occurred in an average of 83% of rural gardens and 66% of suburban gardens. The mean percentage garden occupancy ranged from 43 - 98% in rural gardens and 22 - 92% of suburban gardens. Numbers rose rapidly between weeks 14 and 15 and then fell gradually but with intermittent peaks. The highest levels of garden occupancy were during December, January, February and March after which the number of gardens occupied steadily fell.

In the spring, Robins were recorded feeding in gardens less frequently than at any other time in the survey. The spring peak counts were also low indicating that supplementary food at this time may be less important.

During the winter, Robins of both sexes defend territories so that large numbers are uncommon in gardens. During very cold weather or in periods of snow, the territorial behaviour sometimes lapses and the birds feed in small groups. The winter population has been estimated at 10 million birds (Lack 1986).

BLUE TIT (Fig.2.3)

Peak counts of Blue Tits varied widely between rural and suburban gardens. The mean weekly peak count for rural gardens was 4.6 birds (range 1.2 - 7.4) whilst the mean peak count for suburban gardens was 2.6 birds (range 1.0 - 4.0). Peak numbers were reached in week 12 in suburban gardens and in week 19 in rural gardens. Peak counts rose steadily in October and November and then remained relatively stable until March when the peak counts

declined. Garden occupancy was similar with a mean of 86% of rural and suburban gardens occupied each week. During the breeding season, numbers in gardens are lower than winter although 45 - 55% of gardens still had these birds which were presumably breeding. The peak count data suggests that provided food is less important in the spring than late autumn and mid-winter. From the beginning of April there was a rapid movement of birds out of gardens with many birds presumably going back into woodlands.

During the winter, Blue Tits form large flocks often foraging with other tits and Goldcrests. In severe weather the flocks of foraging tits generally leave the woods and enter gardens which offer a rich and varied supply of food. During some winters the number of resident Blue Tits is swelled by the arrival of immigrants from the continent. The mid-winter peak numbers have been estimated at 15 million birds (Lack 1986).

STARLING (Fig.2.4)

Starlings were more numerous and more frequently recorded in suburban than rural gardens. Weekly peak counts averaged 12.8 birds in suburban gardens (range 5.0 - 21.6) and 9.1 birds (range 3.4 - 18.8) in rural gardens. Numbers reached peaks between weeks 15 and 20. Generally, numbers rose steadily during the first three months of the survey, then declined quite rapidly from week 22 onwards. From week 30, numbers again rose reflecting the use that Starlings made of food which was provided during their breeding season. Garden occupancy rose steadily until December, remained fairly constant until mid March and then gradually declined. A mean of 86% of suburban gardens had Starlings each week whilst in rural gardens, the percentage occupancy was lower at 70%. A minimum of 50% of all gardens had Starlings on a weekly basis.

Within the last century, the Starling has become widespread and is now to be found in gardens throughout Britain. During the winter, the resident population is swelled by the arrival of immigrants from the continent. The Starling is catholic in it's taste of food and in it's habitat choice. The large peak counts are due in part to the Starlings' habit of feeding in a social group. The total

overwintering population has been estimated at 37 million birds (Potts 1967), however, declines in the breeding populations of the continental birds may have led to a decline in our wintering population.

CHAFFINCH (Fig.2.5)

This finch was more numerous and more frequently recorded in rural gardens. Numbers peaked in week 15 as did the percentage garden occupancy. Rural peak counts averaged 6.2 birds (range 1.3 - 14.8). In suburban gardens the peak counts were smaller averaging 2.6 birds (range 0.5 - 6.5). Numbers rose during October, November and December and then fell from the beginning of March. During the breeding season, peak feeding numbers were low reflecting the preference of this finch for insect food. The percentage of gardens with Chaffinches rose through the first three months of the survey and declined from the end of March onwards. During the autumn Chaffinches were recorded in very few suburban gardens. This is almost certainly because the birds exploit the abundant supply of natural foods which can be found at this time of year.

The British resident population is augmented in the winter by an influx of immigrants from Fennoscandia and continental Europe. The continental birds tend to feed in open land in large flocks whilst the resident birds remain in the woodland and scrubland where they breed. In the winter this species is mainly a seed-eater whilst in the summer the majority of food eaten is insects. When the immigrant Chaffinches are added to the resident population it is likely that there are in the region of 30 million individuals wintering in Britain (Lack 1986).

GREAT TIT (Fig.2.6)

As in the case of the Blue Tit, Great Tits were more abundant and more frequently recorded in rural than suburban gardens. The rural weekly peak count averaged 3.0 birds (range 0.9 - 4.2) whilst the suburban peak count averaged 1.4 birds (range 0.7 - 1.9). Numbers rose during October and November and then remained fairly stable until April when the mean peak counts dropped dramatically. The rural peak counts rose again in May and June reflecting the

interest that some birds showed in non-natural foods at this time of year. Blue Tits on the other hand did not show this breeding season peak. The pattern of percentage garden occupancy is similar to that for Blue Tits. The number of gardens in which birds were recorded rose during October and November and then remained fairly constant until March in suburban gardens and April in rural gardens. An average of 83% of rural gardens held Great Tits each week, whilst an average of 68% of suburban gardens were occupied each week. Between 50 and 90% of rural gardens and 41 and 82% of suburban gardens reported Great Tits.

Great Tits are territorial during the summer months, only leaving their territory when food becomes scarce in mid-winter. During the early part of winter, there is a change in their diet with birds preferring seeds and fruits to the insectivorous diet of the summer and autumn. Gardens in rural areas support higher tit numbers presumably because they are surrounded by more natural habitat than is so in urban and suburban gardens. Lack (1986) estimated the winter population as 10 million birds.

HOUSE SPARROW (Fig.2.7)

Of all the birds recorded in the spring GBFS, the House Sparrow aroused more anger than any other birds. These sparrows are very aggressive, often driving larger birds away from the bird table or hanging feeder. The House Sparrow was recorded most frequently in suburban gardens. The peak counts were also generally higher in suburban gardens. The mean weekly peak count in rural gardens was 11.0 birds (range 6.9 - 14.9) whilst the mean peak count in suburban gardens was 11.7 birds (range 6.4 - 15.6). After a steady rise in the peak counts during the first three months of the survey, numbers fell until the end of April. During May and June the peak counts rose particularly in suburban gardens. The percentage of gardens in which sparrows were recorded remained relatively stable throughout the period of the survey. A mean of 80% of rural gardens (range 71 - 86%) and 93% of suburban gardens (range 84 - 98%) reported these sparrows every week.

During the breeding season, House Sparrows in rural areas feed on the abundant supply of seed material found in agricultural land. Birds in urban and suburban areas have a poor supply of natural foods and are therefore more inclined to feed on food provided in the garden. Once the House Sparrow young began to fledge, it was not uncommon to see family parties feeding on mixed seeds and nuts.

The winter distribution of House Sparrows is almost identical to the breeding distribution. Their winter population is estimated at between 10 and 15 million birds (Lack 1986).

GREENFINCH (Fig.2.8)

Greenfinches were recorded in higher numbers in rural than suburban gardens throughout the entire survey period. Rural peak counts averaged 4.0 birds per garden (range 1.5 - 7.9). In suburban gardens, a mean of 2.4 birds were recorded (range 0.5 - 4.1). In both garden types, numbers rose throughout the first three to four months of the survey. Apart from several fluctuations their peak counts remained fairly steady until the beginning of April when they gradually began to decline. Greenfinches still visited feeders in reasonable numbers in May and June. A mean of 62% of rural gardens and 60% of suburban gardens reported Greenfinches feeding in their garden on every week of the survey.

Generally the pattern of garden occupancy was very similar for both garden types with a range of 33 - 77% rural and 28 - 78% of suburban gardens reporting Greenfinches. Almost 40% of gardens were still reporting Greenfinches feeding in their gardens even at the end of June.

The Greenfinch normally feeds on seeds so that by the end of the winter their food is naturally in very short supply. At this time, garden foods seem to be an important food source. During periods of heavy snowfall these finches also come more frequently into gardens to feed on nuts and seeds (Newton 1972).

The Greenfinch is a partial migrant sometimes making short movements in a south-westerly direction during the autumn and winter and then returning in the spring (Gush 1980). The winter population is estimated to be between 5 and 6 million birds (Lack 1986).

DUNNOCK (Fig.2.9)

The Dunnock was more frequently recorded and occurred at higher numbers in rural gardens. Dunnocks are highly territorial, solitary birds and the peak counts were therefore relatively low throughout the survey. The overall mean weekly peak count was 1.6 birds (range 0.9 - 2.5) in rural gardens and 1.1 birds (range 0.5 - 1.6) in suburban gardens. Peak counts rose throughout the first three months after which they steadily declined. The percentage of gardens occupied was similar in both garden types. A mean of 74% of rural and 67% of suburban gardens reported Dunnocks feeding in each week of the survey. The occupation of gardens rose from October to the end of December after which occupation remained fairly constant. From the beginning of April onwards the number of gardens reporting Dunnocks declined, however, at this time, the percentage of gardens with feeding Dunnocks was as high as in the early autumn.

Within Britain, Dunnocks are sedentary choosing to live the entire year in a small area. Although continental Dunnocks do migrate, there is no evidence that these birds come into Britain in significant numbers. The birds which spend the winter in our gardens are therefore almost certainly residents or at least resident in the surrounding habitat. Dunnocks are common nesting birds in gardens, but their solitary nature and habit of skulking amongst the shrubbery means that they are frequently overlooked. The mid-winter population is estimated at 20 million birds (Lack 1986).

SONG THRUSH (Fig.2.10)

The Song Thrush is recorded rather infrequently in the GBFS except during mid-winter. The mean peak count of 0.4 birds in rural gardens (range 0.1 -1.0) was identical to the mean peak count for

the suburban plots (range 0.1 - 1.4). During week 15 of the survey the peak counts were highest for both rural and suburban gardens. In week 15, severe weather forced many birds to move into gardens throughout Britain to feed on food provided by householders. The percentage of gardens occupied was highest in January after which there was a decrease in the number of gardens reporting the thrush. The mean percentage of rural gardens occupied each week averaged 50% (range 11 - 61%). Song Thrushes were reported slightly more frequently in suburban gardens with a mean of 62% gardens occupied (range 11 - 73%).

Generally this thrush feeds on earthworms and fruit. During prolonged periods of frost, the natural food is less available forcing the Song Thrush to undertake local movements to areas where food is available. Whilst the mid-winter rise in peak counts and garden occupancy may represent a movement of birds from woodland and farmland into gardens, it is also likely that part of the increase is due to immigration by continental birds into Britain (Goodacre 1960). The winter population has been estimated at between 6 - 10 million birds (Lack 1986).

COAL TIT (Fig.2.11)

The number and frequency of occurrence of Coal Tits in British gardens is very much less than the levels reported for both Blue Tit and Great Tit. This is perhaps not surprising since Coal Tits are primarily birds of coniferous woodlands, and indeed they were more frequently reported from rural gardens. The mean weekly peak counts were 0.7 birds per garden (range 0 - 1.1) in rural gardens and 0.6 birds (range 0 - 0.6) in suburban gardens. A mean of 36% of rural and 26% of suburban gardens had Coal Tits present and feeding in them. Numbers decreased gradually in suburban gardens from December onwards. In the rural gardens, both the peak counts and the percentage of gardens reporting Coal Tits dropped dramatically from the beginning of April. At this time, birds left gardens and went back into the woodlands.

During the winter, the main food eaten is seeds, such as beechmast. When seed production is low (poor beechmast years) the

birds tend to enter gardens more frequently to feed on nuts, fats and seeds. It appears that Coal Tits do not feed widely on bird table foods when they are provided in the spring.

Lack (1986) estimates the mid-winter population at 4 million birds.

COLLARED DOVE (Fig.2.12)

Prior to the 1950's the Collared Dove did not occur in Great Britain. Since then, the range of this dove has expanded so rapidly that it is now one of our top twelve garden birds. Whilst the mean peak counts were largest in rural gardens, the dove was most frequently reported from suburban gardens. The mean rural peak count was 1.6 birds (range 0.9 - 2.2) whilst the mean suburban peak count was 1.3 birds (range 1.0 - 1.6). The plot of mean peak counts does not highlight any particular seasonal trend, although there is a slight rise in the number of birds feeding in the gardens during the first three months followed by a period where the feeding stations are used to a greater or lesser extent. During the last three months there is a decline in peak counts, but only after the maximum peak count was reported in April. Collared Doves have the capability to breed almost the whole year round, but normally they begin nesting in the late spring. It may be that the peak counts in April represent the efforts of birds feeding up to condition themselves for breeding. The percentage of gardens in which Collared Doves were recorded feeding rose throughout the survey period until the end of April, when there was a slight decline. This species was recorded in a mean of 39% of rural gardens (range 23 - 48%) and a mean of 56% of suburban gardens (range 43 - 65%).

Collared Doves have greatly benefitted from the provision of food by householders and will eat a wide range of foods where it is presented on the ground. Lack (1986) states that the winter population is a minimum of 150,000 birds. Thus, although this is one of the commonest garden birds, they are not nationally as abundant as many other species which are recorded less frequently in gardens.

MAGPIE (Fig.2.13)

Like the House Sparrow, Magpies are frequently chastised by GBFS participants, being accused of finding and robbing garden bird nests, and of frightening the smaller birds away from feeding stations. Generally, Magpies are more numerous and more frequently recorded in rural gardens. During the period of the survey, the mean peak count in rural gardens was 0.9 birds (range 0.6 - 1.3) and in suburban gardens 0.4 birds (range 0.3 - 0.6). Numbers declined very gradually from the beginning of December onward. Magpies were recorded each week from a mean of 41% of rural gardens and 26% of suburban gardens. Whilst the number of gardens reporting Magpies remained fairly constant throughout the first six months, there was an increase in the number of rural gardens reporting Magpies during May and June. Clearly if these birds are coming into gardens to feed during their breeding season, they do represent a threat to garden bird populations. However, even during the peak time at which Magpies were being recorded they were never reported from more than about 50% of gardens.

Magpies are sedentary in Britain and there is no influx of birds during the winter from the continent. The winter population has been estimated at 0.5 - 1 million birds (Lack 1986).

MISTLE THRUSH (Fig.2.14)

For many of the species outwith the top twelve, the peak count plots are not a good visual representation of the observed data. In the case of the Mistle Thrush, the peak counts were highest in both garden types in week 15. The mean weekly peak count was 0.1 birds in both rural and suburban gardens. Week 15 was also the week in which most observers reported Mistle Thrushes feeding in their garden. Mistle Thrushes were reported rather infrequently from gardens during the period of the survey.

The Mistle Thrush is a highly territorial and aggressive garden bird, often defending food from all comers. There is no evidence to suggest that the winter population of Mistle Thrushes is swelled in numbers by continental immigrants, but migrants do

sometimes pass through Britain stopping to feed on their way south. In milder weather they feed on earthworms and wind-blown fruit and berries. The winter population has been estimated at 4 - 800,000 birds (Lack 1986).

BLACK-HEADED GULL (Fig.2.15)

Along with House Sparrows and Starlings this bird is famous for eating vast quantities of almost any food provided. The peak count plot suggests that during the winter, the gulls abandon the rural areas and move into the suburban and urban gardens. Prior to the end of December, peak counts were at a maximum in the rural gardens. From this point on, the weekly peak counts declined to very low levels throughout the rest of the survey period. In the suburban gardens there was a large influx of birds from week 15. Whilst the peak counts dropped from this point on, the gulls were still more numerous than in the rural plots at the same time. The mean peak count for the Black-headed Gull was 0.3 birds in rural gardens and 0.8 birds in suburban sites. Black-headed Gulls were recorded each week from an average of 6% of all rural gardens and 11% of suburban gardens. During the peak week, these gulls were reported coming to provided food in 20% of all rural gardens and 38% of all suburban gardens. Thus during periods of cold weather, when the ground is frozen making their normal feeding for worms difficult, the gulls move into gardens where there is an abundance of food. In particular these birds are great scavengers, eating large amounts of commercial and domestic scraps.

Whilst British breeding Black-headed Gulls are resident, the winter population is augmented by large numbers of immigrants from northern Europe. The winter population is conservatively estimated at 3 million birds in the BTO Winter Atlas (Lack 1986).

JACKDAW (Fig.2.16)

The plot of peak count data is one of the most remarkable generated in the analyses. Whilst the Jackdaw was reported in small numbers in suburban gardens it is recorded at higher numbers in rural gardens. The mean weekly peak count was 1.4 birds (range 0.4 - 2.7) in rural gardens and 0.4 birds (range 0.1 - 2.8) in

suburban gardens. Thus where they occur, the Jackdaw occurs in higher numbers in rural plots. Whereas there is a gradual rise in the weekly peak counts in suburban plots, the rural birds show a dramatic decline in numbers at the beginning of April, followed by an increase again in May. Jackdaws begin egg-laying in April with incubation solely by the female (Goodwin 1976), so that there is a period of time when the female is tied to the nest receiving all her food from the male. From week 33 the peak counts return to their pre-nesting levels indicating that the female is once again foraging, bringing food to the young. No corresponding trough is apparent in the suburban Jackdaw peak counts. As Jackdaws do not begin breeding until their second year (Goodwin 1976), it may be that the suburban birds are non-breeders. Jackdaws were recorded feeding in a mean of 22% of rural and 26% of suburban gardens. In both garden types there was a gradual seasonal increase in the percentage of gardens in which Jackdaws were recorded. Like the other members of the crow family which enter gardens, the Jackdaw feeds chiefly on scraps and grain.

The winter population is estimated at 3 million birds (Lack 1986).

BRAMBLING (Fig.2.17)

The Brambling is an immigrant to Britain from Fennoscandinavia, arriving in the late autumn and leaving in the spring. The mean peak count survey data are not given as this is unrepresentative. Bramblings were only present for about half of the survey period. Bramblings were slightly more numerous feeders in rural than suburban gardens. The peak number plot indicates that feeding activity in gardens peaked in week 15 (rural) and 17 and 18 (suburban) and later in the early spring in week 27. Although Bramblings are present in the country from October onwards, they do not enter gardens until their natural preferred food (beechmast) is exhausted. These birds are very opportunistic and will feed on nuts and seeds which are provided in gardens. Bramblings depart for the north very suddenly leaving in large flocks. The percentage of gardens occupied rose sharply in week 15 and remained high until the birds began to depart in April.

Bramblings do not return to the same wintering grounds every year. Because the beechmast crop varies widely from one year to the next, Bramblings tend to move over large areas until they find a large sustaining crop. Much of the beechmast eaten is gathered from the forest floor with the result that in periods of heavy snowfall, the food is difficult to find. At such times, the birds may undertake hard-weather movements to the west and south. In a good year, the Brambling winter population may be as high as 2 million birds, but in a poor year there may be as few as 50,000 birds (Lack 1986).

WOODPIGEON (Fig.2.18)
The mean weekly peak count was 0.4 birds (range 0.2 - 0.8) in rural gardens and 0.5 birds (range 0.1 - 1.0) in suburban gardens. The Woodpigeon plot is very interesting in that as the weekly peak counts decline in the suburban gardens, there is a corresponding increase in rural gardens. This seems to suggest that some of the Woodpigeons have left the suburban gardens and moved into rural gardens. However, there is not a corresponding decrease in the percentage of suburban gardens with feeding pigeons, so there may be some other factor involved here. A total of 14% of rural and 17% of suburban gardens reported Woodpigeons feeding each week.

Like the Collared Dove, the Woodpigeon has the ability to nest almost all the year round. Woodpigeons are predominantly birds of woodland and farmland and are not particularly common in urban areas. Surburban areas with open parkland and some scrub is occasionally occupied, but not as frequently as rural areas. The winter population has been cautiously estimated at 10 million birds (Lack 1986).

SISKIN (Fig.2.19)
The 1986 - 87 winter was a 'good' Siskin winter, with this finch being recorded on at least one occasion from 31% of all gardens. Throughout the survey, Siskins were reported feeding each week in a mean of 6% of rural and suburban gardens. The majority of gardens did not record Siskins until March. Traditionally, Siskins

only move into gardens when their natural foods (alder and birch seeds) are exhausted. Thus in years when their natural food is plentiful, Siskins may be expected to move into gardens late as was the case this winter. The peak counts were also at their highest in March and early April, supporting the idea that this was the time of greatest garden use. Although most Siskins have left gardens by the end of April the provision of food in the spring is important as at this time, natural foods are at their lowest levels. Typically, when they enter gardens, Siskins feed on peanuts and have been shown to prefer feeding from red bags.

This small finch is becoming a more common visitor to our gardens. An increase in afforestation has meant that the British population has increased significantly in the last 20 years, thereby ensuring that Siskins are no longer rare winter visitors. Large numbers of immigrant Siskins from northern and central Europe enter the country in late autumn in some years. The wintering distribution of migrating Siskins may vary greatly from one year to the next. As a result, in some years there are few immigrant Siskins in Britain. The overwintering population is difficult to estimate because of the fluctuating wintering habits of the birds. In good Siskin years, the population may be as high as 500,000 birds (Lack 1986).

GREAT SPOTTED WOODPECKER (Fig.2.20)

This is the only woodpecker which regularly enters gardens to feed. The peak count plot shows that rural gardens are more important, presumably because these are the gardens which are more likely to be surrounded by natural woodlands. The mean weekly peak count was 0.3 birds (range 0.1 - 0.5) in rural gardens. Whilst the percentage of suburban gardens recording this woodpecker remained fairly constant (mean 7%) the use of rural gardens was less regular. The percentage of gardens reporting woodpecker feeding activity rose through the first three months and then steadied until mid March when the use of gardens again declined. A mean of 24% of rural gardens had this woodpecker feeding.

During the spring the Great Spotted Woodpecker spends most of it's time foraging in the woods where it feeds entirely on invertebrates. Garden woodpeckers prefer to feed on nuts and also have been found to feed on fat and suet.

The mid-winter population is estimated in the BTO Winter Atlas as between 150 and 200 thousand birds (Lack 1986). The vast majority of these birds are residents wintering in the same areas as they breed.

CARRION CROW (Fig.2.21)
The weekly peak counts are irregular, mainly reflecting the irregularity with which this crow is recorded feeding in gardens. The highest peak counts were in January (during severe weather) and in June. The drop in the peak counts between March and late May represents the time when egg laying and incubation is taking place (Goodwin 1976). As in the case of the Jackdaw, incubation is by the female only, so at this time there is a drop in the number of feeding birds. Carrion Crows were more frequently recorded feeding in rural than suburban gardens. During week 15 over 20% of rural gardens had Carrion Crows feeding in them. During late May and June, more gardens had Carrion Crows than at any other time in the survey. At this time, both adults are foraging to gather food for nestlings and fledged youngsters.

Like the Magpie and Jackdaw, the Carrion Crow is a scavenger eating large quantities of human waste foods. Whilst by no means a popular garden bird, the Carrion Crow is a very important part of the garden bird community, in that it is skilled at finding nests and robbing the eggs or young.

The winter population has been estimated at 3.5 million birds (Lack 1986).

SPARROWHAWK (Fig.2.22)
Apart from a very few instances, Sparrowhawks were only recorded feeding in rural gardens. Whilst not actually feeding on provided food, this hawk is of interest because of it's predatory habits.

Sparrowhawks frequently enter gardens to feed on the small birds which are attracted in to provided food. Many GBFS participants have had the dubious pleasure of watching Sparrowhawks catch and kill birds feeding in their garden. The male and female Sparrowhawk are very different in size, the male being substantially smaller than the female. The male therefore prefers to feed on slightly smaller birds such as the tits and finches, whilst the female can take larger birds such as members of the thrush family (Newton 1986).

Sparrowhawks were recorded from a mean of 9% of rural gardens each week. At the time when the majority of garden birds were leaving the gardens, the Sparrowhawk showed a corresponding decline in garden usage. At this time, the hawks return to the woodlands and open farmland to hunt where the smaller residents have also returned to breed.

The mid-winter population is in the region of 130,000 birds (Lack 1986).

FIELDFARE (Fig.2.23)

The Fieldfare is a winter visitor to Britain from Fennoscandinavia, arriving in northern Britain from September onwards. As in the case of other non-residents, mean figures would not be truly representative and are therefore not given here. The Fieldfare is not a hardy thrush and many individuals have difficulty in surviving prolonged periods of cold weather. During cold weather many birds actually migrate South in an attempt to find more favourable living conditions. During the cold weather in this survey (week 15) Fieldfares entered rural and suburban gardens in quite large numbers. Fieldfares feed on earthworms and insects, but like other thrushes they are partly frugivorous, feeding on wind-blown fruit and berries. The departure of Fieldfares from their breeding grounds is dependent on the abundance of rowans. In a poor rowan year, the Fieldfare leaves the breeding grounds early. During week 15, Fieldfares were recorded feeding in 26% of rural and 19% of suburban gardens.

This thrush is territorial in defence of a fruit source, but the level of aggression displayed to would-be fruit-eating competitors, is much less than that exhibited by Mistle Thrushes.

The winter population has been tentatively estimated at 1 million birds (Lack 1986).

JAY (Fig.2.24)
The Jay is chiefly to be found in the winter months in rural gardens. The peak counts are rather erratic and as a result they cannot be reliably used. The mean weekly peak count in rural gardens was 0.3 birds. Peak counts in suburban gardens were significantly lower than those recorded in rural plots. Jays were reported feeding from a weekly mean of 15% of rural and 7% of suburban gardens. It would seem that the provision of artificial food is not of particular importance to Jays and yet bird table food is regularly used by some individuals. During the course of the survey, Jays were normally recorded feeding in 10 - 20% of gardens each week.

Jays, like the other members of the crow family, are unwelcome garden guests because of their nest-robbing habits. In the case of the Jay the problem is less serious as they are wary of people and tend to minimise their visits to gardens.

Winter populations are occasionally supplemented by continental immigrants. The BTO Winter Atlas estimates the winter population at between 350 - 400,000 birds (Lack 1986).

REED BUNTING (Fig.2.25)
This small bunting is found during the summer months in wetland and scrubland. During the winter months many of the summering habitats are deserted as the buntings move into areas offering a reliable source of food. Reed Buntings moved into both rural and suburban gardens from the end of November. From March onward the level of the mean weekly peak counts dropped suddenly. Reed Buntings appear to move into rural gardens slightly later than into suburban gardens. In week 15 of the survey, there was an

increase in the percentage of gardens reporting the presence of feeding Reed Buntings. The highest percentage of rural gardens were not occupied until April and soon after the gardens were deserted.

Reed Buntings are granivorous in winter, feeding on seeds taken mainly from the ground. As is the case for most ground-feeders, a covering of snow can seriously hamper their feeding effort. Thus during very cold weather or periods of snowfall, Reed Buntings come into gardens to feed on the rich supply of seeds and scraps to be found in many gardens.

The winter population has been estimated as 1.2 million birds (Lack 1986).

REDWING (Fig. 2.26)

The Redwing is a winter visitor from it's northern breeding grounds, arriving in some winters in huge numbers, but in other winters they are less common. They normally arrive in October as is evident from both graphs, but generally do not overwinter in great numbers in northern Britain. The Redwing is the smallest of the thrush family found in Britain, and is vulnerable to cold weather. Whilst they normally prefer to feed on earthworms, they also feed extensively on fruits, especially when the ground is frozen. Because of it's taste for fruit, this thrush may vary it's wintering ground from one year to the next, staying only in those areas where an abundant fruit supply is to be found. Redwings are not common visitors to gardens except when cold weather arrives.

As can be seen, the percentage of gardens with feeding Redwings rose sharply in week 15. At this time, a maximum of 19% of rural and 15% of suburban plots reported the presence of feeding Redwings. Once in the garden, Redwings will feed on fruits (almost any type) and on seeds.

Wintering Redwings in Britain are predominantly from the Icelandic and Fennoscandinavian breeding populations. The winter population

is estimated at 1 million birds, but in good years the numebrs wintering may be very much higher (Lack 1986).

NUTHATCH (Fig.2.27)

The Nuthatch is predominantly found in rural gardens presumably because these gardens contain more mature trees and because this garden type is more likely to be in the vicinity of natural woodland. Throughout the year these birds are territorial, remaining in the breeding area the whole time. During the survey period the mean weekly peak count in rural gardens was 0.2 birds. Feeding activity remained relatively constant until the end of March from which time Nuthatches fed less frequently in gardens. A mean of 16% of rural and 9% of suburban gardens were occupied throughout the survey period. Generally, Nuthatches were recorded feeding in fewer gardens from the end of March onwards. Whilst their preferred foods are hazel nuts, beechmast and acorns, they will also feed on peanuts when available in gardens.

Due to their sedentary habits, the winter population and distribution is thought to be similar to the breeding population and distribution. There is thought to be no significant immigration of continental birds into Britain (Lack 1986). The winter population is estimated at 60 - 80,000 birds (Lack 1986).

BULLFINCH (Fig. 2.28)

The Bullfinch is an infrequent visitor to most of our gardens. However, it's shy nature and mobility mean that this is one bird which may be under represented by the GBFS. The mean peak counts were slightly higher for suburban gardens but the infrequency of recording suggests that this may not be truly representative.

Bullfinches were recorded feeding each week from a mean of 3% of rural and suburban gardens with the highest number occurring in week 15. Bullfinches are predominantly seed eaters, but they also eat buds when seeds are scarce. During the later half of winter when seed stocks are low, Bullfinches feed on the buds of fruit trees and other trees. The habit of eating buds has made the Bullfinch an enemy of the commercial fruit grower and gardener

whose potential crop can be almost or completely destroyed by the continuous visit from a number of these finches (Newton 1972). Visitors to the garden feed on seeds, but their shy nature and solitary habits means that they are not a common sight.

The winter population has been estimated at 1 - 1.5 million birds (Lack 1986).

ROOK (Fig.2.29)
The mean peak counts of Rooks rose for the first 15 survey weeks and then remained fairly constant for a further 5 weeks, before declining. Therefore, during February and March, there was a drop in the mean peak counts. At this time of year, Rooks are nesting with the female incubating the eggs and being fed by the male. Once the eggs hatch, the male continues to provide some food for the female, but it may not be enough, forcing her to forage also (Goodwin 1976). From April onward there is therefore an increase in the mean weekly peak counts representing the increased foraging effort of both the male and female. Only a small percentage of gardens had feeding Rooks (less than 10% each week) suggesting that gardens are very much a minority feeding ground.

Typically Rooks prefer to feed in agricultural land taking worms and grubs from the soil as well as seeds and grain. Rooks are not welcome garden visitors because they can eat a large amount of food very quickly. The winter population is mainly sedentary and has been estimated at 4 million birds (Lack 1986).

PHEASANT (Fig.2.30)
A mean of 10% of rural gardens recorded Pheasants coming for food whereas a negligible proportion of suburban gardens had feeding Pheasants. The peak count plot is very variable making meaningful comment difficult. However, the suggestion is that where they are present, they will enter gardens to feed.

Pheasants are commonly to be found in wooded low-lying agricultural land so their absence from suburban gardens is not surprising. Pheasants are sedentary with identical winter and

breeding ranges. The Pheasant is a game bird with large numbers being reared in captivity and then released into the wild for shooting. It is estimated that the winter population consists of approximately 8 million wild birds and an unknown number of released birds (Lack 1986).

COMMON GULL (Fig.2.31)
Common Gulls are less frequent visitors to our gardens than Black-headed Gulls. Traditionally this gull is known as a hard-weather bird moving into gardens only when the weather is cold or there is extensive snow coverage. In week 15 which was climatically the coldest week in the survey, these gulls moved into some gardens. Even at this time, less than 10% of both rural and suburban gardens actually had feeding gulls. Thus whilst they are forced to search for food when pastureland is frozen over or covered in snow, this is only for a very short period. When in gardens they feed on scraps and grain.

The winter population of 700,000 birds largely consists of immigrants from Scandinavia and Germany (Lack 1986).

YELLOWHAMMER (Fig.2.32)
The seed-eating Yellowhammer was mainly found to enter and feed in rural gardens. Feeding activity rose throughout the winter until the middle of March from when it declined rapidly. In suburban gardens feeding activity rose in week 15 and again in the last week in February. The percentage of gardens from which Yellowhammers were recorded feeding peaked in rural gardens in week 15. From this week on, less than 10% of rural gardens reported Yellowhammers.

During the winter the normally solitary Yellowhammer gathers in flocks to forage in farmland where it prefers to feed on cereal and weed seeds. In very cold weather Yellowhammers enter gardens to feed on seeds and bread. The mid-winter population estimate is 3.5 million birds (Lack 1986).

TREE SPARROW (Fig.2.33)

Tree Sparrows enter gardens frequently to feed on nuts and seeds. The mean weekly peak count for rural gardens was 0.5 birds whilst in suburban gardens the mean was lower at 0.1 birds. In both garden types there was a build up in feeding numbers throughout the first four survey months, after which activity dropped steadily in suburban gardens but was maintained until the end of March in rural plots. Rural plots surrounded by farmland and woodland are more likely to be frequented by this sparrow than plots in urban and suburban areas. The percentage of plots with feeding Tree Sparrows peaked in rural gardens in week 15 from which point there was a slight decline followed by a gradual rise in the percentage of gardens occupied. The mean percentage of rural gardens occupied was 7% as opposed to a mean 2% of suburban gardens.

Tree Sparrows prefer to feed on small seeds of weeds and grasses. The mid-winter population is estimated at 800,000 birds (Lack 1986).

GOLDFINCH (Fig.2.34)

The mean percentage of gardens occupied by Goldfinches on a weekly basis indicates that less than 2% of gardens actually had Goldfinches. Because of the flocking nature of this bird, the peak count means are not truly representative of activity in gardens as a whole. Even in those gardens where they do occur, it may only be for a short time in any one week.

Goldfinches feed on a variety of small seeds provided and also on nuts. During mid-winter, many Goldfinches migrate south to France, Spain and the Low Countries (Newton 1972). In extremely cold weather, the number of finches is noticably reduced as there is a rapid migration out of Britain. The mid-winter population may be in the region of 100,000 birds, but in early spring this is augmented by the return of the migrant birds (Lack 1986).

FERAL PIGEON (Fig.2.35)

Feral Pigeons were only recorded feeding in suburban gardens. A mean of 11% of suburban gardens had Feral Pigeons feeding throughout the period of the survey. Peak count figures rose through the first five months before levelling off. Feral Pigeons are related to Rock Doves which are to be found mainly in coastal regions of Britain.

Because of the relationship between the two types, it is meaningless to make a winter population estimate for the Feral Pigeon alone. Feral pigeons are particularly attracted to grain, bread and scraps.

OTHER SPECIES

The last three figures in the appendices indicate the weekly percentage of gardens in which Blackcaps (Fig.2.36), Wrens (Fig.2.37) and Pied Wagails (Fig.2.38) were recorded feeding. For all three species, the peak counts were too low to be worth plotting. Blackcaps were recorded feeding each week in a mean of 1% of rural and 2% of suburban gardens. Wrens were more frequently recorded feeding, being reported from a mean of 9% of rural and 7% of suburban gardens. During very cold weather as in week 15, the percentage of gardens reporting Wrens increased. Pied Wagtails were reported feeding in 7% of rural and 6% of suburban gardens each week. As in the case of Wrens, there was a notable hard-weather shift in feeding habits with a much larger number of birds being recorded feeding in cold weather weeks. In week 15 of the survey, Pied Wagtails were recorded feeding in 16% of rural and 31% of suburban gardens.

Blackcaps were fairly catholic in their taste feeding on fruit, nuts, fat and bread. The insectivorous Wren and Pied Wagtail were less catholic, normally choosing to feed under the bird table on crumbs and nut scraps.

The winter populations are estimated in the BTO Winter Atlas at 3,000 Blackcaps, 12-20 million Wrens and up to 2 million Pied Wagtails (Lack 1986).

Table 2.5 presents a summary of the Winter Atlas findings for the twelve species most frequently recorded in gardens.

TABLE 2.5 An estimate of the winter populations (for Britain and Ireland) of the 12 most frequently recorded garden birds.

SPECIES	ESTIMATED WINTER POPULATION
Blackbird	14-20 million
Robin	10 million
Blue Tit	15 million
Starling	37 million
Chaffinch	30 million
Great Tit	10 million
House Sparrow	10-15 million
Greenfinch	5-6 million
Dunnock	20 million
Song Thrush	6-10 million
Coal Tit	4 million
Collared Dove	150 thousand

All the estimates in the BTO Winter Atlas have been made by specialists who have studied individual bird distributions and populations.

GENERAL CONCLUSIONS

The provision of food is important during the winter and spring months for many garden birds. The twelve most frequent users of bird-table foods during the winter were also the most frequent visitors and feeders on provided food in the spring. For some species, the level of feeding in the spring is almost as high as in the autumn and winter. Figure 2.7 clearly indicated that House Sparrow feeding activity peaked in the late spring, a time when many sparrows were feeding young, both in and out of the nest. Collared Dove peak counts reached a maximum at the end of April. For other species peak counts remained high at least until the middle of May and were often as high as autumn peak counts. The Blackbird, Starling, Chaffinch, Greenfinch and Song Thrush all had peak counts as high as their early winter counts.

The seasonal pattern of garden usage also indicates that some birds are more reliant on garden bird table foods than others. The Blackbird, Starling, Chaffinch, House Sparrow, Greenfinch, Dunnock, Song Thrush and Collared Dove were all recorded feeding in a high percentage of gardens during the spring survey. Other species such as the Robin, Blue Tit, Great Tit and Coal Tit used provided food extensively during the first month of the spring survey after which usage declined rapidly. It is assumed that the drop in the frequency of recording represents a shift in feeding habits from provided foods back to natural prey, which generally becomes more abundant in the spring. Seeds are not naturally produced until mid-spring so the continued use of provided foods by the seed-eaters such as the Greenfinch and Dunnock is to be expected. Food provision in the spring is therefore particularly important for seed-eating birds at a time when their natural food is at an annual low point. Other species which fed on provided food in the spring include the Magpie, Jackdaw, Woodpigeon, Carrion Crow, Rook and to a lesser extent, the Tree Sparrow.

The GBFS results indicate that some species are more frequently recorded, and are perhaps more abundant, in the differnt garden types. All of the top twelve species were more frequently recorded in rural gardens exepct for the House Sparrow, Starling and

Collared Dove, which preferred suburban gardens. The peak count data suggests that Starlings and House Sparrows were more numerous in suburban gardens whilst the other species were more abundant in rural gardens. Both the Starling and the House Sparrow feed extensively on scraps which are possibly more prevalent in urban and suburban gardens.

When the frequency of occurrence is compared with estimated winter populations, it is apparent that the most frequently recorded garden birds are nationally the most abundant wintering birds that normally use gardens. The exception is the Collared Dove which has a very small population (150,000) and yet it is one of the most frequent visitors to gardens to feed. Presumably the Collared Dove's preference for seed and grain based foods and their fairly catholic habitat preferences has allowed these birds to use gardens so successfully.

Most birds which enter gardens during the winter do so to feed and drink. The provision of food during the winter is important for garden birds. Some birds also feed extensively on provided foods during the spring which suggests that food provision may also be important at this time.

PART 3

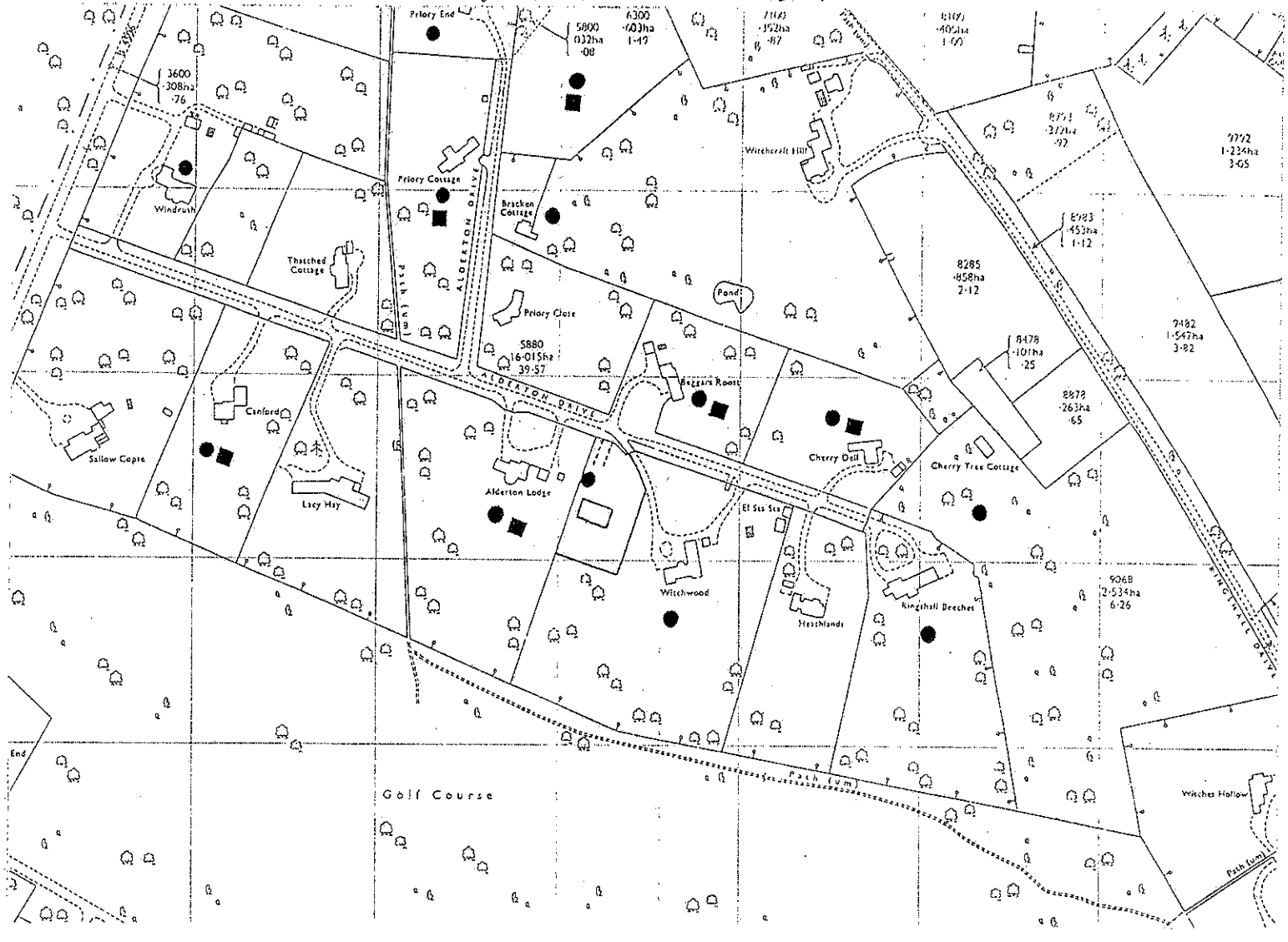
STUDIES ON THE USE OF SUPPLEMENTARY FOOD BY BREEDING BLUE AND GREAT TITS DURING THE BREEDING SEASON

3.1 Introduction

In the general introduction, it was stressed that many people believe that birds should not be fed during the non-winter months. The RSPB advise that during the breeding season and early autumn, natural foods should be abundant and in no way should artificial foods be provided. In particular it is stated that birds 'may be tempted by easy food put on bird tables and this can choke their young' (RSPB information - 'Food fit for birds?'). More specifically, in a leaflet titled 'Feeding Garden Birds', the RSPB suggest that there is no need to feed the birds between April and September and that nestlings may be killed by indigestible, unnatural foodstuffs such as peanuts. Such is the strength of public opinion that when the Spring GBFS was set up, 13 letters were received from seasoned GBFS participants stating that to provide food during the breeding season was detrimental to the health of nestling birds. Whilst some agreed to participate, with the proviso that they would not provide peanuts, others refused outright stating that the provision of nuts and farinaceous (mealy /starchy) foods had been proved to be bad for nestling birds and therefore should not be provided. In fact, there is little published evidence of the harmful effects of these foods on nestling birds. Whilst general texts suggest that food, and in particular fat, and nuts should not be fed in the breeding season (Soper 1965,1976; Glue 1982 and Ratcliffe 1986) there is little actual evidence to prove that this is so.

As part of this research contract, a population of Blue and Great Tits was monitored in a number of gardens in Alderton Drive, Ashridge Park, Hertfordshire. As part of a long term study on the movement and dynamics of a wintering population of Blue and Great Tits, Chris Mead of the BTO has been ringing tits in the Alderton Drive area since 1977. In order to maximise the number of tits captured, supplementary food (mainly peanuts) is provided at the

FIGURE 3.1. Alderton Drive Study area (O.S. Sheet 1:2500)



● Gardens with nest boxes

■ Gardens where feeding observations were carried out

catching centres to lure the birds into the netting area. The nets are set each weekend prior to sunset and captured tits ringed. Supplementary food is available for the birds between the months of October and March. After this period, the tit flocks break up and the birds return to their breeding territories.

In contrast to other years, the feeding was continued at the end of the netting period in order to determine if the birds would use the food and to determine what difference an abundant food supply had on their breeding biology. Whilst the netting required the food to be concentrated in several areas (the catching areas) the spring study required the food to be more widely available such that many birds could utilise it. The number of feeders was therefore increased and they were spread out more, such that the food hoppers were present in more gardens.

The main aim of this study was to determine the regularity with which adults fed supplementary foods to their nestlings and to discover if nestlings were in anyway disadvantaged as a result of receiving such foods.

3.2 Study Area

Ashridge Park consists of a large area of woodland (Beech, Oak and some conifers) which is managed by the National Trust as a recreation and nature conservation area. Parts of the park have been designated by the Nature Conservancy Council as being of special scientific interest and are therefore protected by law.

Alderton Drive comprises 16 houses all of which have large open gardens with large stands of mature trees and a variety of shrubs. Many of the gardens had Oak, Beech, Birch and a variety of fruit trees as well as flower beds, shrubberies, vegetable plots and extensive areas of short grass. All the gardens in Alderton Drive were surrounded by semi-natural woodlands. Field work was carried out in 13 gardens (see Figure 3.1) in which nest boxes were already in position. Many of the gardens have had nest boxes for 5 years and, as a result, the occupancy of the boxes is high.

In addition to working in Alderton Drive, work was carried out in Ringshall Coppice, an area of mixed woodland which had 132 nestboxes already in place. No food was provided in this area and the breeding success was monitored as in Alderton Drive. The two study areas were less than 2km apart and were different in terms of habitat and food provision.

3.3 Methods

One hundred and twenty two nest boxes were sited in a total of 13 gardens in Alderton Drive. Feeding observations were confined to 6 of these gardens because of their all-round visibility and because the residents allowed unlimited access. Large nut hoppers were hung in visible places in each garden. Smaller nut feeders were hung from fence posts, shrubs and tree branches. Feeding observations begun once the eggs had begun to hatch.

Breeding tits are habituated to man, so it was easy to monitor feeding visits from close to the nest. Nests selected for observation were watched from distances of less than 20 metres except in one case where the wary adults would not tolerate such a close intrusion. The feeding adults were monitored with 8 X 30 binoculars from a position where both the nest box entrance and the available food could be seen. All watches were made for one hour periods. During each period the total number of visits made by the adults to the nest box were counted. Each feeding visit was monitored closely to determine if the food carried was artificial or natural. In the majority of cases this could be determined by watching the adults actually feeding in the trees, from where they flew back to the nest box with food. Similarly, birds flying direct from the nuts to the nest box with food were obviously carrying artificial food. In those cases where birds were seen flying from an unknown feeding site to the nestbox, the colour and size of the food in the beak and the arrival direction were used to determine whether natural or artificial food was being carried.

The amount of food in each feeder was carefully monitored and, at the end of each week, the supplementary food was replaced with

fresh food. Breeding success was monitored throughout the nesting season and observations carried out to determine the timing of egg laying, clutch size, breeding success, the number of feeding visits made to nest by foraging adults which consisted of non-natural foods (nuts) and the use made of non-natural foods by adult tits to satisfy their own requirements. Fledging success was used as a measure of breeding success. Fledging success is difficult to estimate accurately because small chicks which die may be removed from the nest by the adult birds (Perrins 1979). In addition, broods cannot be visited once the chicks are over 12 days old as the young are liable to panic and leave the nest prematurely. Young tits do not fledge until they are between 18 and 22 days old (Perrins 1979), so there is a considerable time after the last visit during which young can perish. The box can be checked once the young have left, but this is not simple as dead young are often pushed to the bottom of the box where they become entangled and concealed in the nest lining. The estimates of fledging success must therefore be treated with some caution.

3.4 Results

3.4.1 Breeding Statistics.

Blue Tits generally laid earlier than Great Tits (Table 3.1). Both the Blue and Great Tits laid their first eggs earlier in the Alderton Drive garden nestboxes than they did in Ringshall Coppice. A t-test was carried out to test if the difference in the timing of laying was significantly different in the garden and woodland birds. Blue Tits nested significantly earlier in the garden habitat where food was provided than in the semi-natural woodland ($t = -2.48$, d.f.=54, $P<0.02$). In the case of Great Tits, the timing of egg laying was not found to differ significantly in the two habitats ($t = -1.503$, d.f.=20, n.s.).

TABLE 3.1 First egg laying dates in breeding Blue Tits and Great Tits in a garden and woodland habitat.

SPECIES	STUDY AREA	MEAN DATE *	S.E.	SAMPLE
Blue Tit	Alderton	23.67	0.60	39
Blue Tit	Ringshall	26.41	0.96	17
Great Tit	Alderton	25.07	1.31	15
Great Tit	Ringshall	28.71	2.18	7

* Date is shown as days from 31st. March.

TABLE 3.2 Blue Tit and Great Tit clutch size for garden nesting and woodland nesting birds.

SPECIES	STUDY AREA	MEAN CLUTCH	S.E.	SAMPLE
Blue Tit	Alderton	11.10	0.26	39
Blue Tit	Ringshall	9.59	0.59	17
Great Tit	Alderton	8.78	0.28	14
Great Tit	Ringshall	10.28	0.42	7

TABLE 3.3 The hatching success of garden and woodland Blue Tits and Great Tits.

SPECIES	STUDY AREA	EGGS LAID	EGGS HATCHED	PERCENTAGE HATCHING
Blue Tit	Alderton	433	392	90.5%
Blue Tit	Ringshall	163	147	90.2%
Great Tit	Alderton	123	106	86.2%
Great Tit	Ringshall	61	47	77.0%

In Table 3.2, the clutch sizes for garden nesting and woodland nesting Blue and Great Tits are compared. Blue Tits laid significantly more eggs in garden nests ($t = 2.71$, d.f. = 54, $P<0.01$) than they did in the woodland nests whilst Great Tits laid significantly fewer eggs in the Alderton Drive nests than they did in the woodlands ($t = -3.03$, d.f.=19, $P<0.01$).

Thus, garden Blue Tits nested significantly earlier and produced larger clutches than did woodland Blue Tits. Great Tits produced significantly larger clutches in the woodland habitat but there was no significant difference in the timing of laying between the garden and woodland sites.

Details of hatching success are given in Table 3.3. Of the Blue Tit eggs, 82% of those laid in gardens and 85% of those from the woodland produced fledged young. Great Tit fledging success was lower with 66% of garden eggs and 77% of the woodland eggs giving rise to fledged young. There was no significant difference in the fledging success of Blue Tits ($t = 0.368$, d.f. =49, n.s.) and Great Tits ($t = -0.268$, d.f. = 16, n.s.) nesting in Alderton Drive and Ringshall Coppice.

3.4.2 Feeding observations

The use of the feeders by the adults as a food source was carefully monitored whilst watching the feeding birds. Whilst Great Tit adults very rarely fed their young on nuts, Blue Tits were never seen to do so in Alderton Drive. Figures 3.2 and 3.3 show how much use was made of peanuts by Great Tits as a nestling food source and as an adult food. The majority of food fed to Great Tit nestlings was natural food such as caterpillars, spiders and aphids. Fewer than 7% of all feeding visits were made by adults bringing peanuts. During the majority of the brood rearing season nuts were rarely presented to nestling Great Tits. Adult Great Tits did make some use of the nuts occasionally landing on them to feed before flying into the foliage to search for caterpillars. Adult Blue Tits were only seen feeding on nuts 7 times in 100 hours of observation. Nuthatches were seen 8 times

FIGURE 3.2. THE PERCENTAGE OF THE TOTAL FEEDING VISITS IN WHICH PEANUTS WERE BROUGHT TO NESTLING GREAT TITS

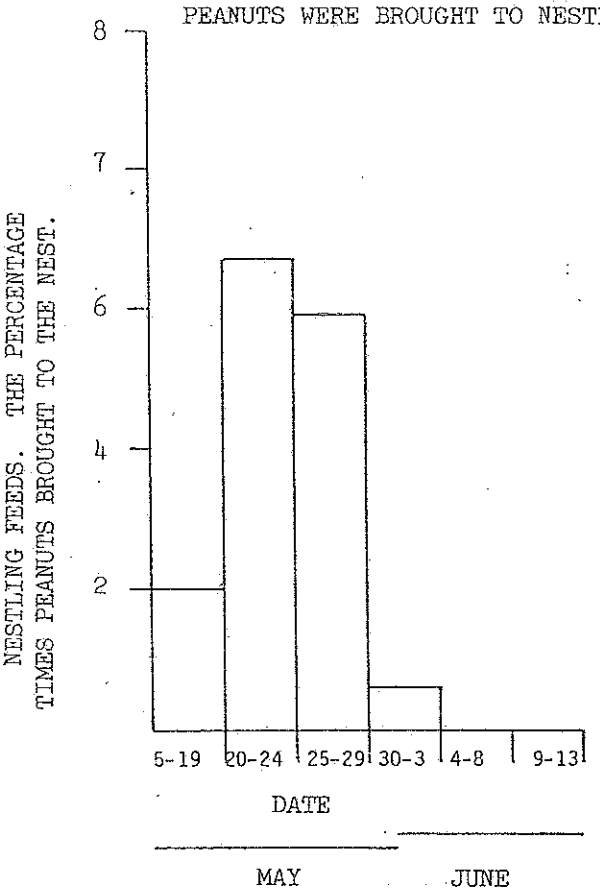
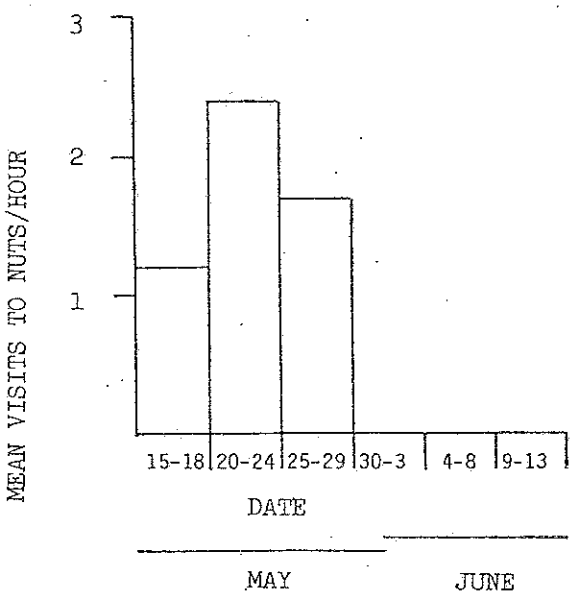


FIGURE 3.3. THE MEAN NUMBER OF FEEDING VISITS/HOUR MADE BY GREAT TITS TO PEANUT HOPPERS*



* Nuts frequently consumed by the adults rather than collecting for young

whilst Coal Tits and Great Spotted Woodpeckers were seen feeding a total of three times during 100 hours of observation.

During the course of this fieldwork no young birds were found which had obviously died as a result of choking on peanuts. In the majority of cases death appears to have resulted from starvation, as the dead young were often emaciated and backward in their development. All dead young found in boxes were checked carefully in particular for objects lodged in the throat. Whilst at no time were nuts found lodged in a young tit's mouth or throat by me or by my field assistant, a BTO colleague did report finding a nut lodged in the throat of a young Blue Tit whilst visiting the nest to ring the young. The chick was still alive so it is impossible to predict what the outcome would have been had the nut not been removed. There are several other cases of similar observations having been made by ornithologists ringing young birds. However, whilst they report such cases they never report those cases where all the young were healthy and well. Clearly the urge to report something abnormal or damaging is much greater than to report the normal. It is also not known whether all such instances result in the death of the nestling.

Because supplementary food was so rarely fed to nestlings in Alderton Drive, it is not surprising that there was little evidence of chicks dying as a result of being fed on unsuitable foods. In an area where supplementary food was more frequently used, resultant nestling mortality may be more evident.

Blue Tits made an average of 34.8 (sample of 58 hours) feeding visits per hour to their young whilst Great Tits made fewer visits at 22.6 per hour (sample 42 hours). In the majority of cases Blue Tit broods were tended by both adults whilst Great Tit broods were chiefly tended by the male (4.2% of the feeds were made by the female).

The number of Blue Tit feeding visits made to the nestlings was correlated with both the date of observation ($r. = 0.302$, $P<0.05$) and brood age ($r. = 0.355$, $P<0.01$). Great Tit visits to nestlings

were correlated with the date observations were made ($r_s = 0.398$, $P<0.01$) and brood age ($r_s = 0.458$, $P<0.01$). Both the date of observation and brood age are interrelated in that as the date of observation increases so to does brood age. For both species, there was no relationship between the number of feeding visits and brood size. Thus as a general rule small broods received the same number of feeds as larger broods.

To study the inter-relationship between the independent variables, a multiple regression analysis was carried out. The multiple regression analysis of the Blue Tit data indicated that the most important factor in determining how many feeding visits would be made to the nest was brood age (Partial $F = 8.08$, d.f.$= 1,56$ $P<0.001$). Other factors did not regress significantly in the analysis. A similar analysis of the Great Tit data found that the number of feeding visits was dependent on brood age and brood size (Partial $F = 5.25$, d.f.$= 2,39$ $P<0.01$). It appears that in the case of Great Tits the size of the brood also partly determines the number of feeding visits made to the nest. In Blue Tits, 35% of the variation in feeding visits was attributable to the age of the brood being fed. In Great Tits, 46% of the variation was due to brood age and 55% due to the combination of brood age and brood size.

3.5 Discussion

Blue and Great Tits tended to nest earlier in gardens than in woodlands but only in the case of the Blue Tit was this difference significant. In a study in Oxford, Perrins (1979) also found that garden Blue Tits nested earlier than woodland nesting birds. The observable differences were not thought to be directly related to food supply or availability but rather to earlier breaking of buds and a general increase in habitat fertility as a result of garden management. Whilst Perrins (1979) demonstrates that garden birds do nest earlier, he also suggests that birds provided with food do not necessarily breed earlier. The timing of egg laying was the same for a population of Great Tits fed on sunflower seeds as a population which was unfed (Perrins 1979).

In a study of Great and Blue Tits in Cardiff, Cowie and Hinsley (1987) found that Great Tits nested earlier in gardens whilst Blue Tits showed no such tendency. In the Cardiff study, the timing of laying of the garden breeding birds was compared with breeding times from other studies. In contrast, Kallander (1974) found that Great Tits fed on a diet of mealworms nested earlier than did unfed birds. In a study of Willow and Crested Tits (von Bromssen & Jansson 1980) laying date was advanced by providing birds in an experimental area with sunflower seeds and nutrient enriched tallow. It would seem that in certain circumstances the provision of food may advance laying date in the tit species.

The findings of my study are complicated by the fact that in Alderton Drive food was provided throughout the winter from October onwards. It could be that the level of food available during mid-winter is just as likely to influence laying date as the level of food available in the early spring.

At the pre-egg laying stage, food is critical to the female as she builds up her resources to produce the large clutch of eggs. The availability of food is not however thought to determine how many eggs will be laid. In this study, Blue Tits laid significantly more eggs in gardens than the woodland birds did whilst the reverse was true for Great Tits. Many factors are known to affect clutch size in tits. One of the most important factors is habitat. Perrins (1979) found that Blue Tits generally laid fewer eggs in gardens than in mixed and deciduous woodland. Perrins suggests that the natural food preferred by the tits is more abundant in natural woodlands than in gardens. The fact that Great Tits did lay more eggs in the woodland habitat whereas the Blue Tits did not is interesting. However, without a detailed invertebrate analysis, comments on the relative abundance of invertebrates in woodland and gardens can only be supposition.

No observable difference in Blue Tit and Great Tit hatching success was found. In a study in urban gardens in Cardiff, Cowie and Hinsley (1987) found that both Blue Tits and Great Tits had low fledging success in garden habitats compared with populations

nesting in deciduous woodlands. They stressed that the main cause of mortality was starvation with many young dying even though the adult birds were bringing a large amount of bird table foods to the nest. Cowie & Hinsley (1987) and Perrins (1979) both stress that nestlings do starve even though large amounts of bird table food may be available. Similar findings to the Cardiff study were made by Schmidt & Einloft-Achenbach (1984) working in suburban gardens in Germany. In this study, clutch size and breeding success were much lower in garden nesting birds than woodland birds.

The results of the brood observations indicated that the number of feeding visits made to the nest related to the date of observation and brood age. A multiple regression analysis showed that in Blue Tits, the number of feeding visits was dependent on the age of the brood whilst in Great Tits, the number of visits to the nest was dependent on brood age and size. Gibb (1980) found that feeding visits increased with brood size and to a lesser extent with brood age. Whilst the results of the two studies were similar, a major difference did exist in the role that the female played. Gibb found that the female Great Tit took a large share in the brood rearing duties, whereas in Alderton Drive the females made a very small proportion of the visits. Royama (1966) and Kluyver (1950) also found that the number of feeding visits depended on the size of the brood. Royama (1966) found that the number of visits with food was inversley related to the weight of the food brought. This suggests that the adults attempt to optimise their effort by bringing the largest food items but, where necessary, they make more visits when bringing smaller items. The factors which govern feeding rate are complex and clearly could not be studied without very detailed field work.

In contrast to the findings of the spring GBFS, adult birds scarcely fed on supplementary food in Alderton Drive. Whilst the amount of feeding recorded was negligible, the importance of individual feeds cannot be underestimated. From mid May onwards adult tits began to forage for food for their nestlings. On several occasions, adult Great Tits were seen to fly from their

nest box to nut feeders where they remained for several minutes to feed themselves. They normally then left the feeder and flew into the canopy in search of food more suitable for their young.

Whilst birds in suburban gardens were continuously coming to feed on the provided food (see Figures 2.1 - 2.38) the birds in Alderton Drive showed little or no interest. This suggests that the birds in the Alderton Drive area had no need to use the supplementary food whereas birds in many of the GBFS plots (particularly suburban plots) had to resort to feeding on the supplementary food. Quite why the populations of birds in suburban gardens are so high if there is insufficient food to support them is uncertain. Perhaps winter feeding allows more birds to survive in these habitats and thus the populations are maintained at an artificially high level. Whilst many of the overwintering birds are non-resident, there are also a number of species which winter and breed in the same area. Birds such as the Robin, Dunnock and Blackbird all tend to winter and breed in the same area and thus an increase in overwintering survival should be reflected in an increase in the breeding population. Where a high breeding population is sustained as a result of an increase in winter survival, one might expect that the breeding birds may have to compete both intra- and inter-specifically for the resources available. Where the resources are not sufficient, breeding success and future recruitment may decrease in level.

3.6 Conclusions

The majority of work carried out on supplementary feeding in garden birds has been on members of the tit family. We do not know how frequently other garden birds utilise supplementary foods either for themselves or for their nestlings. Whilst this report has indicated that some garden bird populations may breed with poor success as a result of nesting in areas of poor food supply there is little to suggest that the provision of extra non-natural foods actually contributes to the poor success. Rather, it seems that birds in many urban and suburban gardens struggle to find enough food to feed their nestlings and in such a situation, extra food may be a valuable food source to adult birds.

A study of the invertebrate abundance of gardens would probably considerably advance our knowledge about the potential of different garden types for birds. Until more is known about our other garden birds it would be unwise to speculate as to how important supplementary food might be. However, it should be stated that several workers have suggested that many nestlings in suburban gardens appear to be dying of starvation even where bird table food is available. This suggests that birds only use these foods when natural foods are scarce and when they do use them they have little overall impact on breeding success.

To determine the full effects of supplementary food on garden bird breeding, a large scale experiment should be conducted. A large area is required which can be experimentally divided up. Part of the area should be provided with supplementary food whilst another area is left as a control. By monitoring differences in breeding success and other parameters it may be possible to isolate those factors which have an effect on breeding success. Only after such an experiment has been carried out would it be possible to determine the full effects of food provision on garden bird biology.

PART 4

NEST RECORD CARD ANALYSIS

4.1 Introduction

The BTO's Nest Record Scheme has been running since 1939. Each year, a large number of amateur ornithologists devote themselves to finding and monitoring the nests of the breeding birds in Britain. The details are recorded on special cards and then submitted to the BTO at the end of each field season. Since the schemes inception, almost 700,000 cards have been submitted with details on the breeding biology of a wide range of species. Whilst many of the more spectacular and rare birds are monitored, one of the great strengths of the scheme is in its monitoring of common bird.

The information submitted allows patterns in the timing of breeding and breeding success to be monitored on a within-year as well as long term basis. As part of the present contract, Nest Record Cards were studied to provide information on the timing of egg laying and hatching in Blue Tits and Great Tits. This would give an estimate of the first dates that nestlings could be present in the nest on which recommendations as to the discontinuation of food provision could be based. The cards were also examined to determine whether recorders were finding garden bird nestlings dying in the nest as a result of being fed unsuitable food items. Many observers follow the nests found from egg-laying to the point at which the young leave the nest, thus allowing them to monitor nestling mortality. Whilst many observers might not always check nestlings for an obvious cause of death (such as choking on a peanut) it was considered that where an unusual cause of death was found it was likely to be reported.

4.2 Timing of egg hatching

An analysis of 1602 Blue Tit and 1400 Great Tit Nest Record Cards was carried out to determine the timing of egg hatching. Hatching date was calculated from the dates of first egg laying. Once the date of first egg laying was known, the number of days

corresponding to the laying period and incubation period were added thus giving a theoretical hatch date for every clutch of known first egg laying date.

It was assumed that during the laying period Blue Tits laid eggs daily (mean clutch size was 9.4 eggs) and that the incubation period of 14 days began once all the eggs had been laid. Blue Tit Nest Record Cards were analysed for the period 1962-80. Of the 1602 cards examined, the timing of egg laying and date of hatching could be determined to the nearest five days for 649 clutches. In the remaining clutches the timing of first egg laying was not known to within five days. For any clutch of known first egg laying date, the hatch date was predicted by adding 23.5 days to the date of first egg laying. Whilst not absolute this gives a very good indication of hatching dates for a large number of birds.

Great Tit nest record cards were analysed for the period 1962 - 78. The timing of first egg laying could be calculated to the nearest five days for 624 clutches. The mean Great Tit clutch size of 8.1 eggs was smaller than Blue Tit clutch size. The assumptions for Great Tit laying period and incubation period were as above. Hatch date was predicted by adding 22 days to the date of first egg laying.

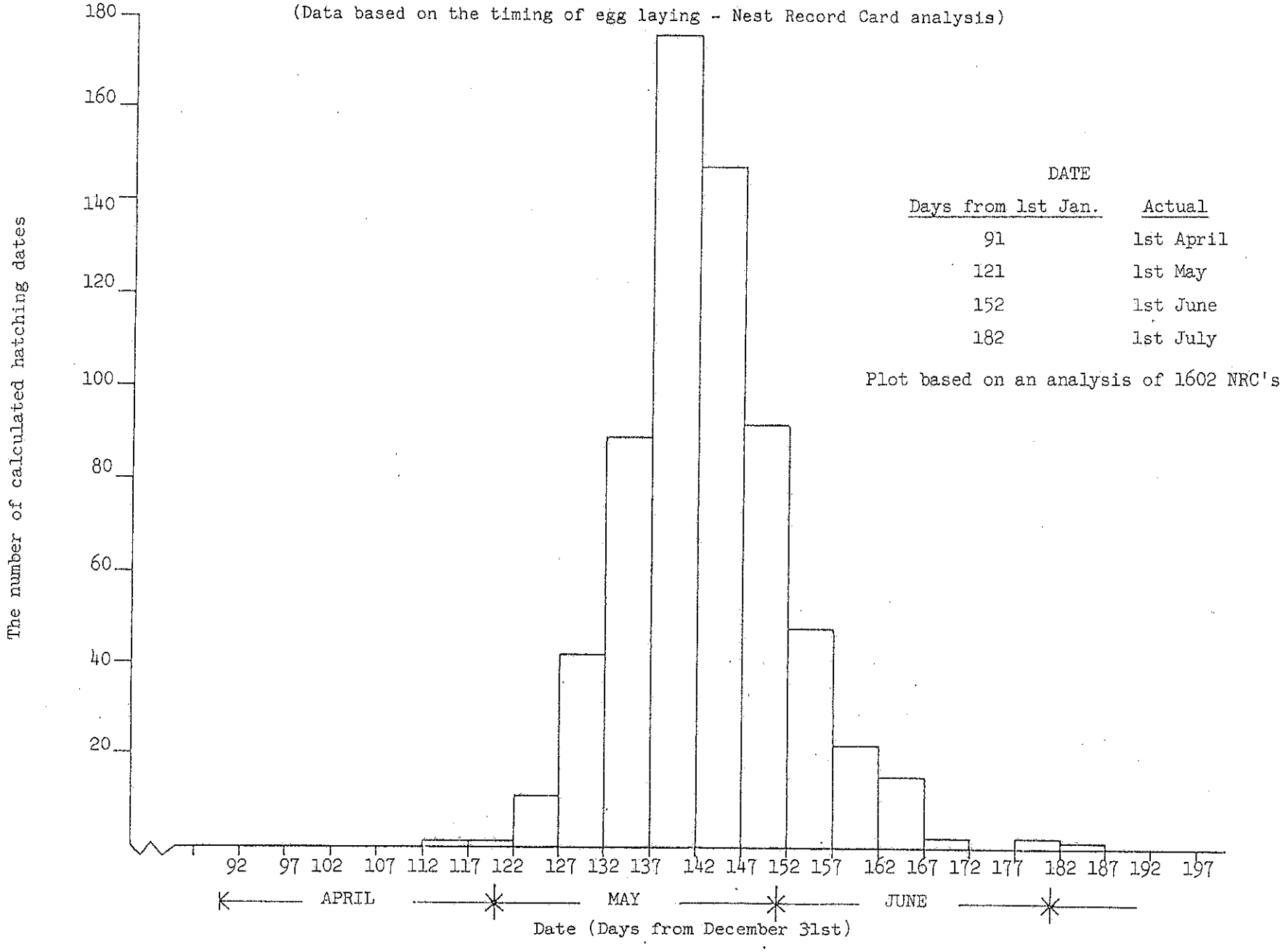
Figures 4.1 and 4.2 illustrate the predicted date of hatching for 649 Blue Tits and 624 Great Tits. Blue Tits hatched from April 22nd onwards. Great Tits generally lay slightly earlier with chicks hatching from 5th April onwards. The peak hatching period for Blue Tits was between 12th May and 1st June whilst in Great Tits the peak hatch period was between 10th May and 30th May. From the beginning of May onwards Blue Tits and Great Tits will have young in the nest. Prior to this date, only a very few pairs will have young.

4.3 Diet-based chick mortality

To determine whether the feeding of artificial foods has led to a noticeable effect on brood survival, nest record cards were

FIGURE 4.1. A FREQUENCY DISTRIBUTION OF BLUE TIT HATCHING DATES

(Data based on the timing of egg laying - Nest Record Card analysis)

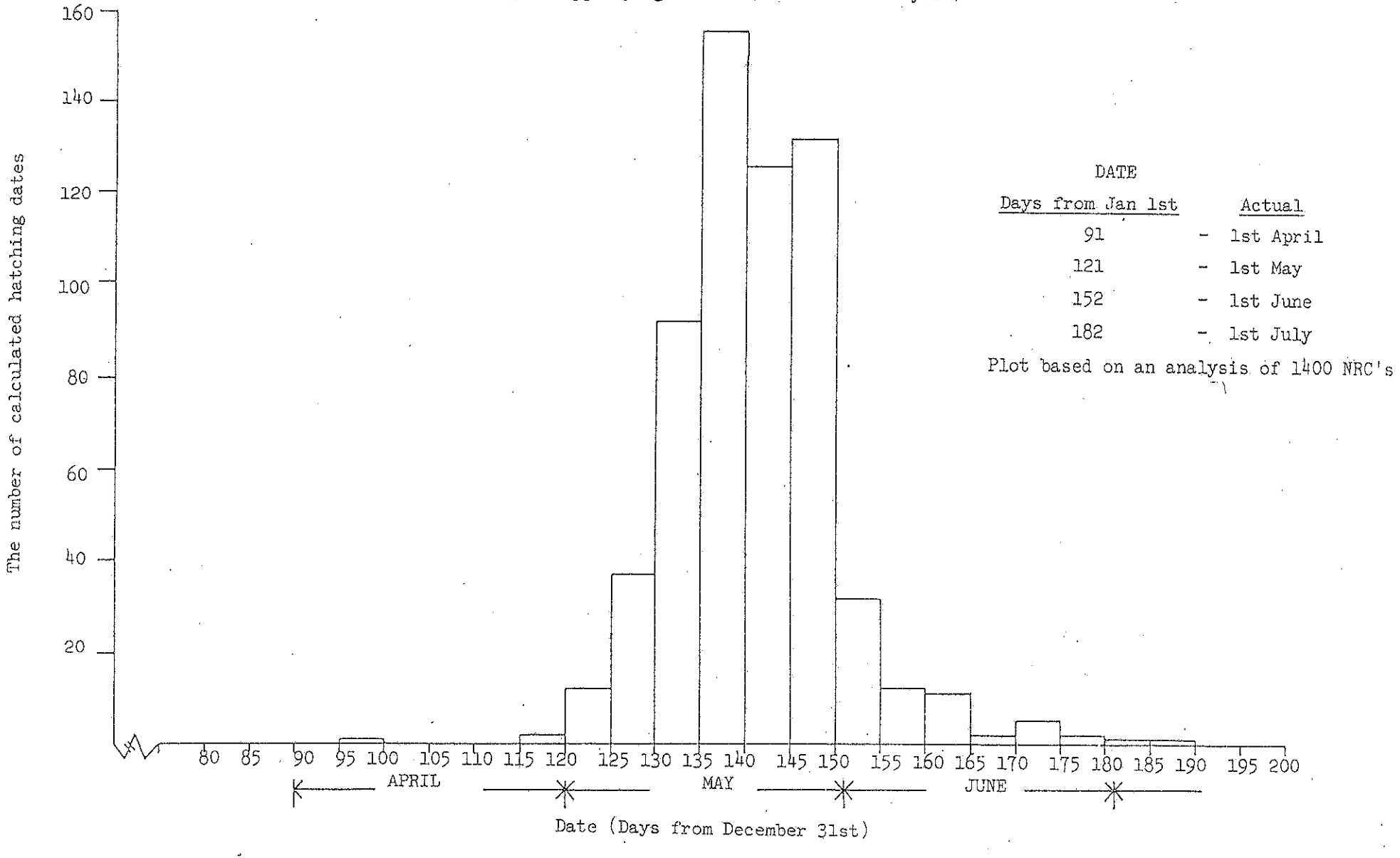


DATE	
Days from 1st Jan.	Actual
91	1st April
121	1st May
152	1st June
182	1st July

Plot based on an analysis of 1602 NRC's

FIGURE 4.2. A FREQUENCY DISTRIBUTION OF GREAT TIT HATCHING DATES

(Data based on the timing of egg laying - Nest Record Card analysis)



examined for four species. The cards were manually checked to see if individual observers commented on actual causes of chick mortality where it was reported. The species selected were :

Great Tit 1959 cards examined.
Blue Tit 2597 cards examined.
Blackbird 3254 cards examined.
Chaffinch 756 cards examined.

The two tit species were selected because of their tendency to feed on nuts during the non-breeding season. As a great deal of the supplementary feeding controversy is centred around tits feeding nuts to their young then these species were an obvious choice. The other two species were selected because nests of each are found each year in large numbers. Blackbirds and Chaffinches do forage in gardens and both are known to take some non-natural foods in the spring. The Blackbird in particular will feed on scraps and bread whilst the Chaffinch will feed on bread and seeds. The Chaffinch is an unusual finch in the sense that it mainly feeds on insects.

Of the 8576 cards examined only two suggested that chicks had died as a result of feeding on artificial food. In one instance, a Blue Tit chick was found dead in a nest box with a half peanut lodged in its throat and in another case, an observer suggested that the low fledging success in a brood of Great Tits was as a result of the chicks being fed on bread. A total of 5 young fledged in the nest from 10 hatched chicks. Some bread crumbs were found in the base of the box and this was the reason that the observer thought the chicks had perished.

There is little nest record evidence to suggest that garden bird chicks are perishing as a result of being fed unsuitable food items. Despite the fact that dead chicks may be removed by adults and that some observers may not check dead chicks carefully to assess causes of death, one would expect at least some observers to note unusual causes of chick death if it occurred frequently. Because so few observers suggested that chicks died as a result of

eating unsuitable food, it would appear that this is an uncommon cause of mortality.

PART 5

CONCLUSIONS

Supplementary food appears to be very important to some species in the spring. The spring GBFS results indicate that birds continue to feed on supplementary foods during the breeding season. All of the most frequently recorded species which were reliant on supplementary food in the winter also used these foods in the spring. Thus, the provision of food is very important for the commonest garden birds. Whilst most of the food eaten is never passed onto nestlings, there is some evidence that some birds do feed supplementary food to their chicks. There is little factual evidence to suggest that nestlings are in any way disadvantaged as a result of being fed these foods, but it is likely that a small number of individuals do perish as a result of being fed unsuitable food items. The results of the field study undertaken did not indicate that Blue or Great Tits were regularly feeding their young on bird table foods. Other studies particularly those carried out in urban areas have suggested that supplementary food is more regularly eaten and fed to nestlings. Whilst such studies have indicated that the breeding successs is significantly lower in urban areas, they have not proved that the reduction arose as a result of chicks being fed on unsuitable foods. Rather, several authors have suggested that birds only use supplementary foods in the breeding season when natural foods are scarce. In urban gardens, natural food is considered to be less abundant and diverse with the result that these birds are normally greater users of supplementary foods.

Other than the top twelve garden birds, the biggest breeding season users of supplementary food were the Rook, Magpie, Jackdaw, Carrion Crow and Collared Dove. The Magpie, Jackdaw and Carrion Crow are all potential nest predators and therefore must be considered as a threat to garden bird populations. During the last 20 years there has been a well documented increase in the Magpie population and a corresponding increase in their use of gardens. Whilst research has shown that Magpies eat a wide range of foods

there is widespread concern that they may seriously threaten the status of some garden birds.

Blue Tits and Great Tits have young in the nest from the beginning of May until the end of June. Where food is naturally scarce and where supplementary food is provided it is likely that adult birds and to a lesser extent their young will be fed on this food. As nuts are thought to be the most potentially harmful of the bird table foods, it is suggested that these are not provided during May and June. The possibillity of providing nuts in shredded form, thus reducing the likelihood of nestlings fed on them from choking, should be investigated.

A considerable amount is known about winter feeding in birds, but little is known about the use of supplementary foods during the breeding season and the autumn. Whilst the results of the spring GBFS have indicated which species eat supplementary foods, little is known about late summer and autumn usage of bird table foods. Garden bird populations are likely to be at their highest after the breeding season, and at this time, the provision of supplementary food may be important. A detailed survey of the use of supplementary food by birds in the autumn would indicate how important supplementary food is at this time.

ACKNOWLEDGEMENTS

A special debt of gratitude is due to the participants of the GBFS who provided the vast majority of data incorporated into this report. I thank Bob Carter who carried out much of the fieldwork at Alderton Drive, whilst studying for an HND in Management and Conservation at Farnborough Technical College.
I am very grateful to all the occupants of Alderton Drive for allowing me unlimited access to their gardens and to Chris Mead for allowing me to work in his study area. Drs. Mike Moser and Rob Fuller both read drafts of this report and considerably improved the text. Dr. Raymond O'Connor and David Pearman guided me in the use of the Nest Record programmes. I am particularly grateful to Carolyne Ray for collecting much of the reference material used in this report and to Dr. Stephen Baillie, Steve Percival and Phil Whittington for advice on the use of the computer. David Glue has always managed to share his ideas with me and has encouraged me during the course of this project. Dr. Richard Cowie of Cardiff University gladly gave advice when asked and was kind enough to provide me with copies of his unpublished papers. Secretarial assistance was given by Liz Murray, Tracy Jarvis and Rita Gray. Finally, a special note of thanks to Dr. Dave Gibbons, Bob Hudson and Lys Muirhead who have helped me in many ways and never complained at the noise generated by my computer!

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APPENDIX 1 A list of the species mentioned in the text.

SPECIES	SPECIFIC NAME
Sparrowhawk	Accipiter nisus
Pheasant	Phasianus colchicus
Black-headed Gull	Larus ridibundus
Common Gull	Larus canus
Rock Dove	Columba livia
Woodpigeon	Columba palumbus
Great Spotted Woodpecker	Dendrocopos major
Pied Wagtail	Motacilla alba
Wren	Troglodytes troglodytes
Dunnock	Prunella modularis
Robin	Erithacus rubecula
Blackbird	Turdus merula
Fieldfare	Turdus pilaris
Song Thrush	Turdus philomelos
Redwing	Turdus iliacus
Mistle Thrush	Turdus viscivorus
Blackcap	Sylvia atricapilla
Chiffchaff	Phylloscopus collybita
Goldcrest	Regulus regulus
Long-tailed Tit	Aegithalos caudatus
Willow Tit	Parus montanus
Crested Tit	Parus cristatus
Coal Tit	Parus ater
Blue Tit	Parus caeruleus
Great Tit	Parus major
Nuthatch	Sitta europaea
Treecreeper	Certhia familiaris
Jay	Garrulus glandarius
Magpie	Pica pica
Jackdaw	Corvus monedula
Rook	Corvus frugilegus
Carrion Crow	Corvis corone
Starling	Sturnus vulgaris
House Sparrow	Passer domesticus
Red-winged Blackbird	Agelaius phoeniceus
Tree Sparrow	Passer montanus
Chaffinch	Fringilla coelebs
Brambling	Fringilla montifringilla
Greenfinch	Carduelis chloris
Goldfinch	Carduelis carduelis
Siskin	Carduelis spinus
Bullfinch	Pyrrhula pyrrhula
Yellowhammer	Emberiza citrinella
Reed Bunting	Emberiza schoeniclus

APPENDIX 2 The GBFS peak count data recording sheet. (sheet A.).

BRITISH TRUST FOR ORNITHOLOGY GARDEN BIRD FEEDING SURVEY

Site Registration No ....

TABLE A1 - WEEKLY BIRD COUNT

Please record PEAK COUNTS only for each week as explained in the instructions. No additions or averages please.

	SPECIES	WEEK NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13
1	BLUE TIT													
2	ROBIN													
3	BLACKBIRD													
4	HOUSE SPARROW													
5	STARLING													
6	DUNNOCK													
7	CHAFFINCH													
8	GREAT TIT													
9	GREENFINCH													
10	SONG THRUSH													
11	COAL TIT													
12	PIED WAGTAIL													
13	COLLARED DOVE													
14	WREN													
15	MISTLE THRUSH													
16	B-HEADED GULL													
17	MAGPIE													
18	MARSH/WILLOW TIT													
19	JACKDAW													
20	GT.SP.WOODPECKER													
	*													
	*													
	*													
	*													
	*													
	*													
	*													

RECORD OF FEEDING UNIT POSITIONS

HANGING													
TABLE													
GROUND													

* Additional spaces are for species not named in list.

APPENDIX 3 The GBFS weekly comments recording sheet. (sheet B.).

BRITISH TRUST FOR ORNITHOLOGY - GARDEN BIRD FEEDING SURVEY

Registration No. ...

TABLE B1 - WEEKLY COMMENTS

October - December.

Week No.	Week No.
1	8
2	9
3	10
4	11
5	12
6	13
7	

(not to scale).

APPENDIX 4 The preferred food of garden birds based on the findings of the winter and spring GBFS.

In addition to assessing weekly numbers and frequency of recording, GBFS participants also recorded the food items that particular species were seen to eat. An analysis of five years GBFS feeding preference data has already been submitted to Pedigree Petfoods. This report briefly reviews the findings of the Spring survey and compares the results with those from the winter survey.

TABLE A Winter feeding preferences of the twelve most frequently recorded species (table based on 5 years GBFS).

SPECIES	Nuts	Seeds	Fruit	Fat	Bread	Other
Blackbird	*		****	**		***
Blue Tit	****		*	**		***
House Sparrow	****	***			*	**
Great Tit	****	**		**		***
Robin	****	*		***		**
Starling	***			**	*	****
Dunnock	**	****	*			***
Chaffinch	****	***	*	**		
Greenfinch	****	***		**		*
Collared Dove		****			**	***
Magpie	*			**	***	****
Coal Tit	****			**		***

**** = preferred food. * = food eaten least.
Seeds included seed mixes and single seed types.
Fat included cooked fat, suet and fat mixes.
Other included table scraps and other food items.

Nuts were the preferred food item of seven of the species. The Blue Tit, Great Tit and Coal Tit fed extensively on nuts and less so on fat and scraps. Greenfinches and Chaffinches were primarily nut eaters but they were also frequently recorded eating seeds. Like the finches, the House Sparrow fed on nuts and seeds but also scraps. Collared Doves and Dunnocks fed on seeds and secondarily on scraps and other food items.

The two major consumers of scraps were the Starling and the Magpie. Both these species were recorded feeding on this food source more than any other. The Robin was found to have a wide range of food preferences with nuts, fat, scraps and seeds all eaten. Both the Blackbird and Song Thrush were fruit specialists. In both birds, 47% of the diet was fruit based. Scraps seeds and fat were also eaten frequently.

Other specialist feeders not referenced above include:
Nut specialists - Brambling, Siskin and Nuthatch
Fruit Specialists - Redwing, Fieldfare and to a lesser extent Blackcap.
Seed specialists - Bullfinch, Goldfinch and Reed Bunting.

TABLE B Spring feeding preferences of the twelve most frequently recorded species (table based on spring GBFS).

SPECIES	Nuts	Seeds	Fruit	Fat	Bread	Other
Blackbird	***	****	*		*	**
Blue Tit	****	**		***		*
House Sparrow	****	***			**	*
Great Tit	****	***		**		*
Robin	**	****		*		***
Starling	****	***		*	**	
Dunnock	***	****			**	
Chaffinch	****	***				
Greenfinch	****	***				
Collared Dove	***	****				
Magpie	***	****		***		
Coal Tit	****	***				

Sveral species were only ever recorded feeding on two types of food and thus their third and fourth ranked food preference is absent from the table. The majority of birds preferred to feed on nuts and seeds presumably because less fat and table scraps were available during the spring. Magpies and Blue Tits fed on fat in addition to nuts and seeds whilst Robins fed less on nuts and more on table scraps.

TABLE C A List of the species recorded feeding or seen carrying bird table foods to young in the nest.

SPECIES	TIMES RECORDED
Blackbird	11
House Sparrow	11
Blue Tit	8
Great Tit	7
Starling	6
Great Spotted Woodpecker	5
Robin	4
Song Thrush	3
Chaffinch	2
Dunnock	2
Coal Tit	1
Greenfinch	1
Magpie	1
Carrion Crow	1
Mistle Thrush	1
Jackdaw	1
Tree Pipit	1

Every species in the top twelve list apart from the Collared Dove has been recorded feeding non natural foods to their nestlings or fledglings.

In 26% of cases where bird table food was fed to young, the food was known to be either scraps (cake, biscuits, cheese) or live

food such as mealworms. Seeds and Nuts were fed to nestlings in 21% of recorded cases whilst a further 17% of feeds were of bread. Fat was fed to young birds in 11% of recorded cases whilst fruit was only rarely fed to nestlings.

During the period of the spring GBFS, Blue Tits were recorded feeding fat and nuts to nestlings on three occassions each whilst the Great Tit was only recorded feeding nuts twice. House Sparrows were reported feeding nuts to their young four times, and seeds also four times. Starlings were recorded feeding their nestlings on bread and scraps as was the Blackbird (except on two occassions). The Great Spotted Woodpecker also fed young on nuts and fat.

Part 3 of this report has already discussed this subject in some detail. Here, it is suffice to say that some species were recorded feeding non natural foods to their young. Some of the foods which were fed were those considered most harmful to breeding birds (e.g. nuts and fats). During the course of the spring GBFS no single participant wrote to say that nestlings had died as a result of consuming bird table foods.

APPENDIX 5 Nestbox Camera Study

Several workers have used nestbox cameras to gather a large amount of data on the feeding biology of Tits. As part of this study, a nestbox camera was set up in order to determine how frequently tits fed artificial food to their nestlings. Because Blue Tits did not appear to be using the artificial food at all, the nestbox camera was only used on Great Tits.

Methods

A Bauer cine camera (C 500 XLM) with a Hannimex flash unit was built into a specially prepared nestbox. The lense was 250mm from the entrance hole and the flash which was in the roof of the box was triggered by a switch which the bird triggered when it entered the box. On triggering the switch, a single frame shot was taken of the adult as it came in through the hole. A single shot was also taken as it left. In order to determine the time of day, a small watch was placed in the nestbox immediately above the entrance hole. Thus, each shot showed the time and an adult with food contents.

In order to set the camera in operation, nestlings were transferred from their nestbox to the camera box when they were five days old. After the transfer, the brood was left for a further two days to allow the adults to habituate to the box. When the adults were considered to be behaving in a normal manner, the flash unit and camera were set and left to run.

Two broods were monitored with the camera for a total period of 11 days.

Results

The nestbox camera was intended to supply a large amount of data in a short period of time. Unfortunately, a number of problems arose which meant that the results may only be used with extreme caution.

Two problems arose which could not be rectified during the season. The first and perhaps least important fault was that adult Great Tits occasionally entered and left the box without triggering the flash. The actual proportion of feeds not recorded was not quantified as at the time this was considered to be a minor problem. The second problem was much more serious and could not be fixed as it was not detected until after the filming was completed. Because the film took so long to develop (one film took over four weeks) and because the breeding season is so short we were completely unaware of a problem until the season was over. When the film was being examined using a cine film editor, it became apparent that something was clouding the lense during the first five hours and during the last two hours of filming. It appears that at these times, warm air from the nest box was condensing out on the cold glass of the camera lense thus clouding the image to the point that it was impossible to determine what food was being carried. Discussions with more experienced workers have suggested that the problem may be rectified by increasing the size of the nestbox. This would reduce the ambient temperature and

the temperature differential between the nest and the camera compartment.

As there may be an important difference in the foods fed to nestlings during the day, the results of this study are biased because all discernible feeding visits were between 09.00 - 19.00 hours. The weather during the field study was atrocious with average air temperatures well below the May and June normal. During cold days, there was also some clouding of the lense during the day.

A total of 2093 shots were taken of Great Tits entering the nestbox. A further 873 shots were spoilt by the clouding of the lense. In one nest, only one adult was feeding the nestlings whilst at a second nest, both adults but mainly the male fed the young.

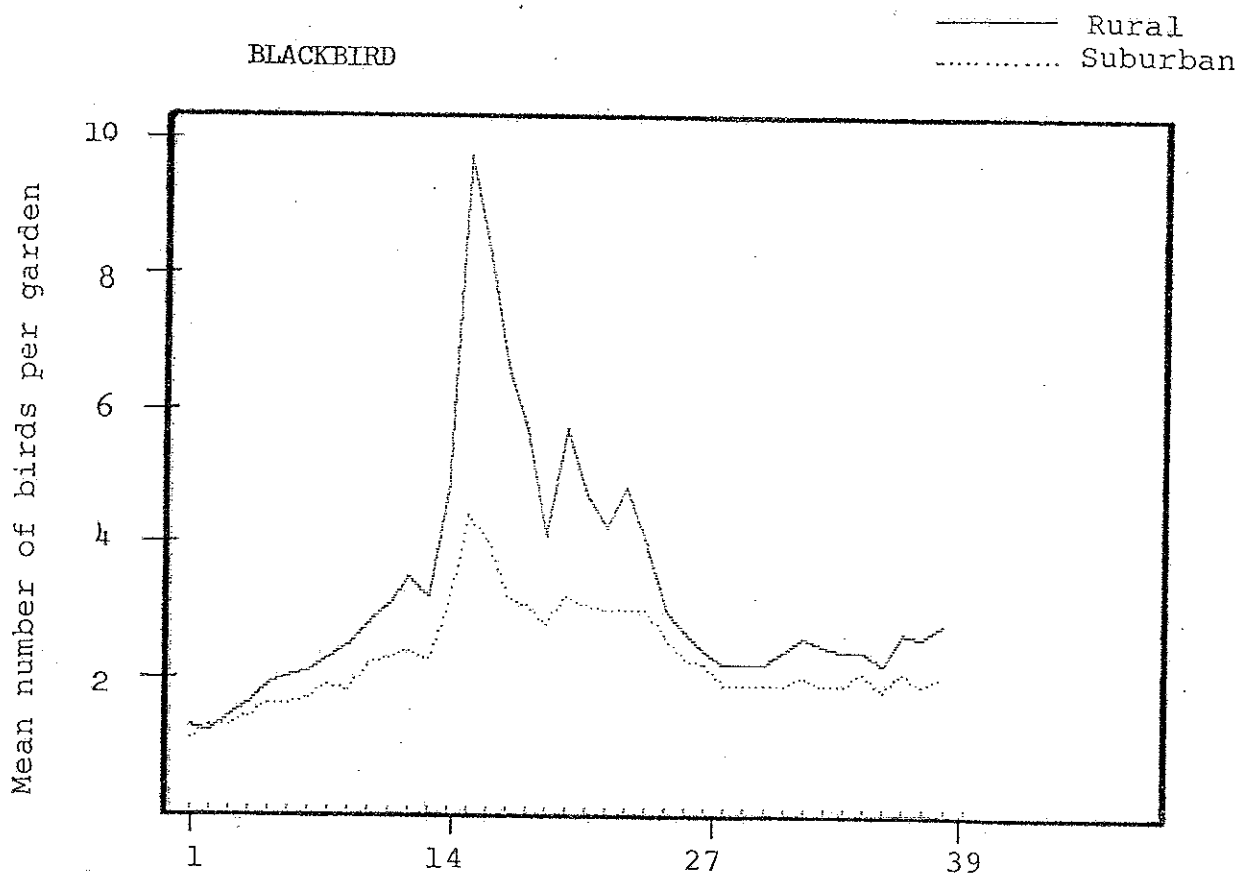
In those photos where, the food could be identified, a total of 1857 caterpillars were fed. A further 114 feeding visits contained invertebrate material of unknown identity. Only 62 visits (3%) were definitely made by adults carrying nuts. A further 60 visits contained food which could not be classified.

Thus only a tiny percentage of the feeding visits were made by adults with supplementary food. As there was an abundance of caterpillars in the Ashridge area from mid May onwards, it is perhaps not surprising that so little artificial food should be used. However, it must be re-emphasised that nuts may have been more frequently eaten in the early morning and evening.

Clearly Great Tits do feed supplementary food to their nestlings. It would seem however, that these foods are not the preferred foods and are fed infrequently.

It should be possible to build a better box and to test it over the winter. If neccessary, the box and camera could then be used to look at the use of supplementary foods in rural and urban gardens.

Fig. 2.1.


BLACKBIRD
Rural
Suburban
Mean number of birds per garden
10
8
6
4
2
1
14
27
39

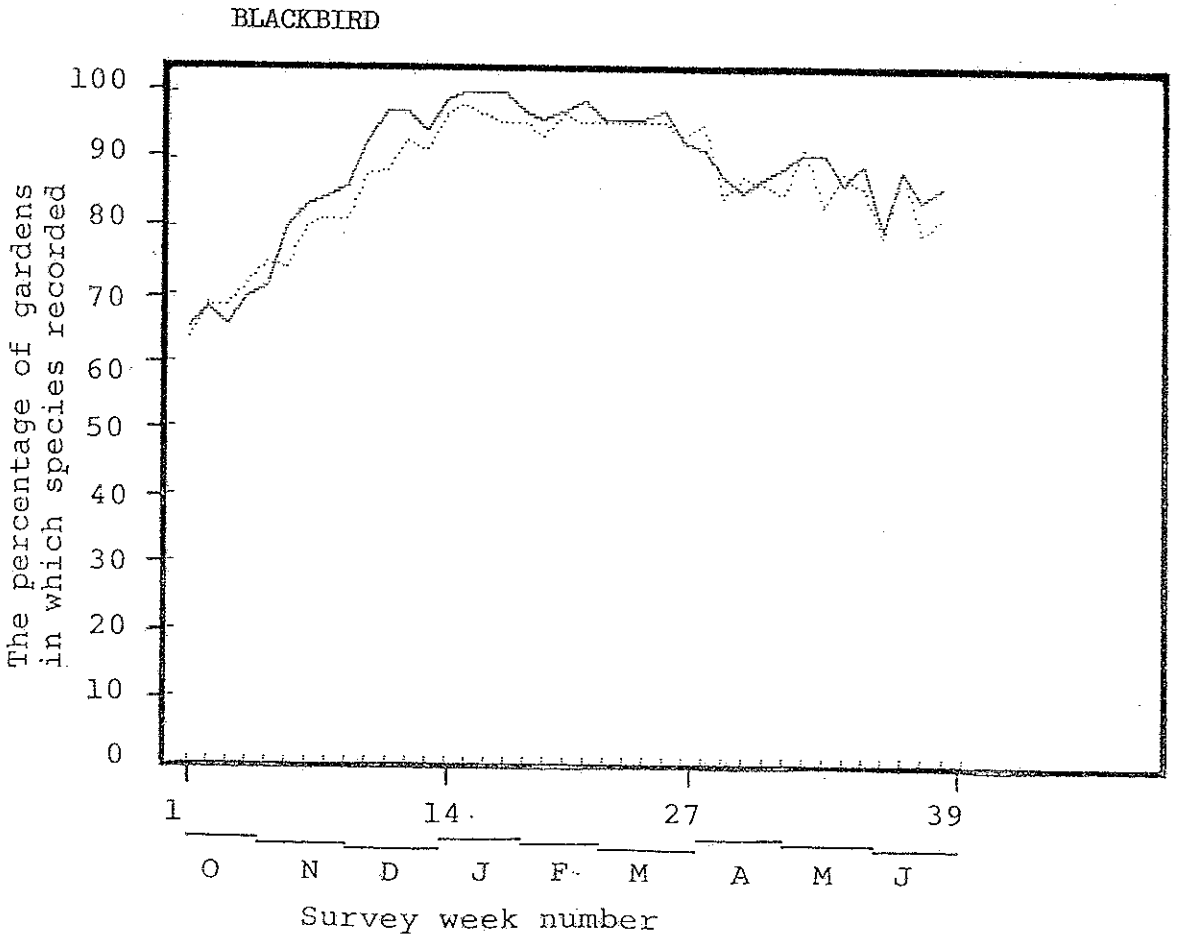

BLACKBIRD
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.2.

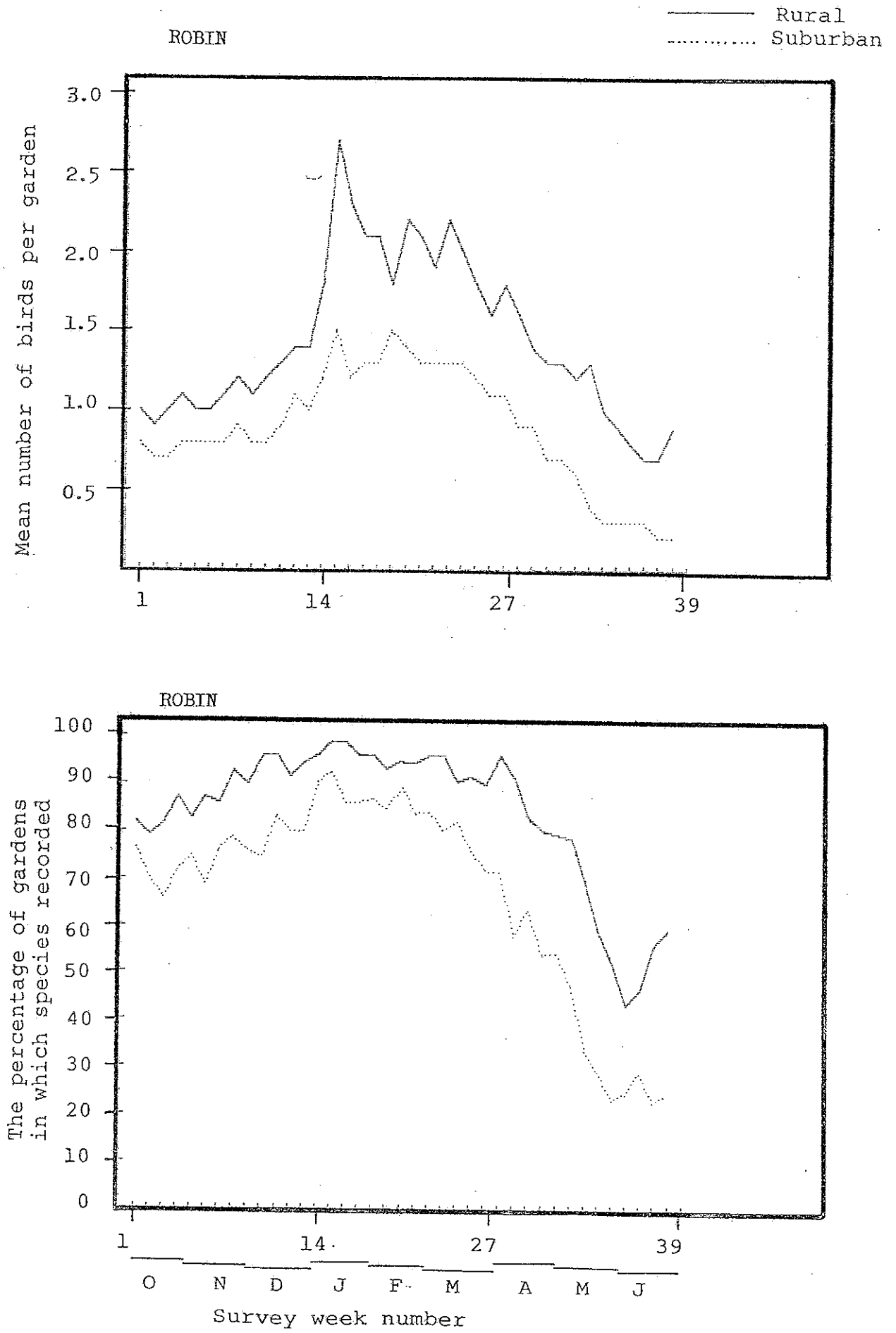
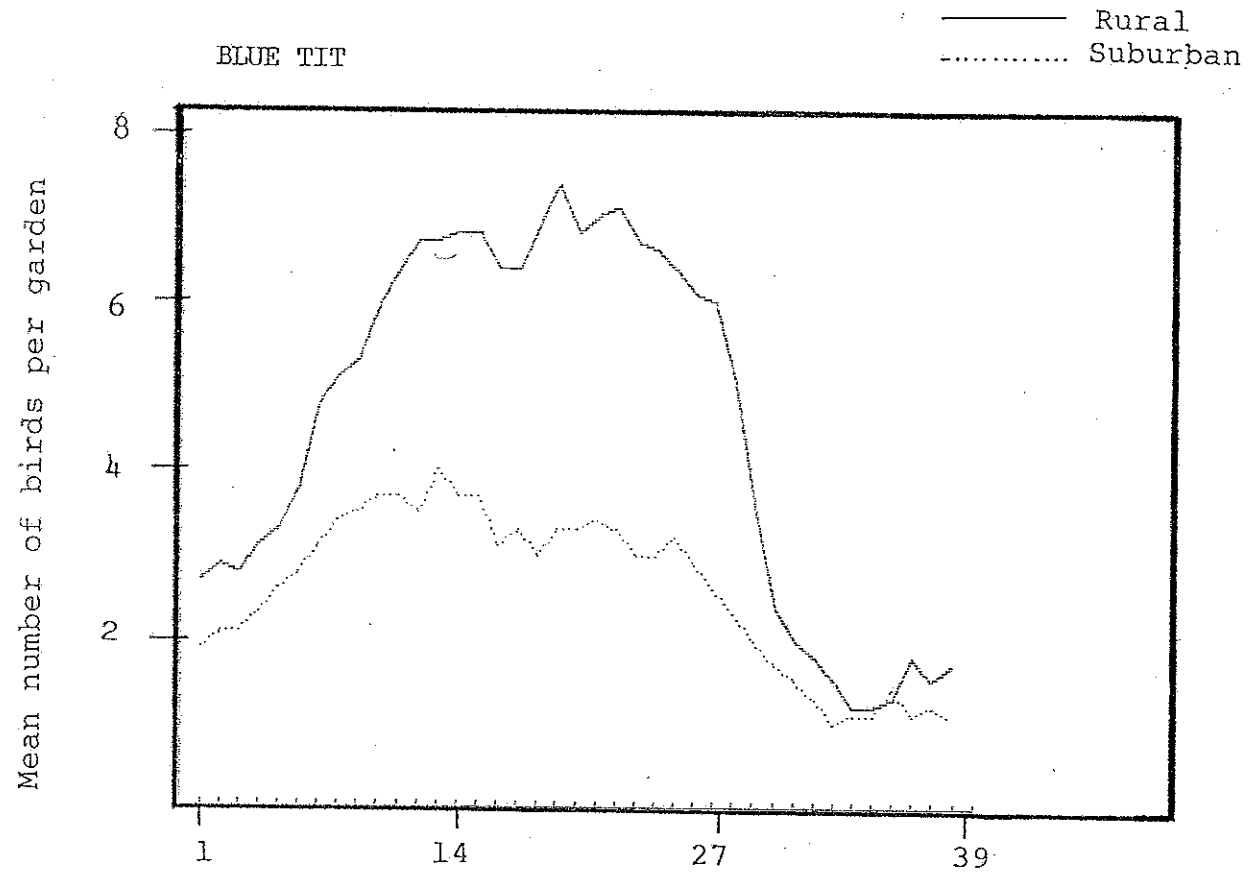

ROBIN
Rural
Suburban
Mean number of birds per garden
3.0
2.5
2.0
1.5
1.0
0.5
1
14
27
39
ROBIN
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.3.


Rural
Suburban
BLUE TIT
Mean number of birds per garden
8
6
4
2
1
14
27
39

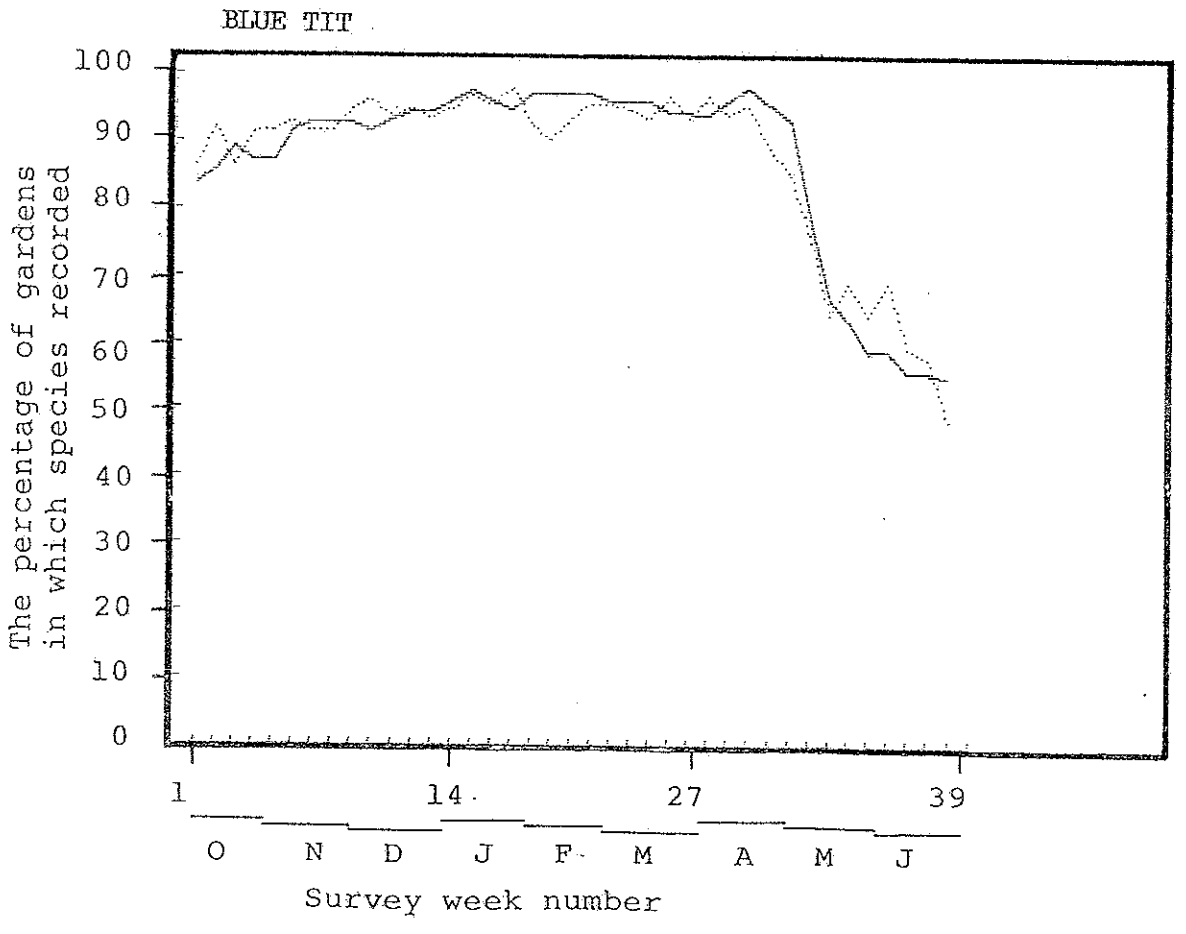

BLUE TIT
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.4.

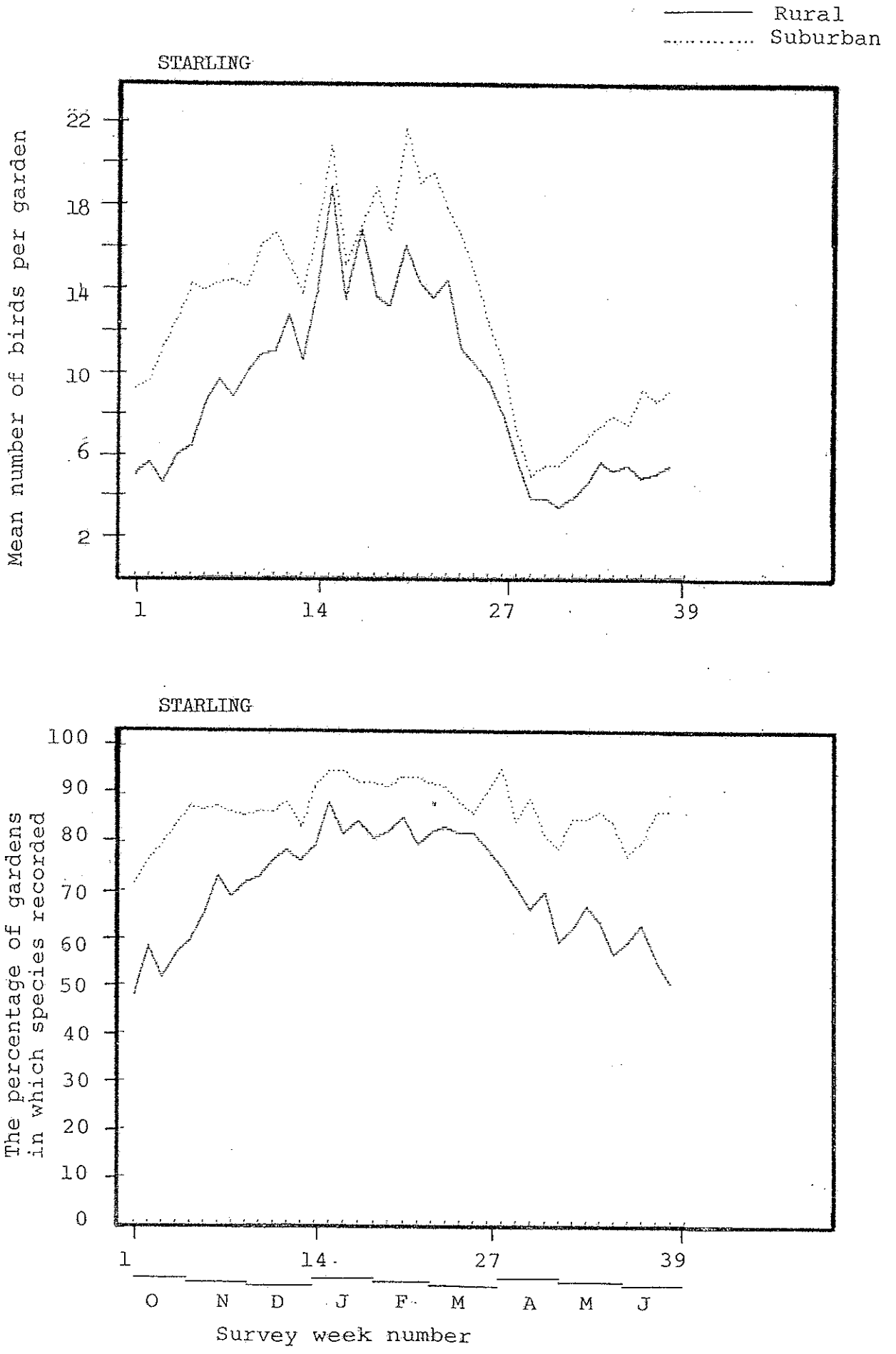
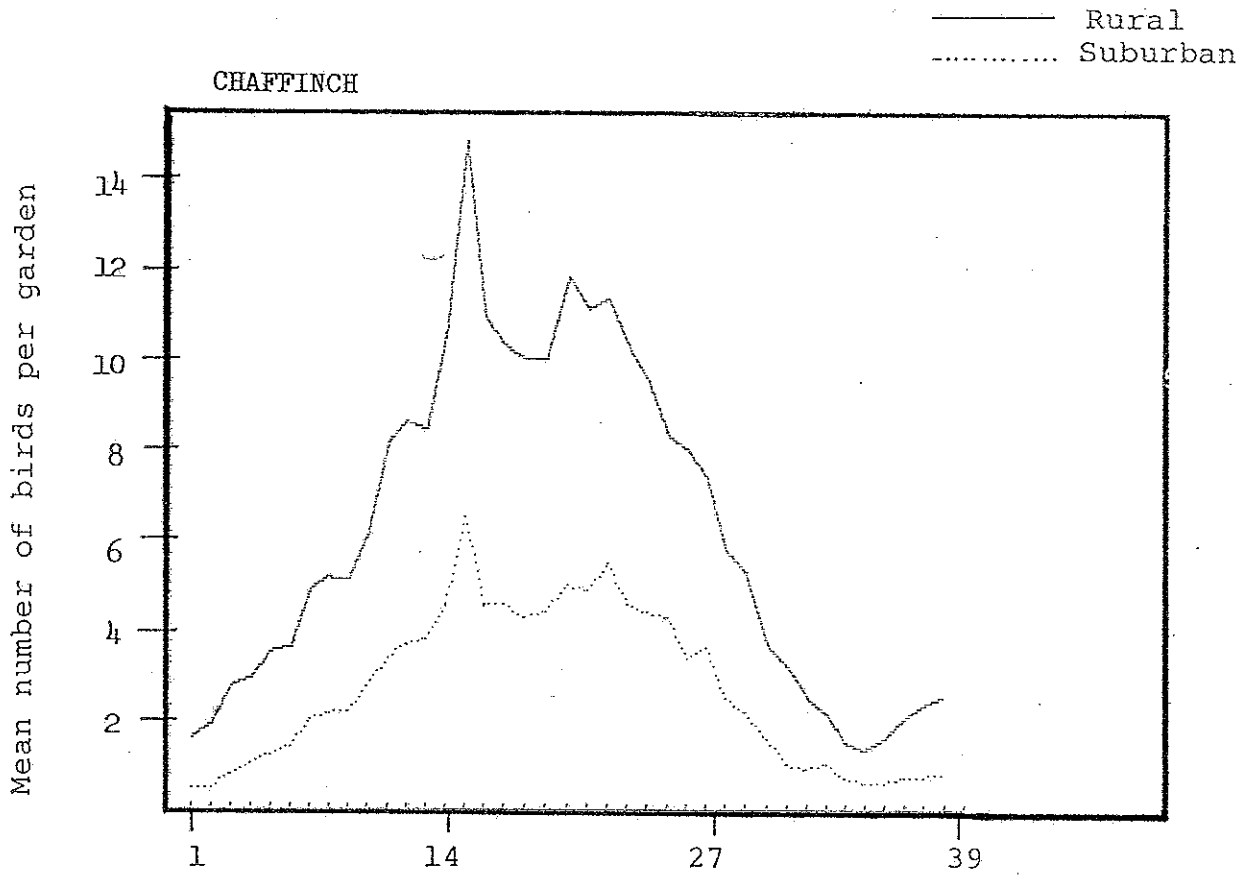

Rural
Suburban
STARLING
Mean number of birds per garden
22
18
14
10
6
2
1
14
27
39
STARLING
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.5.


Rural
Suburban
CHAFFINCH
Mean number of birds per garden
14
12
10
8
6
4
2
1
14
27
39

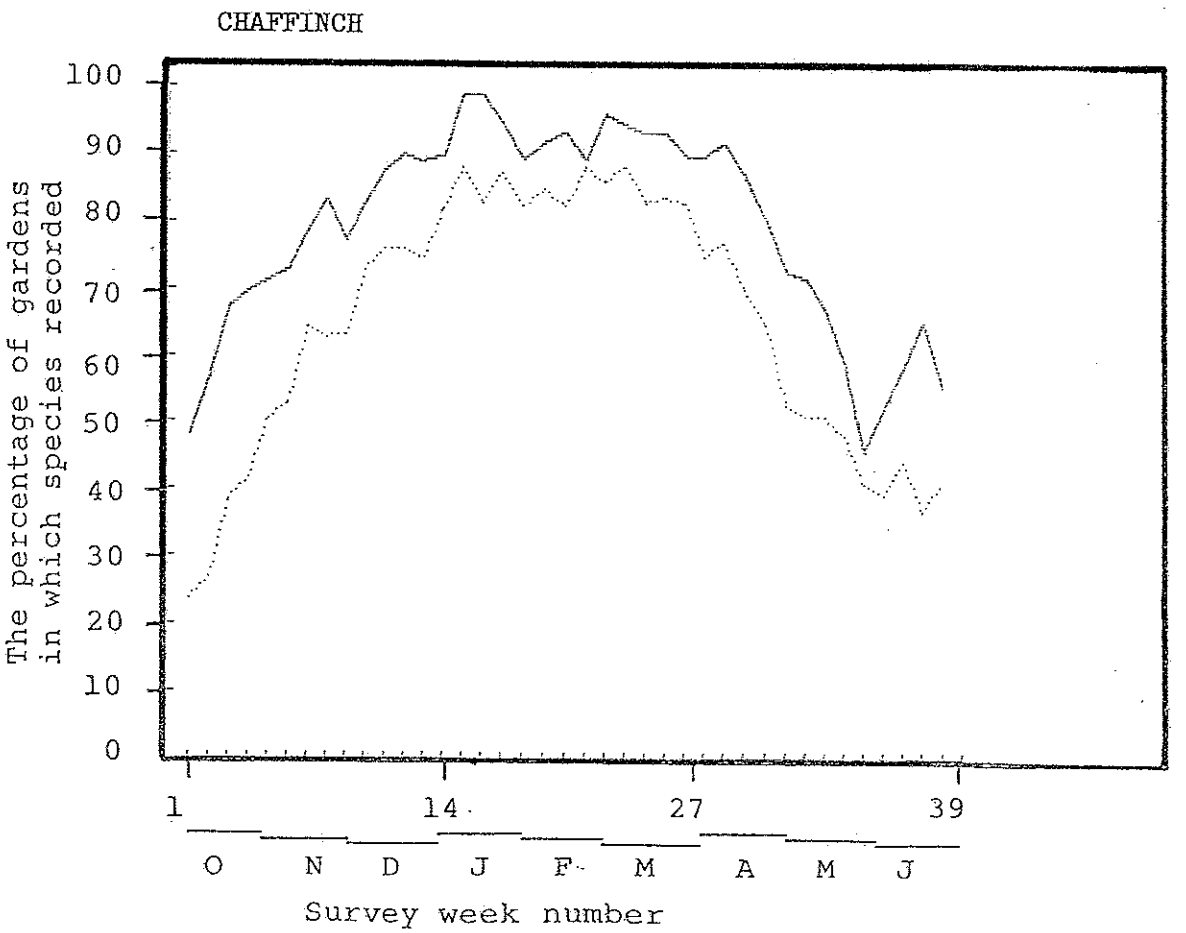

CHAFFINCH
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.6.

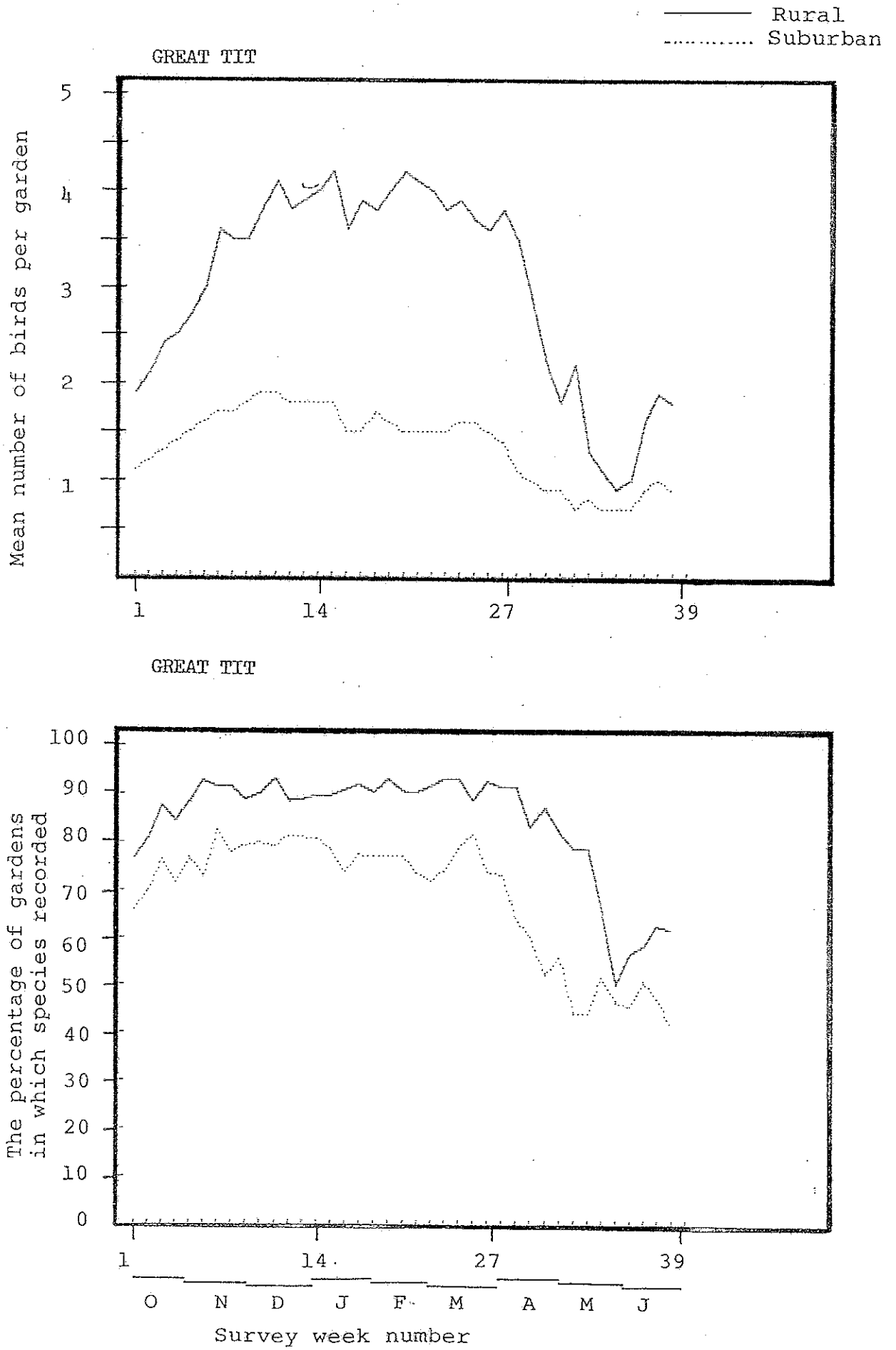
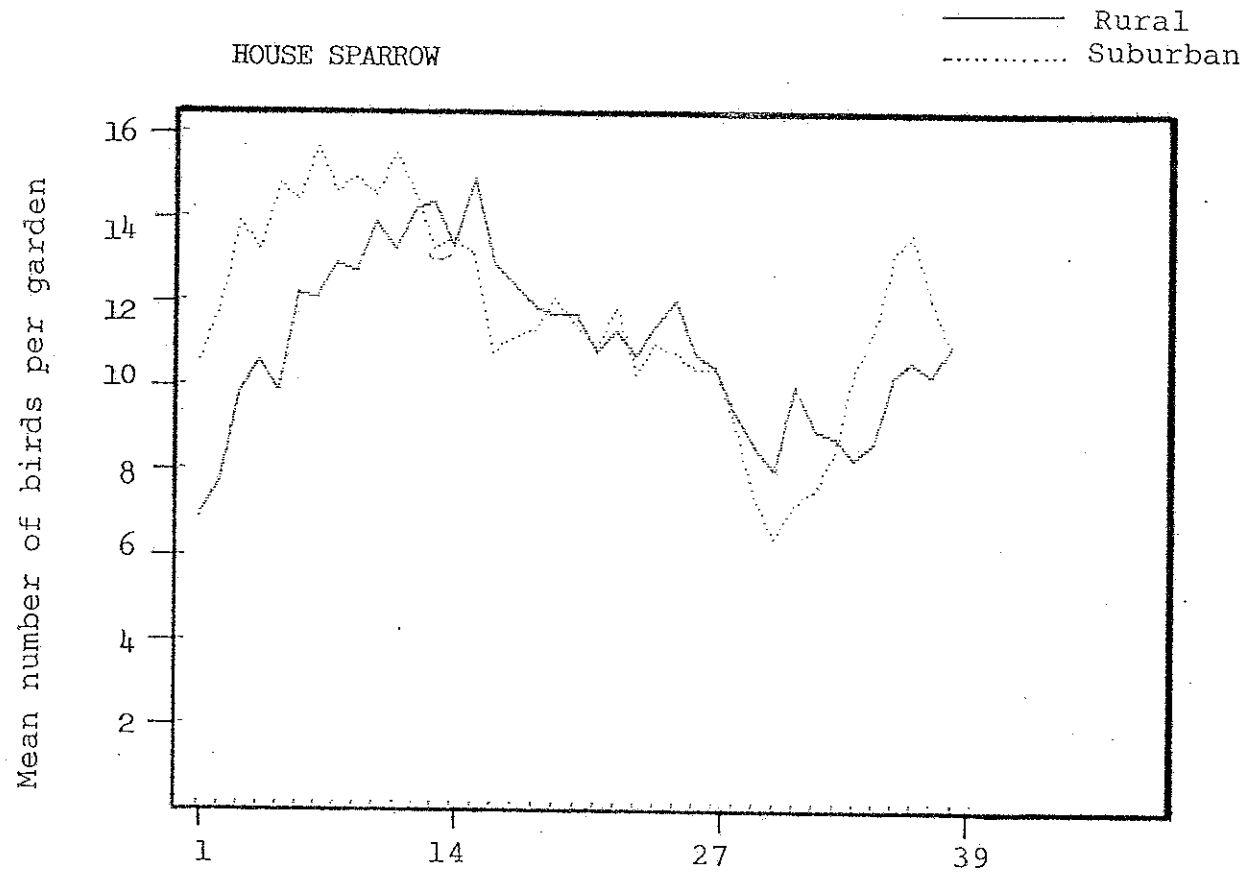

Rural
Suburban
GREAT TIT
Mean number of birds per garden
5
4
3
2
1
1
14
27
39
GREAT TIT
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.7.


HOUSE SPARROW
Rural
Suburban
Mean number of birds per garden
16
14
12
10
8
6
4
2
1
14
27
39

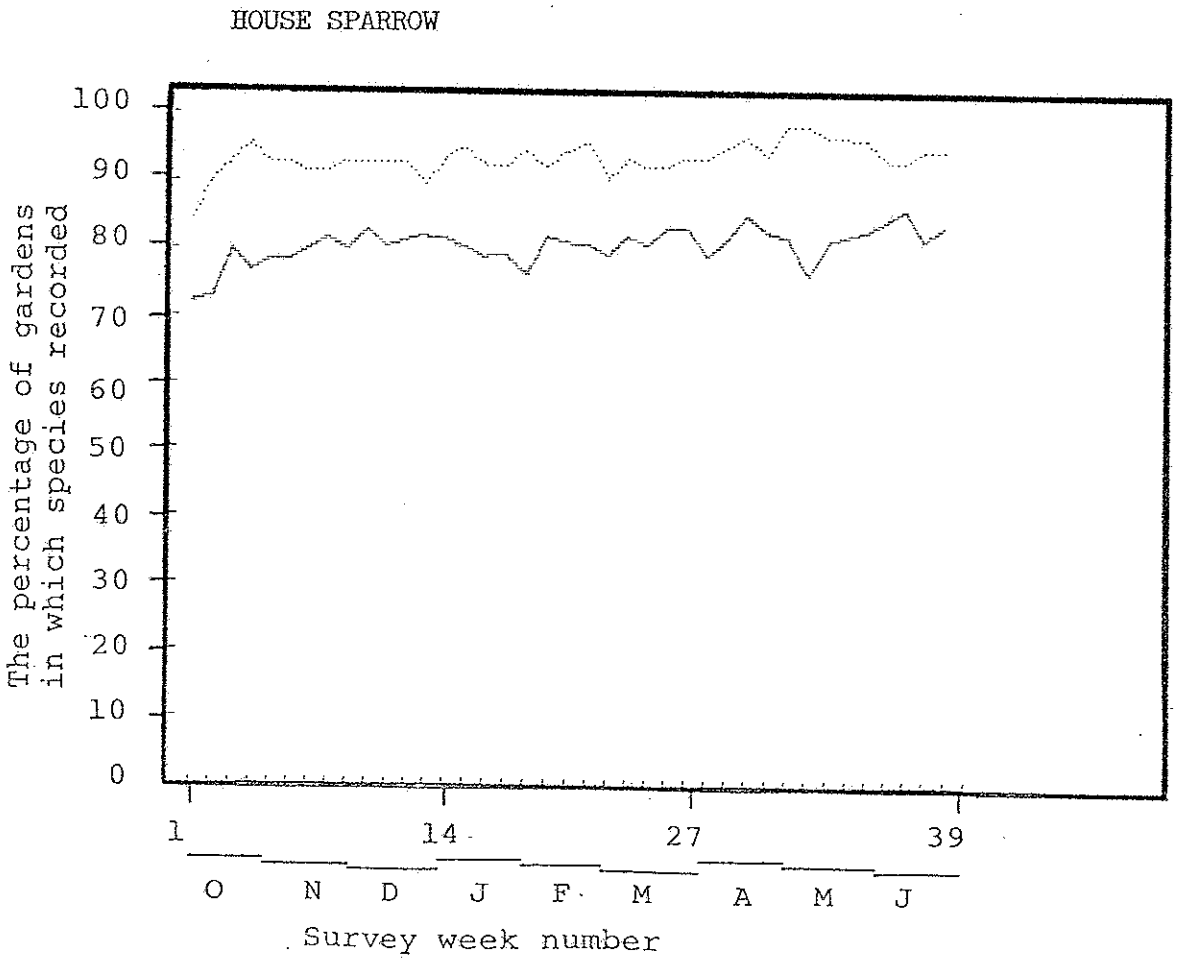
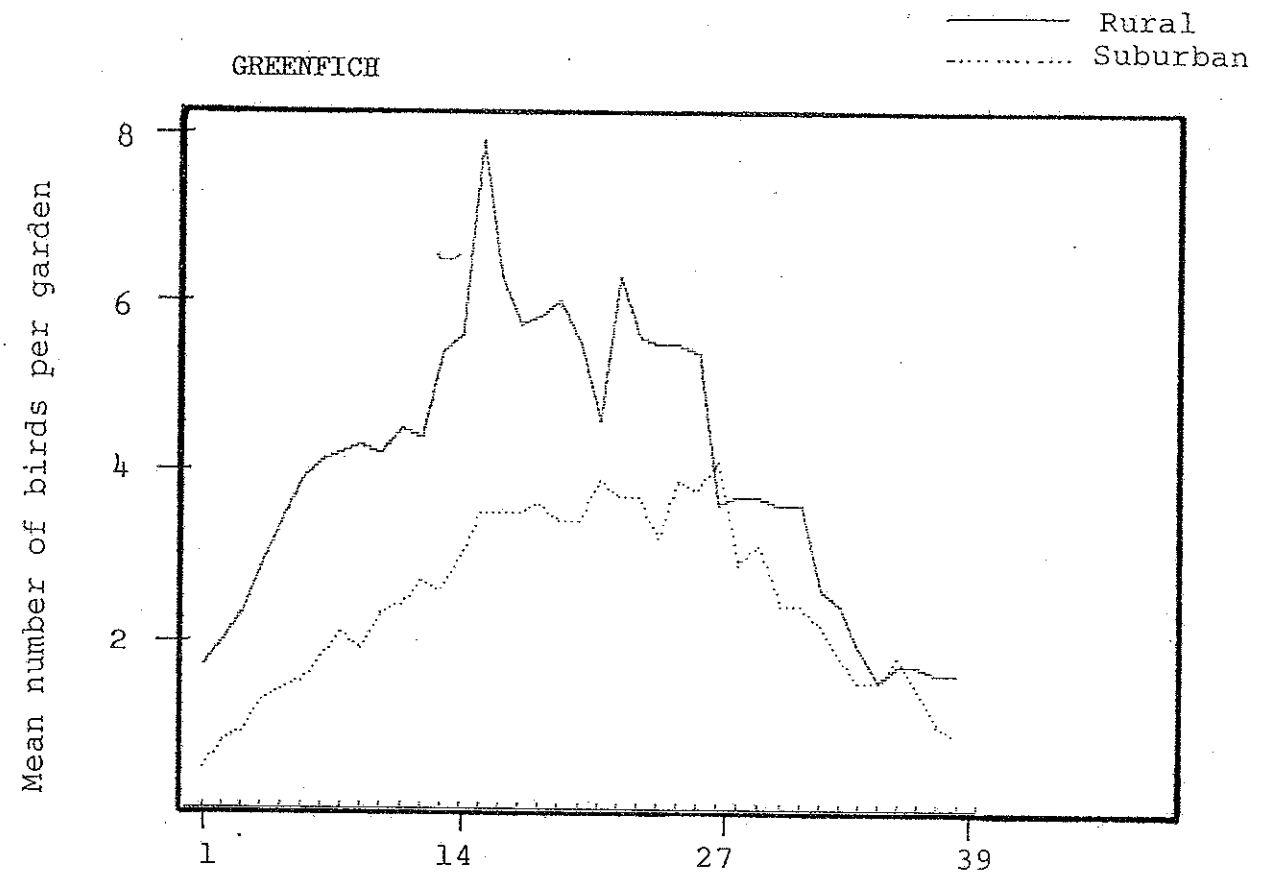

HOUSE SPARROW
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.8.


Rural
Suburban
GREENFICH
Mean number of birds per garden
8
6
4
2
1
14
27
39

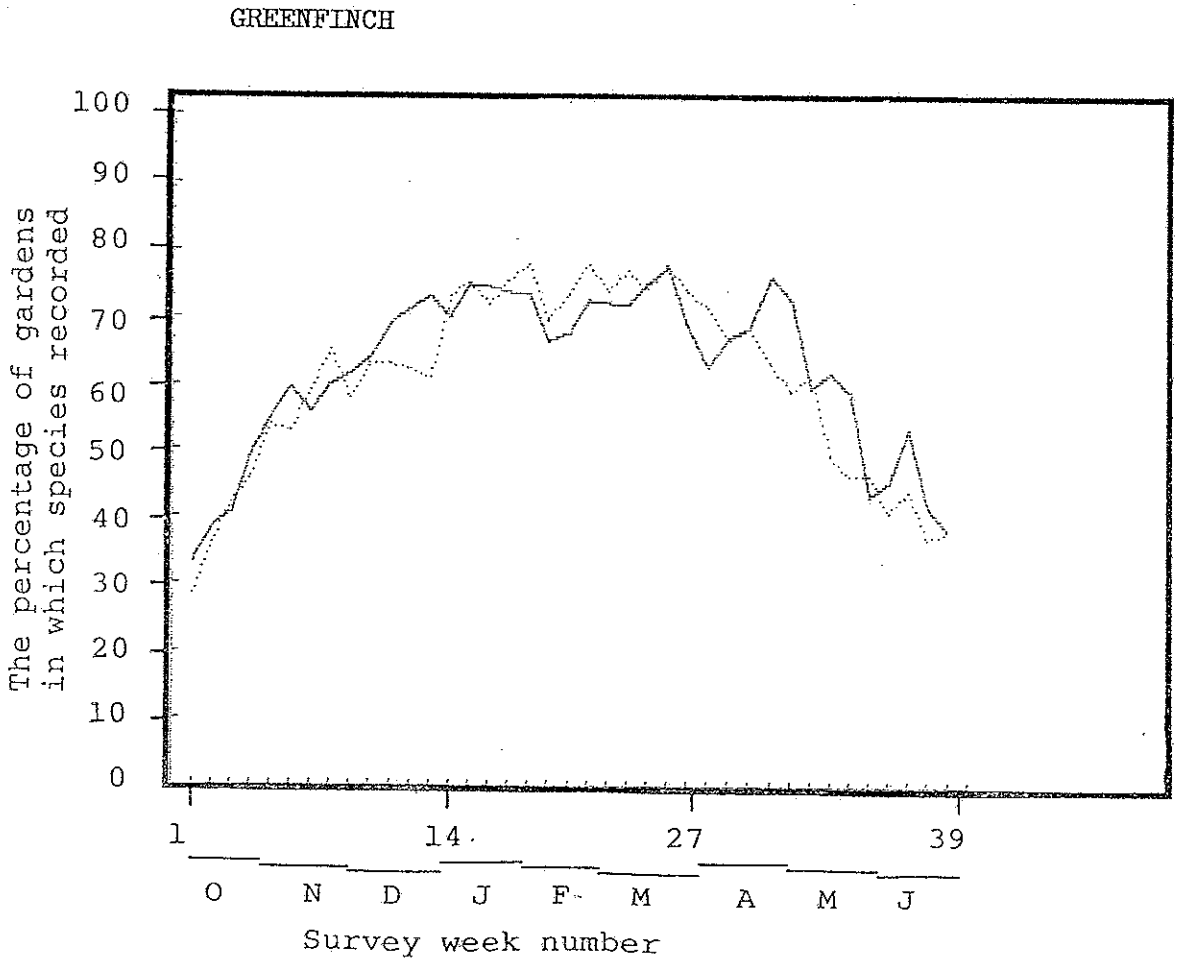
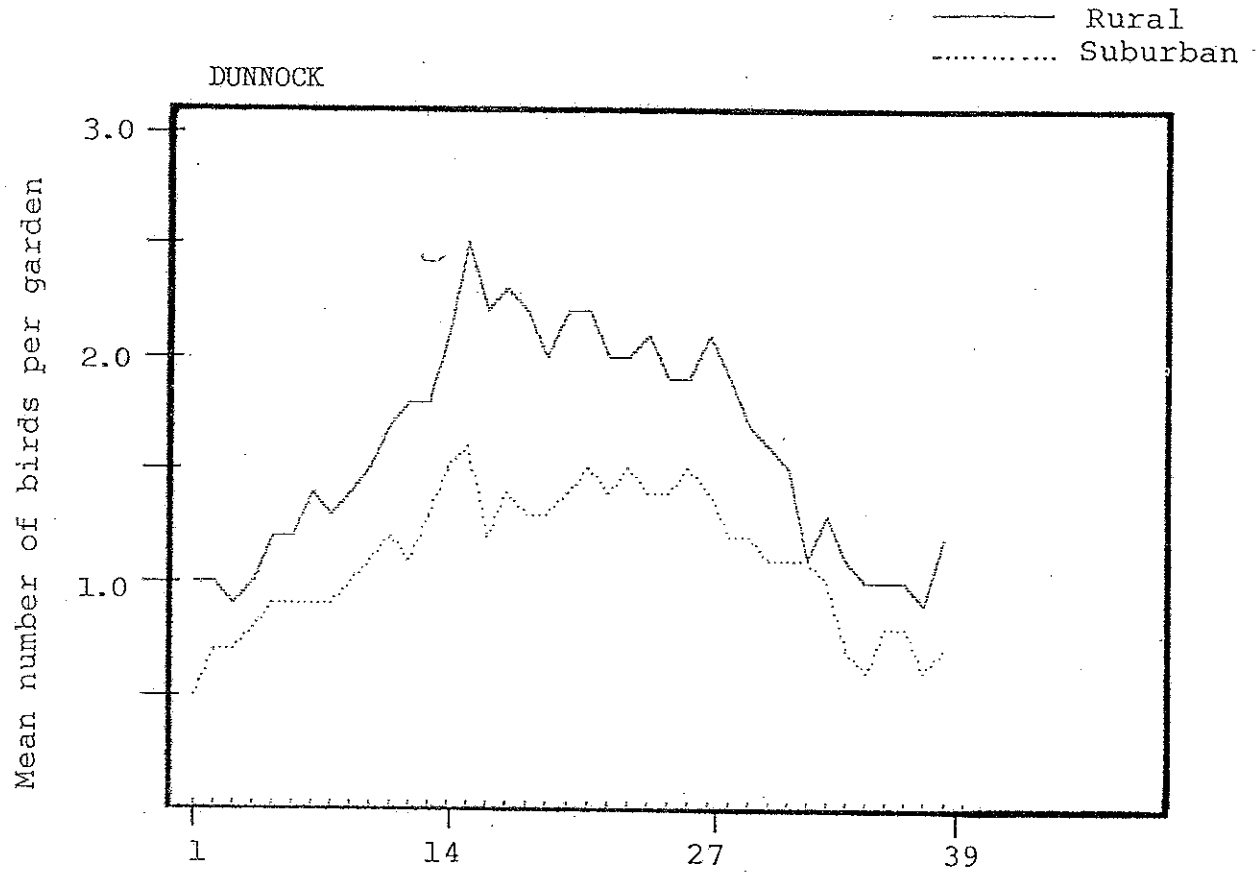

GREENFINCH
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.9.


Rural
Suburban
DUNNOCK
Mean number of birds per garden
3.0
2.0
1.0
1
14
27
39

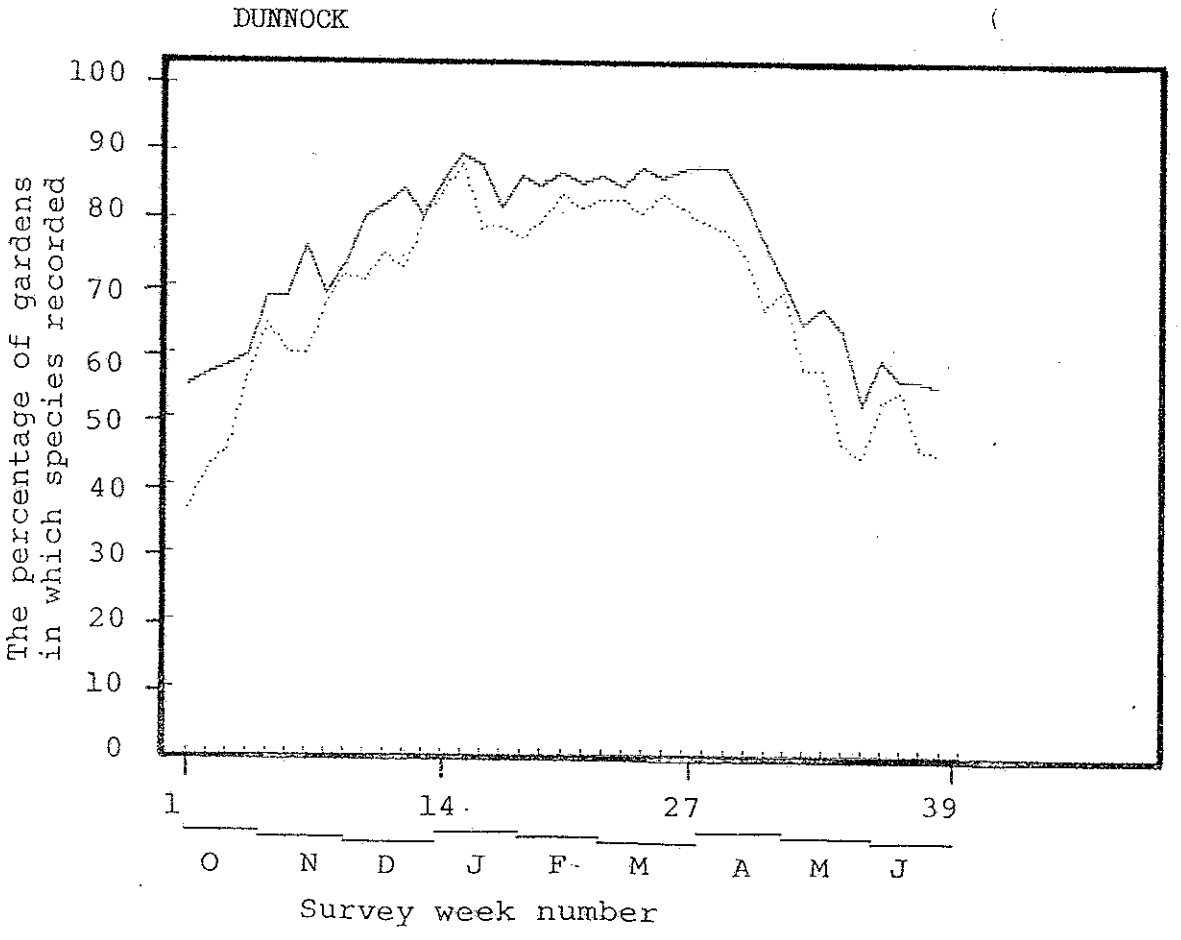
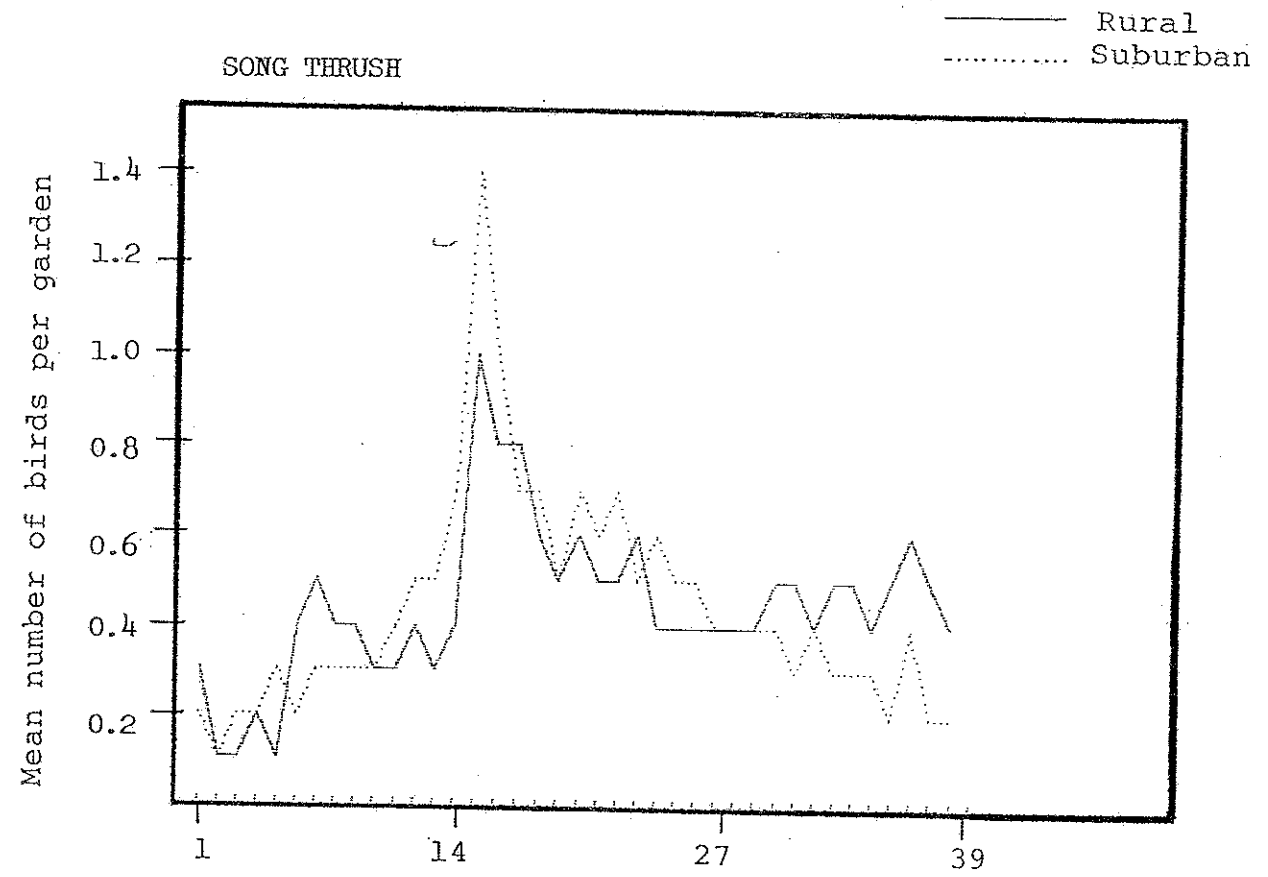

DUNNOCK
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.10.


Rural
Suburban
SONG THRUSH
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

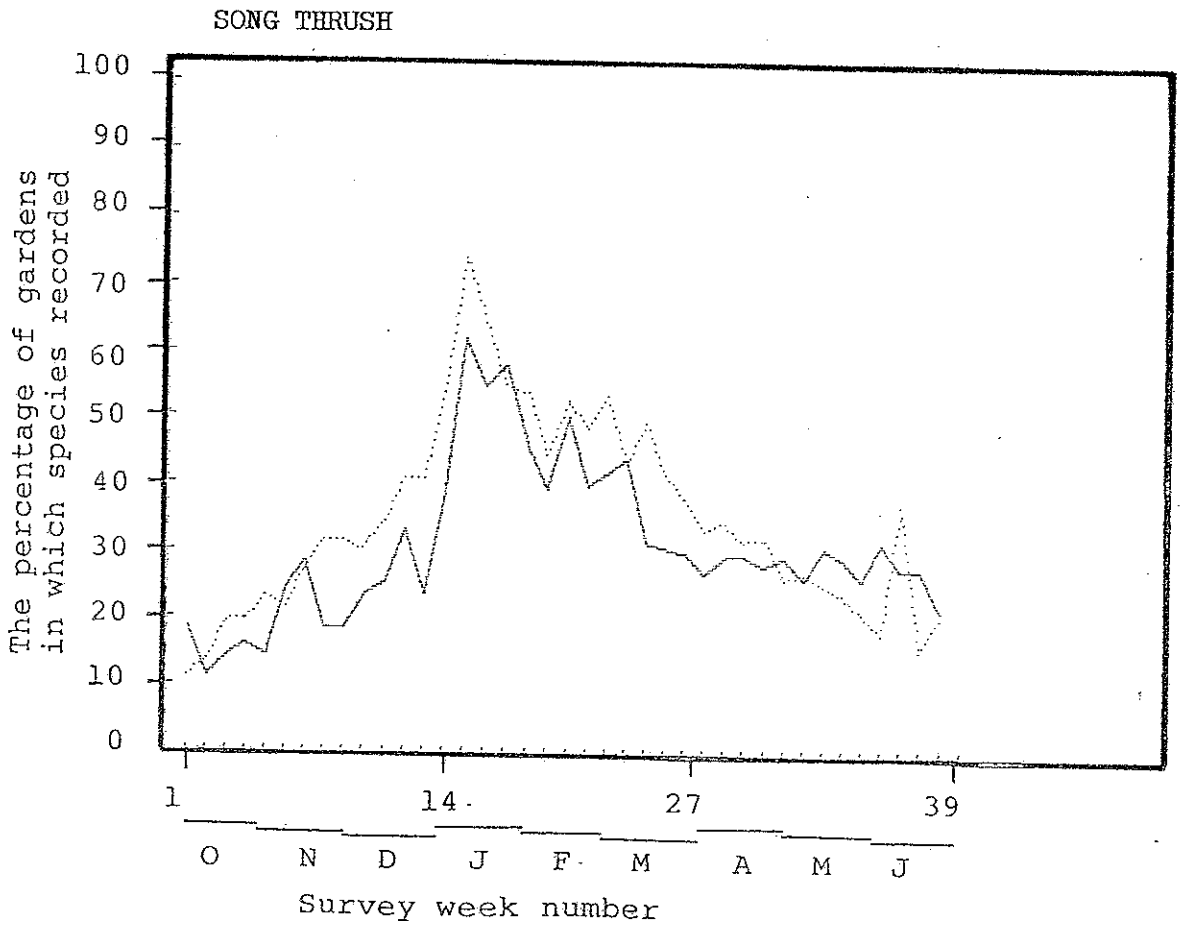
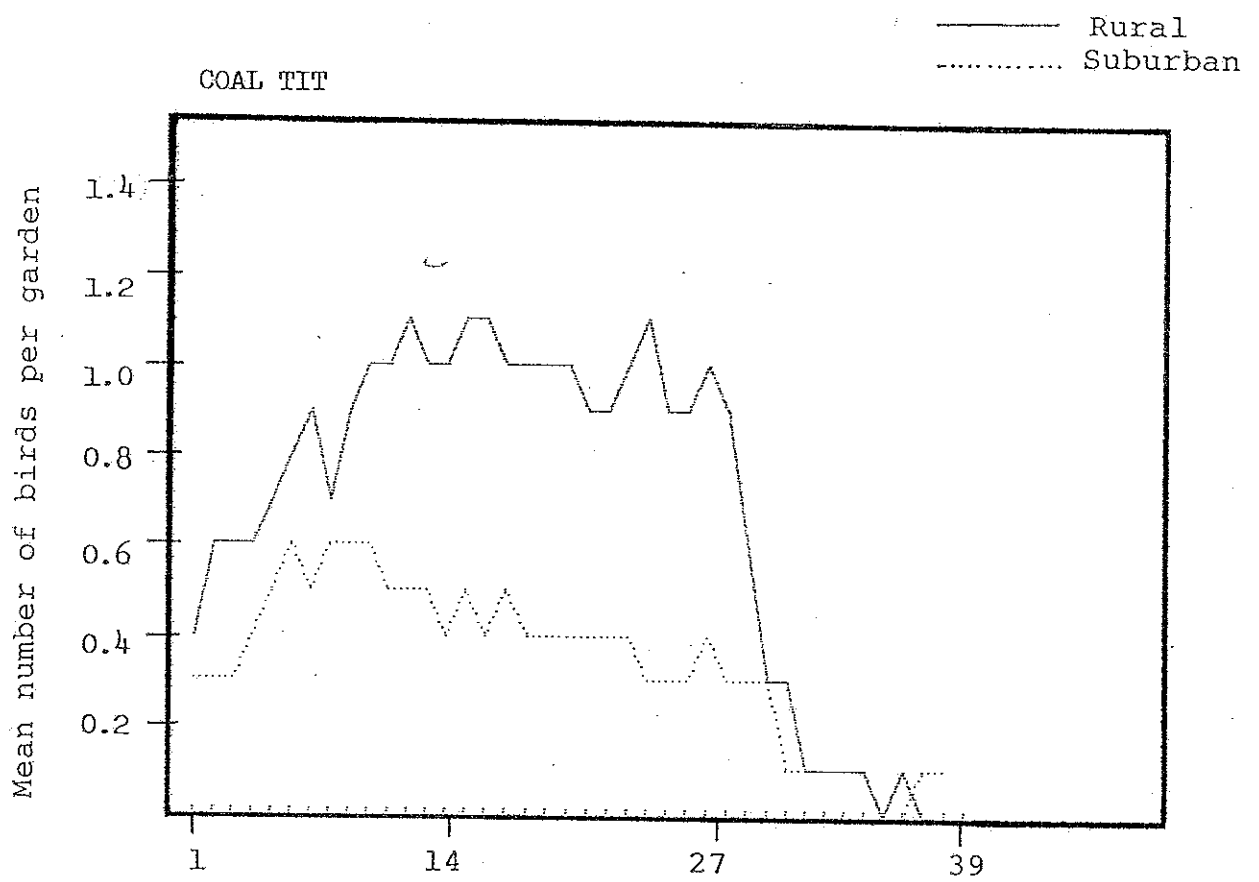

SONG THRUSH
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.11.


Rural
Suburban
COAL TIT
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

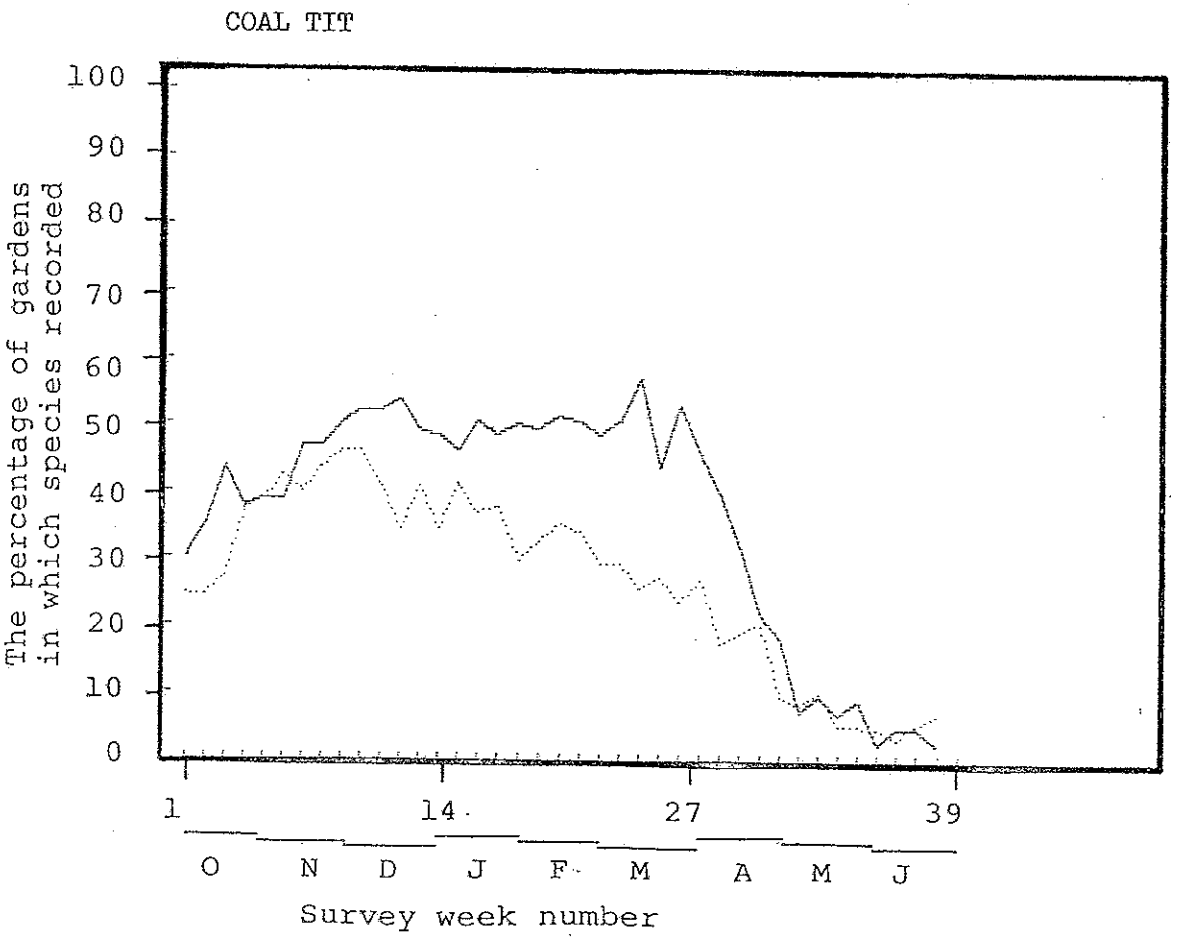
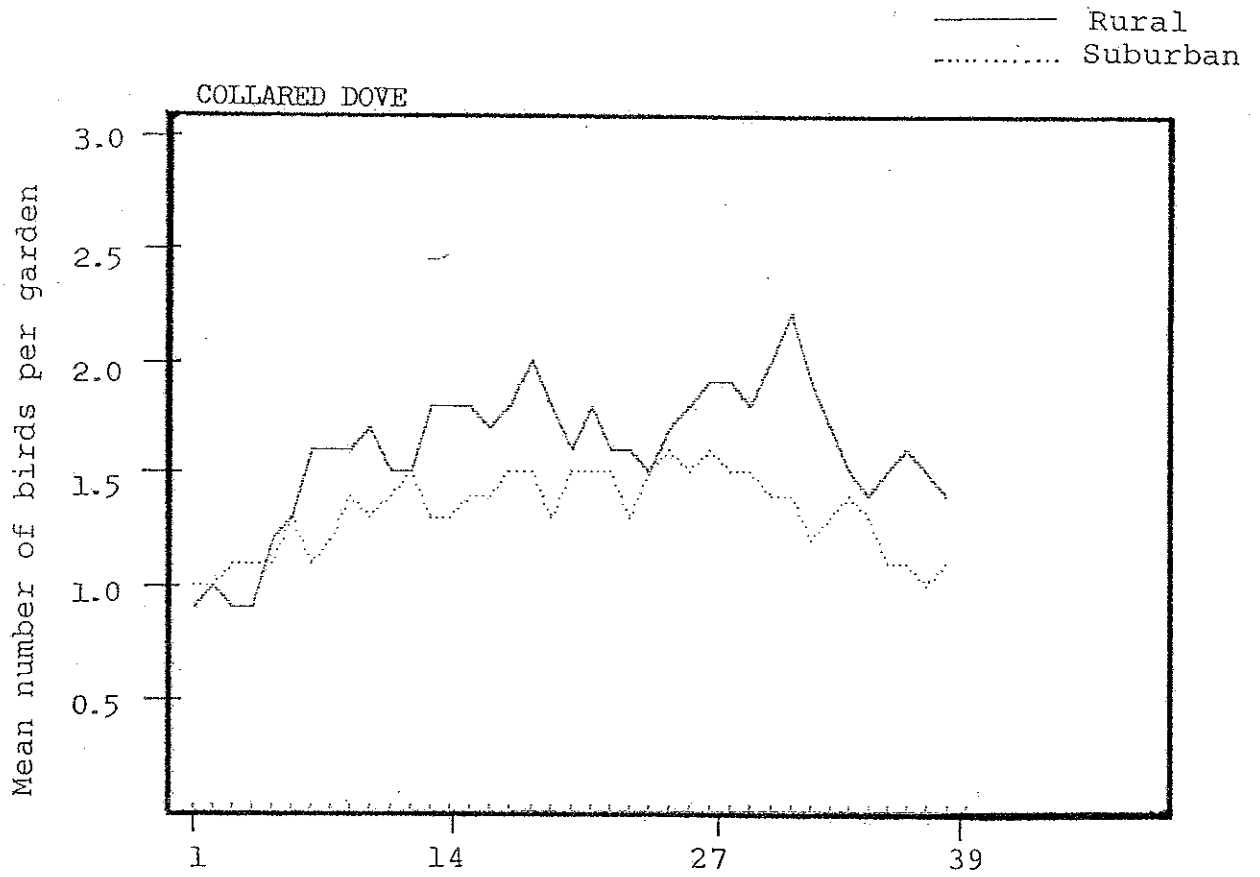

COAL TIT
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.12.


Rural
Suburban
COLLARED DOVE
Mean number of birds per garden
3.0
2.5
2.0
1.5
1.0
0.5
1
14
27
39

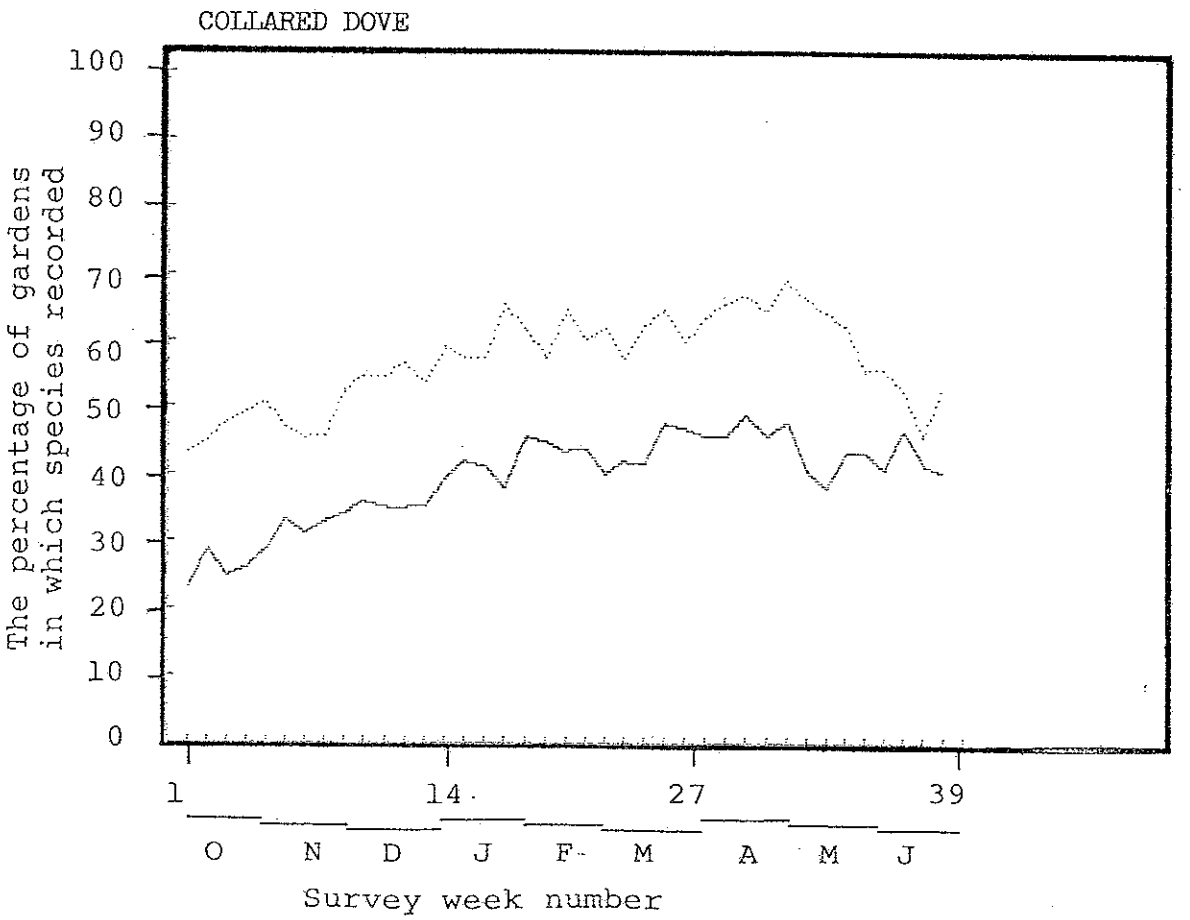
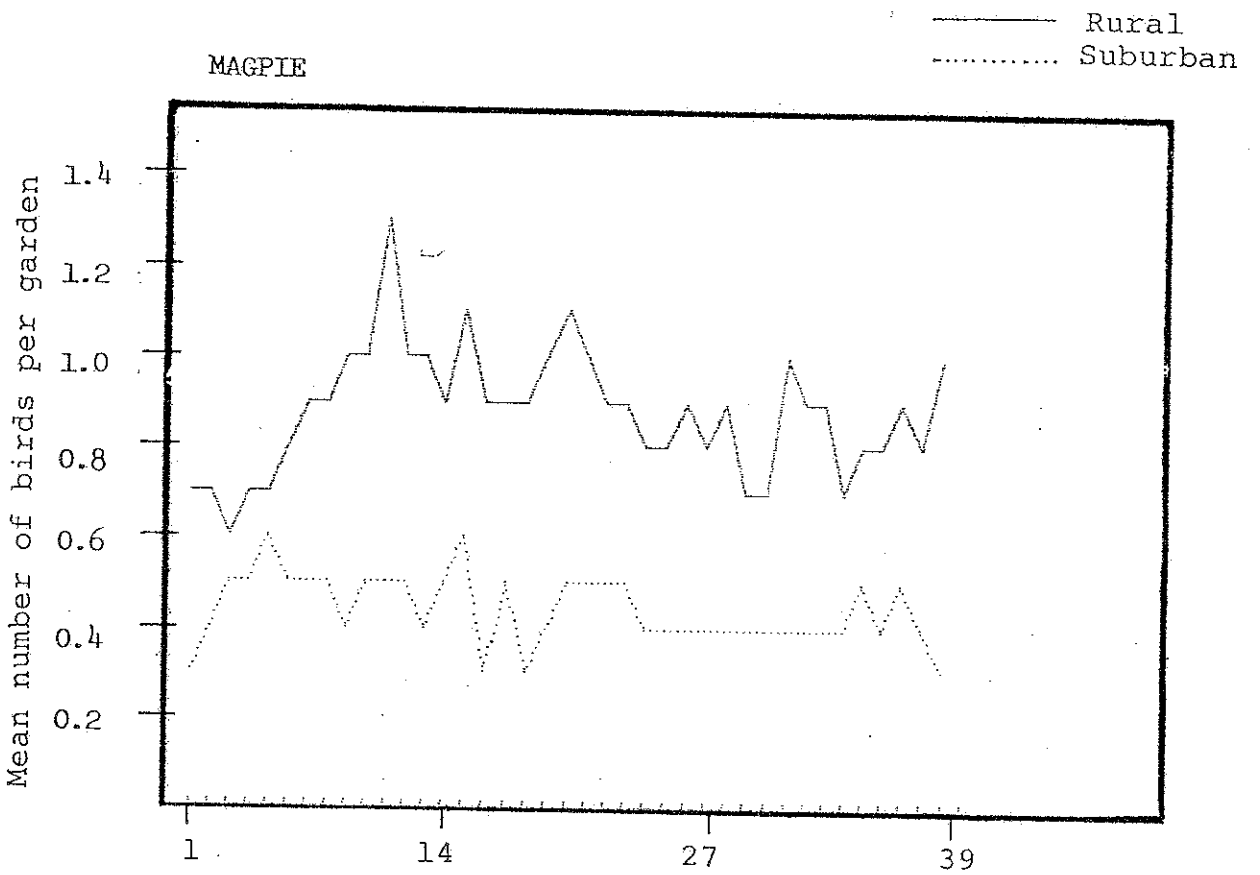

COLLARED DOVE
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.13.


Rural
Suburban
MAGPIE
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

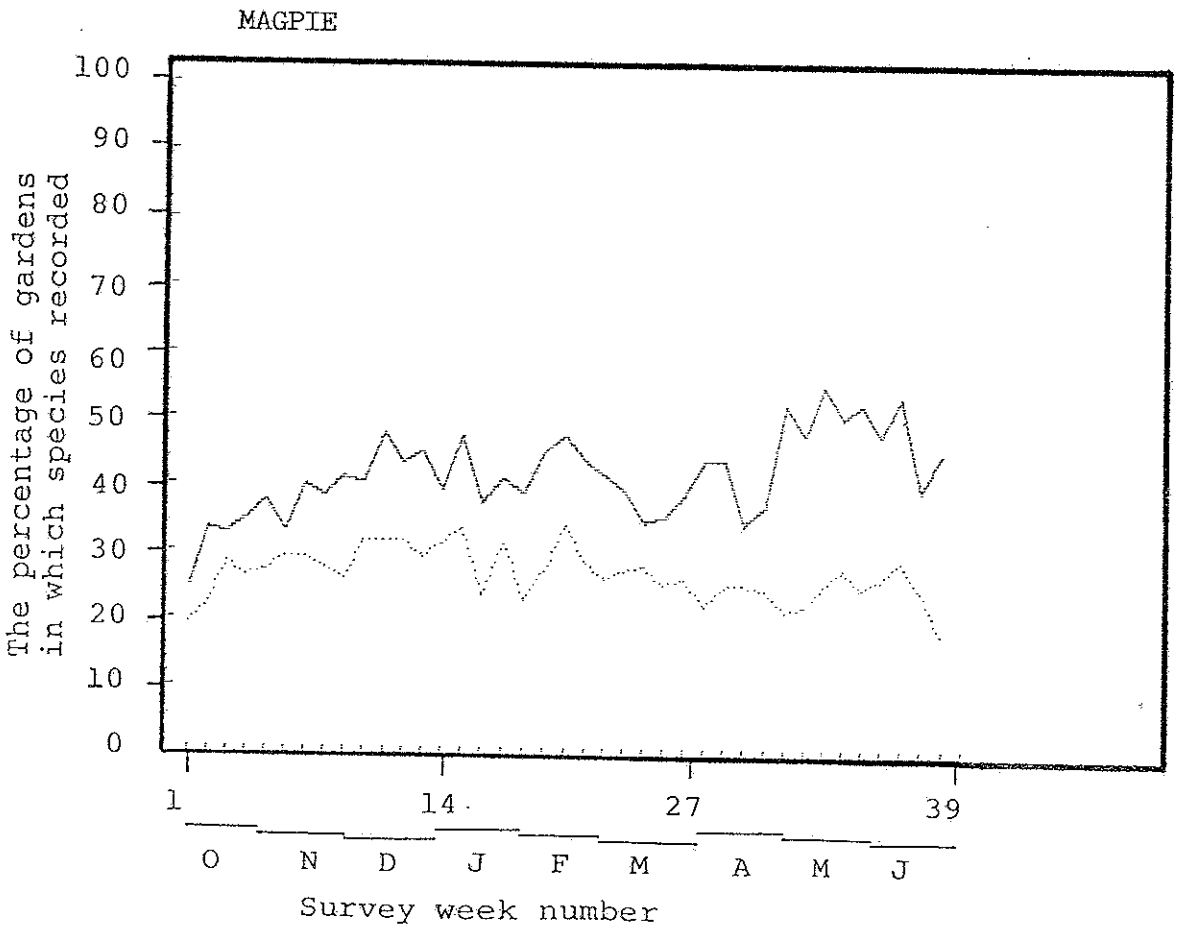
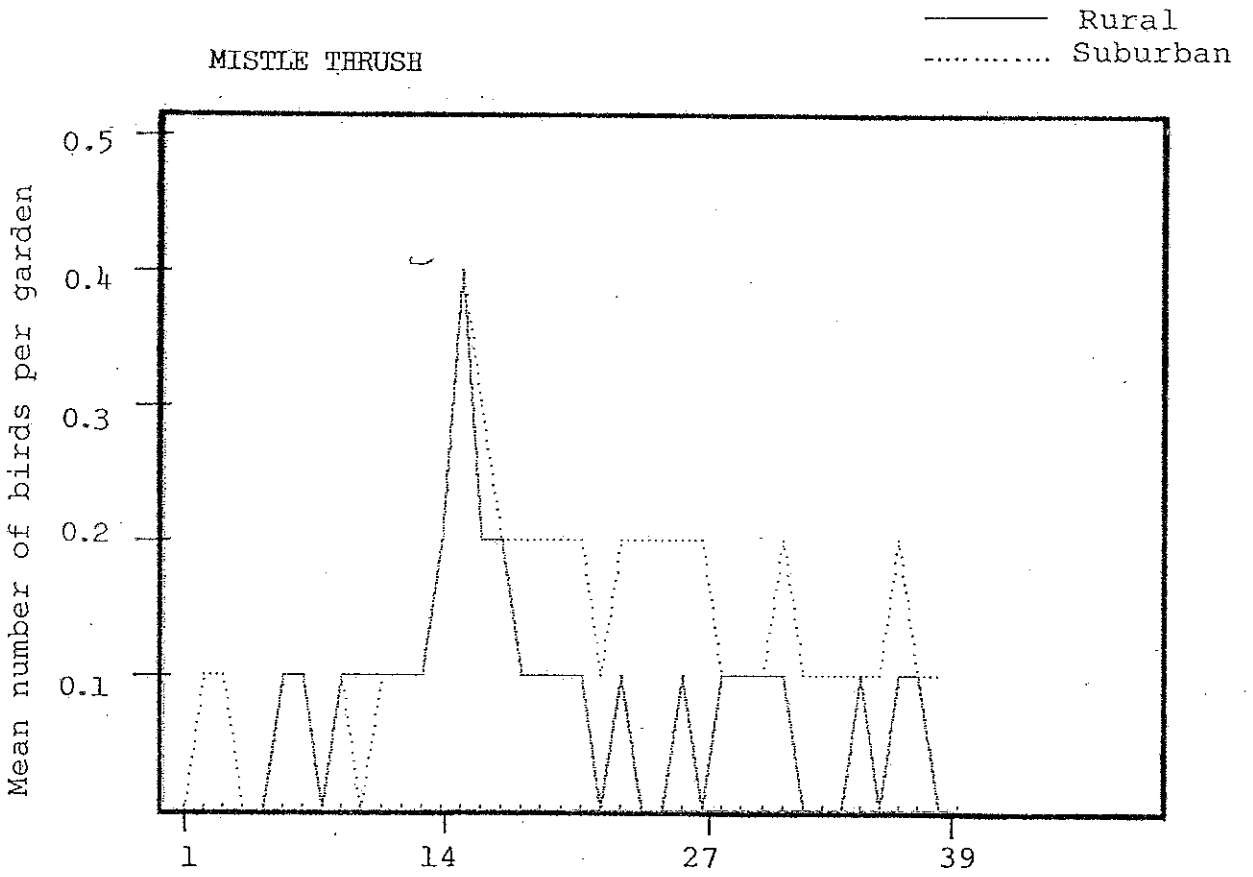

MAGPIE
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.14.


Rural
Suburban
MISTLE THRUSH
Mean number of birds per garden
0.5
0.4
0.3
0.2
0.1
1
14
27
39

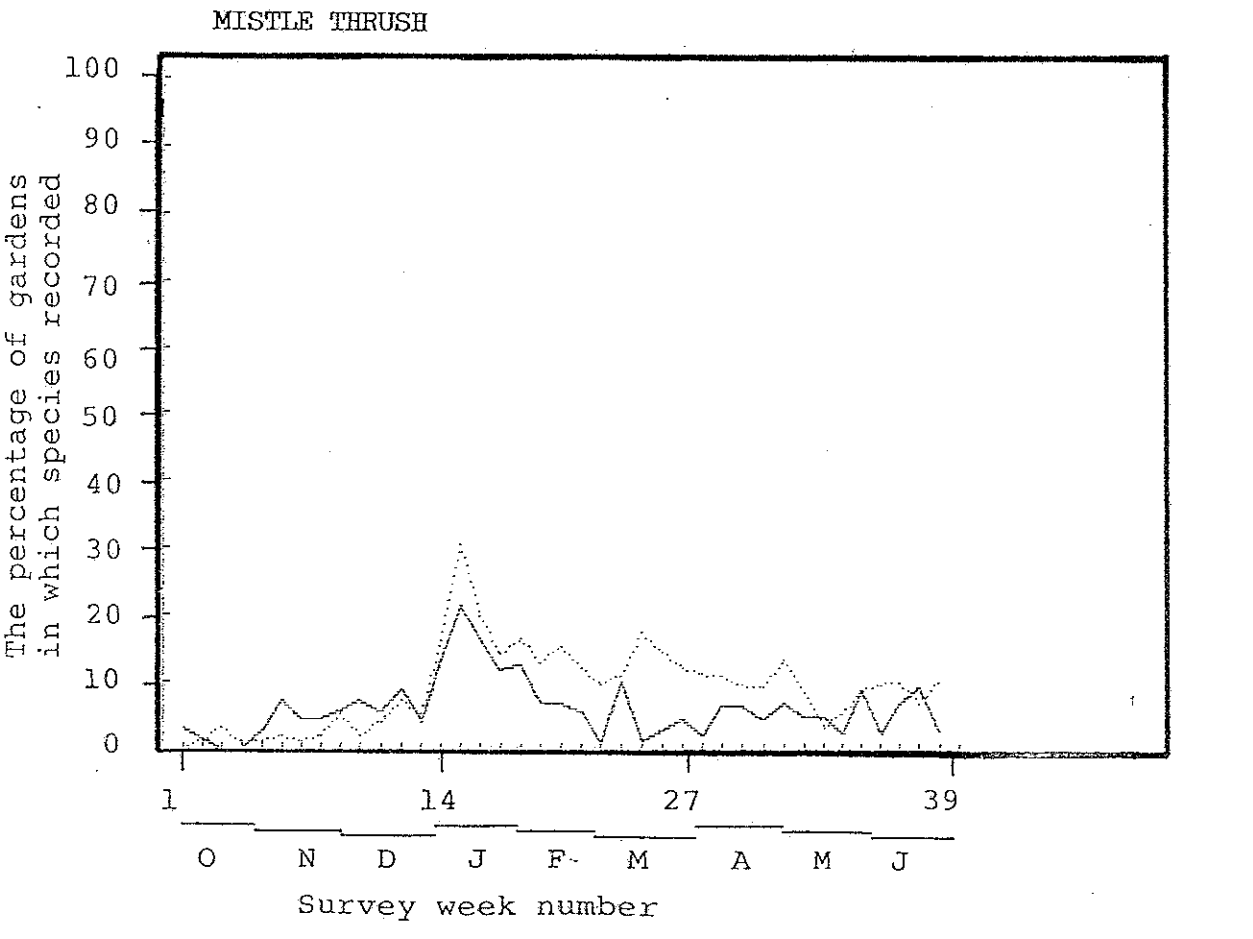
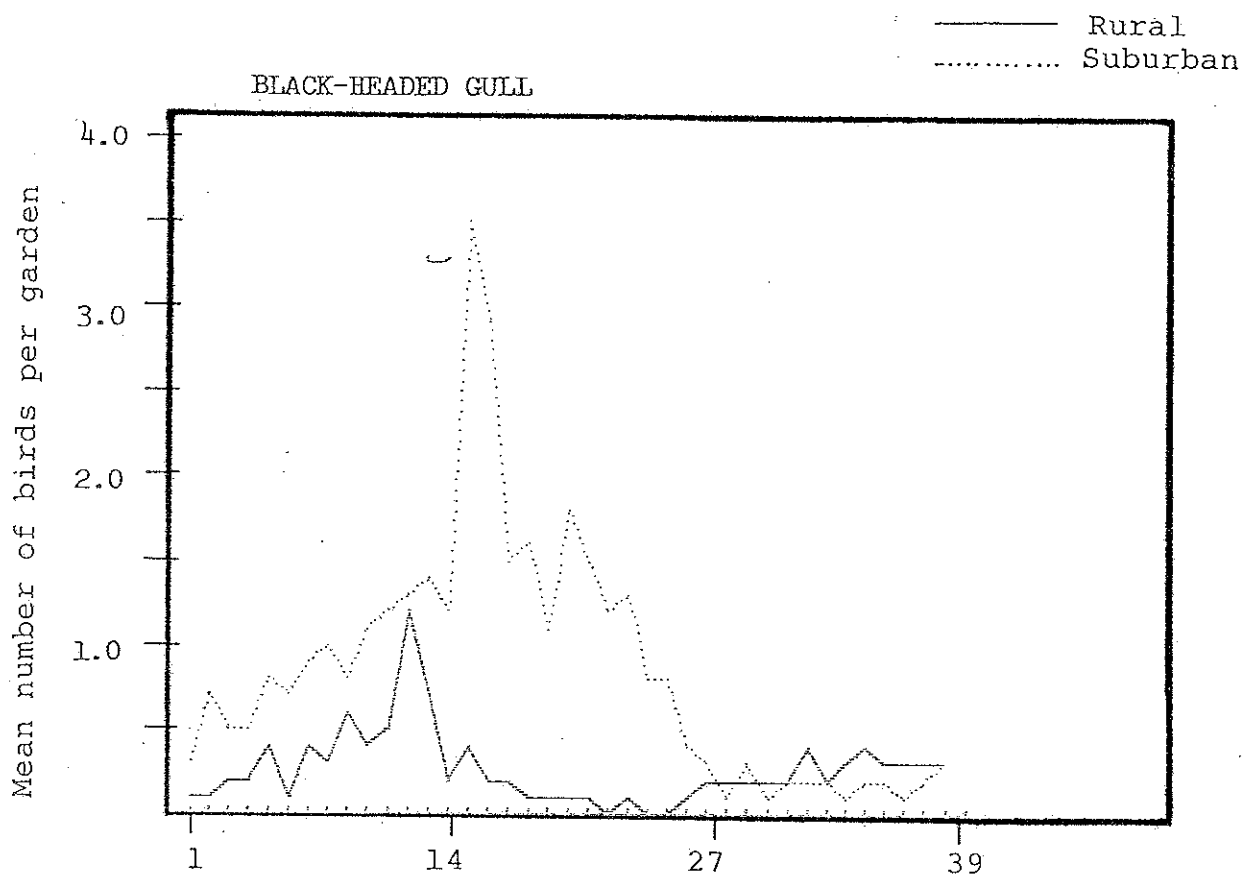

MISTLE THRUSH
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.15.


Rural
Suburban
BLACK-HEADED GULL
Mean number of birds per garden
4.0
3.0
2.0
1.0
1
14
27
39

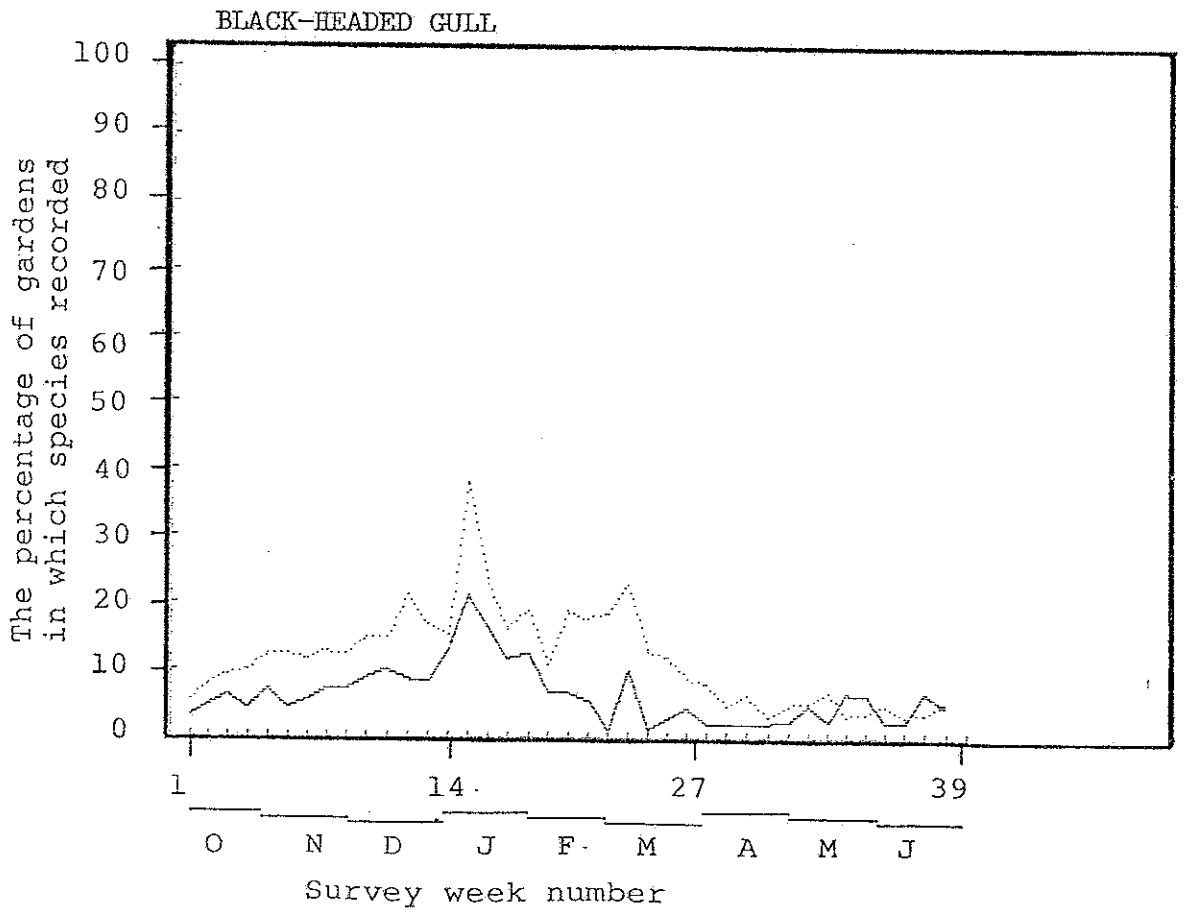
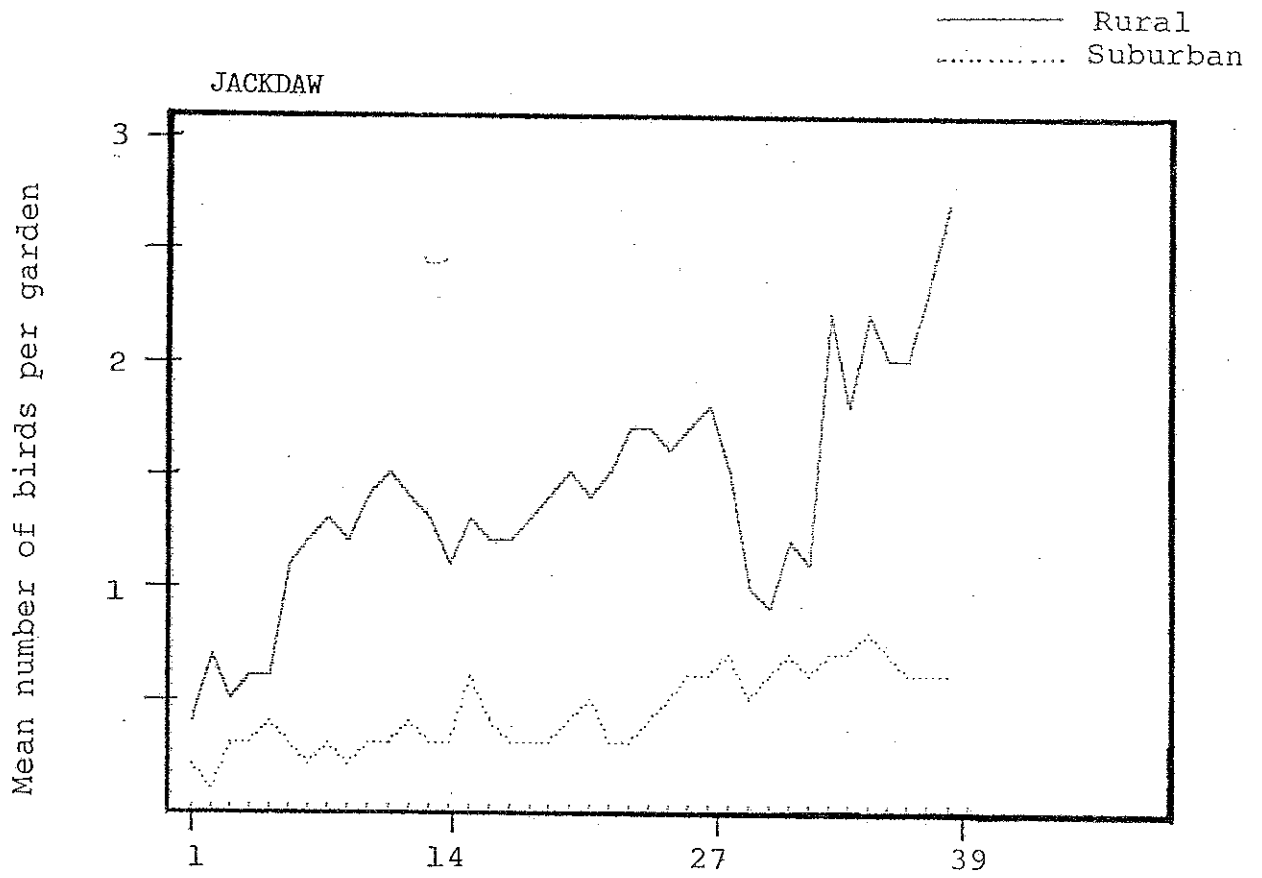

BLACK-HEADED GULL
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.16.


Rural
Suburban
JACKDAW
Mean number of birds per garden
3
2
1
1
14
27
39

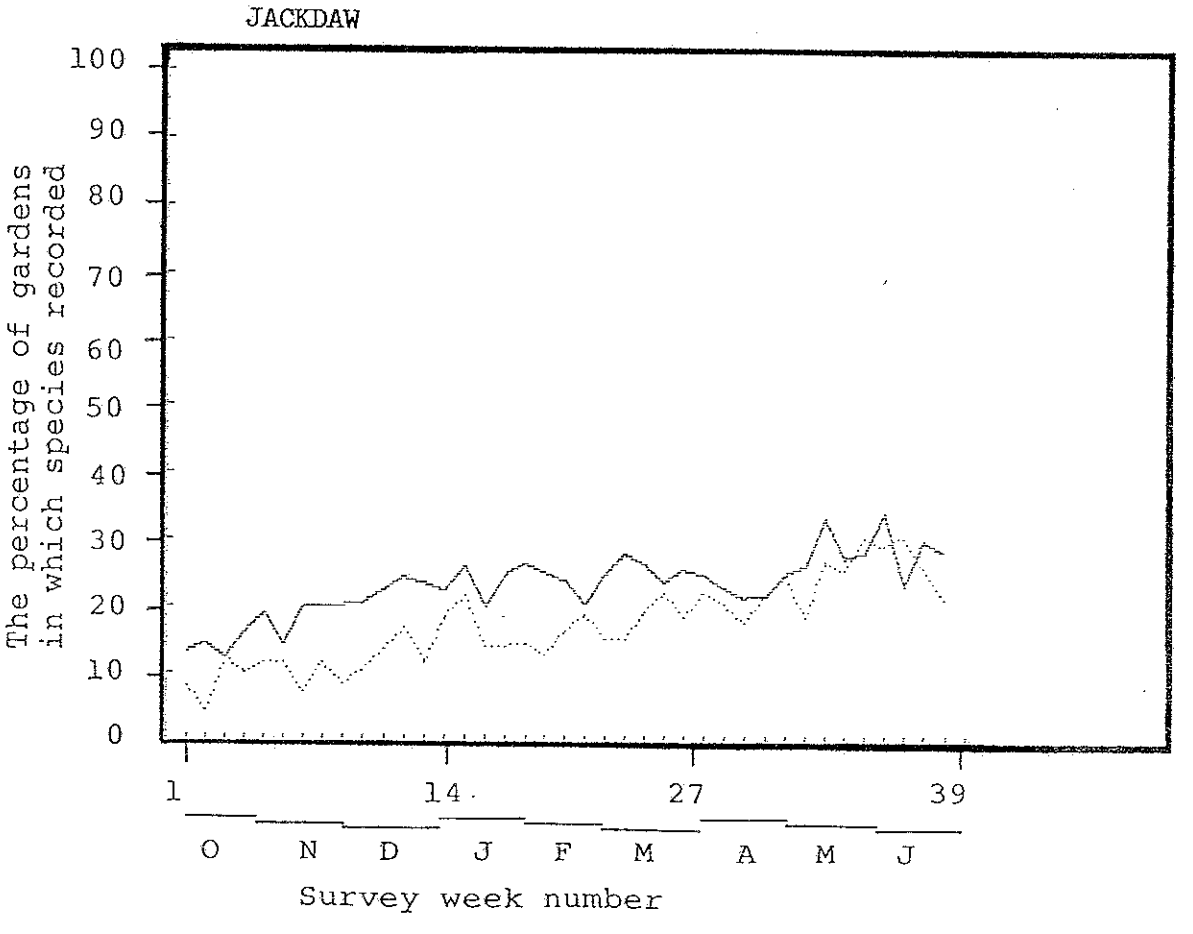
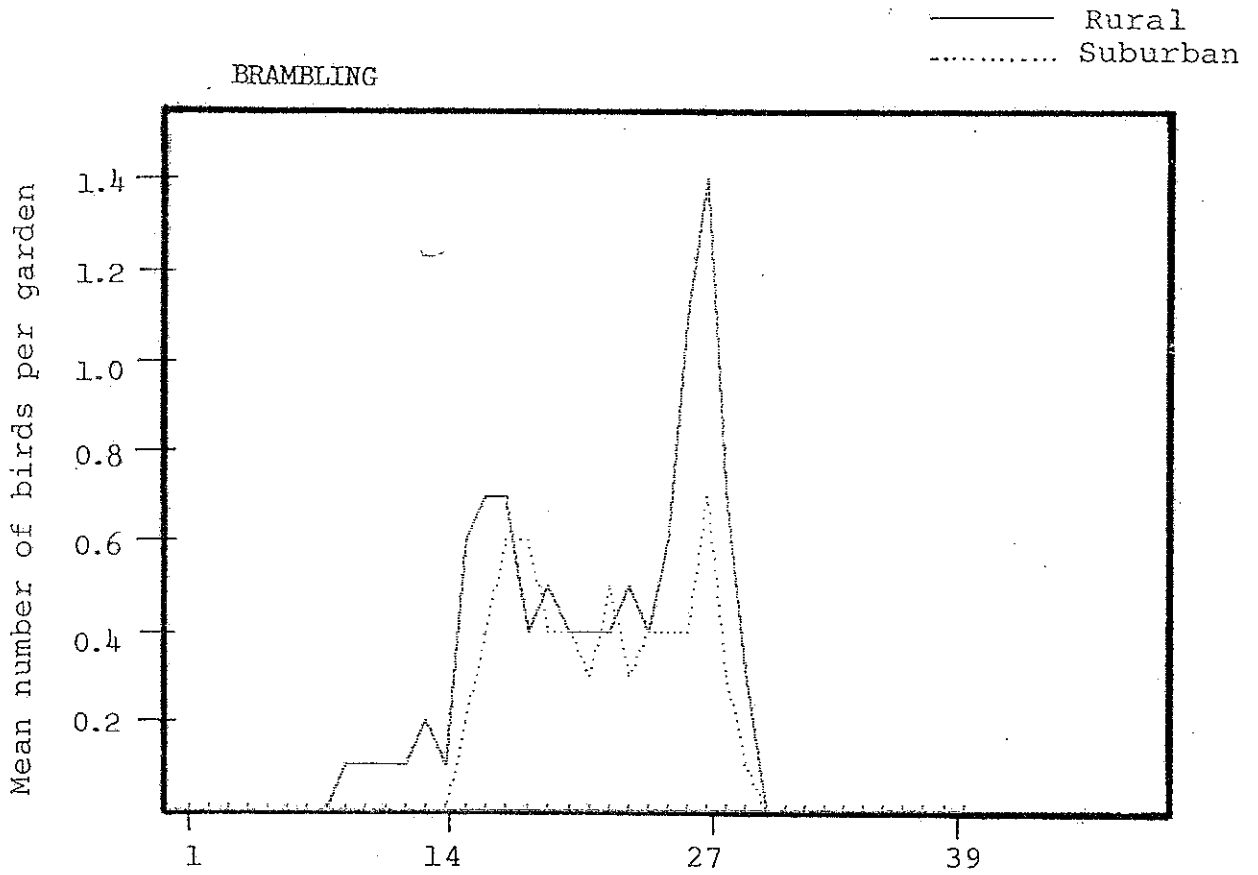

JACKDAW
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.17.


Rural
Suburban
BRAMBLING
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

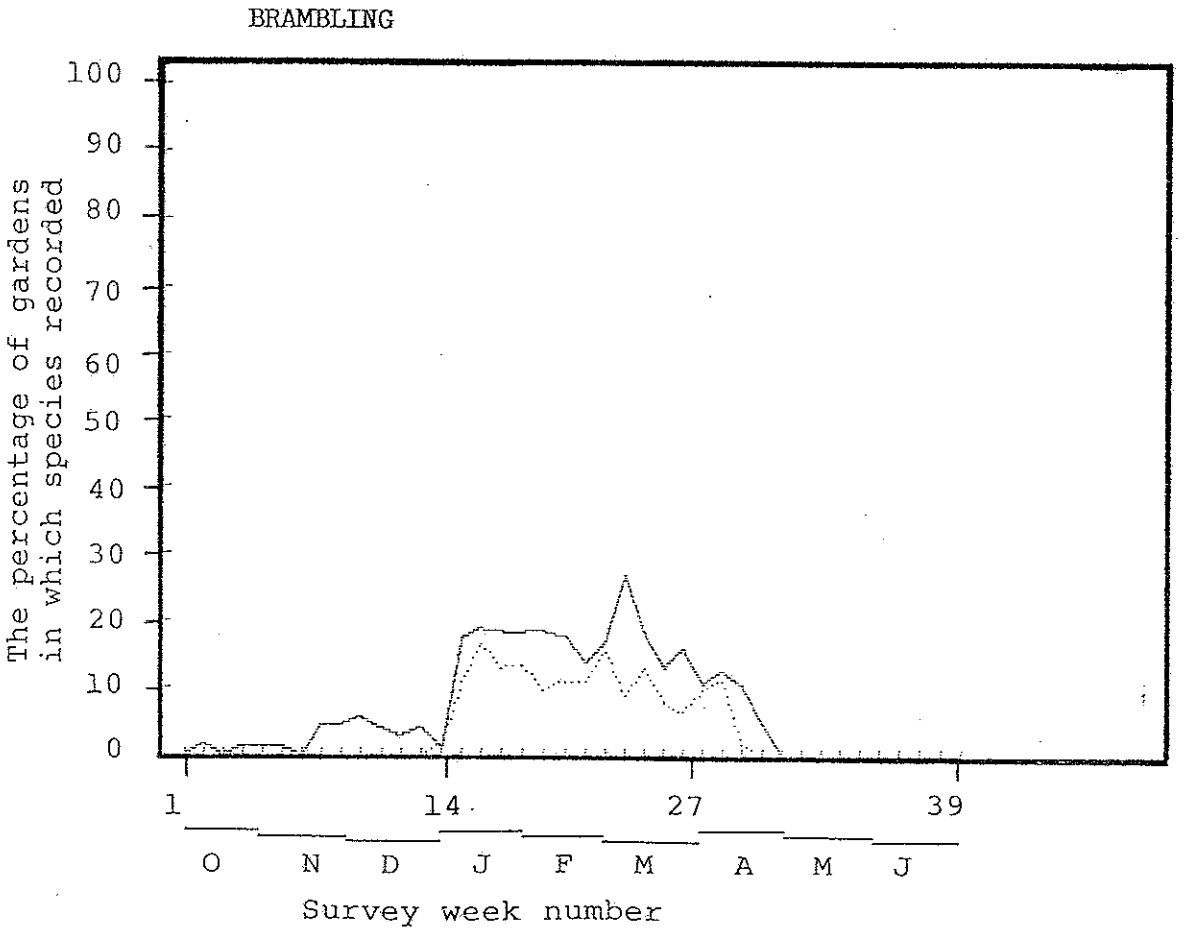
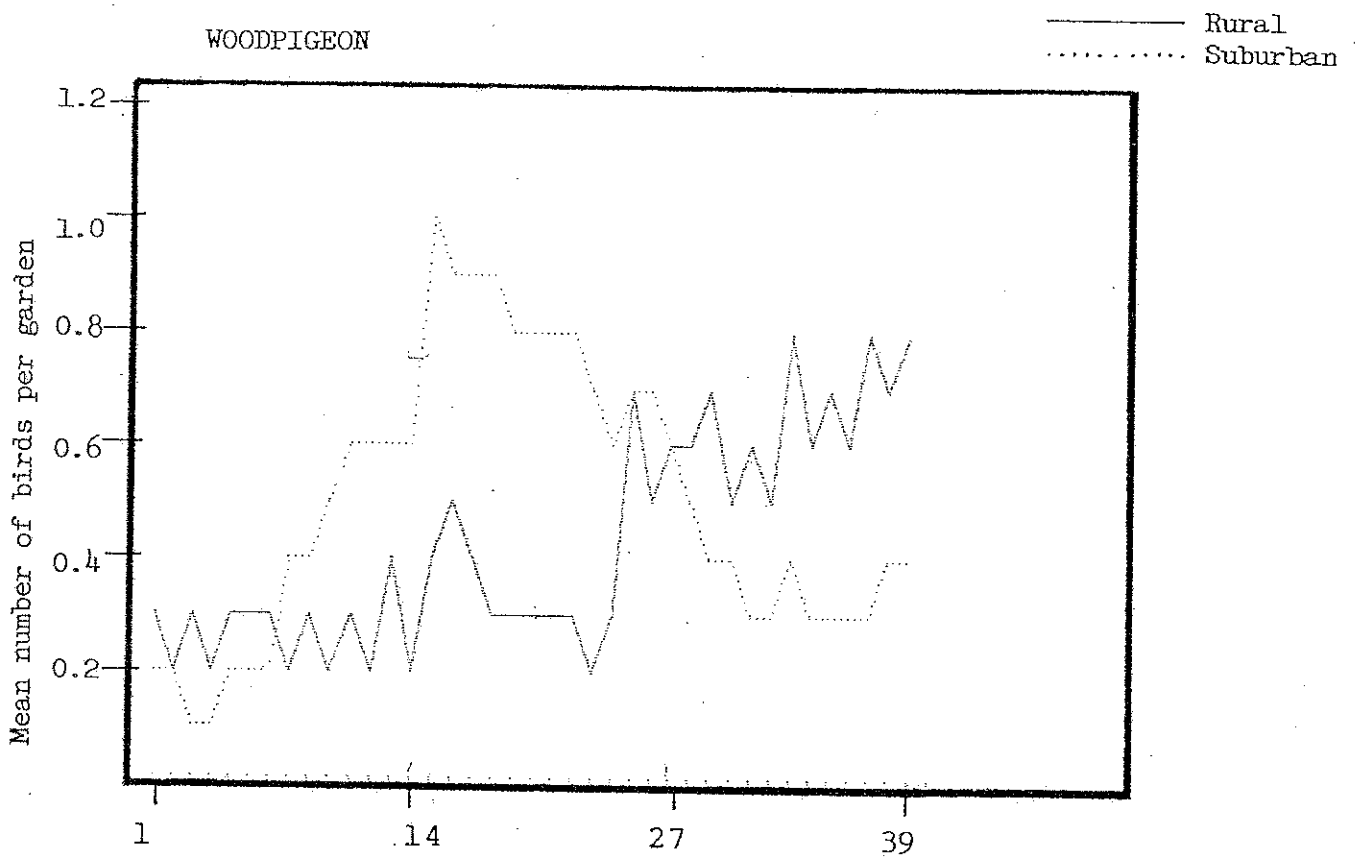

BRAMBLING
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.18.


WOODPIGEON
Rural
Suburban
Mean number of birds per garden
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

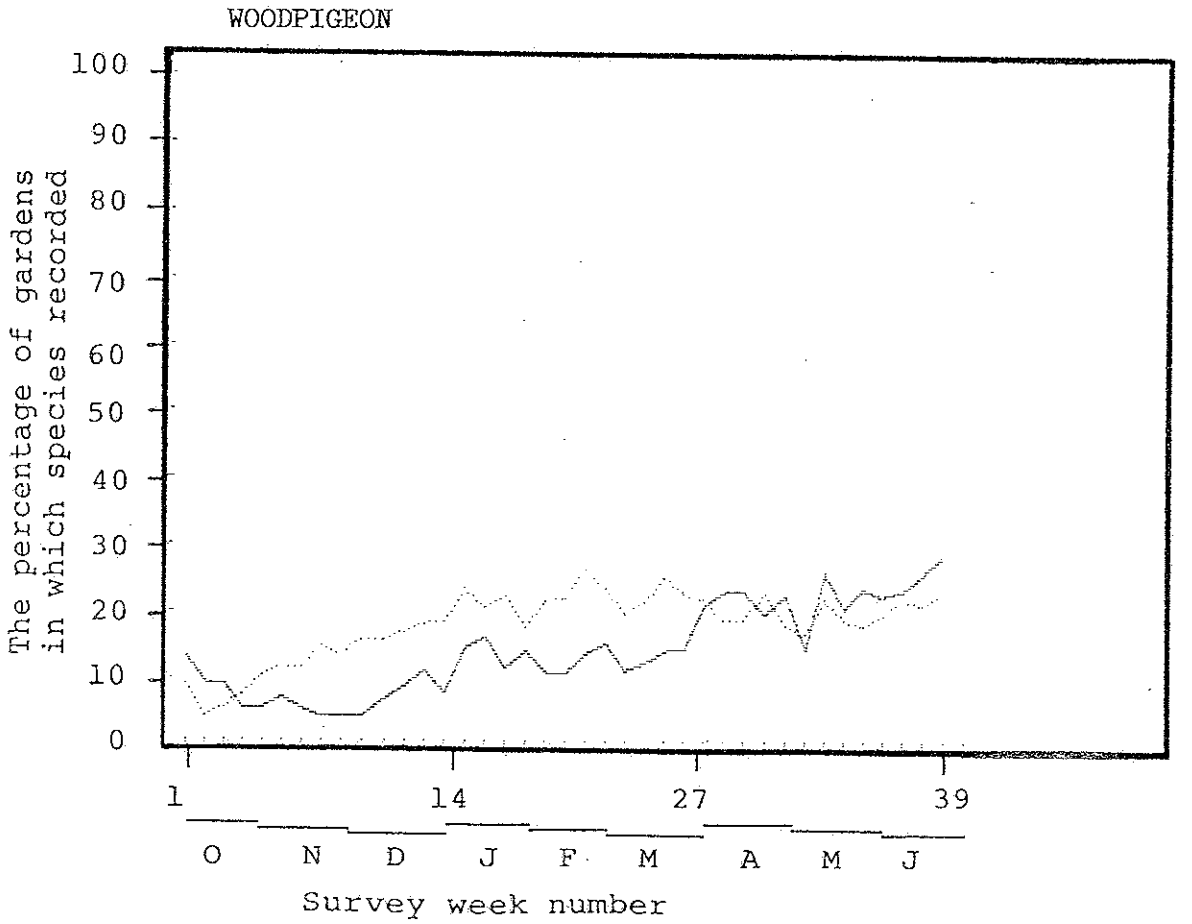
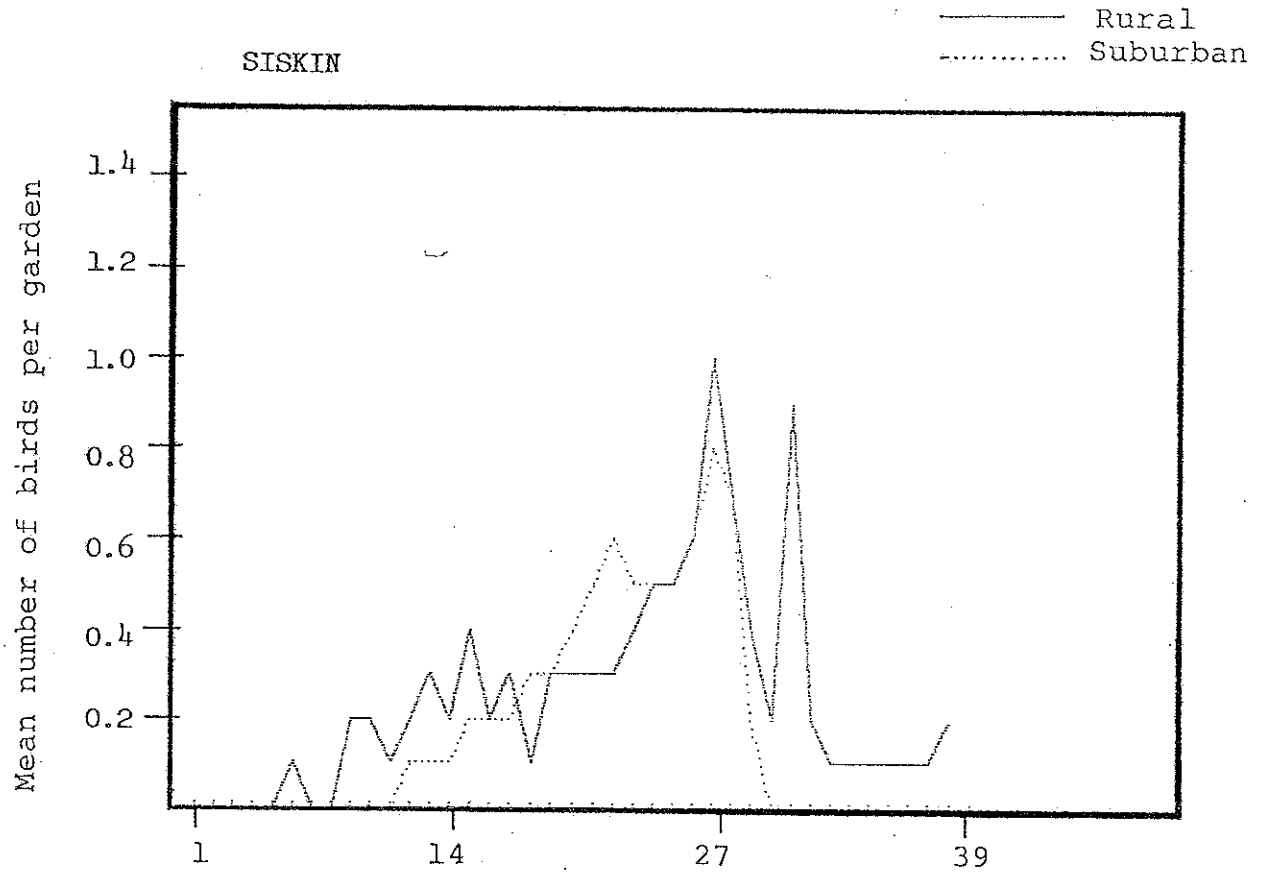

WOODPIGEON
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.19.


Rural
Suburban
SISKIN
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

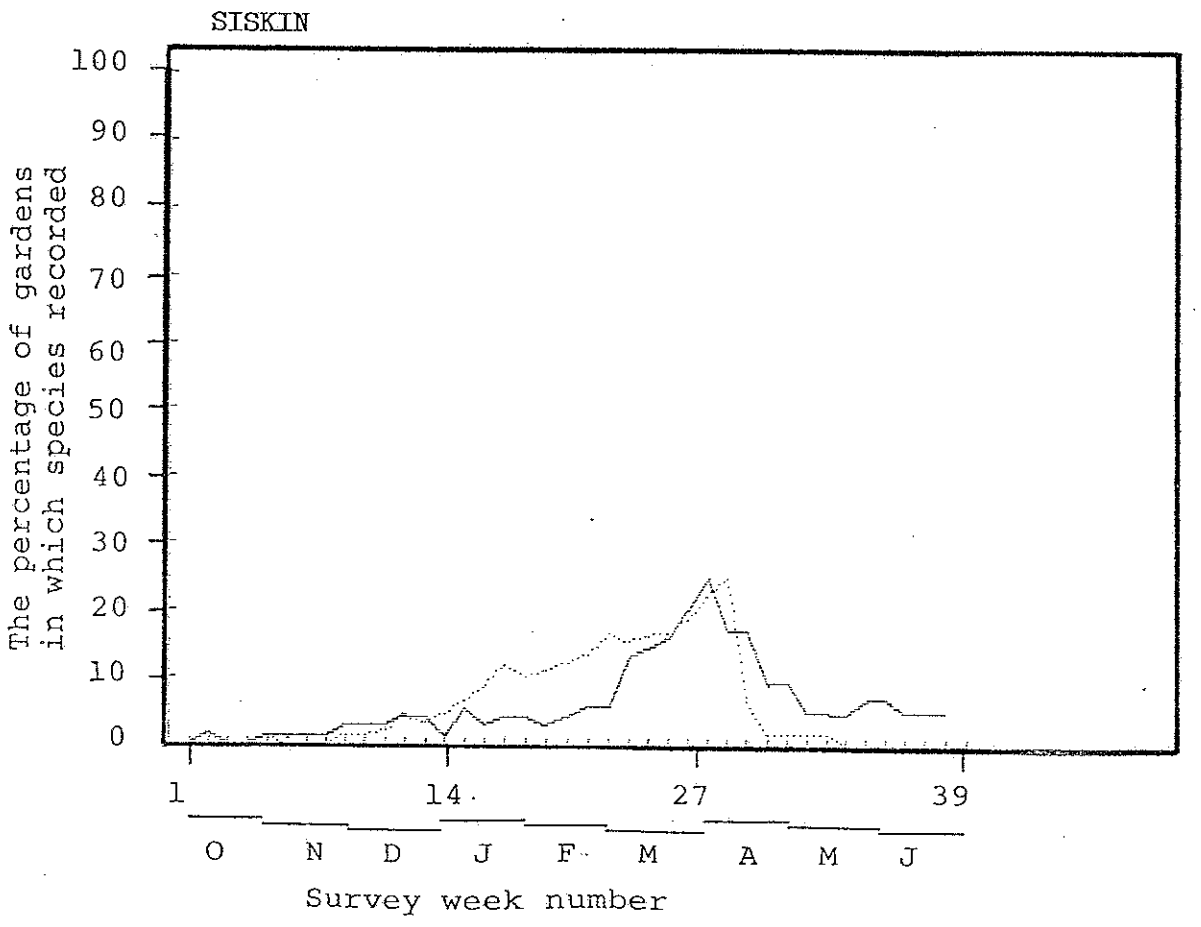
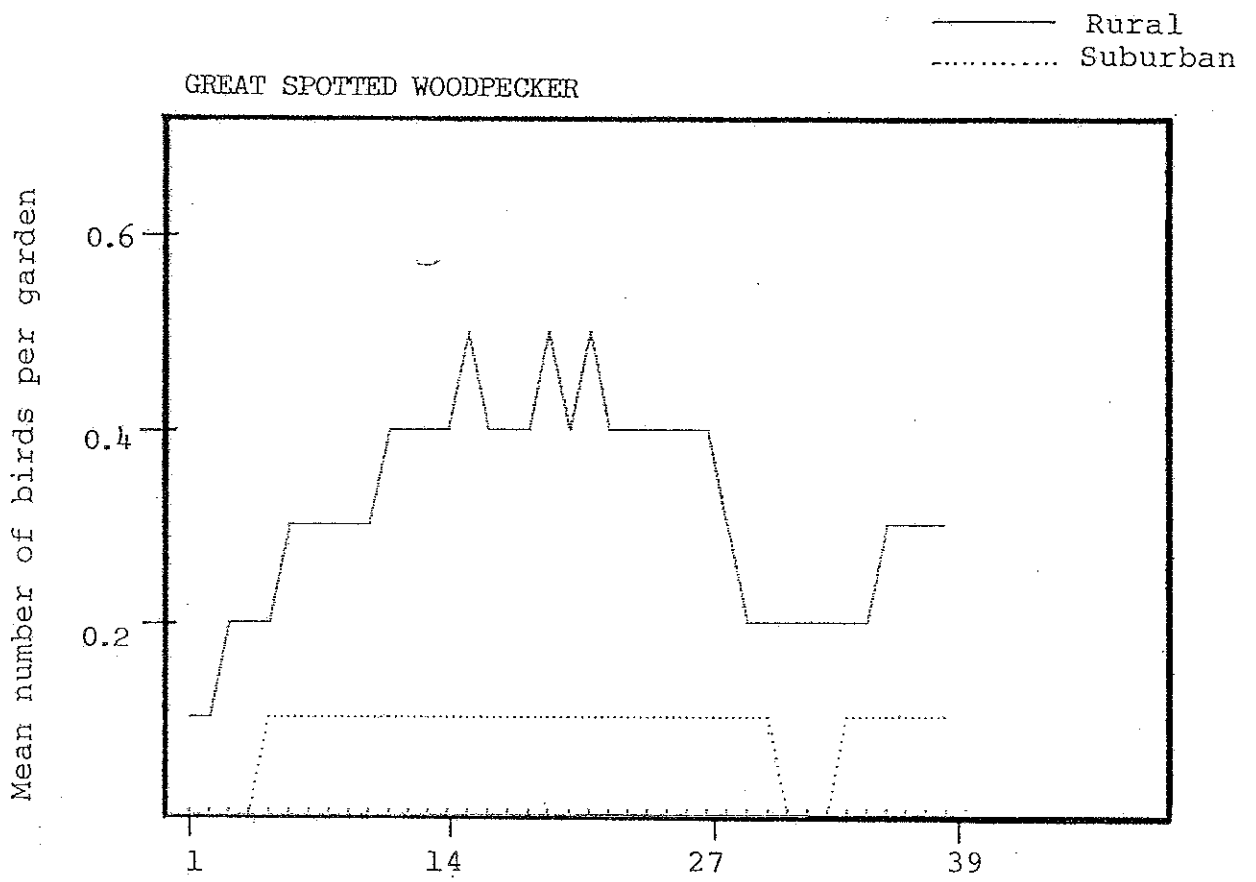

SISKIN
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.20.


Rural
Suburban
GREAT SPOTTED WOODPECKER
Mean number of birds per garden
0.6
0.4
0.2
1
14
27
39

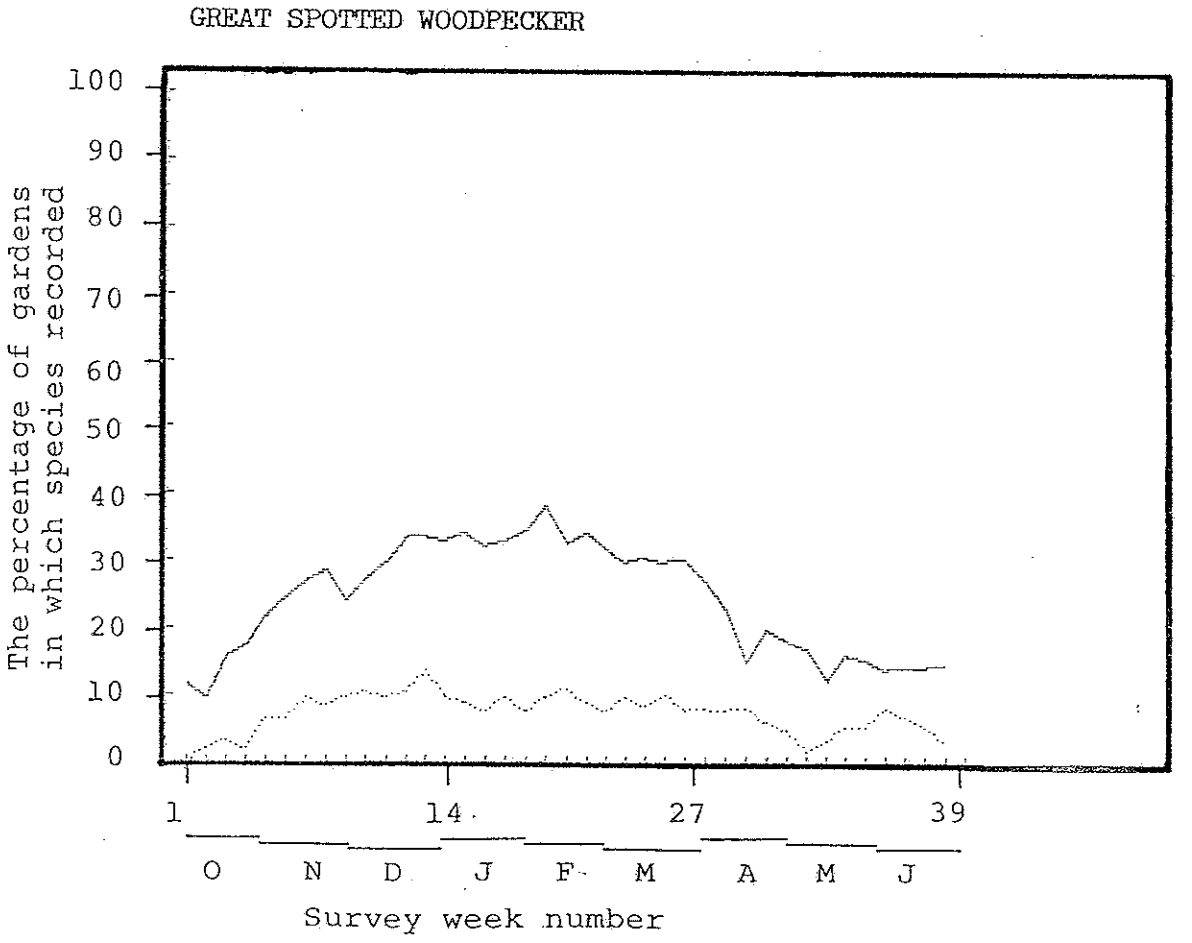
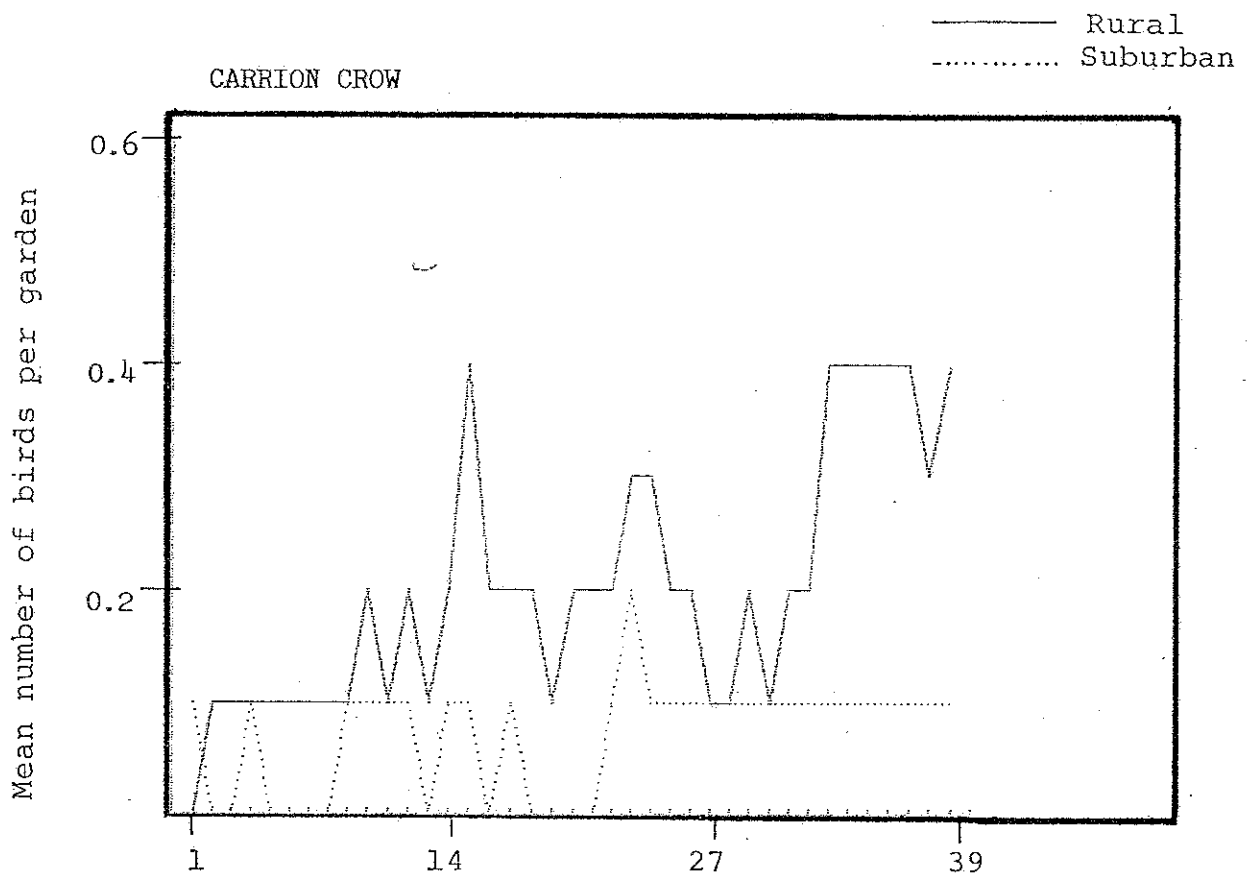

GREAT SPOTTED WOODPECKER
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.21.


Rural
Suburban
CARRION CROW
Mean number of birds per garden
0.6
0.4
0.2
1
14
27
39

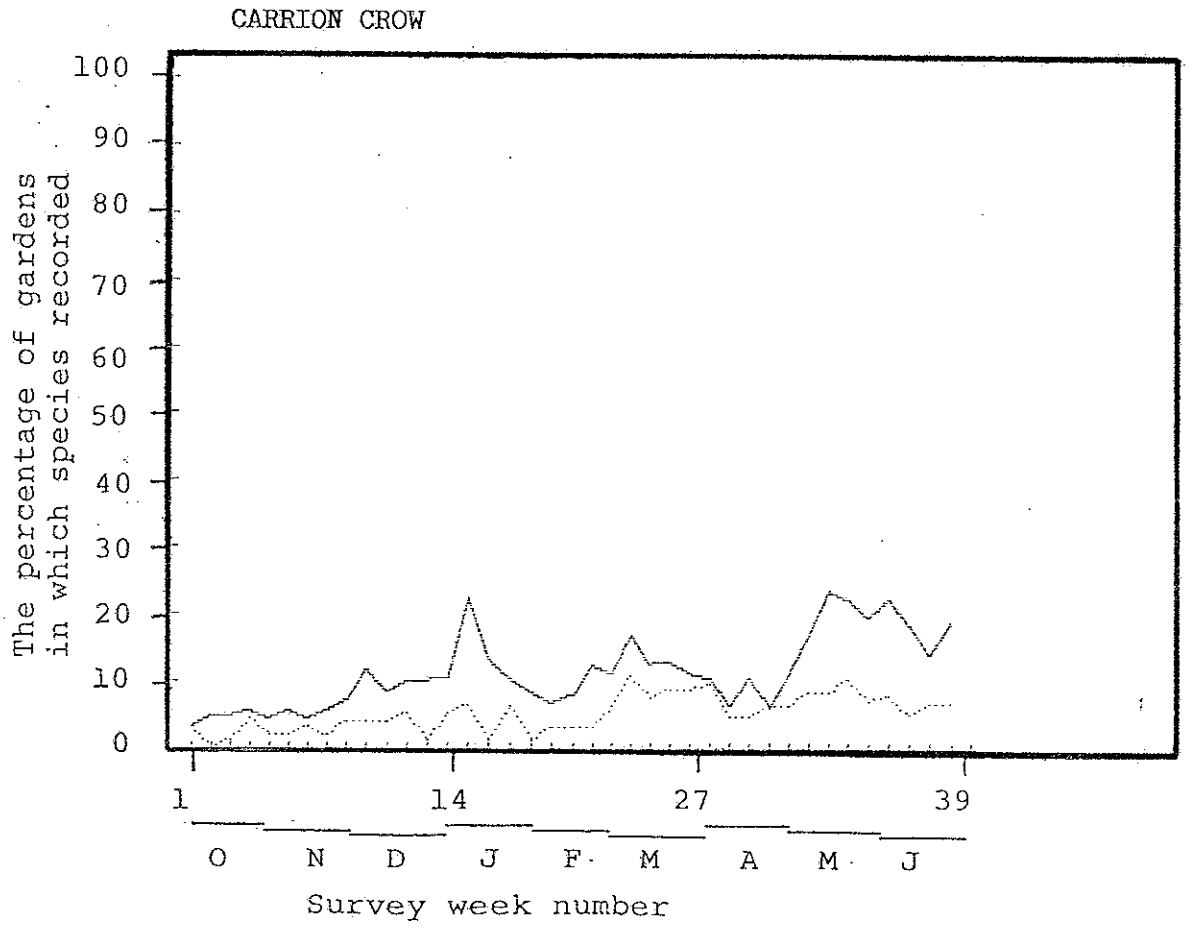
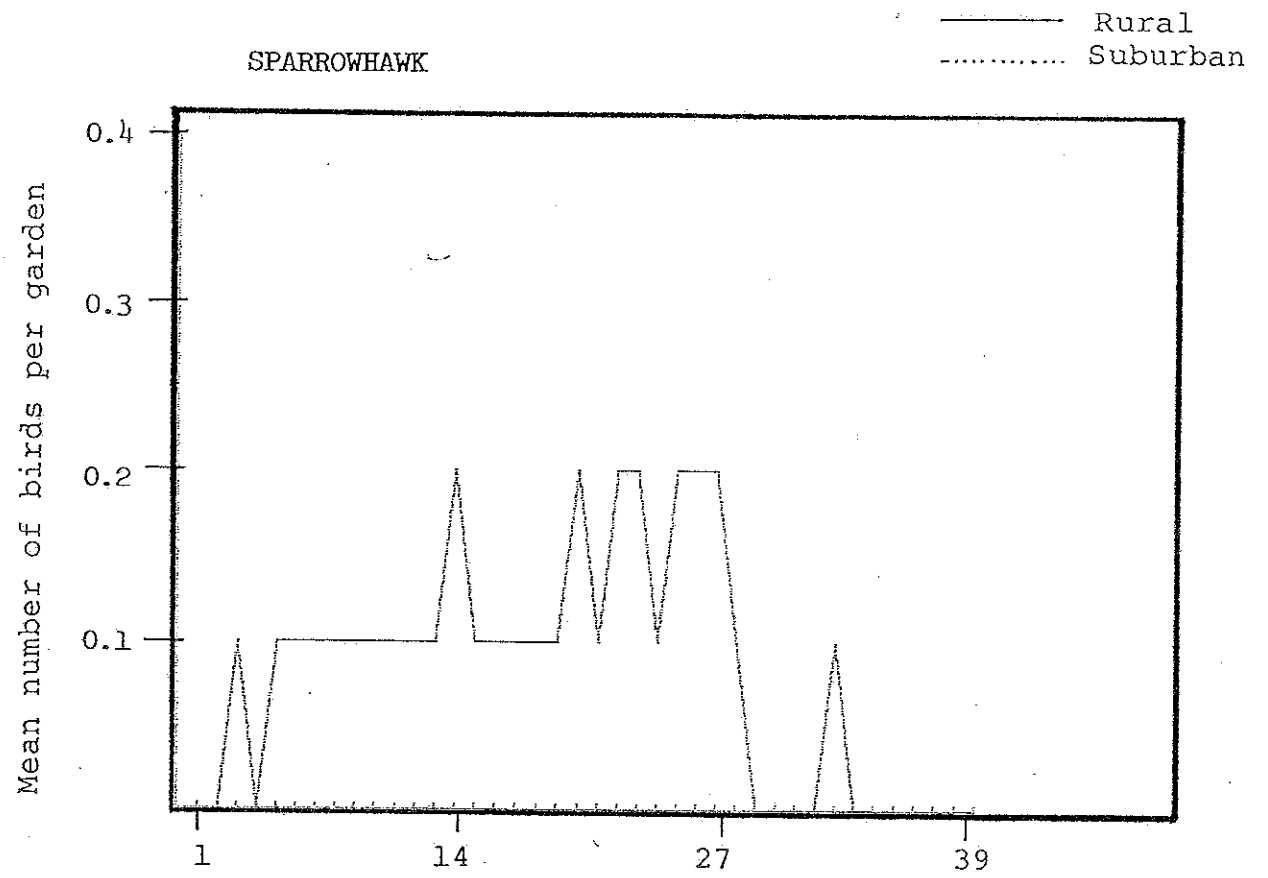

CARRION CROW
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.22.


Rural
Suburban
SPARROWHAWK
Mean number of birds per garden
0.4
0.3
0.2
0.1
1
14
27
39

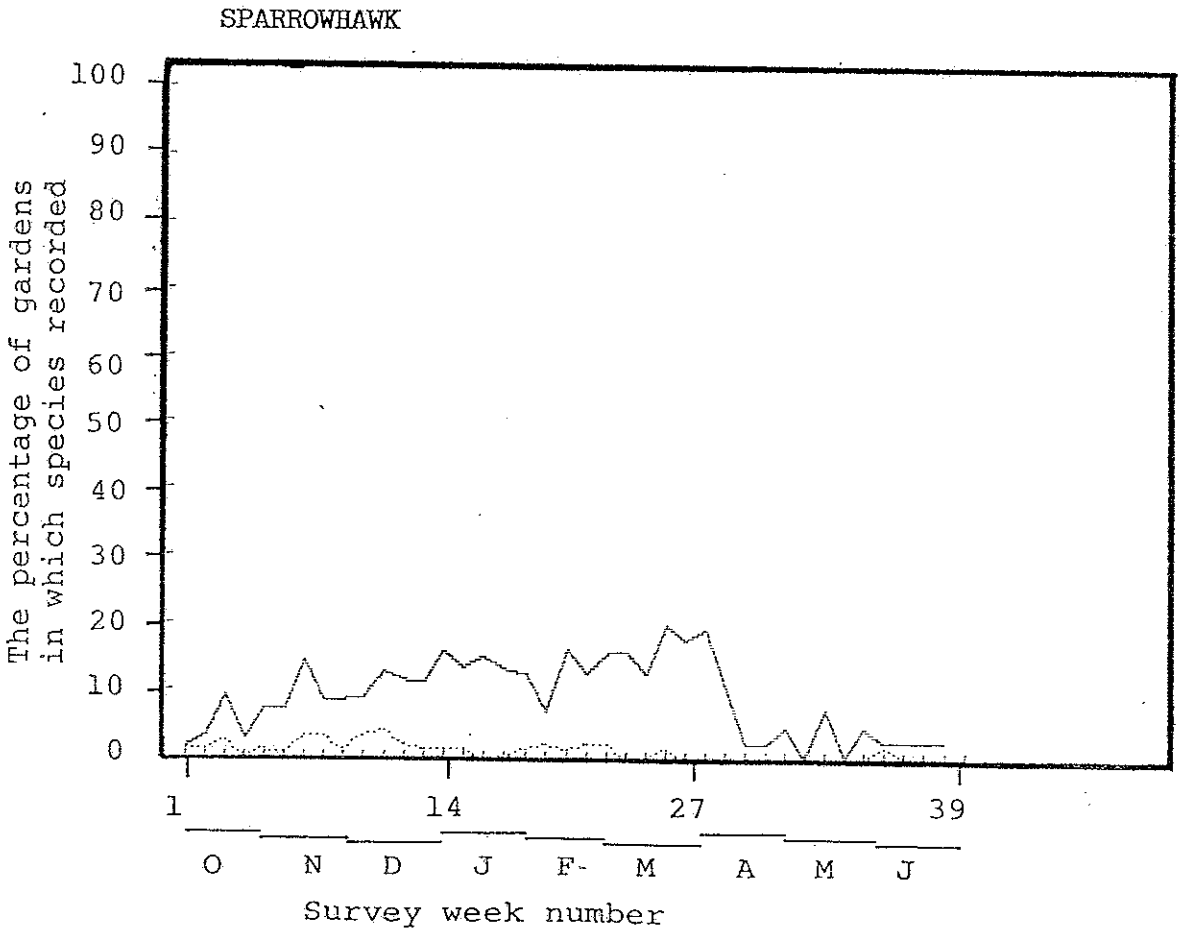
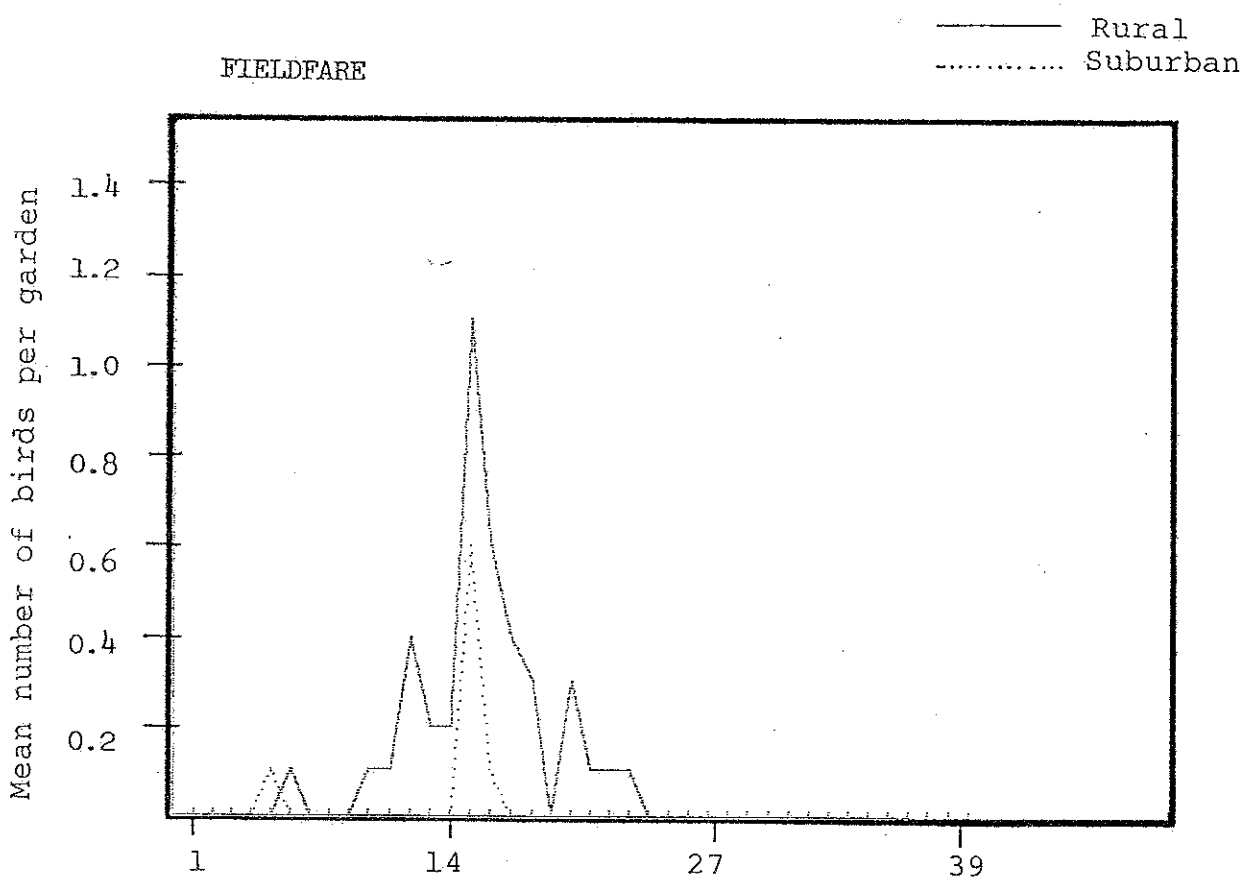

SPARROWHAWK
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.23.


Rural
Suburban
FIELDFARE
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

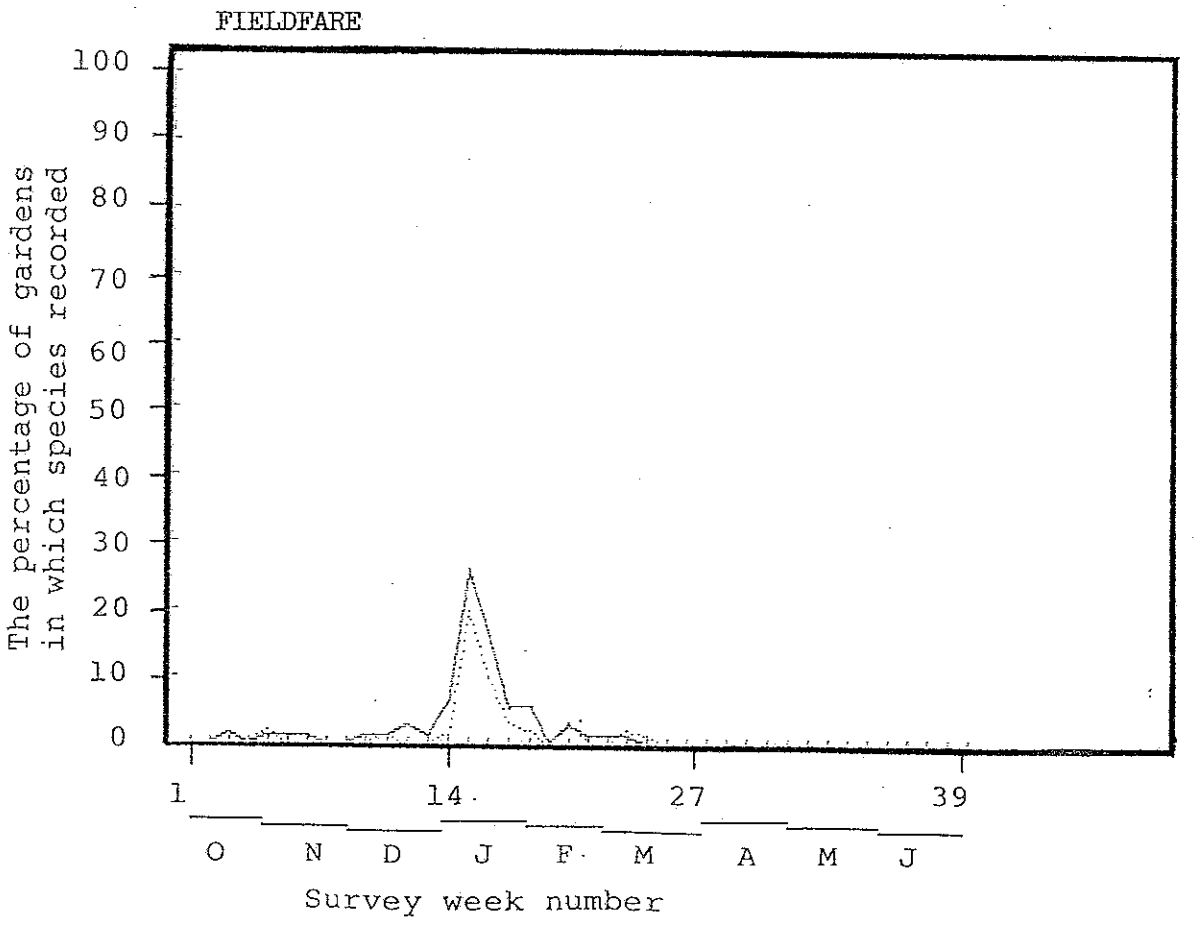
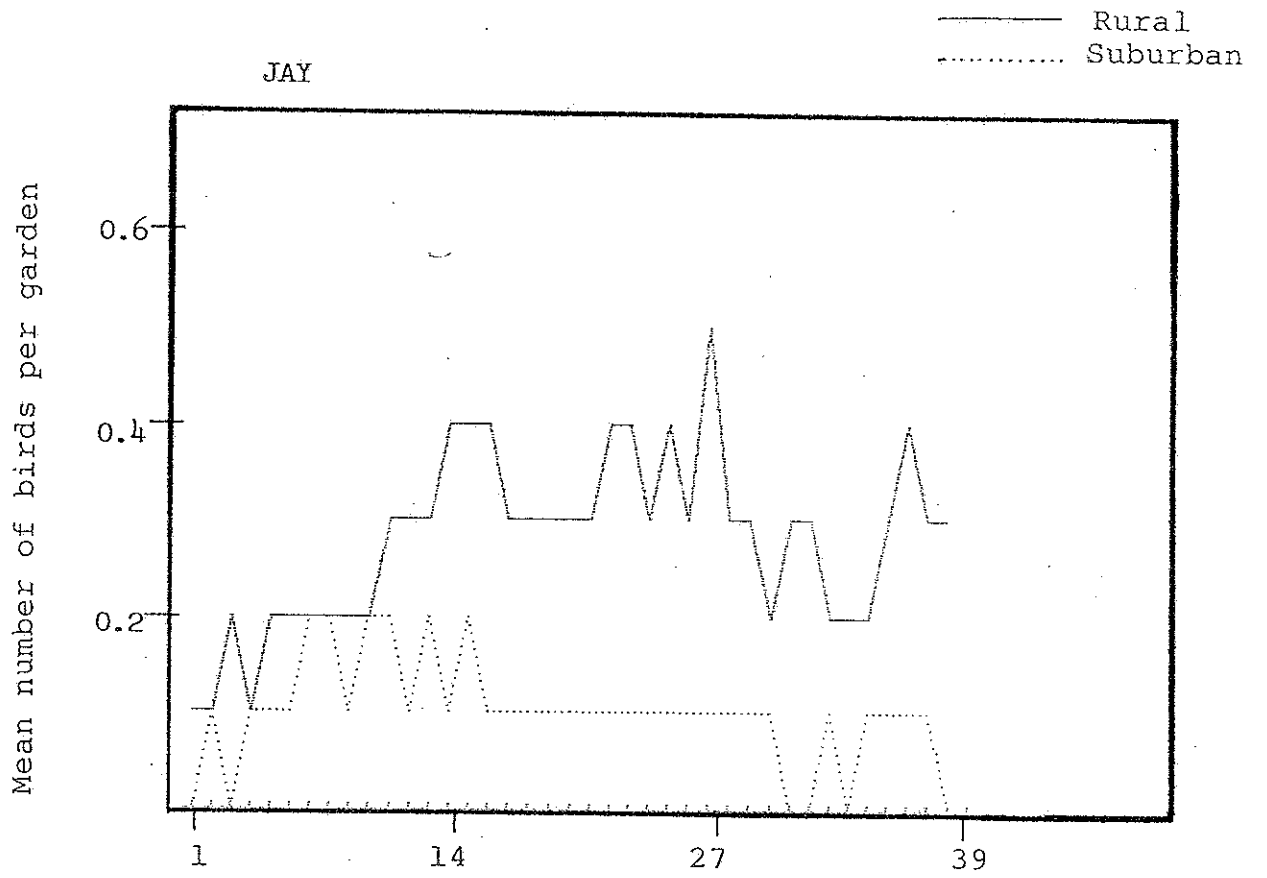

FIELDFARE
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.24.


Rural
Suburban
JAY
Mean number of birds per garden
0.6
0.4
0.2
1
14
27
39

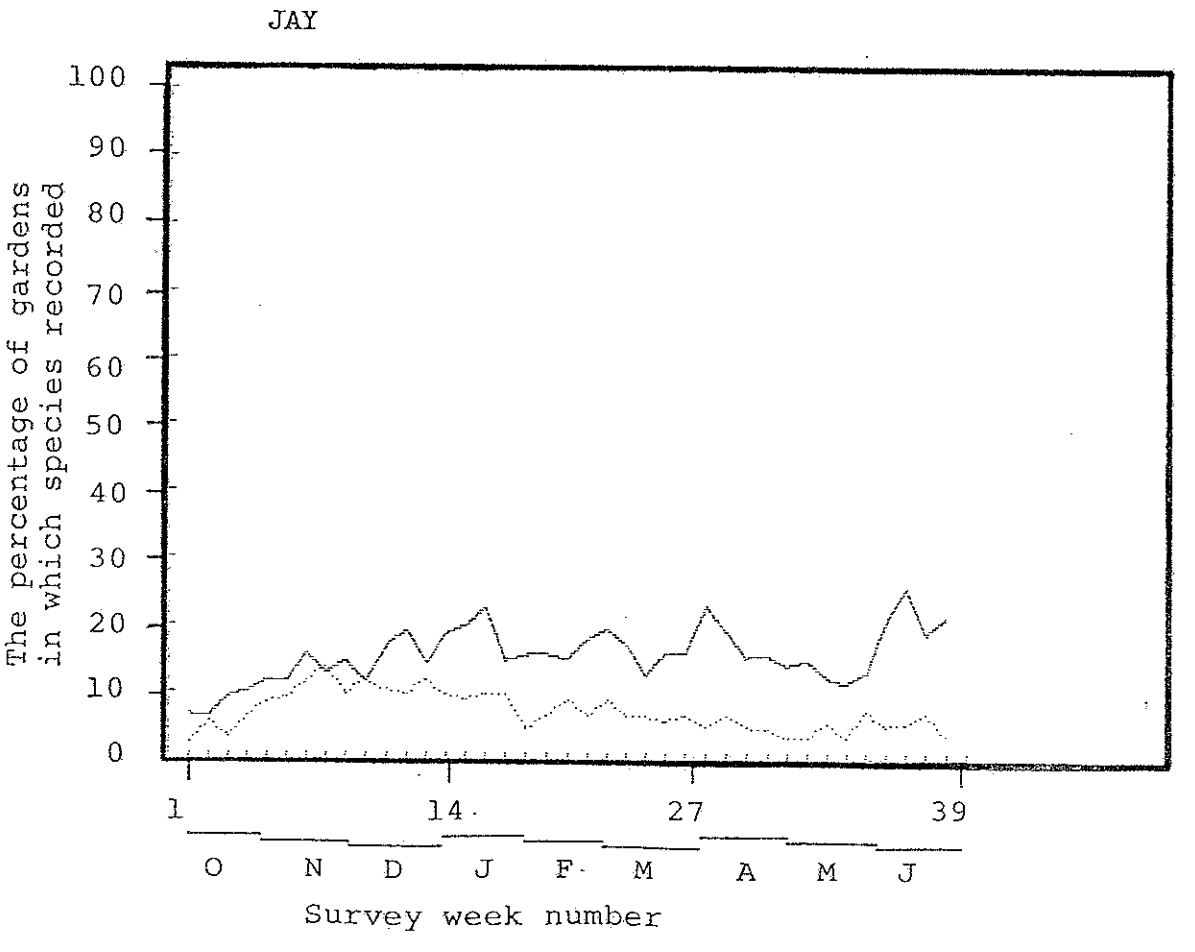
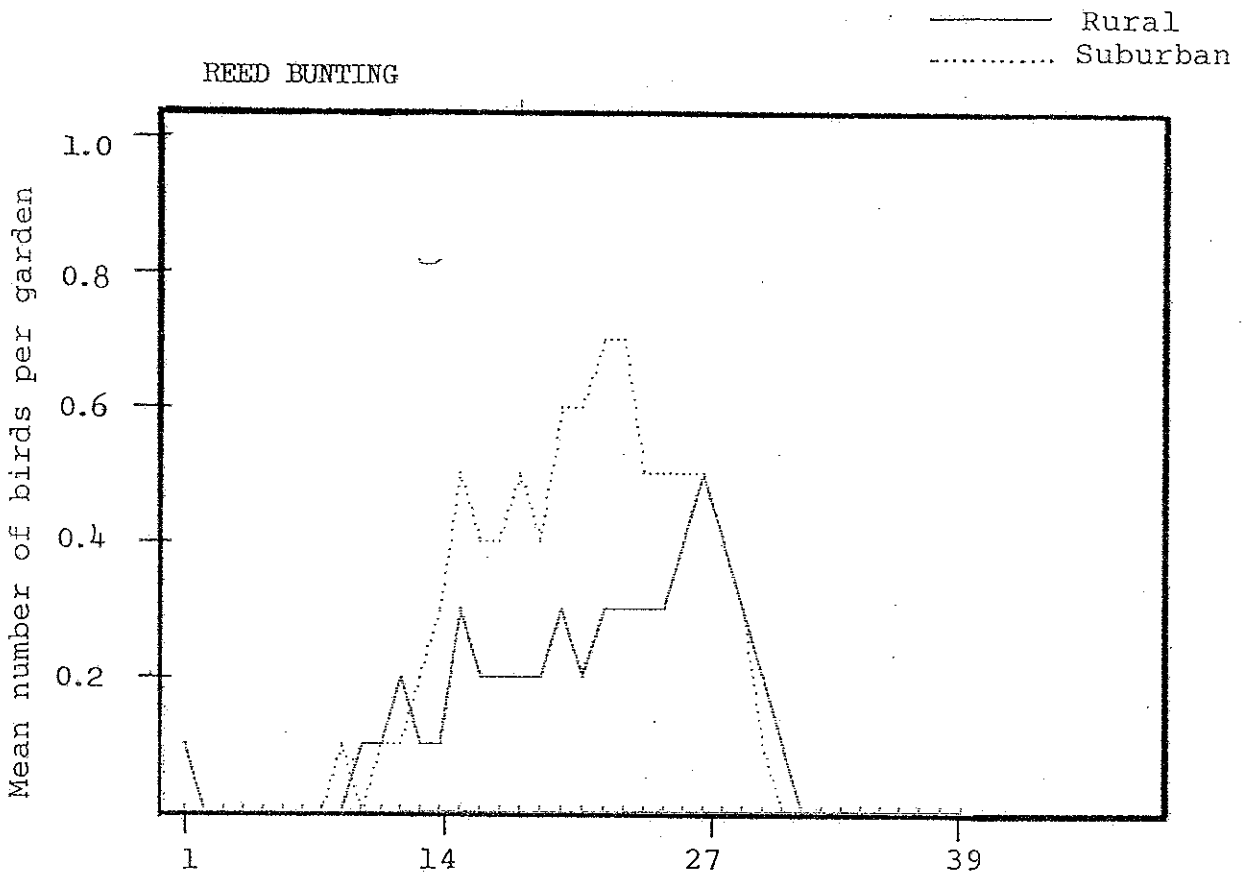

JAY
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.25.


Rural
Suburban
REED BUNTING
Mean number of birds per garden
1.0
0.8
0.6
0.4
0.2
1
14
27
39

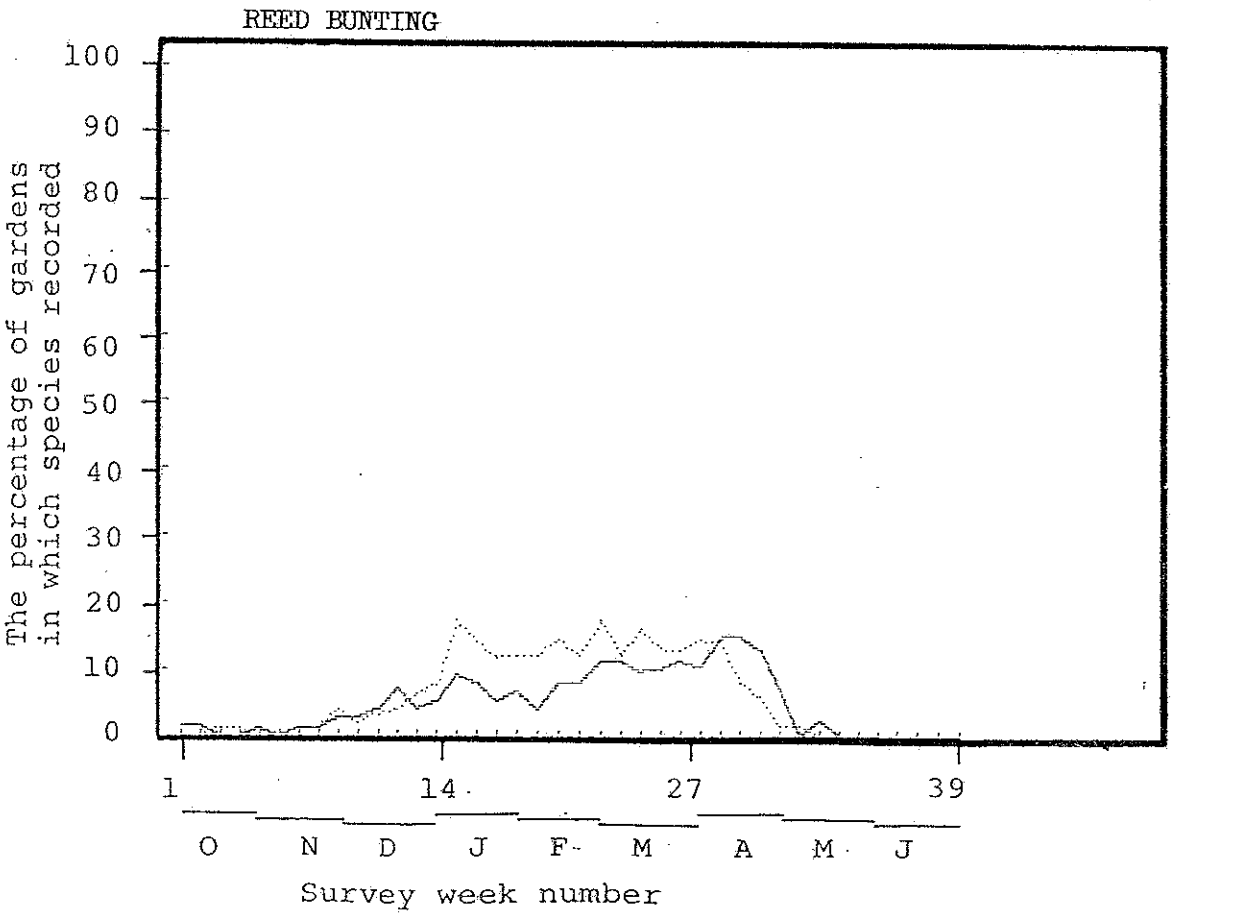
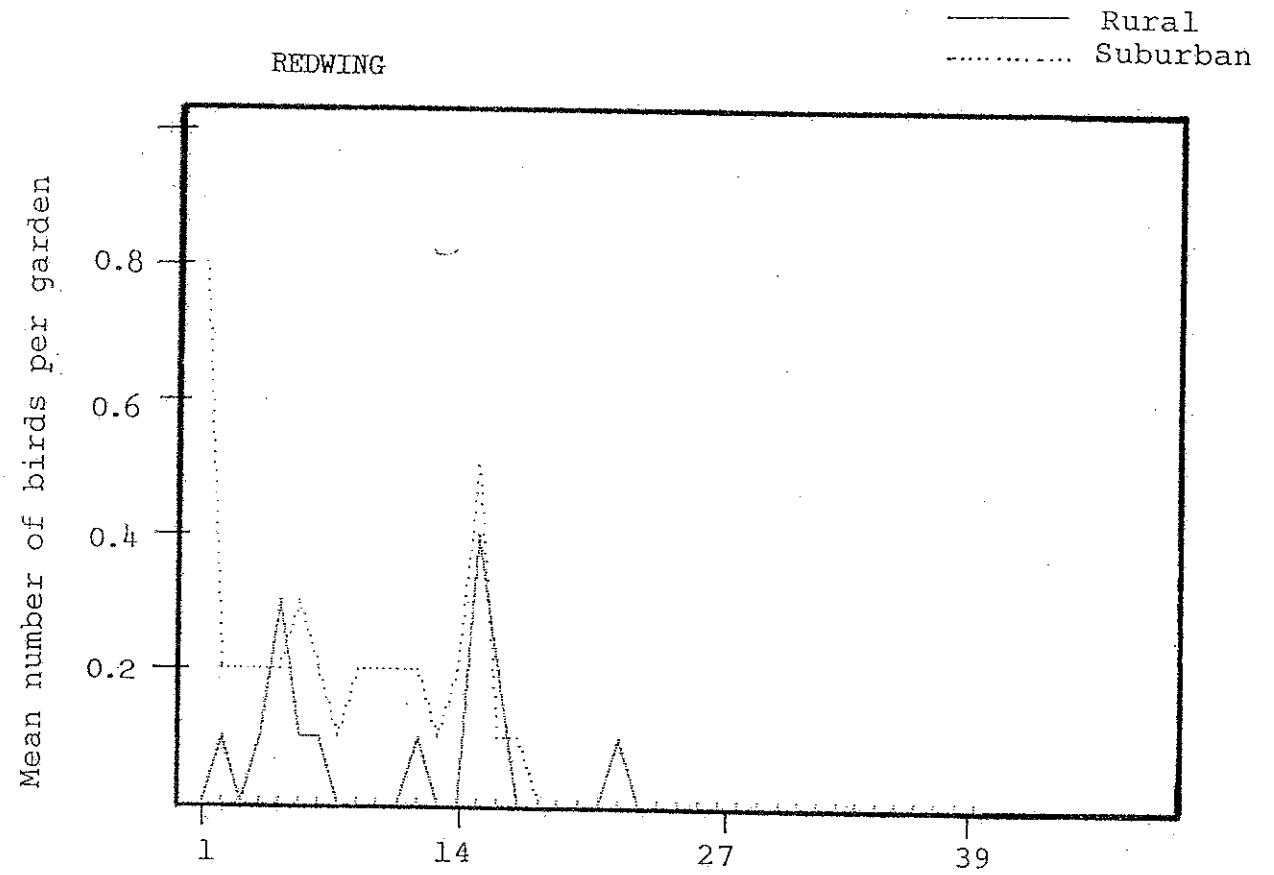

REED BUNTING
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.26.


Rural
Suburban
REDWING
Mean number of birds per garden
0.8
0.6
0.4
0.2
1
14
27
39

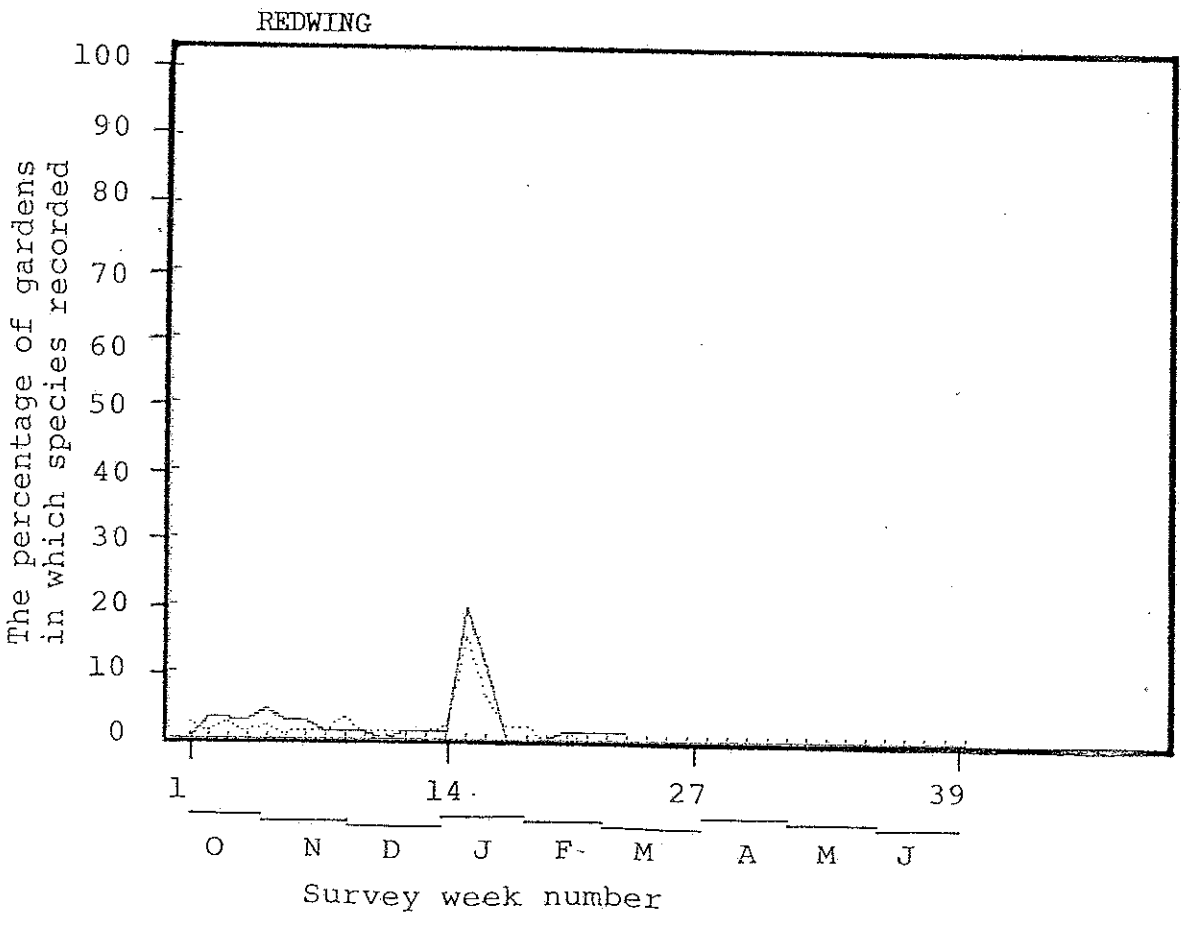
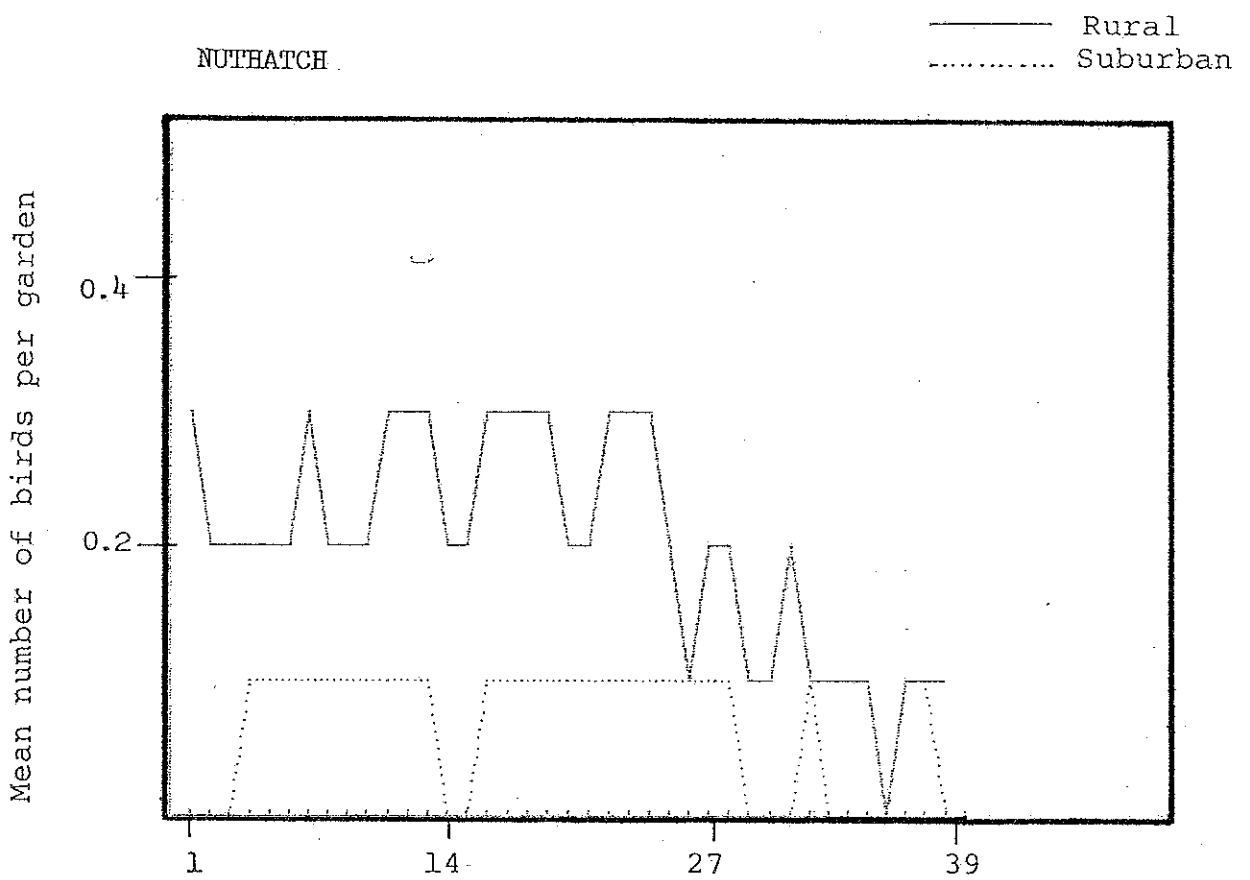

REDWING
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.27.


NUTHATCH
Rural
Suburban
Mean number of birds per garden
0.4
0.2
1
14
27
39

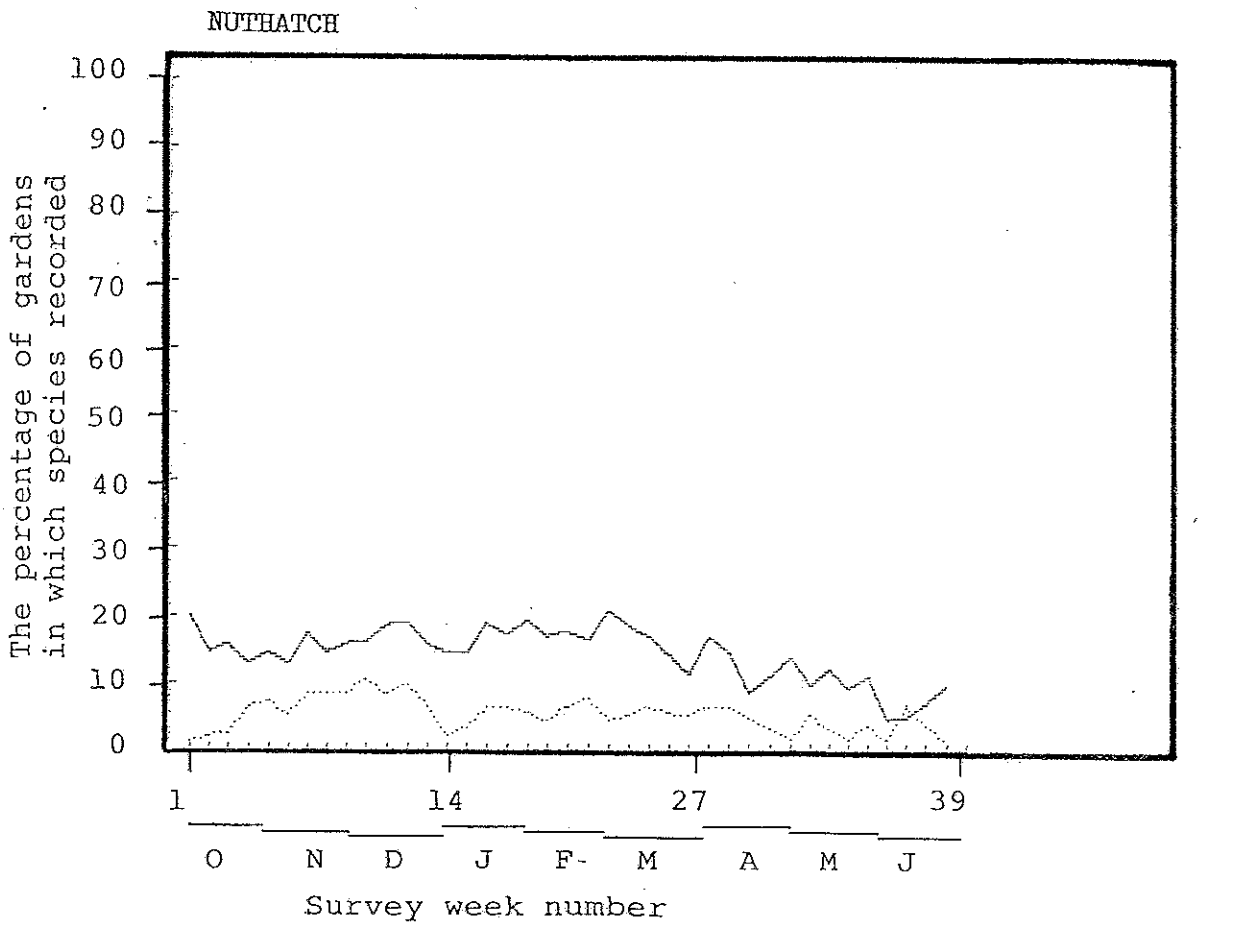
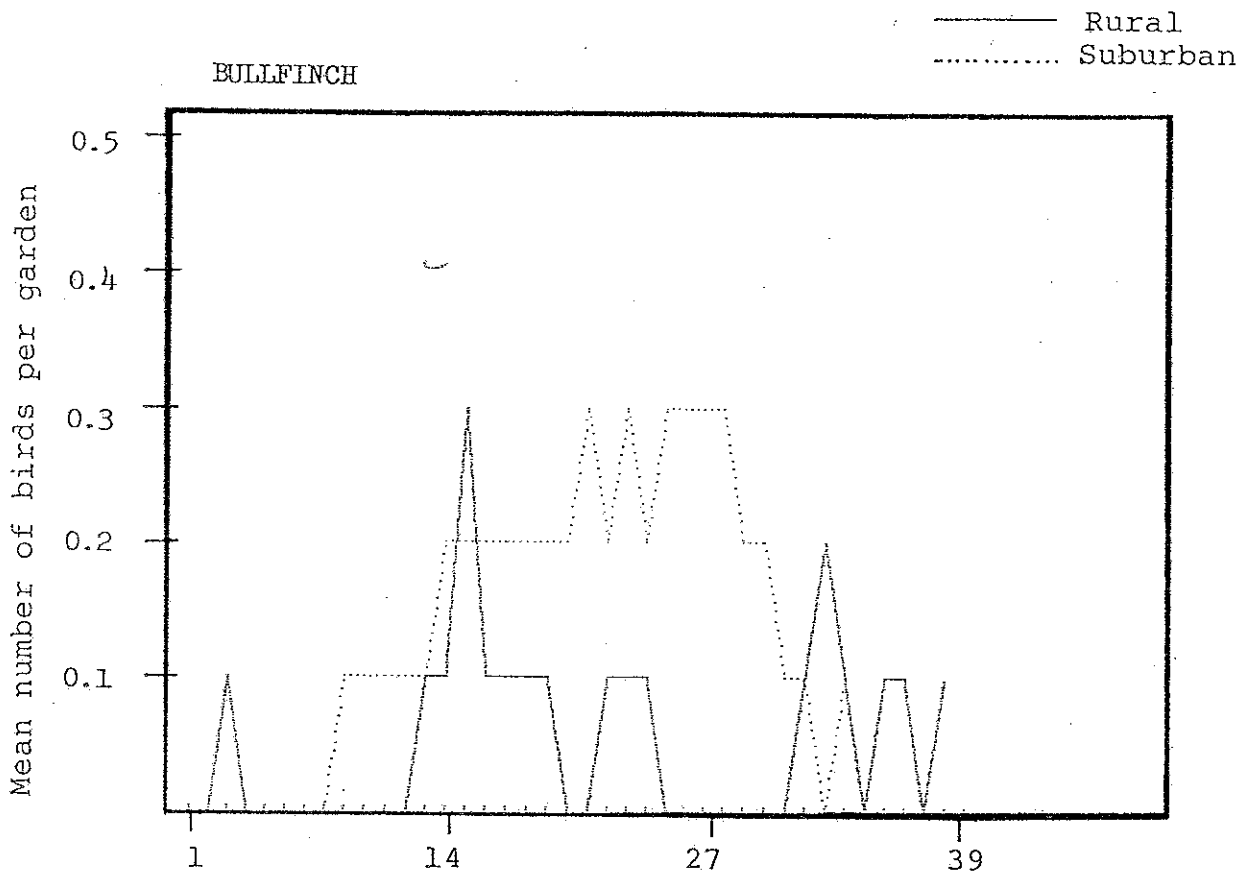

NUTHATCH
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.28.


Rural
Suburban
BULLFINCH
Mean number of birds per garden
0.5
0.4
0.3
0.2
0.1
1
14
27
39

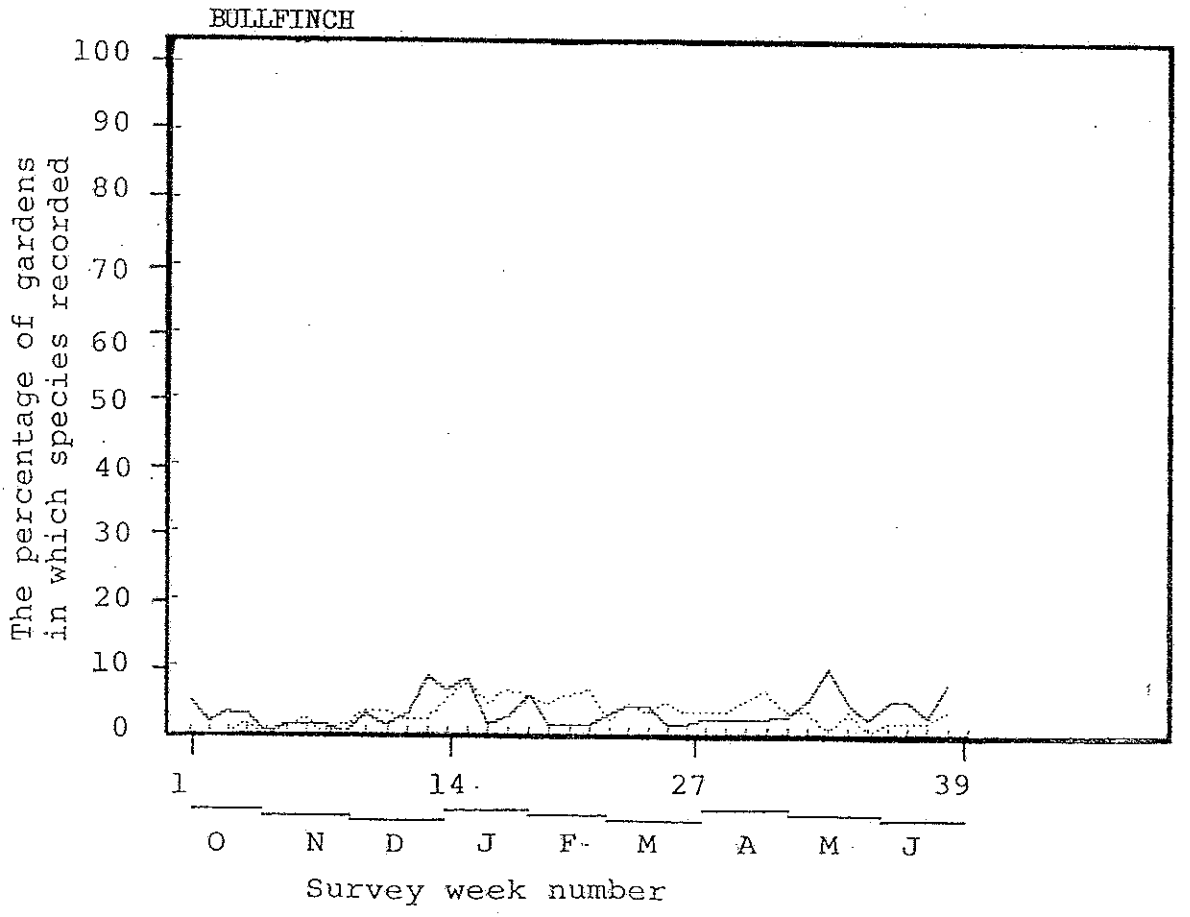
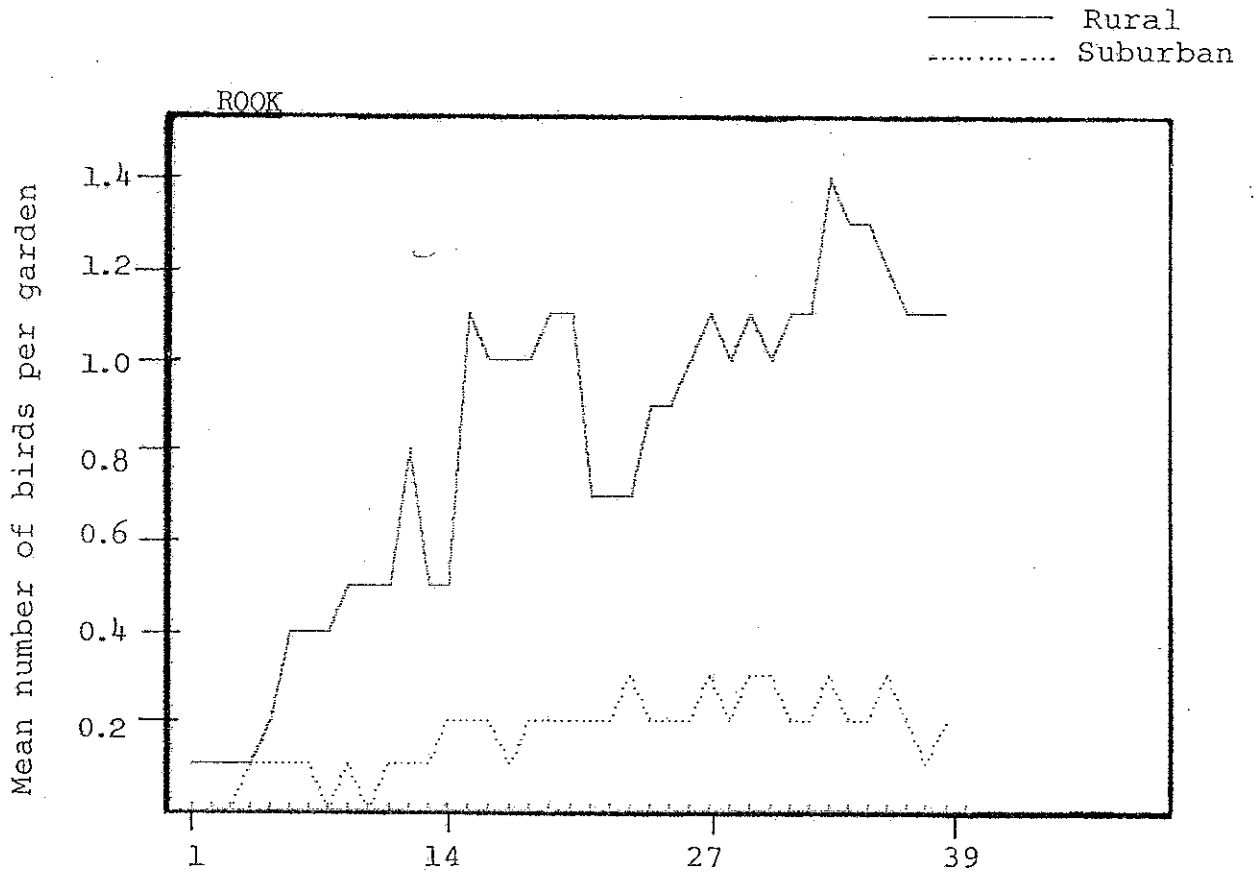

BULLFINCH
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.29.


Rural
Suburban
ROOK
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

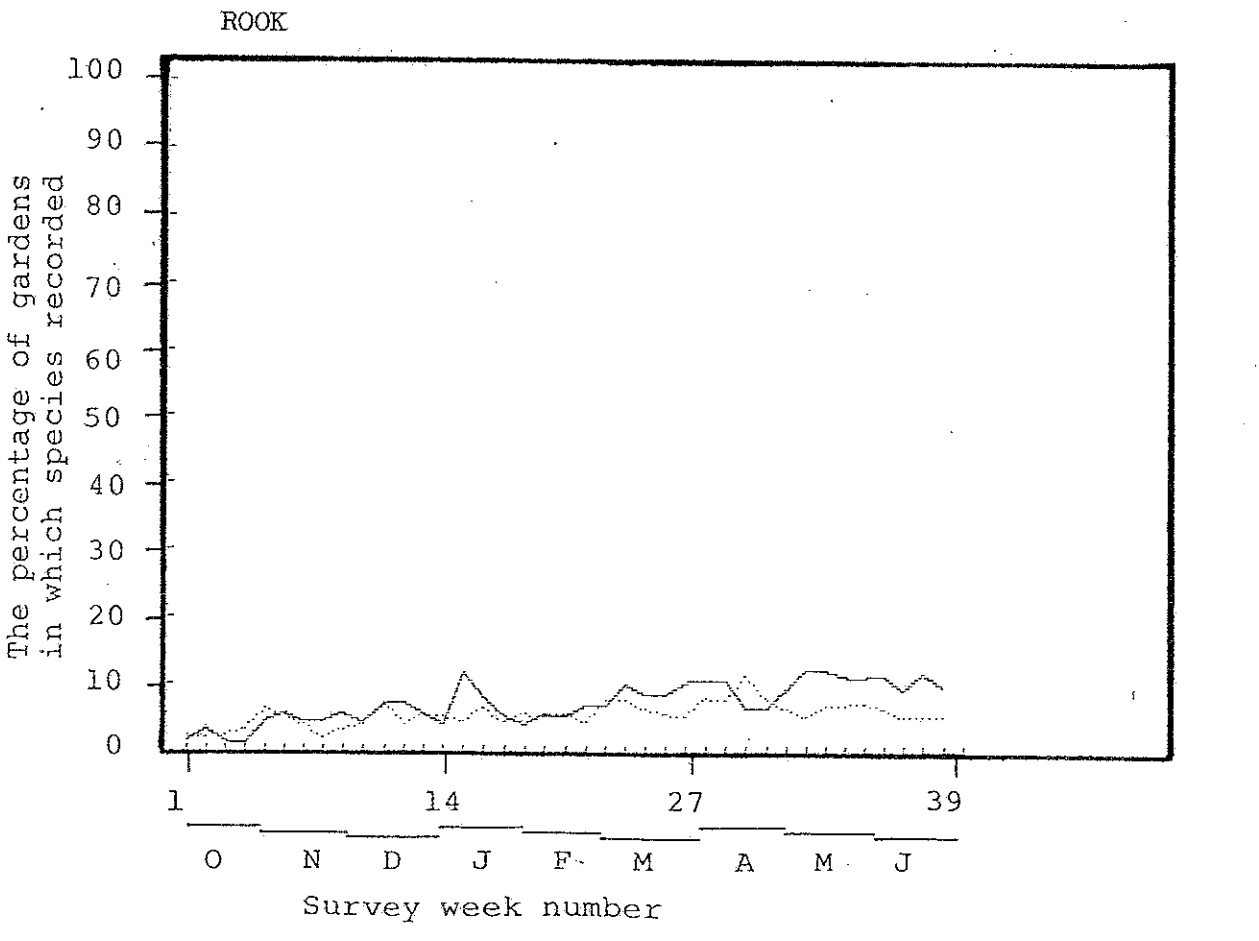
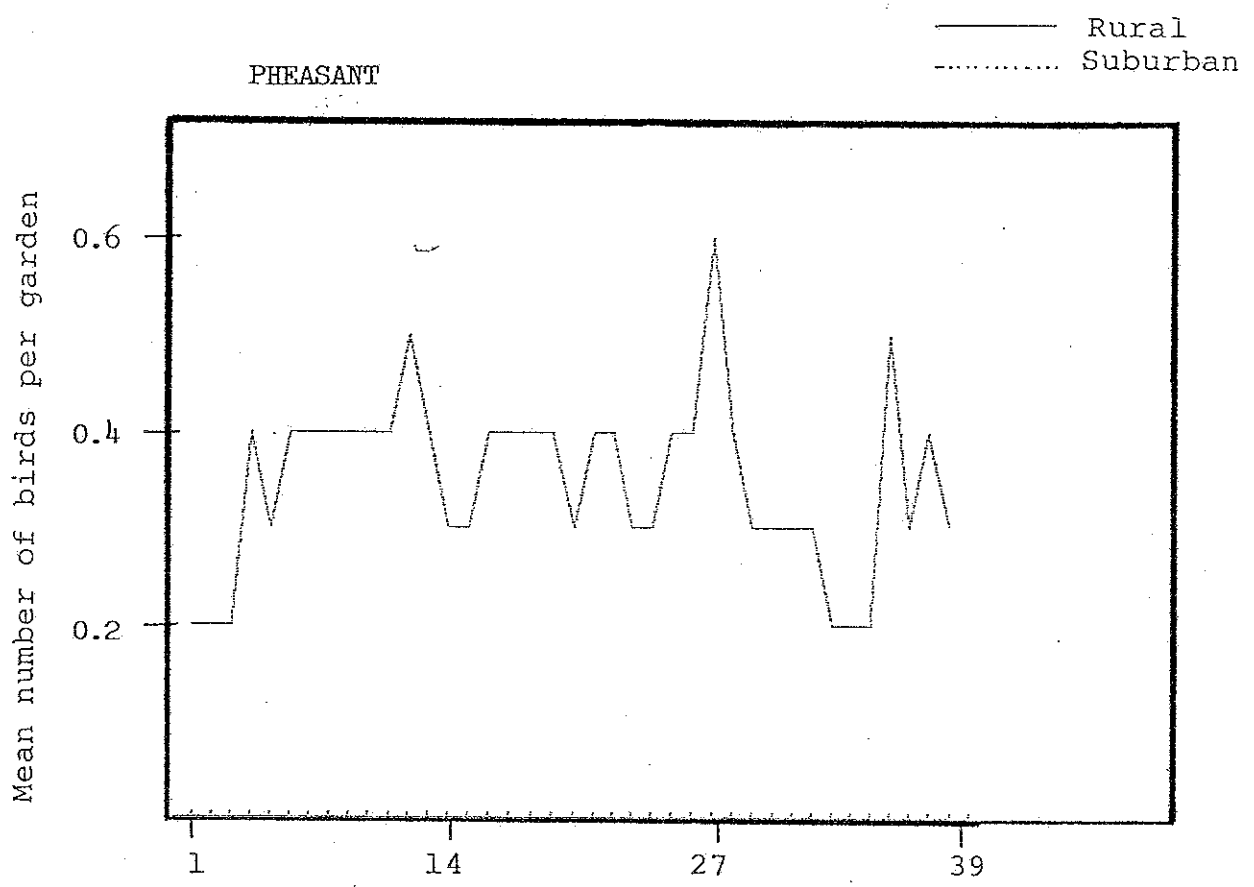

ROOK
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.30.


Rural
Suburban
PHEASANT
Mean number of birds per garden
0.6
0.4
0.2
1
14
27
39

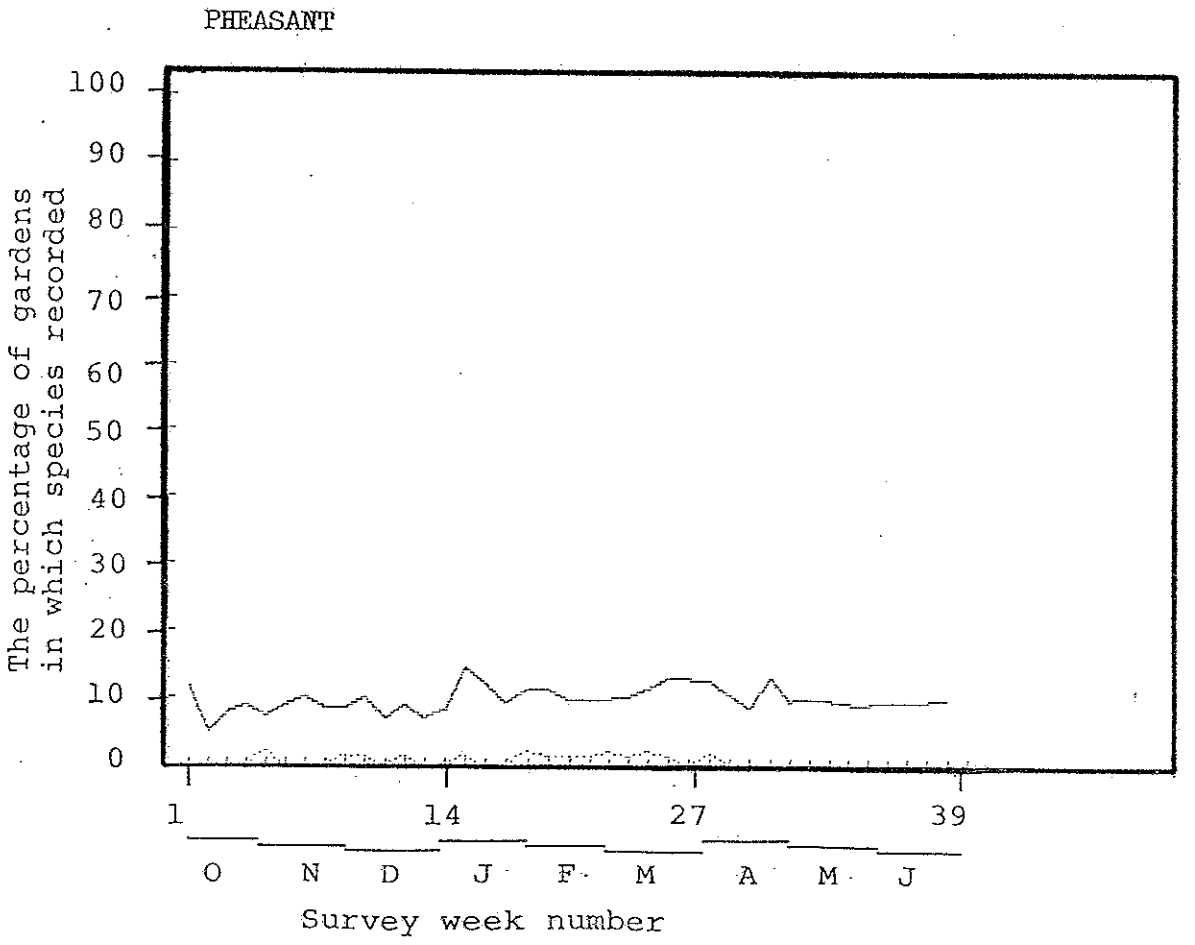
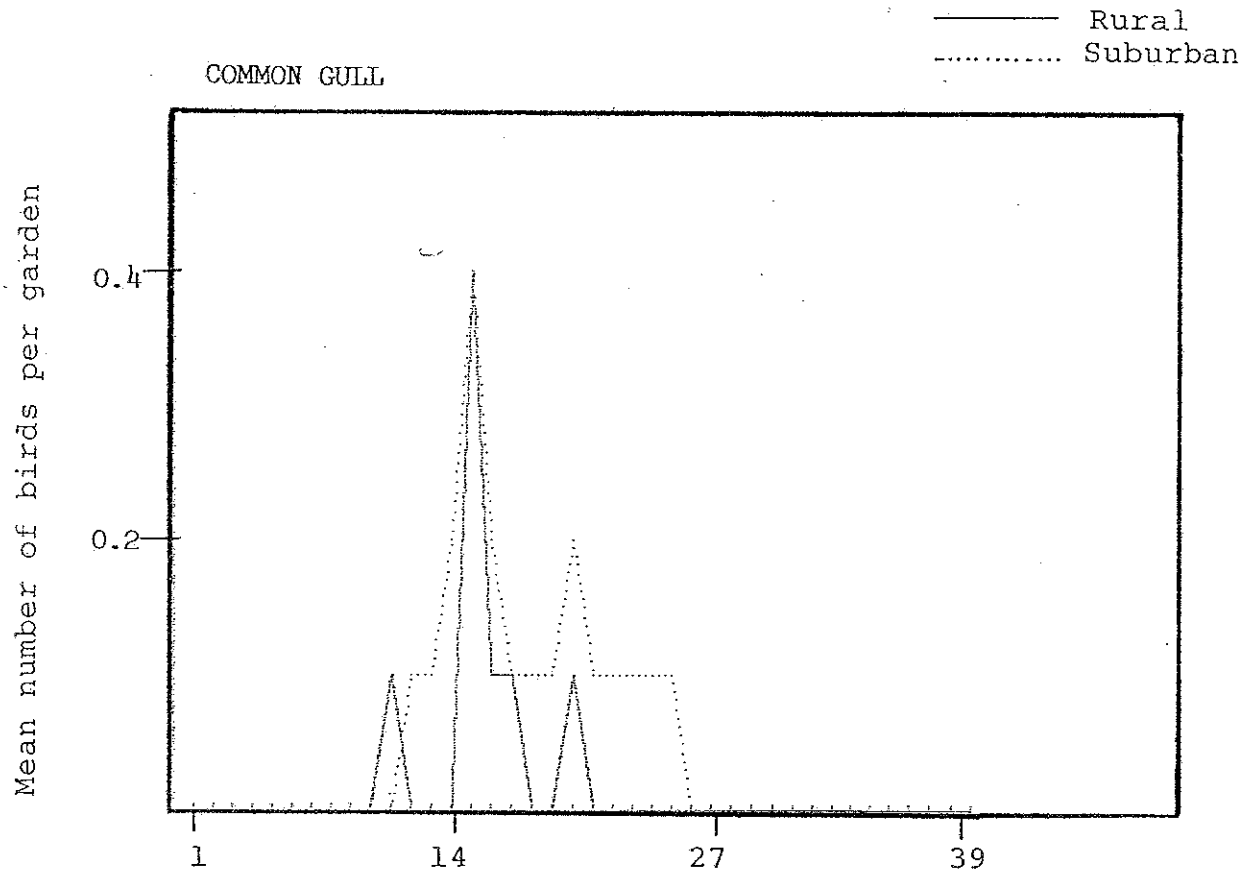

PHEASANT
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.31.


Rural
Suburban
COMMON GULL
Mean number of birds per garden
0.4
0.2
1
14
27
39

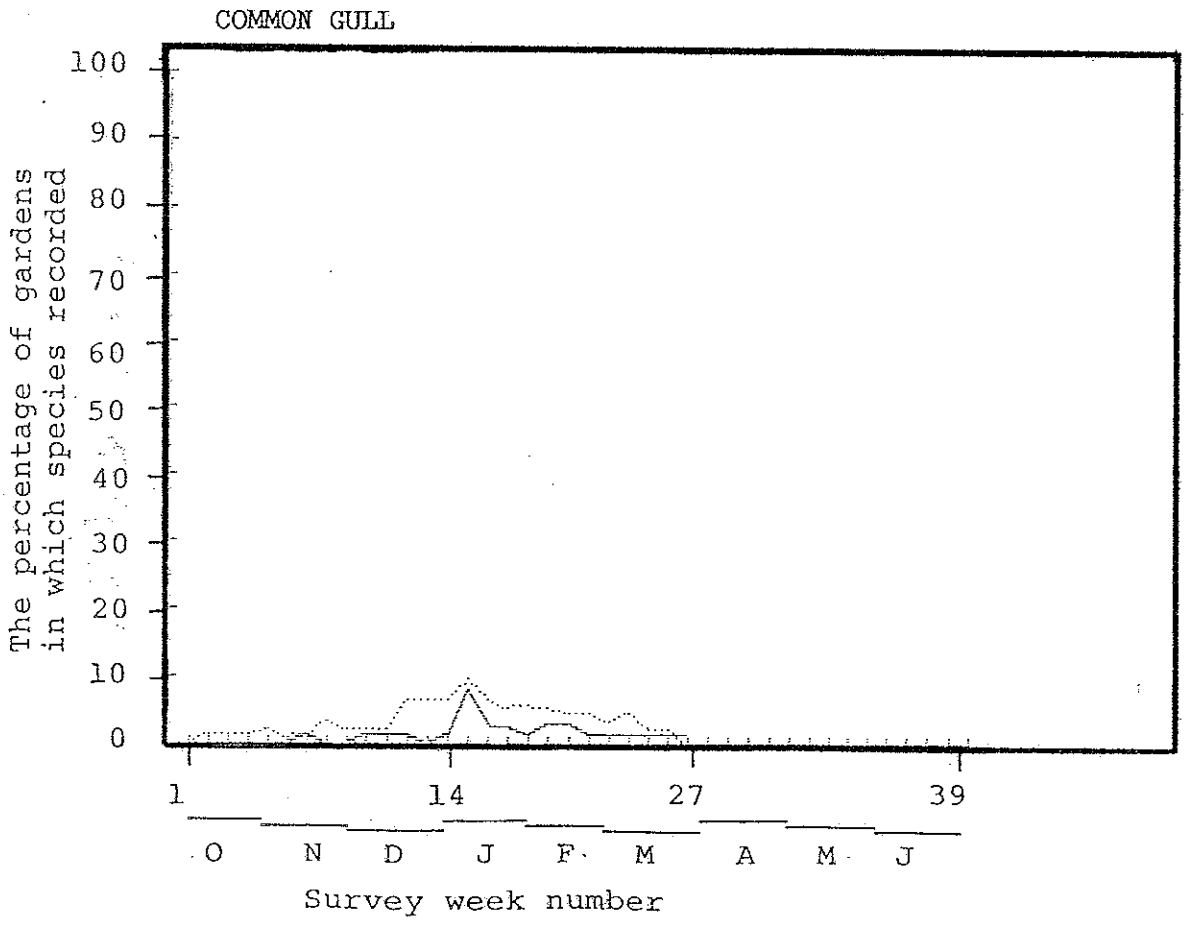

COMMON GULL
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.32.

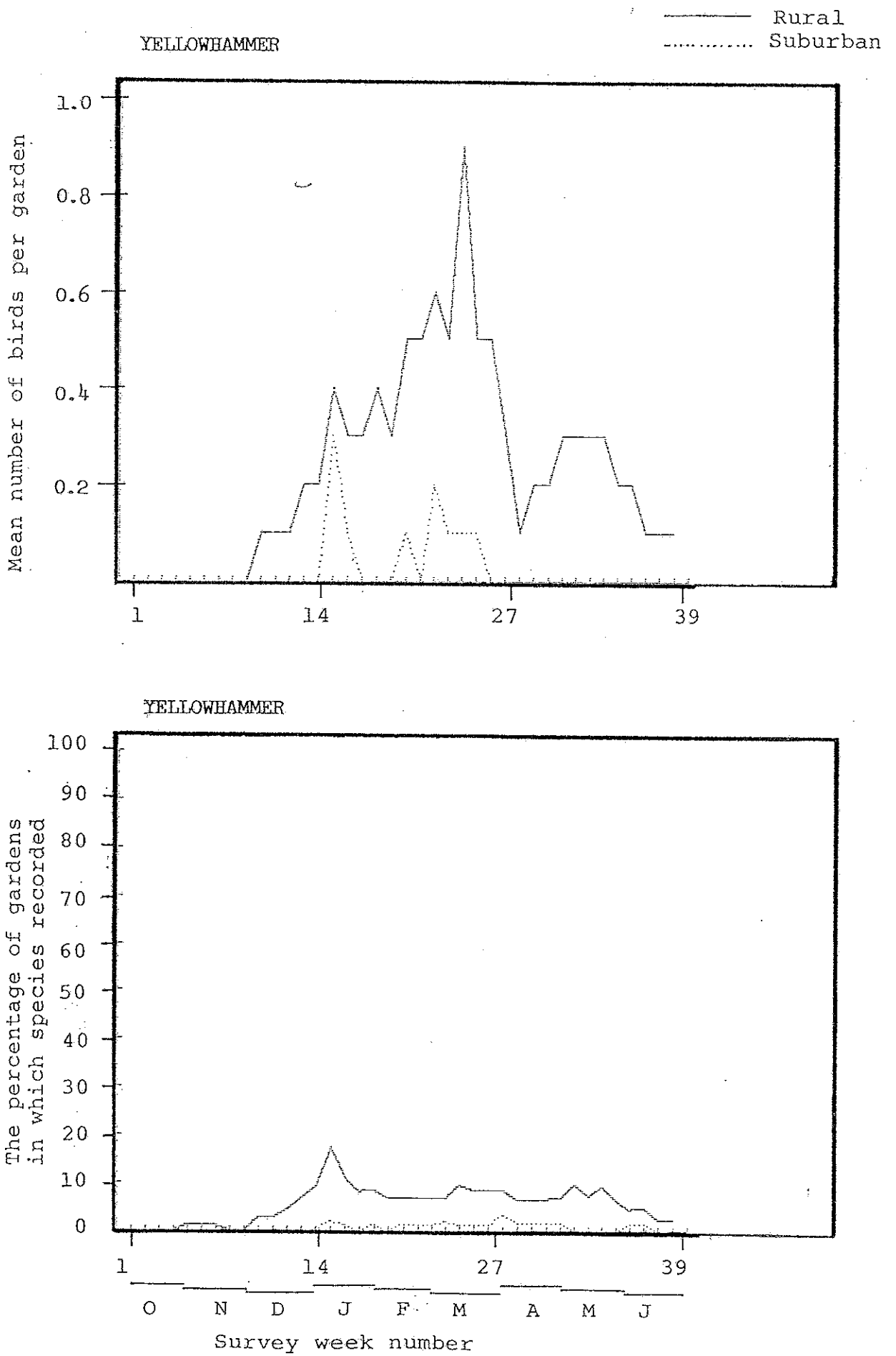
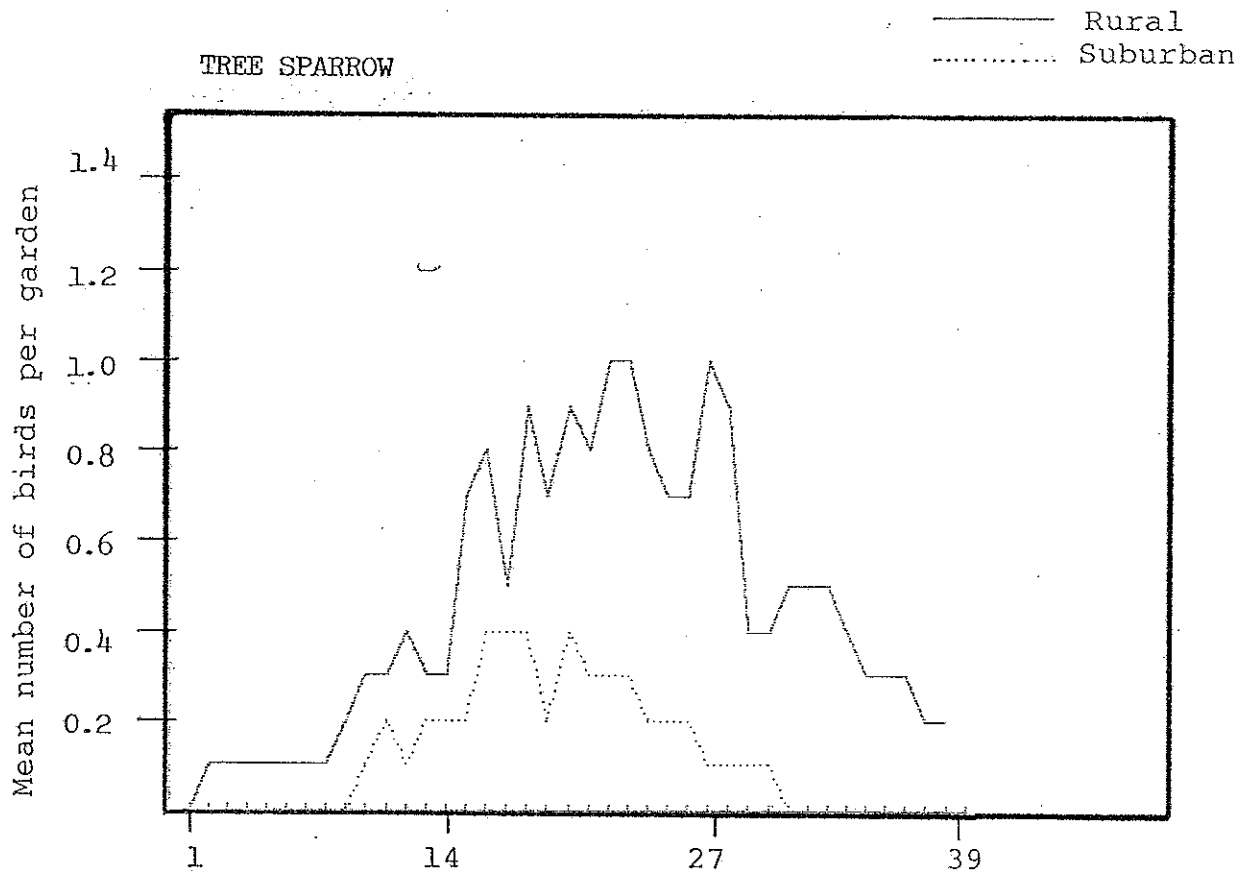

Rural
Suburban
YELLOWHAMMER
Mean number of birds per garden
1.0
0.8
0.6
0.4
0.2
1
14
27
39
YELLOWHAMMER
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.33.


Rural
Suburban
TREE SPARROW
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

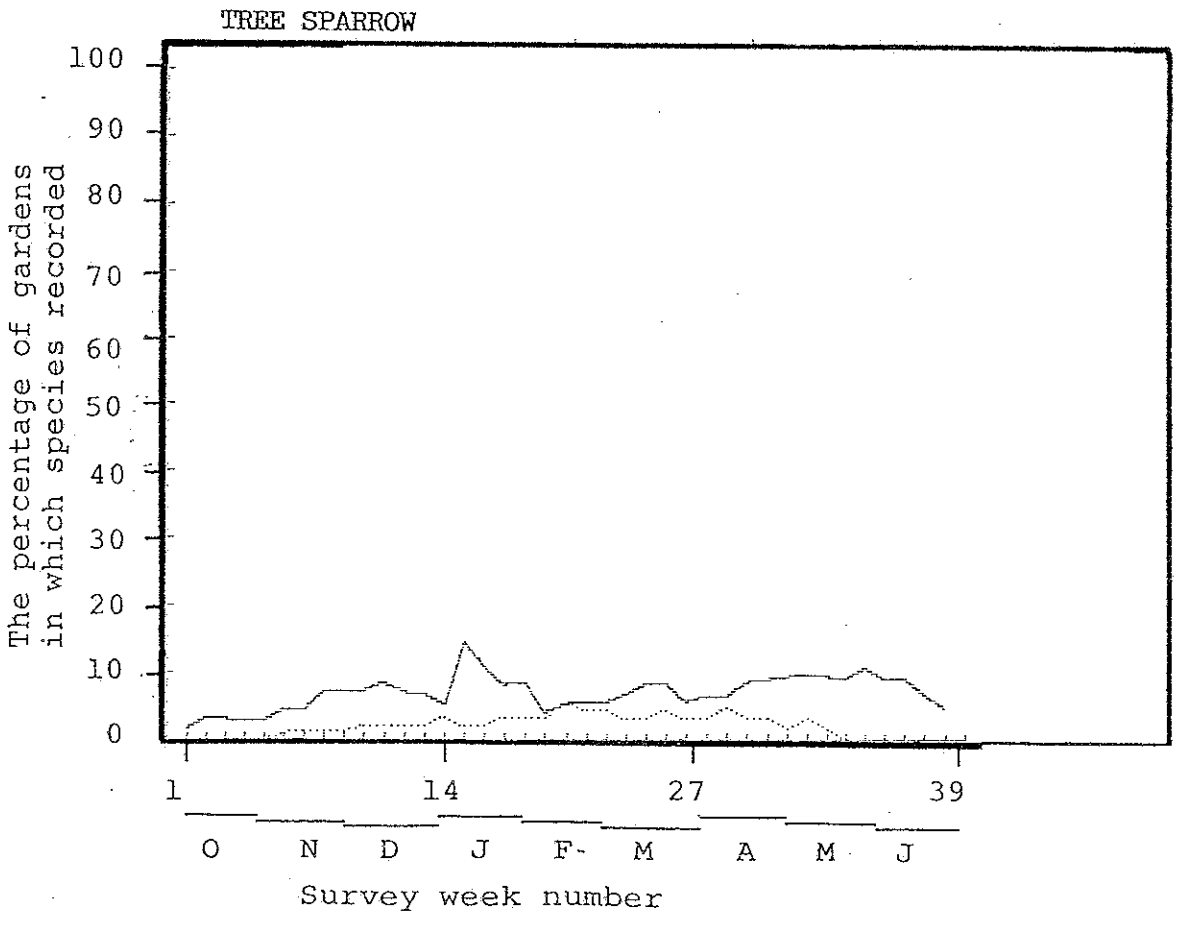
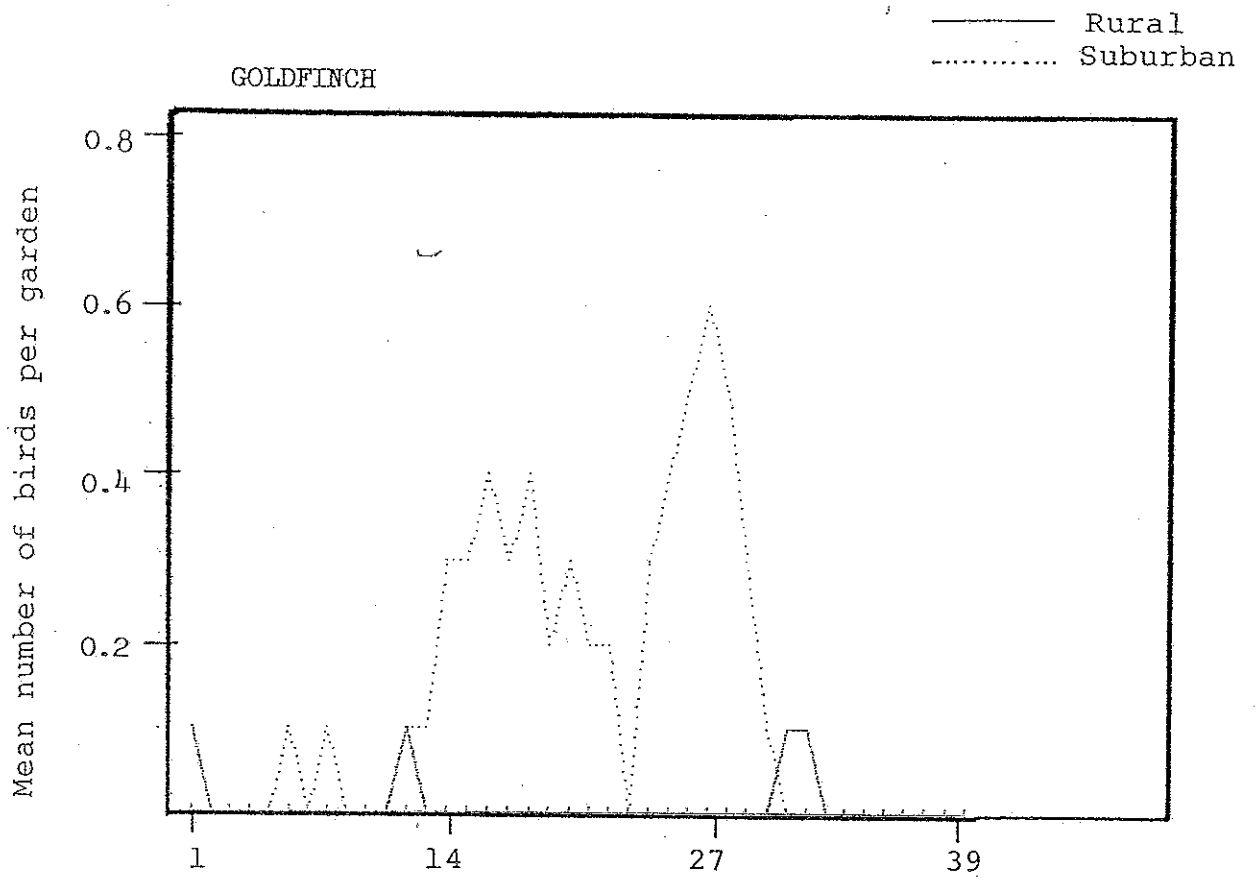

TREE SPARROW
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.34.


Rural
Suburban
GOLDFINCH
Mean number of birds per garden
0.8
0.6
0.4
0.2
1
14
27
39

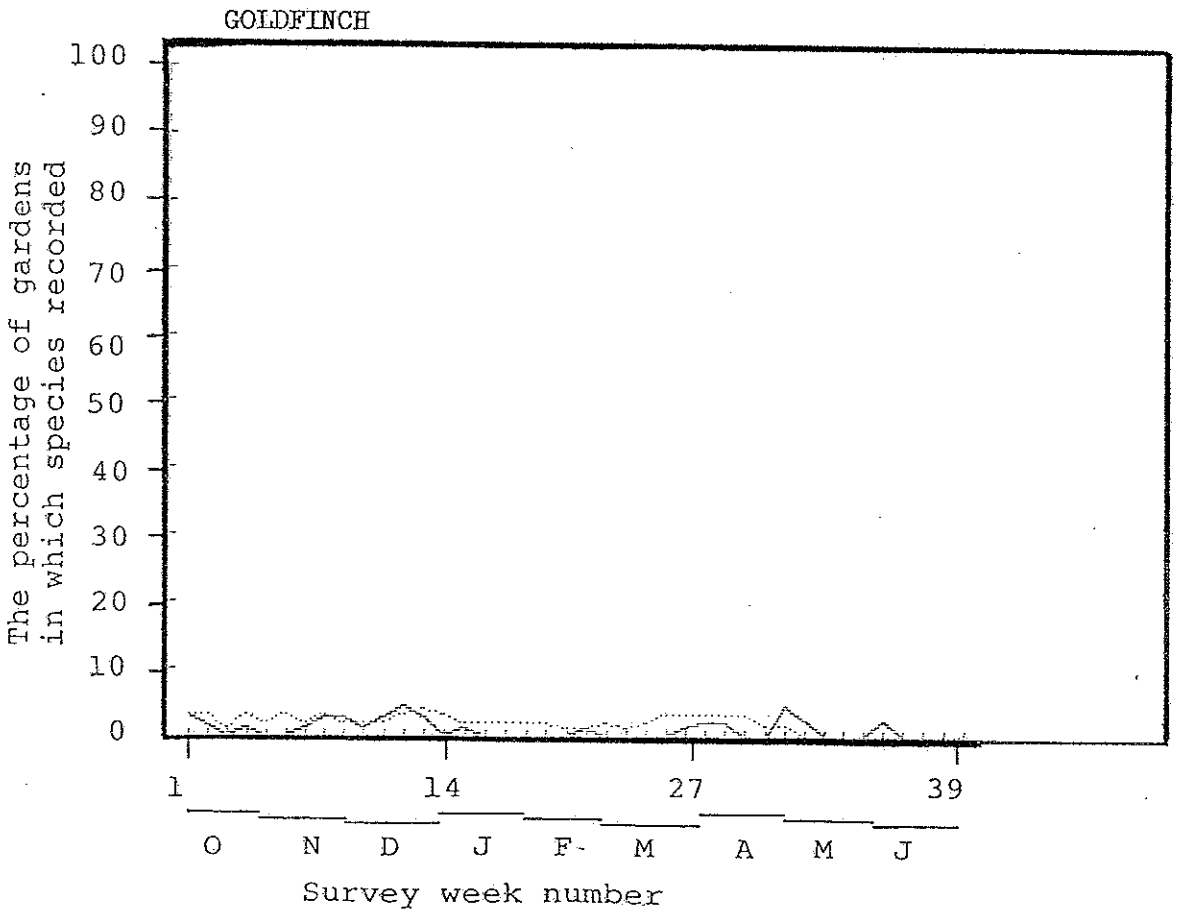
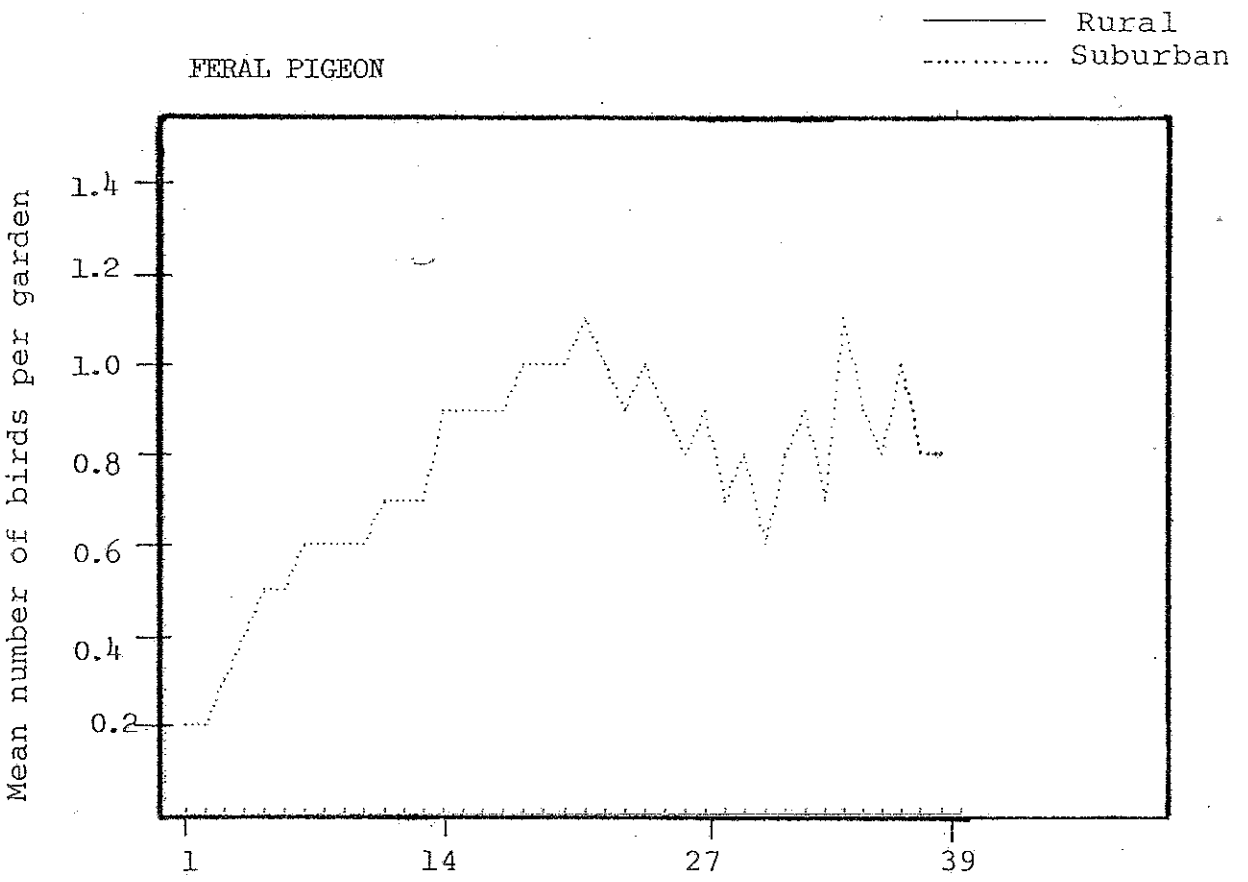

GOLDFINCH
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.35.


Rural
Suburban
FERAL PIGEON
Mean number of birds per garden
1.4
1.2
1.0
0.8
0.6
0.4
0.2
1
14
27
39

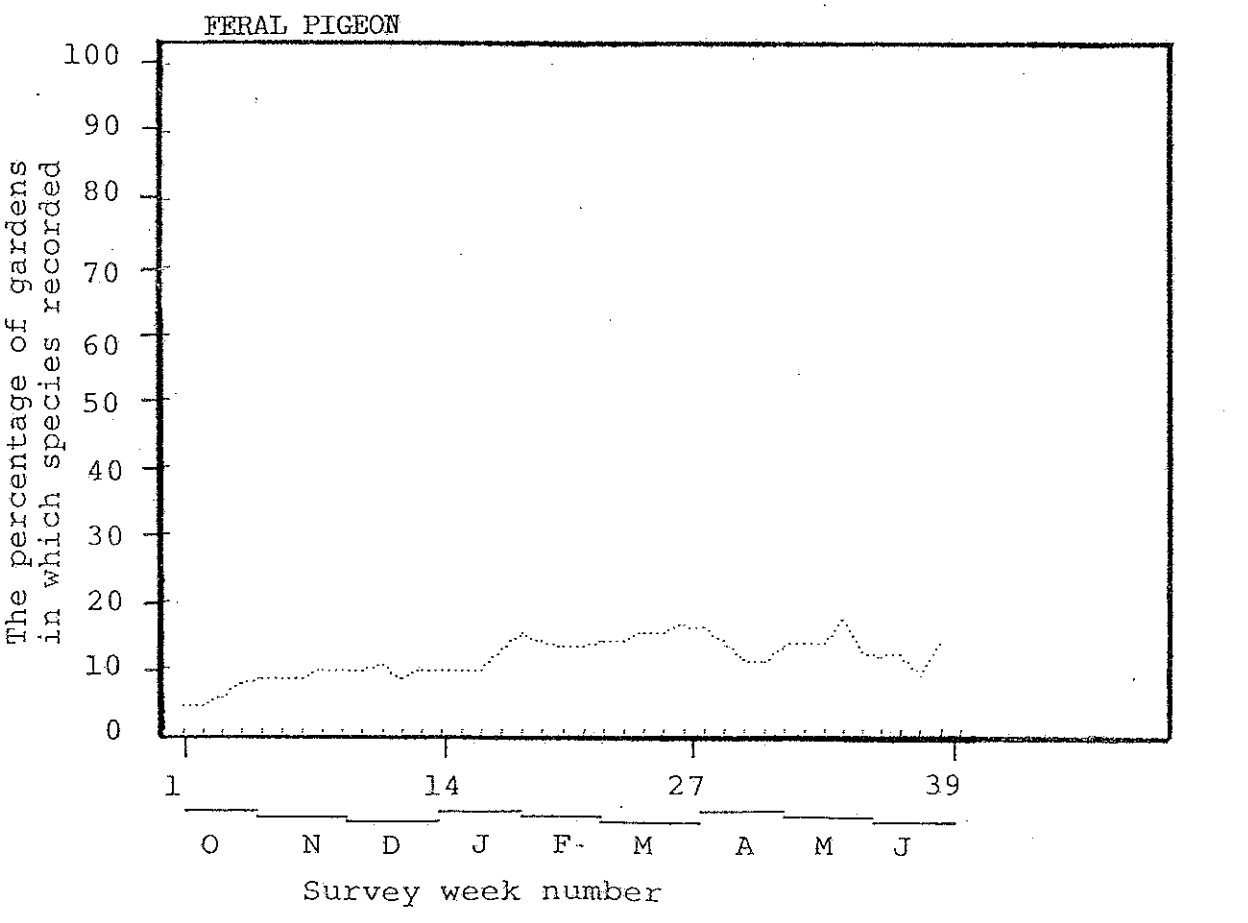

FERAL PIGEON
The percentage of gardens in which species recorded
100
90
80
70
60
50
40
30
20
10
0
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number

Fig. 2.36.

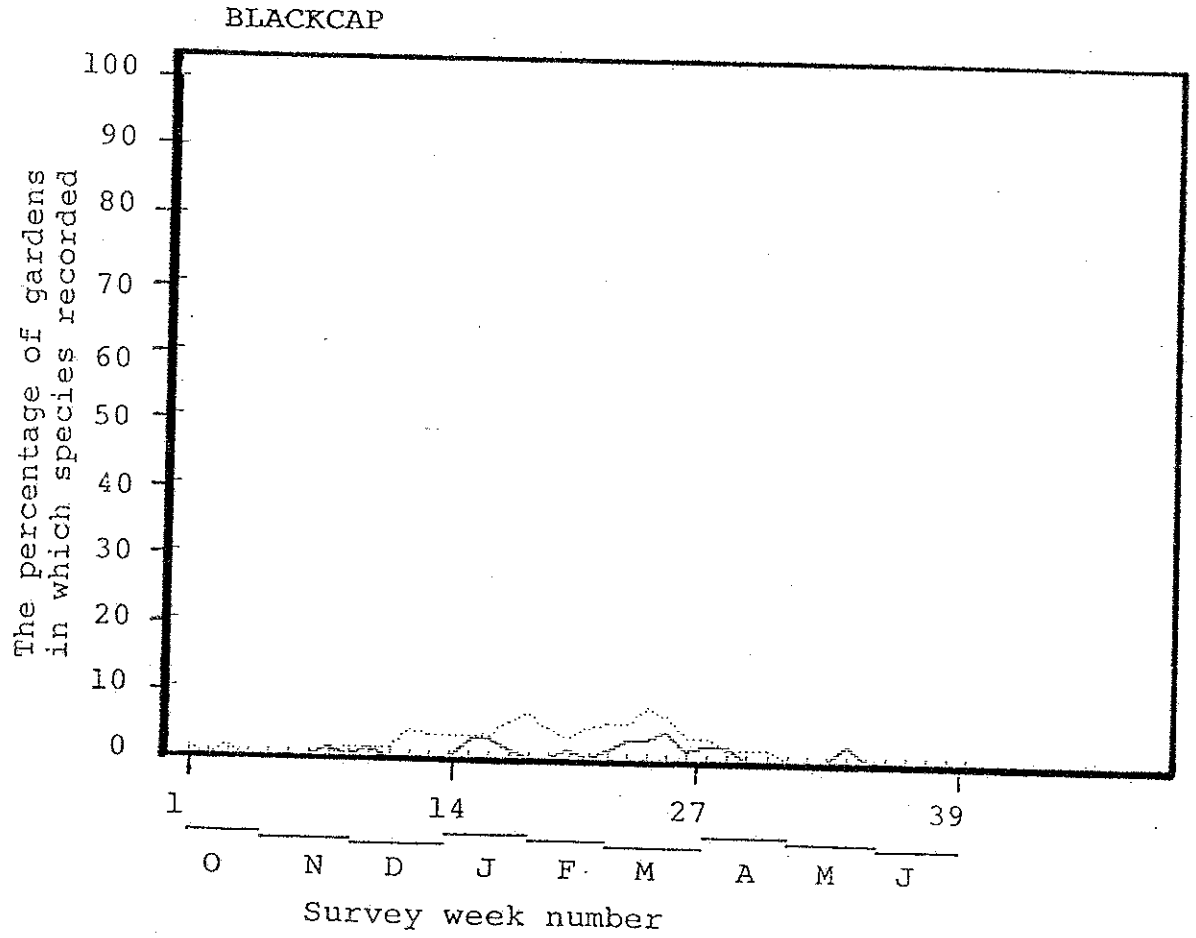


Fig. 2.37.

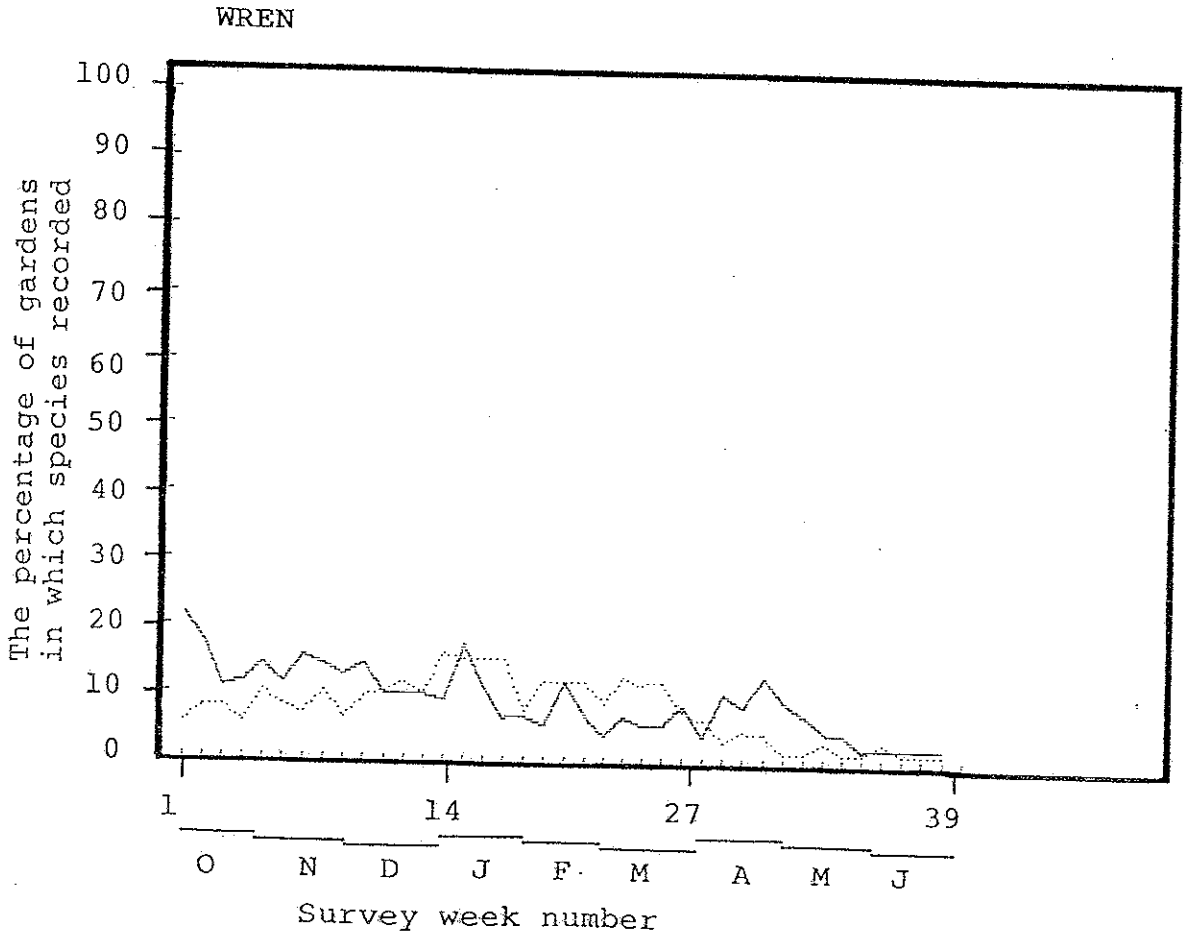
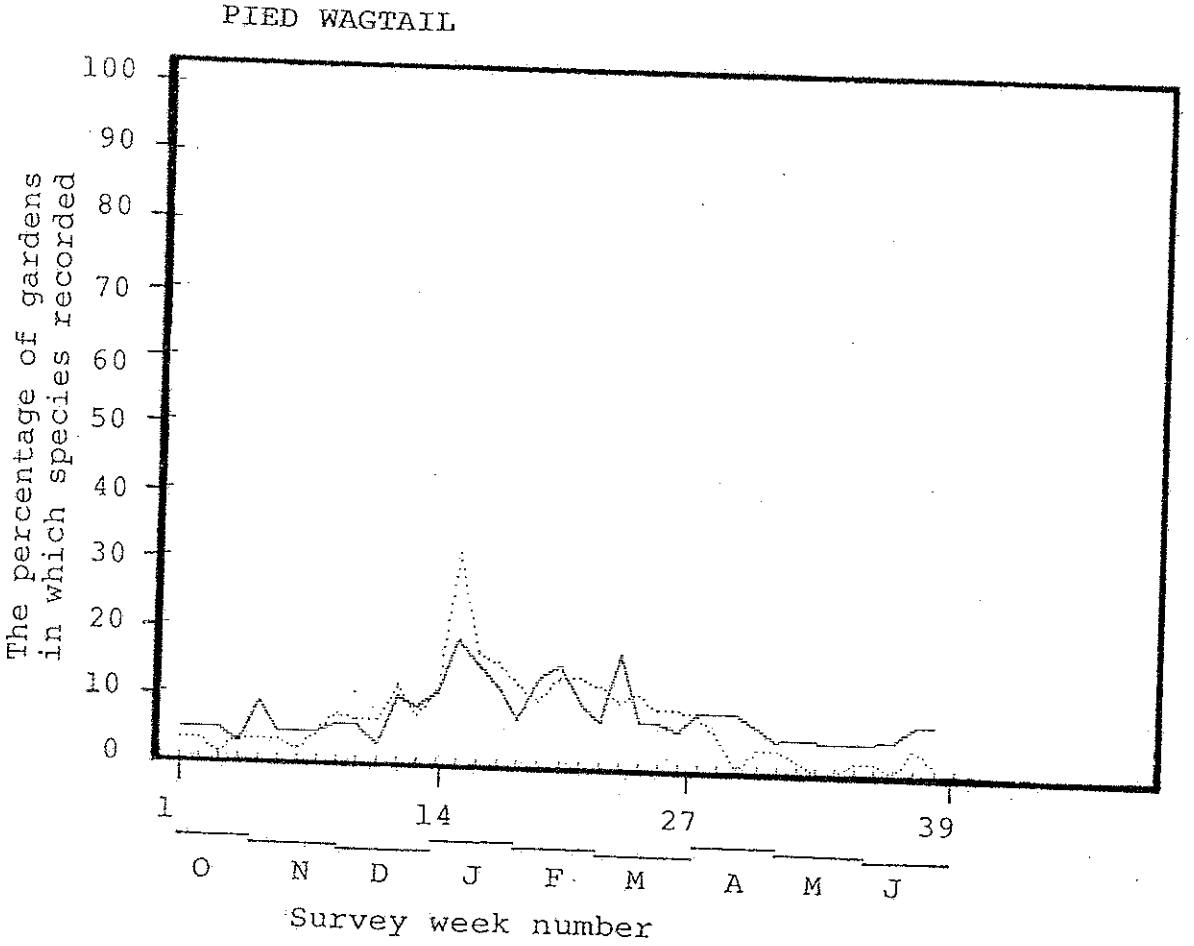


Fig. 2.38.


PIED WAGTAIL
100
90
80
70
60
50
40
30
20
10
0
The percentage of gardens in which species recorded
1
14
27
39
O
N
D
J
F
M
A
M
J
Survey week number