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BIRDS IN EUROPEAN GARDENS IN THE WINTER AND SPRING OF 1988-89

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REPORT OVERVIEW

This report describes the BTO European Garden Bird Survey, which was conducted during one winter and spring. It was funded by the Waltham Centre for Pet Nutrition (Mars UK Ltd). The main aims of the survey were to discover which species were commonest in gardens in different parts of Europe, to determine how patterns of occurrence varied seasonally and in relation to various characteristics of gardens, and to provide information for comparison with the UK, where more is known about garden birds than in most other parts of Europe.

The main section of the report is in the form of a scientific paper that will be submitted for publication when the report is accepted by WCPN. There is an abstract of this main section on page 4. The references for the whole report are listed at the end of the paper.

Appendix 1 tabulates the 12 most frequently and abundantly recorded species in each region in the survey.

Appendix 2 discusses the results in turn for each species that falls in the list of the twelve most frequently or abundantly recorded in at least one region of Europe. The results for each species are presented graphically at the end of this appendix.

The results and the analysis presented so far show that a survey of this type is both possible and fruitful, in terms of the

information it yields. Given time, several further analyses could be carried through to scientific publication. Formal considerations of the similarities and differences between the garden bird communities of different parts of Europe and of the seasonal and regional occurrence of suites of species defined by their ecology and migratory behaviour would be particularly interesting.

These results apply to one year only: they might have been different in a more severe winter. Furthermore, the survey did not cover the summer period. It would be valuable to mount a continuing survey both to monitor changing patterns of use of gardens by birds (we know that dramatic changes have occurred in the UK) and to reveal the importance of factors such as climate in determining the occurrence of birds in gardens. A year-round survey would be valuable as there is increasing evidence that gardens and supplementary feeding are important in summer for at least some species.

BIRDS IN EUROPEAN GARDENS IN THE WINTER AND SPRING OF 1988-89

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ABSTRACT

A survey of the occurrence of birds in gardens in fourteen countries in western Europe was conducted between 23 October 1988 and 20 May 1989. Most of the 440 participating gardens were on the edge of towns and 40% had trees, grass and shrubs. Their average size was 1608m^2. 176 species were recorded in all, with a mean of 21 per garden. Garden size was the most important factor determining the number of species present; gardens with both deciduous and coniferous trees had comparatively many species; urban gardens had comparatively few. The frequency with which artificial food was provided had little effect on the number of species recorded in a garden. The frequency of provision differed between countries but was uniformly greater in winter than in spring. Though there were substantial regional differences, the broad suite of species entering gardens was similar throughout Europe, the commonest species being Great Tit, Blackbird, Blue Tit, House Sparrow, Chaffinch, Greenfinch, Robin and Magpie. The occurrence of many species in gardens varied seasonally, particularly in relation to migration patterns.

INTRODUCTION

Gardens are an important bird habitat in the United Kingdom. During the winter (November to February) birds enter gardens to feed on a variety of supplementary foods that are provided by householders (Glue 1982, Cowie & Hinsley 1988, Thompson & Glue in prep). In spring and summer, birds breed in gardens (Glue 1982, Muirhead 1989) and in the late summer and autumn, when garden bird numbers are highest, supplementary food provided in gardens may be an important resource for young birds (Cowie & Hinsley 1988). Providing food for garden birds appears to be an equally important activity in other parts of the world. For example, in 1985, 82.5 million Americans provided food for wild birds in their 'back yard' spending over one billion American dollars on bird-seed alone (Al Geis, pers. comm.). Responses to a letter that we circulated to a number of European ornithologists revealed that the habit is also popular in some continental European countries. In Fennoscandia for example, sunflower seeds, seed-mixes and peanuts are commonly provided (F.Danielsen, H. Kallander pers. comm.). In West Germany, bird feeding has become increasingly popular since the 1950's with seed-mixes being the predominant food offered (P. Berthold pers. comm.). A wide range of wild bird foods are available in Switzerland. Along with other foods, these are increasingly being provided by householders (W. Suter, O. Biber pers. comm.). Bird feeding is also common in the Netherlands and Belgium where a number of suitable seed-mixes are available. Here however, many householders still only provide table scraps (E.R. Osieck, J. De

Beule, R. Arnhem pers. comm). In southern Europe, where the winter climate is relatively mild, few foods are bought for wild-birds and garden feeding is uncommon, though not unknown (A. Ortali, A.M. Teixeira pers. comm.).

In Finland, the provision of supplementary food is thought to lessen the impact of severe winter weather on some bird populations (Hildén & Koskimies 1969, Hildén 1988). In other parts of Fennoscandia, the provision of supplementary food is associated with increased levels of over-winter survival in the Great Tit, Blue Tit, Willow Tit, Crested Tit and Nuthatch (Jansson et al. 1981, Kallander 1981, Hogstad 1988, Nilsson 1987). Other studies, most notably in West Germany and the Netherlands, have demonstrated that supplementary food provision may influence over-winter survival and timing of breeding of some common garden birds (van Balen 1980, 1987, Berntd & Frantzen 1964, von Haartman 1973). The lack of other published material indicates that little is known about both the frequency and abundance with which birds visit gardens throughout Europe. Furthermore, the importance of European gardens for birds has never been assessed.

This paper presents the results of the BTO European Garden Bird Survey carried out in the winter and spring of 1988/89, in which the data were gathered by volunteers throughout western Europe. The primary aim of the survey was to determine which species were most frequently and abundantly recorded in gardens in different parts of Europe. A further aim was to determine how patterns of

occurrence and abundance varied between seasons and between different garden types. The survey did not include the U.K., where established BTO surveys of garden birds have already produced considerable information (Thompson 1987, 1988a, 1988b, Muirhead 1990, Glue & Muirhead 1991, Thompson & Glue in prep.).

METHODS

The survey was carried out between 23 October 1988 and 20 May 1989 by 440 volunteers from 14 European countries (Finland, Norway, Sweden, Denmark, West Germany, Austria, Spain, Italy, Portugal, France, Switzerland, Belgium, The Netherlands and the Republic of Ireland). These were grouped into six geographical regions for analysis, on *a priori* judgements of similarity of their avifaunas and climates (Fig. 1). As the volunteers were primarily BTO members and friends of members, it is possible that the gardens included in the survey may not be truly representative of European gardens, particularly in terms of features designed to attract birds, such as berry-bearing bushes, water, and supplementary food. They may, however, be fairly representative of the gardens of people who are interested in birds.

Recording was carried out for thirty weeks on a weekly basis. Each week, participants watched a previously defined area, adjacent to their houses, on a number of occasions, preferably at the same time of day. Not all of such areas were gardens in the strict sense: they included various open areas adjacent to houses, such as parks, orchards and meadows. During each recording session, participants noted the maximum number of each species that they saw in the recording area at one time. For each recording week, the maximum number (peak count) of individuals of each species seen at any one time in the whole week was recorded. Records were submitted for 9558 garden weeks -

72% of the possible total of 13200. Participants also recorded each week whether or not they had provided food for the birds. For the analyses in this paper, food provision was classified as infrequent (food provided in less than one-third of weeks), frequent (more than two-thirds of weeks), or moderate (one- to two-thirds).

Observers were asked to record various other details about their gardens, of which the ones used in this analysis were as follows.

Garden area (m^2). For analyses here, classed as small (less than $500m^2$), medium ($500-1000m^2$), or large (over $1000m^2$).

Altitude (to the nearest 100m). For analyses here, classed as low (up to 50m asl) or high (above that).

Trees present - coniferous, deciduous, both or neither.

Commonest habitat type in the surrounding area, the categories on the form being:

Other gardens (town centre)

Other gardens (edge of town)

Farmland

Woodland

Wetland

Other

Some participants did not use these habitat categories in a mutually exclusive way. For analyses here, all gardens with an entry in the first two categories were classed as urban and suburban respectively; those without such entries were classed as rural, as most of them obviously were surrounded mainly by open country. We refer to these classes as 'garden types'.

Some observers did not record all details, so sample sizes for the various analyses were not all the same.

To determine if garden use by birds varied seasonally, the data were arbitrarily split into winter data, drawn from 30 October to 4 March, and spring data, from 5 March to 20 May. (The first week of the survey, 23 - 29 October, was omitted because a significant proportion of the observers did not make observations during it). This division ignores the differences between regions in the date at which spring can be said to start but allowed objective comparisons to be made. A few observers recorded only during one of these seasons.

The total number of species seen in each garden during the survey period was used as a measure of its species richness.

The effects of region and of characteristics of gardens, their surroundings, and feeding frequency on species richness were investigated through a 6-way factorial analysis of variance using the SAS GLM procedure (SAS Institute Inc. 1985), backed up by 5-way analyses for each region separately (to check consistency of other effects across regions) and the examination of 2-way and 3-way tables of means (to examine the significant interactions detected by the anova). Interactions have only been discussed here if they were both formally significant and large: interactions that were so weak that they did not alter the broad patterns of major effects have been ignored, even if formally significant. The effect of season was examined by calculating

the ratio of the number of species seen in each garden in winter to the number seen in spring. The ratio was logarithmically transformed and entered as a dependent variable into a further series of multi-way anovas.

We also examined the frequency with which people provided food, by calculating the proportion of weeks in which food was provided out of those in which observations were made in each garden. We subjected this to analyses similar to those performed for the species richness.

To examine which species were commonest in gardens and their seasonal patterns of occurrence, we calculated the mean frequency of occurrence and abundance (weekly peak count) of each species in each region in both winter and spring. To extract overall patterns, species were ranked according to their order of occurrence and abundance within each region and the mean rank calculated over all regions.

Scientific names of all species mentioned in the text are shown in Tables 13 & 14.

RESULTS

The garden habitats

In all regions, most recording areas were on the edge of towns

(suburban) and many of them were in the immediate vicinity of farmland and woodland (Table 1). In every region, over 40% of all gardens were considered to be "good gardens", that is gardens with trees (conifers or deciduous), grass and some shrubs (Table 1).

Recording areas were largest in southern Europe (region 3) and smallest in Ireland (Table 1). Survey participants lived at various altitudes, generally highest in France and Switzerland (region 4) and lowest in the Low Countries (Table 1).

Variation in species richness

In total, 176 species were seen by the end of the survey, which extended to 9558 garden/weeks. On average, 21.2 species were seen in each survey garden but this number was influenced by various characteristics of the gardens, which we consider in turn.

Region

Overall differences in the mean number of species recorded between regions were small. On average, most species were recorded in gardens in the Low Countries (region 5) and fewest in southern Europe (region 3) (Tables 2 & 3). Also shown in Table 2 are the total numbers of species recorded in all gardens in each region, which differ more than the means per garden. It is noteworthy that, despite their much smaller sample sizes, southern Europe and France (regions 3 and 4) produced totals as

high or higher than Scandinavia and middle Europe (regions 1 and 2), suggesting a greater diversity of species between gardens in the south than in the north.

Area

Of all the habitat-related factors considered, garden size had the greatest effect on the number of species recorded (Tables 2 & 3). Although the effect is not absolutely consistent over all regions (note significant country x area interaction, Table 3), in every region more species were recorded in large than in small gardens. This has particularly important implications for the future design of any garden bird survey.

Altitude

There was no overall effect of altitude on the number of species recorded (Tables 2 & 3). Not surprisingly, however, given the range of geographical variation between regions, there were significant effects of altitude that were different between regions (Tables 2 & 4). In particular, Scandinavia (region 1) had significantly more species at low altitude and middle and southern Europe (regions 2 and 3) more at high altitude.

Garden type

As expected, urban gardens were consistently poorer than the others in terms of the number of species recorded (Tables 2 & 3). However, the degree to which they were poor varied between regions, as did the degree of difference between suburban and rural gardens (Tables 3 & 5). In Scandinavia and middle Europe

(regions 1 and 2), garden type had little effect; in the Low countries (region 5) rural gardens were best but not significantly so; in southern Europe and Ireland (regions 3 and 6), rural gardens were best and urban worst; but in France and Switzerland (region 4) suburban were better than rural gardens (Table 5).

Trees present

The presence of a number and variety of mature trees might be expected to exert an effect on the number and range of species recorded in any one garden. Although there were clear differences between regions in the effects of trees (Tables 3 & 6), the gardens with both deciduous and coniferous trees generally had most species, those with only deciduous had fewer, and those with only conifers fewer still (Table 6).

Feeding frequency

Feeding frequency might have been expected to exert a strong effect on the number of species entering gardens, so it was surprising that there was no major effect of feeding frequency on the number of species recorded (Tables 2 & 3). There appear to be some effects within individual regions but these are slight (Tables 3 & 7). As shall be seen below, the frequency with which supplementary food was itself provided was seasonally and regionally variable.

Season

There were indications that the ratio of winter numbers to spring

numbers was affected by region, garden area, and garden type (though the complete 6-way analysis of variance was not significant) (Tables 8 & 9). These variations were superimposed on a general pattern, in that there were more birds recorded in winter than in spring, on average, in every one of the 54 factorial combinations of region, garden area, and garden type. However, since there were twice as many winter weeks as spring weeks, this pattern may not mean that there were more species per garden in any one week in winter than in spring.

Variation in feeding frequency

Overall, participants provided food during 60.4% of the weeks observed. The frequency varied with region, altitude, and area (Table 10); interactions involving garden type and trees present were formally significant but weak. Scandinavians and the Irish (regions 1 and 6) tended to feed their birds most frequently, Germans and Austrians (region 2) least, and feeding was more frequent in smaller gardens and at higher altitudes (Table 11).

Many house-holders (perhaps the majority) provide food on an irregular basis. To investigate any seasonal variation in the feeding pattern, the log of the ratio of proportion of weeks in winter for which food was provided to the corresponding spring proportion was subject to a 5-way analysis of variance. The overall model was not significant ($F(135,242) = 0.8$, $P=0.9$) and explained only 31% of the variation. However, region and altitude both gave rise to significant components in the analysis

($P<0.001$ and $P<0.01$ respectively): seasonal variation in feeding frequency was particularly marked in France, Switzerland, the Low Countries and Ireland, and at lower altitudes (Table 12). In all 14 combinations of region and altitude, the ratio favoured winter, showing once again an overall seasonal pattern on which minor variations were superimposed.

Individual species

Most frequently recorded species

Of the species recorded, 46 (26%) were recorded from 10% or more of all gardens. The list of species that comprised the twelve most frequently recorded in at least one region extended to 30 in Europe as a whole (Table 13), indicating substantial differences between regions in their garden avifaunas. Winter and spring ranks were highly correlated ($r=0.93$). Overall, the Great Tit was the most frequently recorded species, coming top of the list in four of the six regions in winter and in three of the six regions in spring. The Blackbird was almost as frequent, with Blue Tit, House Sparrow, Chaffinch, Greenfinch, Robin and Magpie not far behind.

Most abundantly recorded species

The 31 species that comprised the twelve most abundantly recorded in at least one region are shown in Table 14. Winter and spring ranks were highly correlated ($r=0.94$). Overall, the House Sparrow was the most abundant species, being the most abundant species in both winter and spring in four individual regions.

In the two remaining regions the Greenfinch was the most abundant bird in both seasons, though the Great Tit was as abundant overall. The other abundant species, in order, were Blackbird, Chaffinch, Blue Tit, Robin and Magpie.

Comparison of frequency and abundance

The same species were both the eight most abundant and the eight most frequent, reflecting a generally strong correlation of abundance of each species with its frequency of occurrence. However, a number of species were ranked higher for abundance than for frequency of occurrence (several not even entering the 'top 30' frequency list). The more striking examples were House Sparrow, Tree Sparrow, Starling, Siskin, Hawfinch, Fieldfare, Brambling, and Jay - most of them species that live in flocks, especially in winter. In contrast were species of a more solitary nature, which tended to rank higher in frequency of occurrence than in abundance: Robin, Wren, Dunnock, Nuthatch, Great Spotted Woodpecker, Pied Wagtail and Black Redstart.

Seasonal patterns

Tables 13 and 14 display various seasonal patterns of frequency and abundance. Some are obviously related to migration patterns. Thus, of the species that tend to withdraw from northern Europe in winter, the Woodpigeon was not only generally more frequent in gardens in spring than in winter but did not occur at all in Scandinavian (region 1) gardens in winter; the Dunnock was scarce in Scandinavian gardens in winter; the Pied Wagtail, a winter garden bird in southern Europe, France and Switzerland (regions

3 and 4), was a spring bird in Scandinavia, Middle Europe, and the Low Countries (regions 1, 2, 5); the Robin and Chaffinch are similar to the Pied Wagtail in this respect, except that they were found in gardens more in winter than in spring in the Low Countries. The Chiffchaff has an even stronger southward withdrawal in winter and as a garden bird was everywhere commoner in spring, except in southern Europe (region 3); but the Blackcap, with a roughly similar migration pattern, was apparently commoner in winter in Scandinavian gardens. This could be because Blackcaps that overwinter in Scandinavia take refuge in gardens, as they do in Britain (Leach 1981), but the sample size for Blackcaps in Scandinavian gardens was very small, so the result may be a statistical quirk. The Black Redstart and Serin also tend to retreat south in winter from their already rather limited breeding ranges: in gardens, they tended to be commoner in spring than in winter, though less so in southern Europe (region 3).

Fieldfare, Siskin, and Brambling are widespread in winter in Europe but retreat north to breed. All were commoner in gardens in winter than in spring, except in Scandinavia (region 1).

Less migratory species also showed seasonal patterns in their use of gardens. Species that were generally more frequent in spring (though not necessarily more abundant) were Collared Dove, Starling and Jackdaw, and possibly also Crow, Magpie, Greenfinch, Goldfinch, and House Sparrow, though with less consistency across regions. Nuthatch, Willow Tit and Marsh Tit were more frequent

and abundant in gardens in winter; the same can probably also be said of Great Tit, Blue Tit, Coal Tit, and Tree Sparrow; and possibly also of Wren and Bullfinch.

Discussion

The over-winter survival of some European birds that frequently enter gardens is known to depend on both climatic conditions and the availability of natural foods (Perrins 1979, O'Connor 1980, Kallander 1981, Enoksson & Nilsson 1983, Bejer & Rudemo 1985, van Balen et al. 1987, Orell 1989, Greenwood & Baillie 1991). Not surprisingly, these factors influence the number of birds that actually enter gardens (Glue 1982, Thompson 1988, Thompson & Glue in prep.). Some of the regional and seasonal effects that we have described above may have been mediated by these factors but we cannot tell, because we neither measured them nor have data for more than one year.

Because the survey covered only one year, it is possible that the results were atypical. However, European mid-winter temperatures, though perhaps a little above the normal, were not markedly atypical in 1988/89 (Meaden 1989), so we think this unlikely.

In terms of species richness, the differences between regions that the survey has revealed are slight. It may be that those regions where the general avifauna is relatively impoverished are those where a particularly high proportion of the species go into

gardens, particularly in winter.

Garden size appeared to be the most important single factor determining how many species were recorded in a garden. This may be a simple result of a bigger area holding more birds. Or perhaps big gardens tend to occur in otherwise bird-rich areas. But it could be that big gardens are intrinsically better for birds, perhaps containing a greater variety of habitat.

Another general result was that urban gardens were less species-rich than suburban or rural ones, perhaps because there are fewer birds in their surrounding areas. It is probably true, as Glue (1982) and Cowie & Hinsley (1988) point out, that urban gardens tend to be smaller and contain fewer tress and shrubs than other gardens but this cannot be the whole explanation for them having fewer species, because our analysis took into account both garden size and presence of trees, showing that there was an effect of urban conditions that was independent of these. The effect of trees - with gardens that contain both deciduous and coniferous trees having the most bird species - is also independent of garden size: it is not just that gardens with diverse trees are large that causes them to attract birds.

It is interesting that the effects of altitude should be different in different countries. To birdwatchers from the northwestern fringes of Europe, the reduction in species diversity at higher altitudes in Scandinavia is not surprising. Perhaps the opposite trend in middle and southern Europe is

because low altitude gardens there are surrounded by more impoverished landscapes than those at higher altitudes.

We were admittedly surprised to find that feeding frequency did not affect species richness. It may be that we would have found an effect if the survey had included a good sample of gardens in which birds were never fed: we had few of those, since most of the participants in the survey were interested in attracting birds to their gardens. It is also possible that both the abundance of birds and the occurrence of particular species is strongly dependent on the frequency with which supplementary food is provided but we have not yet carried out the necessary analyses.

Even our self-selected sample of volunteers only provided food during 60% of the weeks overall, with higher frequencies in Scandinavia and Ireland balanced by lower frequencies in Germany and Austria. Since winters in central, and even southern, Europe can be severe, those who believe that feeding in gardens can be beneficial to birds (for which we have reviewed the evidence in the Introduction), will see room for improvement. Of course, our survey extended well into the spring, when observers in all regions tend substantially to reduce the frequency with which they provide food for birds. This last result was found in Britain by Cowie & Hinsley (1988) but they also found that, if food is provided, many species continue to use it through the spring. Indeed, they found the rate of consumption of peanuts in their study garden to vary only by a factor of four over a

whole year. It may be that the provision of supplementary food by people varies seasonally more than the demand by the birds.

All of the top eight garden bird species (Great Tit, Blackbird, Blue Tit, House Sparrow, Chaffinch, Greenfinch, Robin, and Magpie) take supplementary food (Glue 1982) and this may be a primary reason for their frequent occurrence in gardens. This is probably why some species, notably the tits, Nuthatch and Tree Sparrow, were observed more in winter (when food demand is great) but it is less easy to explain why other species, notably Collared Dove, Starling and Jackdaw, were observed more in spring. Perhaps they are able to subsist on natural food for much of the winter until stocks run out in late winter and spring. Alternatively, they may be more noticeable in spring because of activities associated with the breeding season. As we have demonstrated, seasonal patterns of occurrence in gardens of migratory species can generally be related to their migration patterns.

Though we have demonstrated broad similarities in garden bird faunas throughout western Europe, there were substantial differences between regions in species composition of the garden avifaunas. Two regions stand out particularly. One is southern Europe, where Blackcap and Chiffchaff are strikingly more common as garden birds than elsewhere, as are Robin, Black Redstart and Pied Wagtail in winter, and Serin and Goldfinch in spring. The other is Ireland, where a number of what are otherwise typical

garden birds are missing or scarce (Lack 1986, Hutchinson 1989). In this respect, Ireland is not particularly similar to Britain, where continuing BTO surveys have provided much information on garden birds (Glue 1972, Muirhead 1990, Glue & Muirhead 1991). The top nine species there are Blackbird, Blue Tit, Robin, Starling, House Sparrow, Greenfinch, Great Tit, Chaffinch and Dunnock; Great Tit, Magpie and, to a lesser extent, Chaffinch and Greenfinch tend to come lower in the lists in Britain than in Europe as a whole, whereas Robin and Starling come higher.

Results from other BTO surveys show that the species occurring in British gardens are similar to those recorded in the rest of Europe (Glue 1982, Thompson 1987, 1988a, 1988b, Thompson & Glue in prep.). A conspicuous exception is the Reed Bunting *Emberiza schoeniclus*, which is much more frequently recorded in British gardens than elsewhere. However, this is a recent phenomenon (Thompson 1988a, Thompson & Glue in prep.): British Reed Buntings used to visit gardens only in cold weather. Whether their habits have changed because of increased supplementary feeding, because of deterioration of habitats outside gardens, or because of learning, we cannot tell. But this is not the only species to have changed the frequency with which it visits gardens more rapidly than its national population has changed (Thompson 1988a, Thompson & Glue in prep.). It is inconceivable that similar changes have not occurred elsewhere in Europe or that they will not occur in future. There is clearly value in extending the long-term studies that have been conducted in Britain to the countries covered in this survey.

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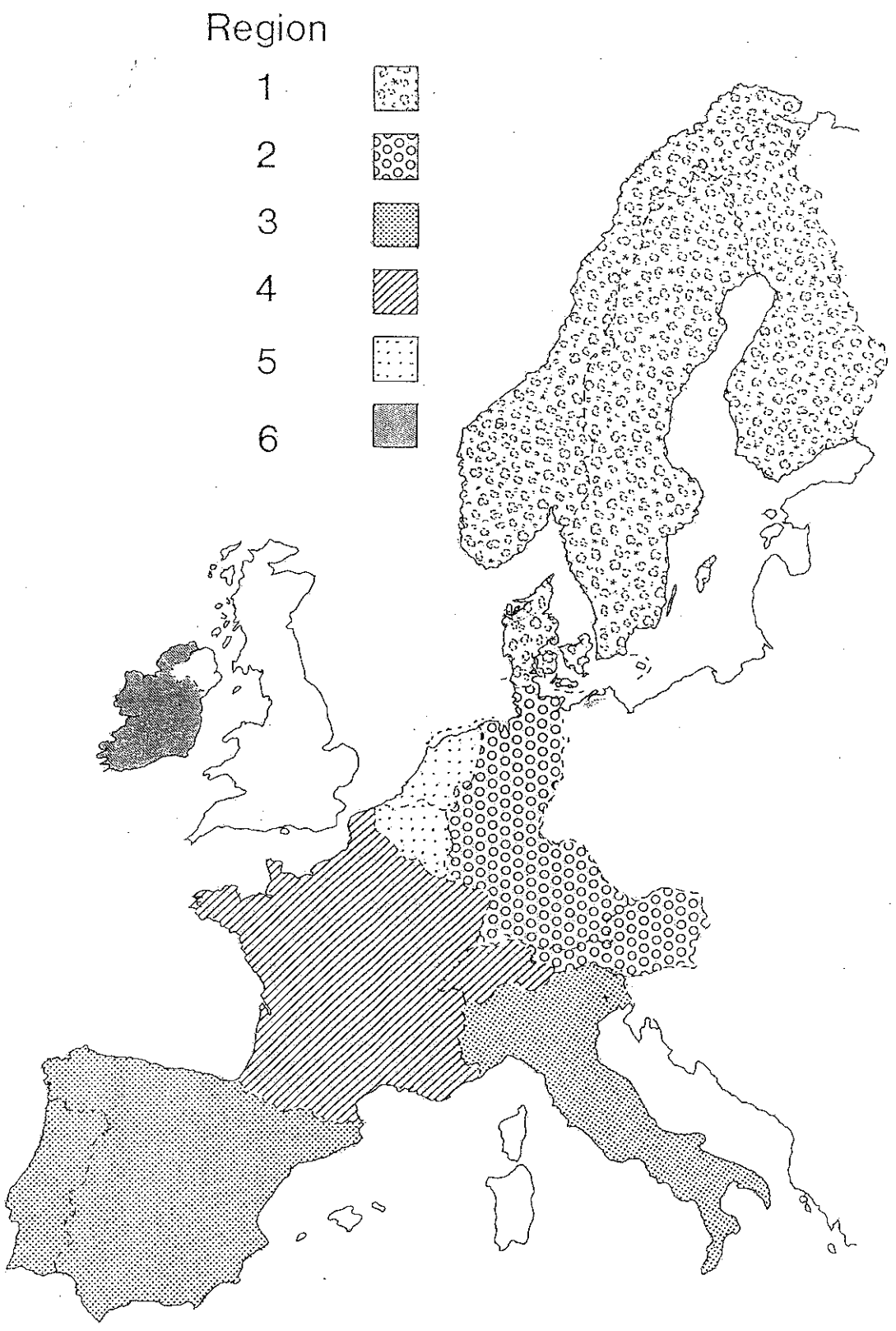

Fig 1 The six regions participating in the European Garden Bird Survey

Table 1 Characteristics of the gardens participating in the survey: the percentages that were urban and suburban, that had farmland, woodland, or wetland nearby, that were "good gardens" (see text); mean garden sizes and altitudes; numbers of gardens and total number of garden-weeks monitored. Note that, while urban and suburban are mutually exclusive categories, farmland, woodland and wetland exclude neither each other nor urban and suburban.

	Garden type (%)		Surroundings (%)			Good Gardens (%)	Area (m^2)	Altitude (m)	No. Gardens	No. Garden-weeks
Region	Urban	Suburban	Farmland	Woodland	Wetland					
1	3	54	36	47	4	42	825	106	118	2561
2	12	66	21	23	5	79	2103	93	121	2298
3	25	48	39	24	3	43	3048	146	60	1427
4	12	52	46	41	19	59	1958	344	61	1305
5	21	46	19	34	0	80	783	15	54	1360
6	8	62	46	11	11	54	654	70	26	607
Total	12	56	32	33	6	60	1608	127	440	9558

Table 2 Mean number of species recorded per garden (species richness) over the entire survey period, according to various characteristics of the gardens. See text for definition of classes. Column n shows sample sizes.

Variable		Mean No. of species	n	Total No. of species
Region	1	20.3	112	106
	2	22.1	117	91
	3	19.6	56	103
	4	22.4	59	118
	5	22.5	50	82
	6	21.7	26	53
Garden area	small	18.6	223	
	medium	22.2	79	
	large	26.1	118	
Garden altitude	low	21.3	252	
	high	21.4	168	
Garden type	urban	18.2	51	
	suburban	21.9	238	
	rural	21.6	131	
Tree presence	conifers	16.2	26	
	deciduous	19.3	83	
	both	22.5	287	
	neither	20.3	24	
Feeding frequency	infrequent	21.0	116	
	moderate	22.0	40	
	frequent	21.4	264	

Table 3 The results of a 6-way analysis of variance to examine the relationship between number of species recorded (dependent variable) and region, garden area, altitude, garden type, tree presence and the frequency with which supplementary food was provided. The model provides a highly significant fit to the data ($F(211,208) = 2.1$, $P<0.0001$), explaining 68% of the variance. DF = degrees of freedom; F = variance ratio; P = probability of obtaining that F or larger by chance alone. Asterisks indicate components that cannot be estimated from the available data.

Source	DF	F	P
Region (R)	5	2.0	0.08
Area (Ar)	2	45.8	0.0001
R x Ar	10	3.5	0.0003
Altitude (Al)	1	0.0	0.9
R x Al	5	5.6	0.0001
Ar x Al	2	0.3	0.8
R x Ar x Al	6	0.1	1.0
Garden type (G)	2	6.0	0.003
R x G	10	5.2	0.0001
Ar x G	4	1.6	0.2
R x Ar x G	16	0.0	1.0
Al x G	2	0.1	0.9
R x Al x G	9	1.0	0.4
Ar x Al x G	4	2.5	0.04
R x Ar x Al x G	2	0.1	0.9
Tree presence (T)	3	10.0	0.0001
R x T	14	2.5	0.002
Ar x T	6	2.5	0.02
R x Ar x T	13	1.9	0.04
Al x T	3	1.2	0.3
R x Al x T	8	0.0	1.0
Ar x Al x T	5	0.9	0.5
R x Ar x Al x T	*	-	-
G x T	6	1.7	0.1
R x G x T	14	0.1	1.0
Ar x G x T	8	0.0	1.0
R x Ar x G x T	*	-	-
Al x G x T	5	1.6	0.2
R x Al x G x T	*	-	-
Ar x Al x G x T	2	0.0	1.0
R x Ar x Al x G x T	*	-	-
Feeding frequency(F)	2	0.3	0.7
R x F	10	2.7	0.004
Ar x F	4	4.0	0.004
R x Ar x F	14	0.8	0.7
Al x F	2	0.9	0.4
R x Al x F	8	2.5	0.01
Ar x Al x F	4	0.0	1.0
R x Ar x Al x F	2	2.6	0.08
G x F	4	2.5	0.04
R x G x F	15	1.7	0.05
Ar x G x F	6	0.3	0.9
R x Ar x G x F	*	-	-
Al x G x F	3	2.0	0.1
R x Al x G x F	*	-	-
Ar x Al x G x F	5	1.5	0.2
R x Ar x Al x G x F	*	-	-
T x F	5	9.0	0.0001
R x T x F	9	0.0	1.0
Ar x T x F	8	0.4	0.9
R x Ar x T x F	*	-	-
Al x T x F	4	3.8	0.006
R x Al x T x F	*	-	-
Ar x Al x T x F	1	0.0	1.0
R x Ar x Al x T x F	*	-	-
G x T x F	6	4.1	0.0007
R x G x T x F	*	-	-
Ar x G x T x F	*	-	-
R x Ar x G x T x F	*	-	-
Al x G x T x F	2	0.0	1.0
R x Al x G x T x F	*	-	-
Ar x Al x G x T x F	*	-	-
R x Ar x Al x G x T x F	6	2.6	0.02

Table 4 The mean number of species recorded per garden in each region according to altitude. Columns n show sample sizes. Column P shows the significance levels associated with the difference between altitudes in each region (- means not significant at P=0.05).

	Altitude				
	low	n	high	n	P
Region					
1	21.8	58	18.7	54	<0.01
2	20.6	88	26.8	29	<0.01
3	17.5	23	21.1	33	-
4	23.7	24	21.5	35	-
5	22.5	47	22.7	3	-
6	22.4	12	21.0	14	-

Table 5 The mean number of species recorded per garden in each region according to garden type. Columns n show sample sizes. Column P shows the significance level associated with the differences between types in each region (- means not significant at P=0.05).

	Garden type						
	urban	n	suburban	n	rural	n	P
Region							
1	20.3	3	20.8	63	19.7	46	-
2	20.2	14	22.6	77	21.7	26	-
3	15.1	14	17.9	28	27.6	14	<0.01
4	16.0	7	27.0	30	18.1	22	<0.01
5	21.6	11	21.3	24	25.1	15	-
6	11.5	2	21.3	16	25.0	8	<0.05

Table 6 The mean number of species recorded per garden in each region according to trees present. Columns n show sample sizes. Column P shows the significance level associated with the differences between tree classes in each region (- means not significant at P=0.05).

	Trees Present								
	conifer	n	deciduous	n	both	n	none	n	P
Region									
1	17.8	11	20.7	28	21.4	62	15.8	11	<0.01
2	13.0	4	15.9	14	23.6	97	13.0	2	<0.01
3	12.9	7	17.3	14	20.0	30	33.2	5	<0.05
4	20.0	3	20.8	15	23.0	40	28.0	1	-
5	-	0	19.4	7	23.2	42	16.0	1	-
6	24.0	1	21.2	5	22.2	16	19.5	4	-

Table 7 The mean number of species recorded per garden in each region according to the frequency with which supplementary food was provided. Columns n show sample sizes. Column P shows the significance level associated with the differences between feeding frequencies (- means not significant at P=0.05).

	Feeding Frequency						
	infrequent	n	moderate	n	frequent	n	P
Region							
1	17.5	4	13.3	4	20.7	104	<0.05
2	19.8	59	24.8	10	24.4	48	<0.01
3	22.1	22	23.0	4	17.3	30	-
4	24.3	15	21.6	11	21.8	33	-
5	21.5	14	22.4	8	23.0	28	-
6	24.0	2	23.0	3	21.2	21	-

Table 8 The results of a 6-way analysis of variance to examine the relationship between seasonal variation in numbers (dependent variable) and region, garden area, altitude, garden type, tree presence and the frequency with which supplementary food was provided. For clarity, non-significant effects are not presented. The overall model explains 56% of the variation in the log of the ratio winter numbers to spring numbers, but this is not significant ($F(225,203) = 1.2$, $P=0.16$). Abbreviations as in Table 3.

Source	DF	F	P
Region (R)	5	4.0	0.002
Area (Ar)	2	4.3	0.01
Garden Type (G)	2	3.5	0.03
R x Ar x Tree presence (T)	14	2.2	0.008
R x G x T	14	2.2	0.009
Ar x Altitude (Al) x G x T	2	4.5	0.01
R x Ar x Feeding frequency (F)	15	2.2	0.006
R x Ar x Al x F	3	5.4	0.001
R x G x F	16	2.3	0.005
R x Al x G x F	3	4.9	0.003
R x Ar x Al x G x T x F	8	3.1	0.002

Table 9 Geometric mean ratios of number of species observed in a garden in winter to the number observed in spring, in relation to region, garden area, and garden type. The values were obtained by back-transforming arithmetic means of log ratios. Column n shows sample sizes.

	mean ratio	n
Region		
1	1.51	116
2	1.23	119
3	1.32	56
4	1.55	59
5	1.29	53
6	1.20	26
Garden Area		
small	1.45	227
medium	1.26	84
large	1.29	118
Garden Type		
urban	1.29	51
suburban	1.32	244
rural	1.48	134

Table 10 The results of a 5-way analysis of variance to examine the relationship between the frequency with which supplementary food was provided (dependent variable) and region, garden area, altitude, garden type and tree presence. For clarity, non-significant effects are not presented. The overall model explains 51% of the variation in feeding frequency and provides a highly significant fit to the data ($F(143,276) = 2.0$, $P<0.001$). Abbreviations as in Table 3.

Source	DF	F	P
Region (R)	5	26.8	0.0001
Area (AR)	2	19.2	0.0001
Altitude (Al)	1	5.1	0.02
Ar x Gt x Tr	8	2.9	0.004
Al x Ar x Gt x Tr	2	5.1	0.007

Table 11 Mean percentage of observed weeks in which food was provided, in relation to region, garden area, and altitude. Column n shows sample sizes.

	Mean	n
Region		
1	88	112
2	40	117
3	50	56
4	53	59
5	55	50
6	81	26
Garden Area		
small	70	223
medium	55	79
large	46	118
Altitude		
low	57	252
high	65	168

Table 12 Geometric mean ratios of frequency with which food was provided in winter to the corresponding spring frequency. The values were obtained by back-transforming arithmetic means of log ratios. Column n shows sample sizes.

	Mean ratio	n
Region		
1	1.66	97
2	3.23	106
3	1.58	53
4	4.37	49
5	4.79	48
6	1.38	25
Altitude		
low	3.02	229
high	1.95	149

Table 13 Mean weekly percentage frequency of occurrence and overall rank of those species that comprised the twelve most frequently recorded species in at least one region.

	Winter observations Region number							Spring observations Region number						
	1	2	3	4	5	6	Overall rank	1	2	3	4	5	6	Overall rank
Woodpigeon *(Columba palumbus)*	0	41	0	3	10	32	20	12	46	1	8	34	39	19
Collared Dove *(Streptopelia decaocto)*	11	27	15	25	45	18	15	17	39	20	35	61	32	13
Gt. Sp. Woodp. *(Dendrocopus major)*	26	26	5	17	12	0	18	18	28	5	15	10	0	20
Crow *(Corvus corone)*	21	21	6	11	8	9	19	27	30	5	17	13	11	18
Rook *(Corvus frugilegus)*	1	15	0	0	0	41	24	1	2	0	0	2	54	26
Jackdaw *(Corvus monedula)*	6	5	0	0	22	52	21	8	14	0	1	33	60	21
Magpie *(Pica pica)*	69	64	19	36	51	51	8	75	56	21	38	53	56	8
Great Tit *(Parus major)*	97	94	56	91	96	78	2	94	96	56	84	95	76	2
Blue Tit *(Parus caeruleus)*	77	91	31	73	79	86	3	62	91	31	58	74	88	5
Coal Tit *(Parus ater)*	17	19	10	17	8	51	17	11	13	9	15	3	56	21
Marsh Tit *(Parus palustris)*	24	20	3	30	7	0	19	13	17	2	22	3	0	22
Willow Tit *(Parus montanus)*	36	8	0	3	6	0	22	26	9	0	0	3	0	25
Nuthatch *(Sitta europaea)*	31	25	2	31	10	0	17	14	23	1	28	6	0	21
Wren *(Troglodytes troglodytes)*	8	41	30	28	47	57	11	6	41	12	24	52	52	15
Blackbird *(Turdus merula)*	41	90	77	83	94	80	3	41	96	77	83	98	93	2
Black Redstart *(Phoenicurus ochruros)*	0	0	21	1	0	0	25	0	27	11	15	3	0	23
Robin *(Erithacus rubecula)*	21	60	91	72	77	67	7	29	68	42	47	59	79	7
Blackcap *(Sylvia atricapilla)*	2	0	27	8	2	11	21	1	25	36	22	13	7	18
Chiffchaff *(Phylloscopus collybita)*	0	0	33	10	2	2	22	2	47	22	22	35	4	16
Dunnock *(Prunella modularis)*	1	24	16	30	55	70	13	12	57	2	28	64	61	12
Pied Wagtail *(Motacilla alba)*	0	0	22	9	0	22	22	22	28	19	8	13	20	18
Starling *(Sturnus vulgaris)*	4	5	16	15	34	45	17	35	51	17	26	56	49	12
Greenfinch *(Carduelis chloris)*	65	68	23	51	39	68	7	70	87	46	63	50	60	6
Goldfinch *(Carduelis carduelis)*	1	3	14	10	3	6	22	4	13	30	22	6	5	20
Serin *(Serinus serinus)*	0	1	12	2	0	0	26	0	11	32	21	0	0	23
Bullfinch *(Pyrrhula pyrrhula)*	47	35	1	16	3	23	16	38	25	1	9	4	13	20
Chaffinch *(Fringilla coelebs)*	23	62	41	79	71	80	6	57	80	35	74	50	83	6
Yellowhammer *(Emberiza citrinella)*	31	2	0	4	0	0	24	27	6	0	1	0	2	25
House Sparrow *(Passer domesticus)*	52	63	87	72	82	58	5	54	75	89	75	90	51	5
Tree Sparrow *(Passer montanus)*	45	34	20	19	22	0	14	40	40	11	15	21	0	17

Table 14 Mean weekly peak count and overall rank of those species that comprised the twelve most abundantly recorded species in at least one region.

	Winter observations Region number							Spring observations Region number						
	1	2	3	4	5	6	Overall rank	1	2	3	4	5	6	Overall rank
Woodpigeon *(Columba palumbus)*	0	2.2	0	0.1	0.2	0.7	21	0.2	1.4	0	0.1	0.8	0.8	19
Collared Dove*(Streptopelia decaocto)*	0.3	0.7	0.5	0.5	1.8	0.3	14	0.4	0.7	0.7	0.7	1.6	0.6	13
Carrion Crow *(Corvus corone)*	0.6	0.6	0.1	0.3	0.1	0.1	19	0.6	0.7	0.1	0.3	0.2	0.2	18
Rook *(Corvus frugilegus)*	0	1.1	0	0	0	1.8	22	0	0.1	0	0	0	2.7	25
Jackdaw *(Corvus monedula)*	0.2	0.4	0	0	1.4	2.4	19	0.3	0.3	0	0	1.8	3.1	18
Magpie *(Pica pica)*	1.8	1.6	0.4	0.6	0.9	1.1	12	2.0	1.2	0.6	0.6	1.0	1.0	11
Jay *(Garrulus glandarius)*	0.2	0.7	0.1	0.2	0.2	0	21	0.1	0.6	0.1	0.2	0.1	0	22
Great Tit *(Parus major)*	7.4	4.3	1.6	4.7	3.8	2.0	4	4.3	3.3	1.6	2.7	2.8	1.8	4
Blue Tit *(Parus caeruleus)*	2.9	2.9	0.6	2.0	1.9	2.9	7	1.8	2.6	0.6	1.5	1.7	2.4	8
Coal Tit *(Parus ater)*	0.3	0.3	0.2	0.3	0.1	1.2	19	0.2	0.3	0.2	0.4	0	1.2	20
Marsh Tit *(Parus palustris)*	0.6	0.4	0.1	0.7	0.1	0	19	0.2	0.3	0	0.7	0	0	23
Willow Tit *(Parus montanus)*	1.0	0.2	0	0.4	0.1	0	21	0.6	0.4	0	0	0	0	24
Wren *(Troglodytes troglodytes)*	0.1	0.5	0.4	0.3	0.6	0.8	18	0.1	0.8	0.2	0.3	0.8	0.7	18
Fieldfare *(Turdus pilaris)*	0.4	0.7	0	0.1	0.1	0.1	21	0.7	0.6	0	0	0	0	23
Blackbird *(Turdus merula)*	1.1	4.5	2.3	2.8	3.4	1.9	5	1.0	4.0	3.1	2.1	3.6	1.9	5
Robin *(Erithacus rubecula)*	0.3	0.7	2.2	1.1	0.9	1.4	11	0.4	1.0	0.9	0.7	0.8	1.4	12
Blackcap *(Sylvia atricapilla)*	0	0	0.6	0.1	0	0.1	24	0	0.4	0.8	0.3	0.2	0.1	20
Chiffchaff *(Phylloscopus collybita)*	0	0	0.8	0.1	0	0	25	0	0.8	0.4	0.3	0.4	0	20
Dunnock *(Prunella modularis)*	0	0.3	0.3	0.8	0.9	1.1	17	0.1	0.9	0	0.8	1.1	0.9	16
Starling *(Sturnus vulgaris)*	0.3	0.2	3.4	0.8	3.4	3.1	11	2.0	2.9	1.0	1.1	3.3	2.9	6
Hawfinch *(C.coccothraustes)*	0.1	0.4	0.1	0.6	0	0	22	0.2	0.2	0.1	0.7	0	0	22
Greenfinch *(Carduelis chloris)*	9.6	5.1	1.5	4.7	1.7	6.6	4	7.8	3.8	1.9	3.9	1.8	5.4	4
Goldfinch *(Carduelis carduelis)*	0	0.1	0.7	0.3	0.1	0.2	21	0.1	0.3	1.2	0.4	0.1	0.1	19
Siskin *Carduelis spinus)*	0.1	0.6	1.9	0.9	0.5	1.0	14	0.9	0.5	0.4	0.3	0.2	1.2	16
Serin *(Serinus serinus)*	0	0	0.8	0	0	0	25	0	0.2	1.0	0.3	0	0	23
Bullfinch *(Pyrrhula pyrrhula)*	2.8	1.0	0	0.4	0	0.6	18	1.7	0.5	0	0.2	0.1	0.3	20
Chaffinch *(Fringilla coelebs)*	0.5	2.3	1.1	4.3	3.6	6.1	6	3.0	2.8	1.0	2.0	1.5	4.4	6
Brambling *(Fringilla montifringilla)*	0.2	0.4	0.1	0.5	0	0	22	1.0	0.1	0	0.1	0	0	25
Yellowhammer *(Emberiza citrinella)*	4.8	0	0	0.3	0	0	23	2.1	0.1	0	0	0	0	24
House Sparrow *(Passer domesticus)*	6.6	5.5	13.9	6.0	11.8	5.9	2	4.3	5.9	14.8	5.7	8.3	3.6	7
Tree Sparrow *(Passer montanus)*	7.9	2.3	1.3	1.3	1.4	0	10	4.2	2.0	0.7	0.5	0.8	0	13

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APPENDIX 1

The 12 most frequently and abundantly recorded species in each region in the European Garden Bird Survey 1988-89.

Table A1.1 Region 1 (Norway, Sweden, Finland and Denmark)

WINTER

Species	Mean % occurrence	SE
Great Tit	97	0.3
Blue Tit	77	1.5
Magpie	69	1.1
Greenfinch	65	1.4
House Sparrow	52	1.6
Bullfinch	47	1.3
Tree Sparrow	45	0.7
Blackbird	41	1.7
Willow Tit	36	0.7
Yellowhammer	31	1.8
Nuthatch	31	1.1
Gt.Sp. Woodpecker	26	1.6

SPRING

Species	Mean % occurrence	SE
Great Tit	94	1.0
Magpie	75	1.3
Greenfinch	70	1.1
Blue Tit	62	3.0
Chaffinch	57	4.0
House Sparrow	54	1.1
Blackbird	41	1.6
Tree Sparrow	40	1.5
Bullfinch	38	0.8
Starling	35	3.6
Robin	29	3.3
Hooded Crow	27	0.8
Yellowhammer	27	2.1

WINTER

Species	Mean peak count	SE
Greenfinch	9.6	0.40
Tree Sparrow	7.9	0.31
Great Tit	7.4	0.14
House Sparrow	6.6	0.30
Yellowhammer	4.8	0.30
Blue Tit	2.9	0.05
Bullfinch	2.8	0.14
Magpie	1.8	0.05
Blackbird	1.1	0.07
Willow Tit	1.0	0.02
Hooded Crow	0.6	0.05
Marsh Tit	0.6	0.02

SPRING

Species	Mean peak count	SE
Greenfinch	7.8	0.69
Great Tit	4.3	0.57
House Sparrow	4.3	0.18
Tree Sparrow	4.2	0.72
Chaffinch	3.0	0.54
Yellowhammer	2.1	0.48
Magpie	2.0	0.09
Starling	2.0	0.27
Blue Tit	1.8	0.18
Bullfinch	1.7	0.12
Blackbird	1.0	0.03
Brambling	1.0	0.39

Table A1.2 Region 2 (West Germany and Austria)

WINTER

Species	Mean % occurrence	SE
Great Tit	94	0.4
Blue Tit	91	0.5
Blackbird	90	5.3
Greenfinch	68	1.5
Magpie	64	1.1
House Sparrow	63	1.0
Chaffinch	62	1.4
Robin	60	1.7
Wren	41	1.2
Woodpigeon	41	2.1
Bullfinch	35	1.3
Tree Sparrow	34	0.7

SPRING

Species	Mean % occurrence	SE
Great Tit	96	1.0
Blackbird	96	0.7
Blue Tit	91	1.6
Greenfinch	87	1.7
Chaffinch	80	1.8
House Sparrow	75	1.6
Robin	68	5.2
Dunnock	57	1.2
Magpie	56	2.6
Starling	51	3.5
Chiffchaff	47	6.2
Woodpigeon	46	1.9

WINTER

Species	Mean peak count	SE
House Sparrow	5.5	0.14
Greenfinch	5.1	0.35
Blackbird	4.5	0.07
Great Tit	4.3	0.07
Blue Tit	2.9	0.05
Chaffinch	2.3	0.07
Tree Sparrow	2.3	0.05
Woodpigeon	2.2	0.26
Magpie	1.6	0.02
Rook	1.1	0.09
Bullfinch	1.0	0.05
Robin	1.0	0.02
Collared Dove	1.0	0.02
Jay	1.0	0.02
Fieldfare	1.0	0.14

SPRING

Species	Mean peak count	SE
House Sparrow	5.9	0.15
Blackbird	4.0	0.12
Greenfinch	3.8	0.15
Great Tit	3.3	0.12
Starling	2.9	0.27
Chaffinch	2.8	0.12
Blue Tit	2.6	0.15
Tree Sparrow	2.0	0.09
Woodpigeon	1.4	0.09
Magpie	1.2	0.12
Robin	1.0	0.09
Dunnock	0.9	0.03

Table A1.3 Region 3 (Spain, Italy and Portugal)

WINTER

Species	Mean % occurrence	SE
Robin	91	0.7
House Sparrow	87	0.8
Blackbird	78	1.7
Great Tit	56	1.7
Chaffinch	41	2.1
Chiffchaff	33	0.9
Blue Tit	31	1.2
Wren	30	1.3
Greenfinch	23	1.4
Blackcap	27	1.8
Pied Wagtail	22	0.8
Black Redstart	21	0.8

SPRING

Species	Mean % occurrence	SE
House Sparrow	89	0.7
Blackbird	77	1.3
Great Tit	56	1.7
Greenfinch	46	1.8
Robin	42	6.5
Blackcap	36	0.8
Chaffinch	35	2.3
Serin	32	1.5
Blue Tit	31	1.3
Goldfinch	30	1.1
Carrion Crow	22	3.3
Magpie	21	1.2

WINTER

Species	Mean peak count	SE
House Sparrow	13.9	0.40
Starling	3.4	0.64
Blackbird	2.3	0.14
Robin	2.2	0.09
Siskin	1.9	0.21
Great Tit	1.6	0.05
Greenfinch	1.5	0.16
Tree Sparrow	1.3	0.02
Chaffinch	1.1	0.09
Chiffchaff	0.8	0.05
Serin	0.8	0.09
Goldfinch	0.7	0.12

SPRING

Species	Mean peak count	SE
House Sparrow	14.8	0.33
Blackbird	3.1	0.09
Greenfinch	1.9	0.15
Great Tit	1.6	0.03
Goldfinch	1.2	0.15
Chaffinch	1.0	0.09
Starling	1.0	0.09
Serin	1.0	0.06
Robin	0.9	0.09
Blackcap	0.8	0.03
Tree Sparrow	0.7	0.15
Collared Dove	0.7	0.03

Table A1.4 Region 4 (France and Switzerland)

WINTER

Species	Mean % occurrence	SE
Great Tit	91	0.9
Blackbird	83	0.9
Chaffinch	79	0.8
Blue Tit	73	1.8
House Sparrow	72	1.0
Robin	72	1.5
Greenfinch	51	1.9
Magpie	36	1.2
Nuthatch	31	0.9
Marsh Tit	30	1.0
Dunnock	30	2.0
Wren	28	2.1

SPRING

Species	Mean % occurrence	SE
Great Tit	84	1.3
Blackbird	83	1.7
House Sparrow	75	1.8
Chaffinch	74	2.5
Greenfinch	63	1.9
Blue Tit	58	3.1
Robin	47	5.0
Magpie	38	1.3
Collared Dove	35	1.1
Dunnock	28	2.2
Nuthatch	28	1.3
Starling	26	1.8

WINTER

Species	Mean peak count	SE
House Sparrow	6.0	0.16
Great Tit	4.7	0.21
Greenfinch	4.7	0.45
Chaffinch	4.3	0.23
Blackbird	2.8	0.07
Blue Tit	2.0	0.14
Tree Sparrow	1.3	0.12
Robin	1.1	0.02
Siskin	0.9	0.21
Dunnock	0.8	0.09
Starling	0.8	0.09
Marsh Tit	0.7	0.02

SPRING

Species	Mean peak count	SE
House Sparrow	5.7	0.15
Greenfinch	3.9	0.33
Great Tit	2.7	0.12
Blackbird	2.1	0.03
Chaffinch	2.0	0.18
Blue Tit	1.5	0.09
Starling	1.1	0.24
Dunnock	0.8	0.06
Robin	0.7	0.09
Collared Dove	0.7	0.03
Hawfinch	0.7	0.21
Marsh Tit	0.7	0.03

Table A1.5 Region 5 (The Netherlands and Belgium)

WINTER

Species	Mean % occurrence	SE
Great Tit	96	0.3
Blackbird	94	0.5
House Sparrow	82	0.7
Blue Tit	79	1.0
Robin	77	0.9
Chaffinch	71	1.3
Dunnock	55	1.9
Magpie	51	1.5
Wren	47	2.1
Collared Dove	45	1.9
Greenfinch	39	2.0
Starling	34	1.3

SPRING

Species	Mean % occurrence	SE
Blackbird	98	0.7
Great Tit	95	1.4
House Sparrow	90	1.5
Blue Tit	74	2.5
Dunnock	64	2.2
Collared Dove	61	1.4
Robin	59	5.4
Starling	56	3.3
Magpie	53	0.9
Wren	52	1.3
Chaffinch	50	3.5
Greenfinch	50	1.4

WINTER

Species	Mean peak count	SE
House Sparrow	11.8	0.21
Great Tit	3.8	0.05
Chaffinch	3.6	0.19
Blackbird	3.4	0.09
Starling	3.4	0.23
Blue Tit	1.9	0.05
Collared Dove	1.8	0.09
Greenfinch	1.7	0.19
Tree Sparrow	1.4	0.14
Jackdaw	1.4	0.12
Robin	0.9	0.02
Magpie	0.9	0.02
Dunnock	0.9	0.02

SPRING

Species	Mean peak count	SE
House Sparrow	8.3	0.21
Blackbird	3.6	0.09
Starling	3.3	0.18
Great Tit	2.8	0.09
Greenfinch	1.8	0.21
Jackdaw	1.8	0.06
Blue Tit	1.7	0.06
Collared Dove	1.6	0.03
Chaffinch	1.5	0.30
Dunnock	1.1	0.03
Magpie	1.0	0.03
Robin	0.8	0.06
Wren	0.8	0.03
Tree Sparrow	0.8	0.12
Woodpigeon	0.8	0.06

Table A1.6 Region 6 (The Republic of Ireland)

WINTER

Species	Mean % occurrence	SE
Blue Tit	86	5.2
Chaffinch	80	5.2
Blackbird	80	4.8
Great Tit	78	1.6
Dunnock	70	4.4
Greenfinch	68	1.3
Robin	67	8.7
House Sparrow	58	1.2
Wren	57	4.4
Jackdaw	52	3.8
Magpie	51	2.7
Coal Tit	51	2.1

SPRING

Species	Mean % occurrence	SE
Blackbird	93	2.0
Blue Tit	88	3.1
Chaffinch	83	2.9
Robin	79	1.9
Great Tit	76	5.1
Dunnock	61	3.1
Jackdaw	60	1.6
Greenfinch	60	3.4
Coal Tit	56	4.5
Magpie	56	2.9
Rook	54	2.7
Wren	52	2.4

WINTER

Species	Mean peak count	SE
Greenfinch	6.6	0.59
Chaffinch	6.1	0.45
House Sparrow	5.9	0.31
Starling	3.1	0.42
Blue Tit	2.9	0.14
Jackdaw	2.4	0.14
Great Tit	2.0	0.07
Blackbird	1.9	0.07
Rook	1.8	0.12
Robin	1.4	0.05
Coal Tit	1.2	0.07
Magpie	1.1	0.12
Dunnock	1.1	0.02

SPRING

Species	Mean peak count	SE
Greenfinch	5.4	0.87
Chaffinch	4.4	0.66
House Sparrow	3.6	0.36
Jackdaw	3.1	0.24
Starling	2.9	0.57
Rook	2.7	0.18
Blue Tit	2.4	0.15
Blackbird	1.9	0.03
Great Tit	1.8	0.15
Robin	1.4	0.06
Coal Tit	1.2	0.09
Siskin	1.2	0.36

APPENDIX 2

Regional and seasonal variation in the frequency and abundance of birds in European gardens.

In this appendix, a review of the winter distributions and movements of the each of the most frequently and abundantly recorded species is presented. A more general description of the wintering and breeding distributions may be obtained from Harrison (1982). Regional patterns in the frequency of occurrence and abundance of birds in gardens are also described. The results for each species are presented graphically after the text, except where weekly variations in abundance were so large as to obscure completely only seasonal pattern.

Fig. 2.1 Woodpigeon *(Columba palumbus)*

With the exception of Norway, Sweden and Finland where it is migratory, the Woodpigeon in Europe is a partial migrant or resident (Harrison 1982, Cramp 1985). Woodpigeons were recorded most frequently in regions 2, 5 and 6 and were almost entirely absent from region 3. In regions 1 and 5 in particular, the frequency of occurrence was seasonally variable with birds most frequently recorded in the spring. The spring increase in region 1 is almost certainly due to the return of birds from their wintering grounds. In region 5, where the Woodpigeon is a partial migrant, it was increasingly recorded from week 16 onwards. This increase may be indicative of a movement of birds into and through the country at this time. In regions 2 and 6 where Woodpigeons are mainly resident, only small seasonal effects were apparent.

Fig. 2.2 Collared Dove *(Streptopelia decaocto)*

In recent years, Collared Doves have colonised and spread westwards across much of Europe. Collared Doves first bred in France (1952), Portugal (1974), Spain (1974), Belgium (1955), The Netherlands (1950), Germany (1946), Denmark (1950), Norway (1955), Finland (1966), Sweden (1951), Austria (1943), Switzerland (1952) and Italy (1947) (Cramp 1985). Although a large proportion of the population is relatively sedentary, a small number of birds, particularly young birds, continue to disperse (Cramp 1985). In view of the recentness of colonisation, it is remarkable that Collared Doves were so frequently recorded.

Collared Doves were recorded most frequently in regions 2, 4 and 5. In all regions, birds were more frequently recorded in spring than in winter. Collared Doves were recorded in greatest numbers in region 5. Peak counts were also seasonally variable. In regions 3, 4 and 6, more Collared Doves were recorded in the second half of the survey than the first.

Fig. 2.3 Greater Spotted Woodpecker *(Dendrocopus major)*

Although northern Great Spotted Woodpecker populations are subject to eruptions, southern populations are essentially resident (Cramp 1985). The Great Spotted Woodpecker was largely absent from gardens in regions 3 and 6. In regions 1 and 2 they were recorded from up to 40% of gardens. These woodpeckers were more frequently recorded in the early spring than mid-winter in regions 1 and 2.

Fig. 2.4 Pied Wagtail *(Motacilla alba)*

Depending on their geographic origin, Pied Wagtail populations may be resident or migratory. North European populations are entirely migratory, with individuals wintering in southern Europe and north Africa (Cramp 1988). Pied Wagtails from central Europe move mainly south-west. In spring, birds retrace flight paths used in the autumn (Cramp 1988).

Pied Wagtails were absent during the winter from gardens in regions 1, 2 and 5. With the onset of spring, Pied Wagtails returned to these areas. In the other three regions, there was no seasonal effect on their weekly occurrence in gardens.

Fig. 2.5 Wren *(Troglodytes troglodytes)*

Wrens may be migratory, partially migratory or resident (Cramp 1988). In western Europe, individuals may make substantial autumn journeys in a south and south-westerly direction (Cramp 1988). Many birds in northern Europe attempt to over-winter. In some years, many individuals perish as a consequence of cold weather. Consequently, populations may fluctuate considerably from year to year (Cramp 1988). Annual fluctuations attributable to the harshness of winter weather conditions are evident in populations as far south and west as Britain (Marchant et al. 1990).

With the exception of region 1, Wrens were frequently recorded in all regions. In region 5, Wrens were increasingly recorded in the spring. In region 3, presumably as a consequence of return migration, fewer birds were recorded in the spring than in winter. There were no clear seasonal patterns in any of the other regions.

Mean weekly peak counts increased in the spring in regions 2 and 5. At the same time, fewer Wrens were were recorded in region 3.

Fig. 2.6 Dunnock *(Prunella modularis)*

This species can be resident, partial migrant, or, in northern and central Europe, totally migratory (Cramp 1988). Continental populations in northern areas and to a lesser extent those in southern Europe move to winter in south-west Iberia and the Mediterranean (Cramp 1988). Some birds winter in areas such as southern Spain and Portugal where no breeding takes place (Cramp 1988).

From the survey results, several clear patterns emerged. In every region the frequency of occurrence of Dunnocks in gardens was seasonally affected. In regions 1, 2 and 5, Dunnocks were increasingly recorded in the spring. The increase in spring may be the result of a return of breeding birds or a movement of passage birds northwards and eastwards. As expected, Dunnocks were largely absent from gardens in region 1 during the winter. In regions 3 and 4, Dunnocks were most frequently recorded in the late winter period. Clearly in both regions, a larger proportion of Dunnocks winter in these regions than breed. The pattern of occurrence in region 6 was different. From mid-winter, there was a gradual decline in the frequency of occurrence of Dunnocks into the spring. This pattern may be due to a genuine reduction in the number of Wrens in Ireland. Alternatively, it may be as a consequence of more local movements away from gardens into surrounding habitats.

Patterns of abundance were closely related to those reflecting the frequency of occurrence. Dunnocks were recorded in greatest numbers in spring in regions 1, 2 and 5. In regions 3 and 4, peaks in mid-winter were followed by declines in the spring.

Fig. 2.7 Robin *(Erithacus rubecula)*

Most European Robins are at least partially migratory. However, British and Irish populations are largely resident. Some birds do move in a south-westerly direction, but the majority prefer to make more local movements with marked influxes into reedbeds and suburban areas (Cramp 1988). Continental populations vary from totally migratory in north to sedentary in the south. Fennoscandia and West Germany are largely vacated in winter by breeding birds whilst approximately 50% of Belgian birds migrate (Cramp 1988). These migrants move south-west to winter in Mediterranean countries and northern Africa. Migrants from Germany and the Low Countries are replaced by Robins from further north and east (Cramp 1988).

With the exception of region 6, there was a clear seasonal effect on the frequency of occurrence of Robins in European gardens. In regions 1 and 2, there were two peaks of occurrence. Following an early winter peak, Robins were less frequently recorded. In the spring, there was a second marked increase in their frequency of occurrence. In regions 3, 4 and 5 there were marked declines in the occurrence of Robins in the spring months.

Patterns in the relative abundance were identical to those outlined above. Declines in both frequency of occurrence and abundance correspond with the time that Robins return to their breeding grounds from their winter quarters. The peaks in regions 1 and 2 are likely to be due to the movement of Robins through these areas at this time.

Fig. 2.8 Black Redstart *(Phoenicurus ochruros)*

In north and east of range largely migratory whilst in south and west thought to be relatively sedentary. Main wintering area for west European birds is the Mediterranean basin (Cramp 1988).

Black Redstarts were almost entirely absent from gardens in regions 1, 5 and 6. In regions 2 and 4, Black Redstarts were increasingly recorded in the spring. The peak presumably represents the return of birds to these regions to breed. In contrast, presumably as a consequence of birds leaving their wintering grounds, Black Redstarts were recorded less frequently in the spring than winter in region 3.

Fig. 2.9 Blackbird *(Turdus merula)*

Depending on origin of population, Blackbirds may be resident or migratory. A proportion of birds from Fennoscandia, Ireland and Germany winter in western Europe whilst those from further south winter in southern Europe. Although largely migratory, Blackbirds in Fennoscandia are expanding their range northwards. Typically, a few birds now winter in southern Norway, Sweden, Finland and in Denmark. Although some Blackbirds from central Europe move south and south-west, a large proportion of birds from Belgium, The Netherlands and central Europe may be sedentary. German and Swiss Blackbirds winter in central and western France, Spain and Portugal (Cramp 1988).

Blackbirds were amongst the most frequently recorded birds in European gardens. In regions 2, 4 and 5 there was no marked seasonal effect on frequency of occurrence. Blackbirds were most frequently recorded in region 1 in the early winter and again in the spring. In region 3, Blackbirds were most frequently recorded in mid-winter whilst in region 6, Blackbirds were increasingly recorded in the spring.

Mean weekly peak counts also varied with season. In regions 2 and 4, numbers declined in the spring whilst in regions 3 and 5, numbers increased in the spring. Blackbirds were less abundant in region one than in any other region. In region 1, numbers followed a similar pattern to that outlined for frequency of occurrence. There was no seasonal effect on numbers recorded in region 6.

Fig. 2.10 Fieldfare *(Turdus pilaris)*

Largely migratory, but in some winters, particularly when good fruit crop, some individuals may remain resident undertaking more local movements (Cramp 1988, Tyrvainen 1975). Depending on

origin of population, Fieldfares winter in western, central and southern Europe and north Africa (Cramp 1988). Although a few birds may over-winter in southern Fennoscandia, the majority from Finland and southern Sweden winter predominantly in Belgium, France, Germany and Italy. Birds from northern Sweden and Norway move south-west into Britain, Ireland, central Europe, south-west France and Spain. Birds from northern Continental Europe typically winter in southern France and northern Italy (Cramp 1988). All populations may undertake hard weather movements.

Fieldfares were largely absent from gardens in regions 3, 4, 5 and 6. In region 1, Fieldfares were absent from gardens in mid-winter. In the early winter, and again in the spring, Fieldfares were recorded from up to 30% of gardens. Fieldfares were most frequently recorded in gardens in region 2 in the first half of the winter.

Fig. 2.11 Song Thrush *(Turdus philomelos)*

Whilst mainly resident in Europe, Song Thrushes from northern Europe are partially or entirely migratory. Birds from Fennoscandinavia, Germany and Switzerland migrate southwest and southeast through Europe to winter in England, France, Spain and Portugal whilst birds from Denmark, the Low Countries and northeast France are partial migrants with most birds making only short movements south and west. Winter populations in northwest France, Spain and Portugal are further increased with the arrival of birds from Britain and Ireland. All Song Thrushes in northern and central Europe make cold weather movements (Cramp 1988).

Patterns of frequency of occurrence and relative abundance in gardens were identical. In regions 2 and 5, Song Thrushes were largely absent from gardens in the late autumn and winter only returning mid-way through the survey. In regions 3 and 4, the Song Thrush was an infrequent visitor to gardens whilst in region 6 the Song Thrush was most frequently recorded in the early winter.

Despite a large breeding population in Fennoscandia (Cramp 1988), Song Thrushes were largely absent from gardens in this region.

Although there has been a long-term decline in Song Thrush breeding numbers in Britain and Ireland (Marchant et al. 1990), there is no evidence of any such decline in the rest of Western Europe.

Fig. 2.12 Blackcap *(Sylvia atricapilla)*

Blackcap populations are highly migratory. Eastern populations migrate southeast in autumn to winter in eastern Mediterranean countries whilst populations from western Europe tend to fly southwest to winter in north Africa and southwest Europe (Simms 1985). A small, but increasing number of Blackcaps now winter in northern and continental Europe. These birds are thought to be very dependent on supplementary food provision (Leach 1981).

Blackcaps were largely absent from gardens in region 1, though occurred in gardens there were more in winter than in spring (presumably using gardens as refuges in the northern winter). In region 6, Blackcaps were recorded from a small number of gardens in the winter and spring. In regions 2, 3, 4 and 5, Blackcaps were increasingly recorded in the spring. In region 3 there was a gradual increase whilst in the other regions, the increase was sudden and marked. Presumably, the spring change is due to the return of birds to their breeding grounds.

Fig. 2.13 Chiffchaff *(Phylloscopus collybita)*

Chiffchaffs were recorded in gardens in regions 1 and 6 on a few occasions only. In regions 2, 3 and 4, there was a sudden increase in the frequency of occurrence of Chiffchaffs in the early spring. Undoubtedly this corresponds with the return of birds from their wintering grounds in southern Europe. In region 3, birds were recorded less frequently in the spring than in winter.

The patterns of abundance were identical to those already outlined.

Fig. 2.14 Marsh Tit *(Parus palustris)*

The Marsh Tit is an extremely sedentary species, most individuals spending their entire lives in the area in which they breed. They appear not to take part in irruptions (Perrins 1979).

Marsh Tits were scarcely recorded or were absent from gardens in regions 3 and 6. In regions 1, 4 and 5 especially, Marsh Tits were more frequently recorded in the winter than spring. Presumably, the seasonal effect arises due to more local movements made by birds away from gardens in the spring time. In region 2, there is a suggestion of a spring peak in frequency of occurrence.

Fig. 2.15 Willow Tit *(Parus montanus)*

British Willow Tits are thought to be highly sedentary. In contrast, Continental Willow Tits which may be sedentary most of the year may take part in irruptions (Perrins 1979).

With the exception of region 1, Willow Tits were infrequently recorded in gardens. They were generally recorded less frequently in the spring than winter. As in the case of the Marsh Tit, the spring decline is presumably due to local movements of birds away from gardens into the surrounding countryside.

Fig. 2.16 Coal Tit *(Parus ater)*

Unlike Coal Tits on the Continent, British Coal Tits are thought to be largely sedentary. On the Continent, Coal Tits may undertake long movements, especially when seed crops on which they are dependent fail. Following such crop failures, Coal Tits may irrupt moving great distances in to regions where food is

more available (Perrins 1979).

Coal Tits were most frequently recorded in region 6. In regions 1, 2 and 4 there was a clear seasonal pattern with Coal Tits least frequently recorded in the spring. The decline in the spring was presumably due to the movement of Coal Tits away from gardens in to surrounding areas. In region 6, where samples were smallest, there is a suggestion of an increase in occurrence in the spring.

With the exception of region 6, mean weekly peak counts were low. There were no clear seasonal patterns in the number of Coal Tits recorded.

Fig. 2.17 Blue Tit *(Parus caeruleus)*

British Blue Tits are highly sedentary with the majority of birds living the year round in the area in which they breed. Continental Blue Tits are also thought to be relatively sedentary. However, in some years, when food is in short supply, a proportion of the population may irrupt into new areas (Perrins 1979).

Studies have shown that Blue Tit over-winter survival increased in areas where supplementary food was provided (van Balen 1980, Berndt and Frantzen 1964, Krebs 1971). Several other studies found no effect (Jones 1973, Kallander 1981).

Blue Tits were most frequently recorded in regions 2 and 6. In regions 2 and 3 there was no seasonal effect. In the other four regions, the frequency of occurrence declined in the spring. As in the other tits, the spring decline is presumably due to local movements of birds away from gardens back back into surrounding areas. Similar seasonal patterns have been found for Blue Tits wintering in Great Britain (Thompson 1987).

In regions 1 and 4, patterns of abundance were almost identical to those of the Great Tit. Peak numbers in mid-winter were followed by a marked decline in the spring. A similar spring decline was evident in region 6.

Fig. 2.18 Great Tit *(Parus major)*

Like the Coal and Blue Tit, continental Great Tits may irrupt in years when food is scarce. A number of Great Tits, particularly those from northern and eastern populations may also make more regular annual migratory movements. Where these movements do occur, they tend to be in a south or south-westerly direction (Perrins 1979).

Great Tit over-wintering survival has been found to be closely related to climatic conditions and food supply. Haartman (1971), Bejer and Rudemo (1985) and van Balen (1980) all found that over-wintering survival was lower in cold winters. Weather conditions were found to be particularly important when their preferred food, beechmast, was scarce (van Balen 1980). Other workers

similarly found that fluctuations in breeding populations were related to the irregular fruit production of beech trees (Klomp 1980, Kallander 1981, van Balen 1987).

The Great Tit was the most frequently recorded species in European gardens. In regions 1, 2, 4 and 5, there was no effect of season on frequency of occurrence in gardens. In region 3, the Great Tit was most frequently recorded in the middle of the survey. In region 6, there was a sharp decline in the frequency of occurrence of the Great Tit in the latter half of April.

In regions 1 and 4, patterns of abundance were clearly seasonally related. In region 1, numbers peaked in the early and mid-winter. The peak in the late winter was followed by a sharp decline (week 23 onwards) in the number of Great Tits recorded in gardens in this region. A similar pattern was evident in region 4, with Great Tits recorded in greatest numbers in mid-winter before declining in the spring. Great Tits behave in British gardens in a similar way (Thompson 1987). In the other four regions, the seasonal effect was less pronounced. However in each region, fewer birds were recorded in gardens in the spring than in mid-winter.

Fig. 2.19 Nuthatch *(Sitta europaea)*

Like the tits already discussed, Nuthatches are mainly resident the year round. In cold winters or when food is scarce, Nuthatches may undertake irruptive movements, particularly in a southerly direction. Studies in Sweden have demonstrated that the population size in the spring was positively related to winter temperatures and the size of the preceding beechmast crop (Nilsson 1987).

Nuthatches were almost entirely absent from gardens in regions 3 and 6. In regions 2 and 4 no seasonal pattern in occurrence was evident. Fennoscandian Nuthatches were less frequently recorded in gardens in the spring. A similar pattern was evident, though not as marked as in region 5.

The spring decline in numbers and frequency of occurrence of Nuthatches in gardens, especially in region 1, is presumably due to the movement of Nuthatches away from gardens into surrounding areas.

Fig. 2.20 Jay *(Garrulus glandarius)*

Essentially resident, with local dispersion and periodic eruptions south and west of birds from northern and central Europe. As in the tits and the Nuthatch, these eruptive movements are brought on by shortages of food, particularly acorns (Coombs 1978, Goodwin 1986).

Jays were infrequently recorded in region 3 and absent from region 6. In regions 4 and 5 there appeared to be no seasonal pattern of occurrence in gardens. In regions 1 and particularly 2, Jays were increasingly recorded in the spring following mid-

winter peaks. In both these regions, the number of Jays recorded followed the same pattern.

Fig. 2.21 Magpie *(Pica pica)*

Throughout Europe, Magpies are highly sedentary (Goodwin 1986).

Magpies were recorded frequently in gardens in all regions. They were most frequently recorded in region 1 and least frequently in region 3. With the exception of regions 1 and 2, there was no clear seasonal pattern of occurrence in gardens. In region 1, Magpies were increasingly recorded in the spring whilst in region 2, the situation was reversed.

Patterns of abundance varied with season in regions 1, 2, 3 and 6. In region 1, an increase of occurrence in the spring was matched by a spring increase in relative abundance. In region 2, numbers declined markedly in the spring. More Magpies were recorded in the spring than winter in regions 3 and 6. In both regions the increase may have been due to an increase in Magpie activity rather than to a real increase in the number of birds entering gardens.

Fig. 2.22 Jackdaw *(Corvus monedula)*

Whilst British Jackdaws are largely sedentary, many European races are highly migratory in the winter (Coombs 1978). Jackdaws in northern France move south-west and west-south-west to the French Atlantic coast. Danish Jackdaws move into the Low Countries, northern France and south-east England whilst those from Fennoscandinavia generally move into southern Sweden, Denmark and the Low Countries. The winter populations in Germany and France are augmented by the arrival of Jackdaws from the Baltic states and eastern Poland (Coombs 1978).

Jackdaws were most frequently recorded in region 6. In regions 1, 3 and 4, Jackdaws were infrequently recorded. In regions 2 and 5 especially, Jackdaws were most frequently recorded in spring, whilst in region 6 there was no clear seasonal pattern of occurrence.

Fig. 2.23 Rook *(Corvus frugilegus)*

Rooks are primarily ground feeders feeding on soil invertebrates and vegetable matter. In those parts of their range where the soil freezes, Rooks must migrate to feeding areas where conditions are more suitable. Large numbers of Rooks of east European origin are known to pass through Germany in the spring and autumn. Rooks from north-western Europe travel south-west to winter in Britain.

Rooks were virtually absent from gardens in regions 1, 3, 4 and 5. In region 2, the Rook was recorded from up to 20% of gardens in the winter but was less frequently recorded in the spring. In region 6, the frequency of occurrence rose from a trough in week 10 to a peak in week 29.

Fig. 2.24 Hooded/Carrion Crow *(Corvus corone)*

Hooded and Carrion Crows are migratory in north and eastern Europe where weather conditions make this necessary. The Carrion Crow is resident in the British Isles and largely resident in France and the Low Countries. A proportion of Swiss birds are resident but some move south-west as far as the Pyrenees (Coombs 1978). Hooded Crows are resident in Britain and Ireland. Birds from Fennoscandia are migratory wintering in eastern England, the Low Countries and Denmark. Winter populations may also be augmented by the arrival of crows from north-eastern Continental Europe (Coombs 1978).

Crows were most frequently recorded in regions 1 and 2 and were virtually absent from region 3. In regions 1, 2 and 4 Crows were more frequently recorded in the spring than winter.

Fig. 2.25 Starling *(Sturnus vulgaris)*

In most parts of Europe, the winter distribution of Starlings from particular breeding areas is not precisely known (Feare 1984). Starlings are highly migratory with populations moving from breeding areas in the autumn to distant wintering areas. The return journeys are made in the spring. The patterns exhibited are highly complex. For example, juvenile Starlings from Switzerland which initially disperse to the Low Countries and northern France undertake a migration in the autumn across France and the Mediterranean into northern Africa. Adult Starlings from Switzerland, migrate south and south-west across southern France and Spain to winter in Iberia and northern Africa. Smaller numbers move through northern Italy and across the Mediterranean to winter in Tunisia (Feare 1984).

A further example of the complexity is illustrated by examining the winter movements of Polish breeding Starlings. Birds from northern Poland winter in southern Britain and western France; birds from central Poland migrate through southern Germany and the Rhone valley to winter in south-western France and Iberia whilst Starlings from southern Poland migrate through northern Italy to winter in Tunisia and northern Algeria. Starlings from Finland migrate through the Low Countries to winter in England whilst birds from Norway and Sweden winter in Scotland, Ireland and north-east England. Danish Starlings winter in northern England and Ireland whilst birds from The Netherlands, Germany and Russia predominate in eastern England (Feare 1984).

Starlings were recorded in gardens in all survey regions. In regions 1, 2, 4 and 5 their was a clear seasonal influence with Starlings recorded more frequently in the spring than winter. Spring peaks are presumably the result of the return of breeding birds and the passage of birds back to their breeding areas. In regions 1 and 2, the effect was particularly marked with birds infrequently recorded in mid-winter. No clear seasonal effect on the frequency of occurrence was evident in regions 3 and 6.

Starlings were recorded in greatest numbers in the spring in regions 1, 2 and 5. In the other three regions, no clear pattern emerged. Mean weekly peak counts fluctuated markedly in regions 3 and 6. The fluctuations are undoubtedly the result of the arrival in gardens of large numbers (flock) of birds.

Fig. 2.26 House Sparrow *(Passer domesticus)*

The majority of European House Sparrows are highly sedentary. In some high altitude areas, such as the Alps, House Sparrows may make local movements into lower lying areas for the winter. There is also evidence of migratory movements along the north sea coasts of England and the European Continent. These movements which appear irregularly, appear to be of an irruptive nature rather than a regular habit. House Sparrows are known to winter north of the Arctic Circle where they survive, in the absence of daylight, by moving into sheds where cattle are over-wintered (Summers-Smith 1988). A Finnish study suggested that House Sparrow over-winter survival was higher than expected following the severe winter of 1961-62. The authors attributed this to the tendency of sparrows to feed on supplementary foods associated with areas of human habitation (Hildén and Koskimies 1969).

In regions 1, 2, 3 and 5 there was a gradual increase in the frequency of occurrence of House Sparrows in the spring. These increases may be a consequence of increased activity and subsequent observability. In region 6, the frequency of occurrence declined in the spring suggesting that some birds moved out of gardens into the surrounding areas.

Overall, the House Sparrow was the most abundantly recorded species with the greatest numbers recorded in region 3. In regions 1, 5 and 6, more sparrows were recorded in gardens in the mid and late winter than were recorded in the spring. Thus, in region 1 and 5 fewest birds were recorded at the time when the House Sparrow was most frequently recorded. In region 3, despite considerable fluctuations, numbers appeared to increase in the spring.

Fig. 2.27 Tree Sparrow *(Passer montanus)*

Like the House Sparrow, Tree Sparrows are generally sedentary with only a small number of birds involved in migratory movements. Generally, there is a tendency for juveniles to disperse whilst the adults remain sedentary. In those populations where there is some migration, movement is generally in a south or southwesterly direction (Summers-Smith 1988).

Although absent from gardens in Ireland and infrequently recorded in British gardens, the Tree Sparrow is a frequent visitor to gardens in other parts of Europe. In regions 1 and 4, there was no seasonal effect on the pattern of occurrence of Tree Sparrows in gardens. In region 2, Tree Sparrows were recorded most frequently in the early spring, whilst in regions 3 and 5, there was a decline in the frequency of occurrence of Tree Sparrows in the spring.

The Tree Sparrow was one of the most abundantly recorded species in region 1. Numbers peaked in mid and late winter before declining markedly in the spring. A similar seasonal pattern was evident, though not as marked in region 5. In the non-breeding season, adult and juvenile Tree Sparrows gather in autumn flocks and forage on farmland in the immediate vicinity of the breeding areas. Flocks tend break up at the end of autumn, with juveniles dispersing away from the natal area (Summers-Smith 1989). The decline in the number of Tree Sparrows recorded in region one in the spring is most likely due to the movement of birds away from gardens where they have wintered.

Fig. 2.28 Chaffinch *(Fringilla coelebs)*

Chaffinches which breed in Britain are highly sedentary. In contrast, Chaffinches from northern and eastern Europe are highly migratory. For example, Chaffinches from Fennoscandia and northern Germany move south and south-west to winter in Britain, the Low Countries and France and Iberia (Newton 1972).

Chaffinches were frequently recorded in gardens in all regions. In regions 1 and 2, Chaffinches were increasingly recorded in the spring whilst in regions 3 and 5 they were recorded in the spring less frequently than in the winter. In the other two regions, no clear seasonal patterns emerged. Interestingly, a number of Chaffinches over-wintered in gardens in region 1. The spring increase in regions 1 and 2 presumably reflects the return passage of birds to their breeding grounds. Declines in the spring in regions 3 and 5 suggest that a proportion of the birds in gardens in these regions are winter visitors.

Chaffinches were most numerous in regions 1 and 2 in the spring. In contrast, Chaffinches in regions 4, 5 and 6 were most abundant in early to mid-winter. In all three regions, numbers recorded declined in the spring. As suggested above, it appears that the winter populations in these regions are augmented by the arrival of birds from northern and north-east Europe.

Fig. 2.29 Brambling *(Fringilla montifringilla)*

To most of Europe, the Brambling is a winter visitor only. Bramblings are considered to be the most migratory of all European finches. Breeding areas are deserted almost completely, with birds wintering over the whole of Europe, south of the breeding range. Generally, Bramblings do not follow fixed migration routes to particular destinations. Instead, they prefer to move to those areas where beechmast, a preferred food, is abundant. Because beechmast is never abundant in the same area on consecutive years, numbers wintering in a particular area vary greatly on an annual basis (Newton 1972).

Bramblings were never recorded from more than 30% of gardens in any one region. In region 1, the frequency of occurrence rose steadily into the spring as birds returned from wintering grounds. In region 4, Bramblings were most frequently recorded in the early winter and spring. A similar peak in the frequency

of occurrence in spring was also noted in region 5. Like the Siskin, Bramblings only enter gardens when natural foods such as beechmast become scarce or unavailable. Typically these foods become exhausted toward the end of the winter.

Fig. 2.30 Serin *(Serinus serinus)*

In Europe, Serins have undergone a range expansion moving north and east through Continental Europe. Additionally, more subtle changes have occurred with birds moving into cultivated land, towns and villages. The expansion is continuing (Newton 1972). In most of these newly colonised areas, Serins are summer visitors, withdrawing south in the autumn to mediterranean regions (Newton 1972).

Serins were almost entirely absent from regions 1, 5 and 6. In the other three regions, the Serin was increasingly recorded in the spring weeks of the survey. In regions 2 and 4, Serins were increasingly recorded in the spring as they returned to their breeding grounds.

Fig. 2.31 Greenfinch *(Carduelis chloris)*

In southern and Central Europe, Greenfinches are sedentary. In contrast, many northern Greenfinches move southwards in the winter to winter in Central Europe and south to the Mediterranean (Vouss 1960, Harrison 1982). Ringing recoveries from the Netherlands show a clear NE to SW axis with birds from Denmark, Norway and Sweden all being recovered in the winter. Breeding Greenfinches and those ringed in the Netherlands on passage have been recovered from France and Spain. Within Britain, it appears that a proportion of the Greenfinch population remains sedentary (Gush 1980). However, there is also evidence of regular movement of birds into the south-west with some birds crossing the Irish sea into the Republic of Ireland.

Greenfinches were regularly recorded in gardens in all regions. In regions 2, 3, 4 and 5, Greenfinches were more frequently recorded in the spring than they were in the winter. In region 1, Greenfinches were most frequently recorded early in the winter and again in mid-spring. Region 6 was different in that there was a spring decline in the frequency of occurrence of Greenfinches.

The Greenfinch was the second most abundantly recorded species in the survey. Mean weekly peak counts were clearly seasonally dependent in all regions. In region 2, peak numbers were recorded in mid-winter. In four other regions, 3, 4, 5 and 6, peak numbers were recorded much later in the survey. Peak numbers in region 1 were recorded early in the winter and again in mid-spring.

2.32 Goldfinch *(Carduelis carduelis)*

With the exception of region 1, where Goldfinches do not occur in the winter, Goldfinches are to be found throughout most of Europe. In Britain, the majority of Goldfinches winter in the Low

Countries and south-west through France and Iberia (Newton 1972). Other Goldfinch populations are migratory with birds from Continental Europe wintering in southern and south-east Europe into the Mediterranean (Newton 1972).

Goldfinches were infrequently recorded in regions 1, 5 and 6. In the other three regions, Goldfinches were most frequently recorded in gardens in the spring. In regions 2 and 4, the spring increase presumably stems from the return of birds to their winter quarters. The increase in region 3 is less easy to interpret.

Fig. 2.33 Siskin *(Carduelis spinus)*

Siskins from Fennoscandia, central and eastern Europe migrate south and south-west to winter in Britain, Ireland, France and Iberia. Others from northeastern Europe may move east and southeast into central Europe and Italy. Like the Brambling, Siskins may winter in widely separated areas in different years. Such irruptive behaviour is a response to coping with a sporadic food-supply (Newton 1972).

Siskins were recorded in all regions. In regions 3, 4 and 5, Siskins were never recorded from more than 20% of gardens. In region 1, Siskins were increasingly recorded in the spring whilst in regions 2 and 3, peak frequencies occurred earlier in the spring. There was no discernible pattern in regions 4 and 5 but in region 6, as in Great Britain, Siskins were most frequently recorded in the late winter and early spring. Siskins typically feed in the winter on the seeds of alder (*Alnus spp*) and birch (*Betula spp*). When seed-stocks become exhausted, usually in late winter, Siskins move into gardens as in regions 2, 5 and 6 to feed on supplementary food (Thompson & Glue in prep).

Patterns of abundance mirrored the trends in frequency of occurrence. In region one, Siskins were recorded in greatest numbers in the late spring whilst in region 2, most Siskins were recorded in the early spring. Peak counts were highest in regions 3 and 6. Significantly, peak numbers of Siskins were recorded in region 3 several weeks earlier than in region 6.

Fig. 2.34 Bullfinch *(Pyrrhula pyrrhula)*

British Bullfinches are highly sedentary, the majority of birds spending their entire lives in a particular area (Mead and Clark 1987). In contrast, the northern fringes of their range are deserted in winter with birds moving south. The extent of movement is thought to vary annually with large scale irruptions occurring in some winters. Such irruptions may result in northern birds wintering in the southern part of their range (Vouss 1960, Harrison 1982). Birds ringed in the Netherlands have generally been recovered within a short-distance to the south and west of where they were ringed. A few birds have travelled further being recovered in southern Sweden and Eastern Germany (Speek and Speek 1984).

Bullfinches were infrequently recorded in regions 3 and 5. In regions 1, 2 and 4, Bullfinches entered gardens less frequently in the spring than they did in the winter months.

Bullfinches were recorded in greatest numbers in region 1. In three regions, numbers recorded in the spring were lower than at almost any time in the winter.

Fig. 2.35 Hawfinch *(Coccothraustes coccothraustes)*

Northern populations of Hawfinches are migratory whilst southern are resident. As in most other European finches, the general direction of migration is northeast-southwest (Newton 1972).

Hawfinches were infrequently recorded in regions 1, 3, 5 and 6. In the other two regions, Hawfinches were recorded from up to 30% of gardens. There was no clear seasonal pattern of occurrence in region two. In region 4, however, Hawfinches were most frequently recorded in mid to late winter. The decline in spring activity is more likely due to a change in foraging behaviour, with birds making more local than long-distant movements away from gardens.

Fig. 2.36 Yellowhammer *(Emberiza citrinella)*

Over most of Europe, the Yellowhammer is resident, breeding and wintering in the same general area. In northern and north-eastern breeding grounds however, where winters are cold and snow frequently lies for long periods, Yellowhammers move south to winter in central and southern Scandinavia. A few birds leave Fennoscandia altogether moving south to winter in central Europe. A small proportion of Yellowhammers from Germany are also known to migrate to winter in southern France and Spain (Prys-Jones 1977).

Yellowhammers were almost completely absent from gardens in all regions, except region 1, where Yellowhammers were most frequently recorded in gardens in mid-winter and early spring. In the winter, feeding areas are likely to be inaccessible due to snow cover whilst in the spring seed stocks are at their lowest. At these times, as is evident from the survey results, Yellowhammers move into built up areas where food of a variety of types is available. In the absence of these foods, it is unlikely that Yellowhammers could winter so far north (Prys-Jones 1984).

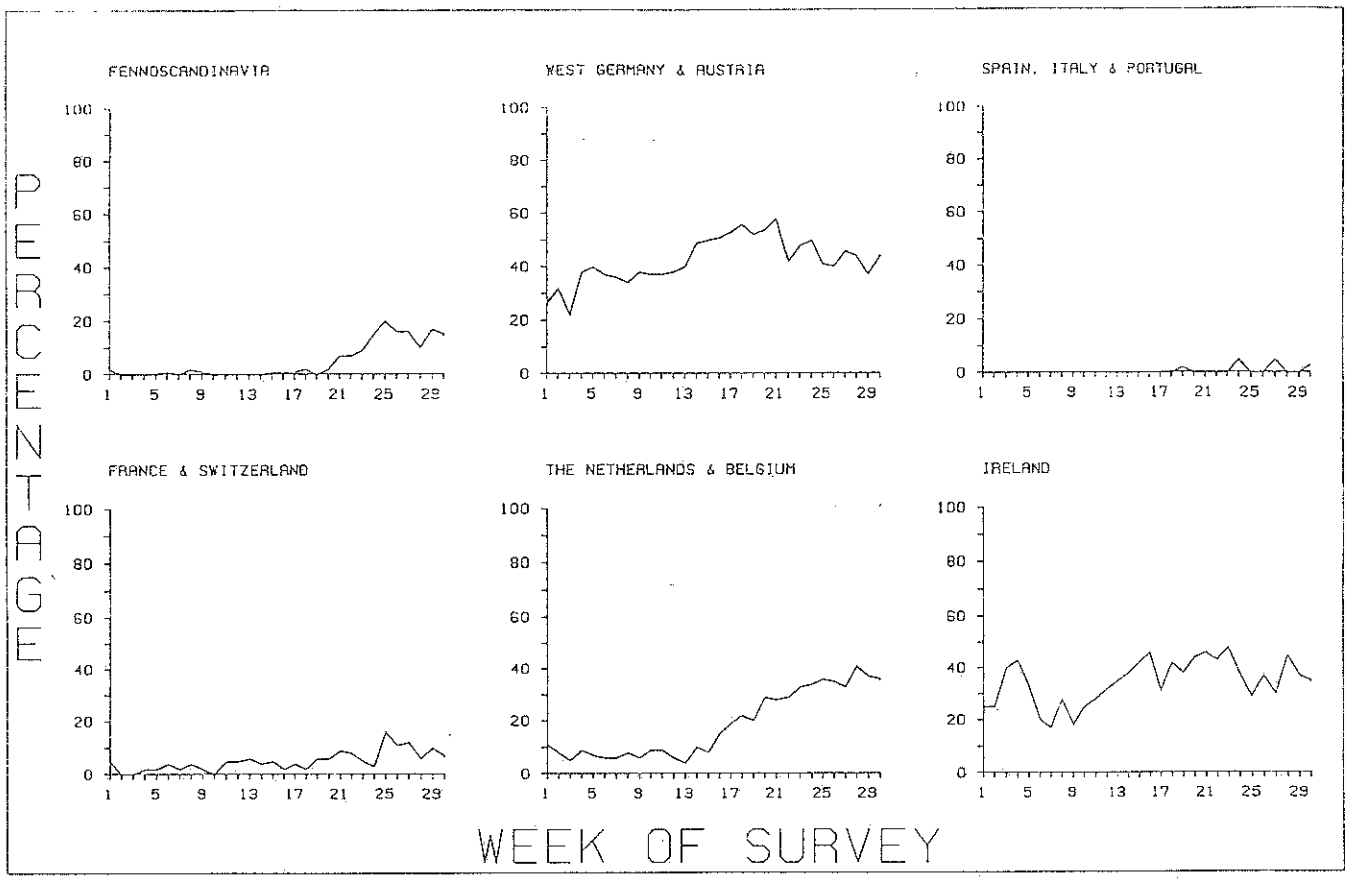
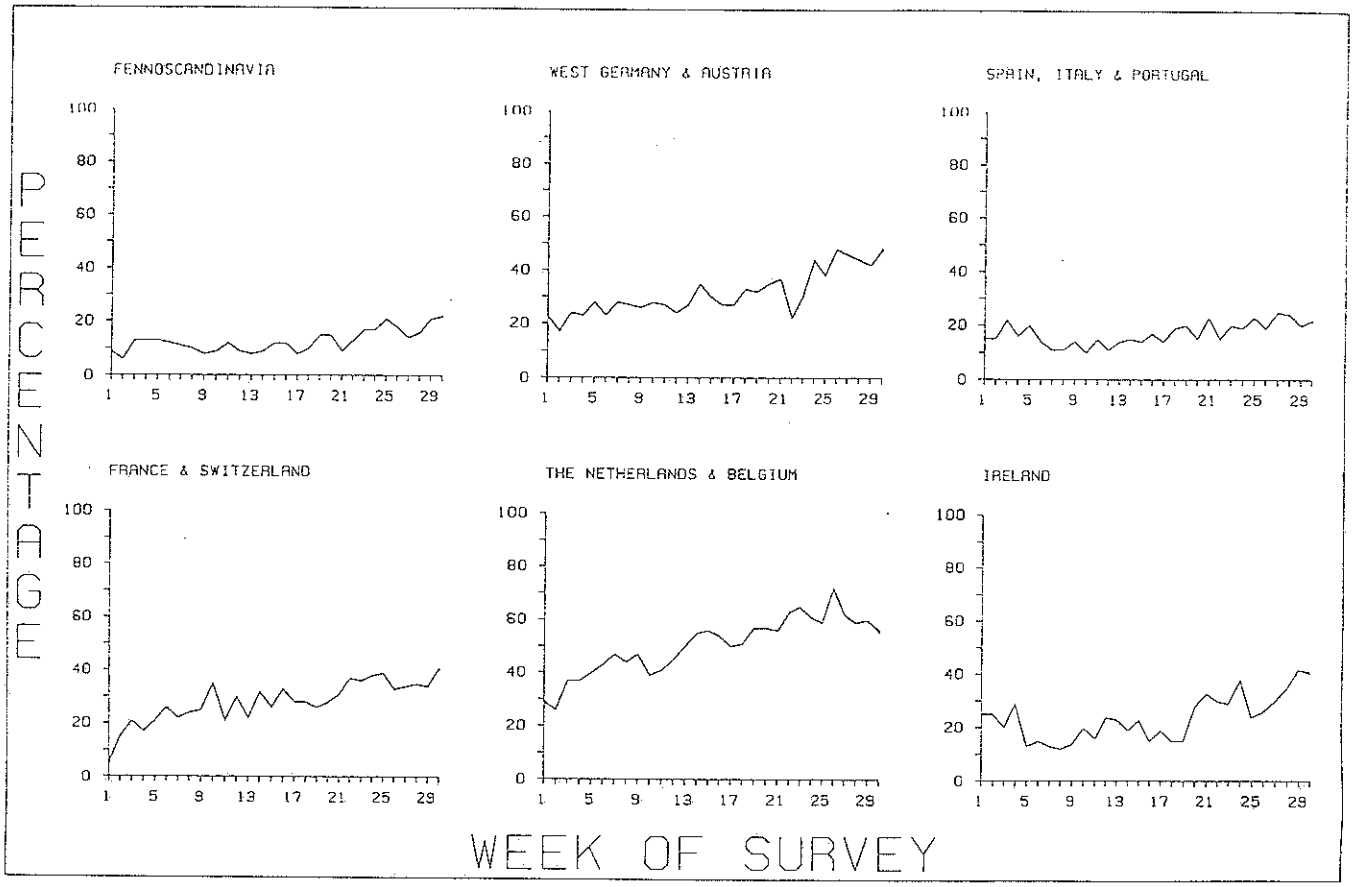


Fig. 2.1 Woodpigeon



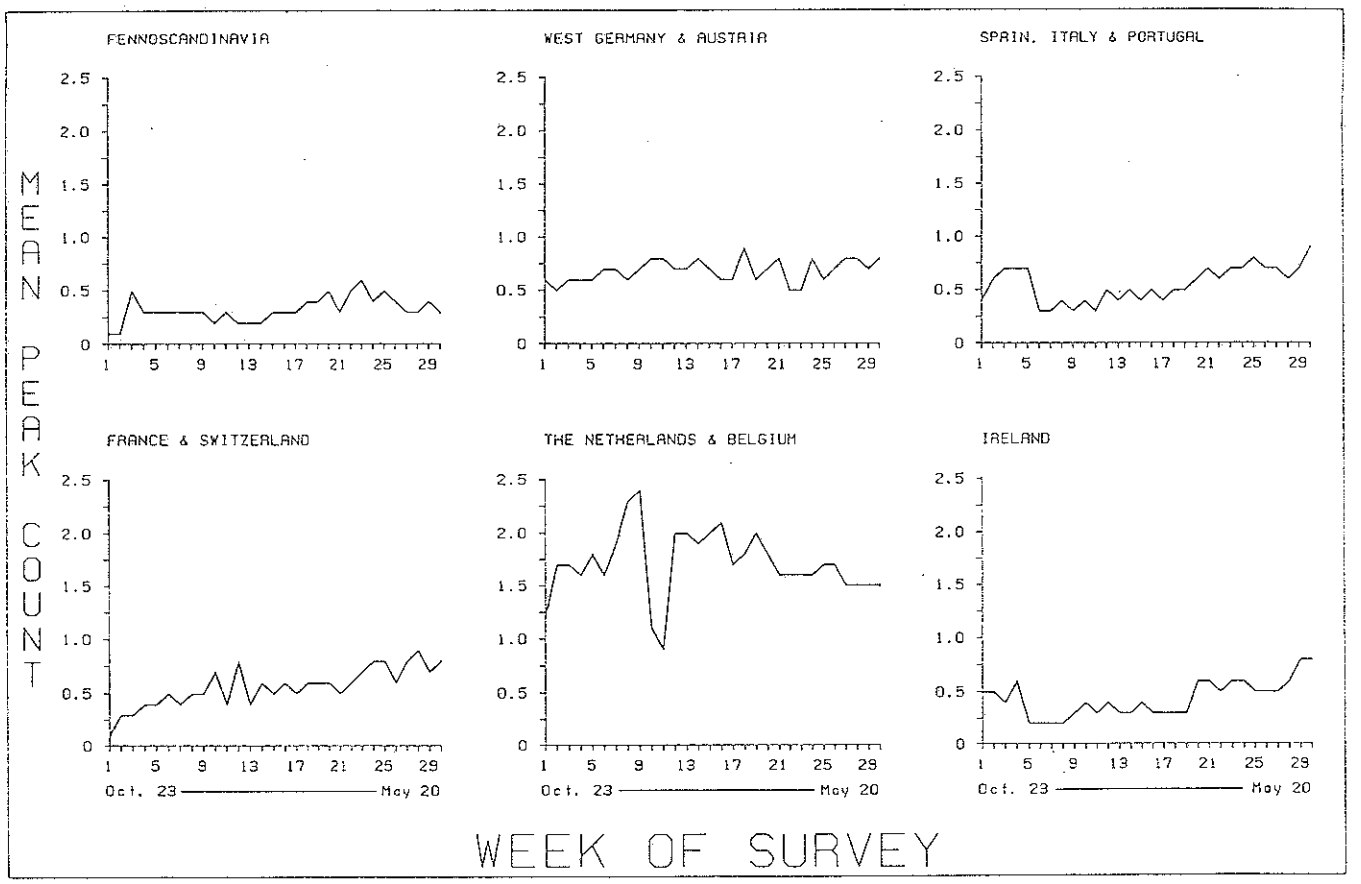


Fig. 2.2 Collared Dove

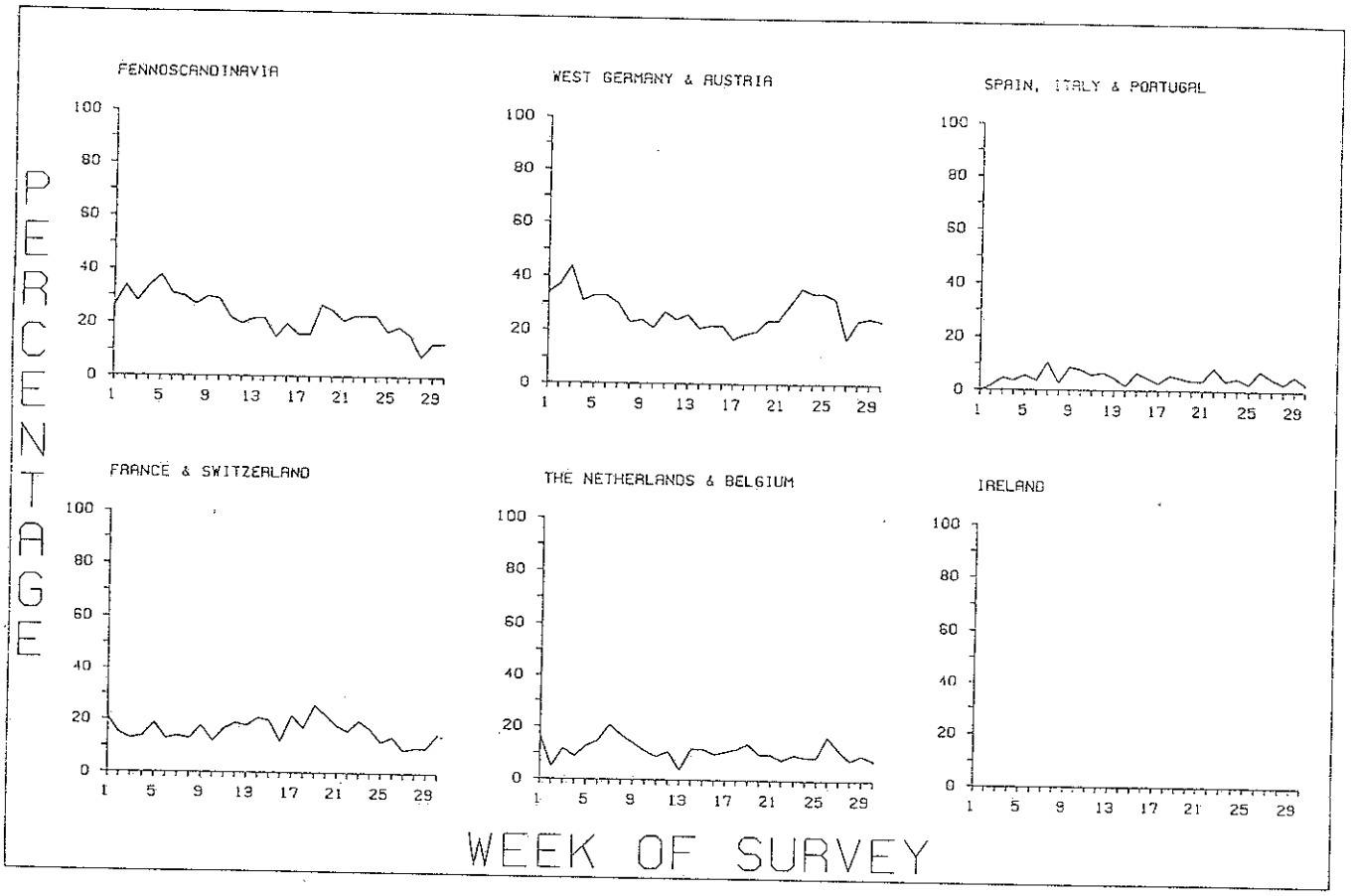


Fig. 2.3 Great Spotted Woodpecker

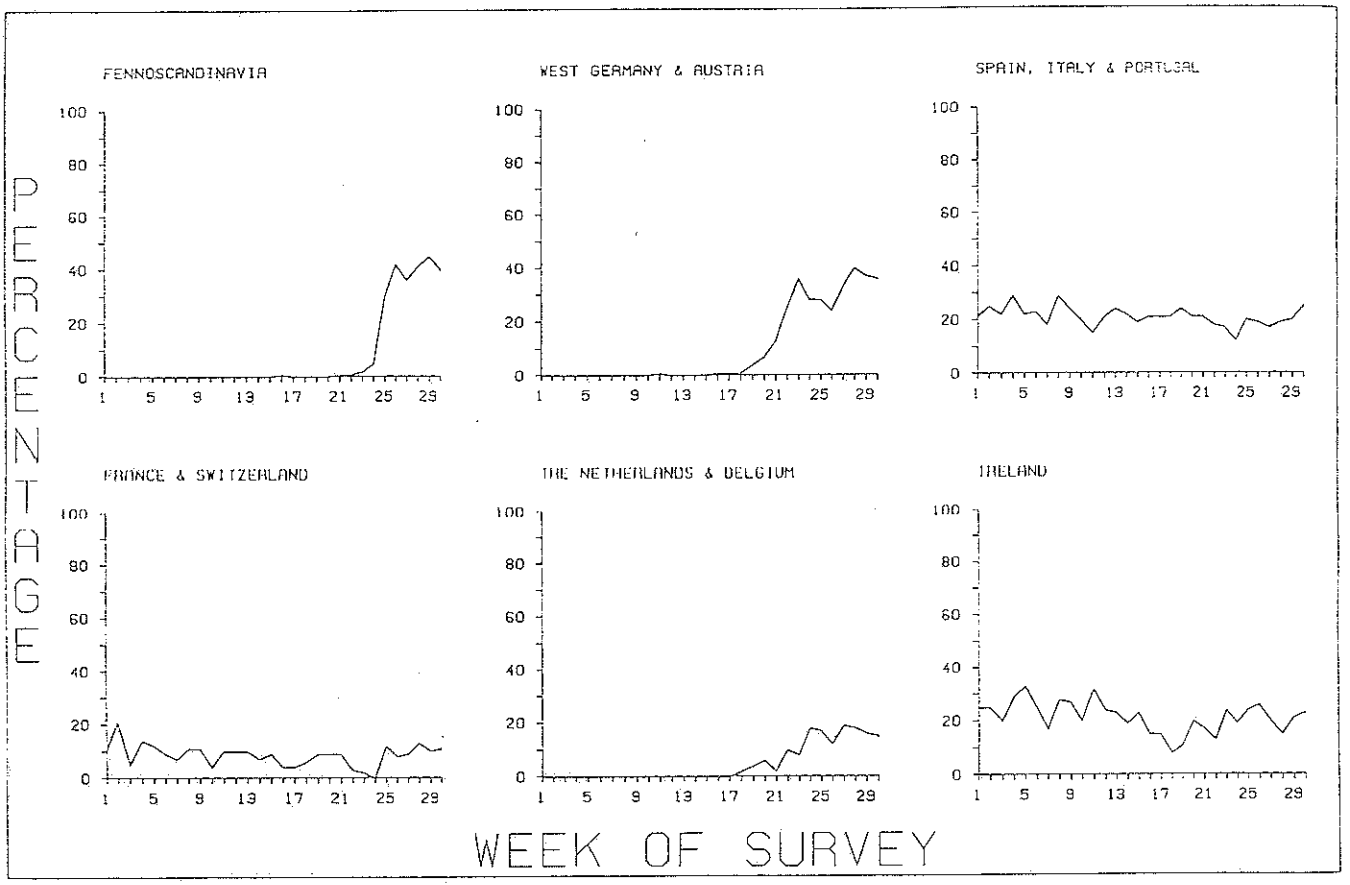
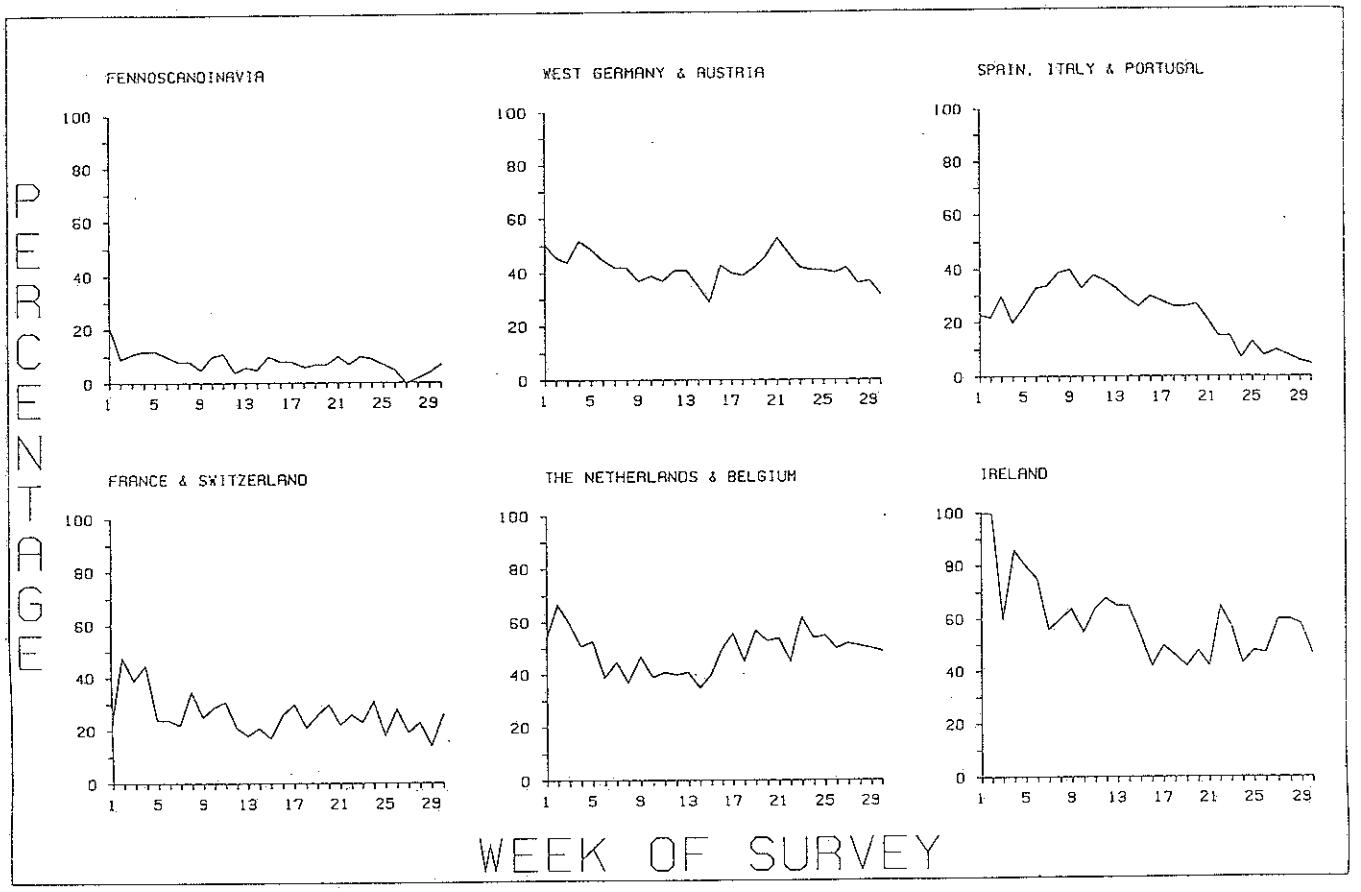
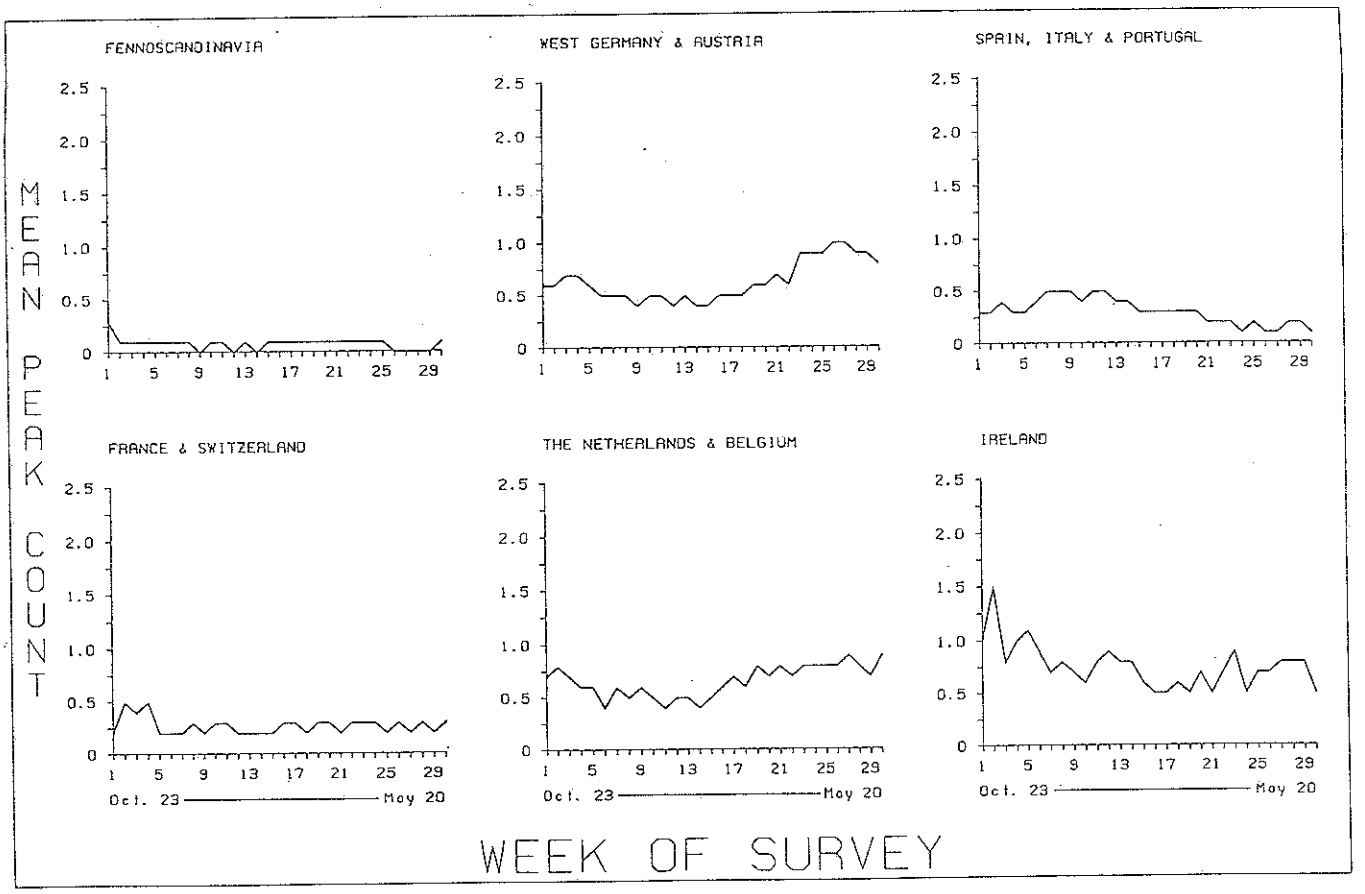


Fig. 2.4 Pied Wagtail


FENNOSCANDINAVIA
WEST GERMANY & AUSTRIA
SPAIN, ITALY & PORTUGAL
FRANCE & SWITZERLAND
THE NETHERLANDS & BELGIUM
IRELAND
PERCENTAGE
WEEK OF SURVEY


FENNOSCANDINAVIA
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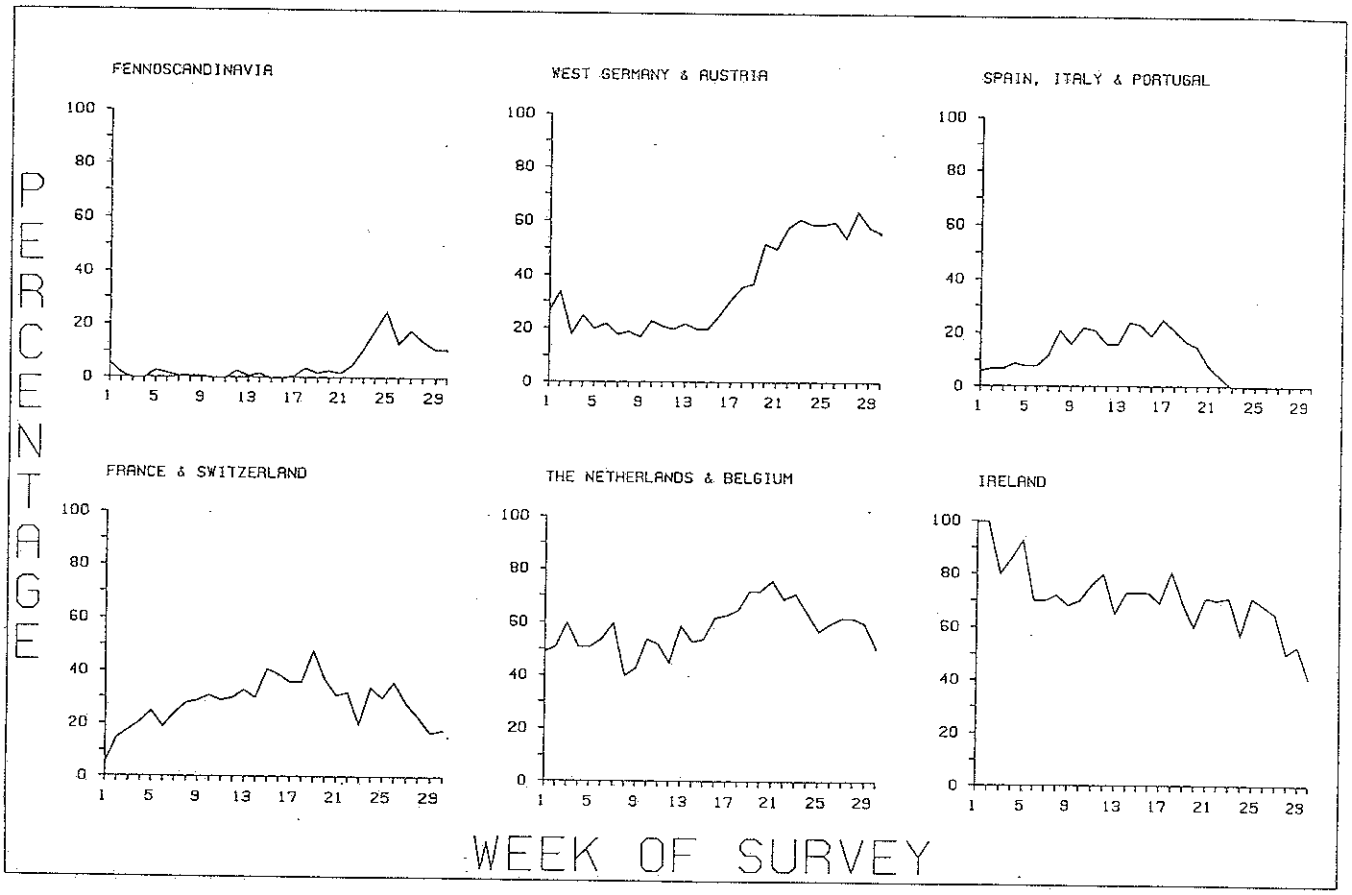
IRELAND
MEAN PEAK COUNT
Oct. 23
May 20
WEEK OF SURVEY

Fig. 2.5 Wren



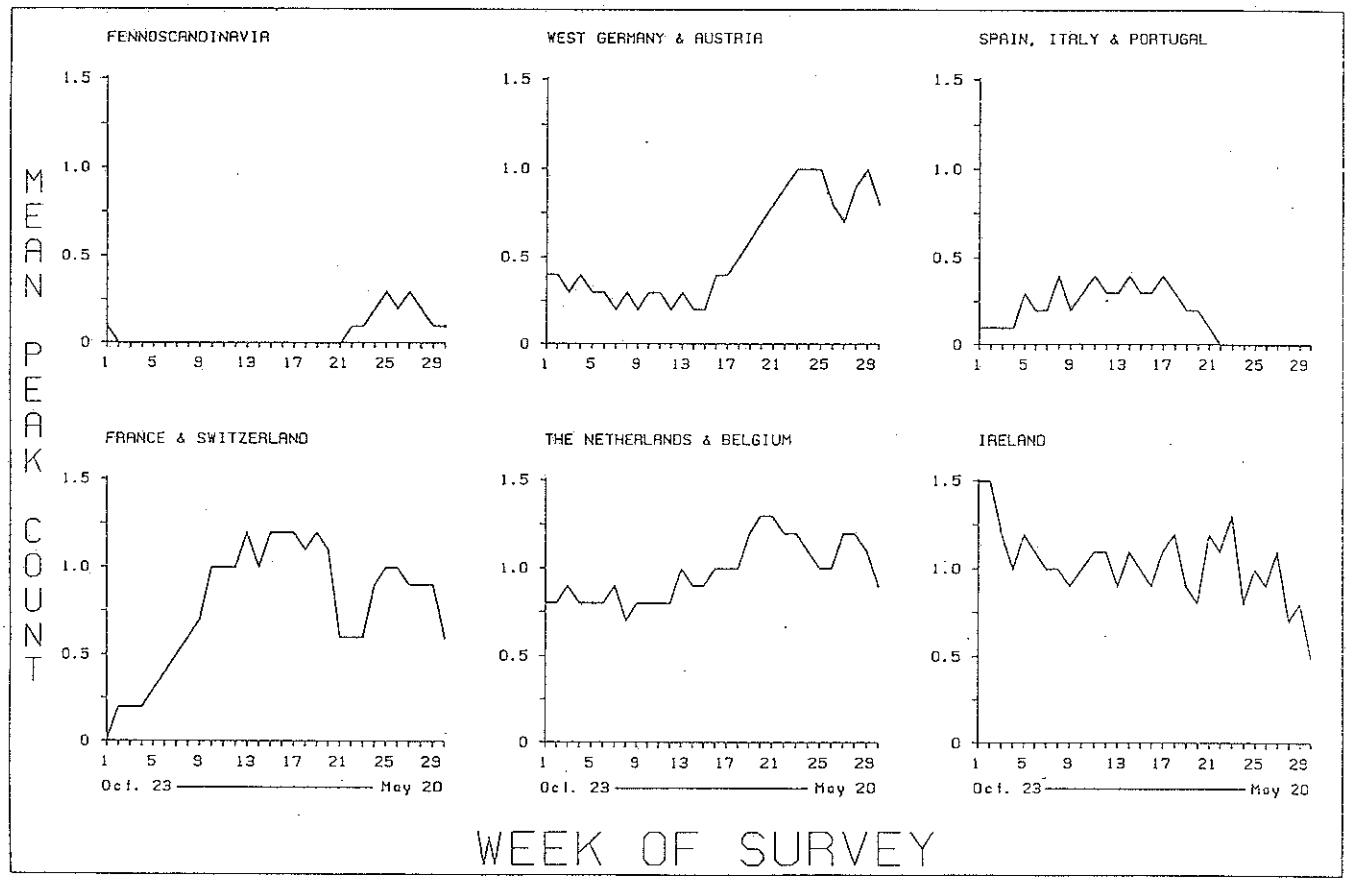
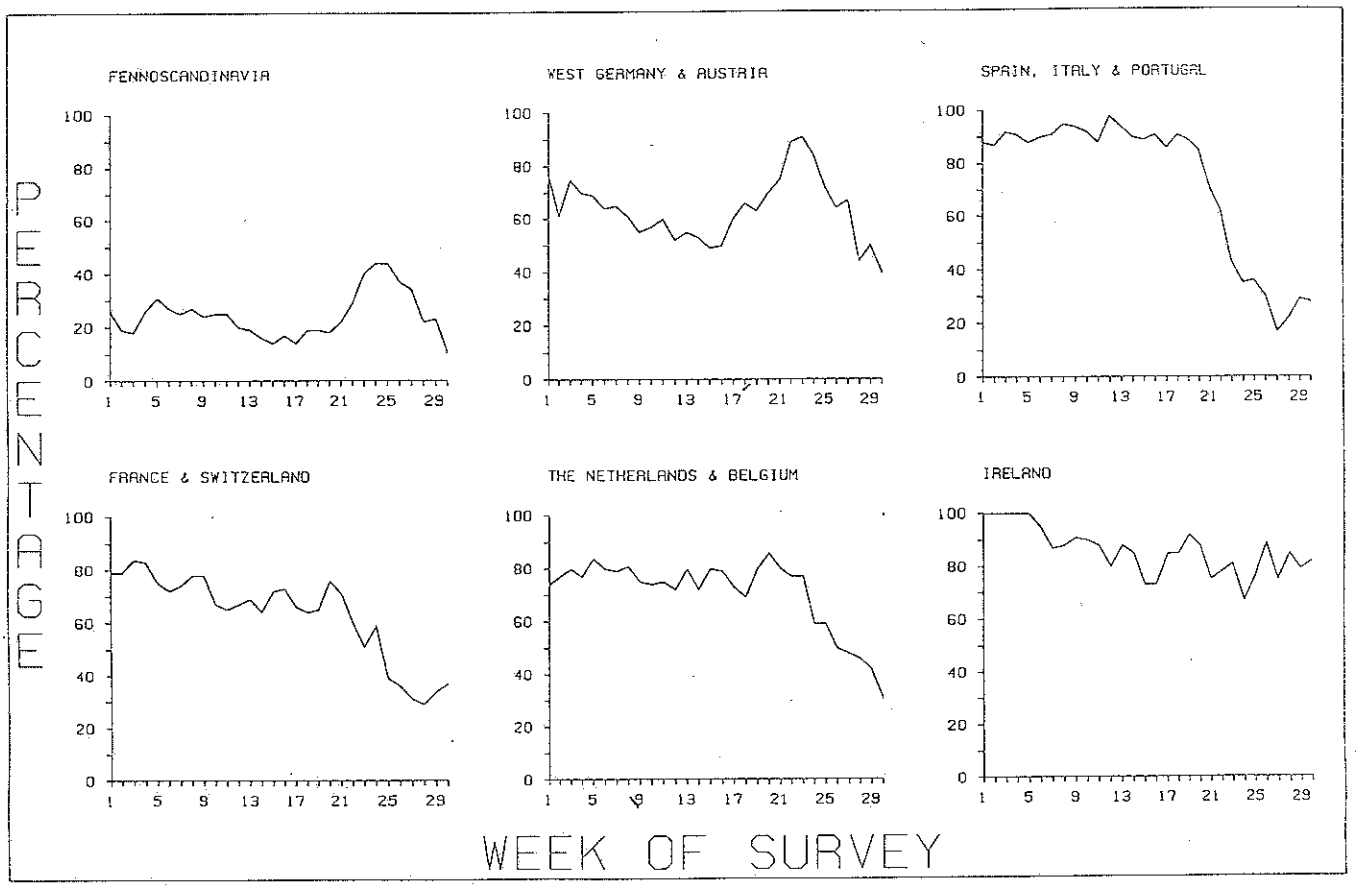


Fig. 2.6 Dunnock


FENNOSCANDINAVIA
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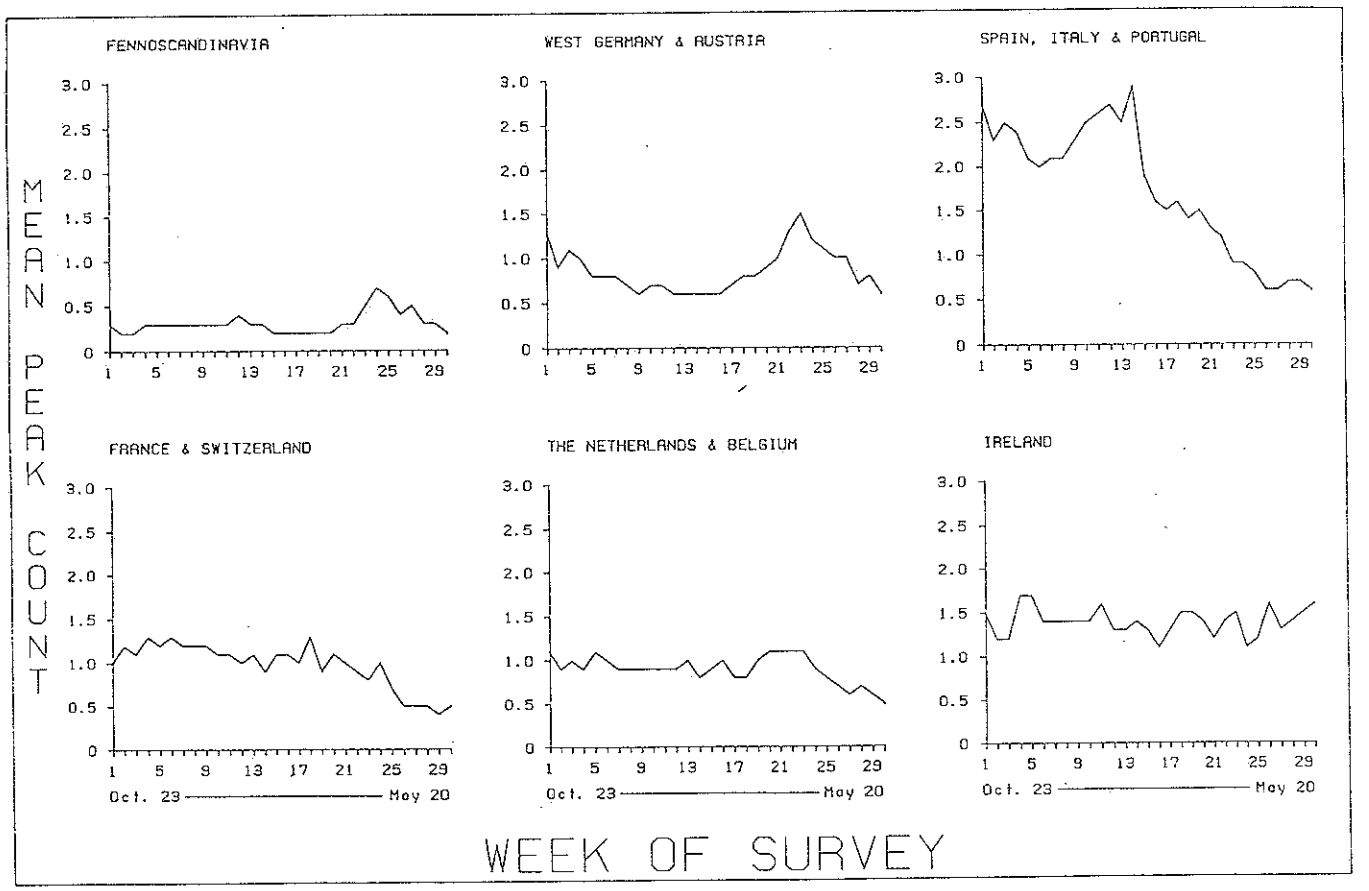
WEEK OF SURVEY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SPAIN, ITALY & PORTUGAL
FRANCE & SWITZERLAND
THE NETHERLANDS & BELGIUM
IRELAND
MEAN PEAK COUNT
Oct. 23
May 20
WEEK OF SURVEY

Fig. 2.7 Robin

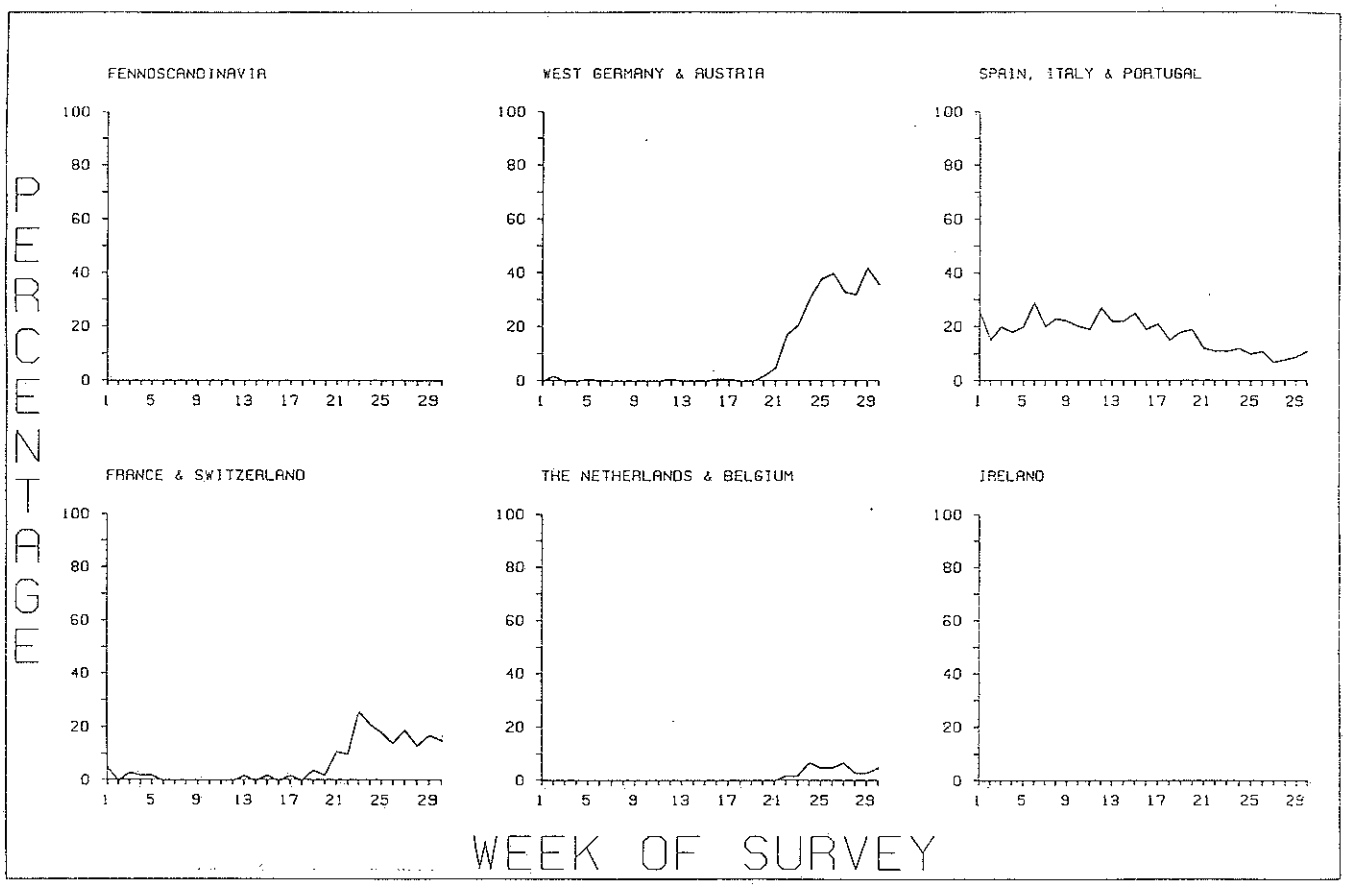
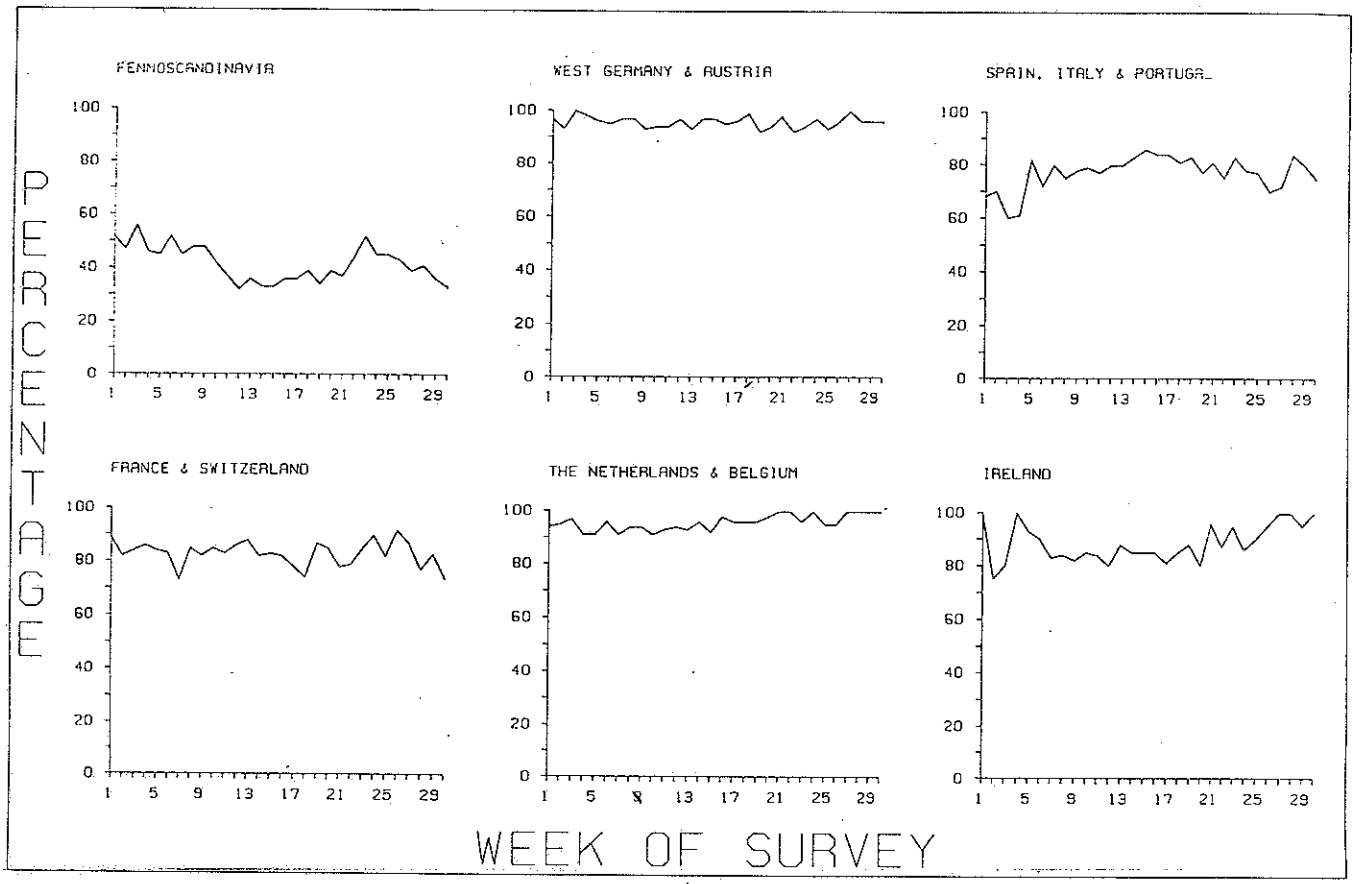


Fig. 2.8 Black Redstart



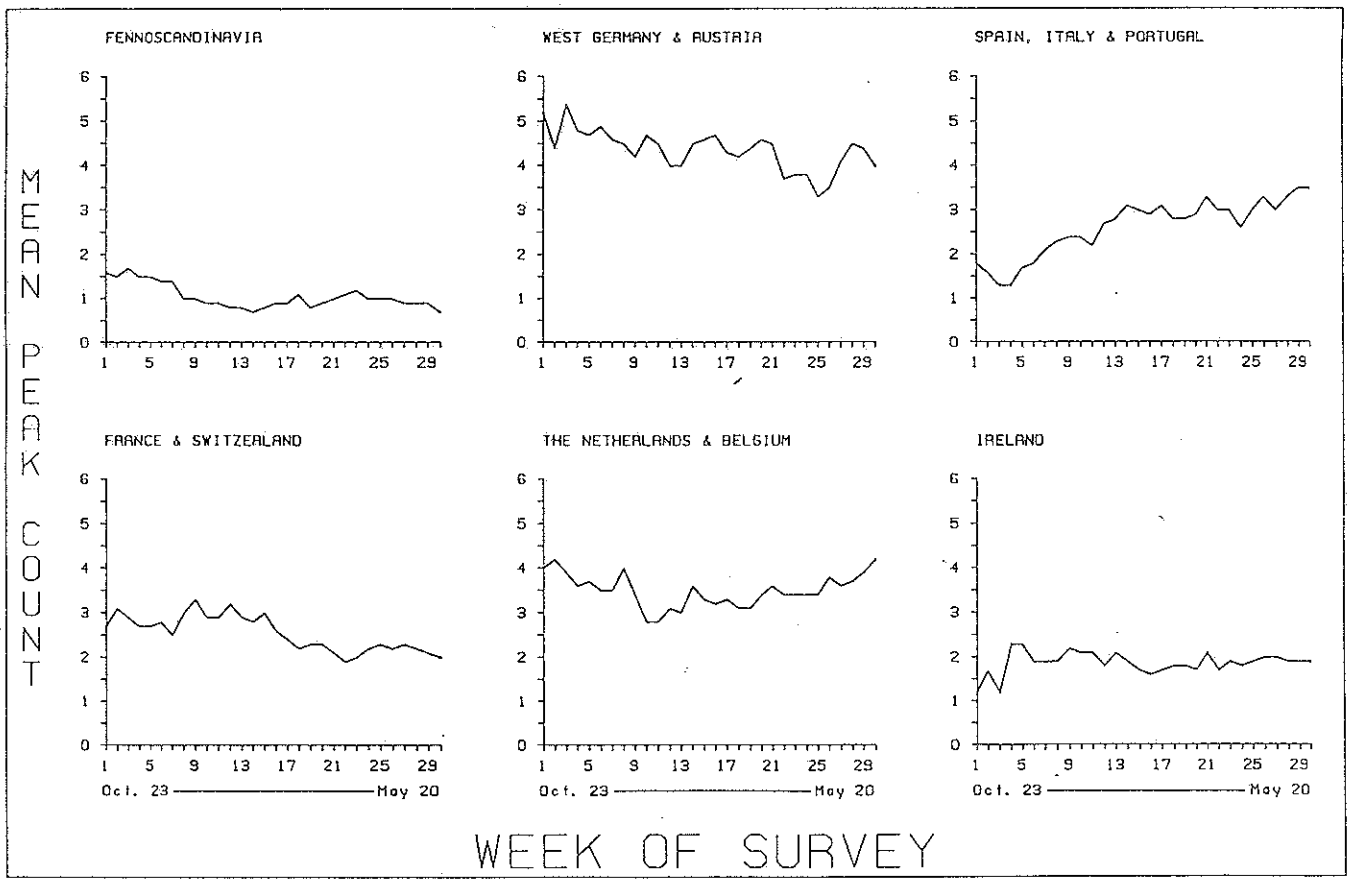


Fig. 2.9 Blackbird

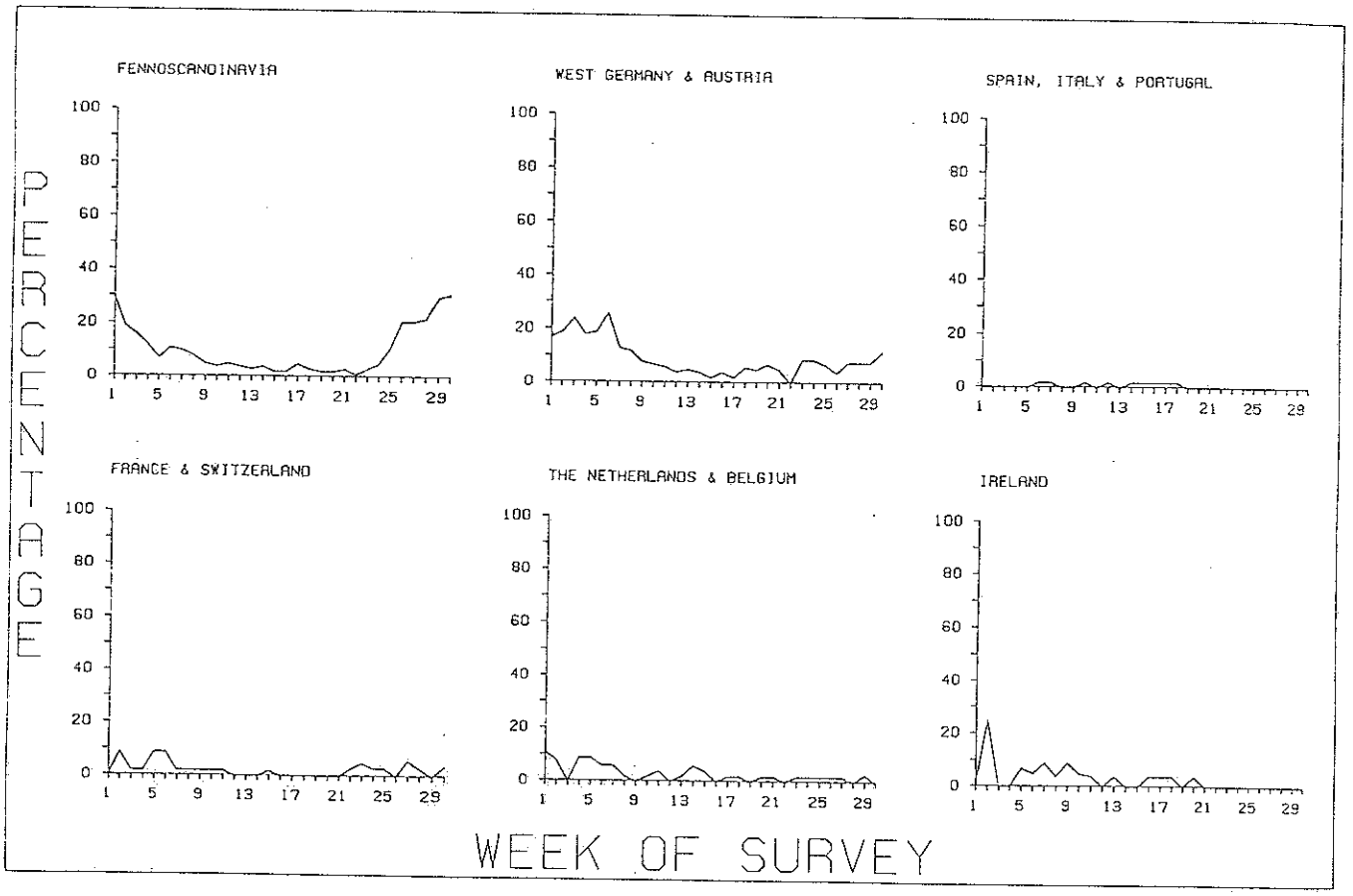
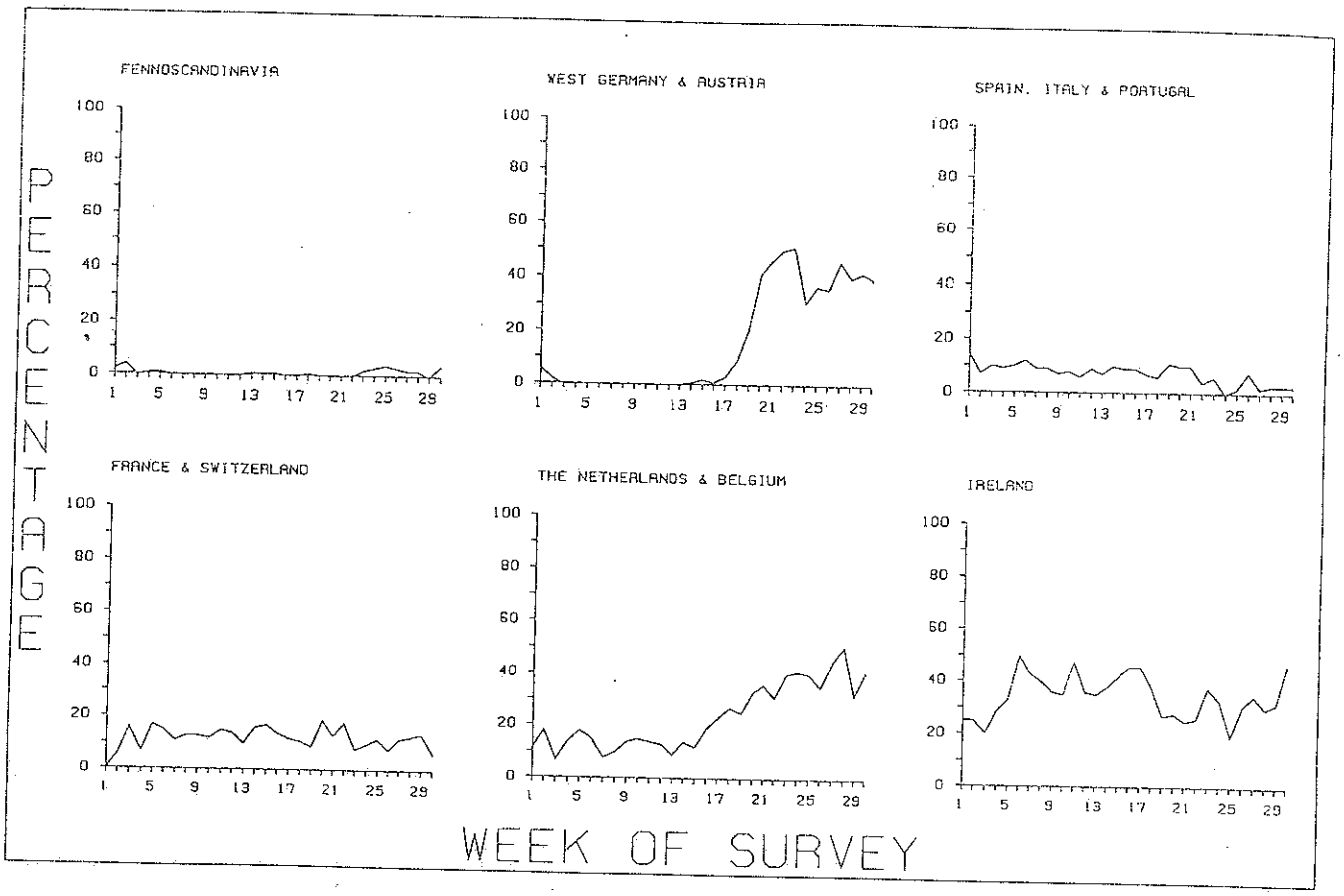


Fig. 2.10 Fieldfare



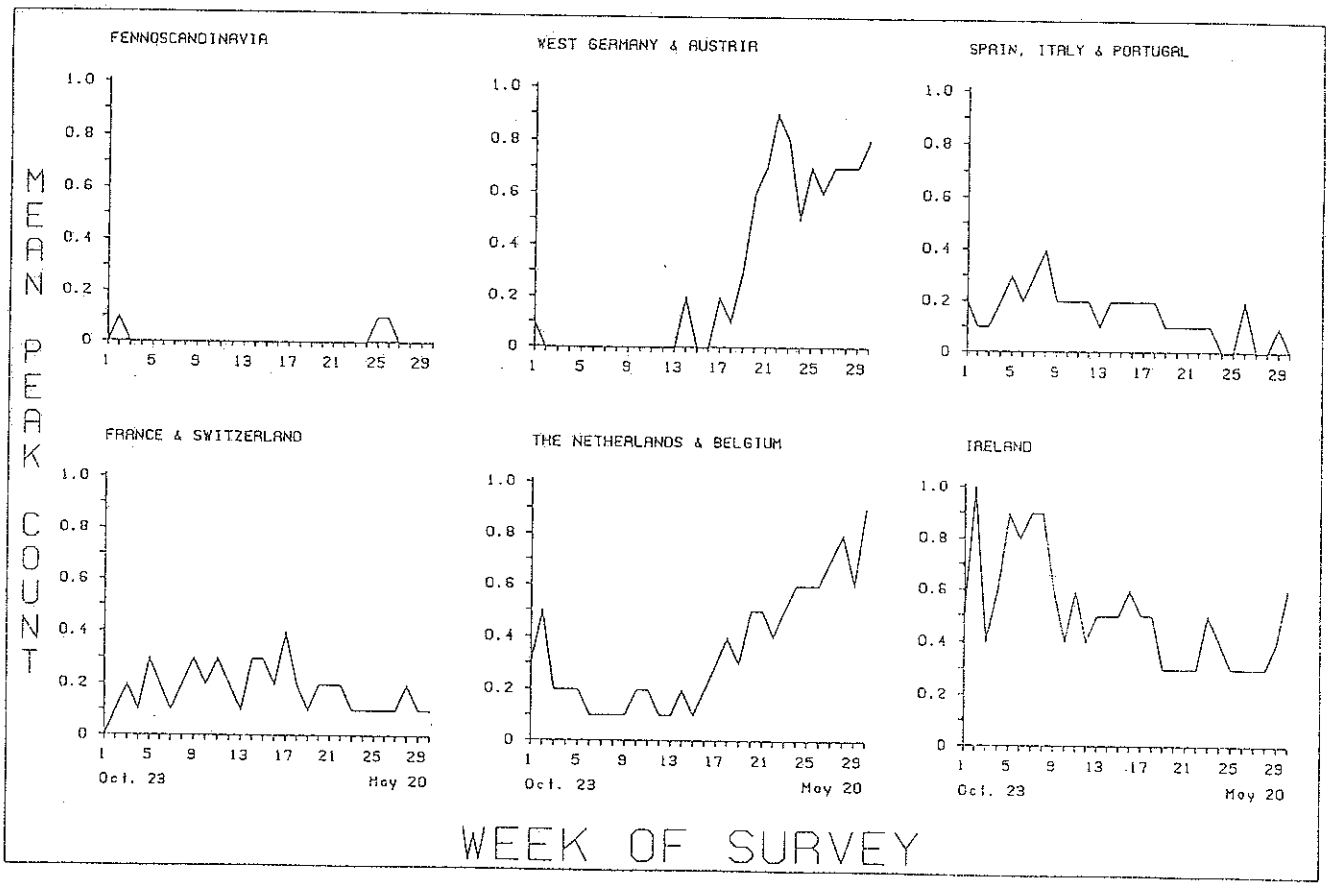


Fig. 2.11 Song Thrush

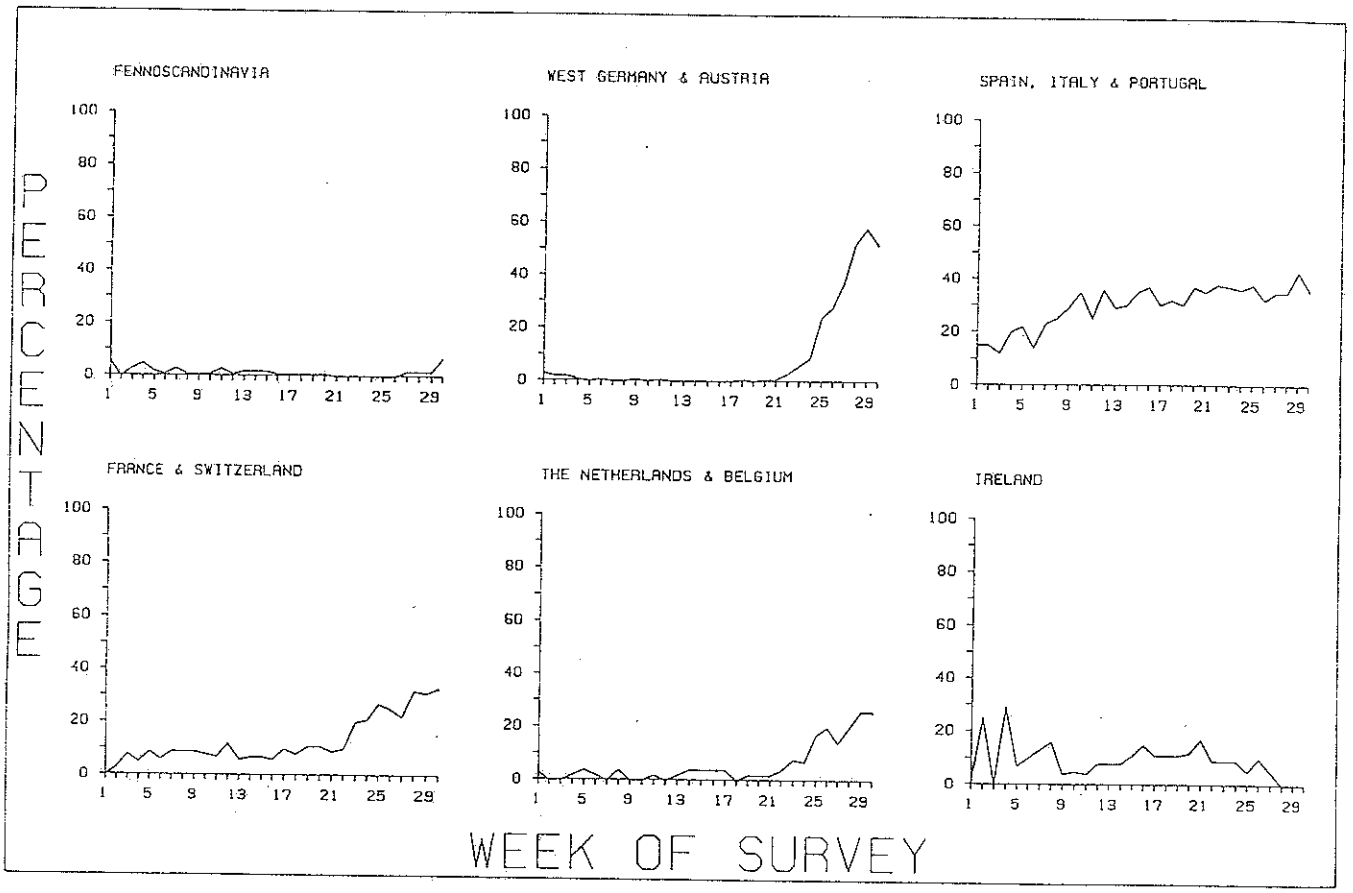
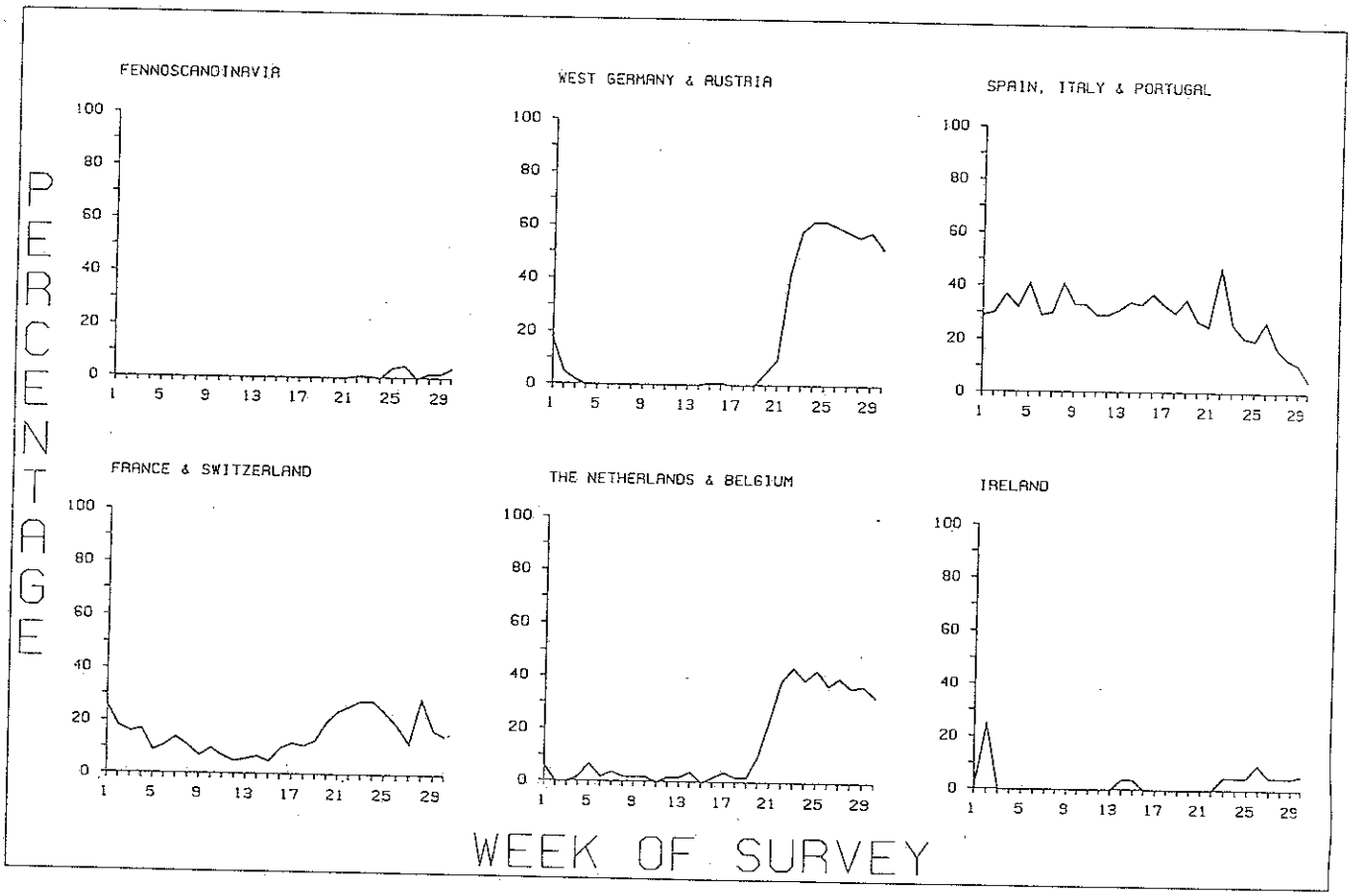


Fig. 2.12 Blackcap



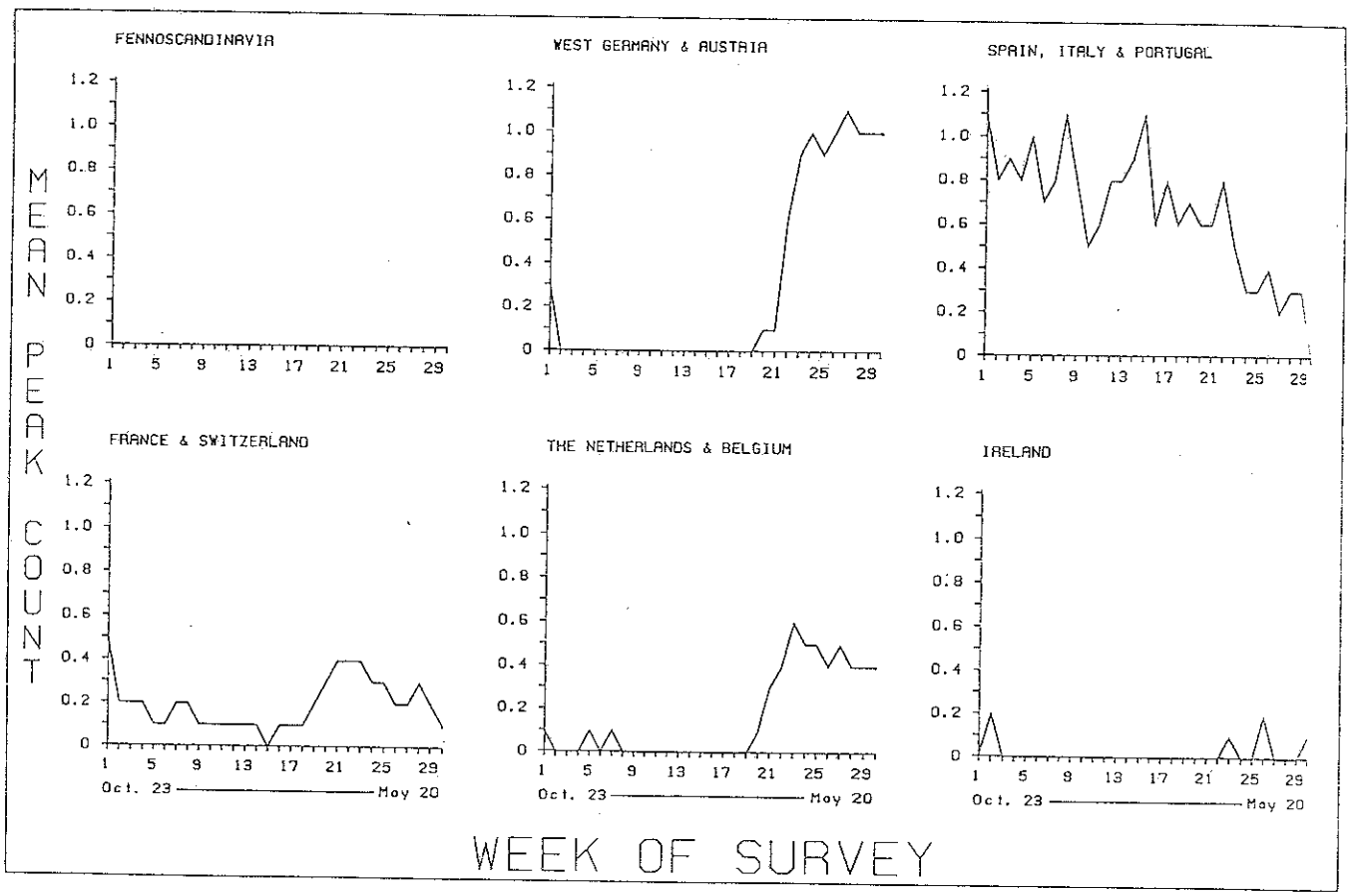


Fig. 2.13 Chiffchaff

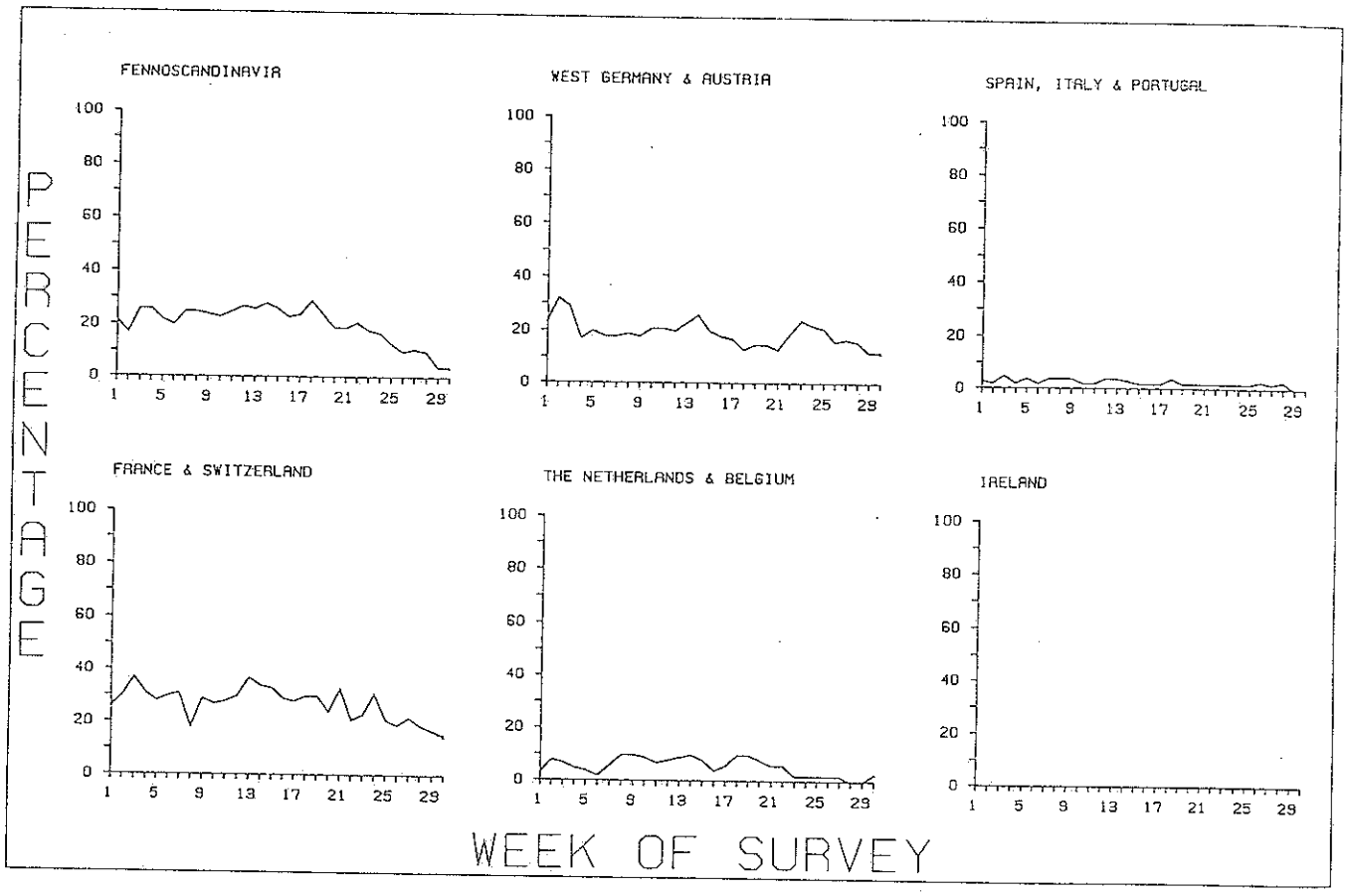


Fig. 2.14 Marsh Tit

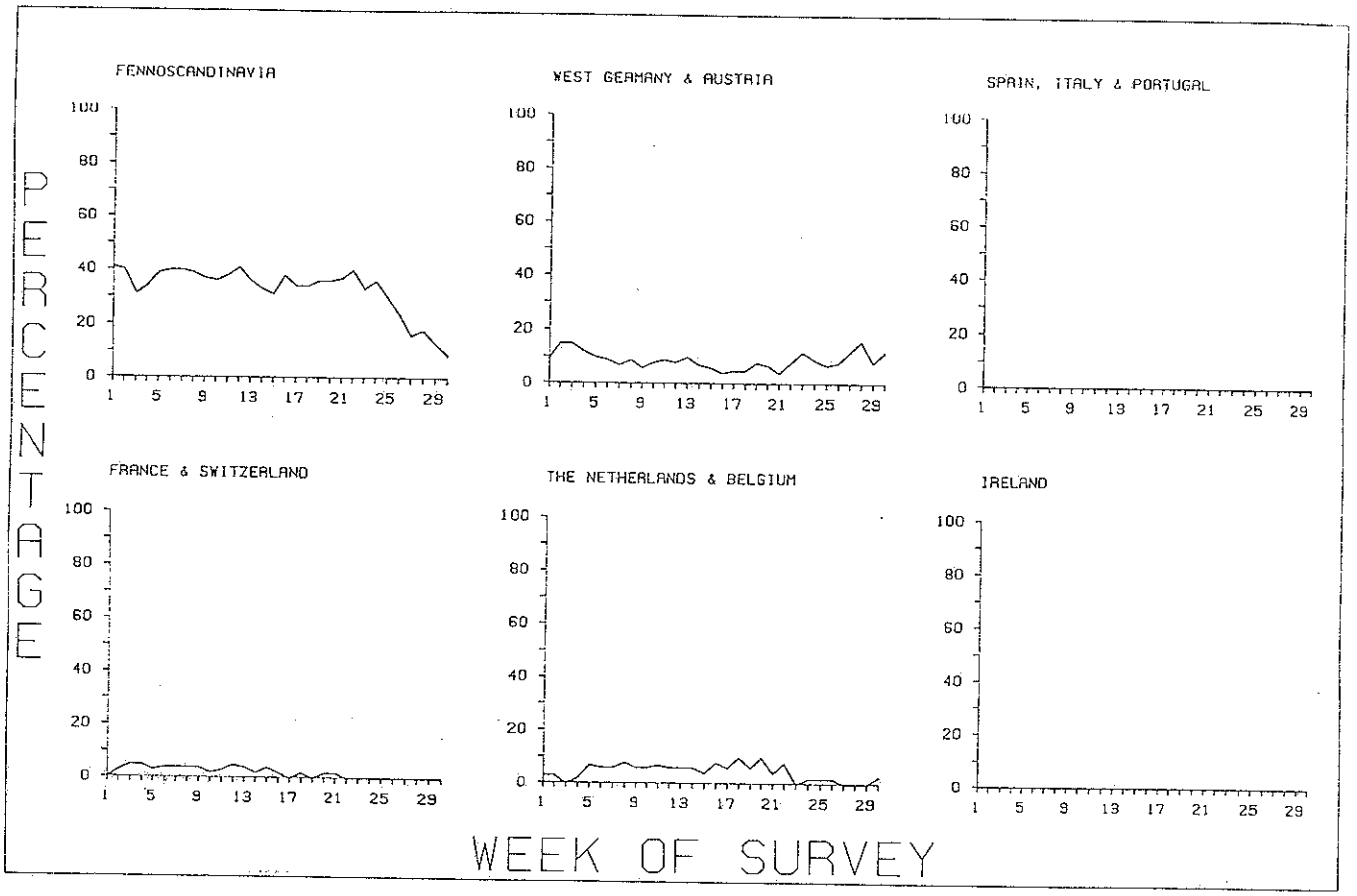
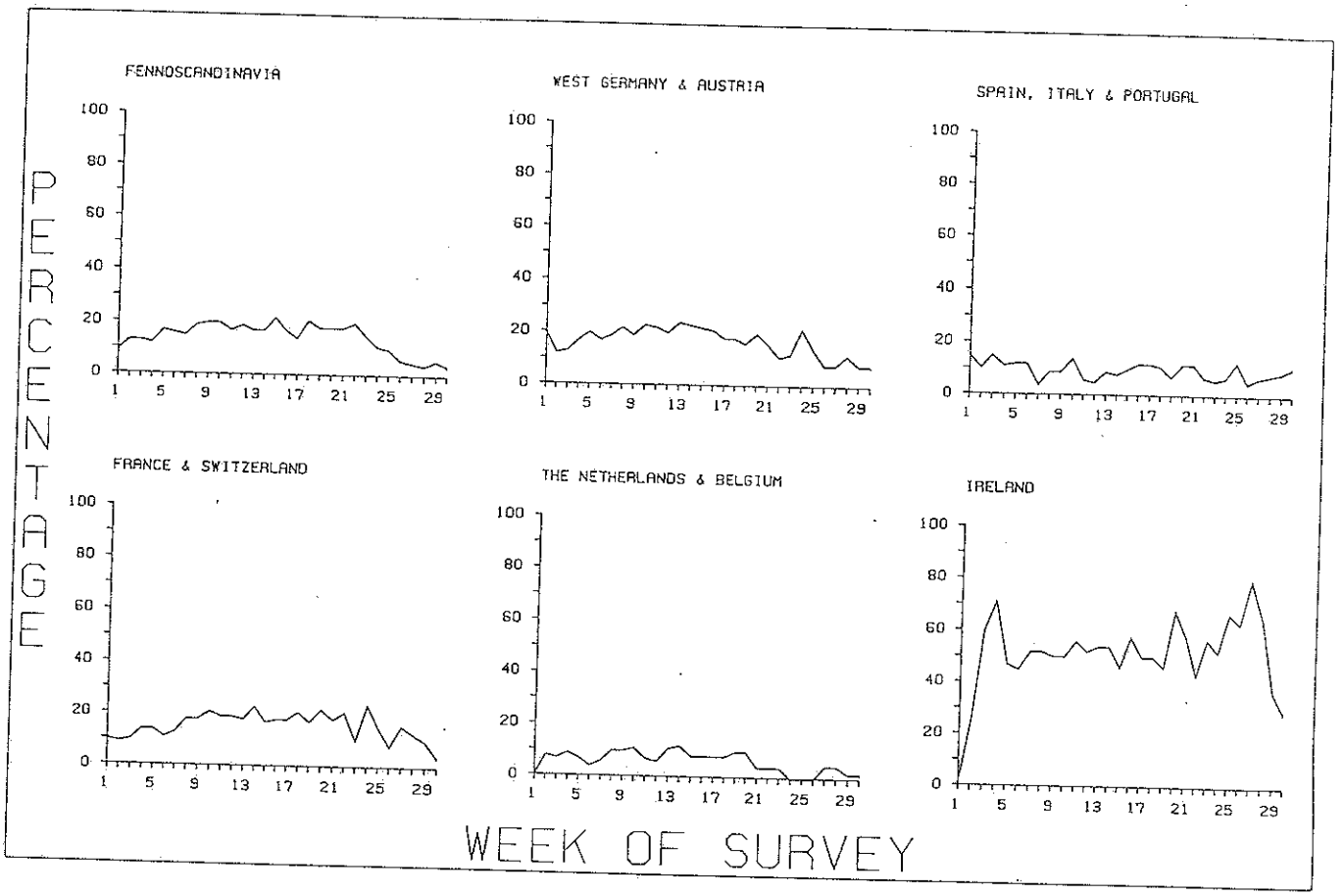


Fig. 2.15 Willow Tit



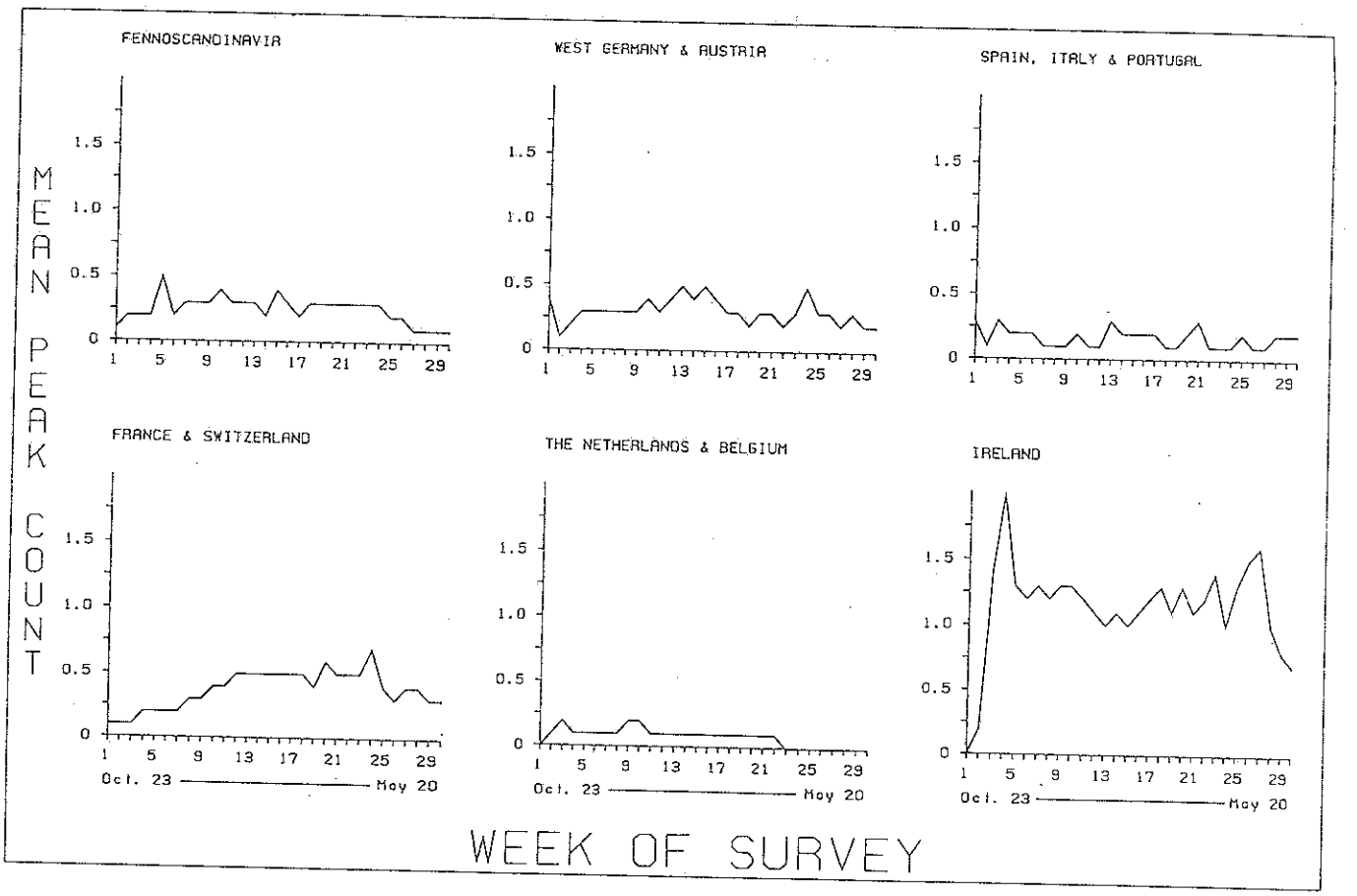
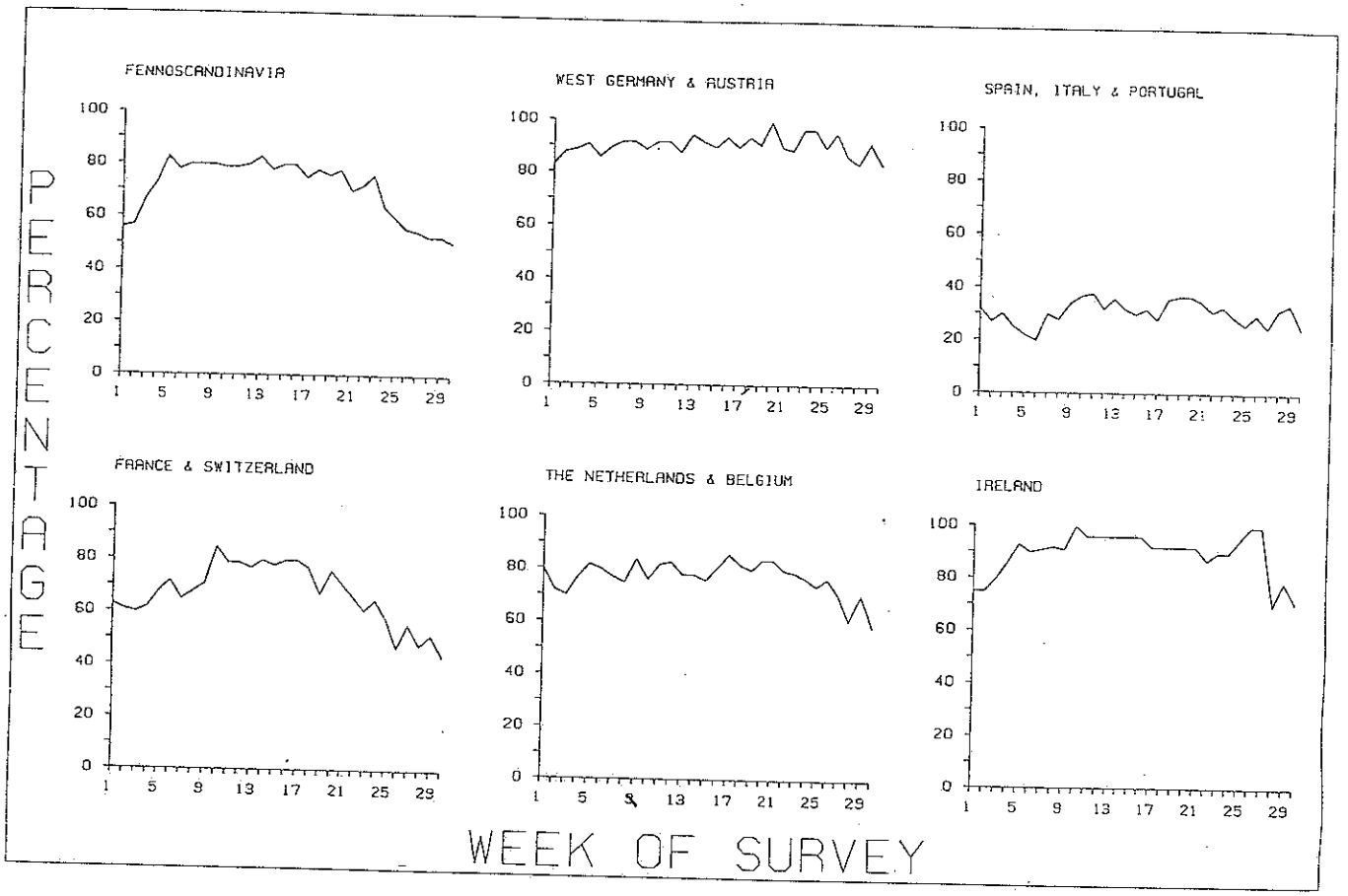


Fig. 2.16 Coal Tit



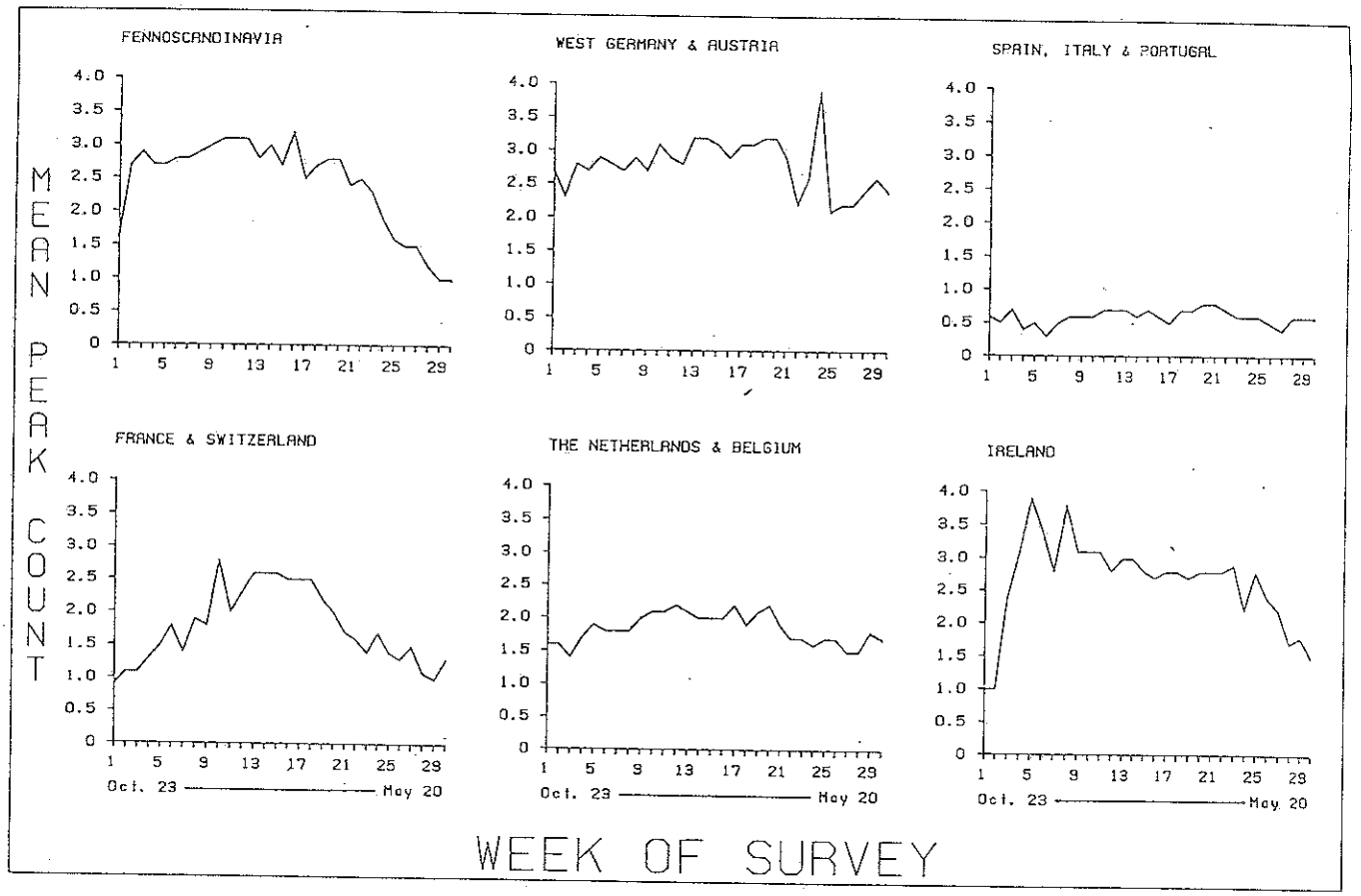
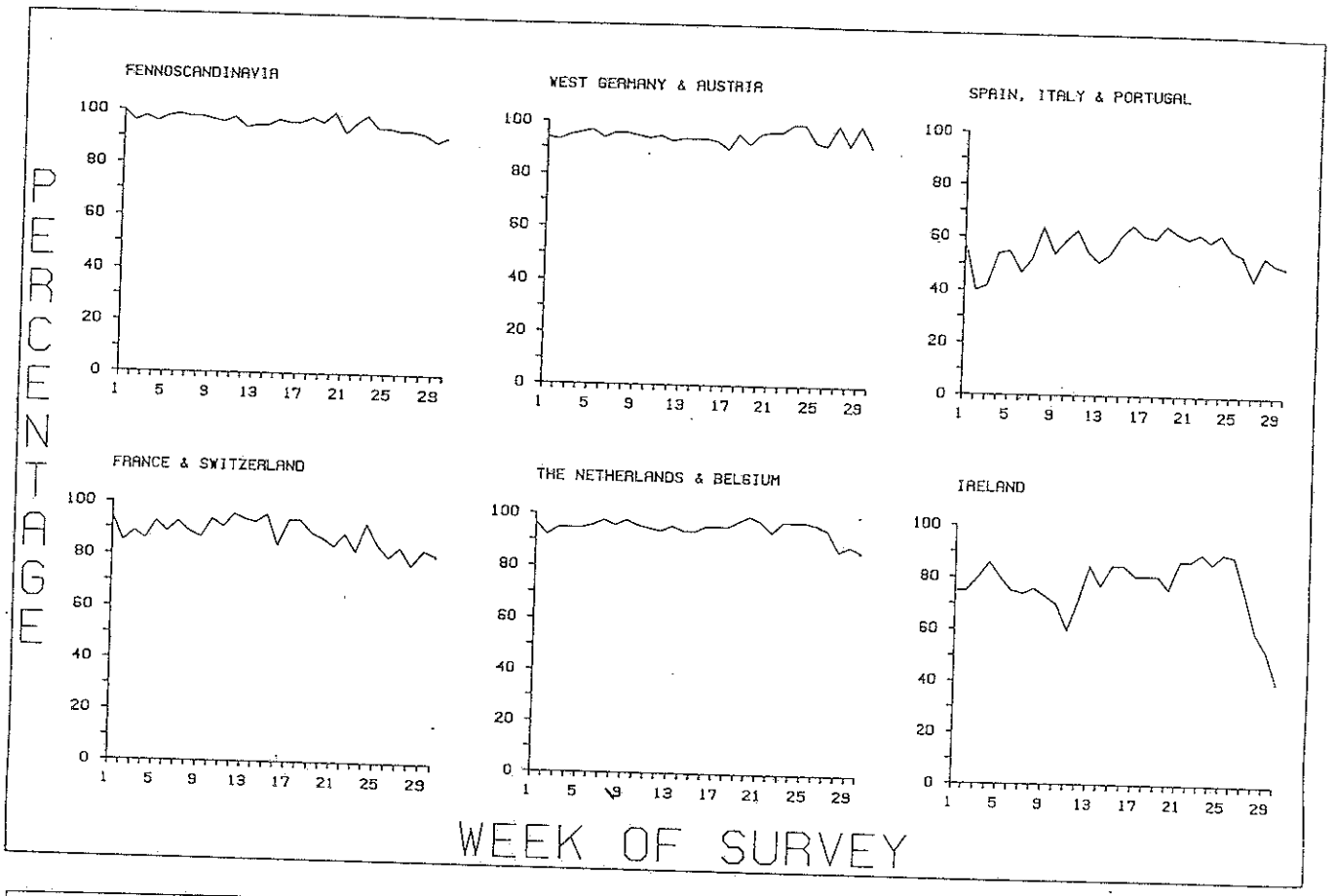


Fig. 2.17 Blue Tit



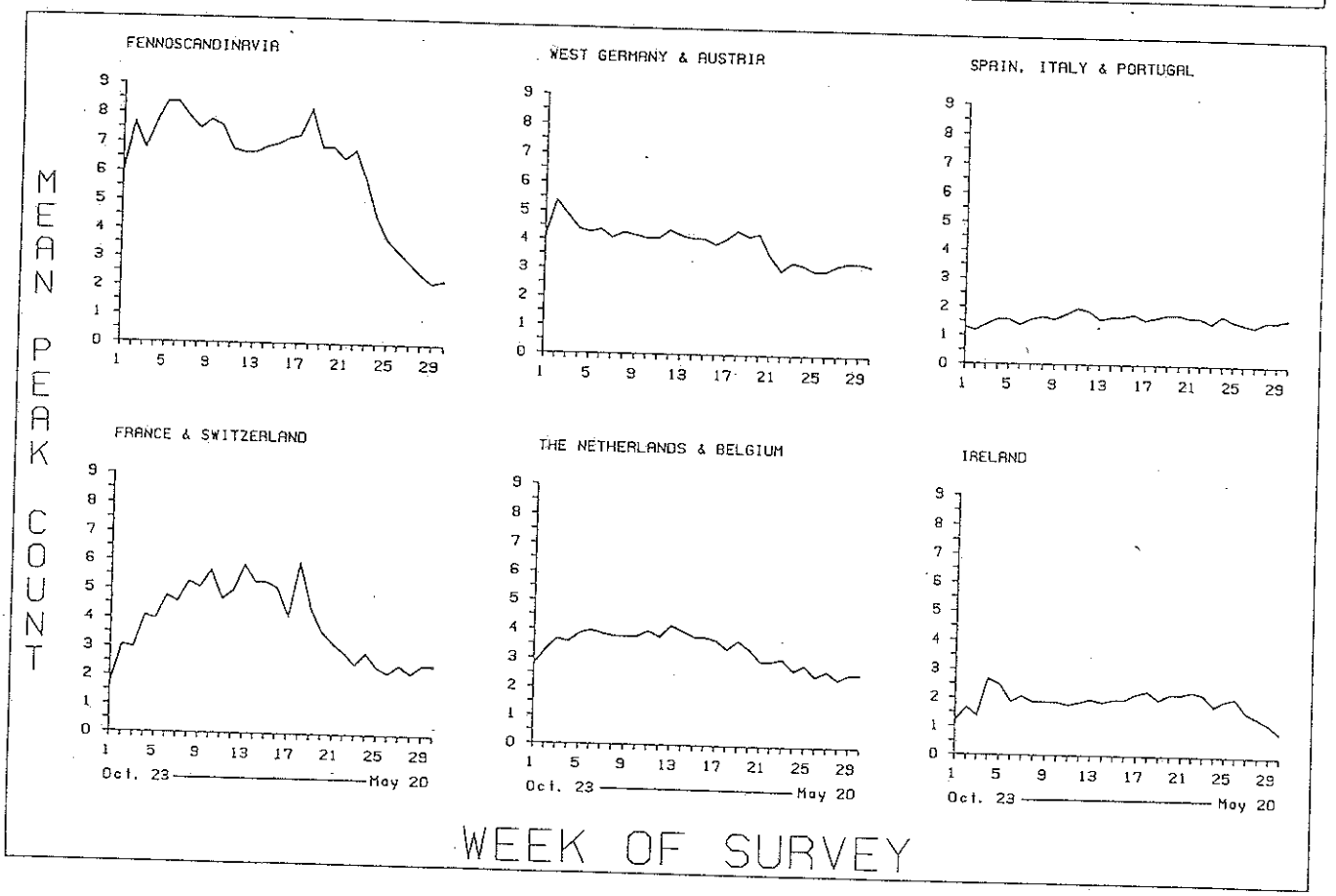
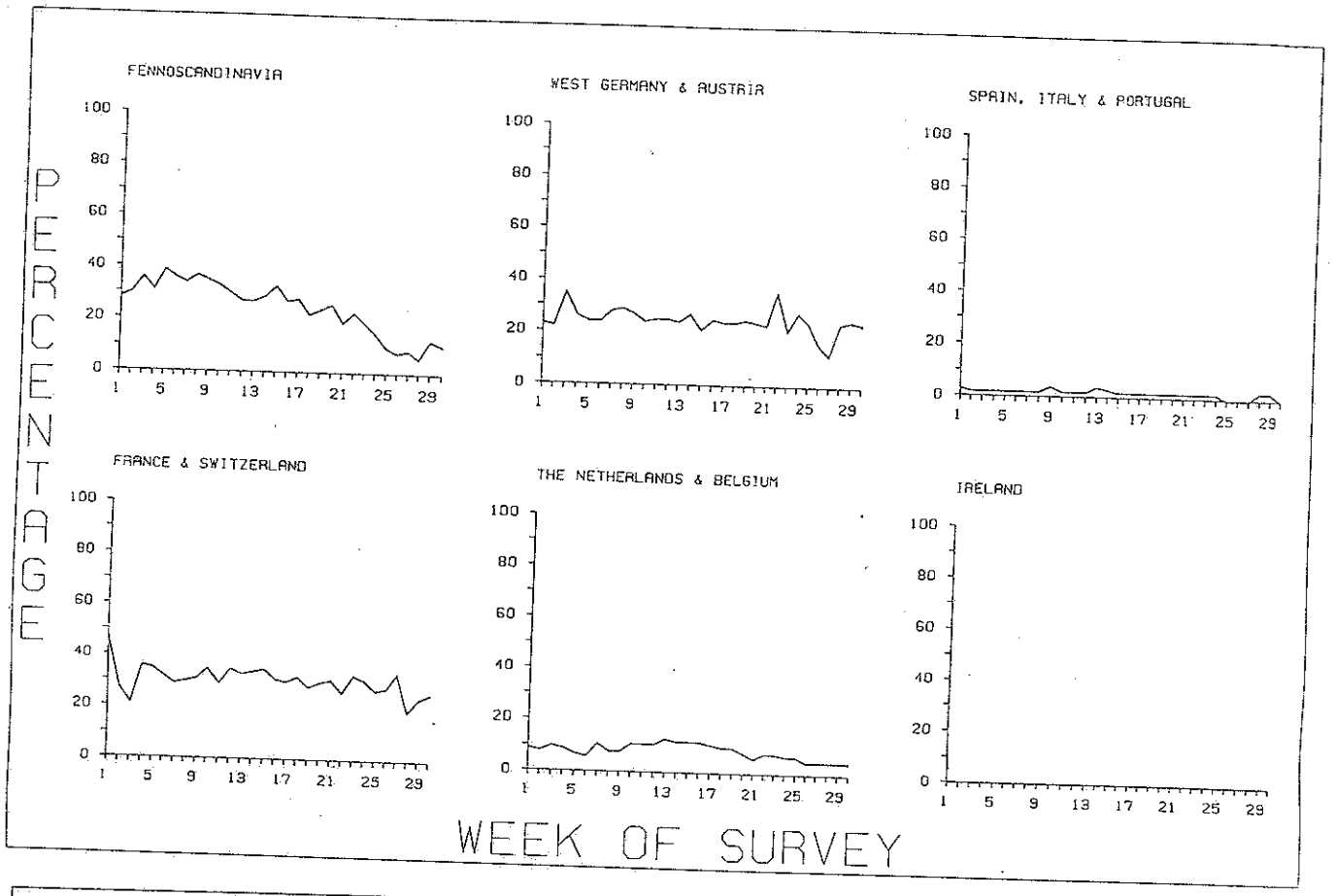


Fig 2.18 Great Tit



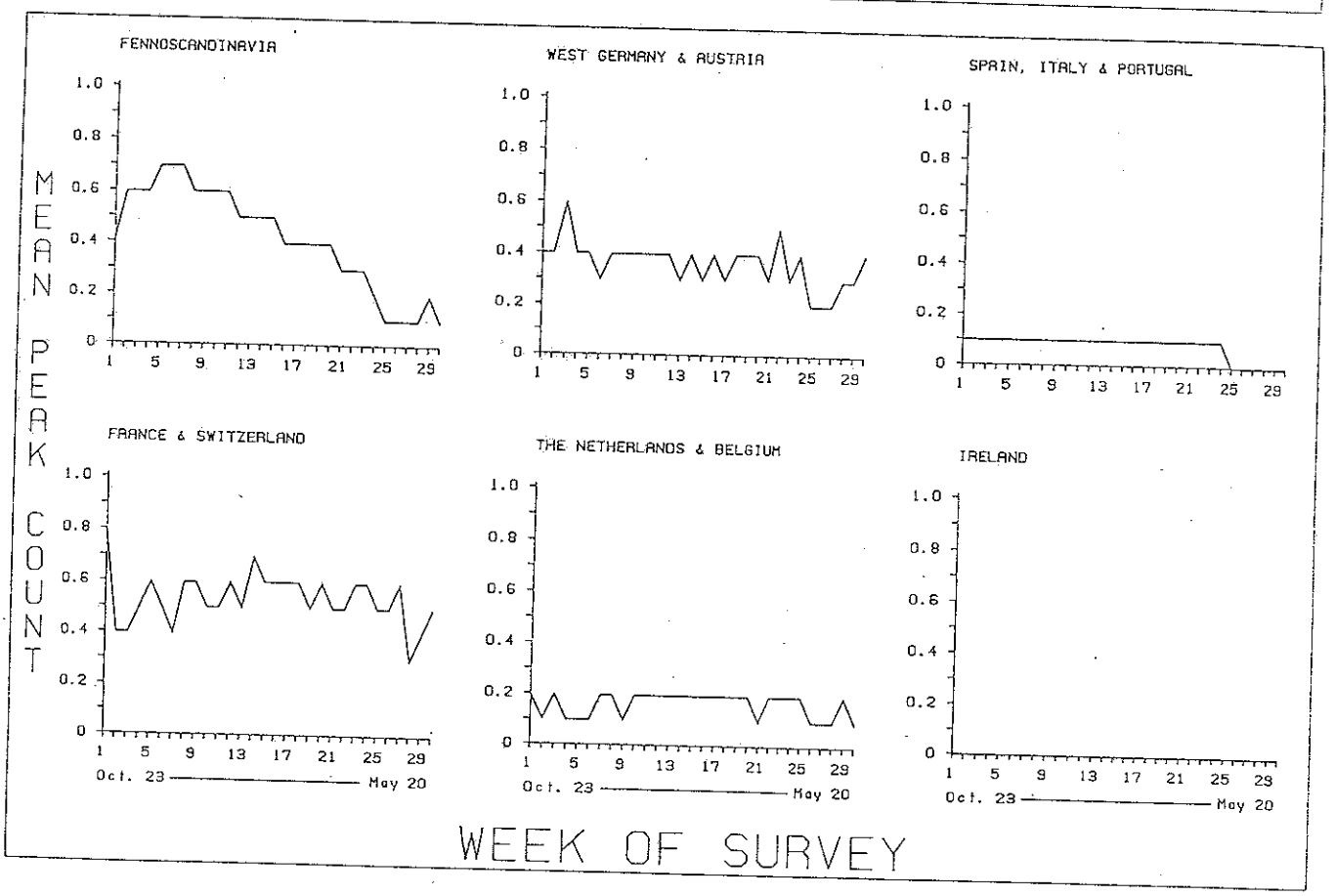
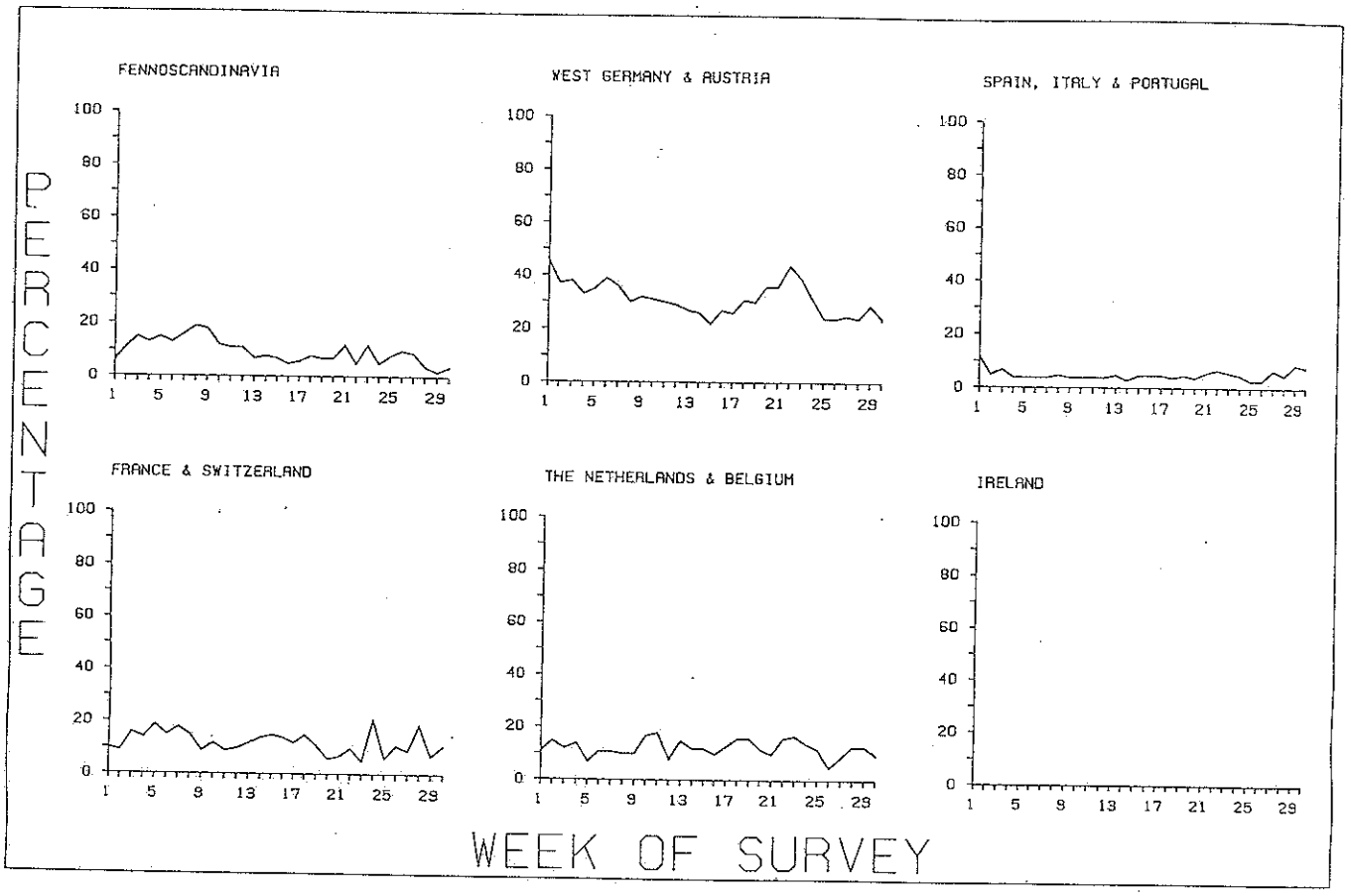


Fig. 2.19 Nuthatch


FENNOSCANDINAVIA
WEST GERMANY & AUSTRIA
SPAIN, ITALY & PORTUGAL
FRANCE & SWITZERLAND
THE NETHERLANDS & BELGIUM
IRELAND
PERCENTAGE
WEEK OF SURVEY

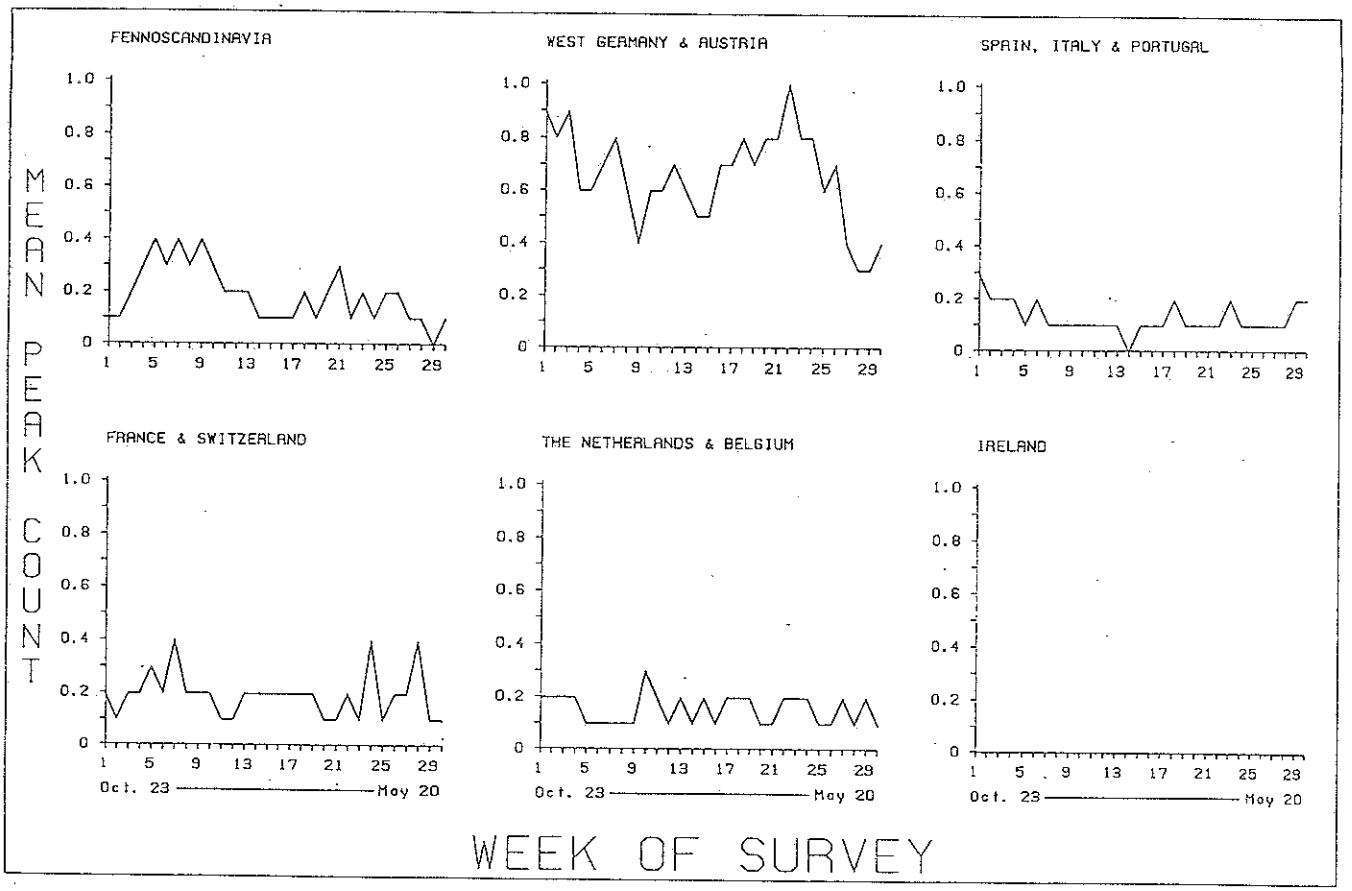
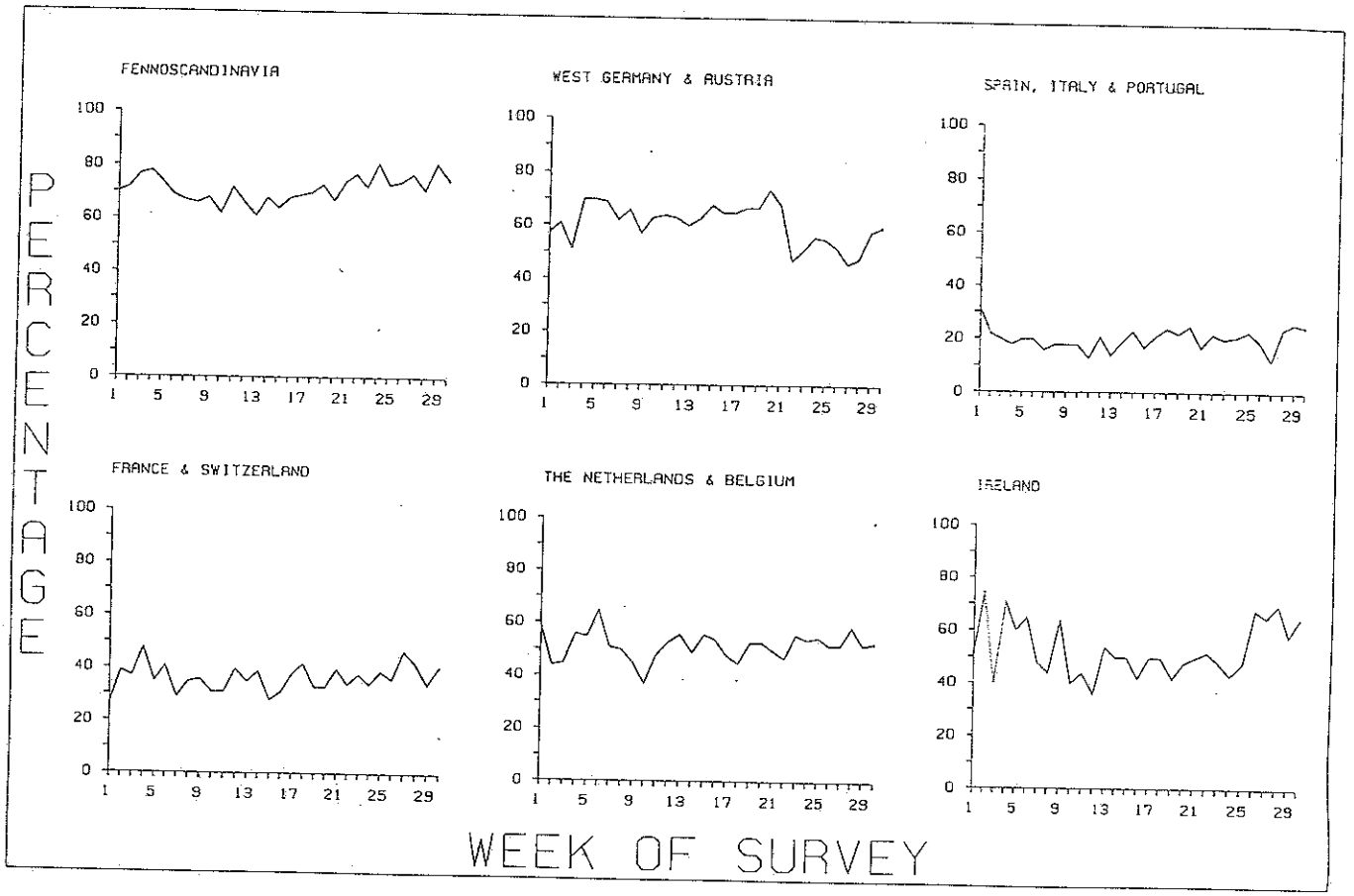

FENNOSCANDINAVIA
WEST GERMANY & AUSTRIA
SPAIN, ITALY & PORTUGAL
FRANCE & SWITZERLAND
THE NETHERLANDS & BELGIUM
IRELAND
MEAN PEAK COUNT
Oct. 23
May 20
WEEK OF SURVEY

Fig. 2.20 Jay



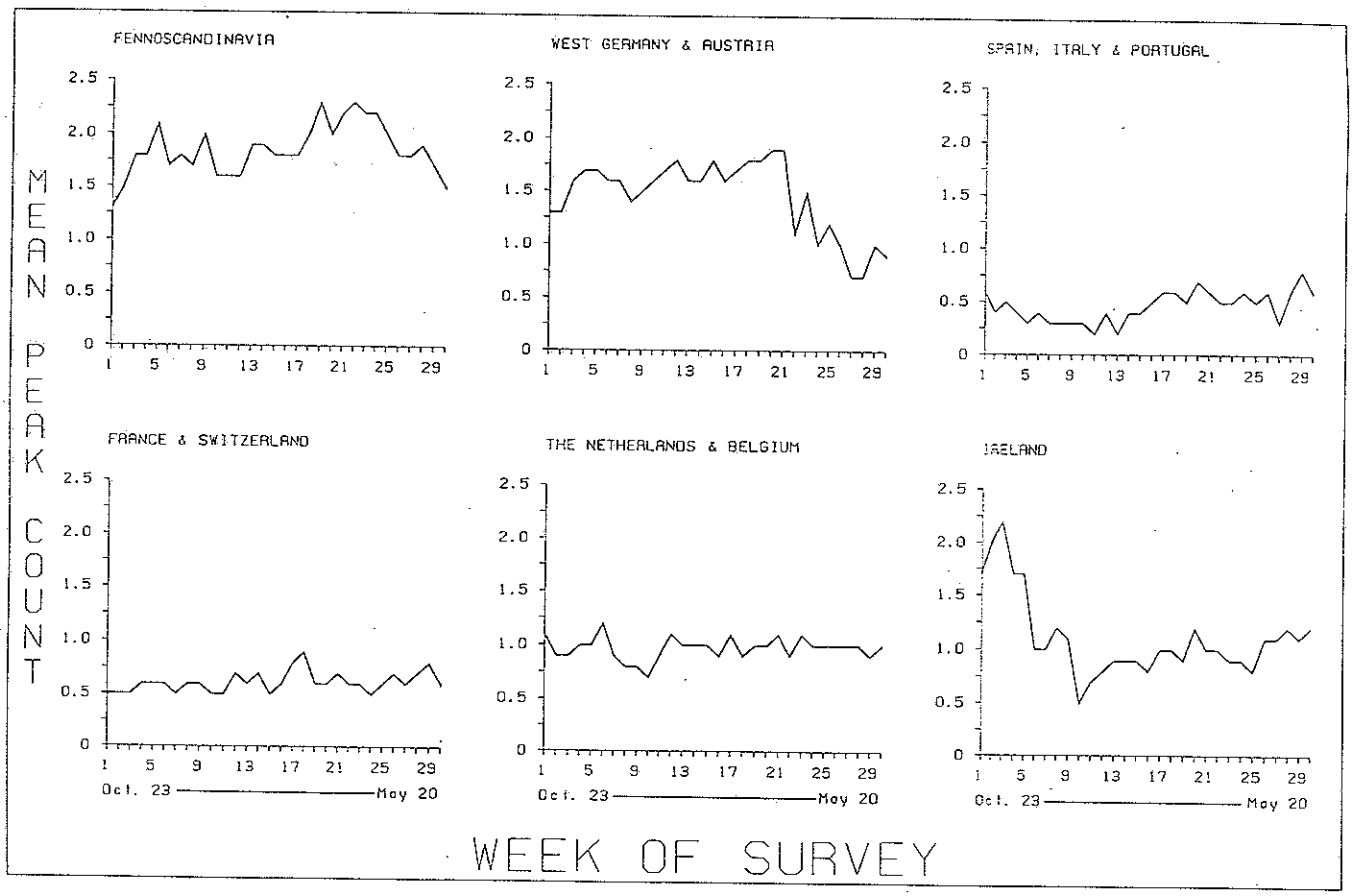


Fig. 2.21 Magpie

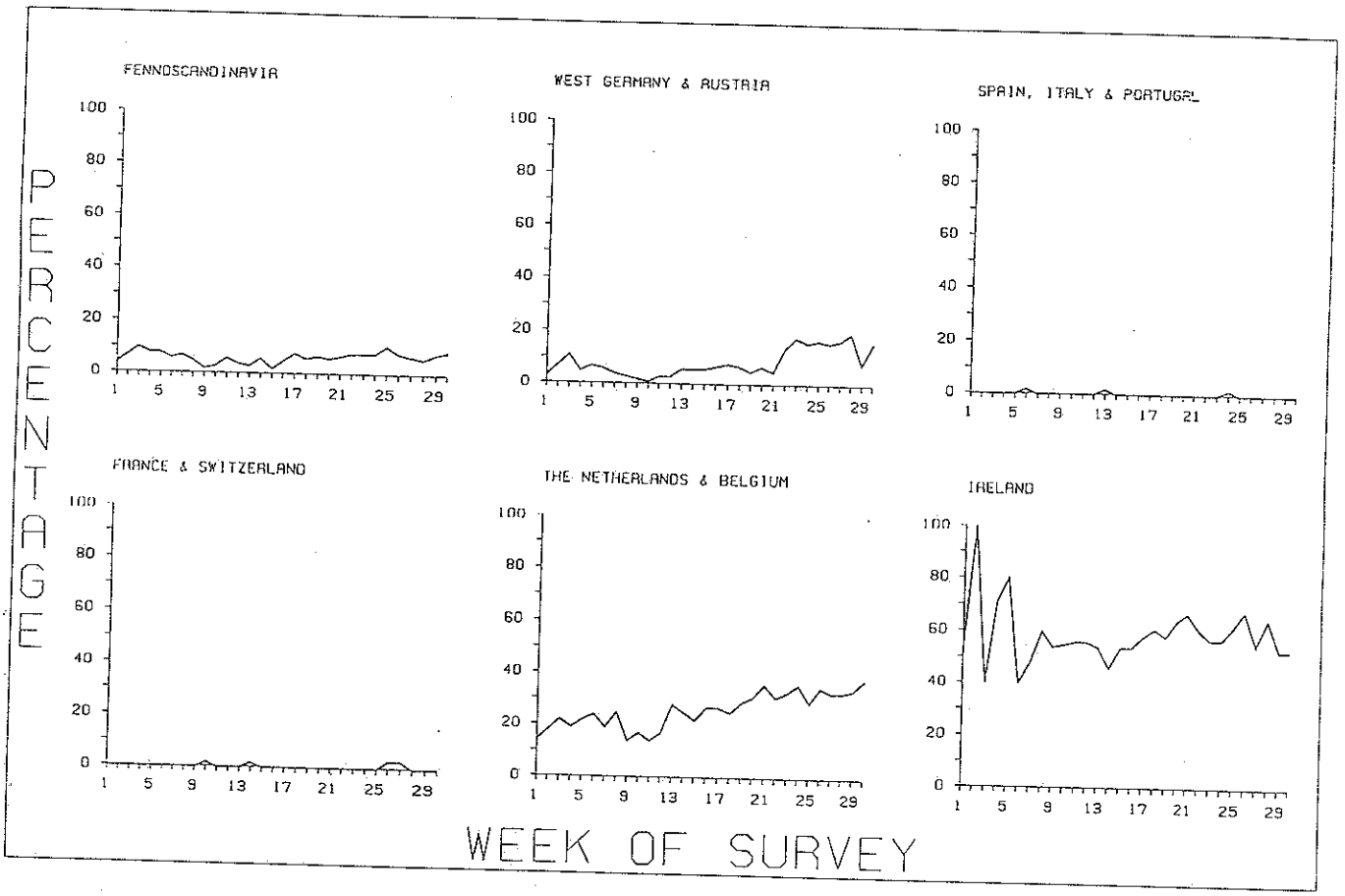


Fig. 2.22 Jackdaw

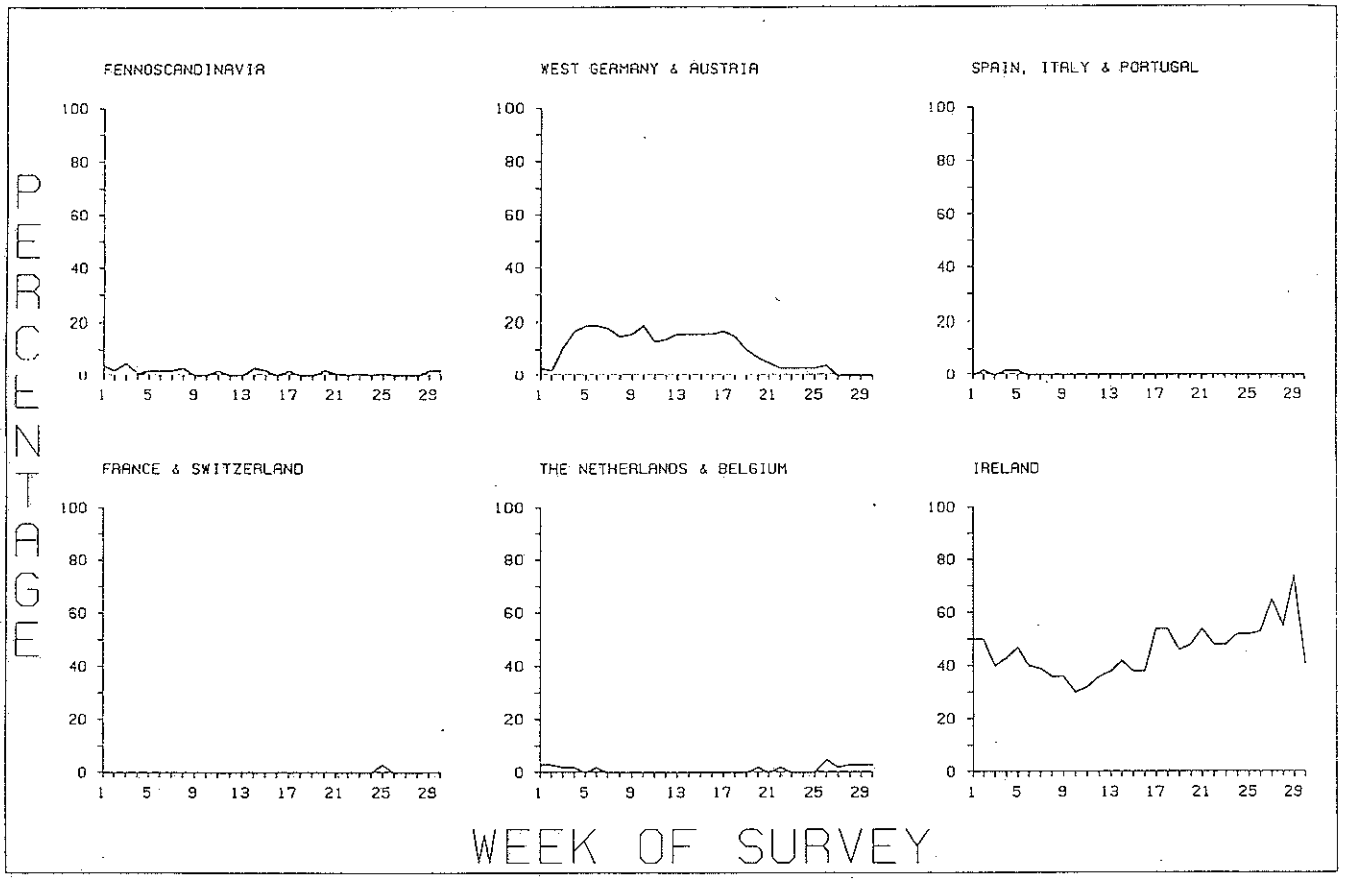

FENNOSCANDINAVIA
WEST GERMANY & AUSTRIA
SPAIN, ITALY & PORTUGAL
FRANCE & SWITZERLAND
THE NETHERLANDS & BELGIUM
IRELAND
PERCENTAGE
WEEK OF SURVEY
0
20
40
60
80
100
1
5
9
13
17
21
25
29

Fig. 2.23 Rook

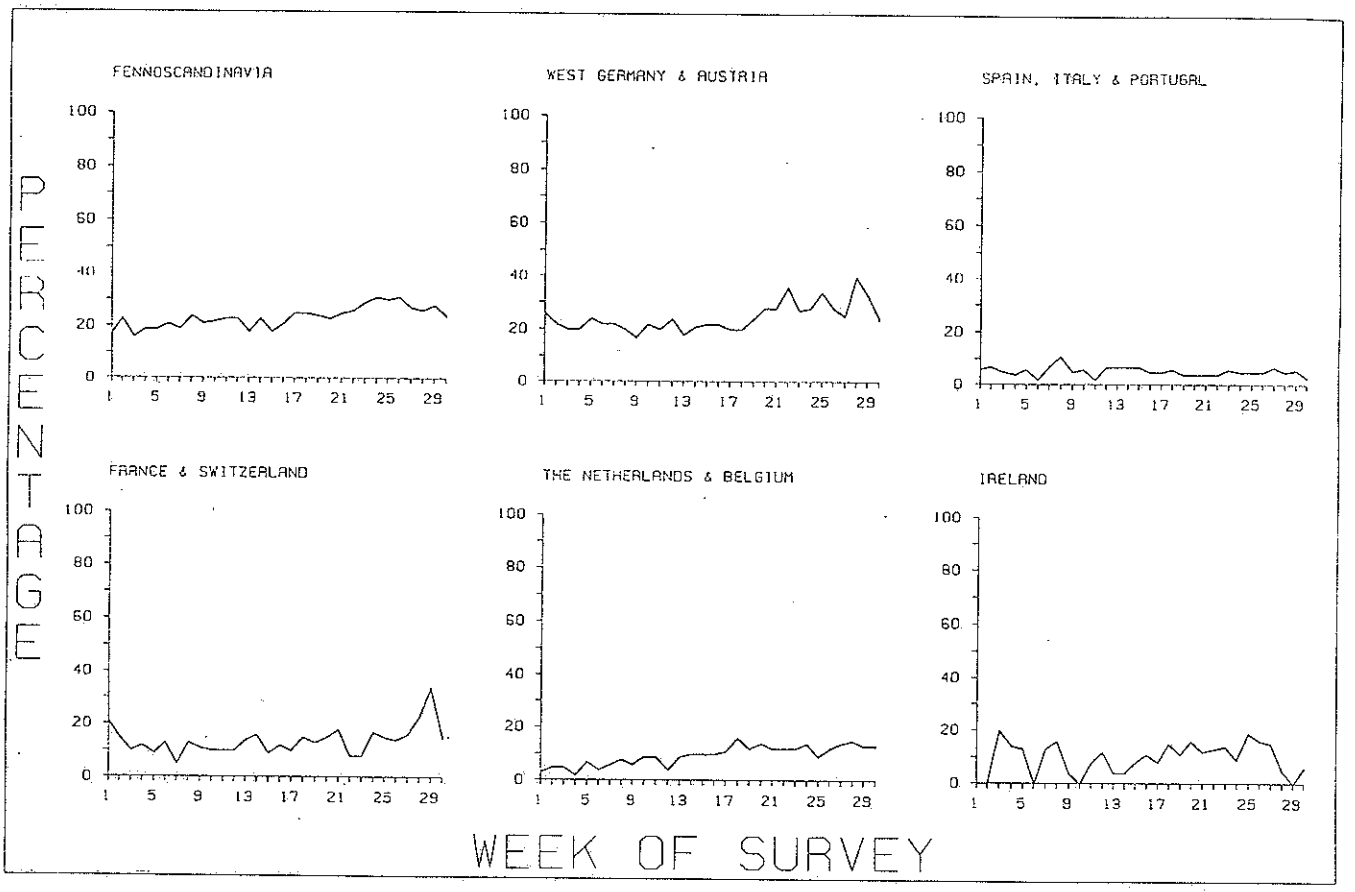
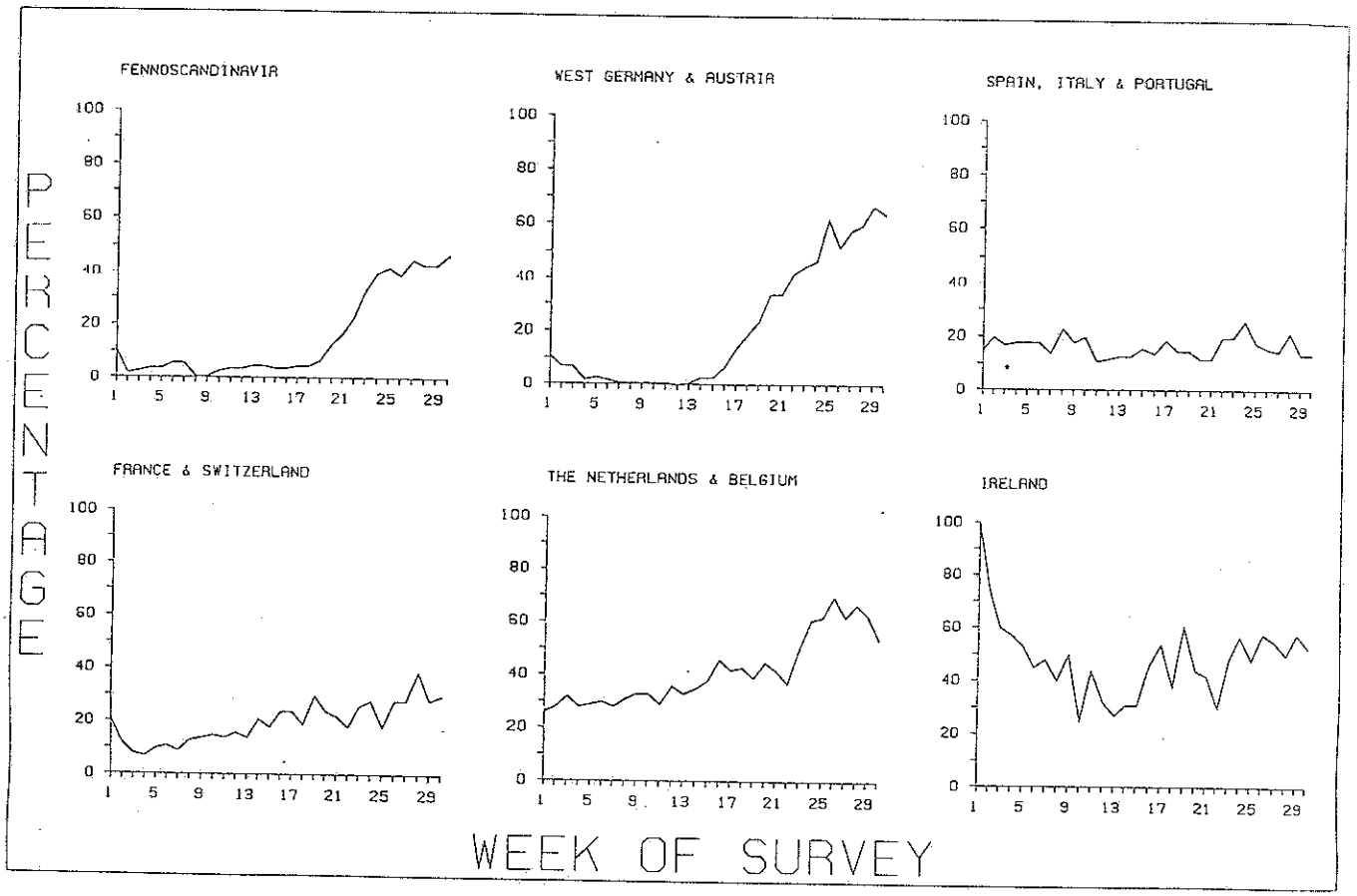


Fig. 2.24 Hooded/Carrion Crow



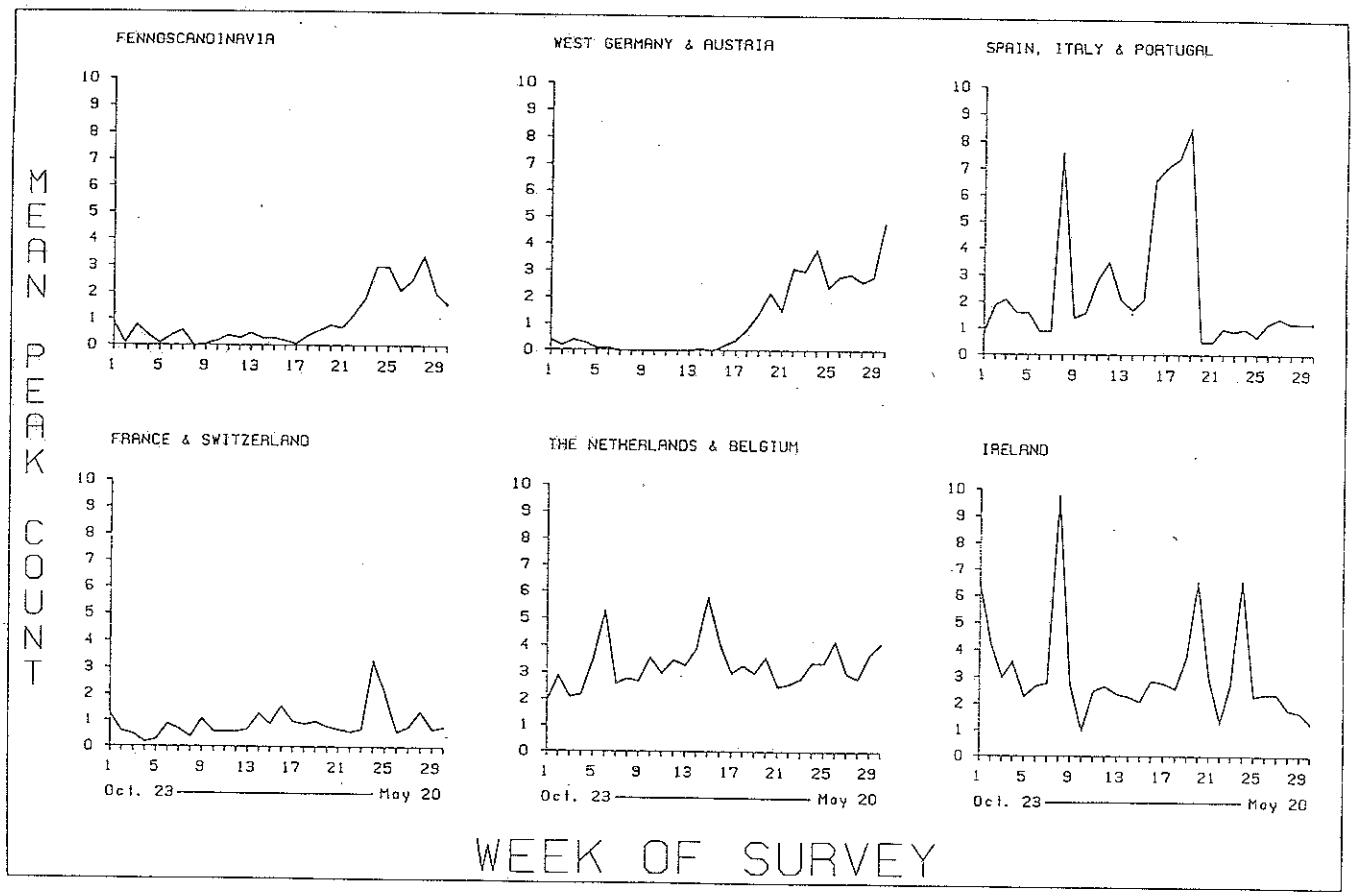
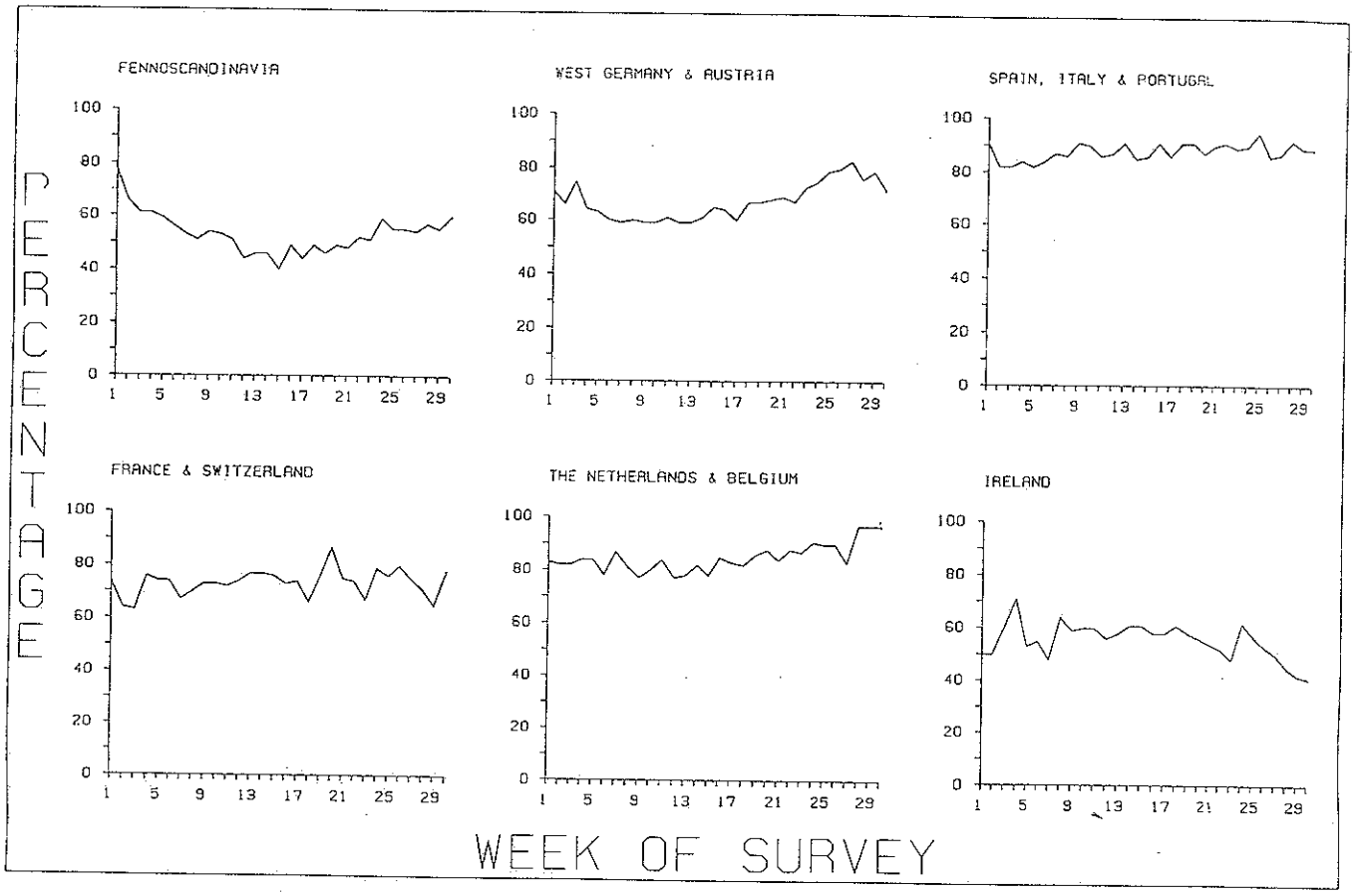


Fig. 2.25 Starling



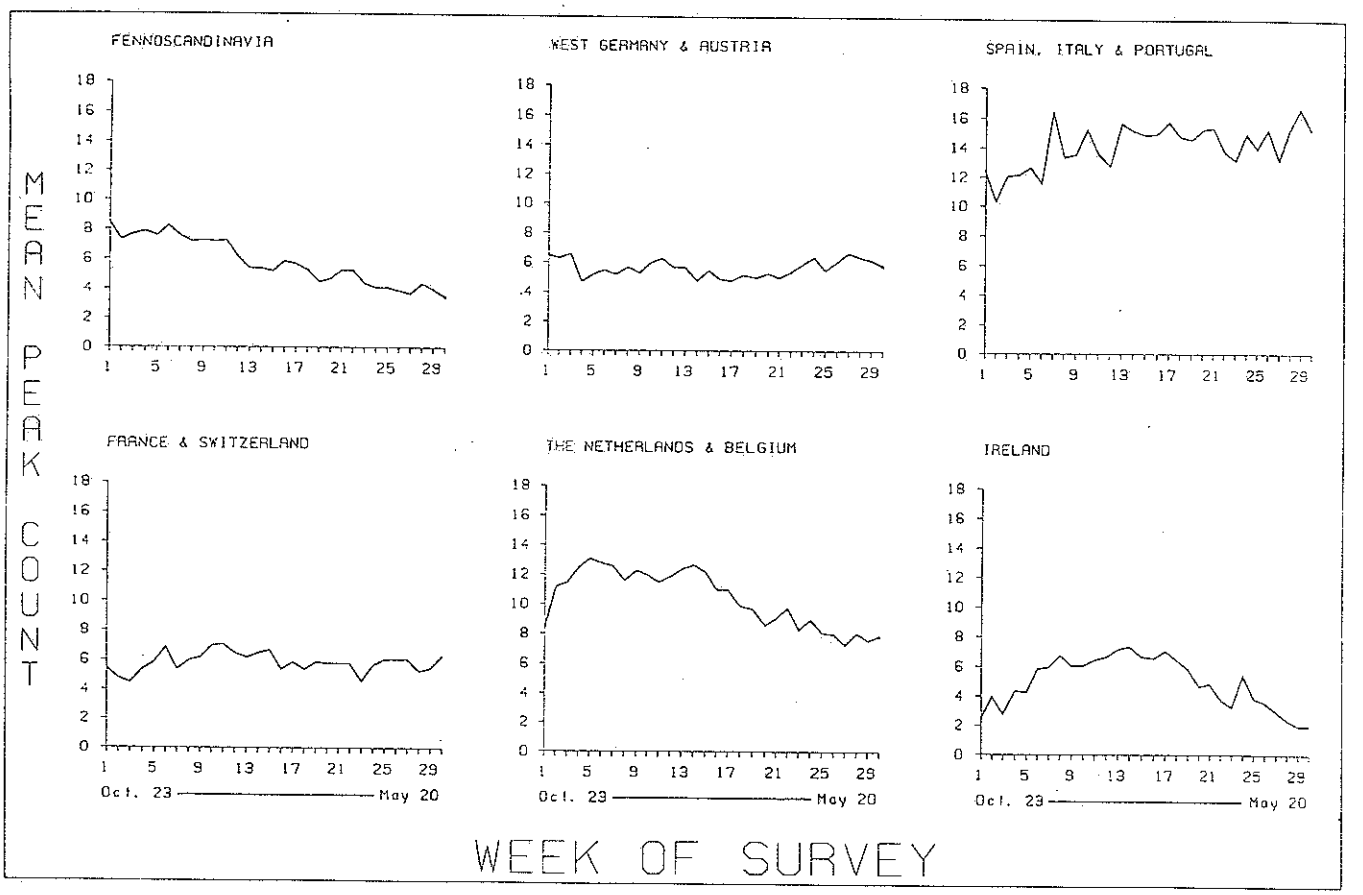
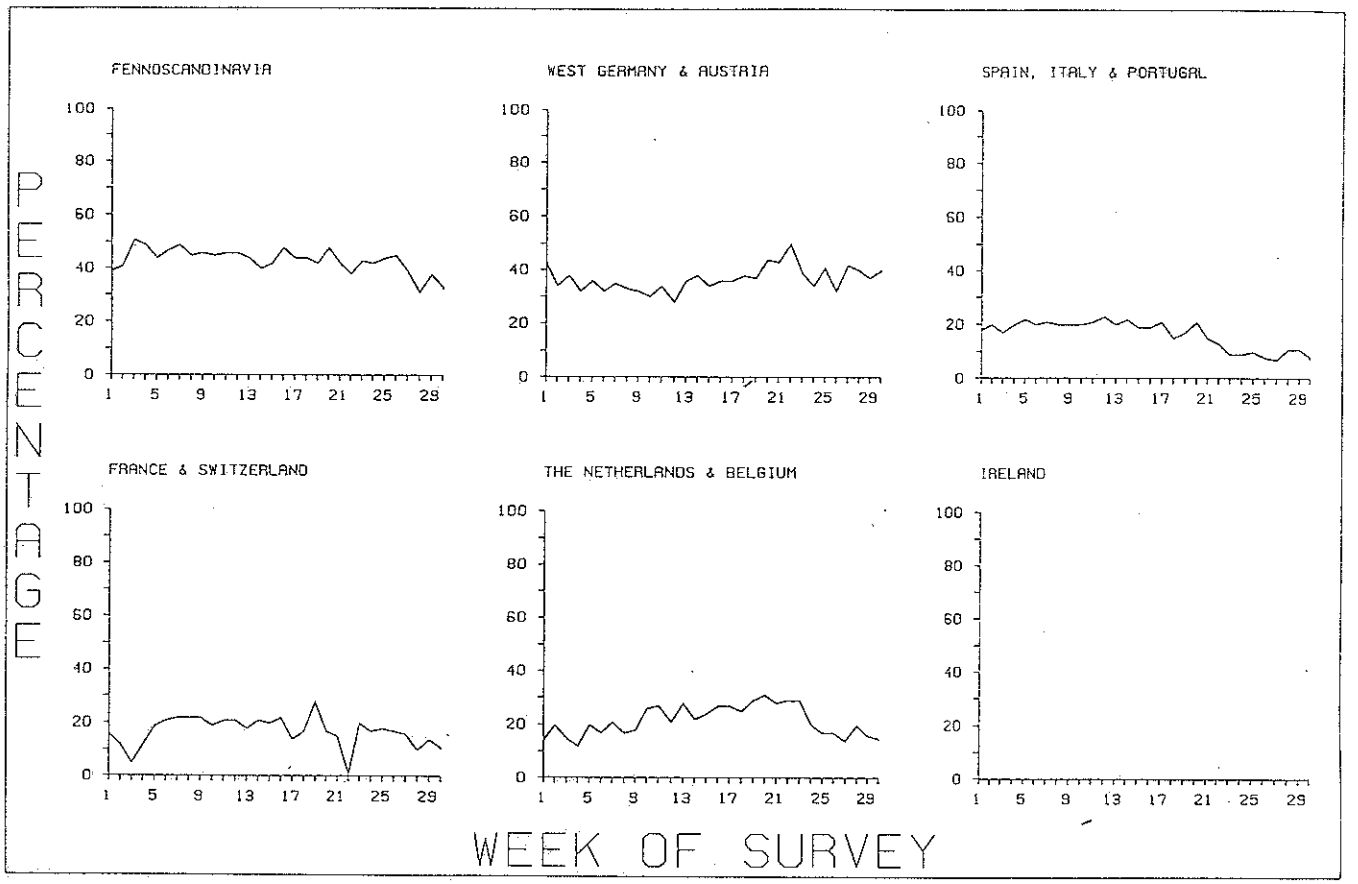


Fig. 2.26 House Sparrow



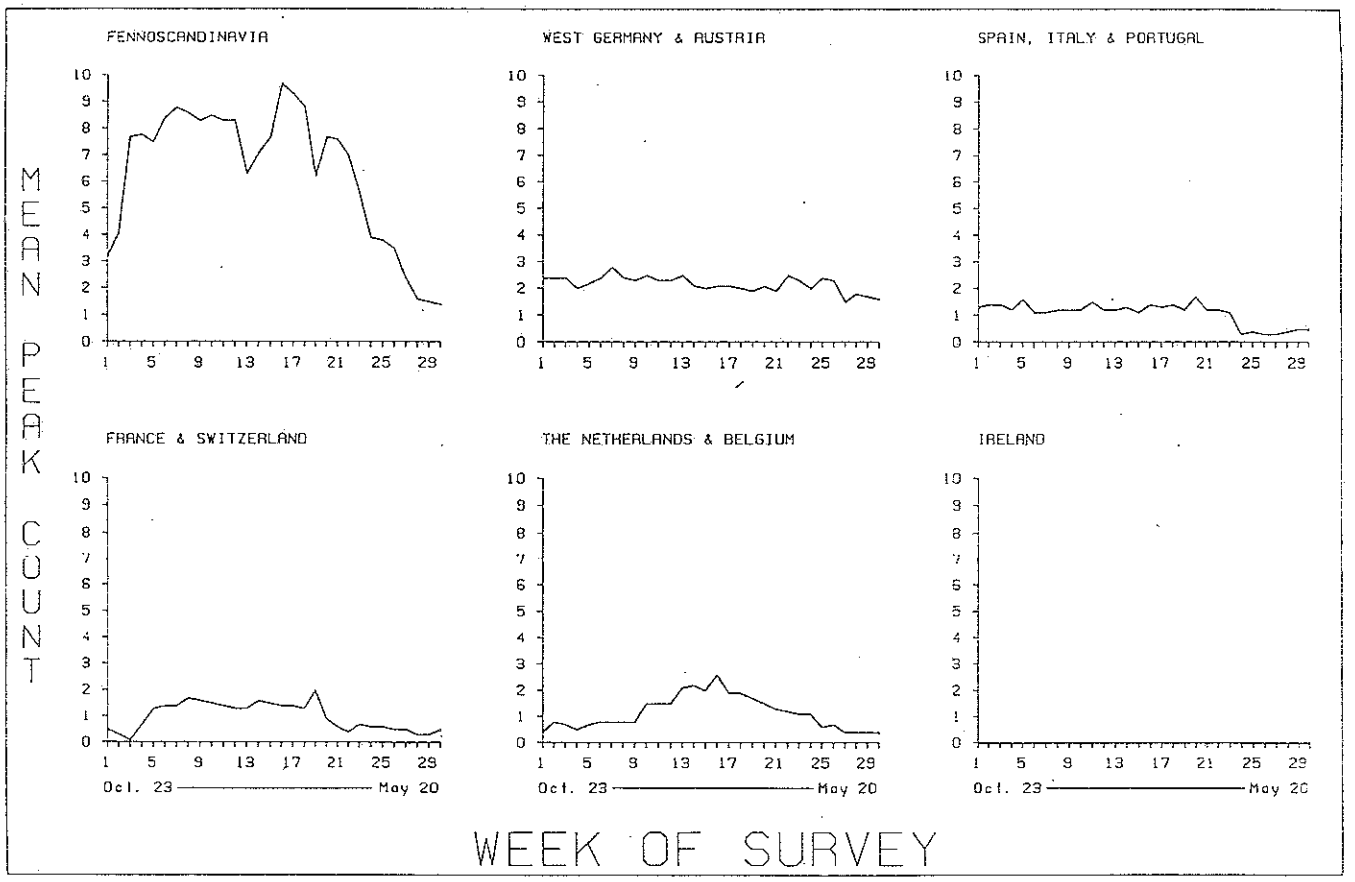
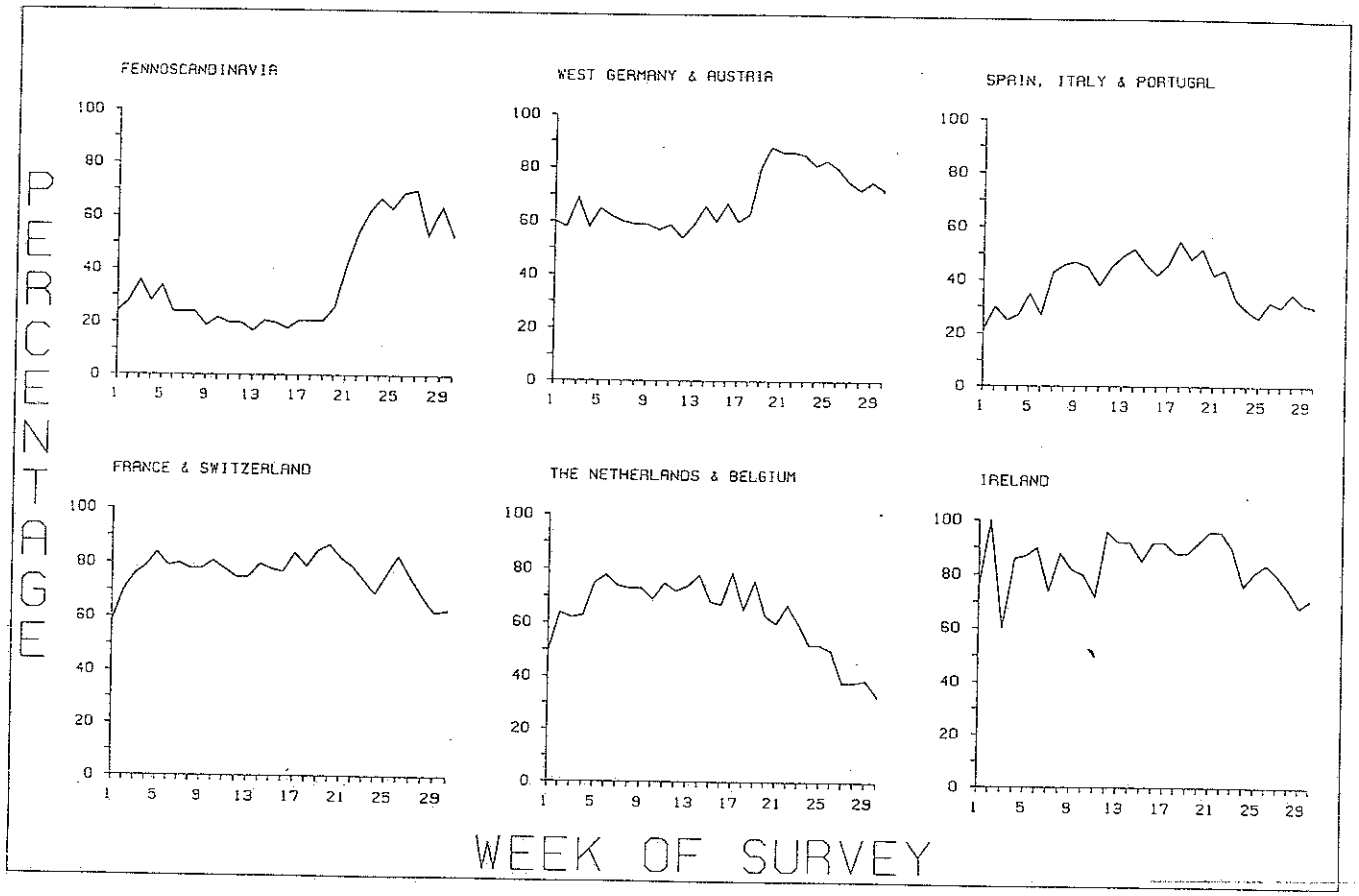


Fig. 2.27 Tree Sparrow



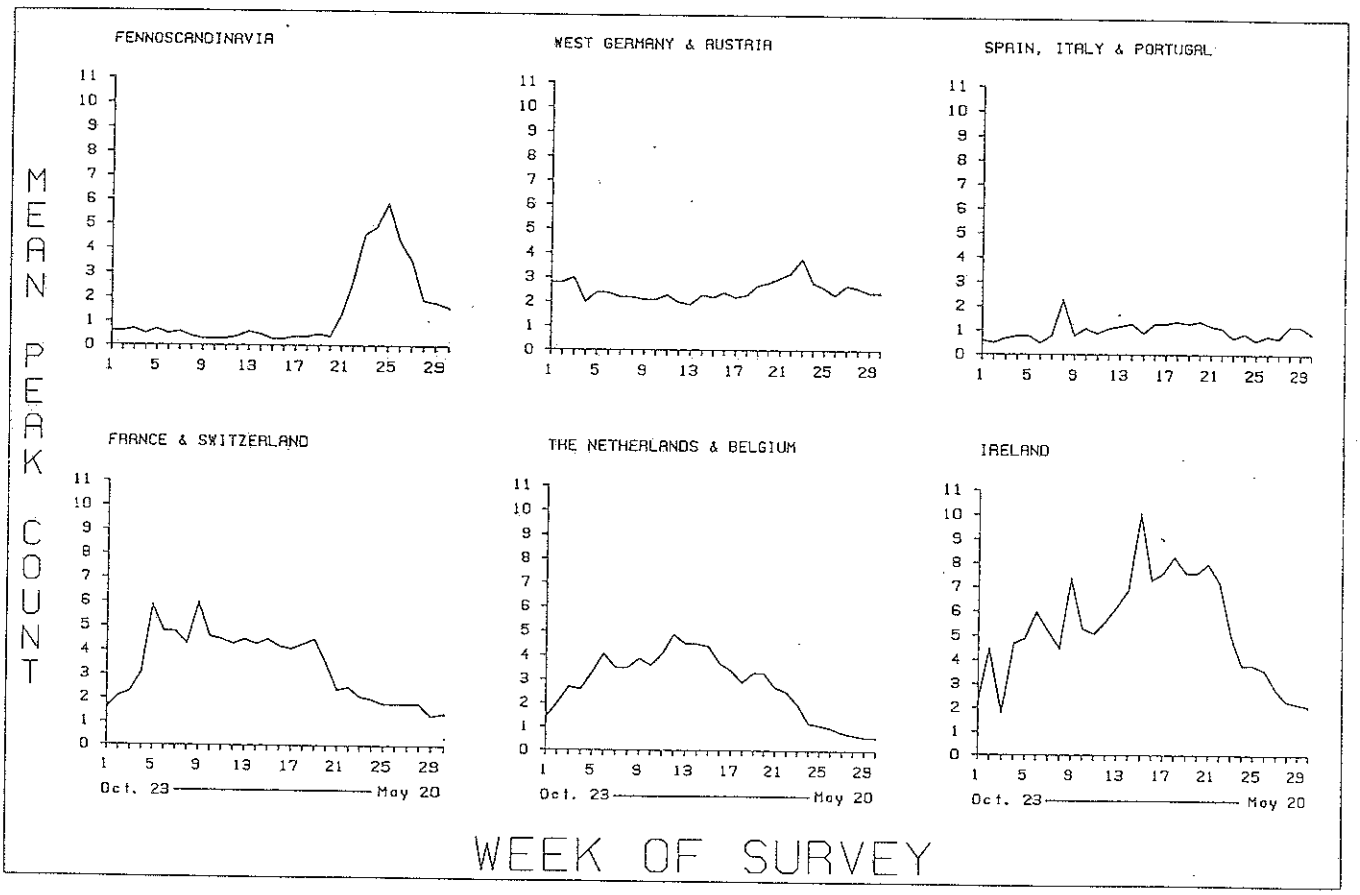


Fig. 2.28 Chaffinch

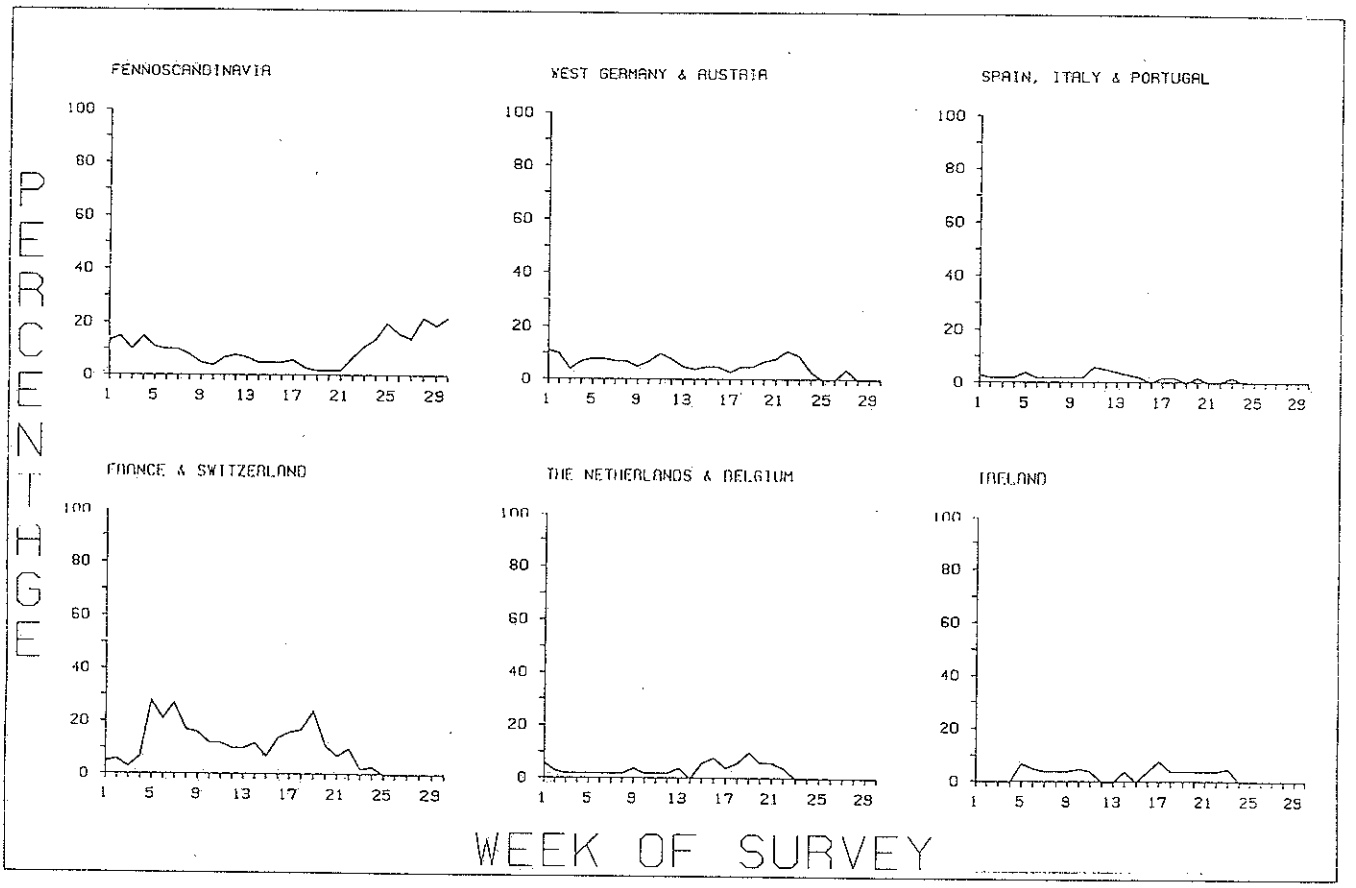


Fig. 2.29 Brambling

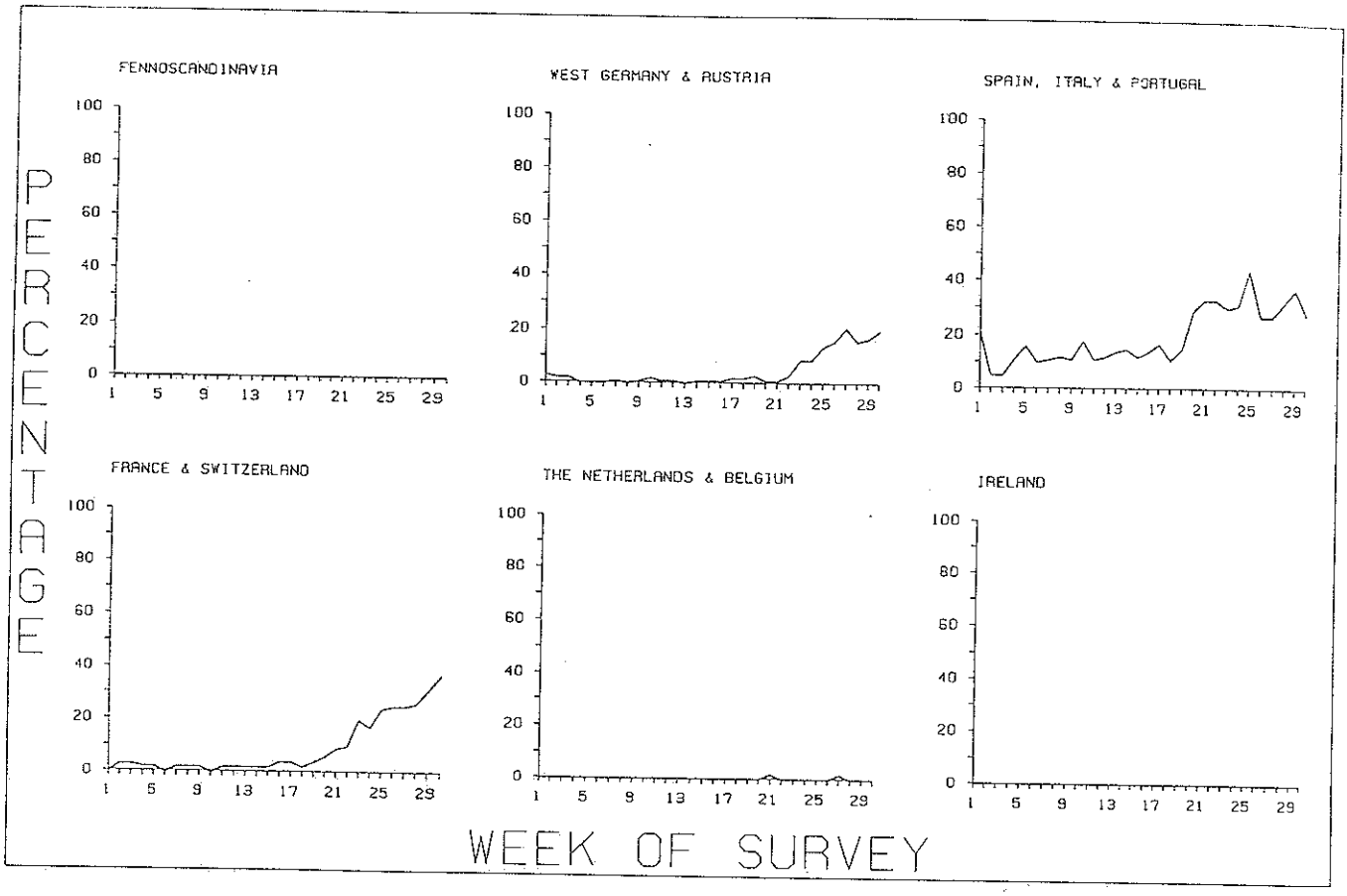
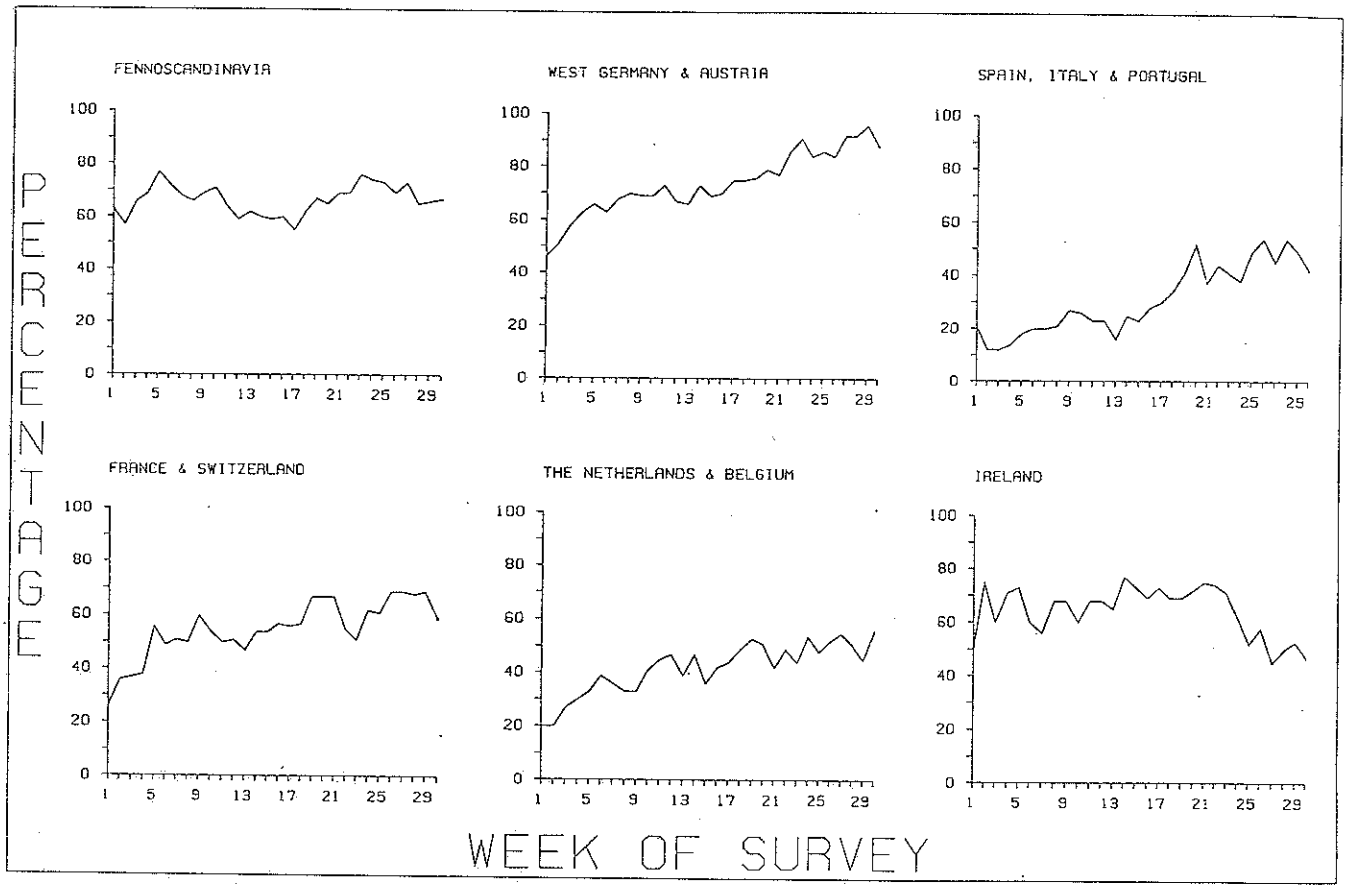


Fig. 2.30 Serin



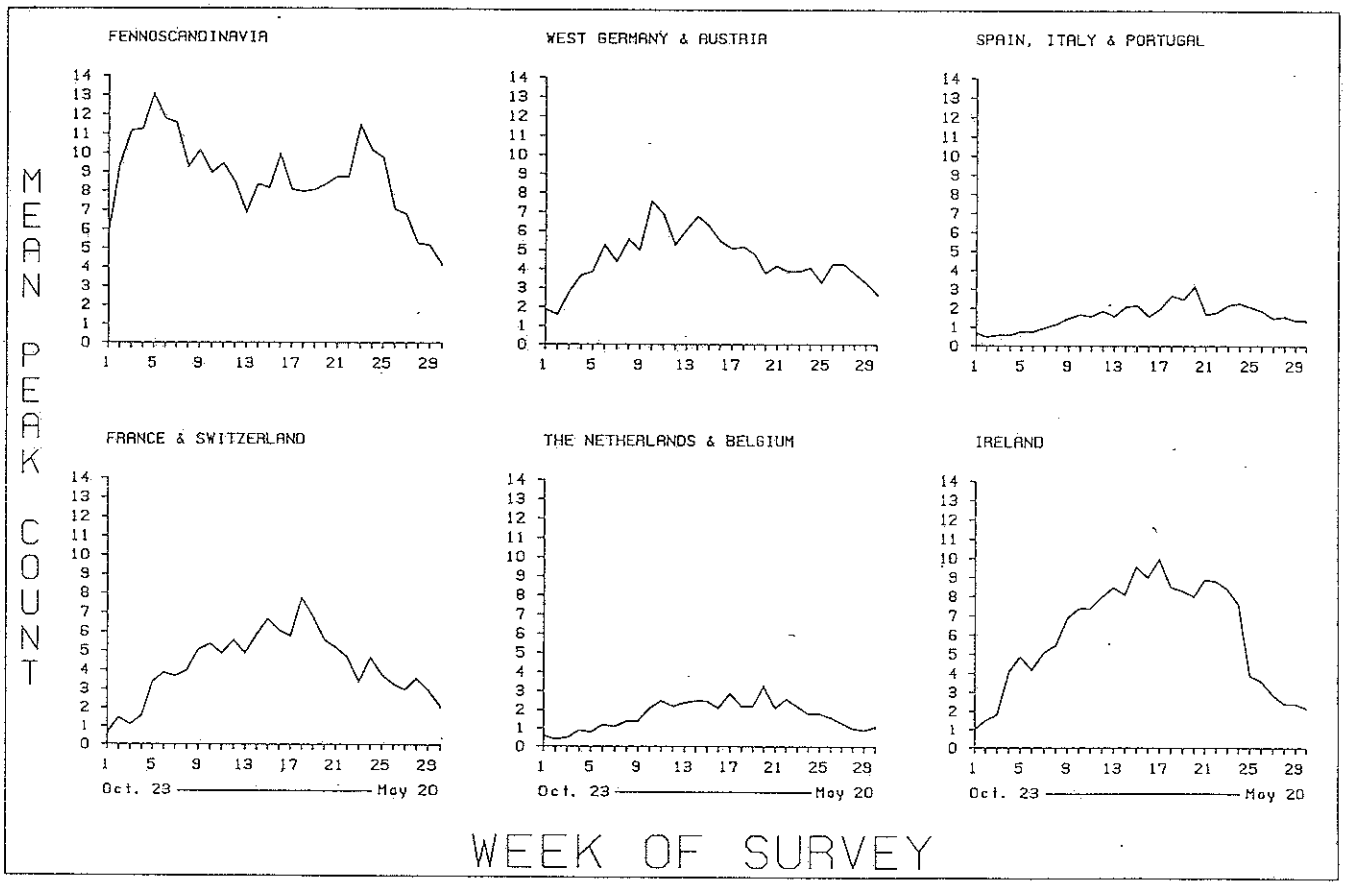


Fig. 2.31 Greenfinch

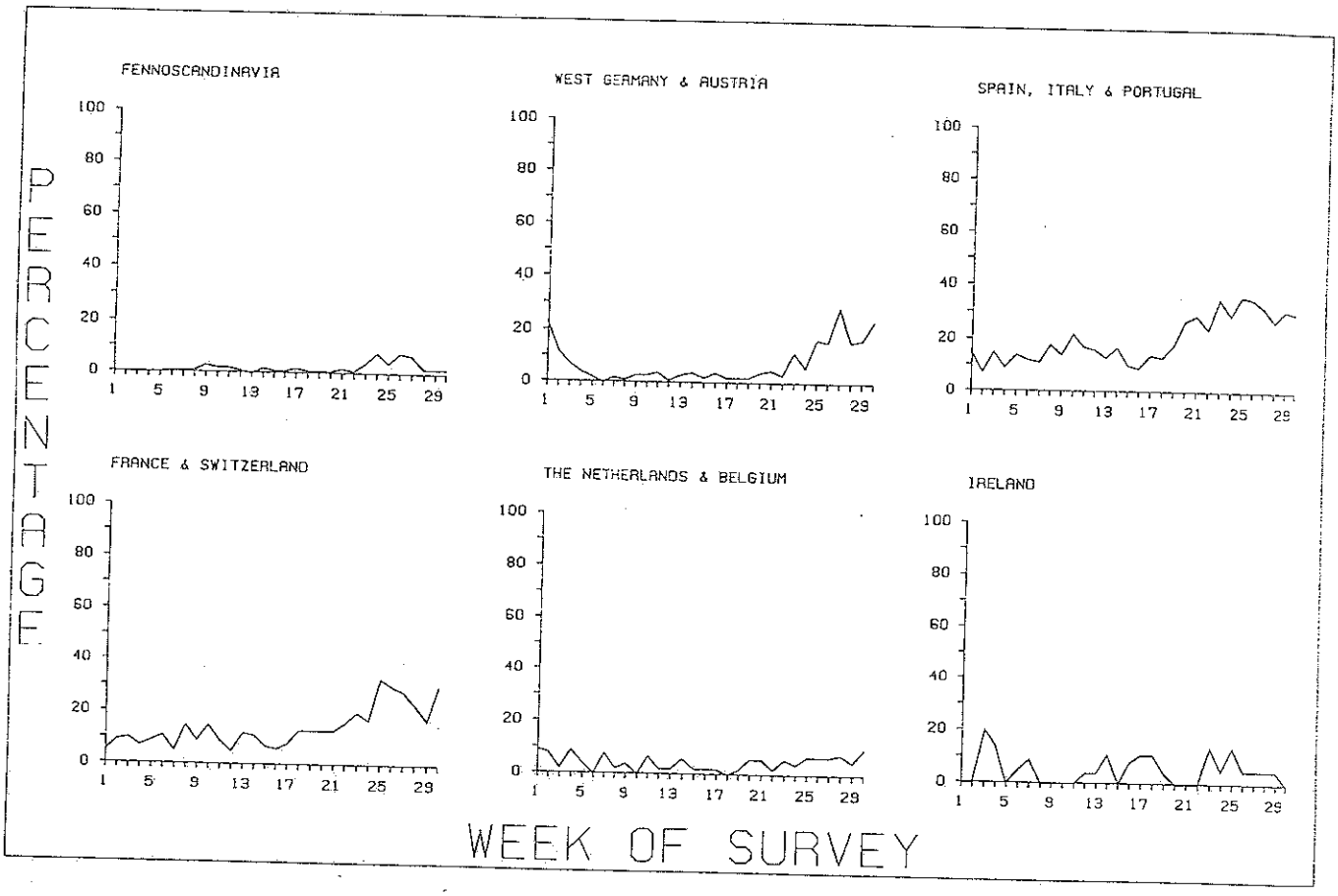
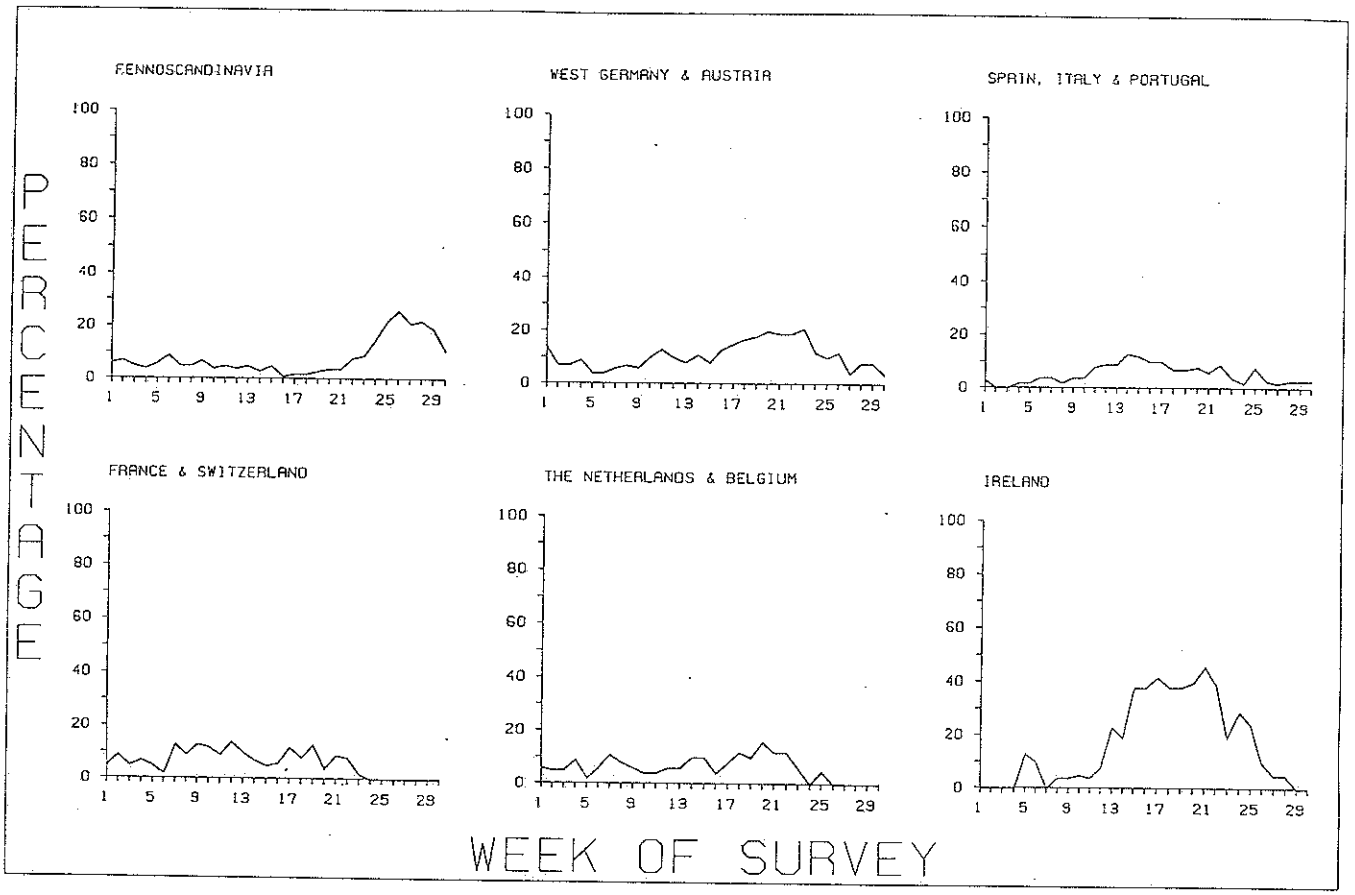


Fig. 2.32 Goldfinch



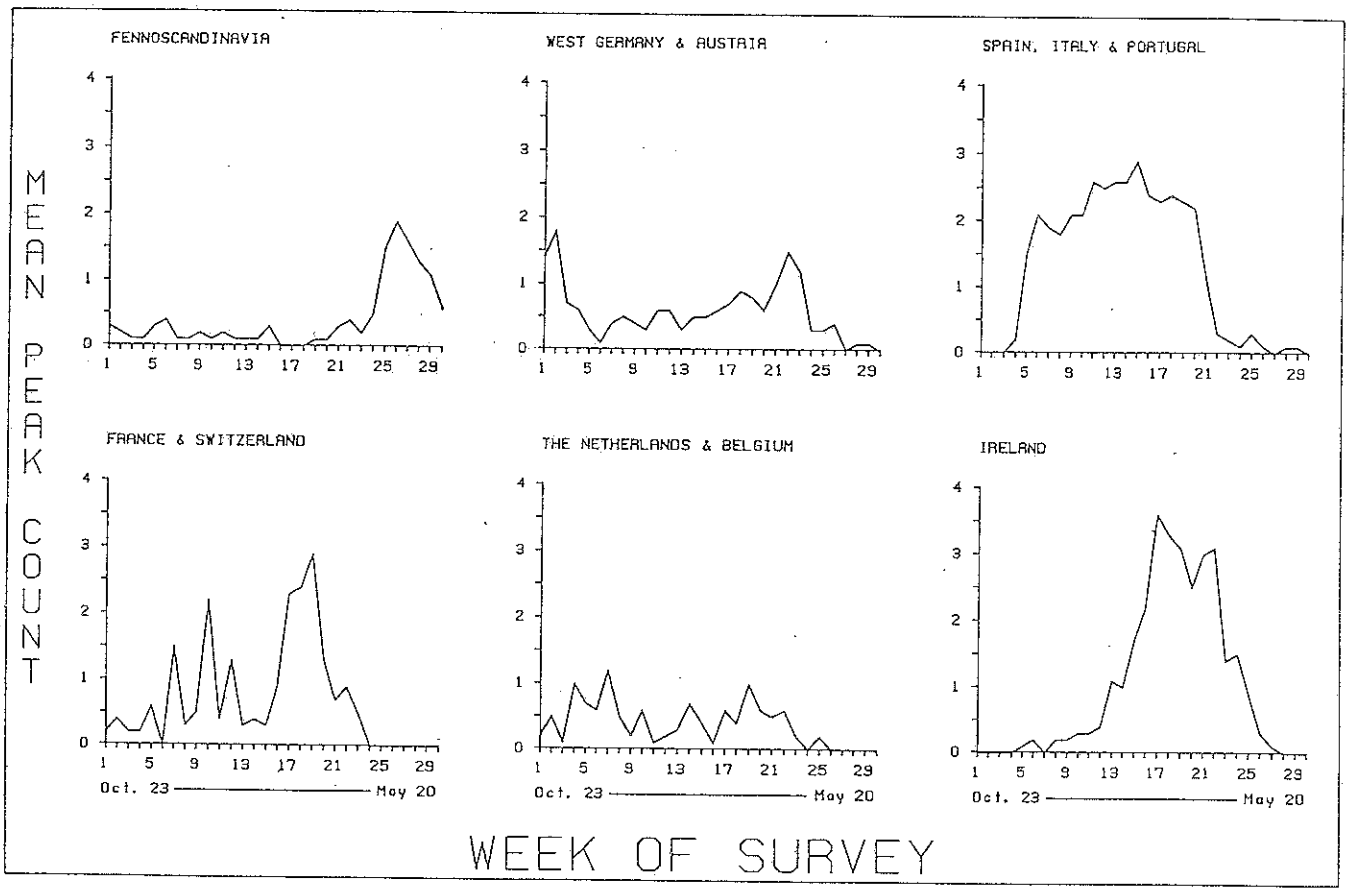
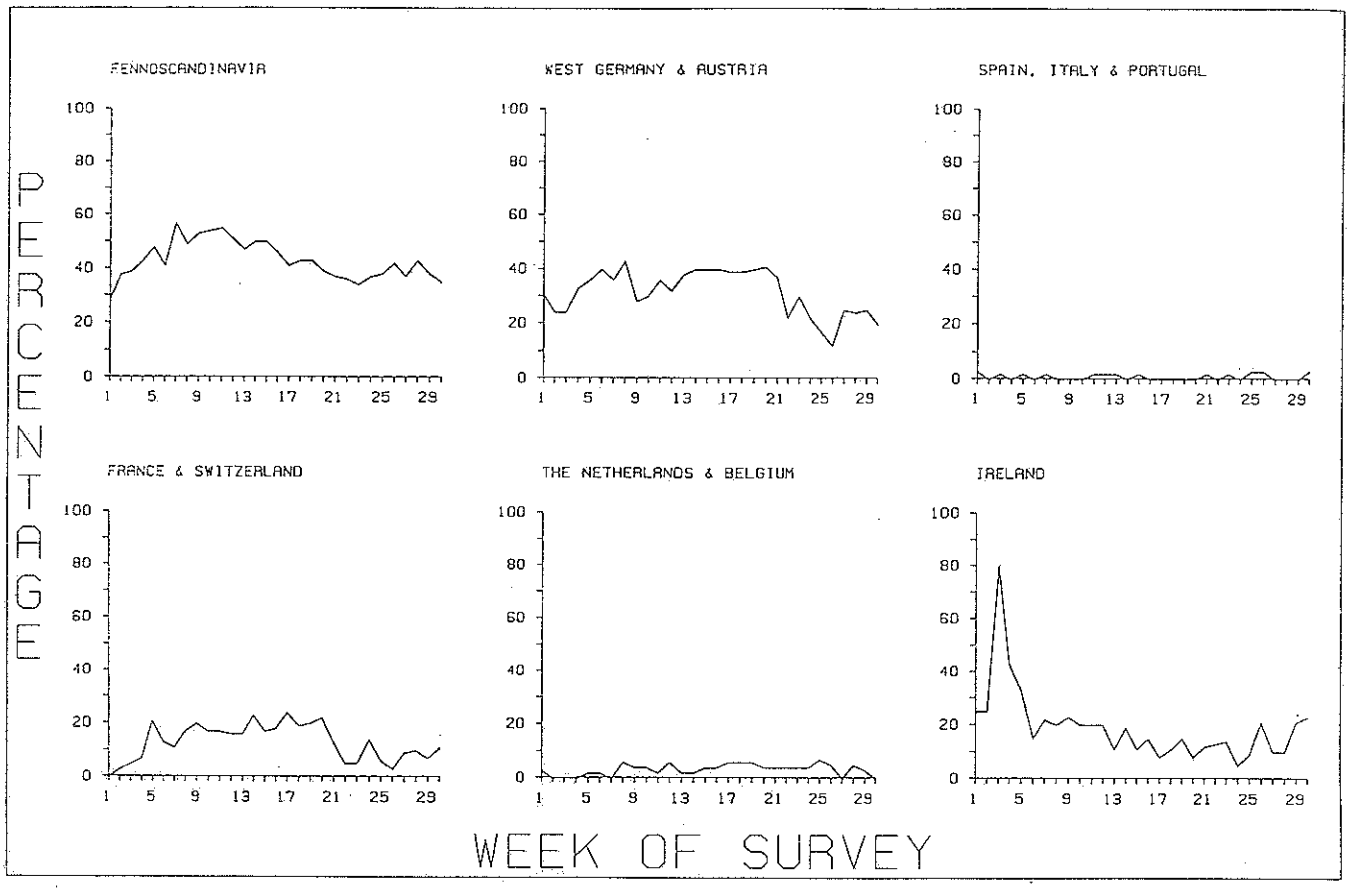


Fig. 2.33 Siskin



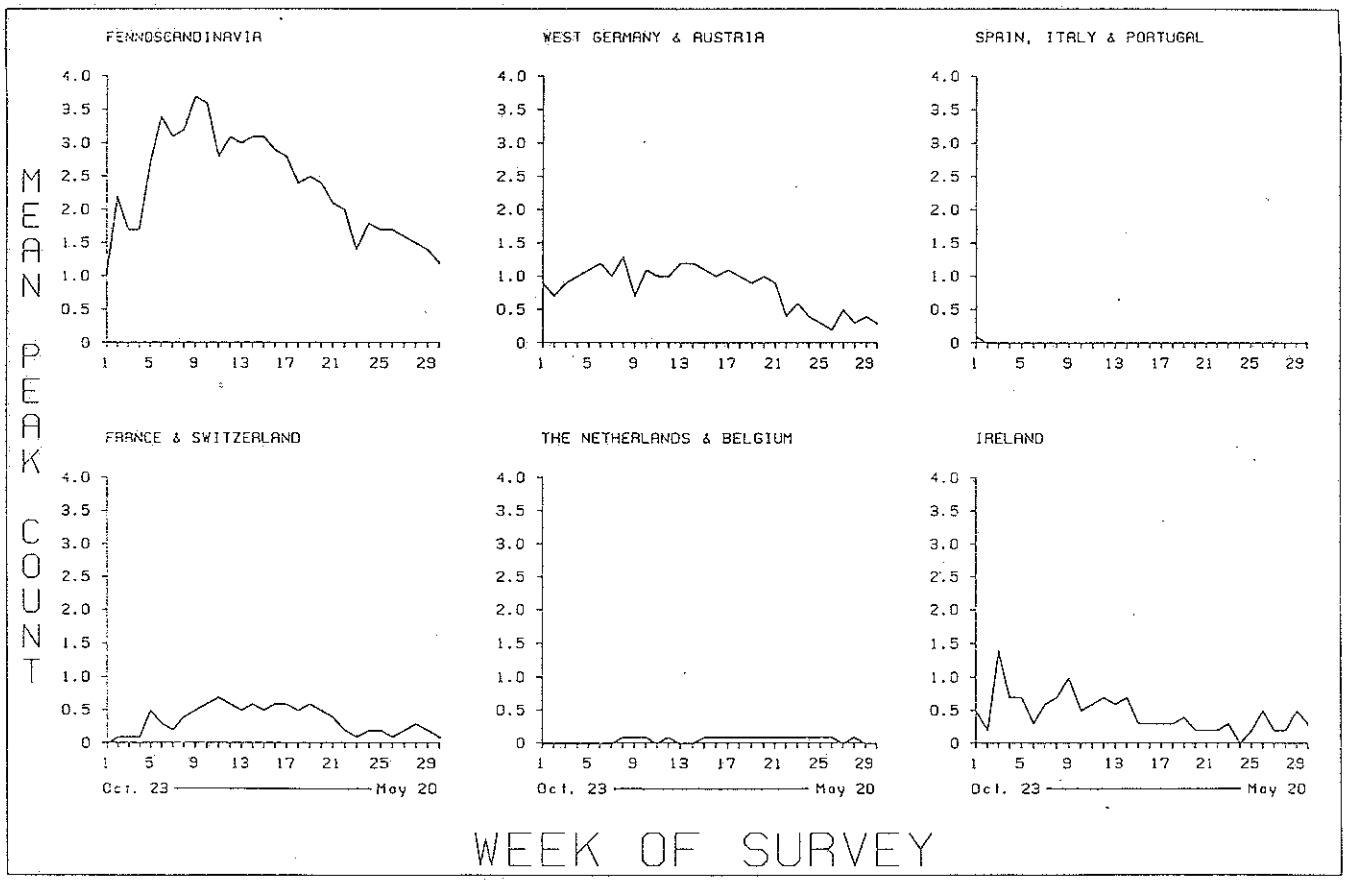


Fig. 2.34 Bullfinch

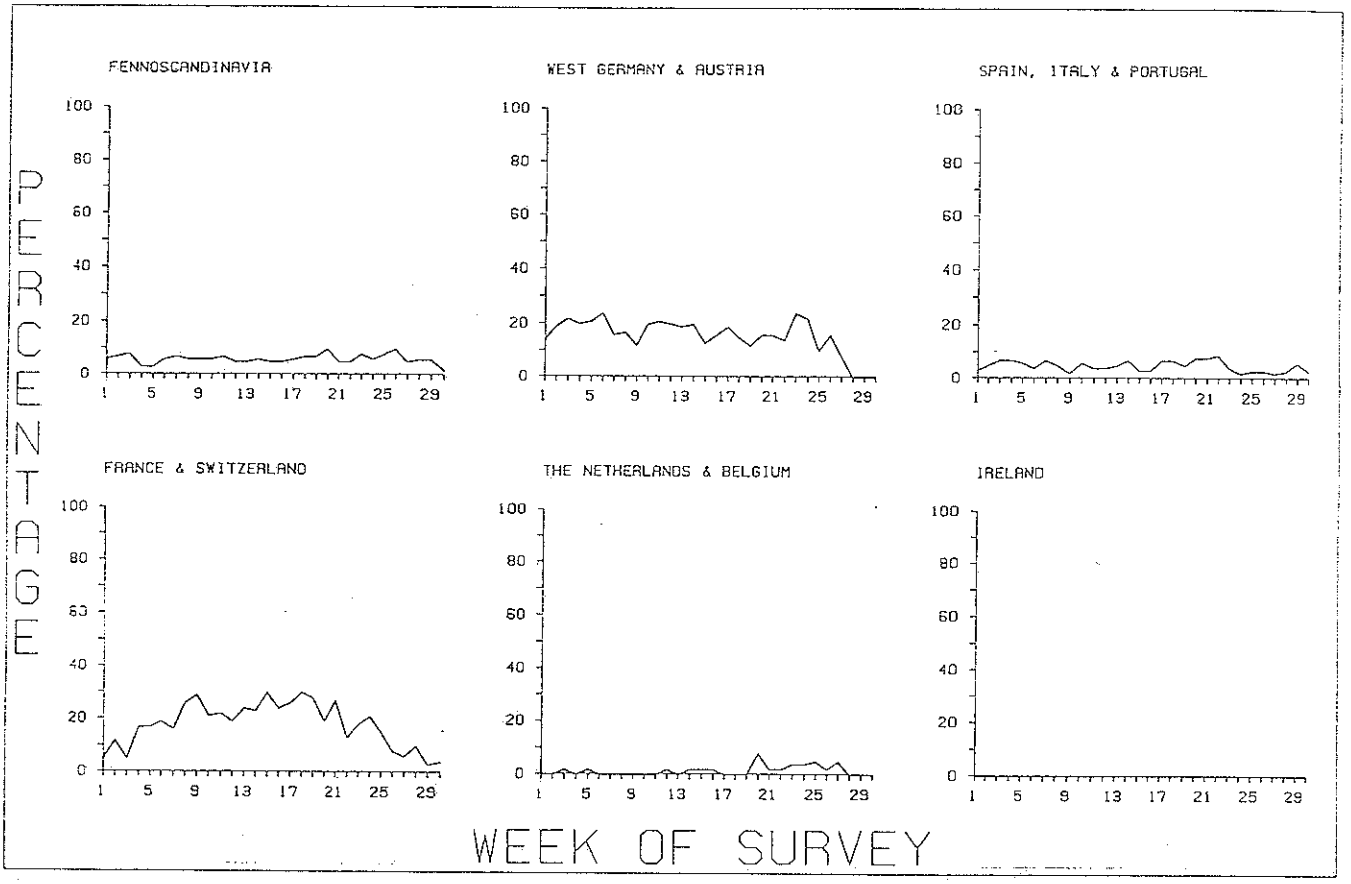


Fig. 2.35 Hawfinch

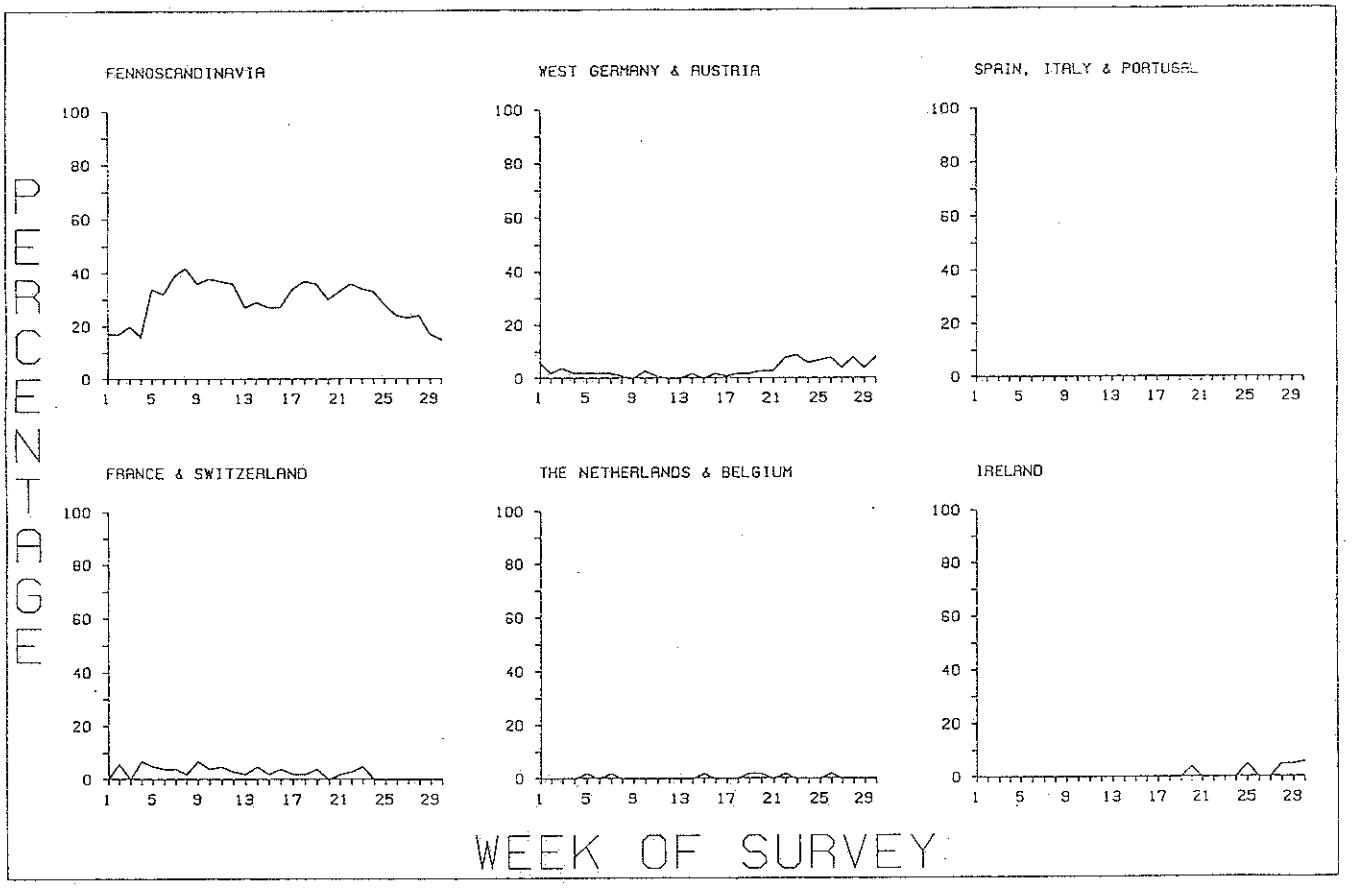


Fig. 2.36 Yellowhammer