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THE HUNTING OF SNIPE AND WOODCOCK IN EUROPE: A RINGING RECOVERY ANALYSIS

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SUMMARY

Regional, seasonal and temporal variation in hunting pressure experienced by European populations of Snipe (*Gallinago gallinago*) and Woodcock (*Scolopax rusticola*) was investigated by analysing ringing and recovery data submitted to the British Trust for Ornithology by 19 European ringing schemes. A total of 6,391 Snipe recoveries and 1,714 Woodcock recoveries were available for analysis. Recoveries were identified as being the result of hunting (shot or trapped) or non-hunting, and variation in the relative frequencies of these two categories was considered across regions, months and years. Because 85% of all Snipe recoveries and 94% of all Woodcock recoveries are reported as hunted, variation in recovery rates of hunted birds (i.e. the proportion of all ringed birds that were subsequently hunted and reported) is considered across regions and years, as an indirect measure of hunting pressure. No data were available for Woodcock ringed in France and for 87% of recoveries of Snipe ringed in France the cause of death was unknown.

For birds of known age, 59% of all hunted Snipe recoveries and 56% of all hunted Woodcock occurred within the first year of life. Eighty percent of all hunted Snipe recoveries were recovered between September and February inclusive whilst 74% of all hunted Woodcock recoveries were recovered between November and January. This marked seasonal variation in hunting pressure coincided closely with European hunting seasons. Autumn migrations of Snipe and Woodcock resulted in large concentrations of both species wintering in France, Britain and the Low Countries and, in the case of Snipe, Iberia.

The ringing recovery data suggest that hunting pressure on both Snipe and Woodcock is greatest in France. For both species the ratio of hunted to non-hunted recoveries was greatest for recoveries reported from France and lowest for recoveries reported from the United Kingdom and Ireland, and Fennoscandia. Although relatively large numbers of Woodcock are hunted in the United Kingdom and Ireland, the relatively low ratio of hunted to non-hunted recoveries suggests that the intensity of hunting may be lower than in other regions of Europe like France and the Low Countries. In the case of Snipe recovery rates of hunted birds were highest for birds ringed in central Europe and France (many of which will be birds of Fennoscandian origin) and lowest for birds ringed in the United Kingdom/Ireland and eastern Europe. Recovery rates for hunted Woodcock were highest for birds ringed in Fennoscandia and the United Kingdom/Ireland and lowest for birds ringed in Central and eastern Europe and the Low Countries.

Recovery rates of hunted Snipe and Woodcock have declined in most regions of Europe since the 1950s and 1960s, suggesting a general decline in hunting pressure. However, recovery rates of hunted birds have not declined for Snipe ringed in France and Finland (a high proportion of which will be shot in France). Recovery rates of hunted birds derived from all of the available European data have declined markedly since the early 1950s in the case of Snipe, and since the early 1960s in the case of Woodcock. For both species there is no evidence of any long-term trend in the recovery rates of non-hunted birds. Assuming that the reporting rates of hunted birds have not declined over the same period, these declines in hunting recovery rates suggest that hunting pressure on Snipe and Woodcock may have declined across Europe during the 1960s and 1970s.

1. INTRODUCTION

In many parts of Europe, Snipe (*Gallinago gallinago*) and Woodcock (*Scolopax rusticola*) are, for at least part of the year, legal quarry since both species are widely shot for sport (Bertelsen & Simonsen 1989).

Snipe breed throughout the northern half of Europe, from the low arctic to the temperate zone but their dependence on marginal wetland vegetation and saturated soils (Green 1988) means that they may be locally distributed within their breeding range (Cramp & Simmons 1983). The European Snipe population was estimated to be 500,000 breeding pairs during the mid 1980s (Piersma 1986), but in parts of Italy, for example, 80% of wetland habitat has been lost to drainage or development, and Snipe hunting figures have declined accordingly (Massoli-Novelli 1991). Population declines, although less dramatic, are also suspected to have occurred in most other regions of Europe (Bertelsen & Simonsen 1989, Marchant *et al.* 1990 although see O'Brien & Smith 1992), and thus it was desirable to investigate the possible compounding effects of hunting on current population trends.

For most of the year Woodcock frequent pasture and woodland with soft soils. They breed throughout the northern boreal zone and possibly have a more continuous distribution than Snipe, mainly due to increased afforestation (Cramp & Simmons 1983). The European population of Woodcock is currently thought to be stable or possibly increasing overall, despite probable regional declines (Marchant *et al.* 1990). During the mid 1980s the breeding population was estimated to be approximately 400,000 'pairs', of which 50% may breed in Finland (Piersma 1986).

Both species retreat from frozen regions in winter (Cramp & Simmons 1983), so that analyses of hunting pressure on breeding populations are complicated by redistribution following extensive seasonal migrations. Licensing policies in some countries have resulted in relatively accurate records being kept of "bag" returns (Bertelsen & Simonsen 1989), but the impact of hunting pressure on European birds can only be understood by linking regional variation in hunting pressure with the breeding origins of the hunted populations. One way of approaching this problem is to analyse variation in ringing recovery data. This approach was used by McCulloch *et al.* (1992) to investigate regional and temporal variation in hunting

pressure of selected passerine and raptorial species and lends itself well to analyses of recoveries from species with high ringing reporting rates. Snipe and Woodcock fall into this category, because, as legal quarry the probability of ringed birds being reported is greatly improved. Furthermore, there is little incentive for hunters to deliberately refrain from reporting ringed birds.

In this study we use European ringing and recovery data from the European Union for Bird Ringing (EURING) Databank to investigate regional, seasonal and temporal variation in hunting pressure on Snipe and Woodcock. We discuss this variation in relation to the breeding populations that are subject to hunting activities.

2. METHODS

2.1 Collection and management of ringing and recovery data

Ring recovery data and ringing totals were received from 19 European ringing schemes or via the European Union for Ringing (EURING) databank (Table 1a & b). Inaccurate and unreliable recovery data were excluded from analyses, including birds held in captivity for more than 24 hours, transported before being moved or moved before being found. For temporal analyses, recoveries were also excluded on the basis of inaccurate ringing or finding dates if the date was not known to within an accuracy of at least one year. For seasonal analyses, recoveries with either a ringing or finding date accuracy of less than 14 days were excluded. The criteria used to define birds 'hunted' followed McCulloch *et al.* (1992), and included EURING finding circumstance codes as follows (Anon 1969):

Code 10. Shot (not to protect food, or for plumage or to protect human life, air strikes or game species, or because it was marked).

Code 11. Found shot.

Code 19. Hunted (probably shot or possibly trapped by other means).

Code 20. Trapped, poisoned intentionally by man (not to protect food, or for plumage or to protect human life, air strikes or game species, or because it was marked).

Code 21. Trapped for caging and not released (removed from the population).

A 'non-hunted' category was devised for comparison with the regional and temporal variation in the frequency of hunted recoveries. Non-hunted birds were those found dead by means other than hunting. Birds for which no reason was given for their death were not included in this category since many of these individuals were likely to have been shot but not killed and captured at the time of hunting. Non-hunted birds included the following EURING finding circumstance categories (Anon 1979):

1. Birds accidentally killed by contact with human artifacts (such as: entanglement in fruit nets (finding circumstance code 33), collisions with motor vehicles, pylons etc. (codes 30-48) or by pollution (code 36-38).

2. Birds killed by animals (codes 60-69) or drowned (code 49).

Birds caught and released, by ringers ("controls") were excluded from the non-hunted category because they are not removed from the wild population. The actual finding circumstance codes and finding condition codes of all the available recoveries are presented in Table 2.

Some countries also submitted information regarding the onset and duration of hunting seasons, and these details are incorporated into the discussion.

2.2 Age at ringing and recovery

The age of Snipe and Woodcock at ringing was coded according to the NEW EURING age codes (Anon 1979) as follows:

Age 0.	Age unknown or not reported.
Age 1.	Ringed as pulli.
Age 2.	Not ringed as pulli but otherwise age unknown.
Age 3.	Juveniles: hatched in the same calendar year as ringed.
Age 4.	Hatched before the current calendar year, but exact year of hatching unknown.
Age 5.	Hatched in the calendar year before the year of ringing.
Age 6.	After the second year, but exact year of hatching unknown.

Recovery age included the period between the date of hatching and date of recovery, and was calculated for a sample of birds ringed with age codes 1, 3 and 5 for which specific years of hatching were known. Recovery age was estimated by assuming that the sample birds hatched on the 30 June of each year. Birds recovered between 30 June of the year of hatching and 365 days later were thus considered to have been in their first full year. Birds recovered between 366 and 730 days from their estimated date of hatching were recovered in their second full year, and so on. In practice, 86% Snipe and 75.1% of Woodcock that were ringed as pulli, were ringed between 1 May and 30 June (Fig. 1), and 98% of both species were ringed before the end of July (cf. Cramp and Simmons 1983). Thus, by using

30 June as the start of the ageing year, all birds recovered during the spring, autumn and winter seasons would assigned to consistent age categories.

2.3 The effect of introduced legislation

Maps were plotted with the locations of Snipe and Woodcock recoveries according to whether they were found before or after the implementation of the European Community Wild Bird Directive (1979) and the Bern Convention (1979), since protection of passerines and other quarry species might have deflected attention towards the remaining quarry species. Two maps were plotted for each species showing recoveries found before and after 1 January 1980.

2.4 The timing of migration and movements

Migration routes were identified by plotting maps of the locations of Snipe and Woodcock recoveries. Maps were generated in four-month periods of which two are presented (April-July inclusive, and December-March inclusive) to show the extremes of the seasonal variation in the distribution of recoveries for each region of ringed birds. This presentation was repeated for birds ringed as chicks in Britain and Fennoscandia respectively.

2.5 Regional variation in hunting pressure

Regional variation in hunting pressure was considered in two ways. First, regional comparisons were made of the proportions of hunted and non-hunted Snipe and Woodcock recoveries. The two distributions were tested for statistical differences using chi-squared contingency tests. Because the vast majority of recoveries of both species were reported as hunted (Table 2), we also considered the number of hunted recoveries as a proportion of the total number of birds ringed for each region (ie. the recovery rate of hunted birds). The first approach gives an indication of regional variation of hunting pressure within Europe, whilst the second approach is used to assess regional variation in the hunting pressure experienced by different breeding populations within Europe.

For analytical purposes, seven geographical regions were selected to cover the British Isles, Low countries, east, west, north, south and central Continental Europe. The regions were grouped and defined as follows including EURING country codes:

1. Britain: United Kingdom (GBT) and Ireland (ERL).
2. Eastern Europe: Czechoslovakia (CSP), Estonia (SUE), Hungary (HGB), Lithuania (SUK) and Poland (PLG).
3. Fennoscandia: Finland (SFH), Norway (NOS) and Sweden (SVS).
4. France: France (FRP) and the Channel Islands (CIJ).
5. German group: Denmark (DKK/DKC), Germany (DDH/DFR/DFH) and Switzerland (HES).
6. Low countries: Belgium (BLB) and Netherlands (NLA).
7. Mediterranean: Italy (IAL) and Iberia (ESM/POR).

Not all these component countries were necessarily included in all analyses (see figure legends) because for some countries the data were incomplete, particularly the ringing totals. (see Table 1). Time periods for which both the ringing and recovery data were considered to be complete are presented in Table 3 and only these data were used in the analyses of regional and temporal variation in the recovery rates of hunted birds.

Tables were also constructed to show the proportional distribution of recoveries of (a) all birds ringed and (b) birds ringed as pulli, according to the region in which they were ringed. Juveniles (EURING age code 3) ringed in Fennoscandia were considered to have been reared in that region since the majority were unlikely to have come from elsewhere (Cramp & Simmons 1983). Fennoscandia juveniles and pulli were therefore pooled.

2.6 Seasonal variation in hunting pressure

To investigate seasonal variation in hunting pressure, we considered monthly variation in the proportion of hunted and non-hunted recoveries. Only recoveries for which the finding date was known to within 14 days were included in these seasonal analyses.

2.7 Long-term temporal trends in hunting pressure

Long-term temporal trends in hunting pressure were investigated by calculating the reporting rate for successive five-year periods between 1950 and 1989, plus an additional period including all birds ringed and recovered before 1950. This analysis was carried out for six geographical regions in the case of Snipe, and four regions in the case of Woodcock. In order to minimise the inclusion of birds that were ringed and recovered in different five-year periods, all recoveries for which at least three years had elapsed between ringing and recovery were excluded from the analyses. Most Snipe and Woodcock are recovered within three years of being ringed (Fig. 2).

3. RESULTS

3.1 Ringing and recovery totals

Between 1909 and 1992 over 95,000 Snipe and over 15,000 Woodcock were ringed in Europe and details of 6,391 Snipe and 1,714 Woodcock recoveries were received from 19 countries (Table 1). From those countries which submitted comprehensive ringing and recovery data, the average recovery rate was 6.7% for Snipe (range 3.1% to 16.2%) and 11.3% for Woodcock (range 2.6% to 57.1%) (Table 3).

3.2 Cause of death

Ninety-six percent of all Snipe recoveries and 95% of all Woodcock recoveries with known finding circumstance codes were hunted, mostly shot (Table 2). Twelve percent of Snipe and 1.7% of Woodcock recoveries were excluded from further analyses because of nonspecific finding circumstances (Table 2). However, the finding circumstances of most (87%) French Snipe recoveries were recorded as unknown. Since in all other regions hunting was the major cause of death, and in France 87% of stated finding circumstances involved hunting, for the purposes of this study we assumed that all non-specified French recoveries were hunted.

3.3 Age at ringing and recovery

3.3.1 Ringing totals

A high proportion of Snipe and Woodcock were recorded as being of unknown age at the time of ringing. Otherwise, the majority of full grown birds of both species were ringed in the year of hatching (EURING age code 3) (Table 4). Pulli represented 5.6% of all Snipe ringed, although Britain, Holland and Finland were responsible for 92% of this age group (Table 1). At least 40% of all Woodcock were ringed in the nest (Table 4). Many ringing schemes did not split ringing totals by age in their early years of operation (especially pre 1960s) so that the exact number of pulli and full grown birds ringed were not known in every case and in these circumstances minimum values are presented (Table 1).

3.3.2 Recovery totals

The age distributions of hunted and non-hunted Snipe recoveries of birds of known age were not significantly different ($\chi 2=2.1$, df=3, ns; Fig. 2), but a higher proportion of Snipe in their first year of life were recovered as a result of hunting since 59% of hunted and 50% of non-hunted Snipe ringed as nestlings or as juveniles were recovered within 366 days of their estimated date of hatching (Fig. 2). There was no significant difference between the two Woodcock recovery age distributions ($\chi 2=1.35$, df=3, ns; Fig. 2). Fifty-six percent of hunted recoveries were of birds killed within their first full year, and this compares to around 52% of non-hunted recoveries also killed in their first full year.

3.4 Seasonal variation in hunting pressure

The majority of hunted (80.2%) and non-hunted (73.5%) Snipe were recovered between September and February inclusive (Fig. 3). Only 6% of hunted Snipe were shot during peak spring migration (March/April) and there was a highly significant difference in the seasonal distributions of hunted to non-hunted Snipe recoveries ($\chi 2=360.3$, df=11, $p<0.0001$). The percentage of non-hunted Snipe recoveries reported in summer (May to August inclusive) was three times that for hunted Snipe (22.3% cf 7.2%; Fig. 3). This marked seasonal pattern in hunted recoveries also coincided with the onset of most hunting seasons (Table 5).

Most (74.1%) of the hunted Woodcock recoveries were recovered between November and January inclusive (Fig. 3). The distributions of hunted and non-hunted Woodcock were highly significantly different from each other (Kolmogorov-Smirnov: D=0.917, df=2, $p<0.025$, n=12) with a higher proportion of non-hunted Woodcock (22.7%) being recovered during spring and summer (March to August inclusive; Fig. 3). The pronounced seasonal variation in the hunting of ringed Woodcock corresponds with the timing of shooting seasons within Europe, some of which continue into February although most end by 31 January (Table 5).

3.5 The effect of introduced legislation

Only 3.9% of both Snipe (945/24263) ringed after 1 January 1980 were recovered compared to 6.3% (3693/58562) of Snipe ringed before 1980 ($\chi 2$ = 188, df=1, $p<0.0001$), fewer apparently being hunted in the Iberian peninsula (Fig. 4a). For Woodcock, the proportions of ringed birds recovered were similar but significantly different before (9.4%: 1123/11916) and after (10.6%: 390/3668) 1 January 1980 ($\chi 2$ = 12.2, df=1, $p<0.01$; Fig. 4b).

3.6 Movements and migration

Snipe tended to be recovered either southwest of their point of ringing in winter or northeast of their point of ringing in summer (Fig. 5a-e). This pattern was repeated for Snipe ringed in all six regions, and resulted in high numbers of birds being recovered in France, Iberia, Britain and the Low Countries in winter (Fig. 5). Extensive southwesterly autumn movements of Woodcock occurred across Europe in all regions except Britain (Fig. 6a-e). Woodcock from eastern European countries were recovered predominantly in Mediterranean regions, France, Iberia and Italy (Fig. 6b). British ringed Snipe and Woodcock that moved to the continent tended to be recovered in Scandinavia in summer and France in winter but most recoveries of both species occurred within Britain (Fig. 5 and 6 a-b). This was also true of British-hatched Snipe and Woodcock (Fig. 7a and 8a). The breeding populations of Snipe and Woodcock of Finland and Norway and Sweden were largely recovered in France and Britain (Fig. 7b and 8b).

3.7 Regional variation in hunting

Almost a half of all hunted Snipe and almost a third of all hunted Woodcock recoveries were reported from France (Table 6). Britain accounted for 42% of all Woodcock recoveries but only 6.0% of Snipe recoveries. Fifty-four percent of Snipe hatched in Finland, Norway or Sweden, and 82.9% of Snipe hatched in Germany, Denmark or Switzerland, were hunted in France, Britain or Iberia (Table 6). The Low Countries hunted large numbers of Snipe (12.7%) and central Europe (Denmark, Germany and Switzerland) was responsible for almost 11% of Woodcock. The majority of British-hatched Snipe (93.5%) and Woodcock (96.1%) were hunted within Britain (Table 6). The Iberian peninsula was less important as a region

for hunted Woodcock than it was for Snipe because less than a quarter of the percentage of Woodcock than Snipe, were hunted there (Table 6).

The regional distributions of non-hunted and hunted Snipe recoveries were highly significantly different ($\chi 2=428.5$, df=5, $p<0.0001$; Fig. 9). Sixty-eight percent of all hunted Snipe recoveries were reported from the French/Mediterranean region, whilst only 15% of all non-hunted recoveries were reported from the same region (Fig. 9). Britain, the Low Countries and central Europe accounted for 20%, 10% and 6% of all hunted Snipe respectively, which was lower than their respective contributions to non-hunted recoveries (Fig. 9).

The proportion of ringed Snipe that were subsequently hunted was highest for birds ringed in the central European and France/Mediterranean regions and was lowest for birds ringed in Britain and eastern Europe (Fig. 10). The proportion of ringed Snipe subsequently hunted varied significantly between regions ($\chi 2=480.1$, df=5, $p<0.0001$; Fig. 10).

The regional distributions of hunted and non-hunted Woodcock also differed significantly ($\chi 2=37.1$, df=5, $p<0.01$; Fig. 9). The ratio of hunted to non-hunted recoveries was highest in the France/Mediterranean region, the Low Countries and central Europe (Denmark and Germany) and lowest in Britain and Fennoscandia (Fig. 9).

The proportion of ringed Woodcock that were subsequently hunted was highest for birds ringed in Fennoscandia and the British Isles and Ireland, and lowest for birds ringed in the Low Countries, eastern Europe and central Europe (Denmark and Germany). The proportion of ringed Woodcock subsequently hunted varied significantly between regions ($\chi 2=125.6$, df=4, $p<0.0001$; Fig. 10). French Woodcock data were not available for inclusion in the study.

3.8 Temporal variation in hunting pressure

Long-term temporal changes in the percentage of ringed Snipe hunted within three years of being ringed are presented in Fig. 11. Consistent declines in the percentage of ringed Snipe hunted occurred in all regions of Europe since the early 1960s, though the trend was less

clear for birds ringed in France. Similar declines in the percentage of ringed Woodcock subsequently hunted are apparent for birds ringed in Britain and Ireland and the Low Countries (Fig. 12). The percentage of German and Danish ringed Woodcock subsequently hunted declined only in the early 1980s, whilst the percentage of Fennoscandian ringed Woodcock subsequently hunted has remained stable at approximately 7-9% since the early 1960s (Fig. 12).

Progressive declines in the percentage of hunted recoveries were also a feature of Snipe ringed as chicks in Britain since the 1950s, but not for Snipe ringed as pulli in Finland which may have experienced an increase in hunting pressure in recent years (Fig. 13). Note that most Finnish-ringed Snipe are hunted in France (Table 6a). The percentage of Woodcock ringed as chicks in Britain and Fennoscandia and subsequently hunted, has declined markedly since the late 1960s (Fig. 13).

Temporal trends in the relative frequencies of hunted and non-hunted recoveries for all the European Snipe and Woodcock recovery data combined are presented in Fig. 14. For both species there is evidence of a declining reporting rate for both hunted and non-hunted recoveries starting in the mid 1950s for Snipe, and starting in the early 1960s for Woodcock (Fig. 14).

4. DISCUSSION

As legal quarry in most parts of Europe, Snipe and Woodcock have high reporting rates (6.7% and 11.3% respectively) compared to many other species (Baillie *et al.* in prep) and over 90% of recoveries of both species were hunted. As a consequence, by using large ringing data sets, it was possible to make comparisons of hunting pressure across regions and over time. Both the regional and temporal analyses presented in this report consider variation in the recovery rates of hunted ringed birds. Variation in these recovery rates could reflect differences in the reporting rates of hunted birds as well as differences in hunting pressure. Therefore, when making inferences about regional or temporal variation in hunting pressure, we are assuming that reporting rates of hunted birds do not vary between regions or over time. Although there is evidence that reporting rates of some passerines have declined since the 1950s (Baillie & Green 1987) there is no such evidence for Lapwings *Vanellus vanellus* (Peach *et al.* 1994) or Mallards *Anas platyrhynchos* (Aebischer 1986).

The strong seasonal variation in hunting pressure shown by the ringing recovery data also supported our rationale to use recoveries for these purposes. Eighty-five percent of hunted recoveries of both species were found in winter (September to February inclusive), whilst potential breeding birds that survived the winter and were returning to their breeding grounds during spring (March/April) comprised only a small proportion of the hunted recoveries. Hunting pressure declined in late winter (February) and increased again from August and September onwards, coinciding with the onset of most of the regulated shooting seasons. This pattern of seasonal hunting pressure was similar for Snipe and Woodcock, although for Woodcock the seasonality of hunting was more abrupt with most birds being hunted between November and January inclusive. For the purposes of this report, the seasonality with which hunted recoveries are reported probably closely reflects seasonal changes in hunting intensity in Europe. Using recoveries of birds ringed as chicks, it was evident that most (>50%) hunted Snipe and Woodcock were recovered within a year of hatching. Young birds may therefore experience relatively high hunting mortality compared to adults, but whether this hunting mortality has an additive or compensatory effect on first-year survival is unknown and merits further investigation.

Extensive seasonal migrations were undertaken by Snipe and Woodcock in most regions of Europe, except the British Isles where large resident populations were added to in winter by northern European and Icelandic migrants (Piersma 1986). The pattern of movement was south-westerly in direction in autumn, and north easterly in direction in spring and this pattern was common to all regions. This redistribution of birds led to large wintering populations of Snipe and Woodcock in France, Iberia and Britain, including birds from eastern European breeding populations. The important Fennoscandian populations, which comprised in the order of 60% of the total European breeding population of Snipe and Woodcock (Cramp & Simmons 1983, Piersma 1986), were recovered predominantly in France and Iberia (approximately 55% Snipe and 45% Woodcock) and Britain (approximately 13% Snipe and 20% Woodcock) and, consequently, almost a half of all hunted Snipe and over a third of all hunted Woodcock recoveries were reported from France. Britain was responsible for over 40% of all Woodcock recoveries but only 6% of Snipe recoveries, despite estimates that in the order of 85,000 Snipe are shot annually in Britain (Lack 1986) and 650,000 in France (Bertelsen & Simonsen 1989). More recent figures suggest that approximately 25,000 Snipe are hunted in Britain each year (Andrew Hoodless, pers comm) and this may partly reflect long-term declines in hunting pressure (see below). Overall, the European ring recovery data suggest that hunting pressure on Snipe is greatest in France, Iberia and the Low Countries.

Early reports have suggested that Britain hunts in the order of 200,000 Woodcock annually (Bertelsen & Simonsen 1989). France hunts over 1.3 million Woodcock and Italy around one million birds per year (Bertelsen & Simonsen 1989). Since Italy was not prominent in this study as a source of hunted recoveries, either reporting rate of ringed birds is low in that country or a high proportion of unringed birds winter in the Mediterranean, possibly from the former USSR.

When comparing regional differences in the ratios of hunted to non-hunted recoveries (Fig. 9), France and the Mediterranean countries had a relatively high ratio of hunted recoveries for both Snipe and Woodcock. The ratio of hunted to non-hunted recoveries was much lower for both Snipe and Woodcock recovered in Britain and Fennoscandia suggesting that the intensity of hunting is lower in these regions than in France. These conclusions depend on the assumption that reporting rates of non-hunted recoveries are similar across regions and that most French Snipe were actually hunted. Recovery rates for hunted Snipe also suggest

that birds ringed in France and central Europe have been subjected to relatively high levels of hunting pressure, whilst birds ringed in Britain, eastern Europe and Fennoscandia have experienced lower levels of hunting pressure. Many British-ringed Snipe originate from Scandinavia where hunting is less intense than in southern Europe. In many central European countries Snipe are afforded full legal protection and the high hunting rates of birds ringed in these countries probably reflect high levels of hunting in the western European winter quarters.

Although we received no information about Woodcock ringed in France, there is good evidence that hunting pressure in France has been relatively high for this species. This conclusion is supported by the relatively high hunting recovery rates in France for Woodcock ringed elsewhere in Europe (Table 6b). Although large numbers of Woodcock are hunted in the UK and Ireland (Table 6b), relatively high numbers of non-hunted recoveries are also reported from the from this region (Fig. 9). This probably reflects the relatively large wintering population of Woodcock in the British Isles and Ireland, but may also reflect a higher reporting rates for non-hunted birds in this region. The relatively low ratio of hunted to non-hunted Woodcock recoveries for the UK and Ireland suggests that hunting pressure here may be lower than in other regions notably France, the Low Countries and central Europe (Fig. 9).

The recovery rates of hunted Snipe and Woodcock have declined in most regions of Europe, including Snipe hatched in Fennoscandia and Woodcock hatched in Britain. There were regions, however, where this trend was not apparent or less pronounced, particularly Snipe ringed in France and as pulli in Finland. In this respect it should be noted that many Snipe ringed in France may have originated from Fennoscandia or central Europe. Also, Scandinavian bred Woodcock have shown a very sharp decline in the recovery rate of hunted birds since the 1960s and this may be indicative of a real reduction in hunting pressure on these populations.

Further supporting evidence for a long-term decline in hunting pressure is provided from the temporal analysis of recovery rates of hunted and non-hunted birds (Fig. 14). This shows that recovery rates of non-hunted Snipe and Woodcock have remained relatively stable since the early 1950s, but that recovery rates of hunted birds (particularly for Woodcock) have

declined markedly. This decline has occurred since the early 1950s in the case of Snipe and since the early 1960s in the case of Woodcock. Although these declining recovery rates could reflect declining reporting rates of hunted birds, it is perhaps more likely that they reflect a real decline in hunted pressure across Europe.

In conclusion, ringing recovery data suggests that hunting pressure on European Snipe is highest in France, Iberia, the Low Countries, whilst for Woodcock hunting pressure was highest in France, Britain, the Low Countries and central Europe. Snipe hunted in France and Iberia were largely from breeding populations in Fennoscandia, Germany, Denmark and the Low Countries. Woodcock hunted in France and Iberia were mainly from the breeding populations of Fennoscandia, the Low Countries and eastern Europe. Most Snipe and Woodcock recoveries from the British breeding population were also hunted in Britain and Ireland.

The ringing recoveries suggest that hunting pressure on both Snipe and Woodcock may have been declining in most regions over the last 20 years except perhaps on Snipe ringed in France and Finland (a high proportion of which are hunted in France). Although no data were available for Woodcock ringed in France, the declining recovery rates of hunted Woodcock across most of northern and north-west Europe may well reflect a genuine reduction in hunting pressure on this species. Further analyses are now required to investigate the possible effect of hunting on the survival rates of European Snipe and Woodcock.

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Table 1a. Ringing totals for Snipe *Gallinago gallinago* from ringing schemes across Europe.

Ringing scheme (code)	Number ringed Pulli	F/G	Total	Ringing date range	Recoveries	Finding date range
Belgium (BLB)	48	9329	9377	1960-1991	626	1960-1991
Czechoslovakia (CSP)	?	?	?		119	1968-1991
Denmark (DKC/K)	1	689	690	1965-1991	420	1949-1982
Estonia (SUE)	83	59	142	1940-1991	1	1983
Finland (SFH)	299*	3683*	6114	1914-1991	438	1957-1991
France (FRP)	17	5181	5198	1956-1986	391	1956-1986
Germany (DFR/H/DDH)	126	8520	8646	1947-1991	678	1933-1987
Hiddensee (DDH)					726	1964-1992
Holland (NLA)	359	10901	11260	1957-1990	698	1938-1992
Hungary (HGB)	1	782	783	1974-1991	28	1913-1992
Italy (IAL/B)	?	?	?		7	1982-1983
Jersey (CIJ)	1	2362	2363	1953-1991	85	1960-1989
Lithuania (SUK)	54	6	60	1931-1988	1	1936
Norway (NOS)	?	?	?		95	1949-1991
Poland (PLG)	22*	6889*	6911	1922-1989	302	1934-1991
Spain (ESM/I)	0	681	681	1983-1990	43	1970-1988
Sweden (SVS)	51*	10183	10234	1922-1989	314	1970-1991
Switzerland (HES)	15	3109	3124	1927-1991	198	1930-1986
United Kingdom/Ireland (GBT)	3973	25733	29706	1909-1991	1140	1911-1991
Total	5033*	85058*	95289		6391	

Table 1b. Ringing totals for Woodcock *Scolopax rusticola* from ringing schemes across Europe.

Ringing scheme (code)	Number ringed Pulli	F/G	Total	Ringing date range	Recoveries	Finding date range
Belgium (BLB)	45	385	430	1960-1991	62	1935-1991
Czechoslovakia (CSP)	?	?	?		10	1974-1989
Denmark (DKC/K)	70	1036	1106	1966-1990	159	1958-1979
Estonia (SUE)	146	16	162	1936-1991	9	1972-1984
Finland (SFH)	787*	653*	1616	1913-1991	275	1933-1992
France (FRP)	?	?	?		0	
Germany (DFR/DDH)	10	79	89	1947-1990	122	1926-1987
Hiddensee (DDH)					8	1966-1990
Holland (NLA)	120	1221	1341	1911-1990	232	1937-1991
Hungary (HGB)	0	7	7	1974-1991	10	1914-1965
Italy (IAL/B)	?	?	?		1	1982
Jersey (CIJ)	0	48	48	1964-1991	10	1964-1991
Lithuania (SUK)	12	27	39	1927-1988	4	1961-1985
Norway (NOS)	?	?	?		57	1925-1991
Poland (PLG)	8*	19*	85	1931-1991	4	1936-1984
Spain (ESM/I)	1	17	18	1983-1990	0	
Sweden (SVS)	170*	1284*	1454	1922-1989	38	1963-1991
Switzerland (HES)	4	175	179	1935-1991	108	1953-1991
United Kingdom/Ireland (GBT)	6159*	2283*	8609	1909-1990	686	1911-1991
Total	7532*	7250*	15183		1714	

* = minimum total

Table 2. A summary of the distribution of the finding circumstances and finding condition of recovered European Snipe and Woodcock.

(a)

Finding circumstance	Snipe %	Woodcock %
Shot	79.9	90.5
Hunted (not shot)	4.9	3.3
Accidental trapping	0.2	0.6
Collision	0.9	2.3
Drowned	0.0	0.1
Injury	0.4	0.2
Predation	1.1	0.9
Starvation/cold	0.2	0.3
Unknown	11.7	1.7
TOTAL NO. RECOVERIES	6391	1714

(b)

Finding condition	%	%
Condition unknown	3.4	2.6
Dead, unknown how long	7.4	6.0
Dead <1 week	80.2	86.9
Dead >1 week	0.9	1.1
Alive, not released	0.4	0.4
Alive, released	7.8	3.1
TOTAL NO. RECOVERIES	6391	1714

Table 3. **Ringing and recovery totals used in the analysis of regional and temporal recovery rates (number recovered/number ringed) for (A) Snipe *Gallinago gallinago* and (B) Woodcock *Scolopax rusticola*.**

(A) Snipe

Ringing scheme (code)	Ringing date range	Total ringed	Finding date range	Recoveries: Total	Hunted
Belgium (BLB)	1960-1991	9377	1960-1991	626	557
Denmark (DKK)	1965-1976	312	1965-1991	69	46
Finland (SFH)	1957-1991	6090	1957-1991	438	345
France (FRP)	1956-1986	5198	1956-1986	381	372
Radolfzell (DFR)	1947-1991	8616	1947-1987	669	633
Holland (NLA)	1937-1990	11260	1937-1990	694	642
Hungary (HGB)	1974-1991	780	1975-1991	28	26
Jersey (CIJ)	1960-1989	2234	1960-1989	85	75
Poland (PLG)	1933-1991	6924	1934-1991	302	282
Spain (ESM)	1983-1990	681	1983-1990	11	9
Sweden (SVS)	1964-1990	8122	1970-1991	314	286
Switzerland (HES)	1947-1985	2856	1947-1991	279	253
United Kingdom/ Ireland (GBT)	1909-1991	29706	1909-1991	1140	1005
Total		92156		5036	4432

(B) Woodcock

Ringing scheme (code)	Ringing date range	Total ringed	Finding date range	Recoveries: Total	Hunted
Belgium (BLB)	1960-1991	430	1960-1991	56	55
Denmark (DKK)	1950-1991	1106	1950-1991	163	119
Estonia (SUE)	1970-1984	100	1970-1984	9	9
Finland (SFH)	1933-1992	1590	1933-1992	275	236
Radolfzell (DFR)	1956-1988	43	1956-1988	2	2
Holland (NLA)	1957-1990	1278	1957-1991	217	209
Hungary (HGB)	1950-1991	7	1950-1991	4	3
Jersey (CIJ)	1964-1991	48	1964-1991	10	10
Lithuania (SUK)	1960-1985	34	1961-1985	4	4
Poland (PLG)	1931-1984	78	1936-1991	4	4
Sweden (SVS)	1964-1990	1459	1970-1991	38	38
Switzerland (HES)	1970-1990	179	1970-1990	27	26
United Kingdom/ Ireland (GBT)	1909-1991	8609	1911-1991	686	632
Total		14961		1556	1408

Table 4. The age distribution of European Snipe and Woodcock at the time of ringing based on birds that were subsequently recovered.

Age code		Snipe		Woodcock	
		N	%	N	%
0	Unspecified	199	3.9	23	1.4
1	Pulli	99	1.9	679	40.5
2	Unspecified (not pulli)	2918	56.5	441	26.3
3	Juveniles	1306	25.3	150	8.9
4	Hatched before current year	604	11.7	247	14.7
5	Hatched in previous year	31	0.6	60	3.6
6	Hatched before previous year	11	0.2	78	4.6

Table 5. Hunting seasons and protected status of Snipe and Woodcock in parts of Europe.

a) Snipe	Hunting season	Breeding pairs (,000)	Population trend
Belgium	15/09-31/01***		
Britain	12/08-31/1	35**	Decreasing
Denmark*	01/09-31/12	1.5-2.5	Slight decrease
Finland		200-300**	
France	20/07-28/2***	0.3****	
Germany (East)*	Protected	2-3.5	Decreasing
Germany (West)	Protected	20**	
Hungary*	Protected	0.2-0.5	Decreasing
Norway		40**	
Poland*	15/08-31/10	15-25	Slight decrease
Spain*	04/10-07/2*	1.5-2.5	Stable
Sweden	Protected*	100**	

b) Woodcock	Hunting season	Breeding pairs (,000)	Population trend
Belgium	15/11-31/01***		
Britain/Ireland	01/09-31/1	60**	Slightly decreasing
Denmark*	01/10-31/12	3-5	Slightly increasing
Finland		200**	
France	15/09-28/2***	<10****	Possibly increasing
Germany (East)*	01/09-31/12	10-20	Slightly decreasing
Hungary*	01/03-20/4	0.05	Stable
Norway		30**	
Poland*	01/04-30/04	10-25	
Spain*	04/10-14/2*	0.1-0.4	Increasing
Sweden*	Hunted	90**	

Source: * Local ringing group 1992. ** Piersma 1986.
*** Bertelsen & Simonsen 1989. **** Cramp & Simmons 1983

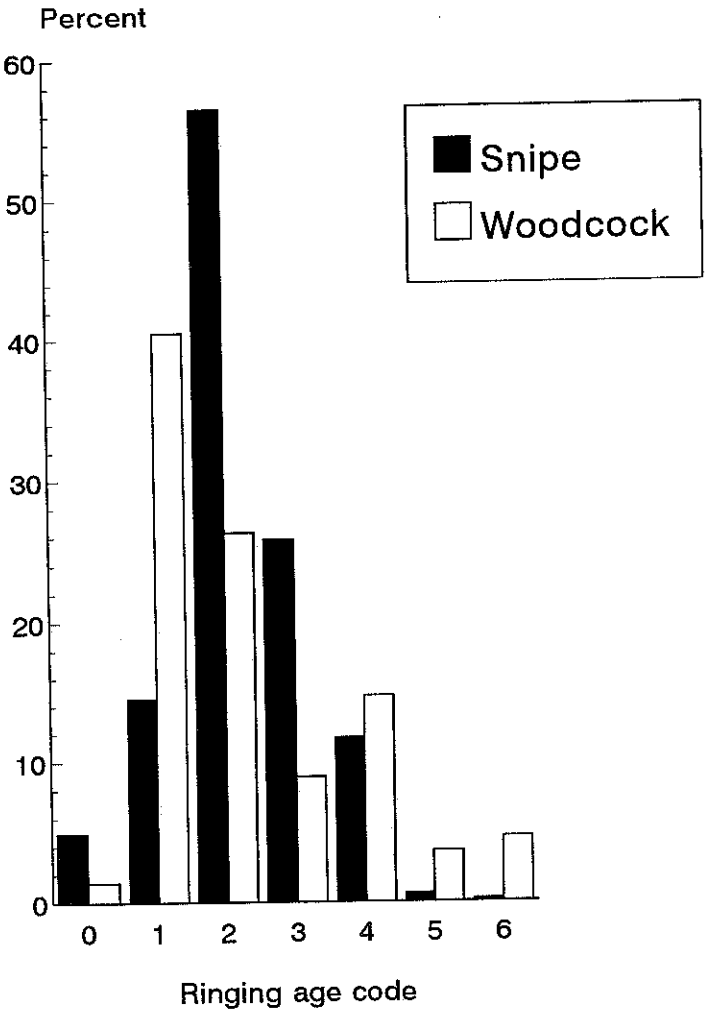
Table 6a. The percentage regional distribution of hunted Snipe recoveries in Europe.

Region recovered	Total hunted	Birds hatched in: Britain/ Ireland	Fenno-scand	German group	Low countries
Britain/Ireland	6.0	93.5	12.8	20.0	8.3
Eastern Europe	1.5	0.0	0.6	0.0	0.0
Fennoscandia	1.5	0.0	5.2	0.0	0.0
France	47.9	3.7	40.1	51.5	33.3
German group	6.6	0.0	14.0	12.7	0.7
Iberia	14.8	1.8	15.6	11.4	25.0
Italy	5.4	0.0	4.1	2.9	0.0
Low countries	12.7	0.0	7.6	2.9	33.3
N	5087	234	172	35	12

Table 6b. The percentage regional distribution of hunted Woodcock recoveries in Europe.

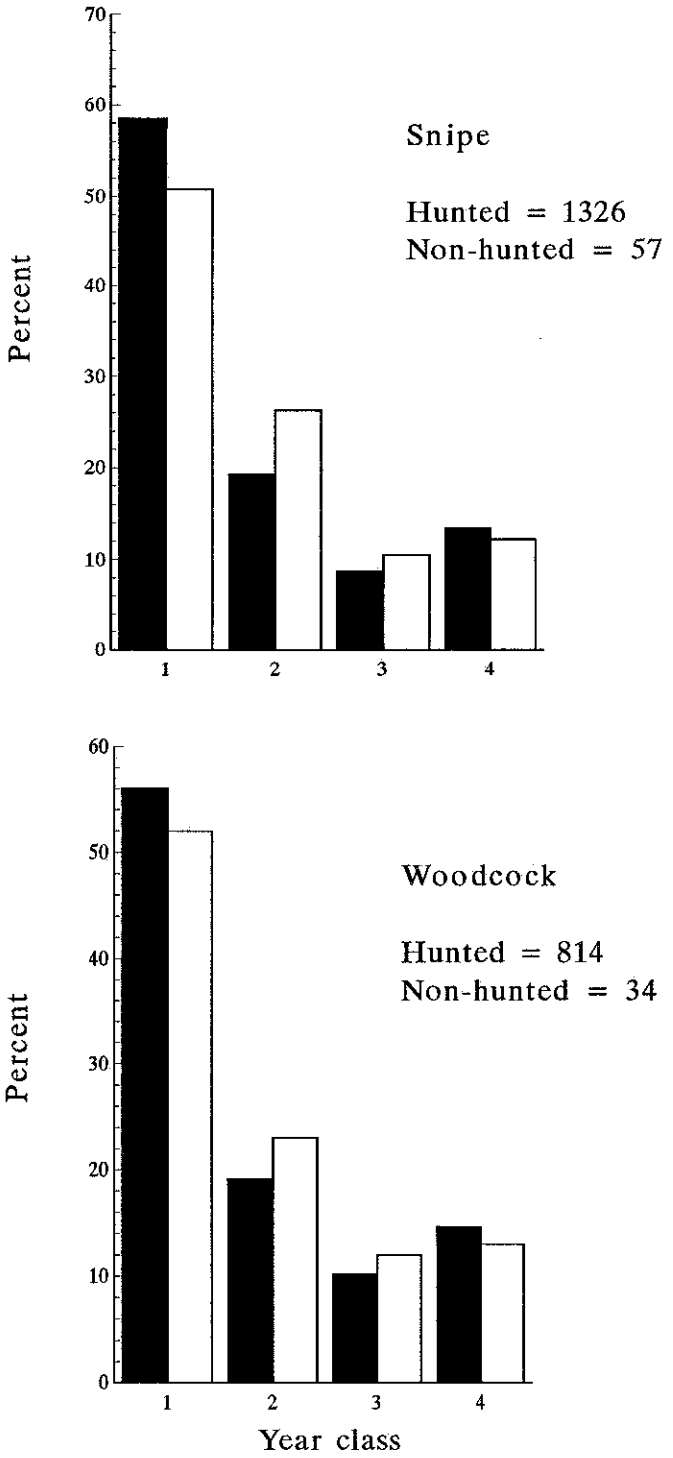
Region recovered	Total hunted	Birds hatched in: Britain/ Ireland	Eastern bloc	Fenno-scand	German group	Low countries
Britain/Ireland	42.4	96.1	0.0	19.6	30.8	9.1
Eastern Europe	4.0	0.2	44.0	4.3	0.0	0.0
Fennoscandia	6.3	0.9	0.0	10.8	0.0	0.0
France	32.3	1.4	37.5	39.7	15.4	50.0
German group	10.9	0.0	0.0	5.4	38.5	4.5
Iberia	2.8	0.9	12.5	4.7	0.0	4.5
Italy	1.5	0.0	18.6	6.4	0.0	0.0
Low countries	8.6	0.5	0.0	5.4	15.4	29.8
N	1544	436	16	234	13	22

Fig. 1. Age of recovered Snipe (n=6391) and Woodcock (n=1715) when ringed for all European records



Ringing age codes:
0. Age completely unknown or unrecorded
1. Pullus or nestling
2. Full-grown, able to fly but age unknown
3. First calendar year, able to fly
4. After the first-calendar year but exact age unknown
5. 2nd calendar year
6. After second calendar year but exact age unknown

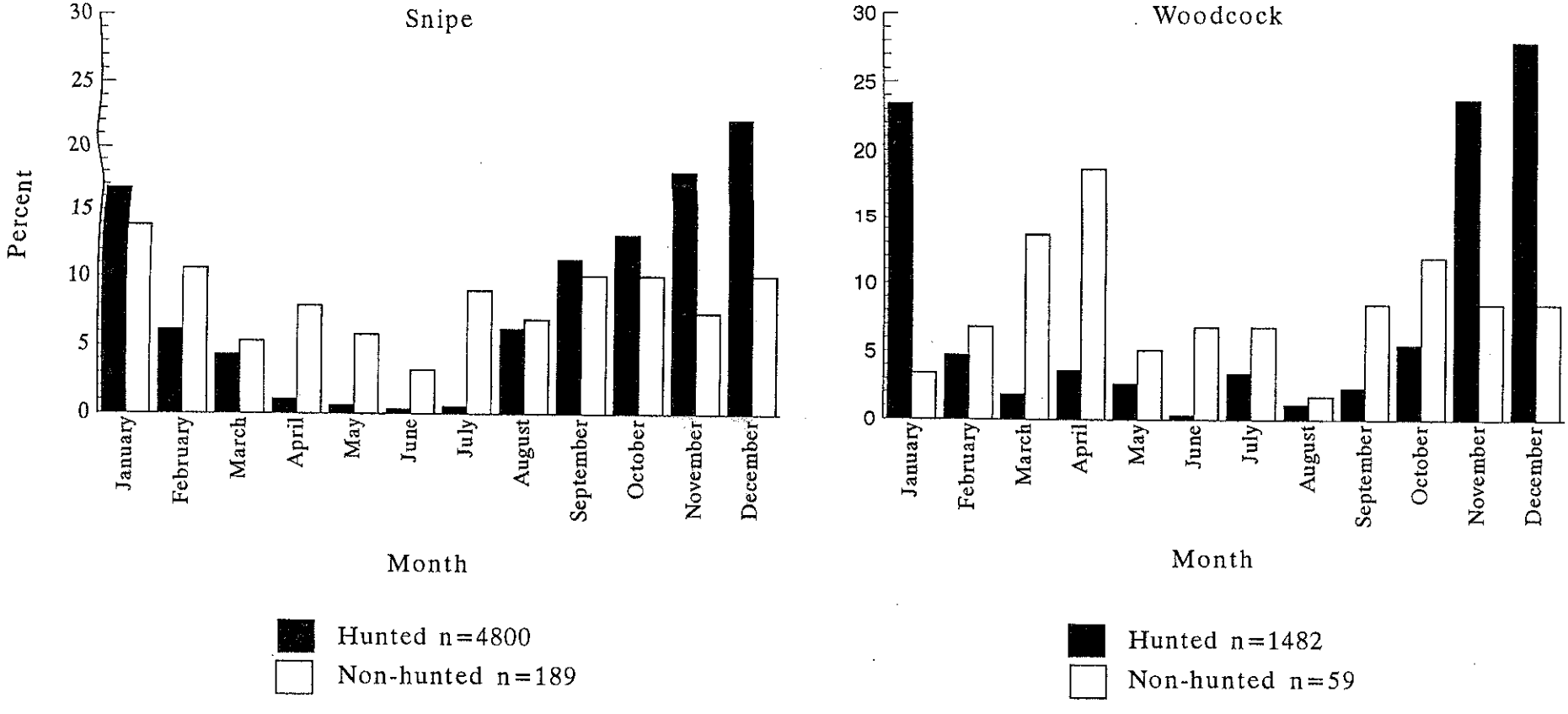
Fig. 2. Age distribution of hunted and non-hunted Snipe and Woodcock recoveries of birds that were ringed as pulli or juveniles (n = recoveries)



Age category:
1. <366 days from hatching. 2. 366-730 days from hatching
3. 731-1097 days from hatching. 4. >1097 days from hatching

■ Hunted □ Non-hunted

Fig. 3. Monthly distribution of hunted and non-hunted Snipe and Woodcock recoveries for all Europe.



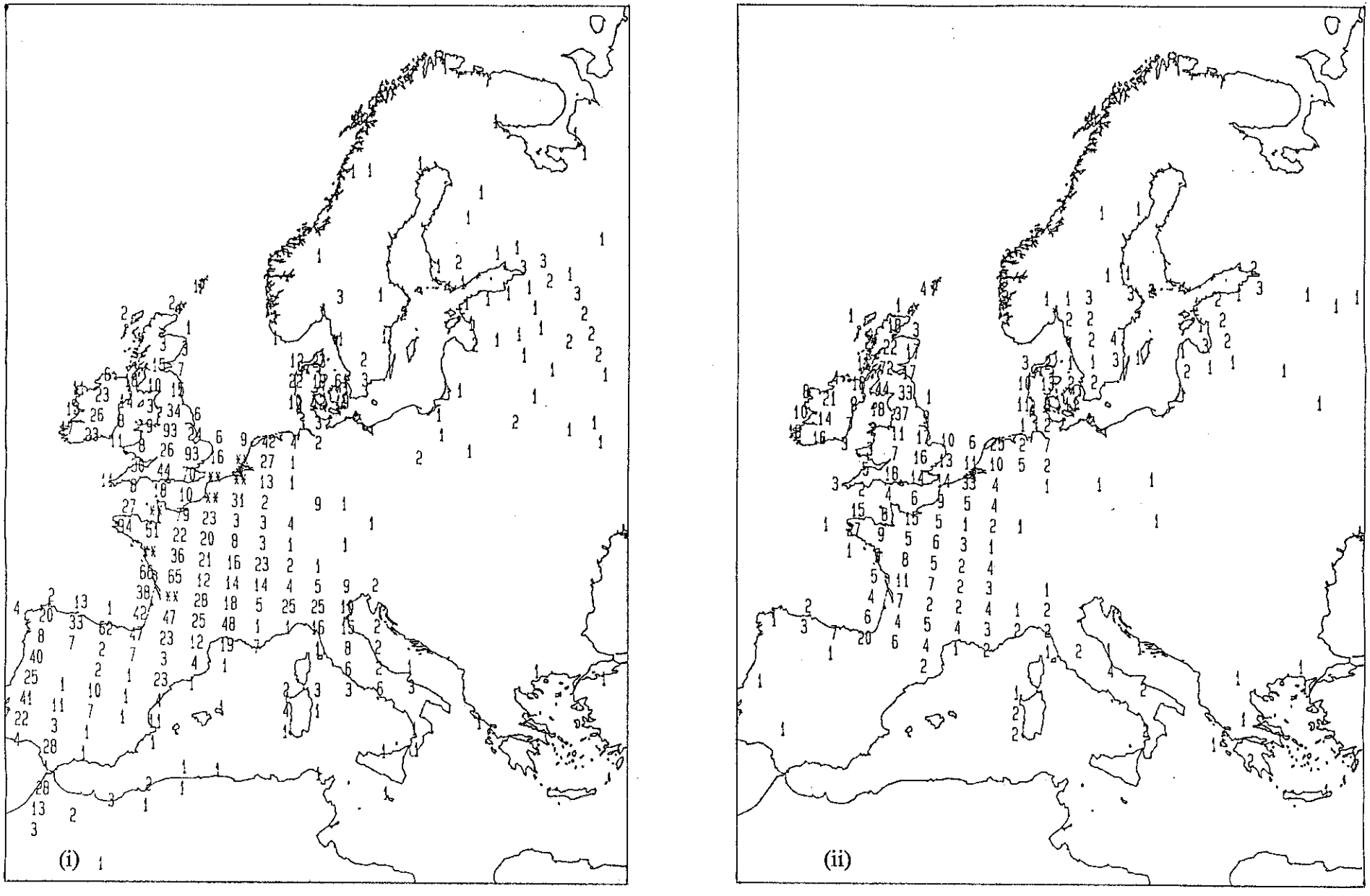


Figure 4a. Recoveries of European-ringed Snipe hunted (shot or deliberately trapped) (i) before 1980 and (ii) on or after 1st January 1980. ** indicates areas for which there have been more than 99 hunted recoveries.

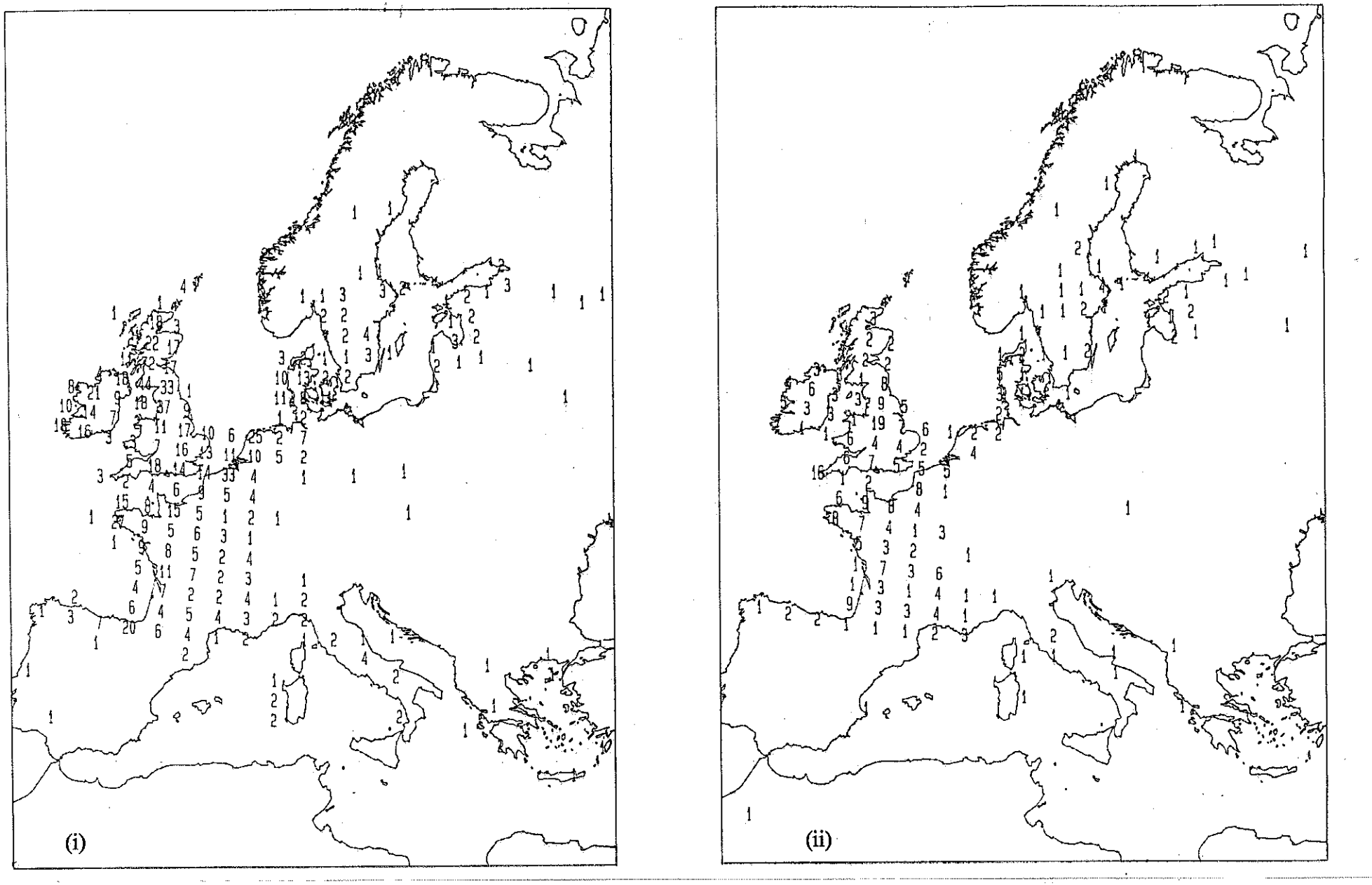


Figure 4b. Recoveries of European-ringed Woodcock hunted (shot or deliberately trapped) (i) before 1980 and (ii) on or after 1st January 1980.

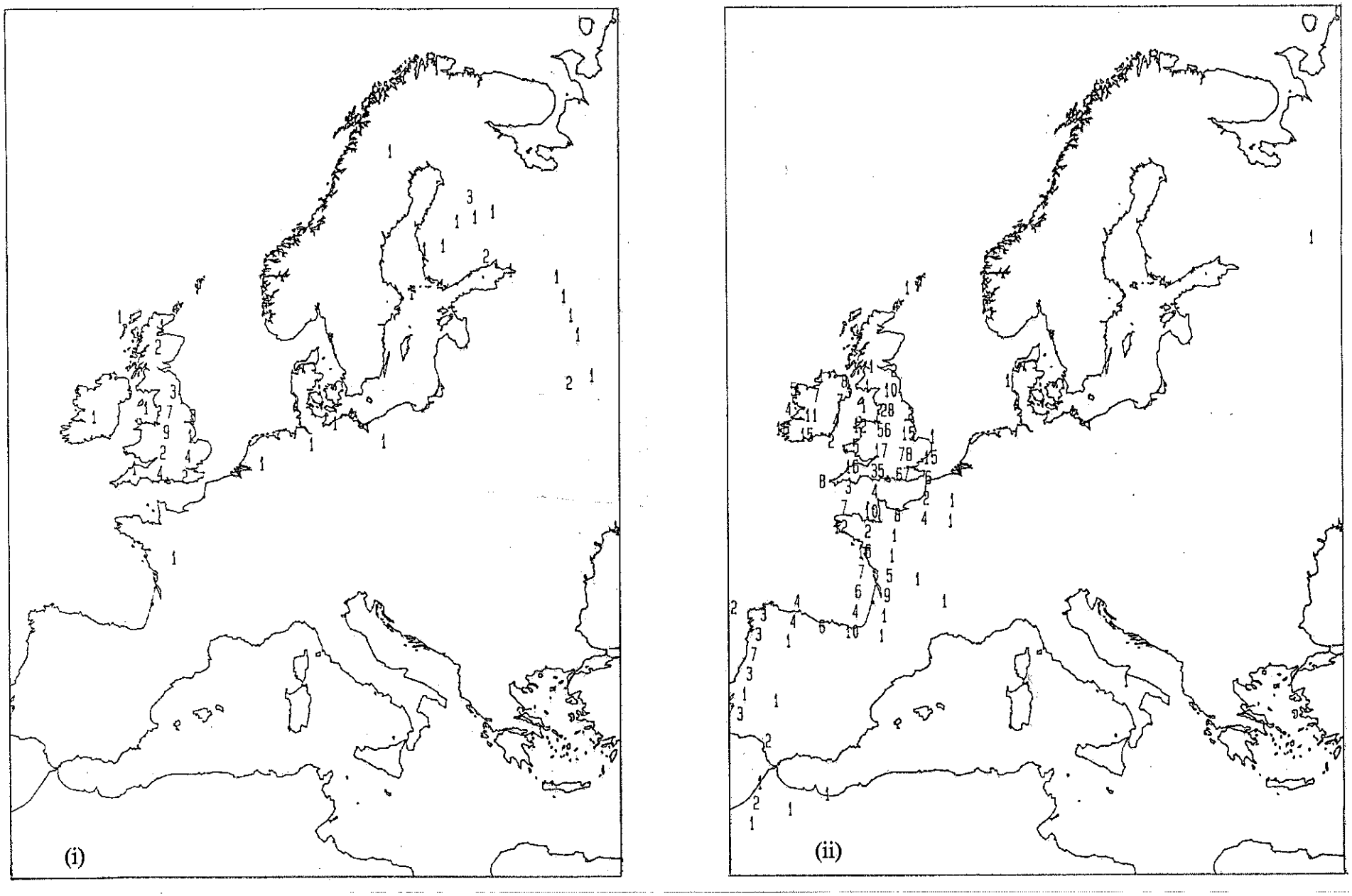


Figure 5a. Recoveries of Snipe ringed in the UK and Ireland and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

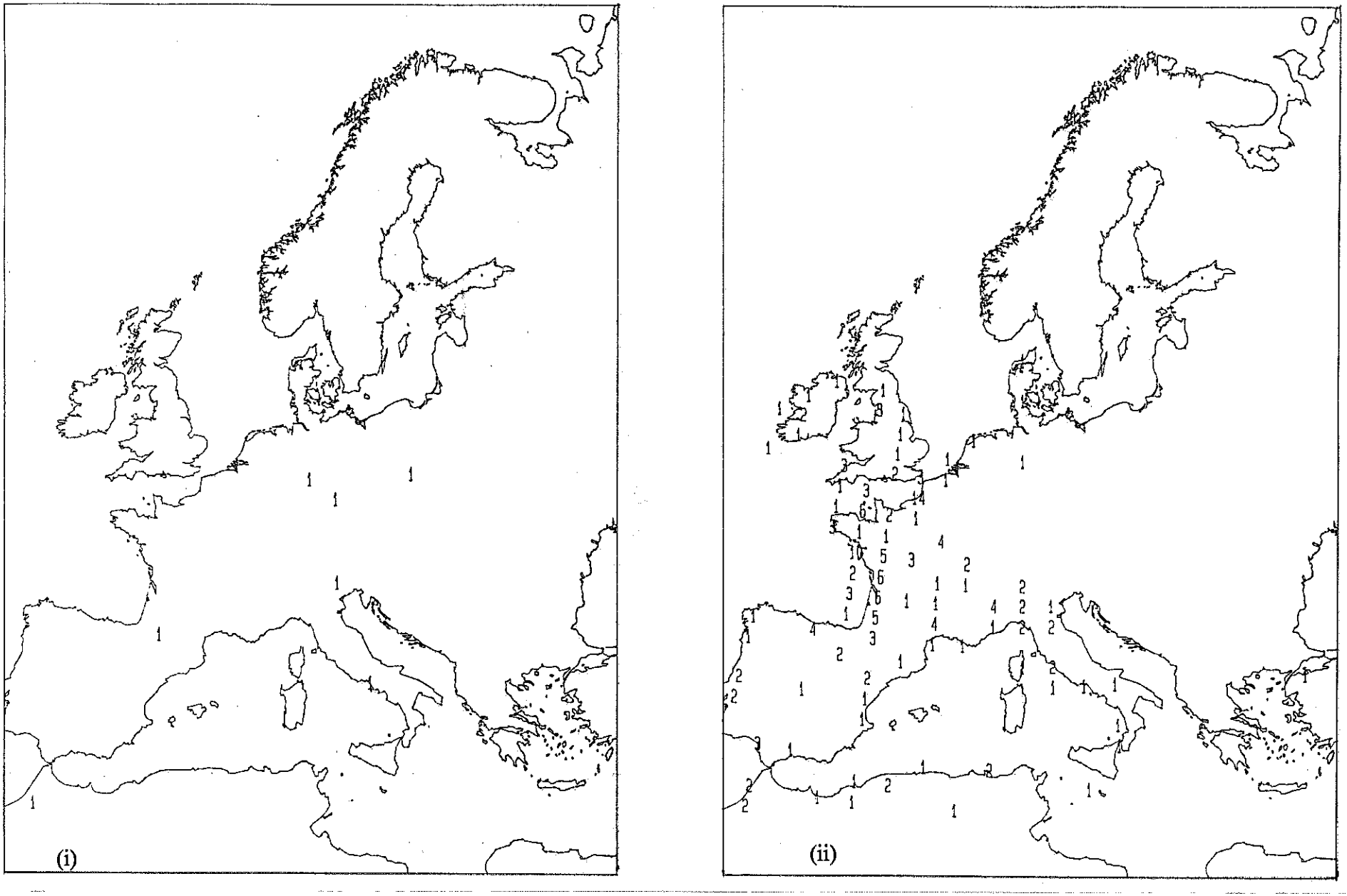


Figure 5b. Recoveries of Snipe ringed in eastern Europe and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

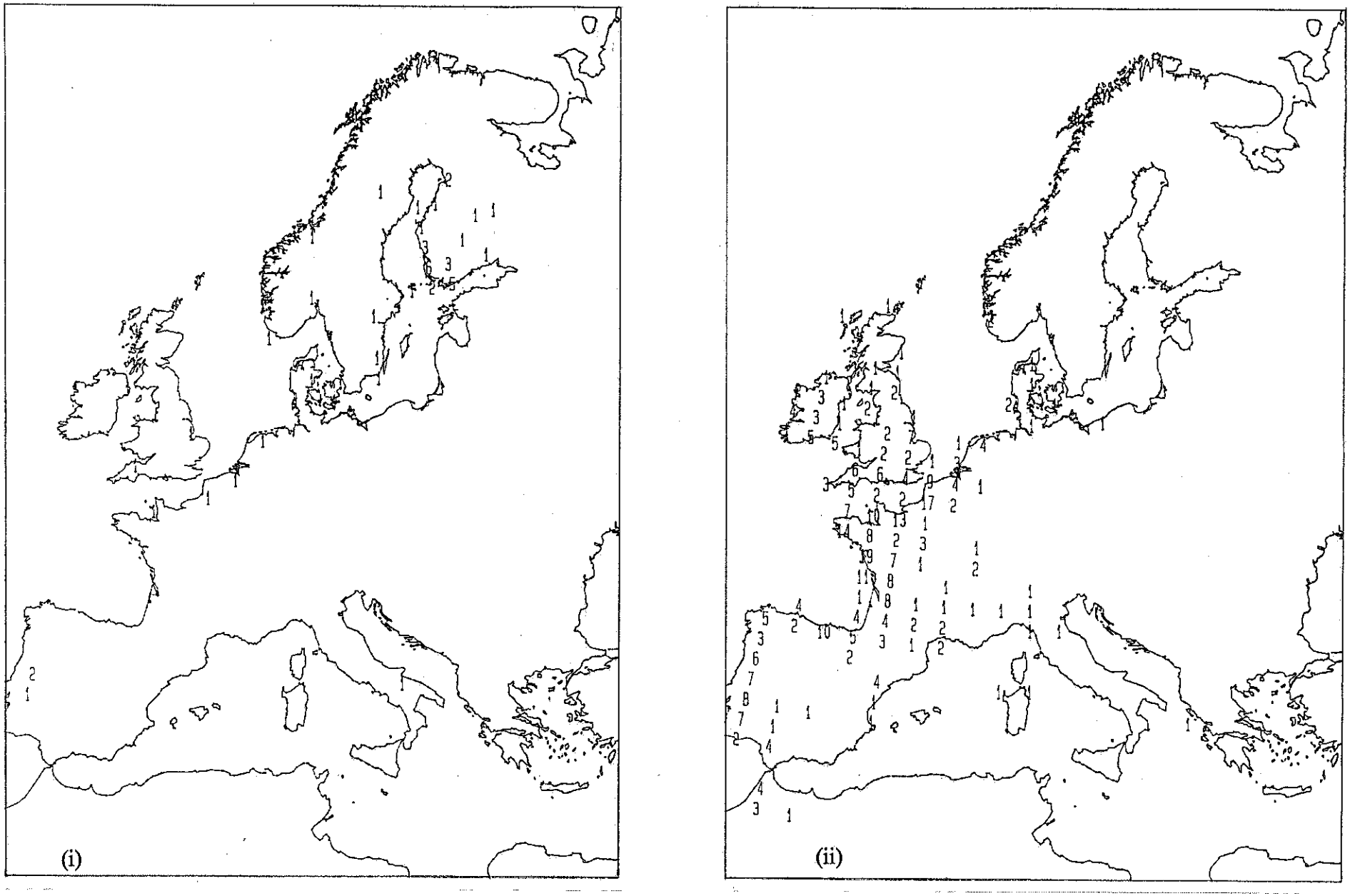


Figure 5c. Recoveries of Snipe ringed in Fennoscandia and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

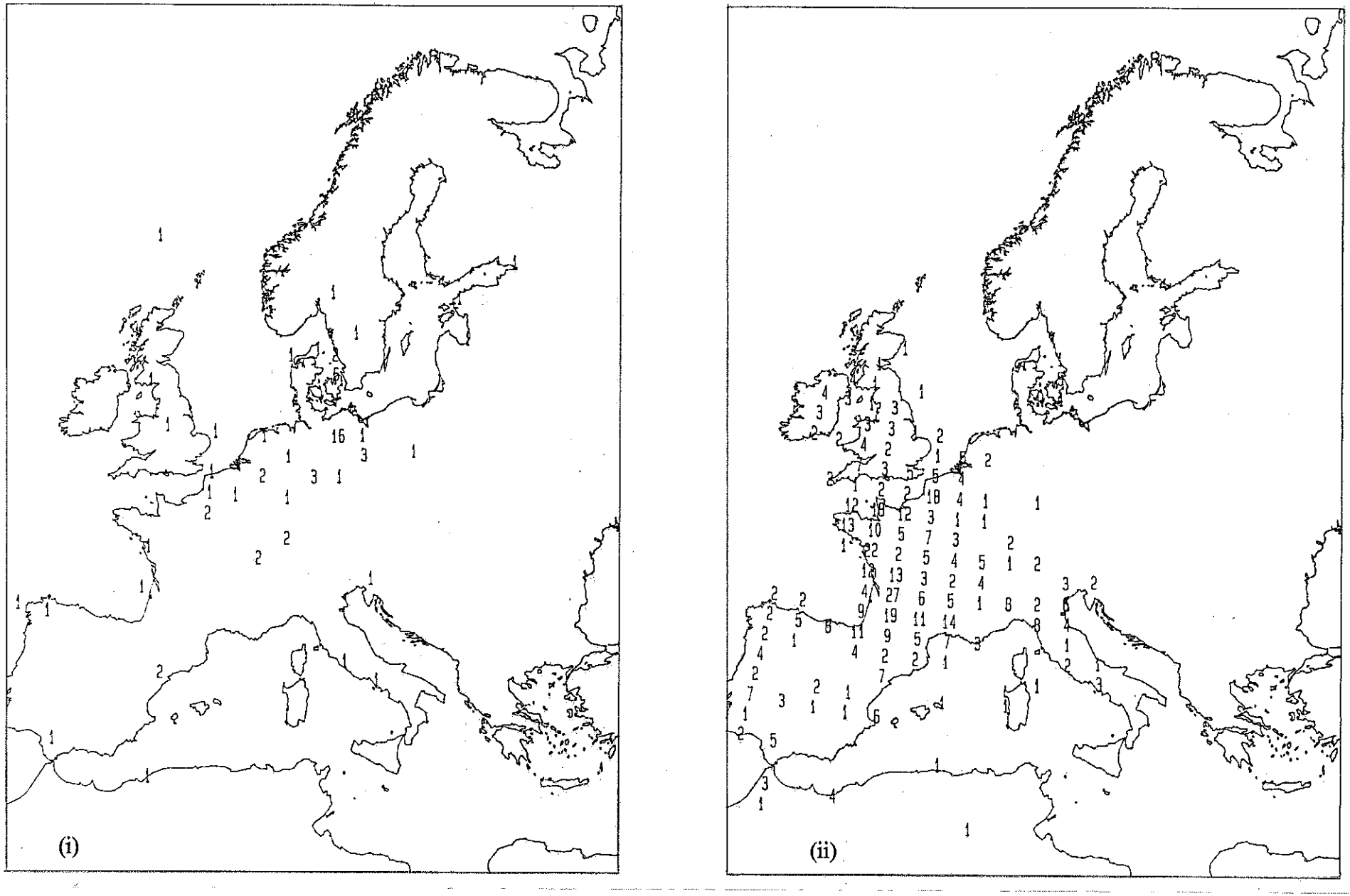
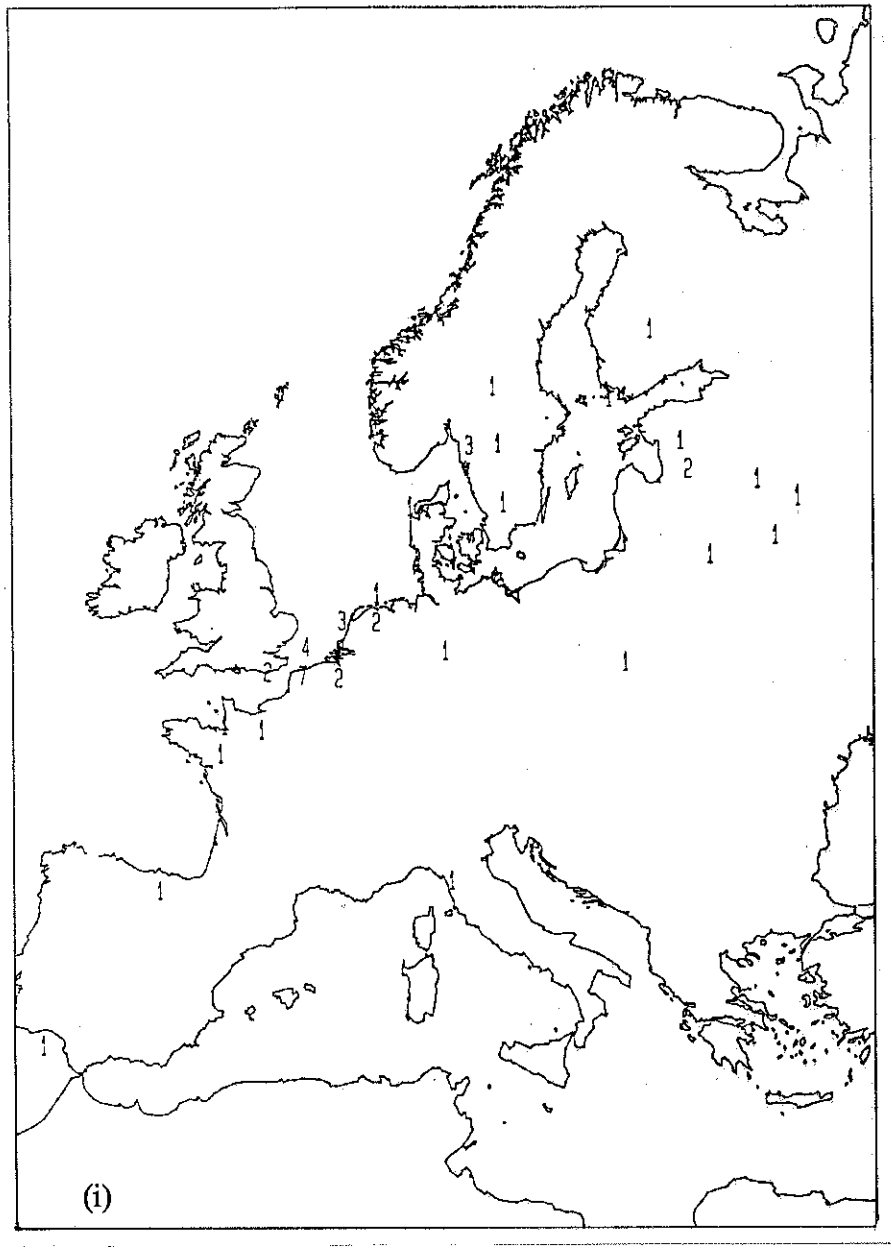


Figure 5d. Recoveries of Snipe ringed in Germany, Switzerland and Denmark and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.



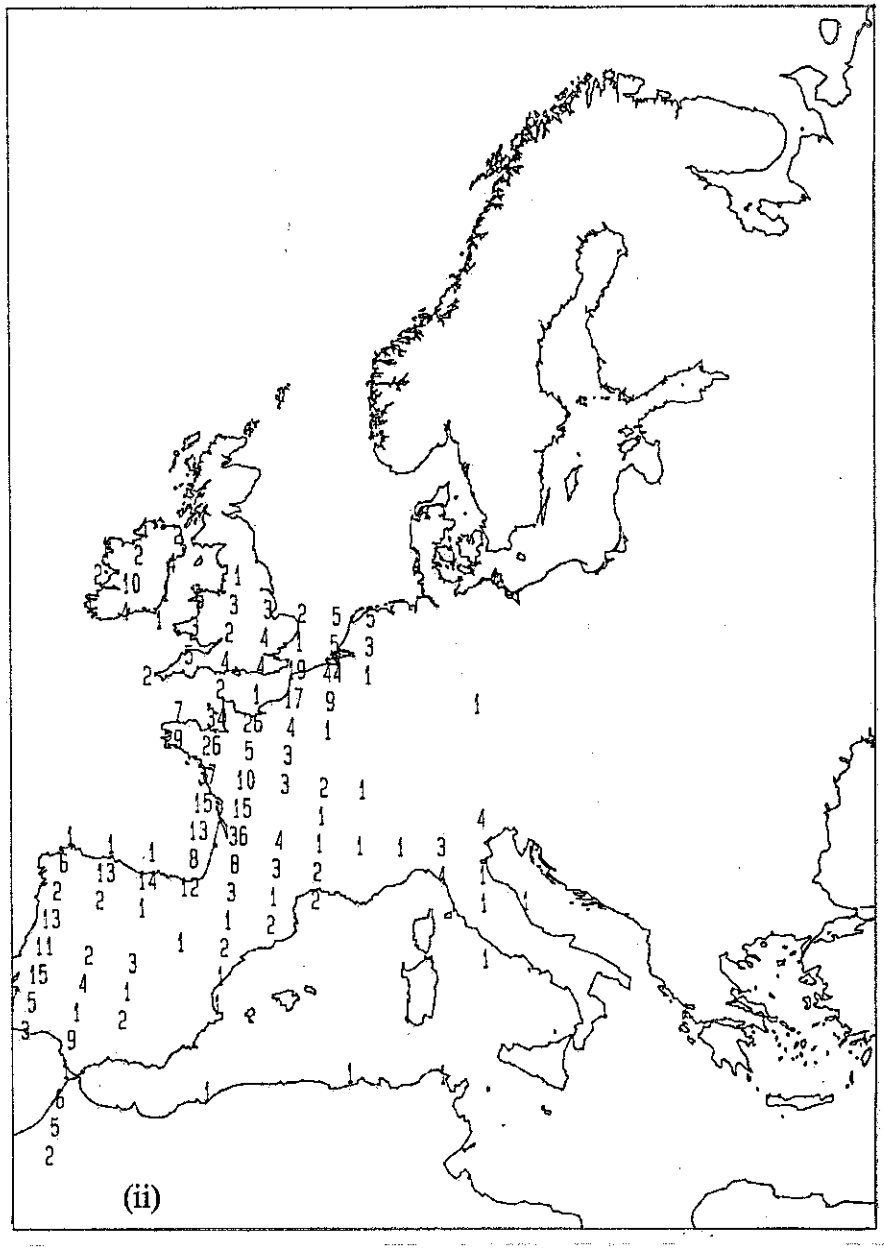


Figure 5e. Recoveries of Snipe ringed in Belgium and Holland and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

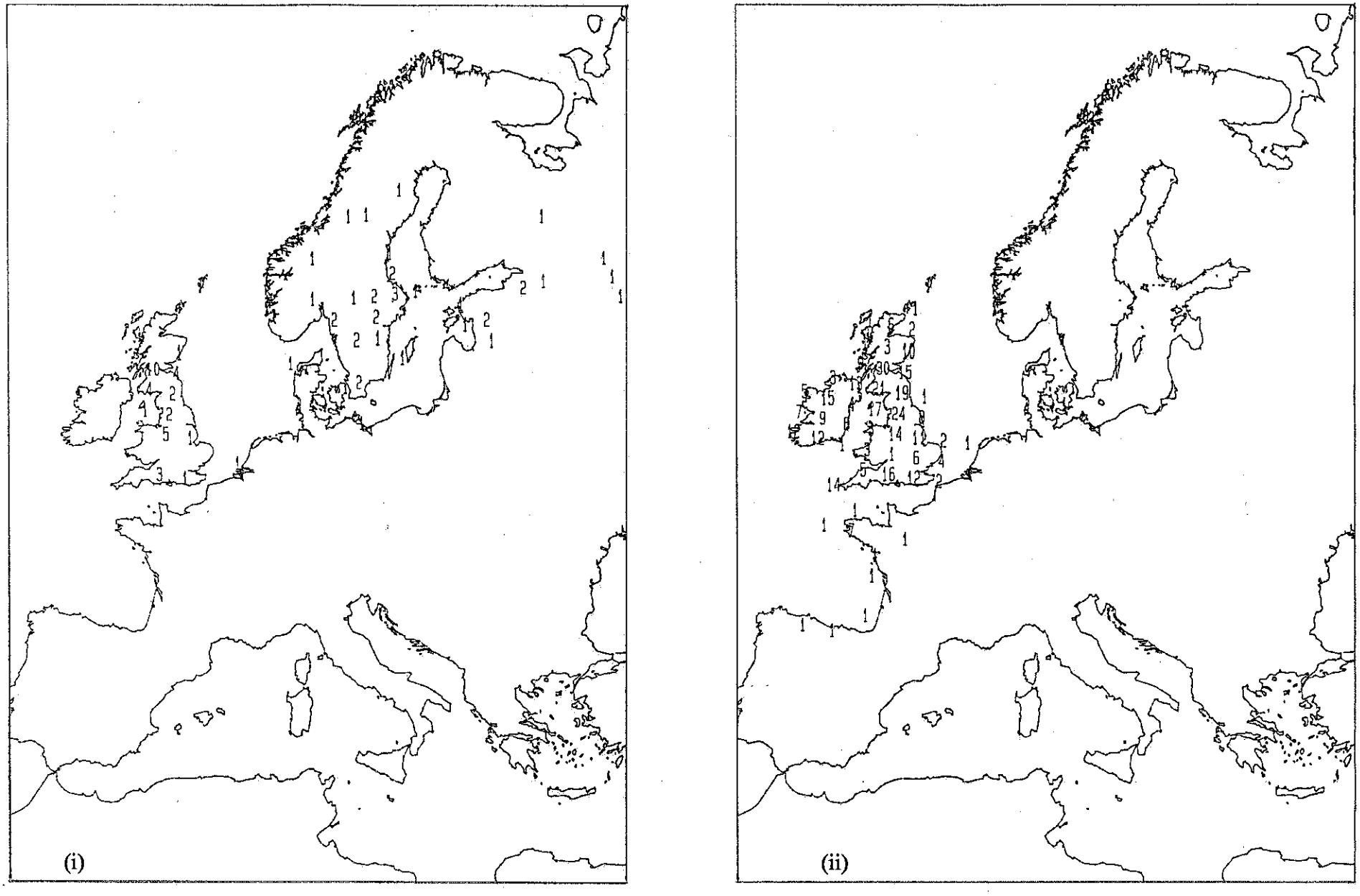


Figure 6a. Recoveries of Woodcock ringed in the UK and Ireland and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

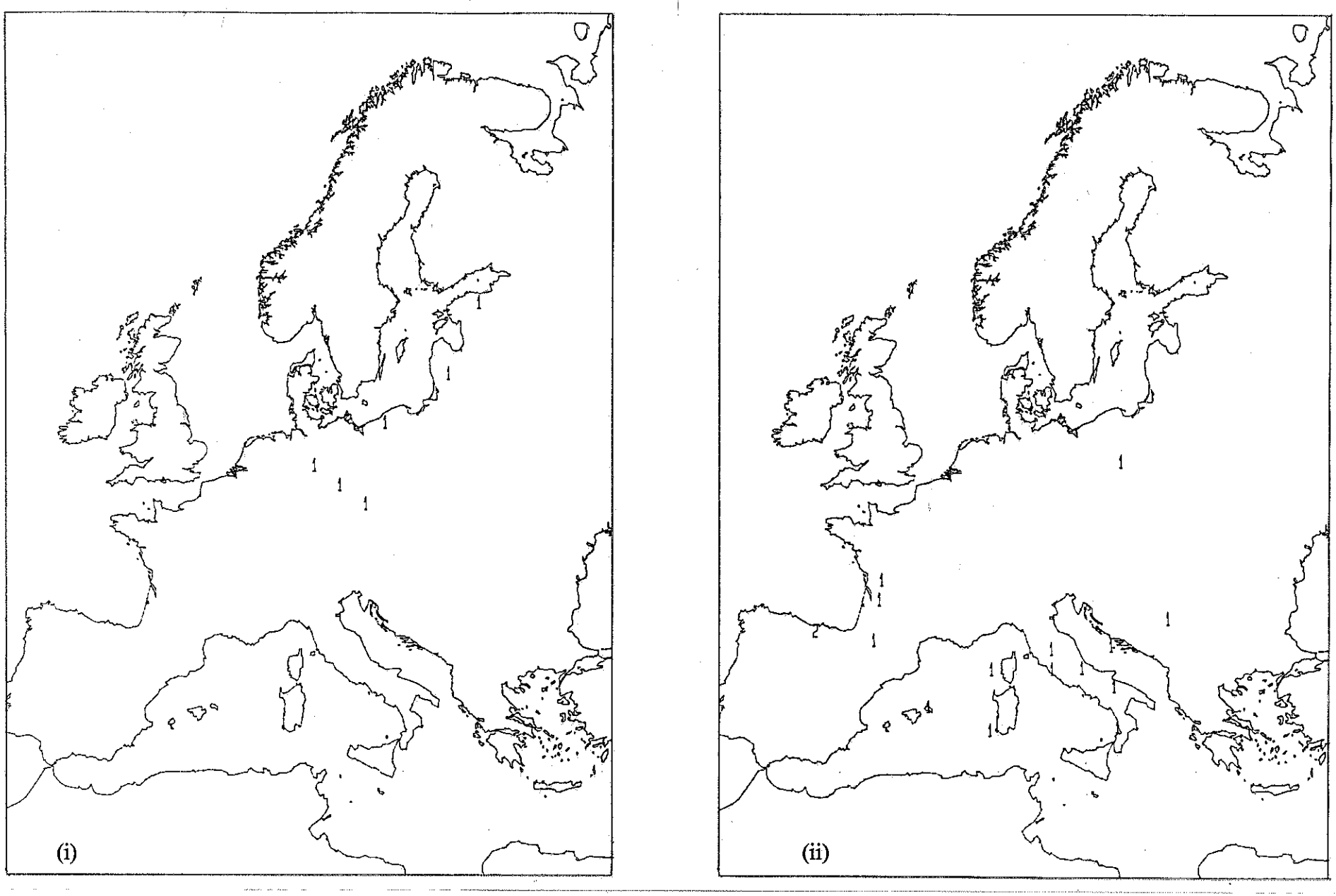


Figure 6b. Recoveries of Woodcock ringed in eastern Europe and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

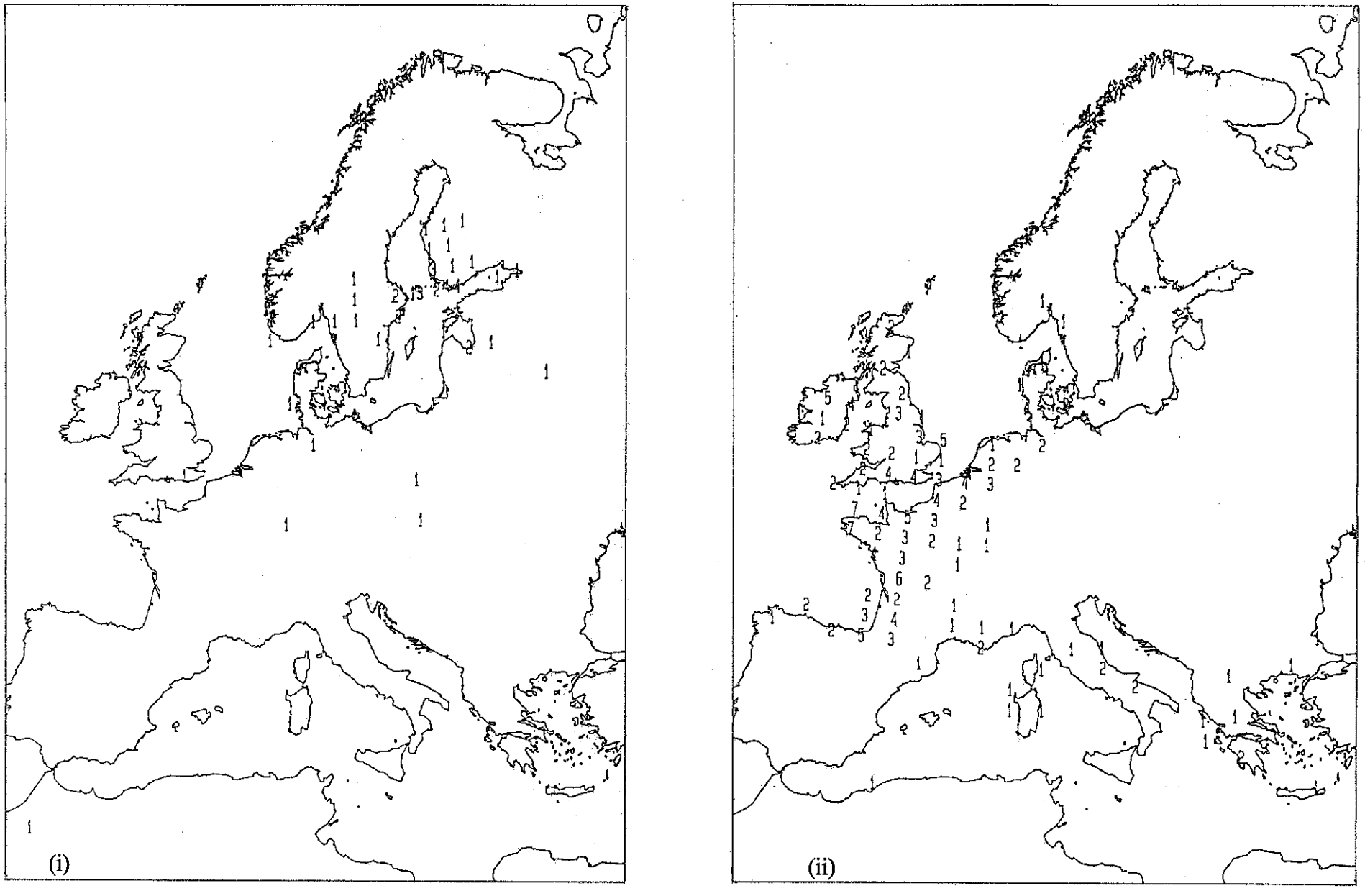


Figure 6c. Recoveries of Woodcock ringed in Fennoscandia and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

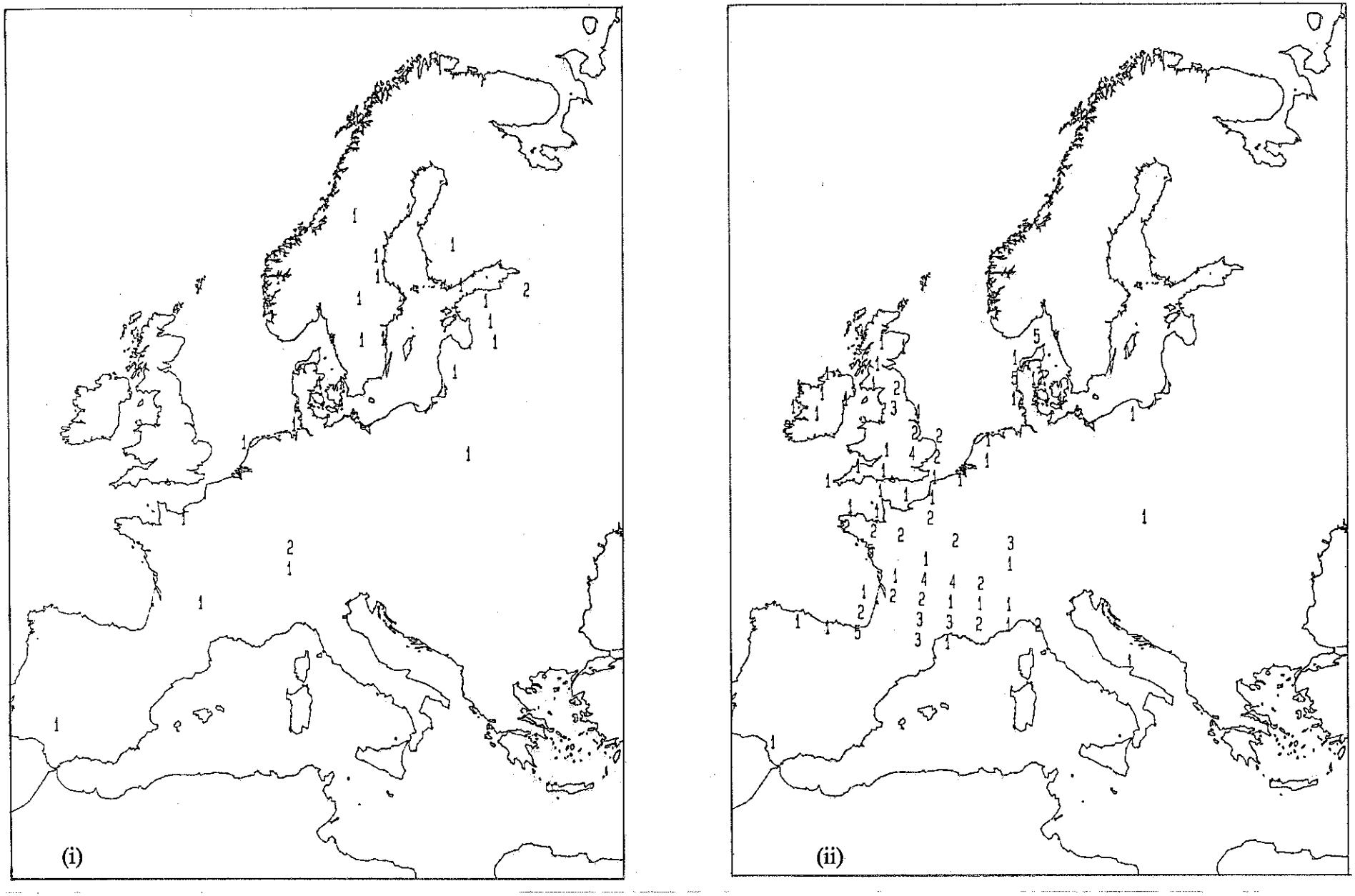


Figure 6d. Recoveries of Woodcock ringed in Germany, Switzerland and Denmark and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

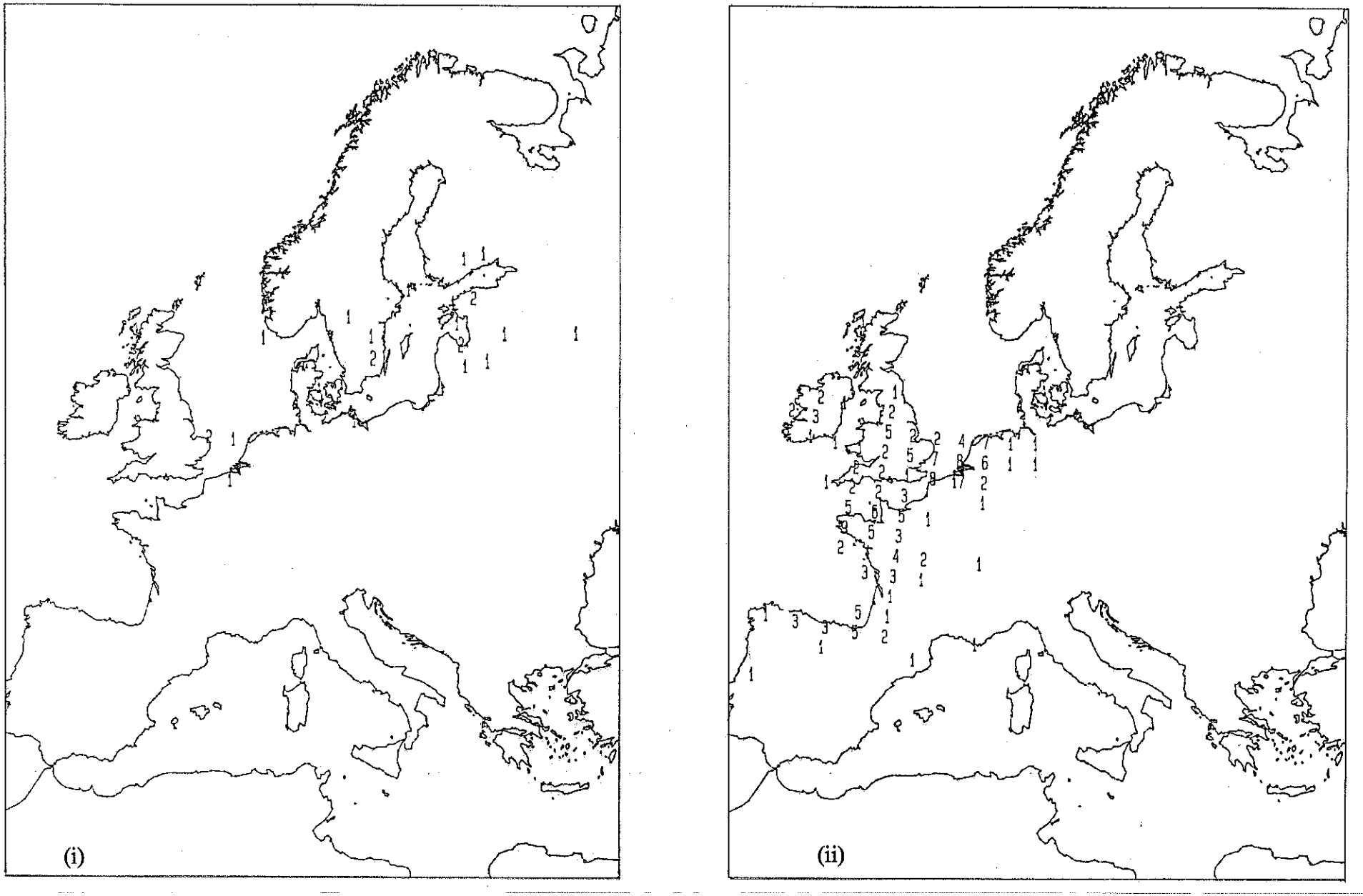


Figure 6e. Recoveries of Woodcock ringed in Belgium and Holland and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

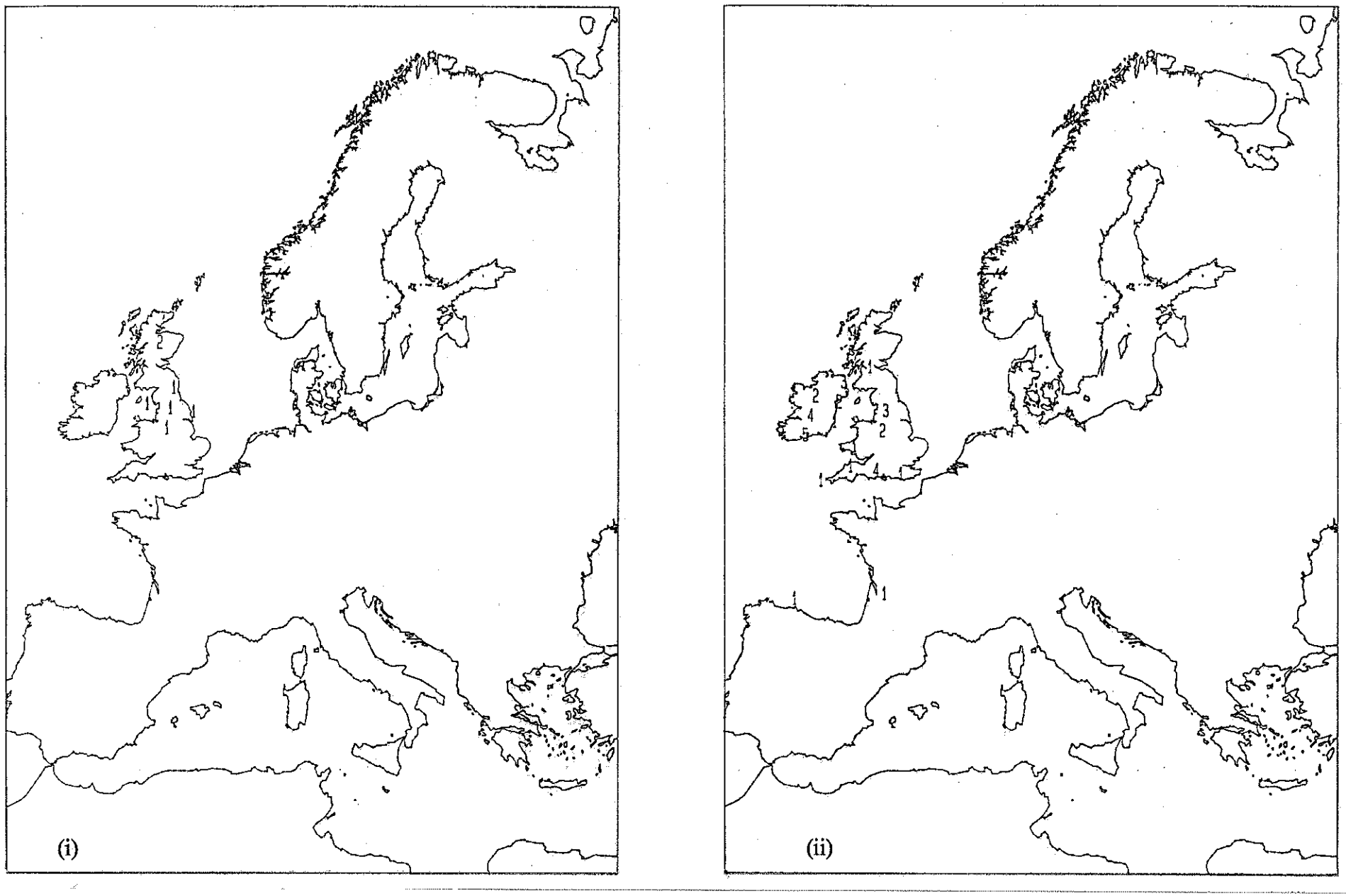
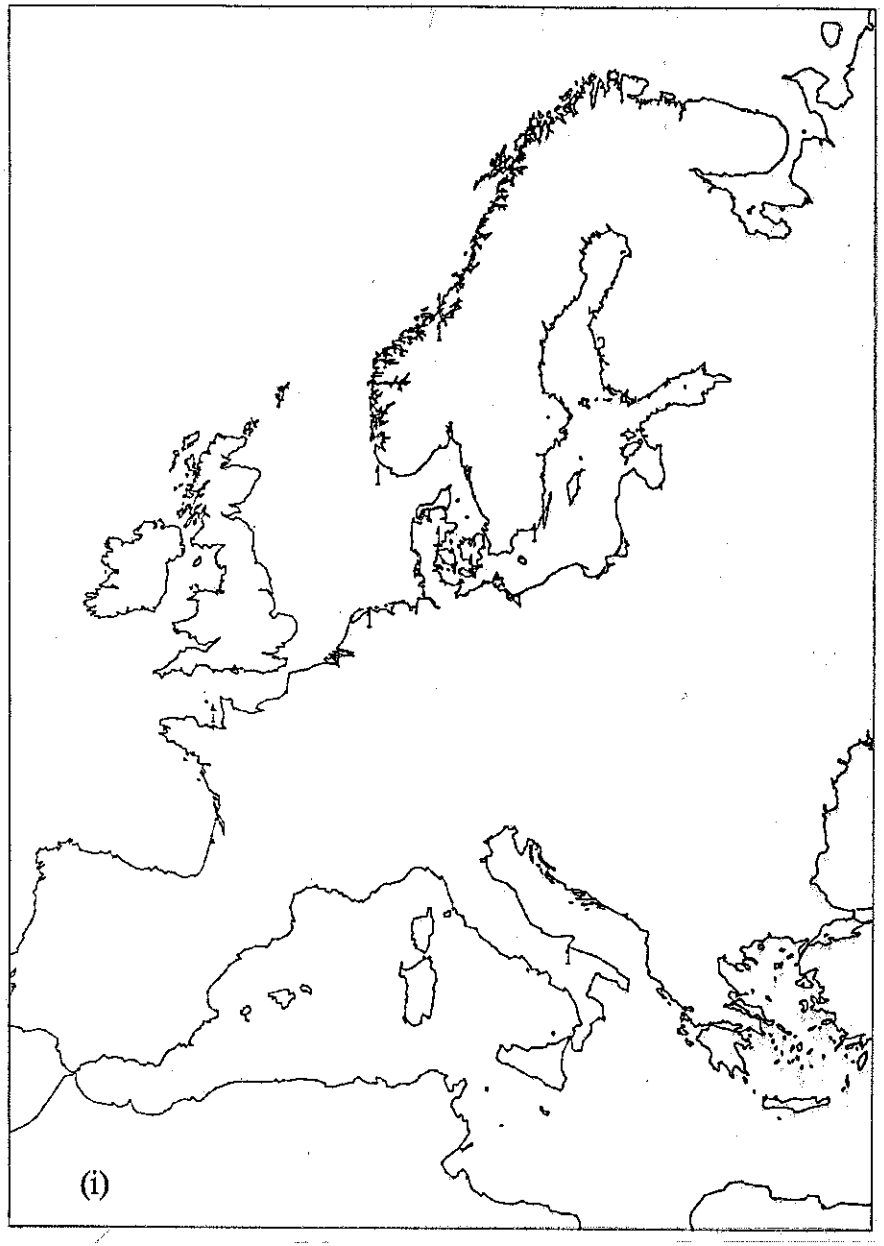


Figure 7a. Recoveries of Snipe ringed in the UK and Ireland as chicks and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.



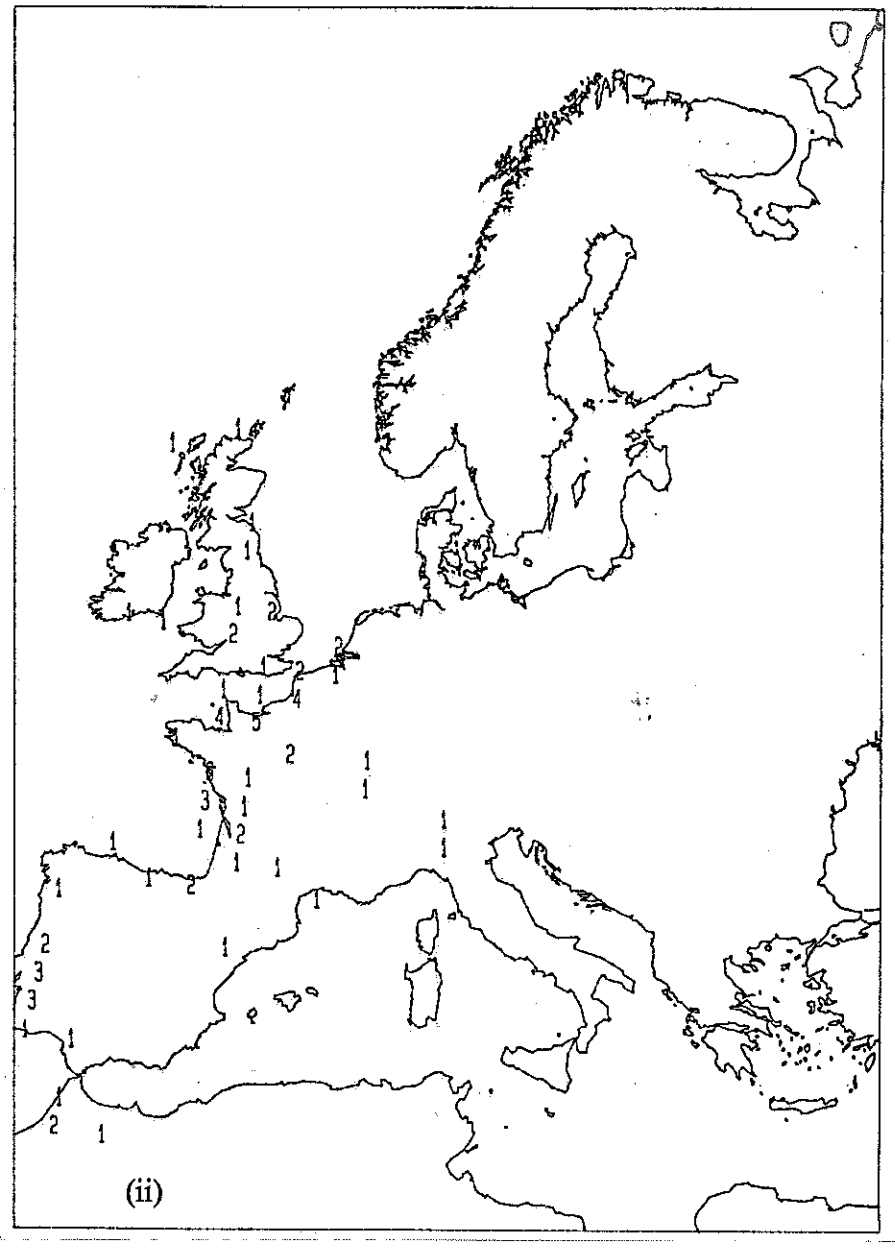


Figure 7b. Recoveries of Snipe ringed in Fennoscandia either as chicks or as recently fledged young (EURING age code 3), and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

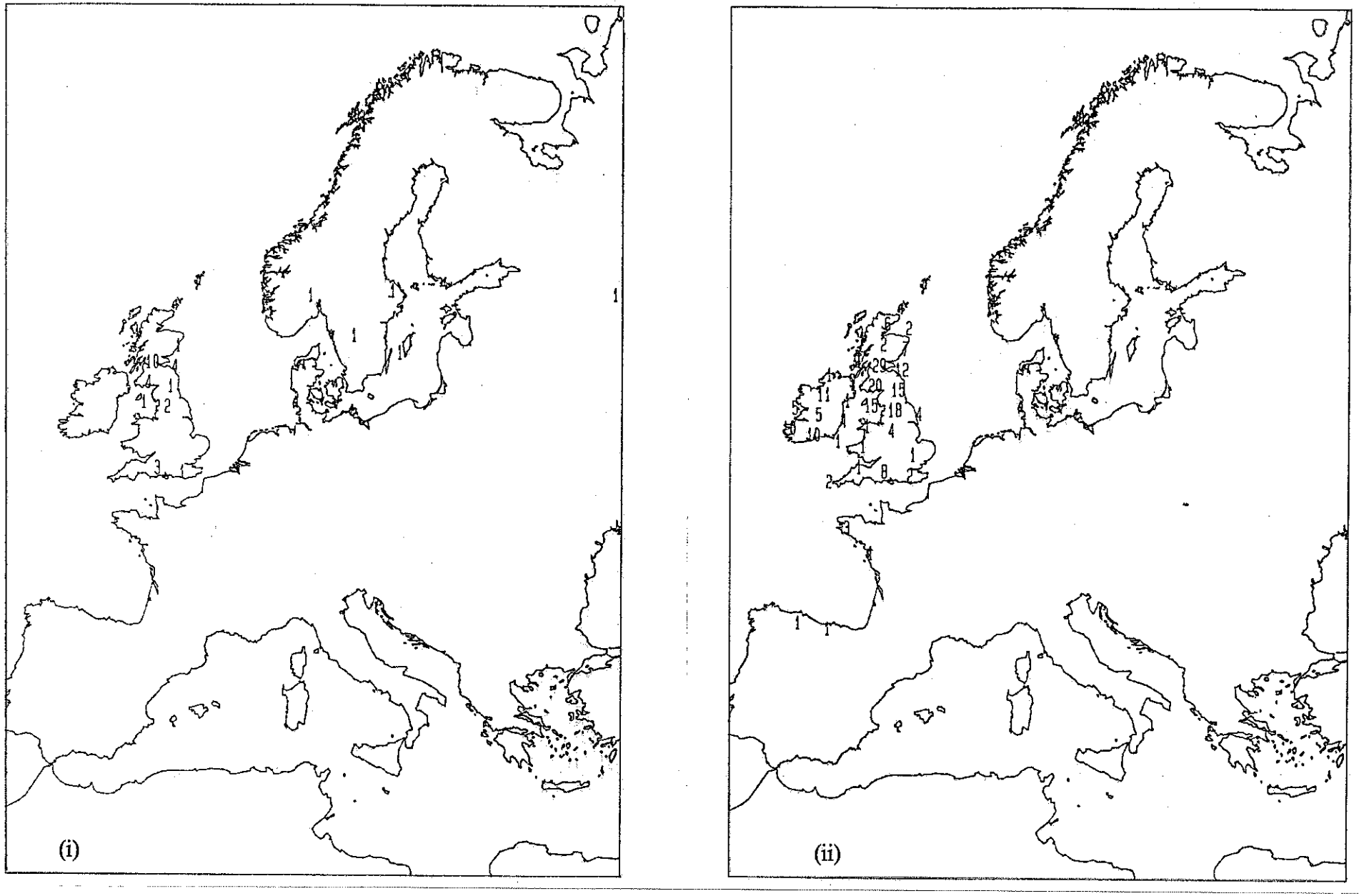


Figure 8a. Recoveries of Woodcock ringed in the UK and Ireland as chicks and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

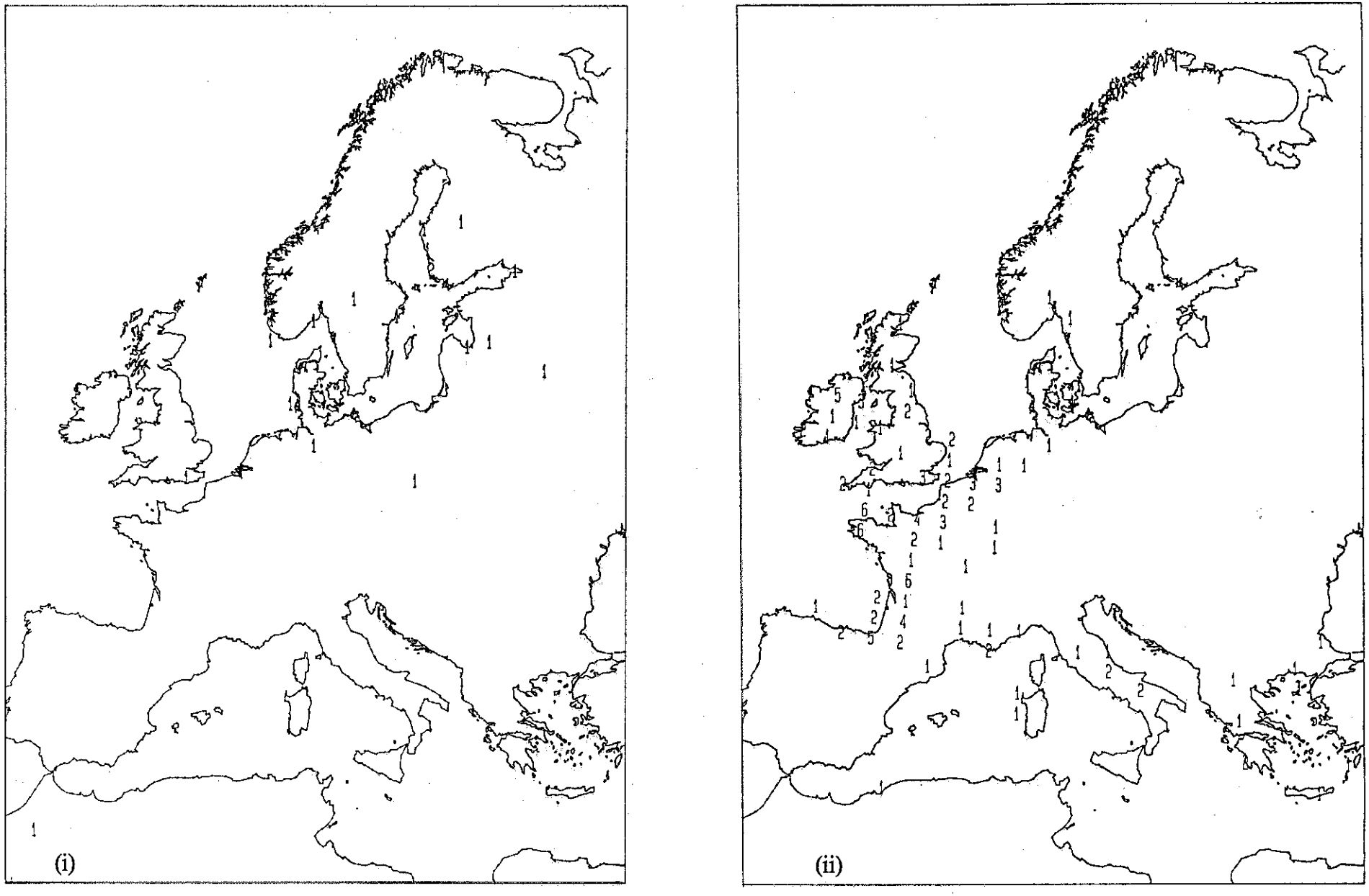
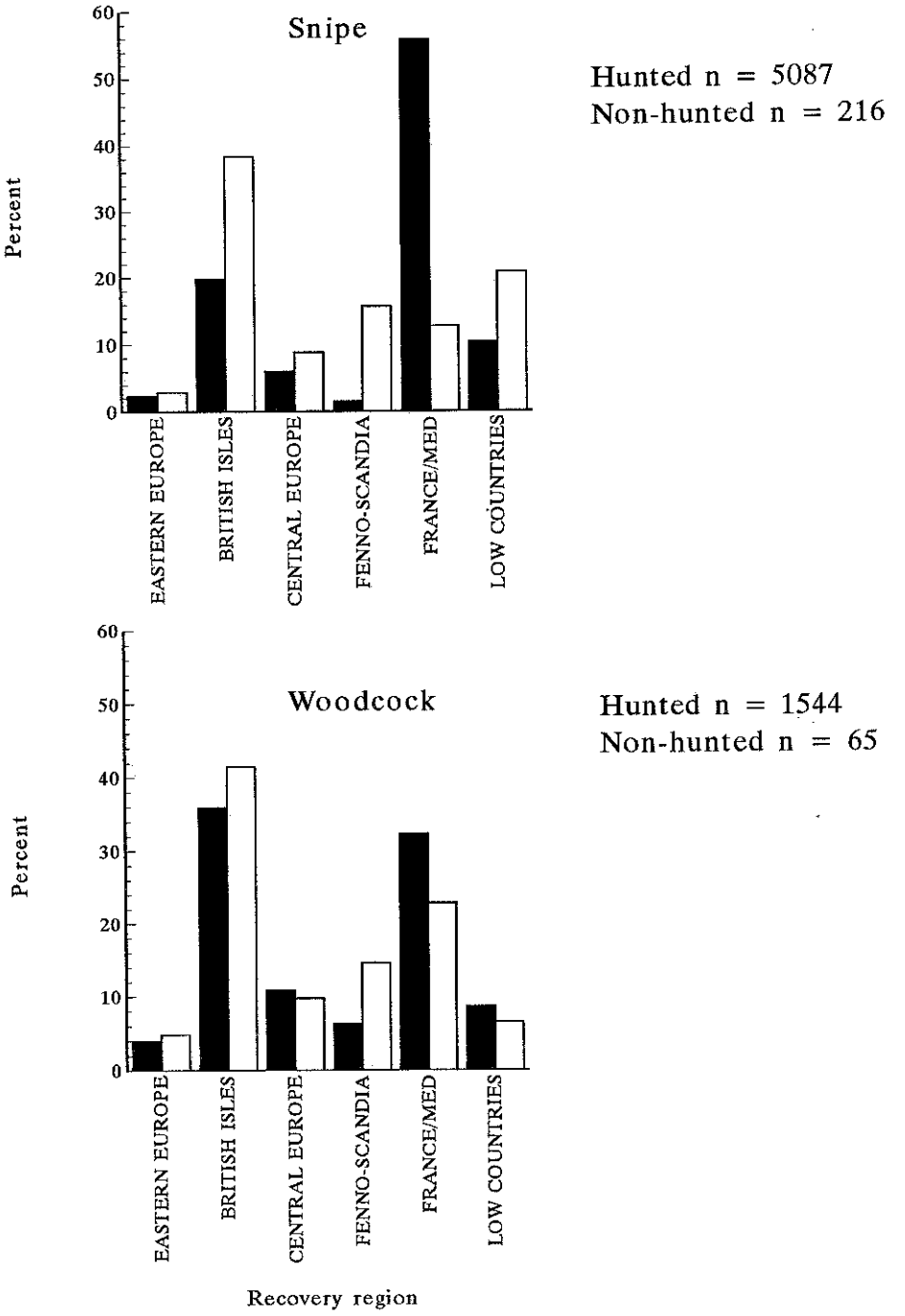


Figure 8b. Recoveries of Woodcock ringed in Fennoscandia either as chicks or as recently fledged young (EURING age code 3), and recovered (dead or alive) during (i) April-July inclusive and (ii) December-March inclusive.

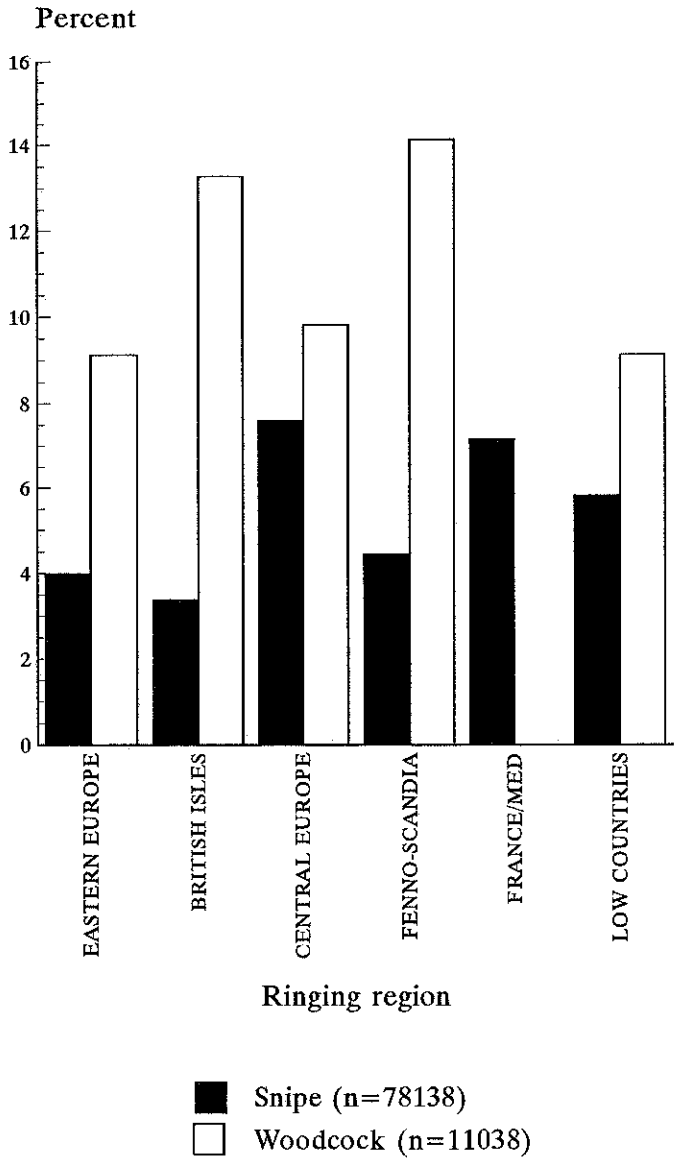
Fig. 9. Regional distribution of hunted and non-hunted Snipe and Woodcock recoveries in Europe



Regional definitions:

EASTERN BLOC: Czechoslovakia, Estonia, Hungary, Lithuania and Poland.
BRITISH ISLES: Britain and Ireland
CENTRAL EUROPE: Denmark, Germany and Switzerland
FENNO-SCANDIA: Finland, Norway and Sweden
FRANCE/MED: France, Iberia, Italy and Malta
LOW COUNTRIES: Belgium and Netherlands

Fig. 10. Regional distribution of hunted Snipe and Woodcock recoveries as a proportion of the number of birds ringed (n = Total number ringed).



Regional data used above:

EASTERN EUROPE: Hungary and Poland.
BRITISH ISLES: Britain and Ireland
CENTRAL EUROPE: Denmark, Germany (DFR) and Switzerland
FENNO-SCANDIA: Finland and Sweden
FRANCE/MED: France, Iberia, Italy and Malta.
LOW COUNTRIES: Belgium and Netherlands

Fig. 11. Long-term variation in the number of hunted Snipe recoveries in each region of Europe as a percentage of the number ringed in each region during each year class (n = number ringed, bars = SE). Country codes are defined in the Methods.

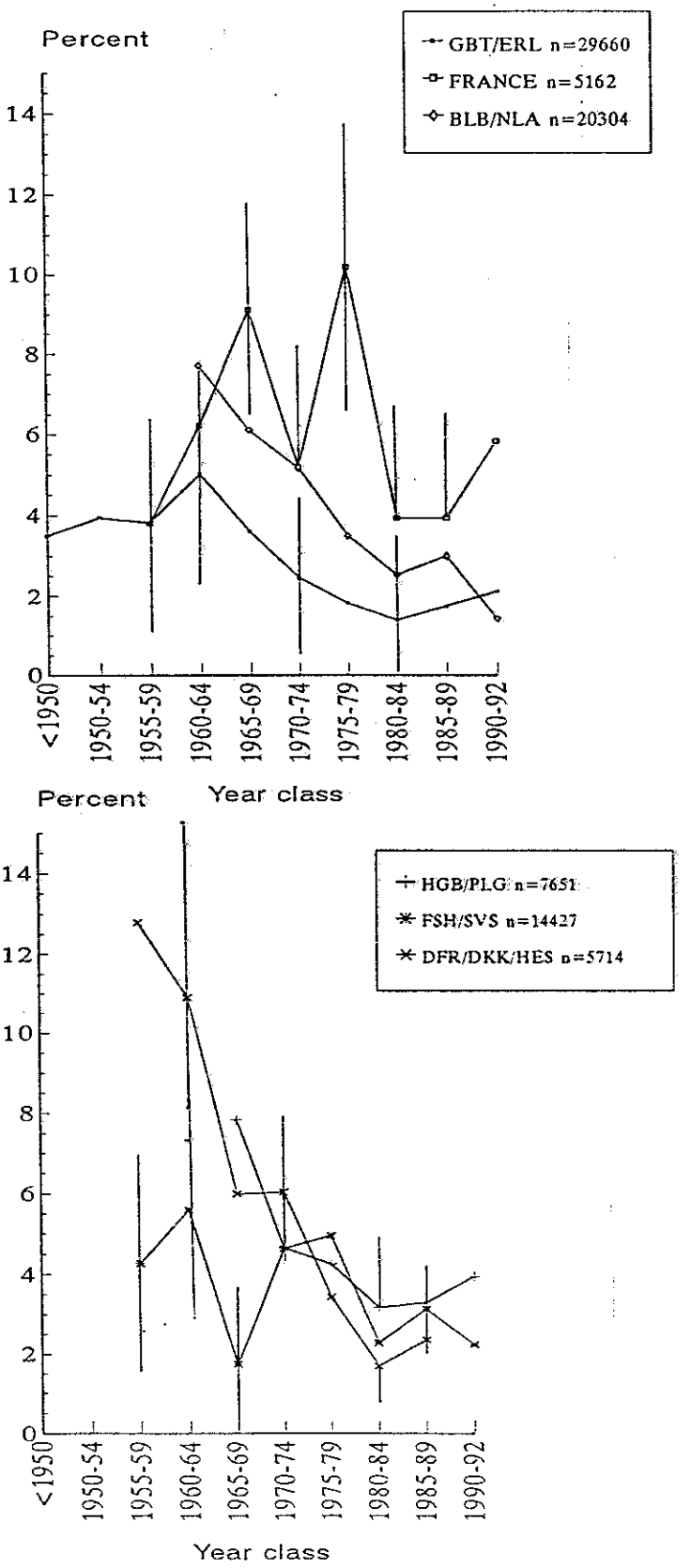
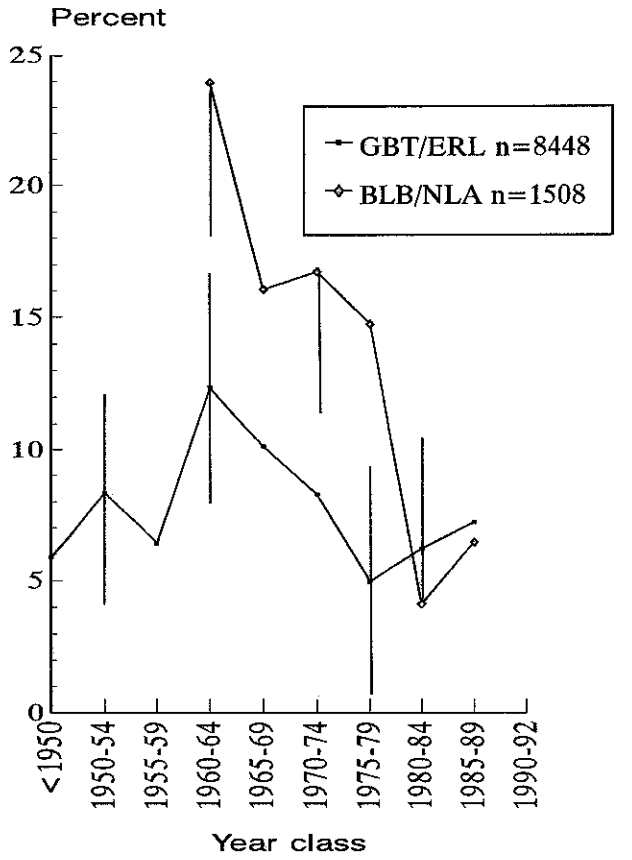


Fig. 12. Long-term variation in the number of hunted Woodcock recoveries in each region of Europe as a percentage of the number ringed in each region during each year class (n = number ringed, bars = SE). Country codes are defined in the Methods.



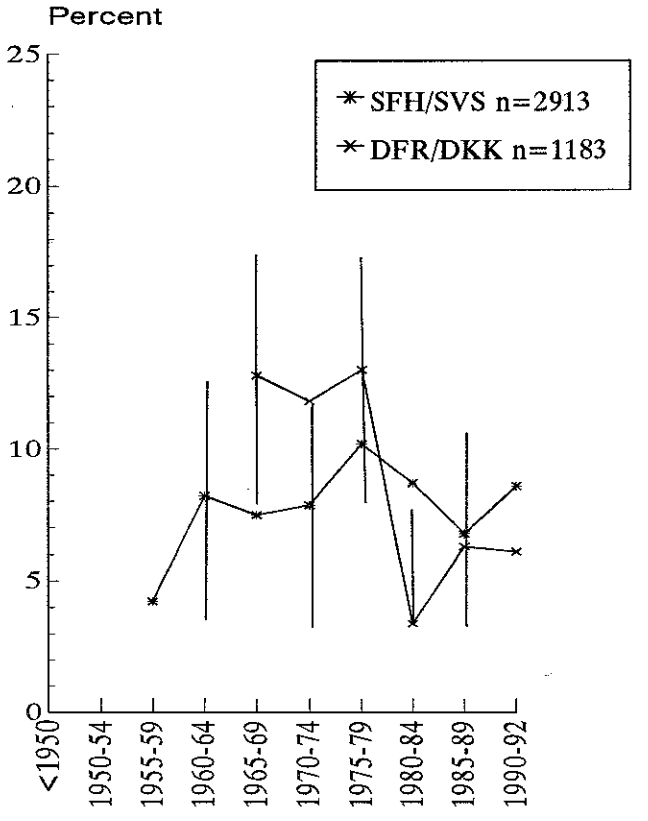
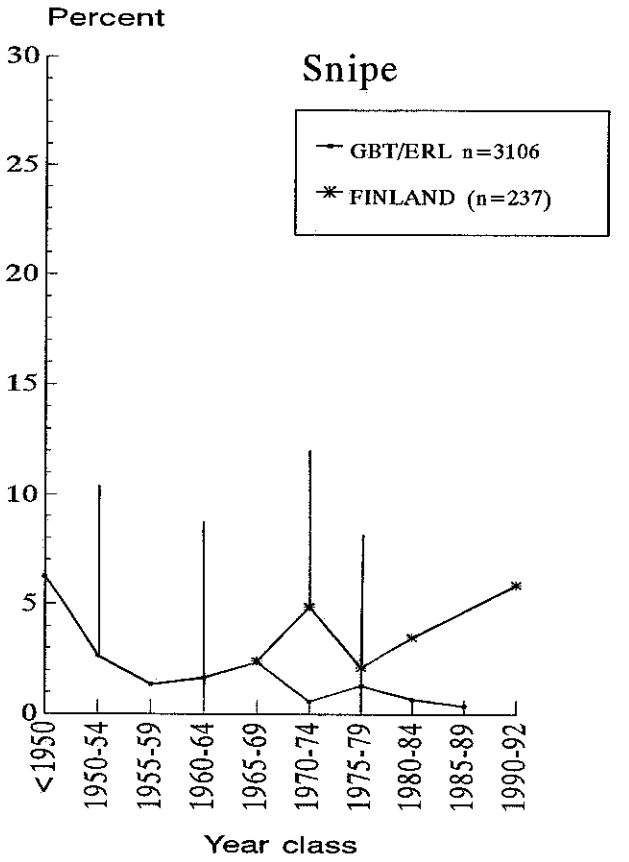


Fig. 13. Long-term variation in the number of hunted Snipe and Woodcock recoveries in two European regions, as a percentage of those ringed as pulli in each region during each year class (n = total number ringed, bars = SE). Country codes are defined in the Methods.



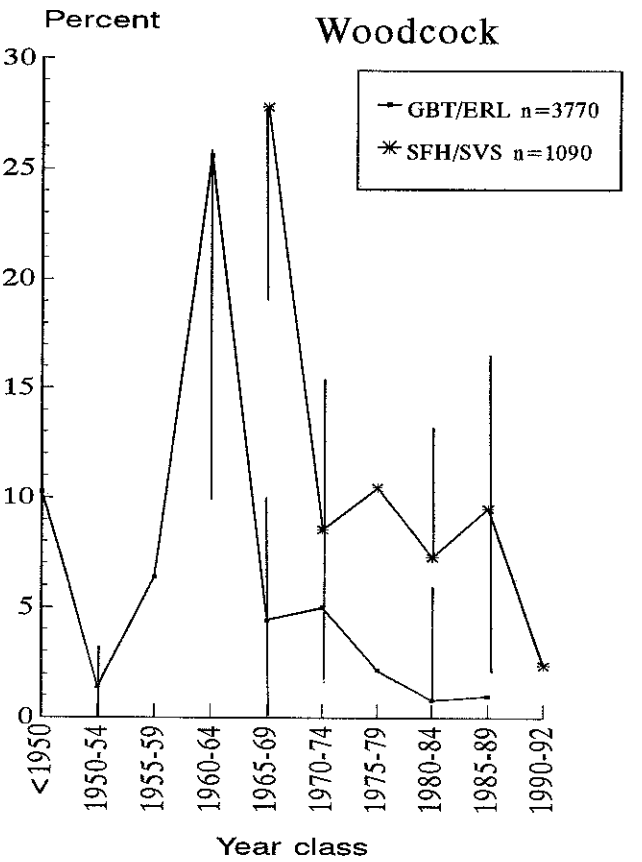


Fig. 14. Temporal variation in the number of Snipe and Woodcock hunted and non-hunted recoveries for the whole of Europe as a percentage of the total number ringed during each year class (n = total number ringed, bars = SE).