The irruption of tits in autumn 1957

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(*Concluded from page 117*)

DISCUSSION

The reasons for the 1957 tit irruption

Lack (1954) suggested that food shortage is the ultimate factor in irruptions and that the proximate stimulus is sometimes this and sometimes a behaviour response to high numbers, as a result of which emigrations may occur before food becomes scarce.

In 1957 there were a number of reports that Blue and Great Tits were more than usually abundant after the breeding season in parts of the British Isles and N.W. Europe. Fortunately, long-term population studies had been carried out on these two species in both England and Holland and these agreed in suggesting the causes of these increased numbers.

A ten-year study (1948-57) of Blue and Great Tits in S. England (Lack 1958) showed that in three broad-leaved woods 76, 55 and 49 pairs of Great Tits bred in 1957, compared with the previous highest figures in the period of 40, 54 and 32 pairs. Similarly, in two pure oak woods, the preferred habitat of the species, 83 and 88 pairs of Blue Tits bred in nest-boxes (plus an unknown number in natural holes) compared with the previous highest figures of 61 and 77 pairs which, it is interesting to note, were in 1949, the year of the previous major irruption. (In two conifer areas the increase of Blue and Great Tits was not so striking and the Coal Tit had been no less abundant in two previous years.) Success per pair, however, was actually lower than usual in 1957, and the high numbers in the autumn were not due to an unusually successful breeding season, but to an unusually large number of breeding pairs resulting from a low mortality in the previous winter (Lack 1958).

In his report on a five-year study of relationships between populations of tits and Goldcrests and their food supply in the pine plantations of Thetford Chase (Norfolk/Suffolk), Gibb (in press) shows that in the winter of 1956-57 the stock of invertebrate food was sustained throughout January and February, when the weather was exceptionally mild, at a level only slightly less than in the autumn, instead of declining sharply at this time as in normal years. Aphids continued to breed prolifically during these two months. The winter began with all species more numerous than usual; and, with the great abundance of aphids in particular, neither Coal Tits nor Goldcrests decreased

perceptibly from October to February. Blue Tits, feeding less on aphids, decreased slowly from September to March, but the eventual breeding populations of all tits in the pines were about twice those of former years. Most of the Goldcrests left unusually early in the spring to nest elsewhere.

In Holland, H. N. Kluyver (*in litt.*) states that breeding Blue, Great and Coal Tits were extremely abundant in 1957. The numbers of pairs nesting and young fledging in five study areas with some 450 nest-boxes are given in Table III. It will be seen that in 1957 all three species showed an increase in breeding pairs, but that only the Great Tits produced more young than in the previous year, though more young Blue and Coal Tits fledged than in 1955. The population

TABLE III—NUMBERS OF PAIRS OF GREAT, BLUE AND COAL TITS (*Parus major, caeruleus* and *ater*) BREEDING IN SOME 450 NEST-BOXES IN FIVE AREAS IN HOLLAND, 1955-57, TO SHOW THE CORRESPONDING NUMBERS OF YOUNG FLEDGED (FIRST AND SECOND BROODS COMBINED)

	Great Tit		Blue Tit		Coal Tit	
	Pairs	Young	Pairs	Young	Pairs	Young
1955	122	897	22	239	9	129
1956	120	1,045	23	296	10	169
1957	248	1,559	34	291	20	156

of Great Tits at one of the sites, which had been surveyed regularly since 1912, had only been as high in two previous years, 1925 and 1941; in 1957 the increase was greatest in the poorer habitats, Scots pine woods, where this species is normally scarce. Kluyver suggests that the extremely high number of breeding pairs might be due both to a fairly successful breeding in 1956 and to the very mild winter of 1956-1957. Breeding success per pair in all three species was lower in 1957 than in the two previous years, agreeing with Lack's findings in England. Kluyver measured the winter population of Great Tits by counting the numbers roosting in the nest-boxes in December and January each year. The figures were 224 in 1955-56, 311 in 1956-57 and only 189 in 1957-58, reflecting both the high winter population in 1956-57 and the high emigration in the late summer and autumn of 1957. He considers that the movements were most probably stimulated by population pressure and both intraspecific and interspecific competition for food.

In Scotland, in another long-term study near St. Andrews, J. M. D. Mackenzie (*in litt.*) states that although he was unable to make a complete survey in 1957 the evidence suggests that Blue Tits were more successful than usual in marginal habitats and this could have accounted for the increase noted in the locality; there, also, the winter

was mild. In Kent, in an area of some 15 acres of woodland (mainly old oak, with a few conifers) C. S. Gerrish (*in litt.*) says that in 1957 there was a considerable increase in the breeding population of Blue Tits, which led to some unusual nest sites being used—open front nest-boxes, old nests of Carrion Crow (*Corvus corone*) and Magpie (*Pica pica*), oil drums, and a nest of House Martin (*Delichon urbica*) from which the tits ejected the owners. There was some evidence here that clutch sizes were above normal and second broods more frequent in 1957.

The causes and nature of irruptions are complex and vary with different species. The movements of Blue and Great Tits in 1957 appear to correspond more closely with the pattern described by Lack (1954) than with that outlined by Svärdson (1957). Lack suggested that big irruptive movements might be stimulated by a behaviour response to high numbers and might then occur before food became scarce, whereas Svärdson thought that they were started by food shortage and tended to stop as soon as areas of abundant food were reached (although he pointed out that they might pass over locally good food resources when a cold air mass had released their urge to fly). The high numbers were present in the late summer and autumn of 1957 in many areas, and such high numbers could lead to pressure on food supplies. There is no definite evidence of food shortage or otherwise in the areas they left, though in England a few observers commented on the poor crops of certain foods, e.g. berries, beechmast, seeds, and some insects and larvae, in their districts. It is difficult to believe, however, that the Blue and Great Tits which moved rapidly through many areas in the south of England in the autumn did so because there was then an absolute shortage of food, or that the areas where they were relatively less abundant in winter (e.g. some parts of southern England) offered less sustenance than places elsewhere where numbers were unusually high (e.g. in the north and west). Lack also pointed out that the irrupting birds often seem abnormally restless and excited and that the flocks contain an abnormally high proportion of juveniles. Many observers commented on this excitement in 1957 (which may have been a factor in their readiness to invade houses) and most ringers noted a high proportion of juveniles, whilst the recoveries show that birds of the year are much more likely than adults to move any distance. In the case of the Coal Tit, Gibb (in press) shows that many birds disperse from the pine plantations at the end of the summer before there is any food shortage, and he believes that aggressive territorial behaviour plays an important part in this.

Other points made by Svärdson were that the irruption species studied by him start an annual flight which is stimulated by the same factors as affect ordinary migrants, but that the duration and length of this flight is very variable in different years; at the same time the

tendency to return to the home of the previous year is weak and the breeding range is therefore fluctuating. The species discussed by him, however, are ones mainly dependent on such vegetable food as seeds, berries and buds. Blue and Great Tits have a more varied diet and in their case there is little to suggest that movements of considerable numbers over any distance are an annual event; in fact, as has been shown in this paper, any journey over ten miles is unusual among British birds in normal years. Many Blue and Great Tits did return to the Continent in the spring of 1958 (though few Coal Tits appear to have done so) and, although the numbers were much less than those in the autumn, it is probable that this can largely be accounted for by the lower intensity of observation on the coasts (departures, too, are often less conspicuous than arrivals) and deaths during the autumn and winter; the latter were probably increased as a result of the high population, the large proportion of first-year birds and the cold spells during January-March 1958. The late return dates of some individuals on the coast suggests that odd birds may have remained to breed here, but there are no reports of unusually high nesting populations in 1958.* Finally, in N.W. Europe at least, there appears to be little evidence that the breeding areas of Blue and Great Tits fluctuate to any extent.

Svärdson mentioned also that the direction of flight of invasion species is often mainly west and the tit movements showed this tendency. The central European tits in 1957 appear to have moved chiefly south-west, whereas in N.W. Europe the direction was west and south-west until they reached the British Isles, when they tended to move mainly between north and west. It is difficult to suggest a reason for the northerly tendency in these movements here, which would seem unlikely to lead them to increased food supplies or less severe climatic conditions.

The Coal Tit, in contrast to the Great and Blue, is known to be an irruption species in some parts of Europe. It occasionally passes through E. Prussia in large numbers, often in those years in which Great Spotted Woodpeckers are also irrupting, and movements have been recorded from Sweden, Holland and Italy, whilst in parts of Russia it is a variable migrant (Lack 1954). There are, however, few previous records of such movements in the British Isles (only 1930, 1947, 1949 and perhaps 1921, with odd Continental birds in other years). The 1957 movements were recorded over a large area of N.W. Europe, including Belgium, Holland, N.W. Germany, S. Sweden,

*In 40 acres of dense oakwood at Eastern Wood, Bookham Common (Surrey), the site of a long-term census, the numbers of Blue Tits in the breeding-season of 1958 showed no significant change from the average of 1950-56 (no counts were made in 1957), but Great Tit numbers were only about half those of previous years (Beven 1959).

Finland and the E. Baltic, whilst there was a fall in numbers in Finland in the winter of 1957-58 compared with the previous year. This suggests that, unlike the Blue and Great Tit, birds of this species from N. Scandinavia (Sweden and Finland) may have been involved to some extent, although there are no ringing recoveries to confirm this. Passage of Coal Tits also occurred in Switzerland, some reaching N. Italy and S. France and one being recovered in E. Germany in the following breeding season. There were few reports of returning Coal Tits in Britain and none in N.W. Europe, perhaps indicating a heavy mortality during the winter.*

Other *Parus* species were clearly little involved. We have seen that a small passage of Marsh Tits was reported in Holland and Germany (and Switzerland) and that there were a very few reports of this species on the coasts of this country (as well as some inland increases), but there is no evidence that any crossed from the Continent. Nor does there appear to be any evidence of large scale movements of this species in the past. Movements of Crested Tits were noted only in Holland.

Svärdson stated that Long-tailed Tits invade Sweden from the east in some autumns. Reports of coastal movements in the British Isles are, however, infrequent and the Northern form (*A. c. caudatus*) has been only rarely identified. In 1957 it seems possible that birds from further north in Scandinavia were also concerned, for there was a heavy passage at Ottenby and a few flocks were seen at the Åland Isles, whilst birds apparently of the Northern race were noted near Bremerhaven in Germany. In addition, movement was reported in most countries in N.W. Europe and Switzerland, though in much smaller numbers than the Blue, Great or Coal Tits and up to a month later (October and November). No examples of the Northern form were recorded in the British Isles, but it seems probable that some of the intermediate race (*A. c. europaeus*) did reach our coasts from the Continent.

The paper tearing and other behaviour

We have seen that in the British Isles the irruption coincided with an increase in the long-standing and widespread habit of opening milk-bottles, and with an even more marked rise in attacks on paper, putty and other materials, although little of this behaviour was reported from elsewhere in Europe.† The opening of milk bottles obviously pro-

*Gibb (in press) shows that Coal Tit mortality is density-dependent in the winter.

†Enquiries by Logan Home (1953) produced three cases of attacks on paper outside the British Isles, in France, Germany and the Canary Isles, and our correspondents gave negative replies for 1957, except for attacks by Great Tits on butter and wrapped meat in E. Germany and on putty in Czechoslovakia. Milk-bottle attacks have previously been reported from a number of European countries (Hinde and Fisher 1951).

vided food for the increased numbers of tits, but there is much less certainty about the causes underlying the attacks on paper, etc. Logan Home (1953), whilst drawing attention to the increased numbers of tits in the autumn of 1949, suggested that there was a tendency for paper-tearing to occur more often in dry autumns (September to November). After 1949, although paper attacks occurred on a small scale in most years, there was no major outbreak until the autumn of 1957, when this even larger irruption took place. In 1957, September rainfall in England and Wales was much above average (although rather below average in October and November); from 1950 to 1956 there were a number of years in which the September to November rainfall was well below average and yet no marked outbreaks occurred. It would seem therefore that paper-tearing is correlated with increased numbers of tits, rather than with the dryness of the autumn.

The reason for these attacks on paper is still puzzling. The most simple explanation is that given by Lack (1958)—that in the autumn the Blue Tit strips bark off branches in searching for food and that, owing to its abnormally high numbers, it was unusually short of food in 1949 and 1957. Logan Home was, however, emphatic that the birds were not driven into houses to attack paper because they were exceptionally hungry. His colour-ringed birds began tearing paper immediately after a good meal at the bird-table, and many of his correspondents said that the birds tore paper or other material while ignoring food placed near-by. The observers recording paper-tearing in 1949 were asked if they habitually fed birds and 80% stated that they did, while 22% of the letters received after the radio appeal (in which no specific question was asked on the point) volunteered such information; similarly, in 1957 24% of the correspondents stated, without being asked, that the birds were regularly fed. In 1957, as in 1949, several observers noted that paper-tearing ceased abruptly at the onset of severe weather and during both invasions October and November were the peak months for the attacks. In his studies of the feeding ecology of tits, Gibb (1954) found that it was in mid-winter that food was especially short and competition for it at its severest; he saw most supplanting attacks for food from November to January and more recently (in press) he has concluded that the population of the Coal Tit is controlled by food shortage in winter. In addition, Logan Home noted that the birds did not eat the paper; the scraps were not usually held in the foot or examined, but were dropped immediately. A number of observers confirmed this in 1957-58 and there were no cases of tits being seen to eat things under the paper. The entering of houses did, however, lead to the discovery and eating of such food as butter, chocolates and sweets in a number of instances, though these records were far fewer than the attacks on paper.

Nevertheless, the vastly increased numbers of tits must have led to greater pressure on the supply of food unless this increased in proportion with the birds or unless there is normally a superabundance of it. A parallel increase of all foods is unlikely, and it has already been mentioned that a few observers reported shortages of some berry and nut crops and certain insects. The poor crop of beechmast would affect Great, Blue, Coal and Marsh Tits, as Gibb has shown that all four species feed on it to an important extent in autumn. The mild winter, however, may have led to an increase in the numbers of some insects. Dr. R. Hull of the Rothamsted Experimental Station has pointed out that there were large numbers of aphids on crops in May and June 1957 in northern France, Belgium, Holland and part of W. Germany, as well as in this country (especially S.E. England), and he also believes that the mild winter of 1956-57 was the most important factor responsible (see also Gibb in press). He adds (*in litt.*) that the winter of 1948-49 was also mild and that this was similarly followed by an increase in aphids, though on a smaller scale. Tits, especially Coal Tits, do feed on aphids and he suggests that the high population may have been able to feed successfully on them in the early summer of 1957, and may then have found themselves short of food when aphid numbers dwindled in the late summer.

Tits are catholic feeders and there is no full information on the effect of weather and other factors on their different food supplies in 1957, so that it is impossible to say whether their food was in short supply that autumn, though this is possible and perhaps even probable. The scale of milk-bottle attacks and the severe increase in damage to fruit in Kent orchards (Wright 1959) suggest this. But though the tits which entered houses were often able to obtain adequate supplies of certain food items such as milk, or fats, nuts and bread from bird-tables, they may have still been short of certain kinds of insect food which provide some unknown but essential feature of their diet at this season. Hinde (1953) first pointed out that the movements made by tits tearing paper are very similar to those they make in tearing bark from a twig when searching for insects underneath and Gibb's researches (1954) showed that Blue Tits in deciduous woodland search dead parts of trees mainly in those months of the year when paper tearing is most frequently reported. Hinde, however, thought it highly unlikely that the birds were looking for some specific and essential item of food temporarily in short supply (though his reasons for dismissing this hypothesis are not clear) and argued that paper tearing was simply an expression of the hunting or food-searching drive. Given a certain combination of internal and external causal factors, he suggested, the tits must behave in this way; the behaviour brings "satisfaction" because the internal drive finds expression, even though no immediate biological advantage is gained. He quoted

Gibb's view that there might be a long-term advantage for a species relying on a succession of temporarily (super)abundant food sources, each liable to give out at any time, to continue a general search even in times of plenty to avoid a hiatus between exhausting one food supply and discovering the next.

It is worth stressing again that most of the attacks on paper and similar materials involved entering buildings, mainly houses. Tits are normally reluctant to do this, and it may be that the excitement and crowding in invasion years (or hunger) help to overcome their normal fears. And there is evidence that where tits are free to wander round inside a house attacks on paper are a regular occurrence in autumn. Thus Howard (1956) described how many of her Great Tits indulged in paper tearing, hammering at furniture or ripping upholstery between September and November every year. She referred to it as a "game" or "pastime" and said that it was abandoned by the end of November, when days are short and natural food takes longer to find. This view that tits tear paper not when food (whether general or particular) is in short supply, but when they have ample food and time and energy to spare is not inconsistent with Hinde's explanation. It is supported by another observer (Miss M. R. Robertson, *in litt.*) who has had Blue Tits entering the house regularly for some years. She also finds that some paper tearing occurs every year, between the end of the moult and the first onset of cold weather, and similarly believes that the tits cease then because they are too busy searching for food to have time for "games". She has found, however, that only a small proportion of her Blue Tits tear paper and tentatively suggests that tearing is an intensified form of play, indulged in by a few "rogue" individuals, probably males. This hypothesis needs testing by others who can study colour-ringed tits in such circumstances. F. Turček stated (*in litt.*) that paper tearing was usual in his captive Great and Coal Tits, and Logan Home quoted a number of records of such behaviour by tamed individuals of other species.

The correlation between increased numbers of tits in irruption years and increases in attacks on milk bottles, paper and putty appears to be established. Food seems clearly the reason for the opening of milk bottles (and perhaps putty attacks also, for in most cases the putty was fresh and it may then provide edible oils). There is, however, a sharp difference between those explanations of paper tearing which link it with a general or particular food shortage and those which connect it with an abundance of food that allows time for "play" or the expression of the hunting or food-searching drive. Further research appears necessary to resolve these differences.

The birds other than tits

It is probable that the mild winter of 1956-57 led to an increased

survival in N.W. Europe of many other species besides the tits, particularly the smaller ones which are often particularly vulnerable to hard weather. This seems the most likely reason for the increased coastal movements here of species which are regular migrants in variable numbers, such as Goldcrests, Firecrests and Tree Sparrows. The increases of Dunnocks, Wrens and Treecreepers on the coast and inland, and of Nuthatches entirely inland and Bullfinches mainly so, may also probably be ascribed to the mild winter here (though there are some indications in the case of the Bullfinch that a general increase is taking place in a number of areas in Britain). Reports of these species on the move in Europe were few (Nuthatches and Treecreepers in small numbers in Switzerland, and a heavy passage of Treecreepers at Ottenby, S. Sweden), but the southern and eastern distribution of many of our records makes it not impossible that odd individuals of some of these birds crossed the sea (e.g. the Treecreeper at Dungeness on 10th October).

In the cases of the other four species mainly concerned—Redpoll, Siskin, Jay and Great Spotted Woodpecker—irruption movements are known to occur over parts of their ranges. Whereas in the past the Redpolls involved in the British Isles have been mainly of the Northern or Mealy form (*C. f. flammea*), the movements in 1957 appear to have concerned the British and Central European races (*C. f. disruptis* and *cabaret*). Unusual passage of Redpolls on the Continent was reported only from Holland and Switzerland, and the ringing recoveries and dates of the main movements of this species on our east and south coasts suggest that mostly native birds were involved, or perhaps that some from the adjoining parts of Europe were re-orienting themselves after moving here. With the Great Spotted Woodpecker also, previous major irruptions have concerned the Northern form (*D. m. major*) and the reports of movements in the E. Baltic and the Åland Isles suggest that there may have been a small irruption of this race in 1957. Unlike 1949, this form was not identified in the 1957 movements in Britain, and the birds involved were probably natives with, possibly, in view of the more southerly distribution of records and the coastal movements reported in France and Holland, a few from the immediately adjoining areas of the Continent.

Siskins and Jays, like most of the spectacular irruption species, have specialised food requirements in autumn—Siskins being heavily dependent on the seeds of birch and alder (Svärdson 1957) and Jays on acorns—so that food shortage may have played a direct part in their movements. There was also a major irruption of Siskins in 1949 when birds ringed in Sweden and Belgium were recovered in the winter as far south as S. France, Spain and Italy; Svärdson shows that this was caused by a shortage of birch seeds in autumn, after a rich spruce crop in the previous winter had led to an unusually high

breeding population in Scandinavia. In 1957, however, unusual movements were recorded only in S. Sweden and Switzerland (apart from a few on Ushant, France). The passage of Jays in 1957 attracted more attention, with large-scale passage recorded in the adjoining parts of Europe (Holland, Belgium and Luxembourg), whence most of the birds seen here probably came, as well as in the E. Baltic and Switzerland. No definite information is available on the state of the acorn crop in N.W. Europe, but it is probable that the shortage noted in some parts of this country also occurred on the Continent.

SUMMARY

(1) In 1957, increases of Blue and Great Tits (*Parus caeruleus* and *major*), and to a much lesser extent of Coal (*P. ater*), were noted in the British Isles after the breeding-season and were followed by an influx of all three species on the east and south coasts of England in mid-September. The invasion reached a peak in early October, when almost the whole of the English coast from Northumberland to the Isles of Scilly was affected. On the west coast the main movements occurred later, and it is likely that some Continental and many native birds moved between north and west across the country. The coastal influx largely ceased in early November. Blue Tits were the most numerous; in the south Great Tits outnumbered Coal, while the position was reversed in the north. Long-tailed Tits (*Aegithalos caudatus*) occurred in much smaller numbers, mainly in October on the coast.

(2) Winter numbers were above normal in many areas. The return passage lasted from January to mid-May 1958, with peak numbers on the coast (mainly Blue and Great Tits, with very few Coal) in late March and April.

(3) The irruption was marked by an increase in the opening of milk-bottles by tits and an outbreak of paper-tearing on a scale not known here since 1949, as well as attacks on putty, textiles, etc. These attacks were most frequent between October and December.

(4) British-ringed Blue and Great Tits are normally very sedentary, but in 1957-58 the proportion of recoveries more than ten miles from the place of ringing almost doubled, while those of more than thirty miles trebled. Some juvenile tits ringed in summer 1957, and birds ringed on the coast and elsewhere after the irruption began, moved mainly between north and west in the autumn and winter. Recoveries after early March 1958 show return movements mainly between east and south-west. Recoveries confirm that Blue and Great Tits from N.W. Europe were involved in the irruption into Britain.

(5) Similar increases occurred on the Continent after the 1957 breeding-season, and in N.W. Europe as a whole there were marked movements of Blue, Great and Coal Tits in the autumn in many coastal and inland areas; these were mostly between south-west and west, extending to the British Isles and S.W. France. There was a similar passage from central Europe, through Switzerland to S. France and N. Italy. No reports of attacks on milk-bottles or paper were received from the Continent.

(6) It is argued that Blue and Great Tits should be regarded as true irruption species in N.W. Europe. The evidence for previous irruptions is discussed; these may often have been overlooked in the British Isles owing to the difficulty of detecting movements and increases of common species before the present network of coastal and inland observers was established. There is strong evidence that the irruption was due to the high numbers surviving the mild winter of 1956-57.

It may have been caused by a behaviour response to these high numbers before any actual food shortage occurred.

(7) While hunger probably led to the increased opening of milk-bottles, there are two conflicting kinds of explanation for the paper-tearing: one of these links it with food shortage (general or specific) and the other considers that it is the result of an abundance of food allowing time for "play" or the expression of the hunting or food-searching drive.

(8) Increases in other birds are discussed. These included four species that are known to be subject to irruption movements—Redpoll (*Carduelis flammea*), Siskin (*C. spinus*), Great Spotted Woodpecker (*Dendrocopos major*) and Jay (*Garrulus glandarius*). The movement of Jays in Britain was on a considerable scale, involving birds from adjacent areas of the Continent.

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Thanks are also due to the many listeners who responded to the radio appeals. But perhaps above all are we grateful to the observers throughout the country who kept records of the movements, increases and behaviour of these common species and so enabled the nature and extent of the irruptions to be adequately described. Their names are listed below. We regret that space has prevented their records being given in full and we hope they will feel that their labour was not in vain.

England

M. C. Adams, Mrs. Adlam, A. F. Airey, W. B. Alexander, A. Allen, R. C. Allan, Lt.-Col. W. E. Almond, R. Angles, G. A. Arnold, M. A. Arnold, R. W. Arnold, R. W. Arthur, Dr. J. S. Ash, J. Ashbee, Rev. J. Aspinal, H. E. Axell.

R. H. Baillie, C. Balch, A. Baldridge, D. K. Ballance, J. Barlee, N. Barnes, Mrs. R. G. Barnes, T. L. Bartlett, J. Bassett, I. R. Beames, Rev. J. E. Beckerlegge, D. G. Bell, T. Hedley Bell, H. Bentham, Dr. G. Beven, H. A. Bilby, D. F. Billett, J. Bonets, C. Gordon Booth, J. A. S. Borrett, J. K. Bowers, A. W. Boyd, H. J. Boyd, W. G. Breed, T. E. Brice, Miss E. P. Brown, K. W. Brown, Mrs. R. Brown, R. Brown, M. Bryant, A. Bull, A. L. Bull, J. F. Burton, Mrs. E. M. Butler, Major A. Buxton, E. J. M. Buxton, J. Buxton.

Mrs. O. M. Cairnes, Major F. G. Caldwell, Dr. Bruce Campbell, W. D. Campbell, T. Cavalier-Smith, P. J. Chadwick, W. A. Chaplin, Miss H. Charles, G. L. Charteris, Miss J. Chester, R. Chestney, R. Chislett, F. R. Clafton, P. R. Clarke, Miss J. Clarkson, Mrs. Clesney, Lady Mary Clive, G. E. Clothier, B. J. Coates, R. P. Cockbain, R. Codd, E. Cohen, H. Cole, Mrs. M. L. Colthurst, P. J. Conder, Miss M. Conway, A. J. Cooke, R. Cooke, B. E. Cooper, J. F. Cooper, R. P. Cordero, Mrs. M. T.

Corlett, A. V. Cornish, R. K. Cornwallis, E. J. Cottier, L. A. Cowcill, Mrs. S. Cowdy, R. A. F. Cox, S. Cox, Mrs. J. H. Craggs, G. Crees, M. D. Crosby, R. Crossley, J. Cudworth.

W. H. Dady, J. Darnell, G. P. Davies, M. Davy, H. Dawson, E. P. Day, Mrs. H. Dehn, R. H. Dennis, R. F. Dickens, G. Dinwiddy, A. Dobbs, G. Dunkling, C. J. Dymond.

W. Eales, Miss Eldridge, G. S. Elliott, E. A. Ellis, R. Elmes, R. D. English, Dr. E. A. R. Ennion, Rev. and Mrs. A. J. Evans, P. R. Evans.

D. Felstead, G. Felstead, C. Felton, R. Felton, I. J. Ferguson-Lees, J. Field, G. Flock, J. C. Follett, Miss K. G. Foott, F. M. Forth, J. T. Friedlein, D. Frumage, D. E. Fry.

C. S. Gerrish, E. H. Gillham, J. C. Gittins, Miss E. M. Goom, E. Gorton, H. G. Gould, E. Goulden, A. Grasemann, F. C. Gribble, Miss G. A. Griffiths, G. H. Gush.

E. Hardy, Dr. J. M. Harrison, R. H. Harrison, D. Hart, Rev. P. H. T. Hartley, C. H. Hawes, Mrs. M. Hayes, R. W. Hayman, Mrs. A. Haynes, A. Hazelwood, C. J. Henty, Canon G. A. K. Hervey, E. C. Herwin, M. Hessey, J. H. Hewitt, R. A. O. Hickling, J. A. Hicks, Miss E. M. Hillman, N. L. Hodson, H. Holgate, H. C. Holme, P. F. Holmes, F. J. Holroyde, R. C. Homes, A. Hopson, A. G. Horner, R. Hull, H. Hunt, Lord Hurcomb, H. G. Hurrell, W. D. Hyde.

D. E. Jebbett, G. J. Jobson, Miss K. M. Johnson, S. T. Johnstone, E. L. Jones, O. D. Jones.

J. F. C. Keep, Miss M. W. Kendall, Miss E. Kiddie.

Dr. D. Lack, P. D. W. Lalley, A. E. Land, H. Lapworth, J. J. Latham, Miss M. Law, C. R. Lawson, P. F. Le Brocq, Mrs. E. Lee, Miss B. Lonsdale, J. Lord, R. J. Lovell, W. G. Luton.

Lt.-Cdr. E. S. W. Maclure, B. A. E. Marr, Mrs. M. Marriott, R. V. A. Marshall, M. Marston, J. M. McMeeking, H. P. Medhurst, D. S. Miles, A. B. M. Mills, Mrs. I. Mitchell, K. D. G. Mitchell, D. J. Moor, N. C. Moore, P. J. Mountford, W. Mulligan, J. Mutimer.

J. F. Naylor, A. Y. Norris, P. North.

P. T. Paisey, K. H. Palmer, Dr. J. D. Parrack, E. R. Parrinder, A. G. Parsons, J. L. F. Parslow, C. H. F. Parsons, Miss J. M. Pattison, Mrs. J. Payne, J. F. Peake, H. Pease, Col. R. B. Phayre, N. R. Phillips, Major W. W. A. Phillips, E. G. Philp, Mrs. I. Picknell, A. Pilkington, W. A. Pope, R. M. C. Potter, H. E. Pounds, G. A. Pyman.

Miss H. M. Quick.

W. T. C. Rankin, P. A. Rayfield, G. H. Rees, B. W. Renyard, M. G. Ridpath, J. N. A. Rignall, P. Roberts, L. S. Robertson, R. W. Robson, M. Rogers, G. G. Rose, M. P. Roseveare.

B. L. Sage, Col. H. M. Salmon, Mrs. J. Scoles, R. E. Scott, T. Seabrook, M. J. Seago, D. R. Seaward, P. Seaward, Mrs. M. Sée, H. J. C. Seymour, T. B. Silcocks, J. Simons, T. R. Smeeton, M. S. J. Snoxell, C. S. Sore, J. H. Sparks, K. G. Spencer, R. Spencer, J. Stafford, Dr. John Stafford, Col. J. K. Stanford, P. J. Stead, T. J. Stephens, C. J. Stevens, I. F. Stewart, R. Stokoe, Mrs. D. E. Stone, R. C. Stone, B. M. Stratton, Dr. C. Suffern, Mrs. G. Swanston.

J. H. Taverner, W. G. Teagle, L. C. Tearnan, C. F. Tebbutt, G. W. Temperley, Miss E. M. Thouless, H. F. Ticehurst, N. F. Ticehurst, A. D. Tomlin, B. P. Tompsett, G. E. Took, M. J. Torode, M. Townsend, W. H. Tucker.

A. Vittery.

J. Wagstaff, D. I. M. Wallace, J. J. Walling, E. Ward, D. G. Warman, Prof. E. H. Warmington, R. B. Warren, E. L. E. Watkiss, B. Watkinson, L. Watkinson, G. L. Webber, A. Weir, A. Welch, Mrs. A. West, J. K. Weston, P. D. Whalley, S. White, A. A. K. Whitehouse, J. S. Wightman, C. K. Wiles, E. Williams, Miss H. K. Willaws, K. Williamson, R. J. Wilmshurst, D. Wilson, D. R. Wilson, E. J. Wiseman.

A. Yorke-Norris, G. E. Young.

Wales

Mrs. K. E. I. Barham, D. H. Coggins, W. M. Condry, Miss N. Jenkins, R. M. Lockley, Miss V. J. Macnair, A. E. Male, Mrs. D. R. Rees, Mr. and Mrs. L. S. V. Venables.

Scotland

P. Davis, Dr. W. J. Eggeling, Miss W. U. Flower, J. A. Harris, Col. W. M. Logan Home, W. Hower, Rev. J. Lees, T. G. Longstaff, J. M. D. Mackenzie, A. T. Macmillan, M. F. M. Meiklejohn, C. P. Rawcliffe, Miss M. R. Robertson, Rev. E. T. Vernon, G. Waterston.

Ireland

M. Bailie, S. G. Bennett, R. Cowden, H. Gemmell, J. G. Gray, F. King, C. Meredith, Major R. F. Ruttledge.

Channel Isles

Mr. and Mrs. K. Le Cocq, W. D. Hooke, S. F. Hooke, E. D. H. Johnson, I. H. Sutherland.

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APPENDIX A (1)—NUMBERS OF BLUE, GREAT AND COAL TITS (*Parus caeruleus, major* and *ater*) SHOWN IN OBSERVATORY LOGS BETWEEN 11TH SEPTEMBER AND 6TH OCTOBER 1957

		September																			October					
		11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	1st	2nd	3rd	4th	5th	6th
Spurn (Yorkshire)	Blue			1		1	12	4	10	4	4							1	2	2	1	65	13	22	24	2	50+
	Great						8		1	6											1	3					1
	Coal				2	2	1	1	3		4									4	1	13	8			3	1
Gibraltar Point (Lincolnshire)	Blue	2	2	3	4	3	6	3	6	4	.....		6	20	.....							2	50+	2	.....		200
	Great	1	2								.....		1	14	.....										.....		12
	Coal					2					.....			4	.....										.....		
Dungeness (Kent)	Blue					9	25	5	3	3	3	6	2	20	10	15	5	8	6	3	15	20	15	10	25	20	275
	Great						2	1					1	1		1		2						1	2		50
	Coal				2		1	1	1																		40
Portland Bill (Dorset)	Blue							20+	25+	c15	c15	15+	c10	4+	10	12	c12	c200	460+	c10	c10	c20	c20	12	15	60	100
	Great															1		3	27		1				4	1	1
	Coal						2			1							1		1		1	2	2	1	1	2	
St. Agnes (Isles of Scilly)	Blue																							1			25
	Great	(2 pairs bred; c16 from 28.viii to 17.ix when increase to 22 and none next day; then up to 8 on several days)																						5	5	5	20
	Coal																										60+
Lundy (Devon)	Blue																1	4	3	2	4	3	4	4	c80	c65	30
	Great																		1		1				1	4	
	Coal																					2	3	1	3	5	5
Skokholm (Pembrokeshire)	Blue																					15	8	5	15	2	8
	Great																3					3	1	1	1		
	Coal																					3	1	1			
Bardsey (Caernarvonshire)	Blue																			2+	2+	1+	2+	2+	5+	5+	2+
	Great																					1+	1+	2+	p	5+	1+
	Coal																			3+	3+	c8	3+	2+	p		
Great Saltee (Co. Wexford)	Blue																										
	Great																										
	Coal																										

All the observatories were manned every day except during the periods marked by parallel dotted lines; a complete blank thus means that no birds were recorded although observers were present. p indicates that birds were noted but their numbers not estimated

Appendix A (2)—Numbers of Blue, Great and Coal Tits (*Parus caeruleus, major* and *ater*) shown in observatory logs between 7th October and 31st October 1957

		October																								
		7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st
Spurn (Yorkshire)	Blue	80+	42		6		19	15	5	80+	6	12	12	c150	24	8	7	9	18	12	6	2	3	24	4	1
	Great	5	1				2	1		1		5		40	30	1	4		2	1	2					
	Coal	7	6				2	2	1			30	20	c50	1	3	1	1		4	8	2				
Gibraltar Point (Lincolnshire)	Blue	100+	.....																			12	.....			
	Great		.....																			6	.....			
	Coal		.....																			6	.....			
Dungeness (Kent)	Blue	15	15	45	30	5	50	15	10	10	15	40	30	12	8	6	10	10	50	25	50	15	12	4	6	
	Great	20	10	25	20	5	10	25	20	2	4	15	10	2	1			3	5	6	6	6	4	2	6	
	Coal				6		10	10	1			1														
Portland Bill (Dorset)	Blue	300	50	20	75	30	25	60	30	30	.....	50	20	150	30		20		50	6	12	70			50	
	Great	150	40	12	20	30	40	15	10	15	.....	15	10	20	10		6		15	15	10	10			6	
	Coal		2	2	1	2		1	1	3	.....			5	6											
St. Agnes (Isles of Scilly)	Blue	125	200+	70	100	70	50	40	25	(some stayed and 12+ still present 7.xi)																
	Great	40	50	70	50	50	60	50	30	(diminishing number stayed and 12+ still present 7.xi)																
	Coal	20	20	20	25	20	20	20	10	(a few stayed to first week November)																
Lundy (Devon)	Blue	35	12	40	20	c25	13	c20	c20	15	10	5	6	4	4	5	6	.....								
	Great	2	2	10	15	15	10	10	15	10	4	2	2	5	2	5	4	.....								
	Coal	14	8	15	3	30	5	3	4	5	6	1	4	10	6	3	5	.....								
Skokholm (Pembrokeshire)	Blue		4	9	12	16	30	10	25	30	50	9	6	20	12	12	6	4	29	2	1+	.....				
	Great		1	25	11	6	12	5	5	7	15	2	8	16	12	6	4	4	8	6		.....				
	Coal		4	1	2	2	3	3	8	4	10		2	5	4	3	1	3	6	3		.....				
Bardsey (Caernarvonshire)	Blue	c3	c75	20+	15+	c10	c10	5+	c5	c5	c5	1+	5	50+	1+	10+	c10	c10	c10	c10	p	p	10+	.....		
	Great	2+	c15	c5	2+	2+	c5	1+	2	2	2	1+	1+	2+		1+	1+	7	1	1		1	1	.....		
	Coal	1	c120	c5	c15	c10	10+	1+	5+	c3	c3		2+	3+	1	4	c10	5+	10+	c5	p	p	10+	.....		
Great Saltee (Co. Wexford)	Blue			1		2+	6+	.....																		
	Great			10+	12	1		.....																		
	Coal							.....																		

All the observatories were manned every day except during the periods marked by parallel dotted lines; a complete blank thus means that no birds were recorded although observers were present. p indicates that birds were noted but their numbers not estimated

APPENDIX B—THE IDENTIFICATION OF CONTINENTAL TITS

The identification of tits from the Continent (especially from adjoining areas such as France and the Low Countries) is difficult in the field, and even in the hand. Only a few observers felt able to make definite claims of Continental birds in 1957-58 and those willing to express an opinion sometimes differed in the criteria they used. As the evidence from ringing recoveries and the observations in this country and abroad make it clear that Continental birds were involved in the irruption into the British Isles, it is not necessary to examine this complex problem in detail, but two aspects deserve mention.

Some ringers used the wing-measurements of the Blue Tit given in *The Handbook* (Witherby *et al,* 1938) as a means of separating British and Continental races, but as several observers have established that undoubted British breeding birds have wing-measurements in excess of those in *The Handbook* this method must be adopted with caution. During the irruption, however, there were a number of records of measured birds strongly suggesting the nominate race. For example, the *Dungeness Bird Report 1957* (p. 17) gives a summary of the wing-lengths of 208 Blue Tits trapped at Dungeness between 15th September and 17th November 1957, 182 being birds of the year; of these 208, 25 had wings of 67-69 mm. and these larger birds occurred mostly at the peak of the irruption.

Again, though some Continental Coal Tits can be recognised by the clear grey back, this character is of less value for birds from the adjoining areas of Europe, which were the ones mainly concerned in the irruption, for, as Snow (1955) has pointed out, the colour of the back becomes less pure blue-grey and more washed with olive southwards and westwards from Scandinavia, the Baltic and European Russia.

A. Hazelwood (*in litt.*) has suggested that a number of Blue and Coal Tits involved in the irruption in Cheshire and Lancashire and some Blue Tits from Spurn, which he examined, were of Scottish origin. However, we received no observational evidence to suggest any large increases after the breeding season of these species in Scotland, nor of movements from Scotland to N. England, except at Monks' House (Northumberland) where a southerly coasting of Blue Tits occurs most autumns and was not above average in 1957. There are no Coal Tit recoveries which throw light on this, and no distant recoveries concerning Lancashire Blue Tits, but recoveries relating to this species elsewhere in N. England suggest, and in two cases confirm, that some Continental Blue Tits were involved.