

# A BIRD CENSUS CARRIED OUT IN WEST WALES COMPARED TO COMMON BIRDS CENSUS POPULATION TRENDS 1981-86

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## ABSTRACT

A territory mapping census was carried out in Pembroke Upper Millpond Local Nature Reserve (LNR) to describe bird population levels and to compare them with national trends as shown by the British Trust for Ornithology (BTO) Common Birds Census (CBC). In good agreement with the CBC, sedge warbler and possibly spotted flycatcher decreased at the LNR over the years 1981-85, probably due to drought in their wintering grounds. However, both these species and whitethroat, another species earlier affected by the Sahel drought, showed LNR increases in 1986. The chiffchaff, willow warbler and blackcap were the dominant summer visitors, and agreement between their national CBC trends and the Millpond plot results was again good. The smaller resident species (e.g. wren, robin, dunnoek, goldcrest and reed bunting) have generally increased since their drop during the harsh winter of 1981-82, possibly due to a succession of mild winters and the stability of their habitat. For wren and goldcrest, local and national trends were in agreement. Unlike their national CBC trends, data for robin and dunnoek did not show any local decrease in the harsh winter of 1985-86, probably due to the mild, maritime climate of West Wales. Many of the breeding birds of Pembroke Upper Millpond have shown a general stability in numbers over 1981-86 (eg. coot, moorhen, woodpigeon, blackbird, reed warbler, willow warbler, chaffinch, song thrush and carrion crow). Magpie, starling and jackdaw all increased in numbers. Of these three species, only the starling is declining nationally. Most of the stable and increasing species are relatively large, resident birds and are opportunist or generalist feeders. These factors would help them withstand harsh weather and changing conditions. It is suggested that the major differences between local and national trends are the result of the contrasts in winter weather between West Wales and the South and East of England where the majority of CBC plots are concentrated.

## INTRODUCTION

One of the more rewarding aspects of field ornithology for secondary school and undergraduate level students is to survey common breeding birds in the vicinity of the school, college or home, without disturbing rare or sensitive species. This may be carried out as an individual project or as an exercise for a small group, with the aims of sharpening observation skills, learning about the inter-relationships of species with habitat, and as a basis for ecological hypothesis-testing. If the study period can be extended from a week or two to a full breeding season or, better still, to several successive years, the student sees the value of individual data sets in the wider context of a monitoring programme. For example, students may assess the effects of intervening cold winters on the status of the resident common breeding birds.

The Common Birds Census (CBC), organised by the British Trust for Ornithology, gives a sound scientific basis for monitoring population levels of the commoner breeding

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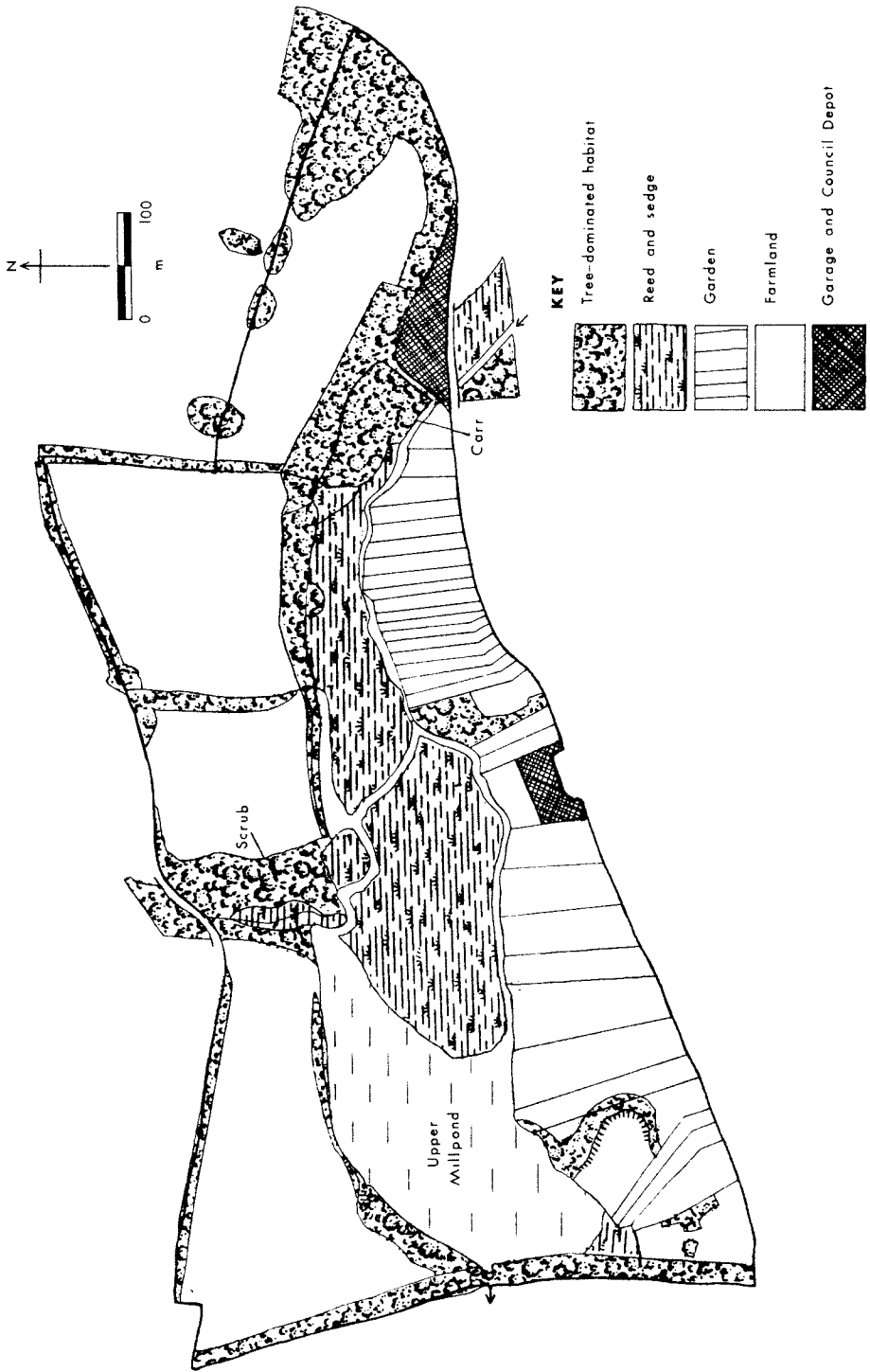


FIG. 1. Pembroke Upper Millpond CBC plot simplified habitat map, 1982.

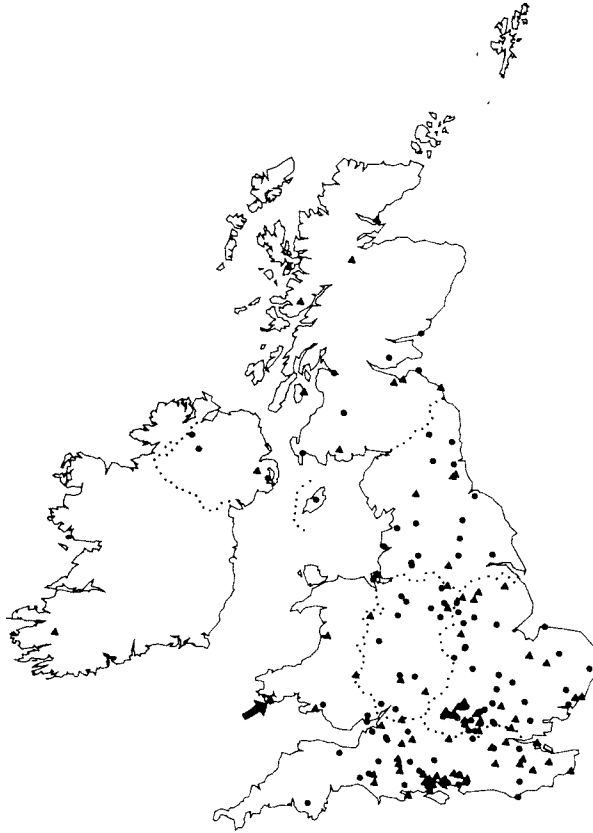


FIG. 2.

Distribution of CBC plots in a typical year (1988) showing farmland (○) and woodland (▲) plots. There are few of either category in the north and west. (Marchant *et al.*, 1990). Arrow indicates Pembroke.

birds. The scheme was started in 1962, following pilot trials in the previous year, at the instigation of the, then, Nature Conservancy. The aim was to monitor bird populations chiefly on farmland, where the increasing use of agricultural chemicals and the destruction of hedgerows were causing particular concern. Other habitats such as woodland were also included in the scheme from about 1964. Field work is carried out according to a written protocol, minimum levels of effort are set down, and a paired sample technique is used by which results are only compared between seasons if the effort has been consistent.

The CBC offers other information of both educational and scientific value to local, national and international conservation. A by-product of the method used is a series of maps showing the location of each territorial bird. These may be used to estimate the density of the various species on the plot, for comparison between years or between plots. Provided the habitat description is sufficiently detailed, it is possible to see how the birds are distributed in relation to different elements of the habitat. This adds to the sum of knowledge of the local area and continues a history of ecological research into woodland bird communities (eg. Lack & Venables, 1939; and Williamson, 1968).

TABLE 1: *Nomenclature and Mapping Symbols of Birds Mentioned in Text*

<i>Common name</i>	<i>Scientific name</i>	<i>Mapping Symbol</i>	<i>Common name</i>	<i>Scientific name</i>	<i>Mapping Symbol</i>
Little grebe	<i>Tachybaptus ruficollis</i>	LG	Jay	<i>Garrulus glandarius</i>	J
Cormorant	<i>Phalacrocorax carbo</i>	CA	Great tit	<i>Parus major</i>	GT
Heron	<i>Ardea cinerea</i>	H	Blue tit	<i>Parus caeruleus</i>	BT
Mallard	<i>Anas platyrhynchos</i>	MA	Coal tit	<i>Parus ater</i>	CT
Teal	<i>Anas crecca</i>	T	Marsh tit	<i>Parus palustris</i>	MT
Tufted duck	<i>Aythya fuligula</i>	TU	Willow tit	<i>Parus montanus</i>	WT
Pochard	<i>Aythya ferina</i>	PO	Long-tailed tit	<i>Aegithalos caudatus</i>	LTT
Shelduck	<i>Tadorna tadorna</i>	SU	Nuthatch	<i>Sitta europaea</i>	NH
Mute swan	<i>Cygnus olor</i>	MS	Treecreeper	<i>Certhia familiaris</i>	TC
Buzzard	<i>Buteo buteo</i>	BZ	Wren	<i>Troglodytes troglodytes</i>	WR
Sparrowhawk	<i>Accipiter nisus</i>	SH	Mistle thrush	<i>Turdus viscivorus</i>	M
Kestrel	<i>Falco tinnunculus</i>	K	Song thrush	<i>Turdus philomelos</i>	ST
Pheasant	<i>Phasianus colchicus</i>	PH	Blackbird	<i>Turdus merula</i>	B
Water rail	<i>Rallus aquaticus</i>	WA	Robin	<i>Erithacus rubecula</i>	R
Moorhen	<i>Gallinula chloropus</i>	MH	Grasshopper warbler	<i>Locustella luscinioides</i>	GH
Coot	<i>Fulica atra</i>	CO	Reed warbler	<i>Acrocephalus scirpaceus</i>	RW
Snipe	<i>Gallinago gallinago</i>	SN	Sedge warbler	<i>Acrocephalus schoenobaenus</i>	SW
Whimbrel	<i>Numenius phaeopus</i>	WL	Blackcap	<i>Sylvia atricapilla</i>	BC
Common sandpiper	<i>Tringa hypoleucos</i>	CS	Garden warbler	<i>Sylvia borin</i>	GW
Redshank	<i>Tringa totanus</i>	RK	Whitethroat	<i>Sylvia communis</i>	WH
Stock dove	<i>Columba oenas</i>	SD	Willow warbler	<i>Phylloscopus trochilus</i>	WW
Woodpigeon	<i>Columba palumbus</i>	WP	Chiffchaff	<i>Phylloscopus collybita</i>	CC
Collared dove	<i>Streptopelia decaocto</i>	CD	Goldcrest	<i>Regulus regulus</i>	GC
Cuckoo	<i>Cuculus canorus</i>	CK	Spotted flycatcher	<i>Muscicapa striata</i>	SF
Tawny owl	<i>Strix aluco</i>	TO	Dunnock	<i>Prunella modularis</i>	D
Kingfisher	<i>Alcedo althis</i>	KF	Pied wagtail	<i>Motacilla alba yarelli</i>	PW
Green woodpecker	<i>Picus viridis</i>	G	Grey wagtail	<i>Motacilla cinerea</i>	GL
Great spotted woodpecker	<i>Dendrocopus major</i>	GS	Starling	<i>Sturnus vulgaris</i>	SG
Skylark	<i>Alauda arvensis</i>	S	Greenfinch	<i>Carduelis chloris</i>	GF
Swallow	<i>Hirundo rustica</i>	SL	Goldfinch	<i>Carduelis carduelis</i>	GO
Sand martin	<i>Riparia riparia</i>	SM	Linnet	<i>Acanthis cannabina</i>	LI
Raven	<i>Corvus corax</i>	RN	Bullfinch	<i>Pyrrhula pyrrhula</i>	BF
Carrion crow	<i>Corvus corone corone</i>	C	Chaffinch	<i>Fringilla coelebs</i>	CH
Rook	<i>Corvus frugilegus</i>	RO	Yellowhammer	<i>Emberiza citrinella</i>	Y
Jackdaw	<i>Corvus monedula</i>	JD	Reed bunting	<i>Emberiza schoeniclus</i>	RB
Magpie	<i>Pica pica</i>	MG	House sparrow	<i>Passer domesticus</i>	HS

Where the habitat alters during the lifespan of a census, for example by removal of hedgerows on farmland or by a change in management in woodland, the effects of these alterations on numbers of breeding birds can be measured by comparing the species maps before and after. The CBC can also be used to predict the likely effects of proposed management by comparison with established case studies.

In 1992, the CBC scheme completed 30 years of continuous monitoring of populations. Recent applications of the CBC data include a study of the effects of Dutch Elm disease (Osborne, 1984), the significance of the reductions in resident birds brought about by recent severe winters (Lack, 1986), and the importance of the drought in migrants' wintering grounds to British populations of these birds (Winstanley *et al.*, 1974).

This paper presents results from a territory mapping census carried out for six years at Pembroke Upper Millpond Local Nature Reserve, Dyfed, SM 993016 (Figs. 1 and



2) and compares the results with the national CBC indices. The plot consists of part of a non-tidal pond and stream channel system with reed, sedge, willow and alder. It is surrounded by mixed farmland, oak, beech and sycamore woodland and by gardens, totalling almost 24 ha.

#### METHODS

The BTO gives full instructions for carrying out a CBC, including the census method, the selection and size of a plot, the number of visits needed, the mapping symbols, the spread of the counts and how to compile species and habitat maps from the visits made (Marchant, 1983a). Also included is a description of how the BTO index populations in order to measure changes in abundance of each species relative to an arbitrarily chosen 'datum-year' (usually 1966) in which the index value was set at 100. Following a review of CBC methods, the population indices are now compared to an index of 100 in 1980, although these recalculations are not presented here (Marchant *et al.*, 1990).

Approximately ten visits were made to the Upper Millpond in each year from 1981-86 between the end of March and the beginning of July. On each visit, all encounters with birds, by voice or by sight were logged on a 1:2,500 scale map of the plot. Particular attention was paid to encounters which had territorial significance, such as two male birds of the same species singing simultaneously, or fighting. The visits were as evenly spaced as possible, ideally at least ten days apart.

An example of one visit map is given in Fig. 3. The species codes and scientific names are given in Table 1. From the visit maps, composite maps of registrations for each species (species maps) were transcribed at the end of the season. A species map consists of all the records of that species over all the visits that season. The map territories are those areas which enclose all registrations of the species which probably belong to the same bird or pair. Interpretation was carried out by a small team of trained analysts at the BTO Headquarters. The numbers of territories assessed were compared to the national CBC indices published annually in *Bird Study* and, since 1983, in *BTO News*.

#### RESULTS AND DISCUSSION

As illustrations of the results, series of Pembroke Millpond species maps for wren (1981-86) and for coot, magpie, reed warbler, blackcap, chiffchaff and house sparrow (1986) are presented in Figs. 4 and 5 respectively. The spatial distribution and habitat occupancy of wrens are seen to vary through time as a function of population levels (Fig. 4). In 1982 to 1984, for example, there were reduced numbers of wrens overall that were reflected most clearly in the closed woodland parts of the LNR plot. During the 1982 and 1983 seasons, there were also lower numbers of wrens present around the water's edge and along some hedgerows. More nearly constant densities of wrens were observed in those parts of the plot containing medium-height scrub, and in the garden-dominated area. After harsh winters, many common resident birds are seen to retreat to core habitats, from which recovery and recolonisation of less-preferred habitats occur over successive seasons.

The species maps illustrated in Fig. 5 show a range of contrasting bird/habitat relationships. The coot occupies all the open water, including the main, wide stream channel through the reedbed. Each magpie territory is large and includes woodland/scrub/hedgerow habitat, and most also include one or more of the following elements; gardens/waste ground/open field/reedbed. In contrast to the generalist tendencies of the

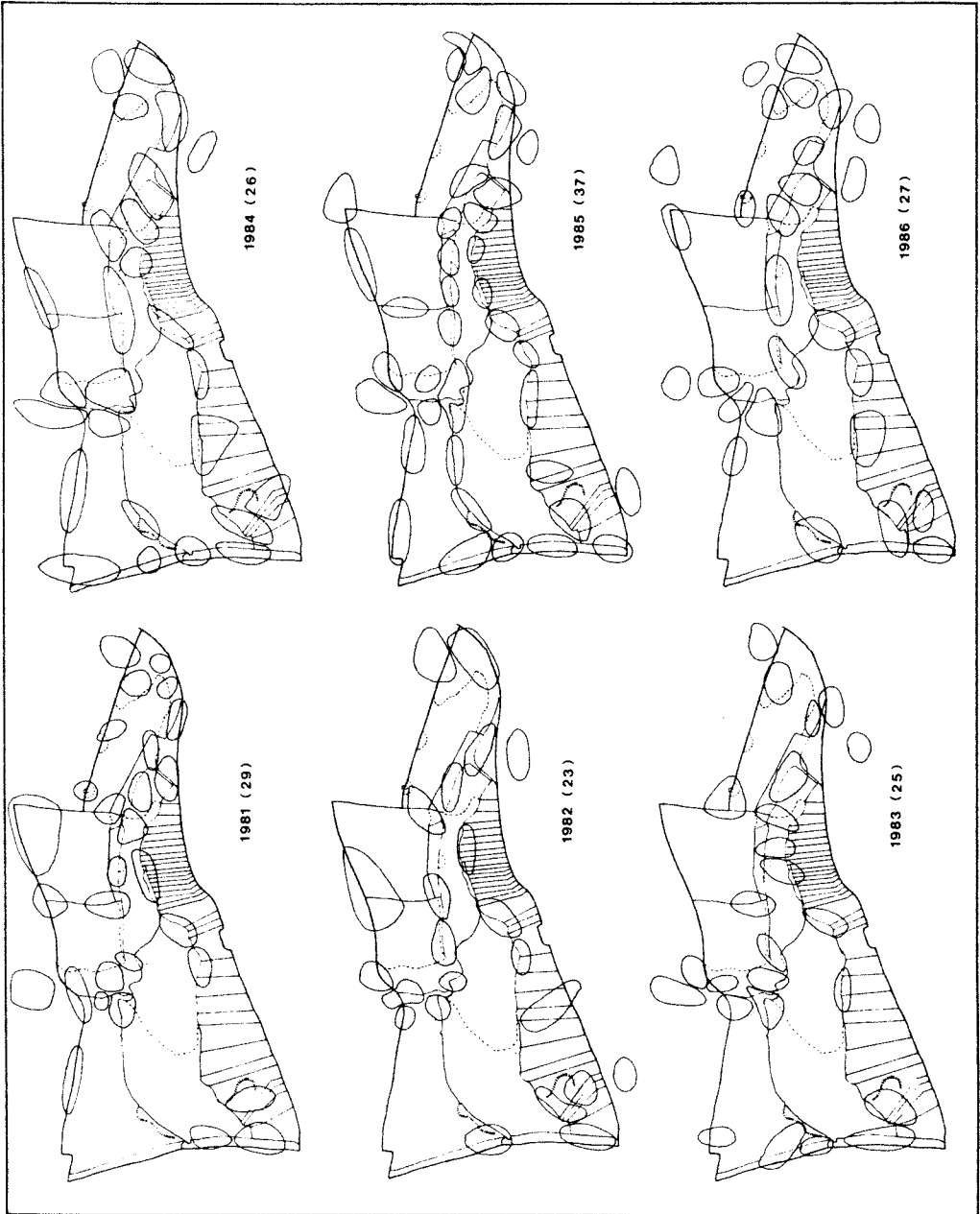


FIG. 4.

Series of species maps for wren (1981-1986), showing decreases in the numbers of territories (in brackets) in the winters of 1981-1982 and 1985-1986. There were substantial reductions in population in the wren's core habitat not just a retreat from marginal territories

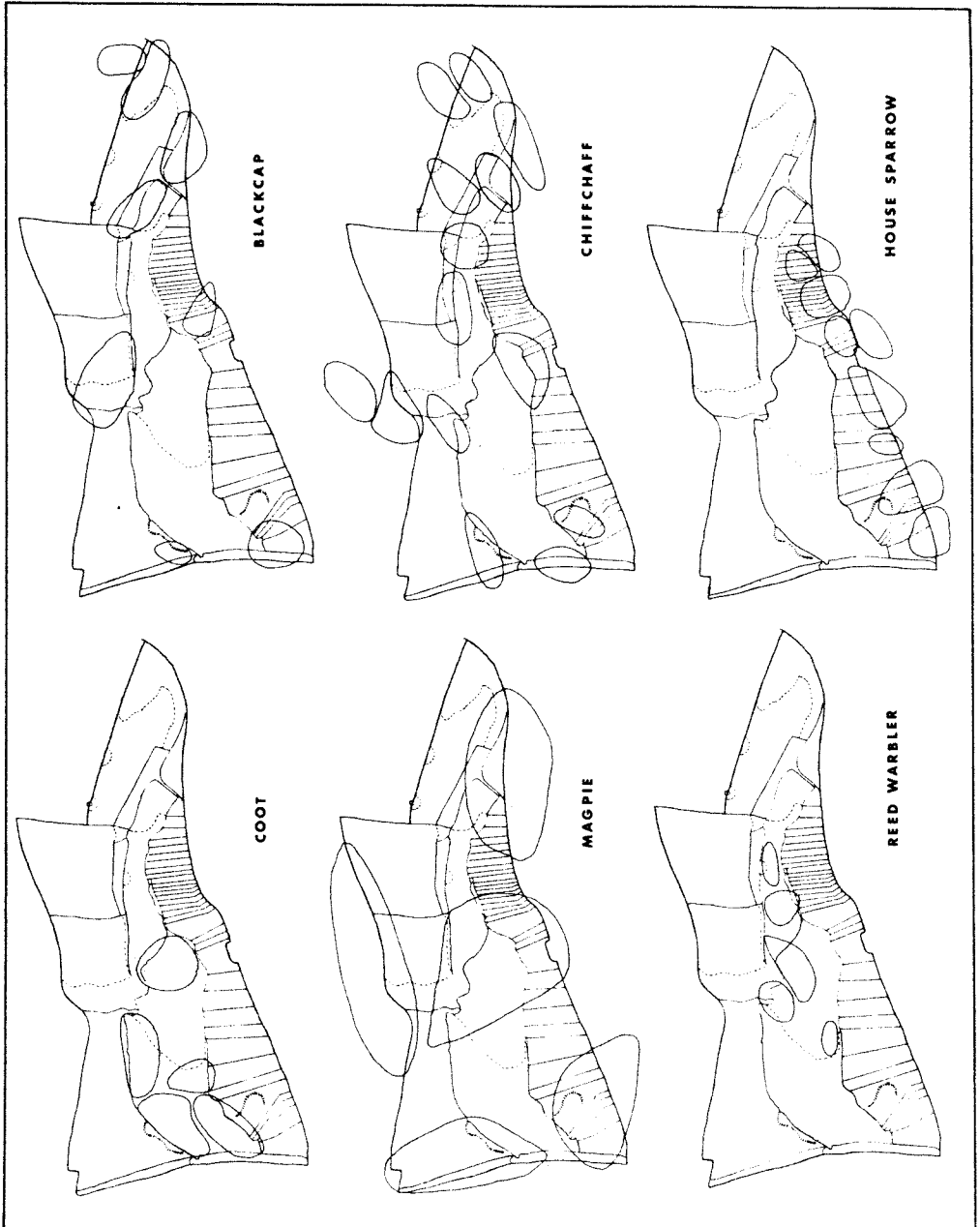


FIG. 5.

Series of species maps for coot, magpie, reed warbler, blackcap, chiffchaff and house sparrow (1986), showing usage of different habitats in the plot.



TABLE 2: Number of Species and Territories, Pembroke Upper Millpond, 1981-86

Species	1981	1982	1983	1984	1985	1986	Species	1981	1982	1983	1984	1985	1986
Little grebe	-	-	-	*	-	-	Blue tit	12	15	23	14	14	17
Cormorant	-	-	-	*	*	*	Coal tit	*	1	*	*	-	1
Heron	-	1	*	*	*	*	Marsh tit	*	2	1	1	-	-
Mallard	4	8	9	13	21	6	Willow tit	-	*	*	-	*	-
Teal	1	*	4	*	*	*	Long-tailed tit	1	-	*	*	*	1
Tufted duck	*	*	3	2	2	*	Nuthatch	*	1	1	2	1	1
Pochard	-	-	-	(1)	*	*	Treecreeper	2	2	1	1	1	2
Shelduck	-	-	-	*	*	*	Wren	29	23	25	26	37	27
Mute swan	2	2	1	1	2	1	Mistle thrush	-	1	*	1	-	1
Buzzard	1	1	1	*	-	*	Song thrush	2	4	4	4	3	4
Sparrowhawk	-	1	*	*	*	*	Blackbird	17	19	18	14	22	18
Kestrel	-	*	-	-	*	*	Robin	15	8	11	12	14	17
Pheasant	1	1	*	*	*	*	Grasshopper warbler	-	*	-	-	-	*
Water rail	-	*	-	-	*	*	Reed warbler	-	4	3	5	3	5
Moorhen	2	5	4	4	5	5	Sedge warbler	5	6	3	2	*	2
Coot	2	5	4	4	4	5	Blackcap	3	8	5	6	11	8
Snipe	*	*	1	*	*	*	Garden warbler	-	-	*	1	-	1
Whimbrel	-	-	-	*	-	-	Whitethroat	-	*	-	*	*	1
Common sandpiper	*	-	-	*	-	-	Willow warbler	6	7	9	5	8	9
Redshank	-	-	-	*	-	-	Chiffchaff	10	14	11	5	11	14
Stock dove	-	*	1	*	-	*	Golderest	1	-	3	2	5	*
Woodpigeon	*	3N	3N	2N	3N	2N	Spotted flycatcher	1	*	*	*	-	*
Collared dove	-	1	1	1	2	2	Dunnoek	6	5	4	9	10	12
Cuckoo	-	*	-	*	*	*	Pied wagtail	1	*	*	-	*	-
Tawny owl	-	*	-	-	1	-	Grey wagtail	-	-	*	-	-	-
Kingfisher	-	-	*	-	*	*	Starling	2	2	2	4	3	6
Green woodpecker	1	*	1	1	*	*	Greenfinch	*	-	8	1	*	1
Great spotted woodpecker	*	1	2	1	1	1	Goldfinch	*	1	3	1	1	*
Skylark	-	-	*	*	*	*	Linnnet	*	-	-	-	-	-
Swallow	-	-	-	-	-	2N	Bullfinch	1	2	2	1	4	3
Sand martin	-	-	-	-	-	*	Chaffinch	7	12	15	11	14	12
Raven	-	-	*	-	-	-	Yellowhammer	*	-	-	-	-	-
Carrion crow	2	5	4	4	4	4	Reed bunting	1	1	1	1	3	3
Rook	-	-	-	-	*	*	House sparrow	3	4	5	6	6	9
Jackdaw	3	10	11	11	8	12	Species Total	45	53	53	57	54	54
Magpie	5	5	6	6	7	5	Species with Territory	33	37	39	39	35	37
Jay	1	1	-	1	1	1	Total Territories	145	200	224	194	220	228
Great Tit	4	9	10	7	10	9	Total Hours in Field	34.5	30.4	36.5	27.5	26.4	27.0

Key: = species absent, \* = species present but not holding territory, ( ) = species present, possibly holding territory, N = nests found

maggie, the specialist reed warbler territories occupy most of the available reedbed, whilst eschewing significant areas of sedge and rush. Almost all the closed woodland areas with adjoining scrub support blackcap and chiffchaff, with the latter present at much higher densities. Predictably, the house sparrow is distributed along both sides of the main road where suitable nesting sites are found. In this way, nearly the entire plot is occupied by at least one of the breeding bird species. The only exceptions are the centres of the larger fields and the well-manicured lawns on the south side of the Millpond.

Table 2 summarises the number of species and territories held from 1981 to 1986 inclusive. From Table 2 it can be seen that the first year of the survey had lower numbers of territories and species than the following years. This is due to the fact that censusing is a skill which takes time to reach an acceptable standard, and so some of the more difficult species may have been missed or confused in the first survey. However, most of the commoner species were assessed adequately, as shown by the comparability of the territory-holding species total over the six years. Over the latter five years the species list, the number of species holding territory and the total number of territories have all stayed fairly constant. It is, however, interesting to compare the 1984 and 1985 seasons. In 1984 there were 39 species holding territory with 194 territories, whereas in 1985 there were only 35 species holding territory, but with 220 territories. The latter year was characterised by a lower species diversity, but a higher total number of territories.

Table 3 shows the more common species' mean densities over 1981-86. It can be seen that most of these were woodland/garden birds and the remainder were aquatic. In spite of the areas of farmland and open water, most of the woodland species were present at densities well within the ranges commonly reported in the literature. When expressed as territories per 100ha, the data may be compared with the woodland CBC 1972 mean densities (Sharrock, 1976). The level of agreement shown in Table 3 was tested using the Spearman Rank Correlation Coefficient ( $r_s$ ). The result was highly significant ( $r_s = 0.56$ ,  $P < 0.01$ ,  $n = 22$ ), indicating that Pembroke Upper Millpond breeding bird densities were in general agreement with those calculated nationally.

As expected from the area of water in the plot, the aquatic species were present at much higher densities than their national farmland averages (in Table 3). When the aquatic species CBC indices were replaced and supplemented by estimates of density per 10km of river (Lewis and Williams, 1984), and assuming that the rivers averaged 10m in width (not unreasonable for lowland rivers) the comparability of the ranked densities was improved (Table 3). After this manipulation of the data, a repeat of the Spearman Rank Correlation Test produced a value of  $r_s = 0.66$  ( $P < 0.01$ ,  $n = 25$ ), indicating that the densities of aquatic species were a major source of disparity between Pembroke Upper Millpond and national CBC densities. This was not unexpected since the local site is dominated by the pond. More surprisingly, the corvids were also present at higher densities in the Millpond survey, a result which may have been influenced by proximity to Pembroke urban areas and garden feeding stations. When the densities of magpie and jackdaw were omitted from the comparison, the recalculated  $r_s$  value was even higher ( $r_s = 0.82$ ,  $P < 0.01$ ,  $n = 23$ ), confirming that these corvids were another major source of disparity between Pembroke Upper Millpond and national CBC densities. The only other common woodland species for which the density comparisons were not very close, were wren, chiffchaff and blackcap (higher in the Millpond survey) and dunnock and song thrush (higher nationally).

TABLE 3: Ranked mean number of territories for some of the commoner species, Pembroke Upper Millpond, 1981-86, and their densities expressed as territories per 100ha, compared with 1972 woodland CBC and (\*) farmland published densities (Sharrock, 1976). Estimates of water birds densities are also given (Column 4) per 10km of river (Lewis and Williams, 1984) - no estimate.

Species	Pembroke Upper Millpond Data		Other Density Indices	
	$\bar{x}$ territories	$\bar{x}$ 100ha <sup>-1</sup>	1972 CBC 100ha <sup>-1</sup>	pairs 10km <sup>-1</sup>
Wren	27.8	117.4	61.4	-
Blackbird	18.0	75.9	66.2	-
Blue tit	15.8	66.9	42.7	-
Robin	12.8	54.2	60.0	-
Chaffinch	11.8	49.8	36.8	-
Chiffchaff	10.8	45.7	12.2	-
Mallard	10.0	42.9	2.4*	30
Jackdaw	9.2	38.7	1.6*	-
Great tit	8.2	34.5	27.7	-
Dunnock	7.7	32.5	52.0*	-
Willow warbler	7.3	30.9	41.0	-
Blackcap	6.8	28.8	12.3	-
Magpie	5.7	23.9	2.8	-
House sparrow	5.5	23.2	-	-
Moorhen	4.2	17.6	3.8*	25
Coot	4.0	16.9	-	20
Carrion crow	3.8	16.2	4.7	-
Song thrush	3.5	14.8	27.1	-
Reed warbler	3.3	14.1	-	-
Starling	3.2	13.5	10.0	-
Sedge warbler	3.0	12.7	-	10-15
Woodpigeon	2.2	9.1	10.0*	-
Bullfinch	2.2	9.1	7.1	-
Goldcrest	1.8	7.7	12.9	-
Greenfinch	1.7	7.0	9.2	-
Reed bunting	1.7	7.0	4.3	10
Mute swan	1.5	6.3	-	5-10
Treecreeper	1.5	6.3	-	-
Collared dove	1.2	4.9	-	-

Graphs of the numbers of selected dominant species' territories at Pembroke Upper Millpond and national CBC indices are given in Figs. 6 and 7. Many of the breeding birds of the LNR have shown stability over the 1981-86 period (e.g. coot, moorhen, woodpigeon, blackbird, reed warbler, willow warbler, song thrush and carrion crow). Magpie, starling and jackdaw have showed signs of increase. With the exception of the warblers these are relatively large, resident birds with generalist habits, factors which would help them withstand harsh winters and changing conditions, and which may account for their numerical stability. It seems that the more common, smaller species such as chaffinch, bullfinch, dunnock, blackcap and possibly robin have generally increased. The species 'lost' are the more scarce species such as garden warbler and mistle thrush which, in any case, have not bred regularly on the site. The only species not holding territory in 1985 which held territory for the four previous years was the sedge warbler. This species has been decreasing gradually over the years, probably due to the drought conditions in its wintering grounds, the Sahel. However, there seems to be a

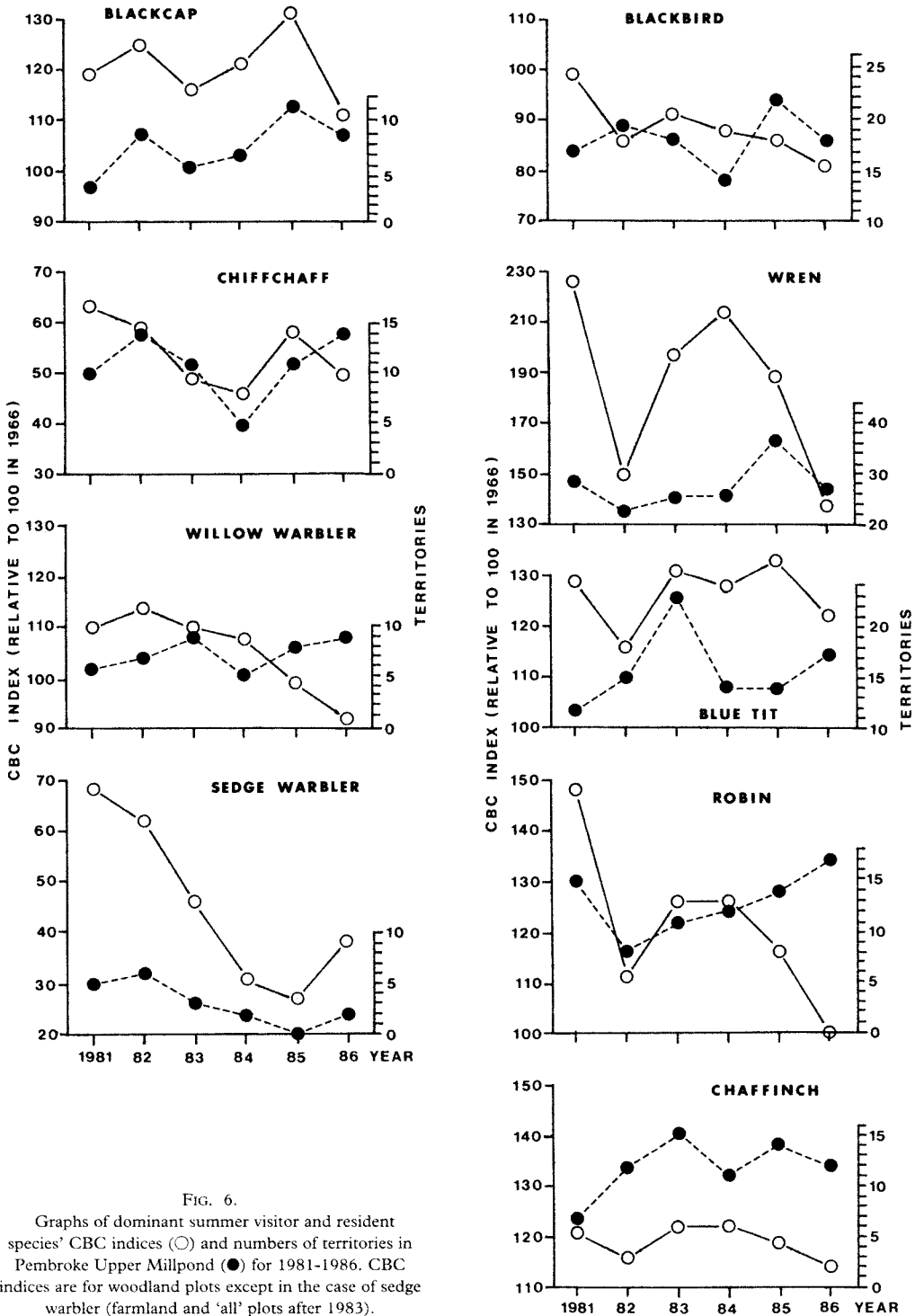


FIG. 6.

Graphs of dominant summer visitor and resident species' CBC indices (○) and numbers of territories in Pembroke Upper Millpond (●) for 1981-1986. CBC indices are for woodland plots except in the case of sedge warbler (farmland and 'all' plots after 1983).

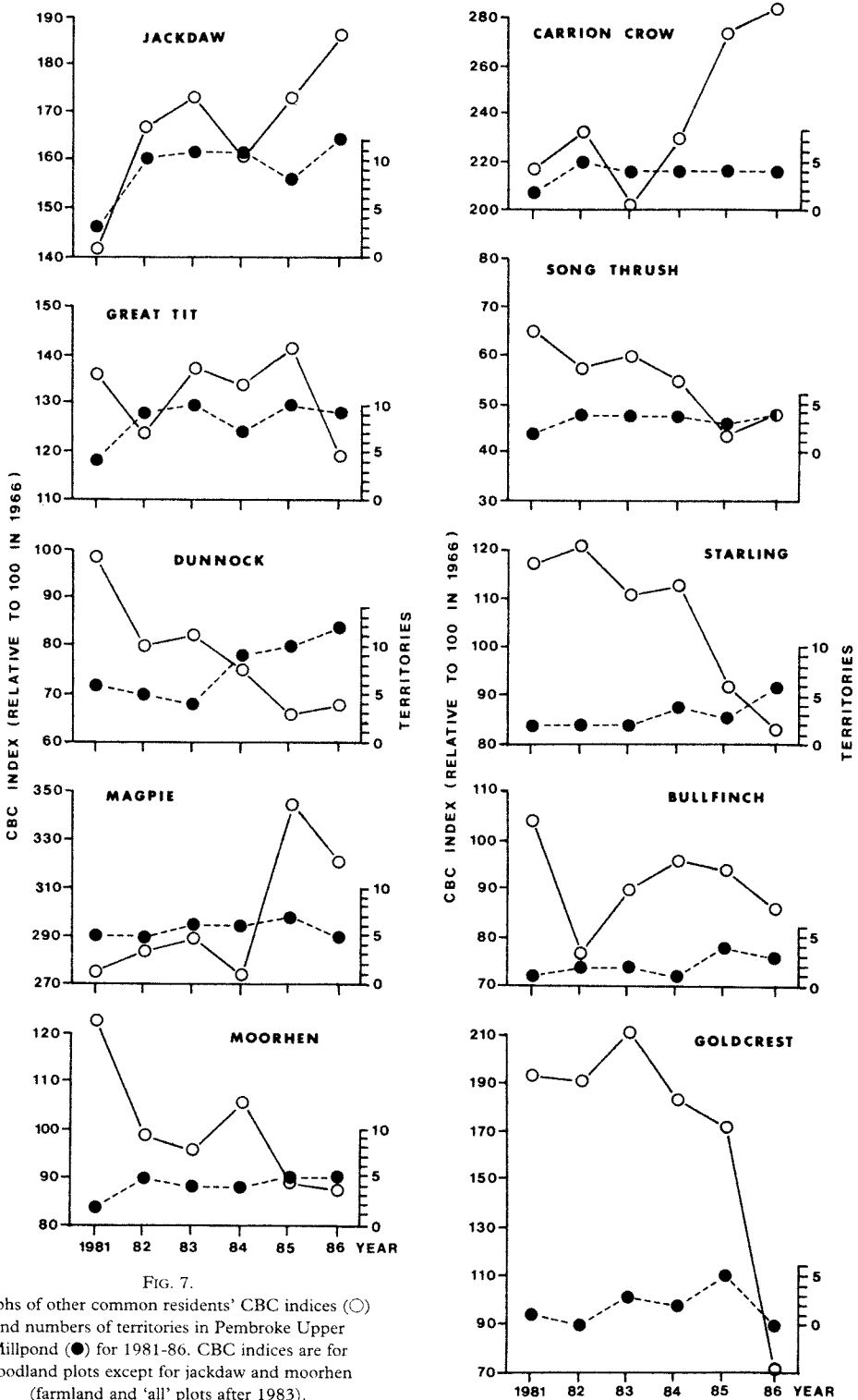


FIG. 7.

Graphs of other common residents' CBC indices (○) and numbers of territories in Pembroke Upper Millpond (●) for 1981-86. CBC indices are for woodland plots except for jackdaw and moorhen (farmland and 'all' plots after 1983).

contradiction here as blackcap and chiffchaff (both species which winter in Africa) have been comparatively stable. This could be because the latter are avoiding drought zones during migration or by wintering mainly north of the Sahara, unlike the sedge warbler. Because of the preceding mild winter, a larger proportion of breeding individuals of blackcap and chiffchaff may have overwintered in Britain and Europe than is usual. Whatever the cause of these fluctuations, they were generally in very good agreement with fluctuations in the national CBC index (Fig. 6).

The greatest cause of reduction in resident populations of small birds, particularly species such as wren, goldcrest and dunnock, is a harsh winter. This was well demonstrated in the 1981-82 census. The 1981-82 winter was particularly severe with more than 20 days of ice-glazed conditions in December 1981 over much of Britain. Wren, dunnock, robin and goldcrest were slightly affected by the 1981-82 winter in the Upper Millpond survey, which correlates with national CBC results (Figs. 6 and 7). The 1981-82 winter tended to affect ground feeders rather than arboreal feeders (Marchant, 1983b). This is illustrated by the fact that the CBC Index for treecreeper (a very small arboreal bird) showed a 22% increase nationally in 1982 and was not adversely affected by the intervening winter in the Millpond survey.

Some significant national changes, however, were not shown in the Millpond survey, such as the 1981-82 decreases in bullfinch and reed bunting (the latter not graphed). This is probably because the populations of these two species are already very low in the survey area. The location of the Millpond plot in the mild south-west may also be important for some, or all species. For example, only wren and goldcrest, of the small residents, appear to have suffered in the 1985-86 winter (Figs. 4, 6 and 7). In contrast, robin and dunnock continued their steady increases from 1982 and 1983 respectively, despite the national trend in the reverse direction. A further factor affecting the winter success of great tit, blue tit and many small resident species at Pembroke Millpond compared with national CBC trends may be proximity to the garden feeding stations (Fig. 1). It would thus appear that agreement between the Pembroke Upper Millpond numbers of territories and the trends of the national CBC index values was not always as good for the small, resident birds as it was for the summer visitors. Robin and dunnock are the best examples of this, although bullfinch, starling and song thrush also showed trends which diverged from their respective national trends (Figs. 6 and 7). It is suggested that the mild climate of the south-west coupled with a numerical bias in the CBC scheme towards plots in the south and east of Britain have produced this result (Fig. 2).

Since the 1981-82 winter there have been increases in the LNR populations of resident small birds particularly wren, goldcrest, dunnock and robin. From 1984 to 1985 wren increased by a third and goldcrest numbers nearly trebled. Both these species have small, well-defended territories and most of the survey area contains suitable habitat for colonisation, so it is not surprising that their populations have expanded.

The results for other species are given in Table 2. The steady increase in collared dove follows their colonisation of Britain since 1955. The far west of Britain was among the places they reached most recently (post 1962), but the increase could also be due to the change in part of the local habitat from agricultural land to maturing urban gardens, which they may prefer. Coal tit and marsh tit were both absent in 1985 and both show a slight decrease since 1982. This is probably because they are quite scarce species and the survey area may only include them by chance. Tawny owl held territory and

produced at least one young in 1985 for the first time since the survey started. This was in agreement with a good year nationally for tawny owl. The lack of buzzard and green woodpecker in 1985 could just be due to a slight shift in the territory of the birds because the survey area has always been on the edge of these species' large territories. It is interesting, however, that the tawny owl was proved to hold the territory in the same area as the buzzard used to be. It is unlikely that the owl would displace the buzzard as, although they are both large birds of prey, their diet and habits are different.

The numbers of territories given for water birds such as mallard, mute swan, coot and moorhen in 1985 are probably a particularly inadequate reflection of the number of young the area produced that year. This is because of a marked change in the water level in May. In Spring the water level of the Millponds in Pembroke (an important tourist attraction) is raised by tidal flushing to decrease the number of breeding mosquitoes. This raising of the level flooded out a mute swan nest and also a coot's nest. No juvenile swans, coots or moorhens were seen on any 1985 visit up to September. The juvenile mallard seen may not have been from the Upper Millpond area or may have hatched before the flooding. The Upper Millpond is not a closed water system so assessment of the number of water birds holding territory is difficult and can best be done by finding nests. However, as the juvenile mallards were obviously not downy young and no downy young had been seen, it seems likely that the mallard have also been adversely affected by the changing water level. Some mallard may also have been introduced to the site by man. Occasional sightings of common sandpiper and other waders, particularly in 1984, were related to the reduced water levels. The non-breeding species list is also increased by the proximity to the estuary of Milford Haven (eg. shelduck, cormorant, redshank and whimbrel). These points demonstrate how changing habitat or management can affect the numbers of birds breeding successfully in an area, and also how it is important to take into account the census plot hinterland when assessing status of both the breeding birds and the transient visitors. It is also useful, particularly with nidifugous birds such as ducks and swans whose young leave the nest soon after hatching, to continue observations after the last census has been carried out. Although the CBC is not intended for the aquatic species in the way which the Waterway Bird Survey is, it is nevertheless possible to achieve useful results.

#### ACKNOWLEDGEMENTS

We would like to thank all the people who have assisted with this study over the years. In addition to past and present BTO staff, particularly S. Carter, R. J. Fuller, D. Glue, K. Taylor and P. A. Whittington, we have been assisted by N. Bartlett, J. D. D. Bishop, L. A. Collison, I. M. T. Dixon, M. L. James, A. F. Lambert, D. Levell, M-A. Longmate, M. Ravenswood, F. Schepers, R. Schols, S. R. J. Sheppard, C. Straw, S. J. Sutcliffe, and H. Taylor. Thanks also to Annette Little and the children, for their support and patience.

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