



**BTO Research Report 332**

**Baseline bird survey of Milton Glen,  
Stirling, 2003**

**Author**

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## EXECUTIVE SUMMARY

1. This survey provides baseline data on the distribution and populations of breeding birds in Milton Glen to inform future development by the Woodland Trust.
2. By virtue of its varied topography and altitudinal range, Milton Glen holds a diverse and interesting avifauna, including twenty Red or Amber-listed species (either scarce species or ones with declining populations). Of particular note are Merlin, Curlew, Snipe, Lapwing, Black Grouse, Ptarmigan, Red Grouse, Ring Ouzel, Whinchat, Yellowhammer, Reed Bunting and Twite.
3. Important areas for the above birds, that require open (non-wooded) habitats, are identified and some management recommendations to maintain, or enhance, these are given. These include the reinstatement of 'traditional' management of meadows, the blocking of some drains, the identification of other key areas to remain as open habitats and managed with seasonal grazing regimes that are appropriate for upland heath or for low lying pastures and meadows.
4. Expansion of woodland at Milton Glen may lead to increases in the numbers of 3 Red-listed species (Song Thrush, Spotted Flycatcher and Bullfinch) and 9 Amber-listed species (Dunnock, Goldcrest, Green Woodpecker, Lesser Redpoll, Redstart, Tree Pipit, willow Warbler, Wood Warbler and Woodcock). Without mitigating actions for species that require open habitats, declines in 6 Red-listed species (Black Grouse, Reed Bunting, Ring Ouzel, Skylark, Twite and Yellowhammer) and 4 Amber-listed species (Curlew, Lapwing, Merlin and Red Grouse) may be expected.
5. The survey included data from reference sites against which measurements of the effectiveness of any mitigation actions will be possible. Recommendations for further monitoring are given.



## **1. INTRODUCTION**

### **1.1 Background**

The surveys detailed in this report were undertaken on behalf of The Woodland Trust in order to inform future development of their proposed acquisition at Milton Glen near Callander. Surveys of breeding birds were undertaken in 2003 over the entire 760 hectares in order to record any existing features of avian conservation interest. The surveys were designed to be readily repeatable and to provide a quantitative approach to permit population changes, both to be assessed and to provide information on the current distribution of birds within the site. Although the development of the area by the Woodland Trust will depend in part on the findings of this survey, it is generally assumed that future management will aim to increase the cover of native-type woodland. The potential impacts of woodland planting on the site are discussed, and some recommendations for mitigating actions that would either reduce the impact of increased tree cover on some of the bird species, or would otherwise enhance conditions for them, are given. The surveys provide baselines against which to assess the effectiveness of any mitigation that is carried out subsequently, and also the impacts of any other management changes on avian diversity. As bird populations vary with other uncontrollable factors, most notably annual fluctuations in weather, surveys of a series of reference sites are also included with which future changes at Milton Glen can be compared. Current comparisons with the reference sites also provide a crude assessment of the local importance of existing bird communities at Milton Glen.

### **1.2 Milton Glen**

The holding covered by the main survey is approximately 760 hectares and in altitude ranges from 100m asl close to the northern shore of Loch Venachar rising to 879m at the summit of Ben Ledi. The altitudinal range and varied topography of the site contribute to the variety of habitats present. These include grassland (from low lying wet to montane), basin mires, blanket bog, upland heath, scrub (of varying stages of development) and some more mature stands of broad-leaf trees on the lower ground. At the time of the surveys, in spring 2003, the entire area was grazed by domestic stock (sheep extensively and cattle on the lower ground).



## 2. METHODS

### 2.1 Surveys of birds

Three general survey techniques were employed: (i) Line transects, to provide systematic and quantitative baselines for ongoing monitoring; (ii) a constant effort search approach, to provide information on bird distribution and relative abundance; (iii) additional searches at dawn and dusk to give further information on some key species. The dates and times of the bird recording visits for each method are given in Table 1.

#### 2.1.1 *Line transects*

The same methods that are used by the national monitoring scheme, the Breeding Bird Survey (BBS), were employed (*e.g.* BTO 2002). Four 1-km squares were selected along the length of Milton Glen to give representative coverage of the area. Within each, two transect lines were set up, in parallel (or as close as the terrain permitted), 500m apart (Fig 1). Each transect line was divided into five 200m-long sections, so that ten sections were covered in each 1-km square. Each transect was walked during the survey period (Table 1). All adult birds were recorded in three distance categories (within 25m, 25 – 100m, and over 100m) from the transect lines, for each 200m section of each transect. A further four sets of two parallel 1-km transects were surveyed at reference sites between 7 – 28 km of Milton Glen (Fig 2). Each reference site was chosen from a random selection of one-kilometre squares based on the Ordnance Survey's national grid. Each was chosen to be of similar altitude and aspect as transects in Milton Glen. These will permit a paired monitoring approach whereby changes in bird populations at Milton Glen can be compared with any contemporary changes at the reference sites. As the reference sites were selected from a random set, they fell within several estates. This will lessen the risk of singular management changes that influence bird populations taking place across all reference sites. All transect surveys were carried out in the early hours (generally between 05.30 and 09.00) when bird activity is highest.

#### 2.1.2 *Constant effort search*

All of the Milton Glen holding was divided into 500m x 500m quadrants for surveying using the OS national grid as a base, and each quadrant was covered using a constant effort of 20 – 30 minutes of searching. All parts of each quadrant were walked to within 100m. At regular intervals, the area was scanned using binoculars, and the identity, location, activity and, where possible, sex of any birds encountered were plotted onto large-scale maps. This methodology is the same as that recommended for surveying breeding waders, and other species that occur at relatively low densities, in open upland areas (Brown & Shepherd 1993, Gilbert *et al.* 1998). The area was thus covered in its entirety twice during the survey period (Table 1). All constant effort searches were carried out between 08.30 and 18.00 to minimise any biases associated with peaks of bird activity outside of these times.

#### 2.1.3 *Additional searches at dawn and dusk*

Visits were made twice each at dawn and dusk to search for, and count, displaying Black Grouse, waders and any other crepuscular species that could have gone undetected or under-recorded by the other two survey methods. As surveying associated with dawn and dusk is inevitably of limited duration, these searches were made only in the very calmest of conditions when calling birds could be detected at the greatest possible distance. The locations and behaviour of the species of interest were plotted onto large-scale maps as for the constant effort searches.

## **2.2 Analysis of survey data**

### *2.2.1 Line transects*

The principal utility of the line transects is to measure relative trends in breeding bird abundance over time to assess any influence of management changes. As 2003 was the first year of monitoring, the analyses presented here are inevitably limited. Comparisons of relative abundance, as indicated by the number of registrations of each species, between transects at Milton Glen and at the reference sites have been used to give some initial indication of the relative importance of current bird populations. The full value of this data set will be realised in the longer term, however (see Section 4.3)

### *2.2.2 Constant effort search and additional searches*

The locations of all birds seen during these surveys were plotted, with activity codes, onto a digitised map of Milton Glen using the ArcView GIS package (ESRI). Distances between registrations and the activities of the birds were then used to assign them to 'apparently occupied territories' (AOTs). AOTs were defined if singing or displaying birds were seen, nests were found, adults repeatedly alarm called or carried out distraction displays, or if territorial disputes were observed. Birds of unknown sex exhibiting any of these behaviours were held to represent different pairs, and therefore AOTs, only if separated by at least 500m within a given survey visit. Registrations were considered to represent different AOTs if they were separated by at least 1000m over separate survey visits. Note that although birds within existing wooded and scrub areas were recorded, they were not assigned to AOTs, as this would require more intensive fieldwork because of their lower detectability.

## **2.3 Existing data searches**

Databases held by the BTO were searched for information pertaining to Milton Glen. That collated for an atlas of breeding bird distribution (Gibbons *et al.* 1993) included two specific tetrads (2km x 2km squares) covering the northern part of the Milton Glen holding, as well as coarser information for the 10-km squares in which the holding lies. These data refer to breeding birds seen during fieldwork in 1988 – 1990. Birds seen during winter atlas fieldwork in 1981/82 – 83/84 (Lack 1986) are also recorded at the scale of 10-km squares. Additional searches of the BTO Nest Records Cards and the (now outdated) ornithological sites databases yielded nothing relevant. The Central Scotland Raptor Study Group supplied specific information from their holdings on raptors within the boundaries of the study area.

## **2.4 Interpretation to inform management**

Birds seen during the 2003 surveys have been grouped according to current conservation interest based on recent population trends within the UK (Baillie *et al.* 2002, Gregory *et al.* 2002) and also their reliance on open, pastoral habitats (grassland, heath and mire). The latter is derived from general ornithological literature (*e.g.* Snow & Perrins 1998) and gives an indication of which species could be adversely affected by an increase in woodland cover. The combined distribution of species of conservation interest that are reliant on pastoral habitats is used to identify areas that may benefit by exclusion from planting. Some broad management prescriptions are also suggested to enhance these areas and potentially mitigate for some local losses (Section 4.2). As with most management prescriptions to date, it must be stressed that the best practices accepted currently need not necessarily have been unambiguously demonstrated as successful, or be founded on high quality scientific approaches. Appropriate references are given where supportive publications exist.



### 3. RESULTS

A total of 43 species were seen during the surveys in 2003, of which 38 were likely, or were confirmed, breeding within the holding at Milton Glen (Table 2). All registrations of birds seen during constant effort and additional searches are plotted and submitted to the Woodland Trust on CD. Summaries of the line transect data are given in Appendix 1.

#### 3.1 Waders

Five species of wader appeared to hold territories within the survey area: Curlew (8 AOTs, Fig. 3), Lapwing (2 AOTs, Fig 4), Snipe (11 AOTs, Fig 5) and Oystercatcher (1 AOT, Fig. 4). In addition, two Woodcock were seen roding (display flights) during both evening searches over the lower part of the survey area. No other breeding waders species were recorded during BTO *Atlas* fieldwork within the 10-km square NN50 (Table3, Appendix 2).

Only Curlew and Snipe were recorded during the line transects. Although there were more registrations from Milton Glen than from the reference sites (Appendix 1), numbers are too low for meaningful statistical analyses. A single Jack Snipe seen during the early transect surveys at Milton Glen would undoubtedly have been a migrant or late wintering bird.

#### 3.2 Raptors

A male Merlin was repeatedly alarming during the early constant effort search visit (Fig 6). The only other raptors seen during these searches were Buzzards (5 registrations during the early survey, 4 registrations during the late survey), all of which were in flight and none showing territorial associations within the survey area itself, nesting within neighbouring plantations is likely, however. A single Kestrel was seen during transect surveys (Appendix 1). The number of registrations from the transect surveys are too low for meaningful comparison.

The only records held by the Central Scotland Raptor Study Group from the area are of Merlin, but the species is still under-recorded and their status not well known within the region (P. Stirling-Aird *pers comm.*). BTO *Atlas* fieldwork found Peregrine, as well as Buzzard, within the two tetrads covering the upper glen in 1988-90, but it should be noted that this also included areas outside of the current survey area. Other raptors seen within the full 100km<sup>2</sup> of NN50 during BTO *Breeding Atlas* fieldwork were Osprey, Hen Harrier, Sparrowhawk and Kestrel (Appendix 2). In addition, a single Golden Eagle was seen during BTO *Winter Atlas* fieldwork (Appendix 3).

#### 3.3 Gamebirds

Red Grouse (4 AOTs), Black Grouse (a single displaying male on both dawn visits) and Ptarmigan (3 males and a single male on early and late visits respectively) were recorded in spring 2003 within the survey area (Fig. 7).

During transect surveys, 2 Red Grouse were seen at Milton Glen and 1 at a reference site. Two registrations of Black Grouse from transects at Milton Glen compared with 16 from reference sites. A single Pheasant was recorded during transect surveys at Milton Glen. No Ptarmigan were seen from transects (Appendix 1)

The only other tetronid reported during BTO *Atlas* fieldwork in NN50 was a single Capercaillie in winter between 1981/82 – 83/84.

### 3.4 Passerines

#### 3.4.1 *Open-country passerines*

These include those passerines that, based on their normal associations with open or non-wooded habitats, are likely to be displaced from areas where native-type woodland is to be developed. Both Meadow Pipit and Skylark were too abundant for AOTs to be determined through the survey methodology used, but the distributions of all registrations during the constant effort searches are shown in Figures 8 and 9. The number of registrations from line transects were comparable for both Skylark and Meadow Pipit between Milton Glen and reference sites (Paired t-tests: for Skylark,  $t_3 = 1.96$ ,  $P = 0.15$ ; for Meadow Pipit,  $t_3 = 2.76$ ,  $P = 0.07$ )

Other birds of note recorded during the survey include Ring Ouzel (3 AOTs, Figure 10), Twite (1 AOT, Figure 10), Wheatear (8 AOTs, Figure 11), Stonechat (2 AOTs, Figure 12), Whinchat (5 AOTs, Figure 12), Whitethroat (3 AOTs, Figure 13) and Yellowhammer (3 AOTs, Figure 13). Ring Ouzels were not seen during transect surveys at the reference sites, but the numbers of other species encountered were broadly comparable (Appendix 1).

#### 3.4.2 *Woodland passerines*

Sixteen species of passerines associated with wooded or developed scrub areas were recorded (Table 3, Figure 14). Note that the survey methodology was principally for birds in open habitats and not appropriate for estimating precisely the numbers of territories within wooded areas.

#### 3.4.3 *Corvids*

Carrion Crows (including Hooded and hybrids) were seen throughout the survey area (a combined total of 30 registrations during both constant effort search visits). Although most were foraging or otherwise flying, at least two nests were found, despite not actually searching for them. Seven registrations of Ravens were recorded during both constant effort searches combined. Displaying Ravens were seen just off the eastern periphery of the survey area.

### 3.5 Other species

Other species of interest recorded at Milton Glen included Mallard (1 AOT at a small pool on the western boundary), Dipper (1 AOT on the Milton Glen Burn) and Common Gull, of which three pairs were behaving as if holding territory on the low mires by the southern boundary of the holding during the late visits.

## 4. DISCUSSION

### 4.1 Current ornithological interest

By virtue of its varied topography and altitudinal range, Milton Glen holds a diverse and interesting avifauna. Of particular note are breeding waders, three species of grouse and a diversity of passerines that includes Ring Ouzel, Whinchat, Stonechat, Wheatear, Skylark, Yellowhammer, Reed Bunting and Twite. Comparison with the reference sites suggests that the area may have local importance based on the densities of breeding waders, the presence of the three tetranids (Red Grouse, Black Grouse and Ptarmigan) and the upland passerines, Twite and Ring Ouzel. Otherwise, current bird populations (diversity and density) are probably typical for the region.

The combined areas occupied by breeding waders, grouse, Ring Ouzel and Twite are about 360ha, or just less than half of the Milton Glen holding (Fig. 15). Four general areas of importance that were identified are:

1. The lowest ground along the southeastern boundary of the holding where most of the waders were found (120ha);
2. The upland heath and montane areas that includes areas for Red Grouse, Ptarmigan, Twite, Ring Ouzel and Merlin (190ha);
3. An area of rough pasture and small mires centred on the site of the single lekking Black Grouse (30ha);
4. An area of wet pasture, flushes and mires 'half-way' up the glen, encompassing 3 AOTs of Snipe (20ha).

These areas also include AOTs for other 'open' habitat species, notably Merlin, Skylark, Reed Bunting and Yellowhammer.

An increase in woodland cover will inevitably impact on birds that inhabit open habitats through the loss and potentially also the fragmentation of those open areas. In determining a management programme for Milton Glen that will provide gross benefit for nature conservation, the decision making process needs to consider (i) whether the benefits of increased woodland cover will outweigh any losses, (ii) whether sufficient areas can remain open to maintain current interest or (iii) whether some of the open habitats can be enhanced in order to mitigate for any losses.

### 4.2 Mitigation measures

The mitigation measures suggested below are principally aimed at maintaining or enhancing some of the current bird interest at Milton Glen. Woodland expansion will certainly see an expansion in the numbers and range of woodland-reliant species on the site (see Section 4.2.4).

#### 4.2.1 Waders

All breeding waders would be displaced if their nesting areas were to be replaced with woodland. Similarly, close encroachment of woodland into peripheral areas close to breeding waders may make them less attractive through a combination of changing hydrology and perception of increased risk from predators. To attempt to maintain the number of breeding waders, the areas identified (Fig. 15) should be retained as open. The most important area is that along the southeastern boundary of the holding and adjacent to the road. This area is the most appropriate for mitigating action to enhance conditions for waders.

Not all waders thrive in the same habitats and, therefore, it is important that a variety of grazing and/or cutting regimes are employed (see below). All species generally require a fairly high water table (wet soil conditions) and a relatively open landscape, however. A number of drains run through the area and some scrub (notably gorse) has encroached onto some areas. Suggested mitigating actions are:

- The blocking of any active drains to either increase wetness or maintain the hydrologic integrity of mires and flushes;
- Judicial clearance of some scrub patches, notably those close to mires, flushes and herb rich areas, (potential meadows), to create extensive 'open' areas;
- Maintenance of a diversity of grazing regimes (stocking densities and grazing animals) to ensure that different sward heights and structures are available to different species - Curlew thrive in fairly tall and varied height swards, Lapwing in short vegetation and Snipe probably intermediate between the two;
- Reinstatement of some 'traditionally' managed hay meadows, to increase floral and invertebrate abundance (food for wader chicks) and also add to the mosaic of habitats and vegetation structures available.

Specifically, two or three areas (old or existing field units) that have not been reseeded should be identified, principally on mineral soils where management as meadows could be reinstated. This should include stock exclusion from early May to August, after which the hay should be cut. Light grazing of the aftermath, continuing through the winter, can enhance floral diversity. The timing of cutting and the grazing regime can influence both bird use and floral diversity (Green 1996, Smith & Jones 1991, Smith *et al.* 2002, Broyer 2003) and the supplementary sowing with some herb seeds may be considered (Smith *et al.* 2002). Traditionally managed meadows are also used by Black Grouse (Bernard 1980, Kolb 2000, Starling-Westerberg 2001) and Twite (Brown *et al.* 1995). The mire by the road, about 500m east of Milton of Callander Farm, is currently grazed and poached, and in its current condition holds numbers of breeding Curlew and Snipe. Reduction, or exclusion of grazing, from this area may enhance the mire vegetation but may also reduce its attractiveness for breeding waders. For the latter, winter grazing by cattle to encourage some moderate or light poaching and to prevent bog myrtle from growing too high is recommended. Elsewhere within the low wader area, a combination of sheep and cattle grazing at varying stocking densities should maintain the diversity of sward height required, but note that high spring stocking levels can lead to excessive trampling of wader nests.

The area identified as important for Snipe, half-way up Milton Glen, does not lend itself particularly well to positive enhancement. Its exclusion from any planting and a reduced level of grazing (or no grazing), even its exclusion, may maintain suitable conditions at least for a number of years.

#### 4.2.2 *Montane and upland heath area*

The montane areas will be at higher altitude than any areas to be planted but their vegetation, and potentially Ptarmigan, may benefit from reduced, or exclusion from grazing. The main area of upland heath interest lies mostly to the west of the Milton Glen Burn. Red Grouse will benefit from management that enhances the ericaceous vegetation (Hudson 1995) while Ring Ouzels are associated with mosaics that include heather and some areas of 'smooth' (grazed) grass (Buchanan *et al.* 2003). Suggested mitigating actions are:

- Low to modest levels of grazing by sheep in summer – in the order of one ewe per hectare, with followers, between late April and September (note the influence of wild herbivores, notably deer, should be included in the determination of stocking rates);

- Very low levels of grazing (less than one ewe per two hectares), or no grazing during winter – in winter, heather is generally more nutritious than grass and will then tend to be specifically targeted by grazing animals, while in summer, the reverse is generally the case.
- Regular, active movement of sheep across the area (at least two or three times a week) to prevent low and sheltered areas from being grazed particularly hard;
- Prevention of excessive deer grazing – their numbers should be incorporated into the grazing management suggested above. Exclusive grazing by deer, and other wild herbivores *may* be an option, however it is unlikely to be as readily manageable, for example to maintain a heather/grass mosaic suitable for Ring Ouzels;
- Some local, rotational strip burning or cutting of heather will increase the young and nutritious growth available to grouse. Some areas of heather should be left to develop and cycle naturally, however.

Such a management regime is also likely to be suitable for Twite and Meadow Pipit. The last are likely to be the preferred prey of Merlin, which could also nest on the small crags or within tall stands of heather.

#### 4.2.3 *Black Grouse*

Numbers of Black Grouse in Milton Glen are low. Only a single male was seen lekking despite searches at the peak times, of day and season, for lekking activity (Baines 1996) and no females were seen. The two registrations during transect surveys refer to the lekking individual and one in flight, possibly the same bird. There are Black Grouse elsewhere in the region and therefore management to enhance their numbers is possible. Although often referred to as a woodland grouse, Black Grouse rely largely on ground vegetation (grasses, sedges, rushes and ericaceous plants), whether it is in open habitats or within woodland (Parr & Watson 1988, Cayford *et al.* 1989, Starling-Westerberg 2001). Woodland structure is of utmost importance in determining whether Black Grouse can be supported. They select young stands, typically 0 – 20 years old, (Brittas & Willebrand, Garson & Starling 1990, Haysom 2001, Swenson & Angelstam 1993) or open woodlands where the tree density is typically between 5 – 200 stems per hectare, with a corresponding canopy cover that is less than 20% (Beichle 1987, Ramanzin *et al.* 2000, McFarlane 2002). Essentially the canopy structure has to be sufficiently sparse to permit the development of well-structured ground vegetation that includes ericaceous plants. At Milton Glen, in order to encourage Black Grouse to use new woodland in the long term, these tree densities will need to be adhered to over significant areas. In addition, mires and flushes should remain clear of trees. Grazing reductions have been demonstrated to be associated with improved breeding success and increased numbers of Black Grouse in open habitats (Calladine *et al.* 2002) and the grazing reductions suggested for other birds in the areas to remain open could also benefit Black Grouse. An additional issue to consider in relation to the control of grazing is that collisions with deer fences can be a significant cause of mortality for Black Grouse (Baines & Summers 1997) and the same may also be true for some stock fences. The marking of fences with orange barrier netting is the only tried and tested method for reducing collision frequencies (Baines & Andrew 2003), however the keeping of all fences to a minimum and their careful positioning should also be effective. In summary, for Black Grouse:

- Grazing reductions and meadow management suggested for other birds can also benefit black grouse;
- Young woodland (< 20 years) can be used, but to ensure long-term suitability, tree densities should be between 5 - 200 stems per hectare (planting at higher densities, provided they are appropriately thinned before reaching a 'thicket' stage *may* maintain some suitable areas for Black Grouse);
- Wet flushes and mires should remain free of trees;
- Fencing should be kept to a minimum, carefully positioned or marked, in order to minimise risks of collision.

#### 4.2.4 Other issues related to open habitats

Within the areas not identified in Figure 15 as of special importance for birds of open habitats, Skylark, Whinchat, Stonechat and Twite were all seen, though the latter did not register as an AOT. Inclusion of open glades within any woodland plan could accommodate Whinchat, Stonechat and some Skylark. Priority areas for glades should include all mires and flushes and a selection of other areas where ericaceous vegetation is likely to regenerate under a reduced grazing regime. Vestigial heather and blaeberry are found currently throughout the grass-dominated areas. Such areas can accommodate Whinchat and Stonechat and also be used by Black Grouse. Woodland-scrub interfaces around such glades in the lower parts of the Glen could also attract Whitethroat, Linnet and Yellowhammer and thereby potentially mitigating for some losses of these species through scrub clearance on the lowest ground to benefit breeding waders (Section 4.2.1).

Two currently widespread species at Milton Glen are Meadow Pipit and Skylark. Reduced areas of open ground will inevitably reduce suitable areas for these birds. Meadow Pipits are not currently listed as species of conservation concern, and good numbers were seen in the areas suggested to remain open as mitigation for other species that are (Figure 8). Accordingly, given adherence to the mitigation measures suggested, Meadow Pipits would be expected to remain on the site in numbers. Skylarks, on the other hand, are red-listed as species of high conservation concern (Gregory *et al.* 2002). Although much of the census and survey work on which knowledge of their declining population is based on lowland sites, there is evidence that the species has also declined in some upland areas at least (Fuller *et al.* 2002). Skylarks tend to occur at reduced densities where management is principally for heather and with relatively low levels of grazing (Tharme *et al.* 2001). The mitigation measures suggested for other species above would only be expected to support reduced numbers of Skylarks than at present. Surveys at the reference sites suggest, however, that the species remains abundant in the region, and so losses may only be significant at the very local level.

#### 4.2.5 Woodland birds

Eighteen species normally associated with woodland were recorded at Milton Glen, most of which could be expected to increase with greater cover by woodland (Table 2). These include one red-listed species (Song Thrush) and seven that are amber-listed (Dunnock, Goldcrest, Lesser Redpoll, Tree Pipit, Willow Warbler, Wood Warbler and Woodcock). An additional 11 woodland species have either been recorded previously at Milton Glen (Table 2) or occur nearby (Appendix 2) and could be potential colonists for new native-type woodlands. This latter group includes two red-listed species (Bullfinch and Spotted Flycatcher) and two amber-listed species (Green Woodpecker and Redstart).

### 4.3 Further monitoring

The surveys undertaken in 2003 aimed to (i) identify the current composition and distribution of the avifauna in Milton Glen, and (ii) set a baseline against which to monitor future trends against which the success, or otherwise, of any mitigating action can be measured. Although numbers of apparent territories have been given for some species, calibrations of such broad surveys against more intensive studies of single species are few. Where the latter has been undertaken, some biases are apparent. For Ring Ouzel, for example, the suggested 3 AOTs, may actually underestimate true numbers, as during survey work across the UK, one-third of territories were only detected by the birds responding to the playing of a recorded song (Wotton *et al.* 2002). For Curlew, estimates based on counts of birds have been shown to overestimate actual populations determined from intensive fieldwork (Grant *et al.* 2000). Because of potential biases, it is paramount that further surveys to assess changes use the same methodology as in 2003. Generally the numbers given should be interpreted as an 'index' that will change in proportion to the absolute population of each species.

To assess changes in bird populations will not require the same intensity of fieldwork annually as in 2003. Annual transect surveys, including the reference sites, are recommended, however. This will not only inform the management programme at Milton Glen but will also provide guidance for other comparable woodland restoration schemes in the uplands. The reference sites used for this survey are selected from a series of random 1-km squares that are monitored as part the UK-wide monitoring scheme organised by the BTO, the Breeding Bird Survey (BBS). Accordingly, there will be further sites within the area against which any changes at Milton Glen can be compared. The rigid methodology associated with this survey will permit further interpretation of a larger data set collected over a number of years. In the first instance, a five year run of annual transect counts is highly recommended.

Because of the local importance of breeding waders at Milton Glen, annual dawn counts (as in 2.1.3) would readily inform of a need to revise any positive management for this group, and require a fairly small time commitment. There will be little to be gained from repeating the extensive constant effort searches annually. A running programme of such monitoring at 5-year intervals would be very useful to assess distributional changes, however. To summarise, a recommended programme for effective monitoring would be:

- Line transects – The four pairs of 1-km transects at Milton Glen, plus equivalent references to be surveyed twice annually, in the first instance for five years (until and including 2007);
- Dawn counts of displaying waders and Black Grouse to be undertaken twice annually, in the first instance for five years (until and including 2007);
- Constant effort search of the entire holding to be repeated in 2007;
- Full analysis of population trends and distributional changes to be undertaken in 2007 to inform management decisions and further monitoring requirements.

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**Table 1.** The dates of bird survey visits to Milton Glen and reference sites in 2003.

| AREA                   | METHODOLOGY            | DATE        |              |
|------------------------|------------------------|-------------|--------------|
|                        |                        | First visit | Second visit |
| <b>MILTON GLEN</b>     |                        |             |              |
|                        | Line transects         |             |              |
|                        | NN5807/5806            | 3 May       | 4 June       |
|                        | NN5707                 | 3 May       | 4 June       |
|                        | NN5607                 | 3 May       | 5 June       |
|                        | NN5509                 | 3 May       | 5 June       |
|                        | Constant effort search | 22-23 April | 4-5 June     |
|                        | Dawn visits            | 23 April    | 3 May        |
|                        | Evening visits         | 10 May      | 17 May       |
| <b>REFERENCE SITES</b> |                        |             |              |
|                        | Line transects         |             |              |
|                        | NN4937                 | 15 May      | 24 June      |
|                        | NN6312                 | 10 May      | 7 June       |
|                        | NN6213                 | 10 May      | 7 June       |
|                        | NN4212                 | 21 May      | 11 July      |

**Table 2.** Birds recorded during survey work at Milton Glen in April – June 2003.

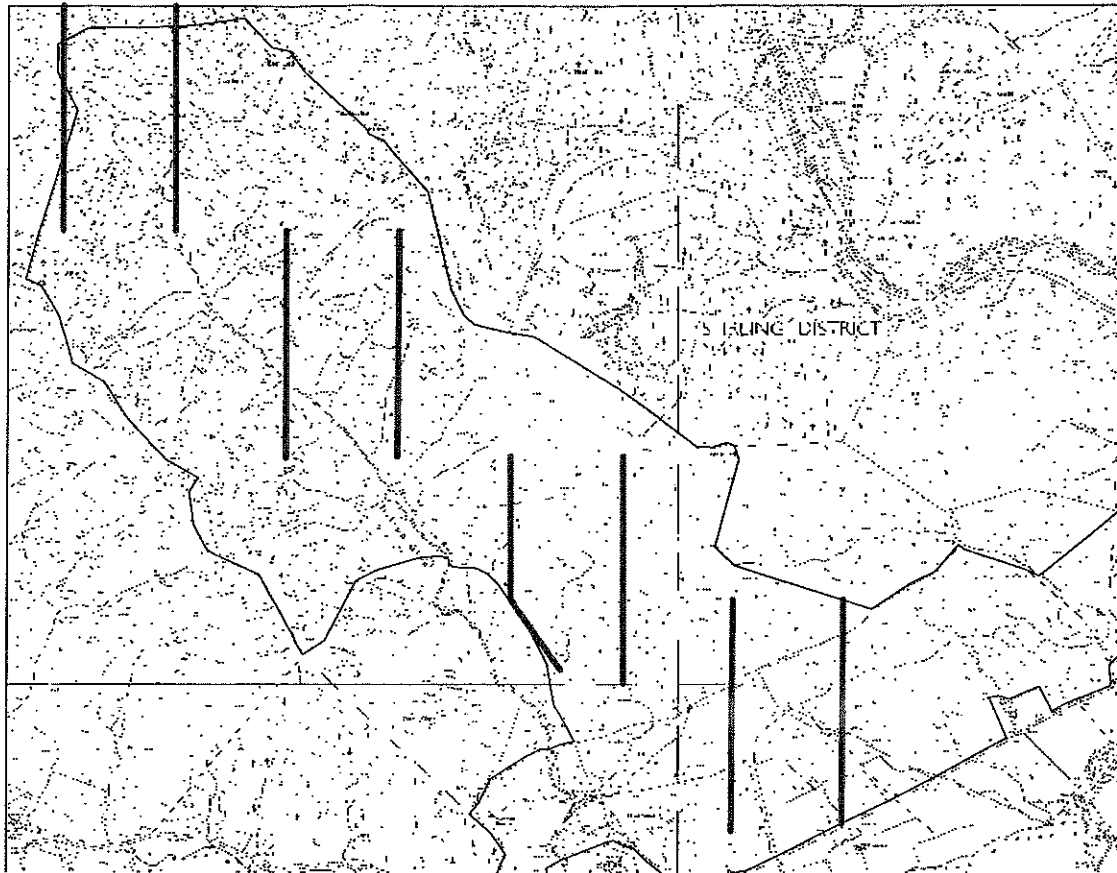
| Species             | Status in 2003 <sup>1</sup> | Recorded previously <sup>2</sup> | UK status listing <sup>3</sup> | Major habitat requirement <sup>4</sup> |
|---------------------|-----------------------------|----------------------------------|--------------------------------|--|
| Blackbird           | Breeding                    | T                                |                                | Wooded                                 |
| Blackcap            | Breeding                    |                                  |                                | Wooded                                 |
| Black Grouse        | 1 lekking male              | D                                | Red                            | Open                                   |
| Blue Tit            | Breeding                    | D                                |                                | Wooded                                 |
| Bullfinch           | Not seen                    | T                                | Red                            | Wooded                                 |
| Buzzard             | Present                     | T                                |                                | Generalist                             |
| Carrion/Hooded Crow | Breeding                    | T                                |                                | Generalist                             |
| Cuckoo              | Breeding                    | D                                | Amber                          | Variable                               |
| Chaffinch           | Breeding                    | T                                |                                | Wooded                                 |
| Coal Tit            | Not seen                    | T                                |                                | Wooded                                 |
| Common Gull         | Breeding                    | D                                |                                | Open                                   |
| Curlew              | 8 AOTs                      | D                                | Amber                          | Open                                   |
| Dipper              | 1 AOT                       | D                                |                                | Riparian                               |
| Dunnock             | Breeding                    | D                                | Amber                          | Wooded                                 |
| Goldcrest           | Breeding                    | T                                | Amber                          | Wooded                                 |
| Great Tit           | Breeding                    | T                                |                                | Wooded                                 |
| Lapwing             | 2 AOTs                      | D                                | Amber                          | Open                                   |
| Lesser Redpoll      | Breeding                    | D                                | Amber                          | Wooded                                 |
| Mallard             | 1 AOT                       | D                                |                                | Open                                   |
| Meadow Pipit        | Breeding                    | T                                |                                | Open                                   |
| Merlin              | 1 AOT                       |                                  | Amber                          | Open                                   |
| Mistle Thrush       | Present                     | D                                |                                | Wooded                                 |
| Oystercatcher       | 1 AOT                       | D                                | Amber                          | Open                                   |
| Peregrine           | Not seen                    | T                                |                                | Generalist                             |
| Ptarmigan           | Present                     |                                  |                                | Open                                   |
| Raven               | Present                     | D                                |                                | Generalist                             |
| Reed Bunting        | 7 AOTs                      | D                                | Red                            | Open                                   |
| Red Grouse          | 4 AOTs                      | D                                | Amber                          | Open                                   |
| Ring Ouzel          | 3 AOTs                      | T                                | Red                            | Open                                   |
| Robin               | Breeding                    | T                                |                                | Wooded                                 |
| Skylark             | Breeding                    | T                                | Red                            | Open                                   |
| Snipe               | 11 AOTs                     | D                                |                                | Open                                   |
| Song Thrush         | Breeding                    | D                                | Red                            | Wooded                                 |
| Stonechat           | 2 AOTs                      |                                  |                                | Open                                   |
| Tree Pipit          | 2 AOTs                      | T                                | Amber                          | Wooded                                 |
| Twite               | 1 AOT                       | D                                | Red                            | Open                                   |
| Wheatear            | 8 AOTs                      | T                                |                                | Open                                   |
| Whinchat            | 5 AOTs                      | D                                |                                | Open                                   |
| Whitethroat         | 3 AOTs                      | D                                |                                | Open                                   |
| Willow Warbler      | Breeding                    | D                                | Amber                          | Wooded                                 |
| Woodcock            | 2 Roding                    |                                  | Amber                          | Wooded                                 |
| Wood Pigeon         | Present                     | D                                |                                | Wooded                                 |
| Wood Warbler        | 1 AOT                       | D                                | Amber                          | Wooded                                 |
| Wren                | Breeding                    | D                                |                                | Generalist                             |
| Yellowhammer        | 3 AOTs                      | D                                | Red                            | Open                                   |

Notes for Table 2:

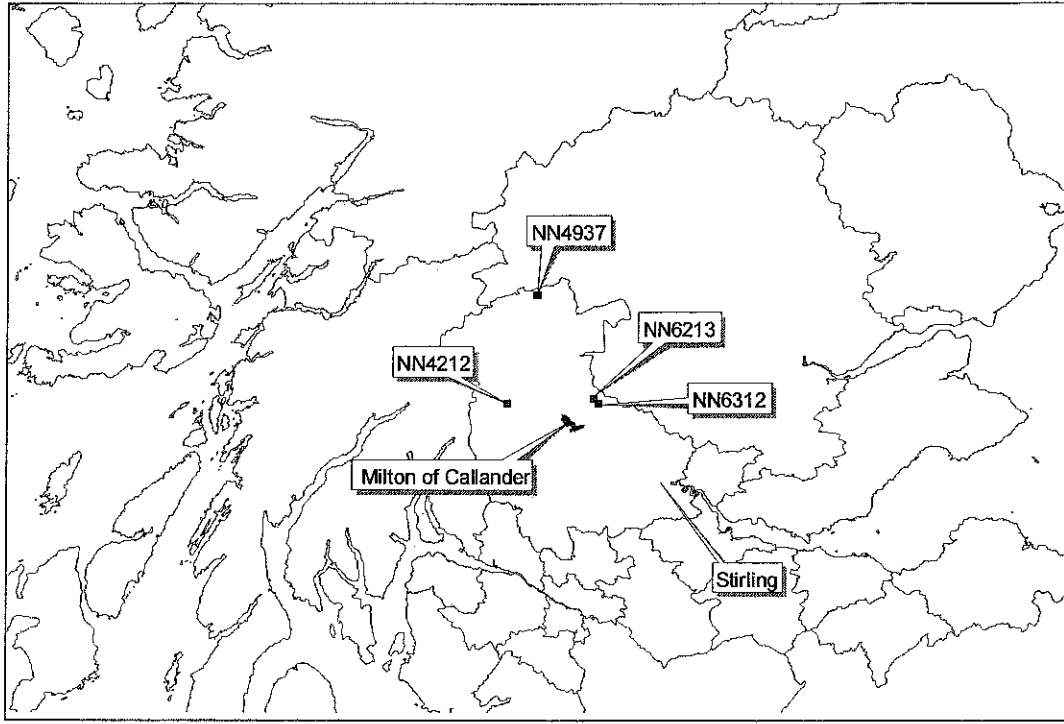
1. 'Breeding' indicates birds recorded displaying, singing, repeatedly alarming or a nest or young seen during survey work in 2003. The number of AOTs are determined through criteria given in Section 2.2.2. Other birds seen are listed as 'Present'.
2. 'T' refers to being recorded within the tetrads NN50P and NN50U during breeding atlas fieldwork in 1988-90. 'D' refers to additional species recorded in the 10-km square NN50 though not in the two tetrads.
3. 'Red-listed' species are those of high conservation concern based on marked population declines in the UK over the last 25 years. 'Amber-listed' species are of medium conservation concern based on historical population declines or more moderate recent declines. Other species are 'green-listed' and usually means recent population trends have not changed sufficiently to give cause for concern. (Source: Gregory *et al.* 2002).
4. These habitat requirements are simplistic but give some indication as to which species (those shown as 'Open') are most likely to be displaced through an increase in native-type woodland cover.
5. Other species recorded elsewhere in NN50 during breeding atlas fieldwork (1988-90) are listed in Appendix 2, and further additional species seen during winter atlas fieldwork (1981/82-83/84) in Appendix 3.



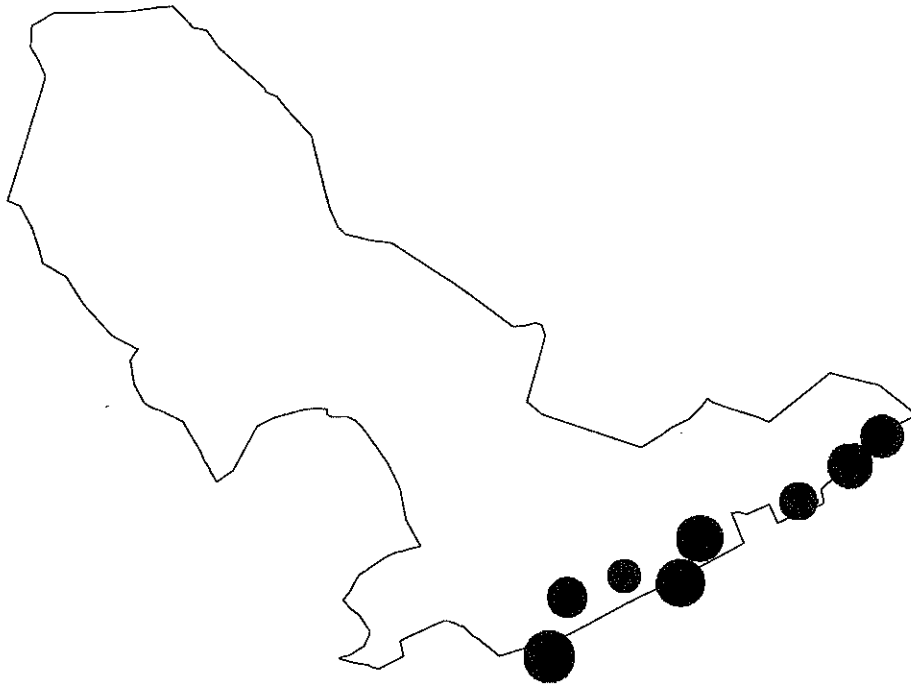




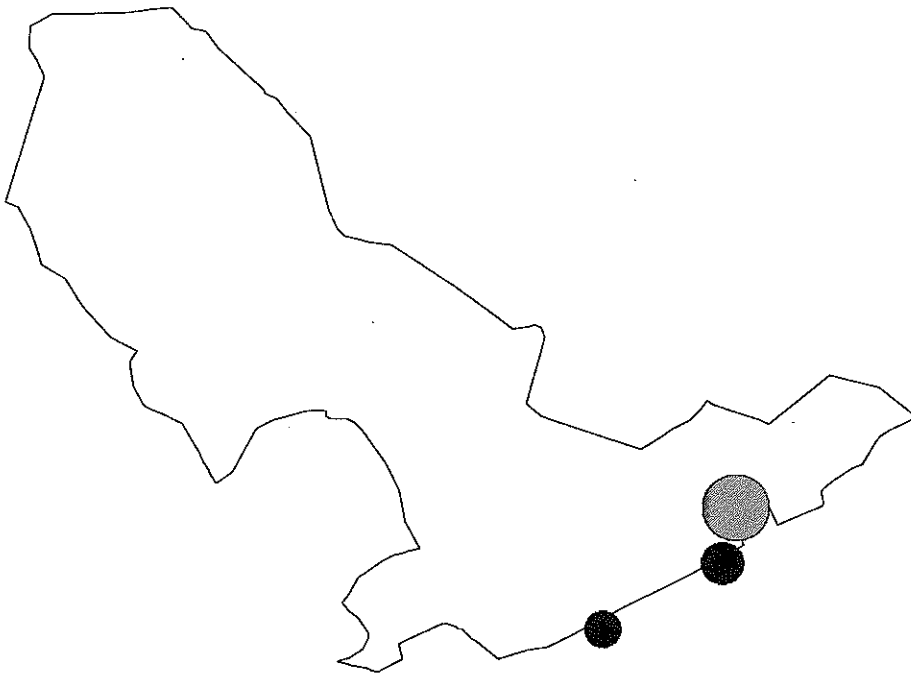
**Figure 1.** Transects used for bird surveys at Milton Glen.



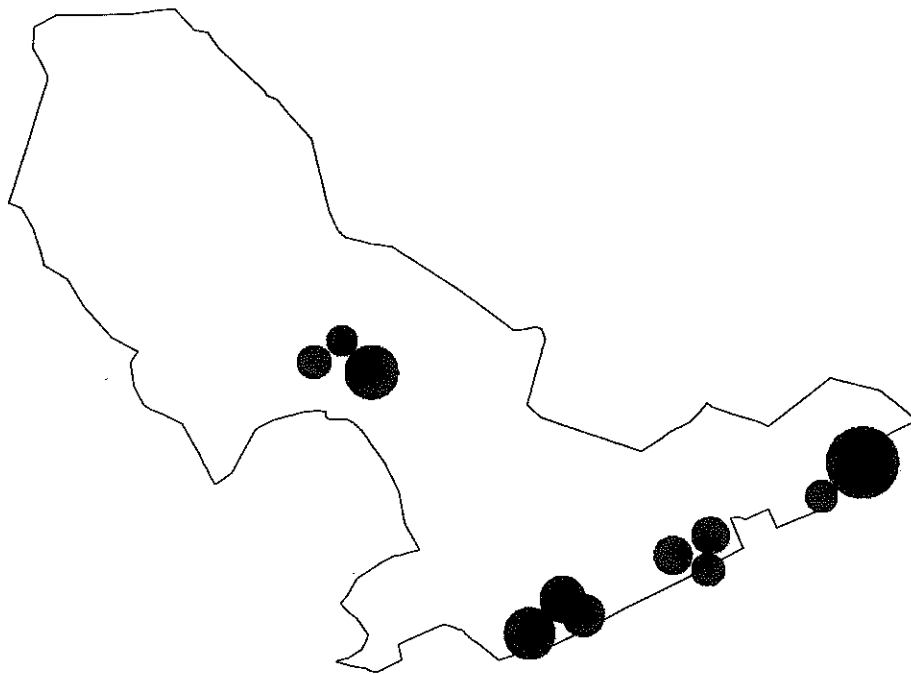
**Figure 2.** The locations of Milton Glen and the reference sites.



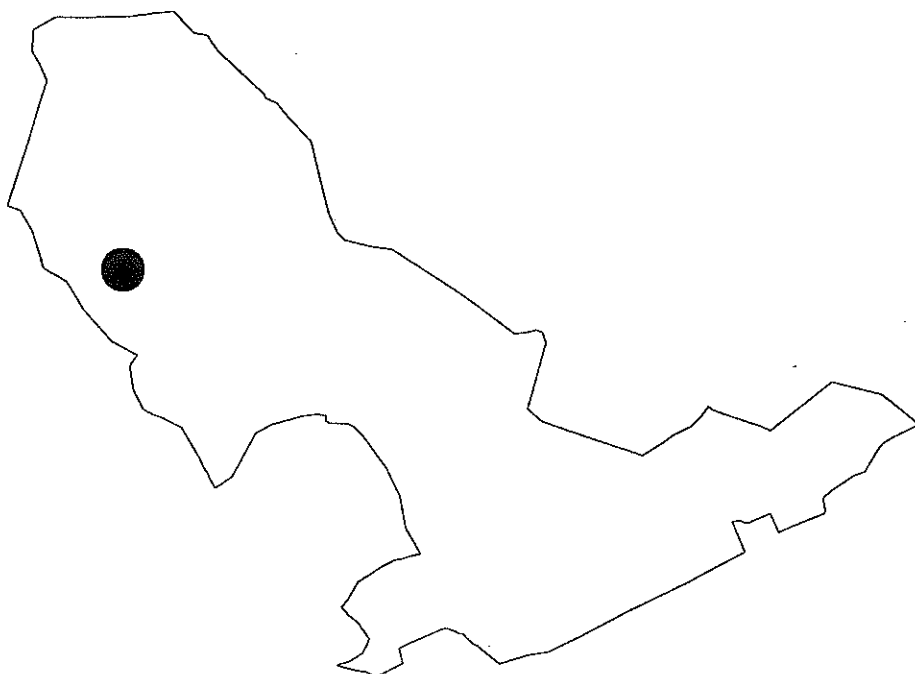
**Figure 3.** Curlew AOTs at Milton Glen, spring 2003.



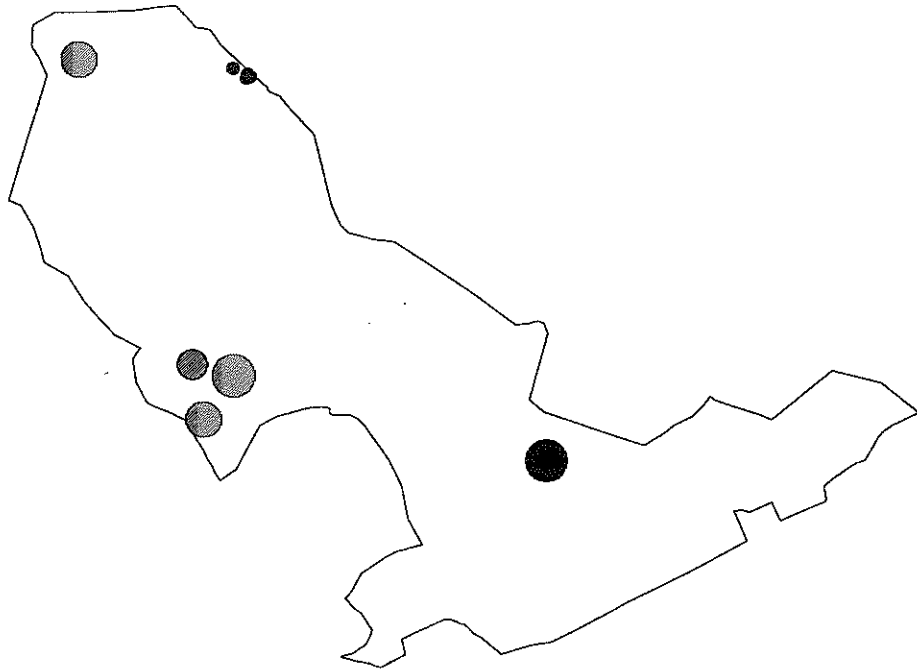
**Figure 4.** Lapwing (solid circles) and Oystercatcher (hatched corcle) AOTs at Milton Glen, spring 2003.



**Figure 5.** Snipe AOTs at Milton Glen, spring 2003.



**Figure 6.** Merlin AOT at Milton Glen, 2003.



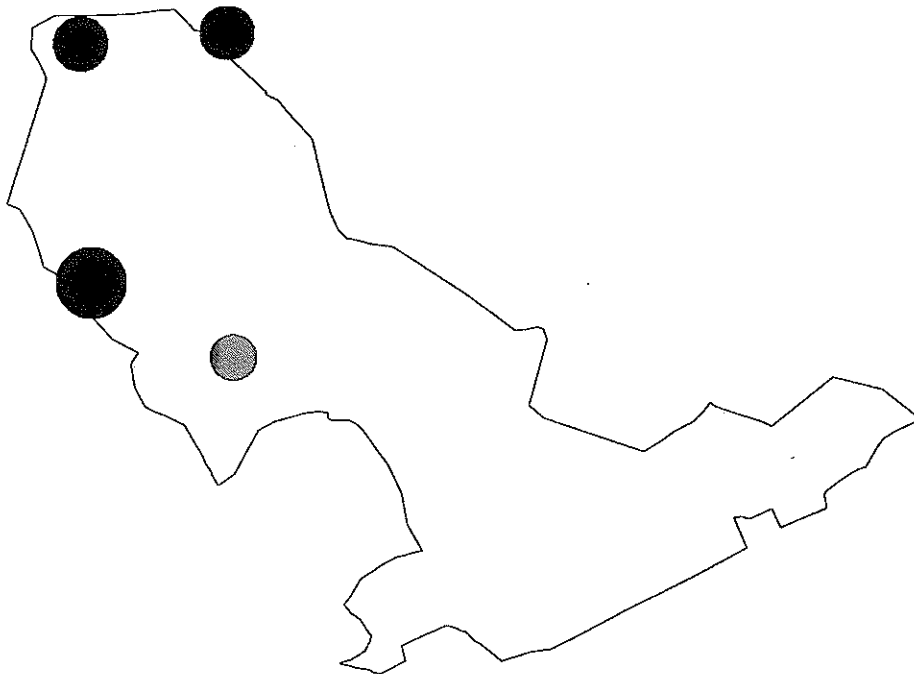
**Figure 7.** Black Grouse (lek site – solid circle), Red Grouse (AOTs – hatched circles) Ptarmigan (all registrations – small dots) at Milton Glen, spring 2003.



**Figure 8.** All Meadow Pipit registrations during Constant Effort Searches at Milton Glen, spring 2003.



**Figure 9.** All Skylark registrations during Constant Effort Searches at Milton Glen, spring 2003.



**Figure 10.** Ring Ouzel (solid circles) and Twite (hatched circle) AOTs at Milton Glen, spring 2003.

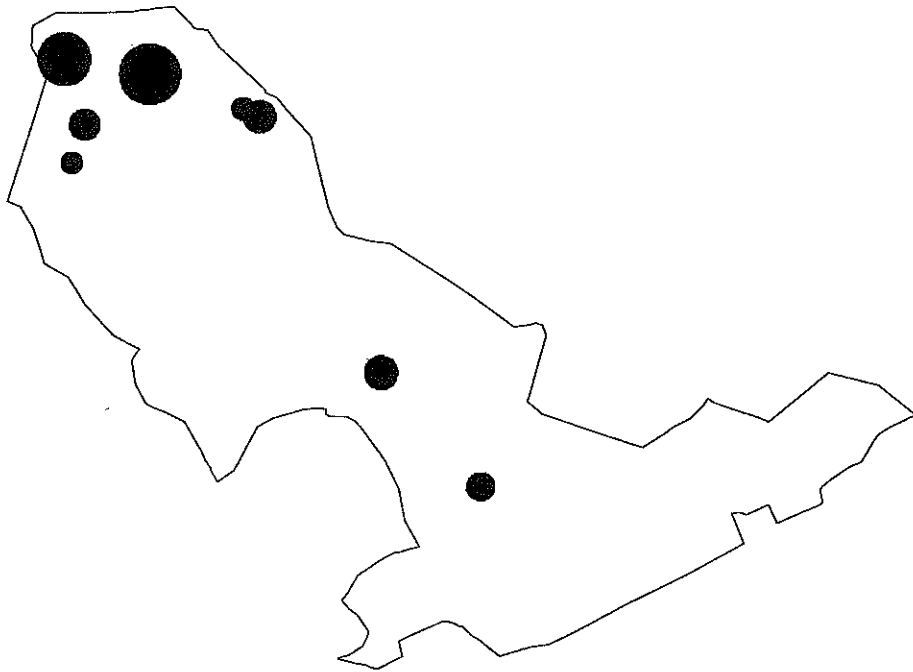
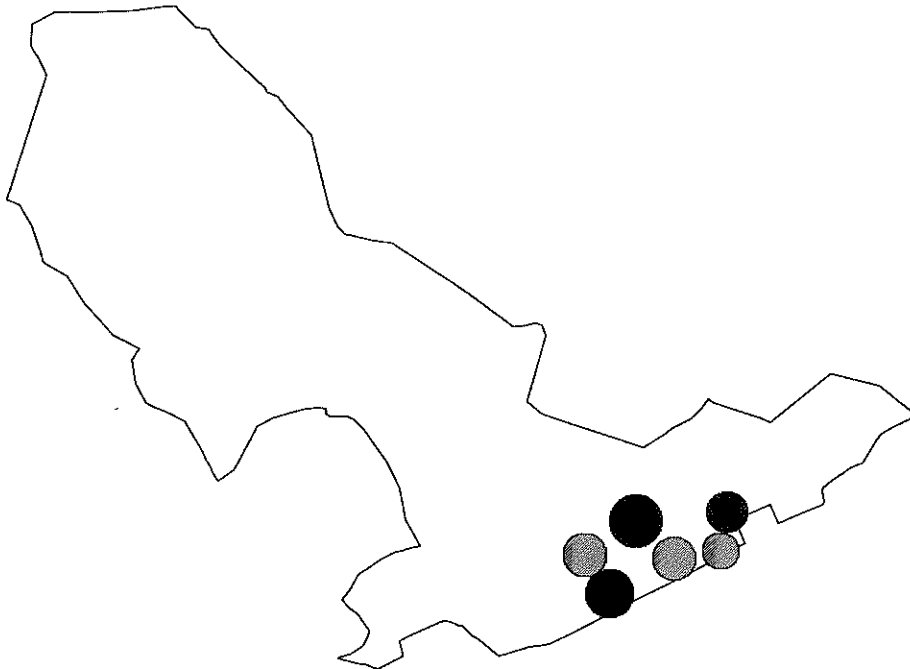


Figure 11. Wheatear AOTs at Milton Glen, spring 2003.



Figure 12. Stonechat (solid circles) and Whinchat (hatched circles) AOTs at Milton Glen, spring 2003.

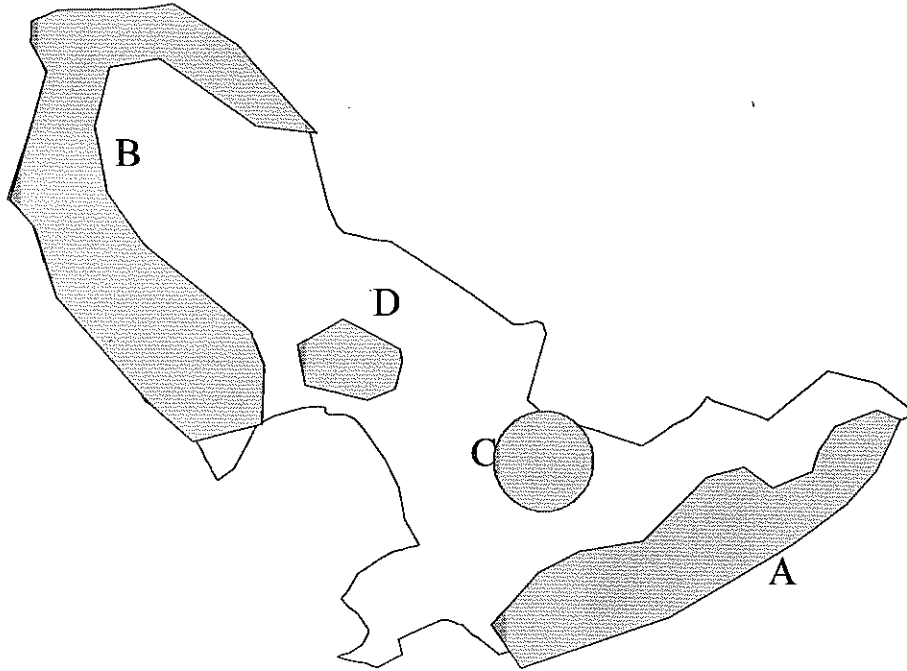


**Figure 13.** Yellowhammer (solid circle) and Whitethroat (hatched circle) AOTs at Milton Glen, spring, 2003.



**Figure 14.** Registrations of all woodland birds at Milton Glen, spring, 2003.





**Figure 15.** The combined areas occupied by breeding waders, grouse, Ring Ouzel and Twite.

Key:

A - The lowest ground where most breeding waders were found.

B - Upland heath and montane areas for Red Grouse, Ptarmigan, Twite, Ring Ouzel and Merlin.

C - Rough pasture and mires centred on the site of a single lekking Black Grouse.

D - Wet pasture, flushes and mires with breeding snipe.



**Appendix 1.** Summary of bird registrations from Line transect surveys, spring 2003.

| Species                | Square | Milton Glen<br>Early | Milton Glen<br>Late | Reference<br>Early | Reference<br>Late |
|------------------------|--------|----------------------|---------------------|--------------------|-------------------|
| Blackbird              | 1      | 0                    | 0                   | 0                  | 0                 |
|                        | 2      | 0                    | 1                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Blackcap               | 1      | 0                    | 0                   | 0                  | 1                 |
|                        | 2      | 0                    | 0                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Black Grouse           | 1      | 1                    | 0                   | 13                 | 0                 |
|                        | 2      | 1                    | 0                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 3                  | 0                 |
| Blue Tit               | 1      | 0                    | 0                   | 0                  | 1                 |
|                        | 2      | 0                    | 0                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Buzzard                | 1      | 1                    | 0                   | 0                  | 0                 |
|                        | 2      | 0                    | 0                   | 0                  | 0                 |
|                        | 3      | 0                    | 1                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Carrion/hooded<br>Crow | 1      | 1                    | 1                   | 0                  | 5                 |
|                        | 2      | 3                    | 0                   | 1                  | 0                 |
|                        | 3      | 0                    | 4                   | 0                  | 0                 |
|                        | 4      | 0                    | 2                   | 1                  | 2                 |
| Canada goose           | 1      | 0                    | 0                   | 2                  | 0                 |
|                        | 2      | 0                    | 0                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Chaffinch              | 1      | 9                    | 10                  | 9                  | 2                 |
|                        | 2      | 5                    | 1                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Cuckoo                 | 1      | 0                    | 1                   | 1                  | 0                 |
|                        | 2      | 1                    | 0                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Common Gull            | 1      | 0                    | 0                   | 0                  | 1                 |
|                        | 2      | 0                    | 0                   | 0                  | 0                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Curlew                 | 1      | 4                    | 4                   | 1                  | 0                 |
|                        | 2      | 1                    | 0                   | 2                  | 1                 |
|                        | 3      | 0                    | 0                   | 0                  | 0                 |
|                        | 4      | 0                    | 0                   | 0                  | 0                 |
| Dunnock                | 1      | 1                    | 0                   | 0                  | 0                 |
|                        | 2      | 0                    | 0                   | 0                  | 0                 |

|                          |   |    |    |    |    |
|--------------------------|---|----|----|----|----|
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Grey Wagtail             | 1 | 0  | 0  | 2  | 1  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Great Tit                | 1 | 0  | 0  | 0  | 1  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Jack Snipe               | 1 | 1  | 0  | 0  | 0  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Kestrel                  | 1 | 0  | 0  | 0  | 0  |
|                          | 2 | 1  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Lesser Black-backed Gull | 1 | 1  | 0  | 0  | 0  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Linnet                   | 1 | 2  | 1  | 0  | 0  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Lesser Redpoll           | 1 | 3  | 5  | 0  | 0  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Mistle Thrush            | 1 | 0  | 0  | 1  | 0  |
|                          | 2 | 1  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Meadow Pipit             | 1 | 24 | 11 | 20 | 55 |
|                          | 2 | 21 | 42 | 15 | 20 |
|                          | 3 | 22 | 35 | 35 | 68 |
|                          | 4 | 39 | 52 | 22 | 33 |
| Pheasant                 | 1 | 1  | 0  | 0  | 0  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Robin                    | 1 | 3  | 2  | 1  | 0  |
|                          | 2 | 1  | 2  | 0  | 0  |
|                          | 3 | 0  | 0  | 0  | 0  |
|                          | 4 | 0  | 0  | 0  | 0  |
| Reed Bunting             | 1 | 0  | 3  | 1  | 2  |
|                          | 2 | 0  | 0  | 0  | 0  |
|                          | 3 | 0  | 0  | 3  | 2  |
|                          | 4 | 0  | 0  | 0  | 0  |

|             |   |    |    |   |    |
|-------------|---|----|----|---|----|
| Red Grouse  | 1 | 0  | 0  | 0 | 0  |
|             | 2 | 0  | 0  | 0 | 0  |
|             | 3 | 2  | 0  | 1 | 0  |
|             | 4 | 0  | 0  | 0 | 0  |
| Raven       | 1 | 1  | 0  | 0 | 0  |
|             | 2 | 1  | 0  | 0 | 0  |
|             | 3 | 0  | 0  | 5 | 0  |
|             | 4 | 1  | 0  | 0 | 0  |
| Ring Ouzel  | 1 | 0  | 0  | 0 | 0  |
|             | 2 | 0  | 0  | 0 | 0  |
|             | 3 | 0  | 0  | 0 | 0  |
|             | 4 | 2  | 1  | 0 | 0  |
| Skylark     | 1 | 2  | 1  | 0 | 0  |
|             | 2 | 5  | 5  | 9 | 10 |
|             | 3 | 10 | 11 | 7 | 15 |
|             | 4 | 3  | 3  | 2 | 9  |
| Stonechat   | 1 | 0  | 0  | 0 | 0  |
|             | 2 | 0  | 0  | 0 | 0  |
|             | 3 | 0  | 0  | 1 | 0  |
|             | 4 | 0  | 0  | 2 | 1  |
| Swallow     | 1 | 0  | 0  | 0 | 1  |
|             | 2 | 0  | 0  | 0 | 0  |
|             | 3 | 0  | 0  | 0 | 0  |
|             | 4 | 0  | 0  | 0 | 0  |
| Snipe       | 1 | 3  | 1  | 0 | 0  |
|             | 2 | 1  | 0  | 0 | 0  |
|             | 3 | 1  | 1  | 0 | 0  |
|             | 4 | 0  | 0  | 0 | 0  |
| Song Thrush | 1 | 3  | 2  | 0 | 1  |
|             | 2 | 0  | 0  | 0 | 0  |
|             | 3 | 0  | 0  | 0 | 0  |
|             | 4 | 0  | 0  | 0 | 0  |
| Tree Pipit  | 1 | 1  | 0  | 0 | 0  |
|             | 2 | 0  | 0  | 0 | 0  |
|             | 3 | 0  | 0  | 0 | 0  |
|             | 4 | 0  | 0  | 0 | 0  |
| Twite       | 1 | 0  | 0  | 0 | 0  |
|             | 2 | 0  | 0  | 0 | 0  |
|             | 3 | 0  | 0  | 0 | 0  |
|             | 4 | 0  | 0  | 2 | 0  |
| Wheatear    | 1 | 0  | 0  | 5 | 7  |
|             | 2 | 2  | 1  | 0 | 0  |
|             | 3 | 2  | 0  | 0 | 0  |
|             | 4 | 2  | 1  | 3 | 2  |
| Whinchat    | 1 | 0  | 1  | 0 | 0  |
|             | 2 | 1  | 4  | 0 | 0  |
|             | 3 | 0  | 1  | 0 | 0  |
|             | 4 | 0  | 0  | 0 | 1  |
| Whitethroat | 1 | 0  | 2  | 0 | 0  |
|             | 2 | 0  | 0  | 0 | 0  |

|                |   |    |    |   |   |
|----------------|---|----|----|---|---|
|                | 3 | 0  | 0  | 0 | 0 |
|                | 4 | 0  | 0  | 0 | 0 |
| Wood Pigeon    | 1 | 0  | 1  | 0 | 0 |
|                | 2 | 0  | 0  | 0 | 0 |
|                | 3 | 0  | 0  | 0 | 0 |
|                | 4 | 0  | 0  | 0 | 0 |
| Wren           | 1 | 2  | 2  | 2 | 1 |
|                | 2 | 3  | 0  | 0 | 0 |
|                | 3 | 9  | 6  | 0 | 0 |
|                | 4 | 6  | 6  | 2 | 1 |
| Willow Warbler | 1 | 14 | 11 | 3 | 1 |
|                | 2 | 6  | 3  | 0 | 0 |
|                | 3 | 0  | 0  | 0 | 0 |
|                | 4 | 0  | 0  | 0 | 0 |
| Yellowhammer   | 1 | 0  | 1  | 0 | 1 |
|                | 2 | 0  | 0  | 0 | 0 |
|                | 3 | 0  | 0  | 0 | 0 |
|                | 4 | 0  | 0  | 0 | 0 |

**Appendix 2.** Species recorded in NN50 in summer 1988-90 but not listed in Table 3 (*i.e.* not seen in 2003 survey nor recorded in the Milton Glen Tetrads in 88-90)

|                          |                          |               |
|--------------------------|--------------------------|---------------|
| Black-headed Gull        | Jay                      | Sparrowhawk   |
| Chiffchaff               | Jackdaw                  | Swift         |
| Collared Dove            | Kestrel                  | Siskin        |
| Common Sandpiper         | Lesser Black-backed Gull | Swallow       |
| Green Woodpecker         | Long-tailed Tit          | Sand Martin   |
| Goosander                | Magpie                   | Sedge Warbler |
| Great crested Grebe      | Mute Swan                | Teal          |
| Grasshopper Warbler      | Osprey                   | Treecreeper   |
| Grey Wagtail             | Pied Flycatcher          | Tawny Owl     |
| Goldfinch                | Pheasant                 | Water Rail    |
| Greenfinch               | Pied Wagtail             | Swallow       |
| Great Spotted Woodpecker | Red-breasted Merganser   |               |
| Grey Heron               | Rook                     |               |
| Hen Harrier              | Redstart                 |               |
| House Martin             | Spotted Flycatcher       |               |
| House Sparrow            | Starling                 |               |





**Appendix 3.** Species recorded in NN50 in winter 1981-82 / 83-84 but not listed in Table 3 or Appendix 2.

|                         |                   |
|-------------------------|-------------------|
| Little Grebe            | Wigeon            |
| Cormorant               | Grey lag Goose    |
| Capercaillie            | Whooper Swan      |
| Brambling               | Pochard           |
| Coot                    | Tufted Duck       |
| Short-eared Owl         | Pied Wagtail      |
| Barn Owl                | Great Grey Shrike |
| Great Black-backed Gull | Fieldfare         |
| Herring Gull            | Redwing           |
| Golden Eagle            |                   |

