Atlasing the distribution of the breeding birds of North America

The why and how of an idea whose time has come

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INTRODUCTION

An atlas is a collection of maps, usually published in book form, very often prepared from a specific point of view (geological, hydrological, zoogeographic, etc.) for a specific purpose In recent years and presently, a very special type of atlas is being compiled in various parts of the world, designed to show, to the limits of our most recent knowledge, where each bird species breeds within specified geographical (thus far almost always political) boundaries. In these atlases a separate map is developed for each species which presents graphically the known boundaries of that species' breeding range, in some of these atlases, a general idea of how that species' breeding population is distributed or concentrated can also be shown.

All atlas mapping has been constructed on some form of map grid, which divides the map into uniform rectangles, often squares, in which field workers concentrate their efforts in verifying which species breed therein. Atlasing requires on-the-spot verification of breeding evidence. Because most atlases are concerned with large or very large entities, such as countries, states, provinces, or eventually even continents, they require enormous expenditures of time and effort, not merely for on-the-ground survey work, but for data collection, storage and analysis, map construction, species write-ups and all the various leadership functions, funding, and activities related to publication. Nowhere in the world can activities such as a breeding bird atlas project be accomplished with all-professional (meaning paid) staff. Fortunately, ornithology is the science that owes more to amateur (meaning unpaid, *not* unsophisticated) field work than any other, and those breeding bird atlas projects that have been, or are successfully being accomplished, depend in large measure on amateur dedication and involvement.

The baseline data gathered by a Breeding Bird Atlas project is invaluable, and collecting it provides an opportunity for volunteer birders of all levels of ability to contribute to a major project far beyond the reach of any one individual, natural history organization or research agency.

As will be detailed below, atlas field work involves the careful canvassing, or censusing, of individual map squares, or "grid blocks", during the breeding season, by individual birders (or teams), seeking to locate breeding birds, recording them on report forms. Each species is keyed to a hierarchical code of 17 specified categories of evidence of breeding, from least certain (possible) through more certain (probable) to most certain (confirmed) (Table 1). Most atlas field work requires merely a breeding/non-breeding judgment; once a species is confirmed in a block it can be ignored—it matters not (for basic atlas purposes) whether there is one pair or 1000—that grid square will be positive for that species on that species' map. Most of the field work, of course, is a constant effort to *upgrade* the species' status: a "possible" one year may become a "probable" the following year and a "confirmed" two years later. In most instances, atlas field work is limited to a five-year span, in order to concentrate the effort and maintain the enthusiasm, and because experience has shown that this is usually the minimum period possible to accomplish all the field work, and the maximum period desirable to "freeze" the status of a population in a discrete time frame.

Birders who have taken part in breeding bird atlas work have almost invariably discovered, often to their surprise, that the work is not only highly valuable scientifically, but fun too. Many have expressed delight at discovering, in blocks they thought they knew well, new places to bird and unexpected breeding species. To many, there is as much challenge and satisfaction in confirming a new breeding species in a block, as there is in adding a new species to their state or life lists Reaching the standards set for a block (75% of *presumed* breeders registered, and 50% confirmed, for example, see below) marks a red-letter day, and confirming that elusive, or unsuspected breeder after hours of search, calls for champagne! Pioneer atlasers exploring little known—even roadless blocks—enjoy the pleasure of contributing all-new data to the mapping.

There is as well, it might be admitted, an aspect of competitiveness in the breasts of some of the more competitive birders. A species list for a grid block is like a little life list: one strives to see it grow, and be upgraded. To have the most confirmed or highest percentage of confirmed species of any block in the county, the state or province, is a cause for pride, and to have atlased more blocks than any rival confers undeniable bragging rights. Admittedly, the habitat is a big factor, and a grid block entirely composed of factories, rail yards and vacant lots, while depauperate of birds, is equally vital to the final maps.

The key element of a successful Atlas appears to be the establishment of a strong coordinating body that is able to enlist the help of all the natural history museums and clubs, Audubon chapters, state agencies, and university or college resources within the state or province as well as being able to attract as many individual, non-affiliated birders as possible.

PURPOSES AND USES OF A BREEDING BIRD ATLAS

THE BASIC OBJECTIVE of an Atlas project is to document the current status and distribution of all the breeding species of birds within a major geographical area, and to publish these data in the form of printed maps, one per species (with some exceptions) for a permanent record. An atlas can be duplicated at any time in the future, and thus has great potential baseline value. The uniformity of the data collection process allows its results to be compared with atlases compiled elsewhere, or to atlases compiled in the same area in future years.

The primary objective of an atlas project is:

1 to accurately determine and map the spatial, or geographical and temporal distribution of every bird species breeding within a defined area during a specific time period (usually five years).

There are, however, a number of secondary objectives which are fulfilled in the course of, and as a result of, fulfillment of the primary objective. These may include:

2 to develop an ecological data base—*i.e.*, where and how much of each habitat type lies within the atlas area.

3 to determine which species breeding therein are endangered or threatened, and to provide distributional data on these species.

4 to provide documentation of the need to protect areas of unique and fragile habitat vital to the maintenance or increase of certain species' populations.

5 to provide a body of environmental data that can be used by legislators, land use planners, developers, conservationists and environmentalists.

6 to provide a distributional baseline data source against which future changes can be measured.

7 to develop survey techniques that can be duplicated in the future.

8 to help educate the public and everyone concerned, about birds.

HISTORY

IT HAS LONG BEEN acknowledged that the precise distribution of bird species is useful and important information. Almost all questions in the realm of conservation, protection and management start here. But such information has not always been available, and important advances in its collection and interpretation are now taking place.

In the temperate, boreal, and arctic zones of the northern hemisphere, seasonal climatic changes require that most bird species restrict their reproductive activities to those seasons during which plentiful food sources provide optimum conditions for raising young. But at the same time, the hostile climates of these regions at other times of the year require the migration of many species to more hospitable areas, often long distances from the species' breeding range. The actions of man can have only limited effect on the multiple hazards of bird migration, and man's research has barely begun the study of the winter ranges of those migrants wintering south of the United States and their problems. Thus an accurate determination of the breeding ranges and required habitats of our breeding bird species are all the more vital in the conservation management, and protection of our breeding species.

Phillips (1922 to 1926), Bailey (1928) and Howell (1932) were among the first to map the distribution of birds over wide areas. At a national level Dement'ev and Gladkov (1951 to 1954) in the Soviet Union and Godfrey (1966) in Canada produced maps that summarized the existing information for their respective countries, as did Voous (1960) for European birds. This type of information is useful and tends to encourage others in efforts to refine the maps and their boundaries. Nothing seems to stimulate an enthusiastic field worker quite as much as the chance to fill in a blank spot on the map.

The major shortcoming of the use of *existing* information has been summarized by Heath and Perring (1975) while commenting on the 1963 distribution map of the common frog in the British Isles: "It shows, very clearly, not the distribution of frogs but the distribution of frog watchers." Inventory work has traditionally, and understandably, been concentrated in areas close to urban concentrations.

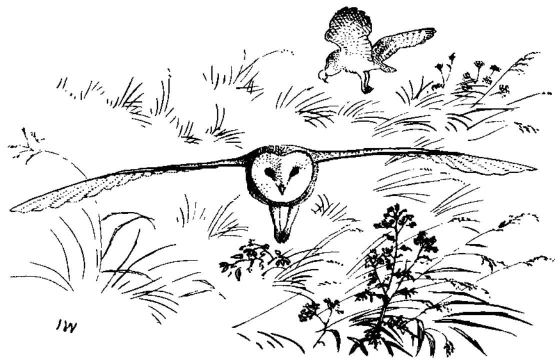
In 1954 the British Botanical Society started a research project that was meant to map accurately the distribution of all species of plants of the British Isles. The British national map grid was used as the basis for divisions of labor in data collection. This system is a grid that overlays all nationally produced topographic (Ordnance Survey) maps Each grid cell is a square 10 kilometers on a side. The botanists compiled existing information and then headed into the field to inventory each grid square. By 1962 the Atlas of British Flora was produced (Perring and Walters, 1962).

The enthusiastic core of British ornithologists and birders was not to be outdone and the initial mapping of the West Midlands counties (Lord and Munns, 1970) soon developed into a full-fledged project covering all of Great Britain and Ireland. Again, the 10-km national grid was used as the basic data collection unit. Between 1968 and 1972, a dedicated group of 1500 observers and 10,000 other participants covered the 3862 squares in the British Isles, including all of Ireland. Five years later the data analysis and map-making was completed and published in book form (Sharrock, 1976). The British atlas maps did not include historical data but the accompanying text did. All information shown on the distribution maps dealt solely with those breeding species that were registered at some time within the 5-year observation period. Each map showed the national grid, with red dots of various sizes placed in each grid block in which that species was noted, the resultant map showed the precise breeding distribution of that species as of that time frame. (Fig. 1) When the British Atlas was published, the reader could apply 12 transparent plastic overlay maps, each with a different topographic or ecological factor, *i.e.*, watercourses, rainfall, elevation, etc , printed on it, so that one could relate that species' distribution to each of 12 factors.

The usefulness of atlases of this type did not go unnoticed elsewhere, and the idea quickly spread to Australia and other countries in Europe, Asia, Africa and North America (Heath and Perring, 1975; Luczak, 1977, Udvardy, 1981, Robbins, 1981). Examples of breeding bird atlases that are readily available include Teixeira (1979) for the Netherlands, Rheinwald (1977) for West Germany, Bull *et al.* (1978) for New Zealand and Schifferli *et al.* (1980) for Switzerland.

Barn Owl

Tyto alba



Barn Owls are found in a wide variety of chiefly agricultural habitats, particularly where areas of rough waste ground and suitable nesting places occur. The nest may be in an artificial site, such as an old barn, derelict building, ruin, or haystack, or in a natural one, such as a hollow tree or a cavity in a cliff face. Though nests in old trees are common (39% of 282 sites on nest record cards), these are usually isolated rather than in dense woodland. Competition with the larger Tawny Owl *Strix aluco*, which will kill Barn Owls, whether for food or as competitors (Mikkola 1976), is thus largely avoided. The occupation of nest boxes by both species has become commoner in recent years.

Breeding Barn Owls can be located by watching at dusk for adults hunting or carrying food, by searching for the characteristic black, shiny pellets at daytime roosts, or by listening for the territorial shrieks of adults and the snoring voices of young in the nest. Despite these clues, pairs may be easily overlooked. The records from *Atlas* fieldworkers were augmented by reports received as a result of appeals on radio, and in various farming and country journals. Most of the replies came from Britain and it should be borne in mind that the Irish picture was not significantly added to in this way. The apparent concentration in Co Kerry is probably largely explained by the local *Atlas* organiser having many contacts in the farming community there. An enquiry relating to 1953–63 (Prestt 1965) indicated that Barn Owls were commonest in SW England, S Wales, S Yorkshire, NW England and S Scotland. The proportion of confirmed breeding records in the *Atlas* shows a similar distribution.

Those nesting in Ross-shire (and also SE Sutherland immediately before the *Atlas* period) probably represent the most northerly breeding Barn Owls in the world. Numbers and range may be limited by the effects of severe winters—not surprising since this is a mainly tropical species—and in this connection it is noticeable that the proportion of proved breeding records is greater in the milder maritime zone of SW Scotland than in the colder SE Scotland. The relative lack of suitable breeding sites, plus winter severity at high altitudes, results in avoidance of parts of the Pennines and the mountains of Wales and Scotland. This owl's degree of abundance in various parts of England and Wales in 1932 (see page 460), based on analysis of returns from 4,000 observers, shows similarities with the distribution indicated by the *Atlas* map.

Though now generally appreciated as a beneficial species, with a diet consisting mostly of Short-tailed Voles, Common Shrews and Wood Mice in Britain, and Wood Mice and Brown Rats in Ireland and the Isle of Man (Glue 1974), Barn Owls were formerly much persecuted, along with all other predators. Even today, the recoveries of ringed individuals show that these protected birds are still shot and trapped, while many more succumb on our roads and railways (Glue 1971).

Short-term fluctuations caused by hard winters or by variations in the density of small rodents tend to mask long-term trends, but there seems no doubt that the Barn Owl has continued to decline in most parts of both Britain and Ireland during this century. Decreases have been attributed largely to loss of habitat, human disturbance, severe winters and, in E England during the late 1950s and early 1960s, toxic chemicals. In Prestt's (1965) enquiry, the Barn Owl came second only to the Sparrowhawk *Accipiter nisus* in the high proportion of returns (76%) reporting a decrease during 1953–63, and this was additional to the long-term decline which was worrying ornithologists even in the 1930s.

Blaker (1934) attempted to estimate the Barn Owl population of England and Wales and arrived at a figure of 12,000 pairs. Parslow commented that some sample areas showed a decline to considerably under half the number found in 1932, and placed the species in the range 1,000–10,000 pairs. At a conservative two to four pairs per occupied 10-km square, the current total would be about 4,500–9,000 pairs.

This species is afforded special protection in Great Britain under Schedule I of the Protection of Birds Act, 1954–67.

Number of 10-km squares in which recorded:
2,279 (59%)
Possible breeding 480 (21%)
Probable breeding 419 (18%)
Confirmed breeding 1,380 (61%)

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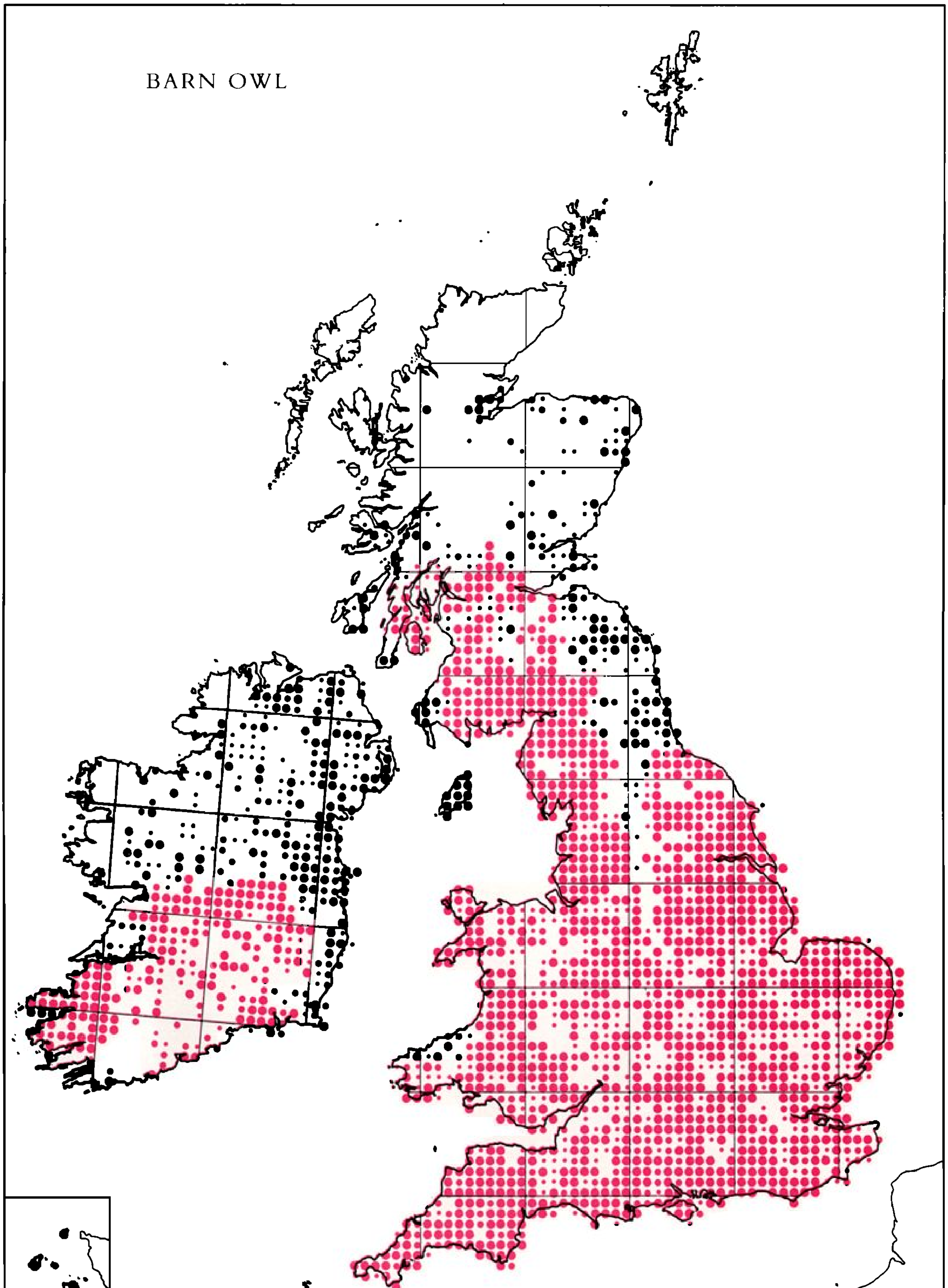


Figure 1. *Map of Barn Owl breeding distribution in Britain and Ireland. Map and text reproduced by permission from the Atlas of Breeding Birds in Britain and Ireland, compiled by J.T.R. Sharrock; T. & A.D. Poyser, publishers. © 1976 British Trust for Ornithology.*

At the same time, grid-based atlas work is being carried on in Europe for a variety of life forms including mammals (Arnold, 1978), reptiles and amphibians (Arnold, 1973), insects (Leclercq, 1972; IBRA, 1980) and marine dinoflagellates (Dodge, 1981). A complete list of the British atlas work under way can be obtained from the Biological Record Center in Abbots Ripton, Huntington, Cambridgeshire, England. It now includes an atlas of winter ranges of birds to complement the Breeding Bird Atlas.

Heath and Perring (1975) summarize the British atlas work by stating that their three major objectives are map making, data supply and conservation. This last objective is assuming even greater importance because complete distributional data make it possible to state accurately which species are rare and possibly endangered within a country The best example of this is the Red Data Book of endangered plants in Britain which is based on a list of those species recorded from 15 or fewer 10-km squares in the atlas. Once the atlas work highlighted these species, special in-depth inventory work was done on every population of each endangered species. At the same time, the Nature Conservancy Council is using the information to rank areas for purchase and placement into the national Nature Reserve system and for special treatment in local and urban planning concerns, and British government conservation agencies and the private Royal Society for the Protection of Birds are using the Breeding Bird Atlas information for nature reserve establishment and management

It can be expected that breeding bird atlas work will continue to spread worldwide. It is to be hoped that both the United States and Canada can follow the British model of establishing a records center that will serve as a vital data storage and dissemination point.

VERMONT'S BREEDING BIRD ATLAS

THE VERMONT EXPERIENCE will be described here in some detail, because it is a fairly typical example of how a comparatively small state, with relatively few observers, managed to produce a viable and creditable atlas.

The Vermont Breeding Bird Atlas Project (1977–1981) owed its inception to the influence of the Massachusetts Breeding Bird Atlas Project (1974–1979). On June 14, 1975, Project Coordinator Deborah Howard of the Massachusetts Audubon Society spoke on atlasing at the annual Vermont Bird Conference, and her talk inspired the leadership of the Vermont Institute of Natural Science, the Vermont Audubon Council and seven Vermont Audubon chapters to undertake the Vermont Atlas. Except for the U.S. Fish and Wildlife Service's Breeding Bird Survey, this atlas represents first baseline data ever gathered on Vermont's nongame bird species, and it is expected to have an important impact on planning in the state.

Because of the relative paucity of birders in Vermont, complete coverage of every grid block was impossible, and a system of stratified random sampling (see below) was employed. The standard unit of area was approximately 25 km^2, or one-sixth of the area shown on a 7.5 minute United States Geological Survey map. One block, called a Priority Block, was randomly selected for censusing in each of these 7.5 minute quadrangles. (7.5 minutes = ⅛ of 1° of Latitude or Longitude). In addition, 24 blocks containing areas of Unique and Fragile Habitats (UFAs) were selected for complete survey. Vermont set as its minimum standard of acceptance (= the block being satisfactorily censused) the registration of 75 species occurring in each block during the breeding season, with half of those "Confirmed." Nearly 200 volunteers participated in the project over the 5 years, contributing at least 24,000 hours of field work. Even in this small state, the numbers of hours given by volunteers are impressive. Any state engaged in an atlas project has, as side benefits to the research and land use data collected, an opportunity to unite amateur birders into an effective field and conservation force and to provide public education. Overall coordination of the project and additional necessary field work, including "block busting"—intensive team forays into remote or sparsely inhabited blocks—was carried out by the Research Staff of the Vermont Institute of Natural Science, to bring those blocks' coverage up to standard.

The structure of the Vermont Atlas might provide guidelines to states planning an atlas project. The coordinating body was the Vermont Breeding Bird Atlas Committee, which is made up of representatives of the above-listed organizations. The VINS Executive Director provided overall direction, and a research staff member served as Atlas Coordinator. The Audubon chapters' geographic areas covered about half the state, and an attempt was made to locate coordinators from the other geographical areas. Each field worker was provided with a full set of working materials on the Atlas Project (information sheet, schematic illustration of the numbering system used to designate blocks, sheets describing nesting habitat relationships of breeding birds in Vermont, the behavior code criteria used in designating the POSSIBLE, PROBABLE, and CONFIRMED breeding, field work recording sheets, a USGS topographical map of the assigned block). In addition, a newsletter was published and sent regularly to each volunteer. A computer recording sheet was provided for each summer, and after the first year of the project, a master sheet was provided volunteers each season showing which species had been located in the block thus far. Data were submitted to VINS each autumn for proofing and compilation. A graduate student at Middlebury College entered all the information into a computer bank, and analyzed the data in terms of Vermont's physiographic regions.

Birds that are rare or of limited or unknown occurrence in Vermont were designated by an asterisk on the recording sheet; full details were required for these species on each report and on the site confirmation by the Regional Coordinator or VINS research staff was attempted wherever possible. For final acceptance, each report was reviewed by three experts familiar with the species, and then considered by the Atlas Committee for its acceptance or rejection.

The Vermont Atlas has provided information heretofore unknown and changed many preconceived ideas on Vermont bird populations and their distribution. A much broader distribution than previously known was established for species once considered very limited in Vermont, *e.g.,* Blue-gray Gnatcatcher, Yellow-throated Vireo, Mourning Warbler, Rusty Blackbird, and Lincoln's Sparrow (Fig. 2). Several species formerly considered regular nesters were found to be either very rare (Short-billed Marsh Wren) or almost totally absent (Henslow's Sparrow: one "Possible" record for the project). First state breeding records were also established for eight bird species:

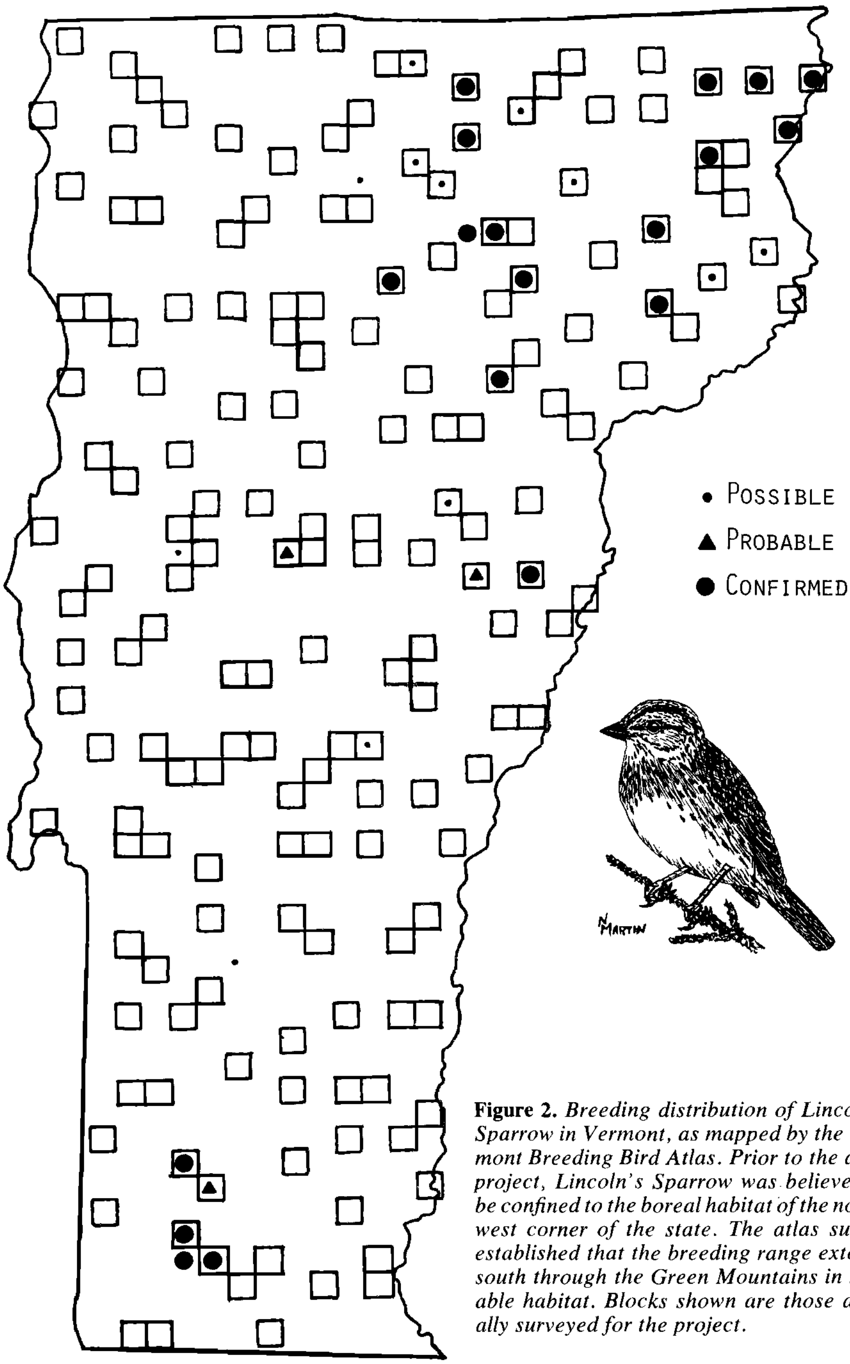


Figure 2. *Breeding distribution of Lincoln's Sparrow in Vermont, as mapped by the Vermont Breeding Bird Atlas. Prior to the atlas project, Lincoln's Sparrow was believed to be confined to the boreal habitat of the northwest corner of the state. The atlas survey established that the breeding range extends south through the Green Mountains in suitable habitat. Blocks shown are those actually surveyed for the project.*

Turkey Vulture
Barn Owl
Tufted Titmouse
Carolina Wren
Blue-winged Warbler
Cerulean Warbler
Bay-breasted Warbler
House Finch

As Vermont's landscape changes, and the economy forces a formerly rural, agricultural society to vie with resorts, second-home developments and light industry, an accurate picture of the distribution of the bird species nesting in Vermont has emerged as a statement of current environmental quality, against which future, inevitable change can be measured. Field work on the Vermont Atlas was completed in the summer of 1981, data analysis will be completed by late spring of 1982, and publication of the *Vermont Breeding Bird Atlas* is projected for spring of 1983.

In all, 191 species of birds were ranked as breeders during the Vermont Atlas—7 species as POSSIBLE breeders, 7 species as PROBABLE breeders and 177 species as CONFIRMED breeders.

NORTHEASTERN BREEDING BIRD ATLAS CONFERENCE

NOVEMBER 1981 MARKED an important and long-awaited event for atlasers. The Northeastern Breeding Bird Atlas Conference was held in Woodstock, Vermont, hosted by the Vermont Institute of Natural Science. It was organized by Sarah B. Laughlin, Chandler S. Robbins, and Douglas P. Kibbe, and funded by a grant from The Fund for the Preservation of Wildlife and Natural Areas, Boston. Representatives of all the known atlas projects in northeastern North America were invited to attend The goals of the conference were to facilitate communications among atlas projects organizations, to discuss all aspects of atlasing, and to establish standard procedures to guide states and provinces about to embark upon an atlas project. This latter goal would serve to spare them many days and weeks of research and evaluation in planning and organizing their own Breeding Bird Atlas. Thirty-four participants attended, representing thirteen states and provinces, the Cornell Laboratory of Ornithology, *American Birds,* and the Patuxent Wildlife Research Center of the U.S. Fish and Wildlife Service (Fig 3).

The conference established communication channels for North American breeding bird atlasers. An exchange of newsletters between projects was initiated, with blanket permission for republication of articles. Three days and evenings of sessions and conferences resulted in a recommendation for choosing a map grid and for a standardized behavior codes. Standardization of the behavior codes was the most difficult topic addressed by the conferees and consumed much time and thought, culminating in post-conference committee work and written recommendations from each of the thirteen states and provinces represented. Table 1 is the result of this consensus.

Proceedings of the Conference will be published by the Vermont Institute of Natural Science in March, 1982 Topics covered include: overview of international atlasing; state atlas reports, behavior code standardization; standards for adequate coverage; mapping scales, random sampling; data analysis, numerical estimates; verification of records, techniques for field work—surveying for problem species and rarities, techniques for "block-busting"; auxiliary data collection; financing an atlas project; publishing the atlas; purposes of breeding bird atlases and secondary use of the data; and bibliography. (Available from VINS, Woodstock, VT 05091, soft-cover, 60 pages; $12).

STANDARD METHODS

Grids

THE MENSURAL BASIS FOR any atlas is the map grid. The survey block size and base map used for the grid system are governed, however, by several practical constraints: size and accessibility of the geographic area to be surveyed, number and distribution of observers available to work on the project; and the existence of readily-obtainable maps of suitable scale. Of paramount concern in establishing the grid system is that block *size* be small enough to meaningfully reflect relatively small shifts in breeding distributions, impacts of urbanization, etc., yet large enough to keep the total number of blocks at a workable level. Two other important considerations are: compatibility with neighboring states or provinces and selection of a grid replicable in subsequent decades (when all maps may be on metric scales). A resolution passed at the Northeastern Breeding Bird Atlas Conference recommended that a 25 km^2 block (about 5 km on a side) be used as the standard sampling area. In situations where the size or accessibility of the area to be sampled (*e.g.*, the Canadian provinces' northern areas and western states), and/or a limited number of available observers (*e.g.*, Vermont and New Hampshire) preclude complete coverage, it is strongly urged that *a sampling of the 5-kilometer blocks be surveyed,* rather than enlarging the block size to reduce the total number of blocks. This sampling procedure has been effectively applied in Vermont and New Hampshire with excellent results

Table 2. State or Breeding Bird Atlases completed or under way

State or Province	*Field Work Time Span*	*Block Side*	*Block Area*	*No. of Blocks*	*Map Basis*
California (Marin County)	1976–1978	2.5 km	6.25 km^2 [1]	220	USGS
Connecticut	1982–1986	c. 5 km c. 3.16 km	c. 25 km^2 [1] c. 10 km^2	726	USGS
Maine	1978–1983	c. 11.8 km c. 7.75 mi	140 km^2 60 mi^2 (full 7.5′ quad)	670	USGS
Maryland	1971– (county by county)	5 km (Montgomery County) 2.5 km (others)	25 km^2 6.25 km^2	4600	USGS
Massachusetts	1974–1979	c. 5 km	c. 25 km^2 [1]	989	USGS
New Hampshire	1981–1985	c. 5 km	c. 25 km^2 [1]	c. 193[2]	USGS
New Jersey	1981–1985	c. 5 km	c. 25 km^2 [1]	c. 913	USGS
New York	1980–1984	5 km	25 km^2	5299	New York TM
Ontario	1981–1985	10 km 100 km	(Sec. 1 & 2) 100 km^2 (Sec. 3) 10,000 km^2 [4]		UTM
Rhode Island	1981–1985	5 km	25 km^2	165	USGS
Vermont	1977–1981	5 km	25 km^2 [1]	227[3]	USGS

[1]one-sixth of a 7.5′ USGS Quadrangle.
[2]178 Priority blocks (random stratified sampling) plus 15 Special Areas (of 999 total blocks).
[3]179 Priority Blocks (random sampling) and 48 Unique & Fragile Areas (of 1058 total blocks).
[4]one 100 km^2 block sampled in each 10,000 km^2 block.

LATILONG STUDIES

State or Province	*Time Span*	*Chief Sponsoring Organization*	*Block Size*	*Number of Blocks to Cover*
Colorado	1963–1978	Colorado Field Ornithologists, Colorado Division of Wildlife	3634 sq. mi (at 40th parallel)	28
Montana	1803–1980	P. D. Skaar	3173 sq. mi (at 48th parallel)	47
Nebraska	not determined	Nebraska Game & Fish Dept.		23
Utah	1980–?	Utah Division of Wildlife Resources	3634 sq. mi (at 40th parallel)	23
Wyoming	1965–1979	Wyoming Game & Fish Dept.	3412 sq. mi (at 44th parallel)	28

Areas desiring more precise mapping may subdivide the blocks into quarters, as was done in Maryland. In northern Ontario, because of size and inaccessibility, sampling has been limited to one 10-km block in every 100-km block.

Virtually all of North America has been mapped at a scale (1:62500 or 1.24000 in the United States, 1:50000 in southern Canada) that allows ready application of a grid of approximately 5-kilometer blocks. In the United States and Canada topographic maps are produced which detail water, forest and open land and may be directly used in atlas projects. An index of all topographic maps within a state or province is available from many local sporting goods and cartography stores, or from

Branch of Distribution,
U S. Geological Survey,
1200 South Eads Street,
Arlington, VA 22202.

(or)

Canada Map Office,
Dept. of Energy, Mines and
Resources,
615 Booth St.,
Ottawa, Ontario K1A OE9.

In the United States a grid of 5-kilometer blocks is easily applied to these maps by dividing each 7.5 minute topographic map into six equal sections or each 15-minute topographic map into 24 equal sections; 7.5 minute maps are easier to work with because they are of larger scale (1:24000). For the sake of practicality, a numerical labeling system should be applied uniformly to the entire area to facilitate coding, handling and assessing data.

In Canada, owing to the size of the area to be covered, it has proven difficult to use a block size of less than 10km. The Universal Transverse Mercator grid (UTM) is very conveniently printed on all large scale Canadian topographic maps so that the blocks are already defined for the atlaser. The standardized UTM numbering system also provides a ready-made atlas grid numbering system.

In western North America, several states have been keeping and publishing records of bird distribution that, while often called atlases, differ in major respects from the Breeding Bird Atlas as defined here and in Europe. Among the most critical differences are the size of the study block, and the methods employed in deriving and recording the data. In the West (Montana, Colorado, Wyoming and Utah) the block uniformly chosen has been the Latilong or Degree Block—an area 1° of Latitude by 1° of Longitude. Although Latilongs vary in size (smaller northward) they are roughly 364 times the size of the atlas block adopted elsewhere (Fig. 2). Additionally and importantly Latilong studies are not essentially time-limited; all the existing and published occurrences are included, data input is continuous and cumulative, in some states year round and not exclusively breeding species occurrence, is recorded, and extensive coordinated field surveys have rarely been used.

Obviously major reasons for adoption of the Degree Block approach to atlasing is the "wide open spaces" situation in these states, and the inaccessibility of much of the mountainous terrain, which its deserts, steep canyons and towering peaks. Additionally, the West has far fewer observers scattered over these vast lands, and even the random sampling approach such as adopted in northern Ontario has not been considered practical.

Westerners point out that the Latilong studies have constituted a major contribution to our knowledge of bird distribution, habitat use, and abundance, and like their eastern counterparts, have involved contributions from hundreds of observers, and that the two types of projects satisfy different conditions They both represent impressive scientific cooperative projects to which amateur bird watchers contribute an essential, indispensible part.

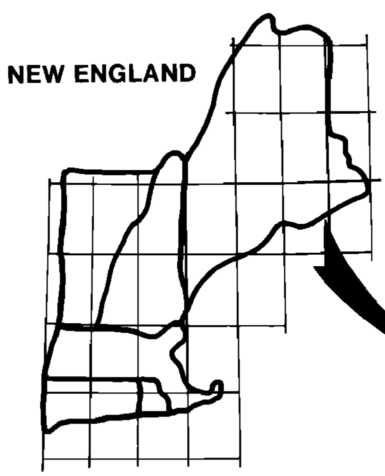
It is the belief of the authors that, while Latilong studies may at present be the only feasible distribution projects in these states, the level of resolution using grid blocks of this size is so large scale that it can give only the most general picture of present-time (or specified-time) species' distribution For example, impacts on a particular species would have to be so catastrophic for it to be eliminated from an entire Latilong block that even the most casual observer would have long since realized that something was amiss

Time Frame

Because, owing to habitat alteration and other factors, changes in bird distribution occur continually, a tight time framework for completion of the field work stage of the atlas project is desirable. Thus five successive years is generally considered as an acceptable time period although, to date, several projects have not been able to meet that schedule. Obviously, the ideal time period would be a single breeding season, but no area has been able to muster the massive field work effort that that would entail.

Behavior Codes

Behavioral evidence of breeding is the principal method used to assess



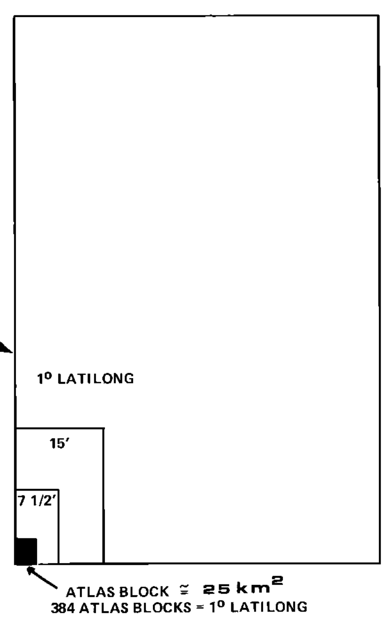


Figure 3. *Latilong coverage as applied to New England and comparative size relationship of a standard atlas block with a 1° Latilong block, 15' topographic map and a 7½' topographic map.*

breeding status of species observed. Normally it will be unnecessary to locate actual nests, since most of the behavior cues which we interpret as indications that a nest is nearby (*e.g.*, distraction display, adults carrying food or fecal sacs) are sufficient evidence to confirm breeding. Locating actual nests can be undesirable because once visited, the possibility of predation is greatly increased, particularly for ground nesters. A hierarchical system of "least certain" to "most certain" codes for use in designating possible, probable and confirmed breeding status of birds observed within the atlas block has evolved from the European and North American Atlas Projects. A compendium of codes used to date was studied by the Northeastern Breeding Bird Atlas Conference and a standardized behavior code system for North America was recommended (Table 1). Letter codes suitable for use on field data forms have been applied to each criterion. Although these criteria include an "observed" category, this category has been ignored by many states and is generally not mapped in the final data analysis since, in the absence of suitable breeding habitats, the mere occurrence of a species within the block during a breeding season does not in itself constitute significant evidence of breeding.

Table 1. Standard Behavior Criteria for Coding Breeding Bird Atlas Report Forms

	Code[1]	*Evidence*
OBSERVED	0	Species (male or female) **observed** in block during the breeding season, but believed not to be breeding.
POSSIBLE	√	Species (male or female) observed in suitable nesting habitat during its breeding season.
	X	Singing male present in suitable nesting habitat during its breeding season.
PROBABLE	P	**Pair** observed in suitable habitat during its breeding season.
	T	Permanent **territory** presumed through defense (*e.g.* chasing of other birds; or song at the same location on at least two occasions a week or more apart).
	C	**Courtship** behavior or **copulation.**
	N	Visiting probable **nest-site.**
	A	**Agitated** behavior or anxiety calls from adult.
	B	Nest **building** by wrens or excavation of holes by woodpeckers.
CONFIRMED	NB	**Nest building** by all except woodpeckers and wrens.
	PE	**Physiological evidence** of breeding (*i.e.*, highly vascularized, edematous incubation [brood] patch or egg in oviduct) based on bird in hand.
	DD	**Distraction display** or injury feigning.
	UN	**Used nest** or eggshells found. Caution: These must be carefully identified, if they are to be accepted.[2]
	FL	Recently **fledged young** (of altricial species) incapable of sustained flight[2] or downy young (of precocial species) restricted to the natal area by dependence on adults or limited mobility.
	ON	**Occupied nest;** adults entering or leaving nest site in circumstances indicating occupied nest (includes high nests or nest-holes, the contents of which cannot be seen) or adult incubating or brooding.
	AY	**Attending young;** adult carrying fecal sac or food for young, or feeding[2] recently fledged young.
	NE	**Nest** with **egg(s)**[2].
	NY	**Nest** with **young** seen or heard[2].

[1]*The letter code* is entered by the field workers in the appropriate space on the field report form. **Possible** and **Probable** categories are represented by single letters or a symbol, **Confirmed** by double letters. Letters have been selected as a mnemonic aid; keyed to boldfaced words in criteria definitions.

[2]—Presence of cowbird eggs or young is confirmation of both cowbird and host species.

Report Forms

A variety of data report forms has been used on North American atlas projects (Fig. 5 & 6). Although each has been developed for a particular state or province with a specific list of expected breeding birds, their general format is similar. Separate columns are allocated for possible, probable and confirmed codes. Each rare species requiring written, photographic or recorded documentation is flagged (asterisked) on the form, to alert field workers of its significance. Experience has shown it helpful to give a brief listing of criteria and codes on the data collection form itself to ensure that observers correctly assign the codes in the field. Innovations initiated by New Hampshire include providing columns for dates upon which a particular nesting activity is recorded and for identification of habitats. Provision may also be made for subjective estimates of abundance, as has been included in the many of the European atlas projects. While these innovations are optional and require additional codes, they may contribute significantly to the final value of the project, particularly in little-studied regions, or if diversity or other analyses are desired.

Administration

An atlas project represents a major undertaking, with all the complexities and financial requirements implicit in the administration of hundreds of largely untrained workers scattered over thousands of square miles. A full-time Coordinator with access to secretarial and data-storing facilities is essential throughout the life of the project. Directing and coordinating the work of hundreds of independent observers requires allocation of administrative functions through a network of Regional Coordinators, and a sharing of information through newsletters and training workshops. Annual analysis of the data is essential to ensure that regional work loads are equitably allocated and that deadlines are met. Regional Coordinators are the major guides and contacts for volunteer

NAME		PO	PR	CO
Sparrow, Savannah				
Grasshopper				
Henslow's				
Sharp-tailed	•			
Seaside	•			
Vesper				
Junco, Dark-eyed				
Sparrow, Chipping				
Clay-colored	•			
Field				
White-throated				
Lincoln's	•			
Swamp				
Song				

DATE	HOURS	OBSERVERS

82-14-25 (2/81)

New York Breeding Bird Atlas Project

Block □□□□□ **Year 19**□□

BREEDING CRITERIA CODES

PO
X Species seen in possible nesting habitat, or singing male(s) present.

PR
P Pair in suitable habitat.
S Singing male present on more than one date.
T Bird or pair on territory.
D Courtship and display.
N Visiting probable nest site, or nest building by wrens and woodpeckers.
B Nest building or excavation of nest hole.

CO
DD Distraction display.
UN Used nest.
FE Female with egg in oviduct.
FL Recently fledged young.
ON Adult entering or leaving site indicating occupied nest.
FS Adult with fecal sac.
FY Adult with food for young.
NE Nest and eggs; identifiable nestlings, or eggshells beneath nest.
NY Nest with young.

NAME		PO	PR	CO
Loon, Common	•			
Grebe, Pied-billed				
Cormorant, Double-crested	•			
Heron, Great Blue				
Green				
Little Blue	•			
Egret, Cattle	•			
Great	•			
Snowy	•			

•Written details required except for well-known, previously established breeding localities.

Figure 4. Field card for New York State Breeding Bird Atlas, showing first and last of 8 pages; data is later transferred to report form.

workers in the project, and must be chosen carefully for their organizational, as well as their birding abilities.

Use of Volunteers

Because volunteer amateur birders form the mainstay of any atlas project, it is obvious that publicity, coordination and education are key words to the project's success. Early publicity and planning are essential, and areas without a regional network of birders (*i.e.*, a State Ornithology Conference, Federation of Bird Clubs, newsletters, etc.) should strive to establish one before launching such a project. Significant assistance from nonaffiliated birders and the general public may be forthcoming and public (newspapers, radio and TV) and other (*e.g.*, agricultural newsletters) media should be utilized to the utmost. Once enlisted in the atlas project, volunteers must be given opportunities for workshop training and kept abreast of the project's progress through frequent contact with Regional Coordinators. This is especially important to keep enthusiasm high. Information on species habitat relationships, breeding dates and survey techniques should be made available through newsletters or handouts.

Inevitably, because of uneven distribution of birders, or for other reasons, it will become necessary to mobilize field teams for surveys of neglected areas, particularly in the last year or two of a project. These "block-busting" teams have proven a highly efficient means of covering inaccessible or otherwise uncovered areas, but present special financial, logistical and coordination problems to project administrators. Team members should be chosen from the existing body of field volunteers, based on their proven capabilities on the project. Teams of two, operating out of a central field location, have proven the most effective method of attacking inadequately surveyed regions.

Adequate Coverage

Even with daily field coverage (in itself an impossibility), it is usually impossible to find or confirm all species breeding in most blocks even over a five-year period. Consequently, a standard for "adequate" coverage should be established. To maximize efficiency, field workers should be assigned new atlas blocks once a certain point of diminishing returns is reached. As Sharrock (*op. cit.*) reported, a law of diminishing returns is at work for atlas block coverage, and in Britain it was found that "experienced observers working in lowland squares with easy access could find about 50% of the breeding species in just over 2 hours, 75% in less than 10 hours and 87% in 16 hours, but that 100% were not found even after 200 hours.

It should be pointed out that Britain is highly populated, with more motivated amateur ornithologists per square mile than almost any other part of the world, few inaccessible or remote areas, and breeding bird distribution already fairly well known. So its achievement, no less remarkable for these factors, will be difficult for many North American states or provinces to match. An arbitrary, yet apparently adequate, cutoff point which has been used is to locate at least 75 percent of the species *believed likely to occur* in a block (a "best guess", based on habitats available) and confirm as breeders at least 50 percent of those found. Although this procedure introduces an inherent bias (*i.e.*, it presupposes the number of species occurring), in actual practice, a rough approximation for the region or even the entire state may be used as a general standard without adversely affecting coverage.

UTILIZATION OF ATLAS DATA

WHILE THE IMMEDIATE objective of every atlas project is the presentation of bird distribution, the subsidiary uses of the data may be equally and, in the long run, perhaps more important. Atlas data form an ecological data base that invites repetition and comparison in subsequent decades Analysis of species occurrences facilitates identification of sensitive species

BLOCK # 1 2 3 4 — 1 8 2 3 YEAR 1 9 5 6 — 1 9 8 1

VERMONT BREEDING BIRD ATLAS PROJECT

Name F. OATMF

NAME	A.O.U.# 7	8	9	10	CODE 11	PO	PR	CO
Common Loon *	0	0	7	.0				
Pied-billed Grebe	0	0	6	.0		✓		
Great Blue Heron	1	9	4	.0		✓		
Green Heron	2	0	1	.0				
Cattle Egret *	2	0	0	.1				
Bl -crowned Night Heron	2	0	2	.0				
Least Bittern	1	9	1	.0				
American Bittern	1	9	0	.0				
Canada Goose	1	7	2	.0				
Mallard	1	3	2	.0				
Black Duck	1	3	3	.0				FL
Gadwall *	1	3	5	.0				
Pintail	1	4	3	.0				
Green-winged Teal	1	3	9	.0				
Blue-winged Teal	1	4	0	.0				
American Wigeon	1	3	6	.0				
Northern Shoveler *	1	4	2	.0				
Wood Duck	1	4	4	.0		✓		
Redhead *	1	4	6	.0				
Ring-necked Duck	1	5	0	.0		✓		
Lesser Scaup *	1	4	9	.0				
Common Goldeneye	1	5	1	.0				
Hooded Merganser	1	3	1	.0				
Common Merganser	1	2	9	.0				
Red-breasted Merganser	1	3	0	.0				
Turkey Vulture *	3	2	5	.0				
Goshawk	3	3	4	.0		✓		
Sharp-shinned Hawk	3	3	2	.0		✓		
Cooper's Hawk	3	3	3	.0				
Red-tailed Hawk	3	3	7	.0		✓		
Red-shouldered Hawk	3	3	9	.0		✓		
Broad-winged Hawk	3	4	3	.0		✓		
Bald Eagle *	3	5	2	.0				
Marsh Hawk	3	3	1	.0				
Osprey *	3	6	4	.0				
American Kestrel	3	6	0	.0		✓		
Spruce Grouse *	2	9	8	.0				FL
Ruffed Grouse	3	0	0	.0				FL
Bobwhite	2	8	9	.0				
Ring-necked Pheasant	3	0	9	.1				
Gray Partridge *	2	8	8	.1				
Turkey	3	1	0	.0				
King Rail *	2	0	8	.0				
Virginia Rail	2	1	2	.0				
Sora	2	1	4	.0				
Yellow Rail *	2	1	5	.0				
Common Gallinule	2	1	9	.0		✓		
American Coot	2	2	1	.0				
Killdeer	2	7	3	.0		✓		
American Woodcock	2	2	8	.0				
Common Snipe	2	3	0	.0			D	

NAME	A.O.U.# 7	8	9	10	CODE 11	PO	PR	CO
Upland Sandpiper	2	6	1	.0				
Spotted Sandpiper	2	6	3	.0				DD
Solitary Sandpiper *	2	5	6	.0				
Least Sandpiper *	2	4	2	.0				
Great Bl.-backed Gull*	0	4	7	.0				
Herring Gull	0	5	1	.0				
Ring-billed Gull	0	5	4	.0				
Common Tern	0	7	0	.0				
Black Tern	0	7	7	.0				
Rock Dove	3	1	3	.1				
Mourning Dove	3	1	6	.0				
Yellow-billed Cuckoo *	3	8	7	.0				
Black-billed Cuckoo	3	8	8	.0				
Barn Owl *	3	6	5	.0				
Screech Owl	3	7	3	.0				
Great Horned Owl	3	7	5	.0		✓		
Barred Owl	3	6	8	.0		✓		
Long-eared Owl	3	6	6	.0				
Short-eared Owl *	3	6	7	.0				
Boreal Owl *	3	7	1	.0				
Saw-whet Owl	3	7	2	.0			T	
Whip-poor-will	4	1	7	.0				
Common Nighthawk	4	2	0	.0				
Chimney Swift	4	2	3	.0		✓		
Ruby-throated Hummingb.	4	2	8	.0		✓		
Belted Kingfisher	3	9	0	.0				FY
Common Flicker	4	1	2	.0				ON
Pileated Woodpecker	4	0	5	.0			D	
Red-headed Woodpecker*	4	0	6	.0				
Yellowbellied Sapsucker	4	0	2	.0				ON
Hairy Woodpecker	3	9	3	.0			S	
Downy Woodpecker	3	9	4	.0		✓		
Bl-bk. 3-T Woodpecker*	4	0	0	.0				FL
N. 3-toed Woodpecker *	4	0	1	.0				
Eastern Kingbird	4	4	4	.0			T	
GreatCrested Flycatcher	4	5	2	.0				
Eastern Phoebe	4	5	6	.0				UN
Yel.-bellied Flycatcher	4	6	3	.0			T	
Alder Flycatcher	4	6	6	.3				
Willow Flycatcher	4	6	6	.4				
Least Flycatcher	4	6	7	.0				
Eastern Wood Pewee	4	6	1	.0		✓		
Olive-sided Flycatcher	4	5	9	.0			T	
Horned Lark *	4	7	4	.0				
Tree Swallow	6	1	4	.0				ON
Bank Swallow	6	1	6	.0		✓		
Rough-winged Swallow	6	1	7	.0				
Barn Swallow	6	1	3	.0				UN
Cliff Swallow	6	1	2	.0				
Purple Martin	6	1	1	.0				
Gray Jay *	4	8	4	.0				FY

PO=Possible, PR=Probable, CO=Confirmed -- Enter Criteria Code in Correct Column *Ind

Figure 5. *Vermont Breeding Bird Atlas summary report form, in part.* As submitted by observer at end of season.

and/or habitats. In Vermont, atlas data were a major source of information used in preparation and support of the State's proposed rare, threatened and endangered avifauna lists. Although rarely site-specific enough to be substituted for site surveys, atlas data have been used in several states in the preparation of regional species lists for environmental reports and impact assessments.

The atlas grid establishes a permanent uniform framework upon which a wide variety of correlation studies may be conducted. Data on latitude, longitude, physiography, habitat types, urbanization or other environmental variables can be readily derived from atlas maps, aerial photos or questionnaires sent to each block Coordinator. This information may subsequently be used in an array of correlation analyses to determine diversity, relationships between environmental or ecological parameters and species distributions, and to assess man's impacts on avifauna.

Overlays of environmental features (*e.g.*, rainfall, habitats, topography) provide an excellent format for graphically portraying these relationships. The atlas grid also provides a basic survey unit for other resource inventories. Mammals, reptiles and amphibians, plants and butterflies are just a few of the organisms that have been atlased to date. Readers interested in studying in depth the application of analyses outlined above should consult Sharrock (1976), Yeatman (1977), Luis *et al.* (in press) and Schifferli (1980) and other references in the Bibliography.

RECOMMENDATIONS FOR SETTING UP AN ATLAS

ACROSS MOST OF North America, atlas workers are faced with similar problems: areas of high human population density surrounded by extensive areas of relatively isolated landscape. This is especially true in the western states and Canada. A breeding bird atlas is a major undertaking that attempts to cover a wide area and therefore must be carefully planned and executed if success is to be assured. Fortunately, the human and financial resources are generally available.

The large size and multi-year nature of a breeding bird atlas dictates that it be most effectively undertaken as a cooperative effort. All wildlife and resource management institutions can potentially use the results and therefore may be interested in helping out along the way. National and state or provincial resource management agencies are obvious participants. State non-game projects and staff may already be in place. Major public groups such as national, state and local Audubon and wildlife societies should be involved. Professional centers of research and knowledge such as museums, universities, bird observatories, research stations, parks, reserves and outdoor education centers have experienced and knowledgeable staffs. Regional resource or water commissions may show an interest. The consortium of institutions will vary from state to state or province to province, but the overall intent remains the same, that is to involve as many different regions as early as possible in the planning. The fundraising and necessary administrative arrangements will come much more easily later on if proper communication channels are opened early.

The establishment of an Atlas Planning Committee composed of people that represent different groups is essential. The committee will serve as the central planning body and will act as a vital communications link among all the different interests.

The major issues that must be dealt with include: timing, field methods, grid size, degree of coverage, required standards, staffing, communication, housing, budgeting and general administration. The project proposal, budget and schedule can serve as both a fundraising and communication device. Careful planning of the logistics will improve the chances of success and will result in a better end product.

A breeding bird atlas is a relatively glamorous project that can provide useful exposure to both private corporations and public agencies. This fact can be emphasized during fund-raising Not all resources need to be provided in moneys. In-kind donations are just as useful, as in New York, where the state Department of Environmental Conservation provides logistic, staff and housing assistance to the state atlas.

Following the British model, a network of local regions can prove useful. Each region should be supervised by a knowledgeable individual who has responsibility for coordinating volunteer recruitment and guidance, data compilation, local communication and importantly, quality control. In large part the atlas will only be as successful as the dedication and expertise of the regional coordinators.

The atlas headquarters can be housed in a number of places: a university, a public interest group, a government office, a corporation or a private residence. It is important that the mailing address remain constant and that someone familiar with the project be available to handle telephone questions or personal visits. It may be unreasonable to rely on unpaid volunteers to handle all the necessary administration, publicity, funding and communication responsibilities. It is for this reason that two of the bigger jurisdictions, New York and Ontario, have established offices with full-time salaried staff for the length of the project.

A breeding bird atlas is useful for typical ornithological studies as well as general environmental and resource management purposes. Given the widespread application of environmental planning in the United States and Canada, such a data base can be of immediate import to any agency contemplating land-use alteration. It is up to the birders to provide the information that is needed for management and conservation of breeding bird populations.

All this may sound formidable and perhaps discouragingly complex to the state or province contemplating an atlas project, but the experience of the countries, states, and provinces which have initiated or completed projects seems to indicate that this project has so much perceived value, and so much fascination in the actual work, that once the project is planned and the people committed, there is an amazing outpouring of enthusiasm and cooperation, and no turning back. Truly, the breeding bird atlas is an idea whose time has come!

Table 3. Atlas Sponsors and Contacts

Atlas projects underway or completed

1. CALIFORNIA (Marin County)
   Sponsored by: Point Reyes Bird Observatory.
   Coordinator: David Schuford, Point Reyes Bird Observatory, Box 321, Bolinas, CA 94924.

2. CONNECTICUT
   Sponsored by: Audubon Council of Connecticut and National Audubon Society Northeastern Regional Office.
   State Coordinator: Elsa Jennings, National Aubudon Society, Northeastern Regional Office, R.R. #1, Box 171, Sharon, CT 06069.
   Chairman, Connecticut Breeding Bird Atlas Project: Christopher S. Wood, Quanotaug Trail, Woodbury, CT 06798.

3. MAINE
   Atlas affiliated with Maine Audubon Society and Bowdoin College.
   Director: Peter Cannell, American Museum of Natural History, Central Park West and West 79th Street, New York, NY 10024.
   Co-director: Bonnie Bochan, Box 306, Winterport, ME 04496.

4. MARYLAND
   Sponsored by: Maryland Ornithological Society, in collaboration with the Maryland Departments of Natural Resources and State Planning, Prince Georges County Audubon Society, and the Audubon Naturalists' Society.
   Coordinators: M. Kathleen Klimkiewicz, Bird Banding Laboratory, U.S. Fish & Wildlife Service, Laurel, MD 20708.
   Chandler S. Robbins, Patuxent Wildlife Research Center, U.S. Fish & Wildlife Service, Laurel, MD 20708.

5. MASSACHUSETTS
   Sponsored by: Massachusetts Audubon Society.
   Project Director: Richard Forster, Massachusetts Audubon Society, Lincoln MA 01773

6. NEW HAMPSHIRE
   Sponsored by: The Audubon Society of New Hampshire and the University of New Hampshire's Institute of Natural and Environmental Resources.
   Coordinators: Alis Kuhn, University of New Hampshire, c/o Wolff House, 8 Ballard Street, Durham, NH 03824.
   Dr. Donald Miller (UNH), 154 Concord Road, Dover, NH 03820.
   Audubon Society of New Hampshire, 3 Silk Farm Road, Box 528B, Concord, NH 03301

7. NEW JERSEY
   Sponsored by: Raccoon Ridge Observatory.
   Project Director: Laura Socha, P. O. Box 407, Sparta, NJ 07871.
   Dorothy Hughes, Director, Raccoon Ridge Bird Observatory, P. O. Box 81, Layton, NJ 07851.

8. NEW YORK
   Sponsored by: Federation of New York State Bird Clubs, in cooperation with New York State Dept. of Environmental Conservation, Laboratory of Ornithology at Cornell University, New York State Museum, and National Audubon Society.
   Chairman: Dr. Gordon M. Meade, 27 Mill Valley Road, Pittsford, NY 14534.
   Project Coordinator: Janet Carroll, New York State Dept. of Environmental Conservation, Wildlife Resources Center, Delmar, NY 12054.

9. ONTARIO
   Sponsored by: Federation of Ontario Naturalists and Long Point Observatory.
   Chairman Management Committee: Dr. George Francis, Department of Man-Environment Studies, University of Waterloo, Waterloo, Ont. N2L 3G1.
   Chairman Technical Committee: Dr. David Hussell, Long Point Bird Observatory, Port Rowan, Ont. NOE 1MO.
   Coordinator: Mike Cadman, Federation of Ontario Naturalists, 355 Lesmill Road, Don Mills, Ont. M3B 2W8.

10. RHODE ISLAND
    Sponsors: Rhode Island Ornithological Club, Rhode Island Natural Heritage Program, Audubon Society of Rhode Island.
    Director: Richard W. Enser, Dept. of Environmental Management, Natural Heritage Program, 83 Park Street, Providence, RI 02903

11. VERMONT
    Sponsored by: Vermont Institute of Natural Science, The Vermont Audubon Council, and the seven Audubon Chapters.

Director Sarah B Laughlin, Vermont Institute of Natural Science, Woodstock, VT 05091.
Coordinator: Annette L. Gosnell, Vermont Institute of Natural Science, Woodstock, VT 05091.

Atlas projects in the planning stages

1 BRITISH COLUMBIA
Coordinator: R. Wayne Campbell, Vertebrate Zoology Division, British Columbia Provincial Museum, Victoria, B.C. V8V 1X4.

2 DELAWARE
Coordinator: Richard West, 8620 Foulkstone Road, Wilmington, DE 19803.

3 FLORIDA
Dr Herbert W. Kale, Florida Audubon Society, 35 First Court SW, Vero Beach, FLA 32960.

4 MARITIME PROVINCES
David Christie, RR #1, Albert, New Brunswick EOA 1AO.
Stuart Tingley, Box 1590, Sackville, New Brunswick EOA 3CO.

4 MICHIGAN
Ray Adams, Kalamazoo Nature Center, 7000 North Westridge, Kalamazoo, MI 49001.
Larry Masters, Natural Features Inventory, 5th Floor Mason Bldg., Box 30028, Lansing, MI 48909.
Larry Ryel, Office of Surveys and Statistics, Dept. of Natural Resources, 5th Floor Mason Bldg., Box 30028, Lansing, MI 48909.

Atlasting Contacts

1 NORTH AMERICAN ORNITHOLOGICAL ATLAS COMMITTEE (co-coveners):
Dr. Miklos F. Udvardy, California State University, Sacramento, CA 95819.
Chandler S. Robbins, Patuxent Wildlife Research Center, U.S. Fish & Wildlife Service, Laurel, MD 20708.

2 HOLARCTIC ATLAS COMMITTEE—Northeastern Representative
Douglas P. Kibbe, P. O. Box 34, Maryland, NY 12116.

3 EUROPEAN ORNITHOLOGICAL ATLAS COMMITTEE
Dr. J.T.R. Sharrock, Fountains, Park Lane, Blunham, Bedford MK44 3NJ England.

Latilong Projects

COLORADO
Sponsored by: Colorado Field Ornithologists and Colorado Division of Wildlife, Non-game Section
State Coordinators: Steve Bissell, Div. of Wildlife, 6060 Broadway, Denver 80216; Charles Chase III, Denver Museum of Natural History, City Park, Denver, 80205; and Hugh Kingery, 869 Milwaukee, Denver 80206

MONTANA
Sponsored by: P. D. Skaar, 501 S. Third, Bozeman, Montana 59715

NEBRASKA
Sponsored by: Nebraska Game & Parks Commission.
Contact: Ross Lock, 2200 N. 33rd., Lincoln, Nebraska 68503

UTAH
Sponsored by: Utah Division of Wildlife Resources
State Coordinator: Robert Walters, Utah Div. of Wildlife Resources, 1596 W. N. Temple, Salt Lake City, Utah 84116

WYOMING
Sponsored by: Wyoming Game & Fish Dept.
State Coordinator: Bob Oakleaf, Non-game Bird Biologist, Wyoming Game & Fish Dept., 260 Buena Vista, Lander, Wyoming, 82520

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——. 1978. Provisional atlas of the mammals of the British Isles Biological Records Centre, Abbots Ripton, Huntington, England. 13 p., 58 maps.

BAILEY, F.M. 1928. Birds of New Mexico. New Mexico Department of Game and Fish, 807 p.

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Figure 6. *Northeastern Breeding Bird Atlas Conference, Woodstock, VT, November, 1981.* Panelists Gilbert S. Raynor and Charles Smith; organizers Chandler S. Robbins, Sarah B. Laughlin and Douglas P. Kibbe.

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