INTRODUCTION

Atlas Methodology

The primary goal of the Ohio Breeding Bird Atlas Project was to document the status and distribution of all birds breeding in Ohio between 1982 and 1987. Additional objectives of this project included providing more accurate information on the distribution and nesting occurrences of Ohio's rare and endangered breeding birds; identifying significant habitats supporting rare or unusual species which could become the focus of preservation efforts; providing baseline data against which future changes in the status and distribution of Ohio's breeding birds can be measured; providing baseline data for the development of environmental impact statements; involving the birders of Ohio in a cooperative effort of scientific value and heightening their awareness of the state's summer birdlife.

This Atlas represents the work of hundreds of birders throughout Ohio who expended over 30,000 hours between 1982 and 1987 collecting data on the distribution of breeding birds in the state. Over 95% of this data was collected between 1983 and 1987 with 1982 serving as a pilot year for the Atlas Project. In order to fully understand and interpret this data, it is necessary to have some understanding of the goals and mechanics of breeding bird atlas projects.

Data Collection: Priority Blocks and Special Areas

The basis of any atlas project is a grid system whereby the geographical area to be surveyed is divided into a series of smaller sub–units (usually squares or rectangles called blocks). In Ohio, as in a majority of other states conducting breeding bird atlases, the grid system employed is based on the 7.5 minute topographic map system. Each 7.5 minute map was divided into six blocks encompassing approximately 10 square miles (25 square kilometers) each. A total of 806, 7 1/2 minute topographic maps are required to encompass Ohio's land mass. Of these 806 maps, many along the boundary with adjoining states and along Lake Erie had so little of Ohio's land mass that they were dropped from the survey. This left 764 quadrangle maps with enough land mass that at least one block could be situated in it.

After assessing the size and distribution of Ohio's birding community with the likely funding levels for the Atlas Project, it was evident that each of the approximately 4584 atlas blocks comprising Ohio could not be adequately surveyed. Following the example of Vermont and several other states with breeding bird atlas projects, a selective sampling system was employed whereby one block in each topographic map was selected as a priority block to be surveyed during the project. This sampling design also assured uniform coverage throughout the state. With the exception ˇof maps where the state's boundaries dictated particular blocks, priority blocks were chosen in a stratified random process. In this process no two priority blocks within adjacent topographic maps could share a common boundary. This sampling design was chosen to reduce random clustering and ensure a more uniform spread between the priority blocks (Fig. 1).

In addition to these priority blocks, data was collected from a number of special areas around the state. Special areas represented sites of ornithological interest which fell outside the boundaries of the designated priority blocks. Sites covered as special areas during the Atlas Project included areas of unique or localized habitats such as hemlock ravine and wetlands which support nesting species with restricted ranges in Ohio; areas with a high diversity of breeding birds; and areas of local or regional significance for breeding birds such as state and local parks, wildlife areas, and nature preserves. While special efforts were made to ensure coverage of some of these areas by atlas coordinators, no official list was developed and the identification and coverage of many of these areas was left to the desires of the local participants. Coverage of special areas was, with few exceptions, always considered secondary to achieving adequate coverage in the priority blocks.

Data was submitted for 205 special areas. However, for 92 of these areas, the data consisted of either partial lists of the bird communities that probably occupied the site, or were composed of only the 50–60 common breeding birds in the state. To ensure clarity during the mapping process, these sites were not included in the Atlas although these data are on file at the Division of Natural Areas and Preserves. A total of 113 sites were mapped as special areas in the Atlas publication (Fig. 2, Table 1).

Recording Methods and Data Collection

A system of codes based upon observable breeding behaviors was used by fieldworkers in recording data. This code system (Fig. 3) represents a synthesis of the codes developed and used by earlier breeding bird atlas projects in Great Britain and the U.S. with one exception. In 1984 the Ohio project coordinators added a new code to the confirmed category known as the "30" code in Ohio or the "multiple male" code in other states. The premise behind this code was the assumption that the presence of seven or more males holding territories within a priority block or special area during the breeding season indicated a strong possibility that nesting activities were taking place. For monogamous species with hard to find nests such as many warblers, vireos, flycatchers, and sparrows, this code allowed atlasers to increase their confirmation rate without spending an inordinate amount of time searching for nests. This code was not acceptable for every species, however, and was not used for species with polygamous breeding systems such as waterfowl, raptors, and colonial–nesting birds.

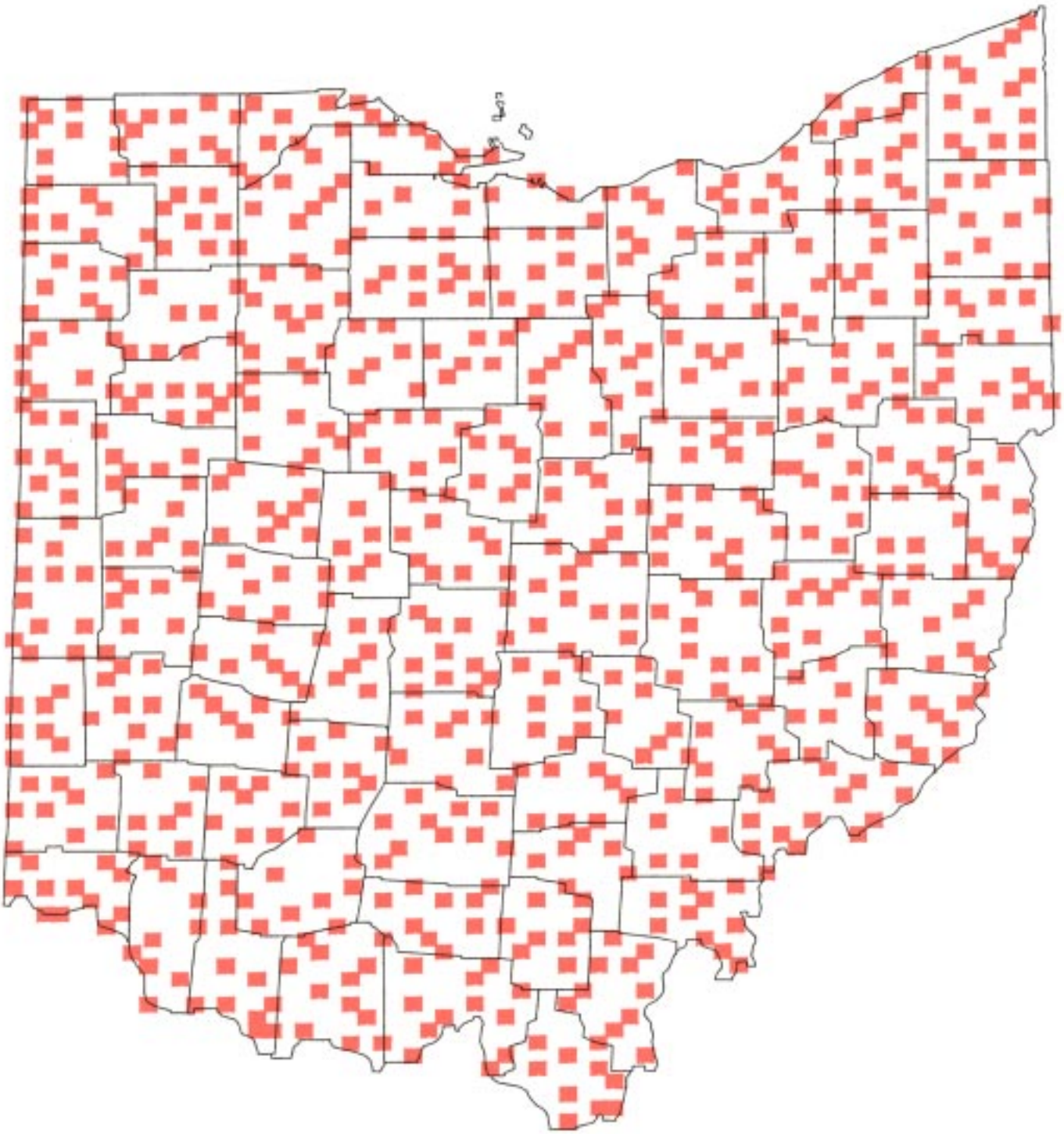


Figure 1. Location of Ohio Atlas priority blocks

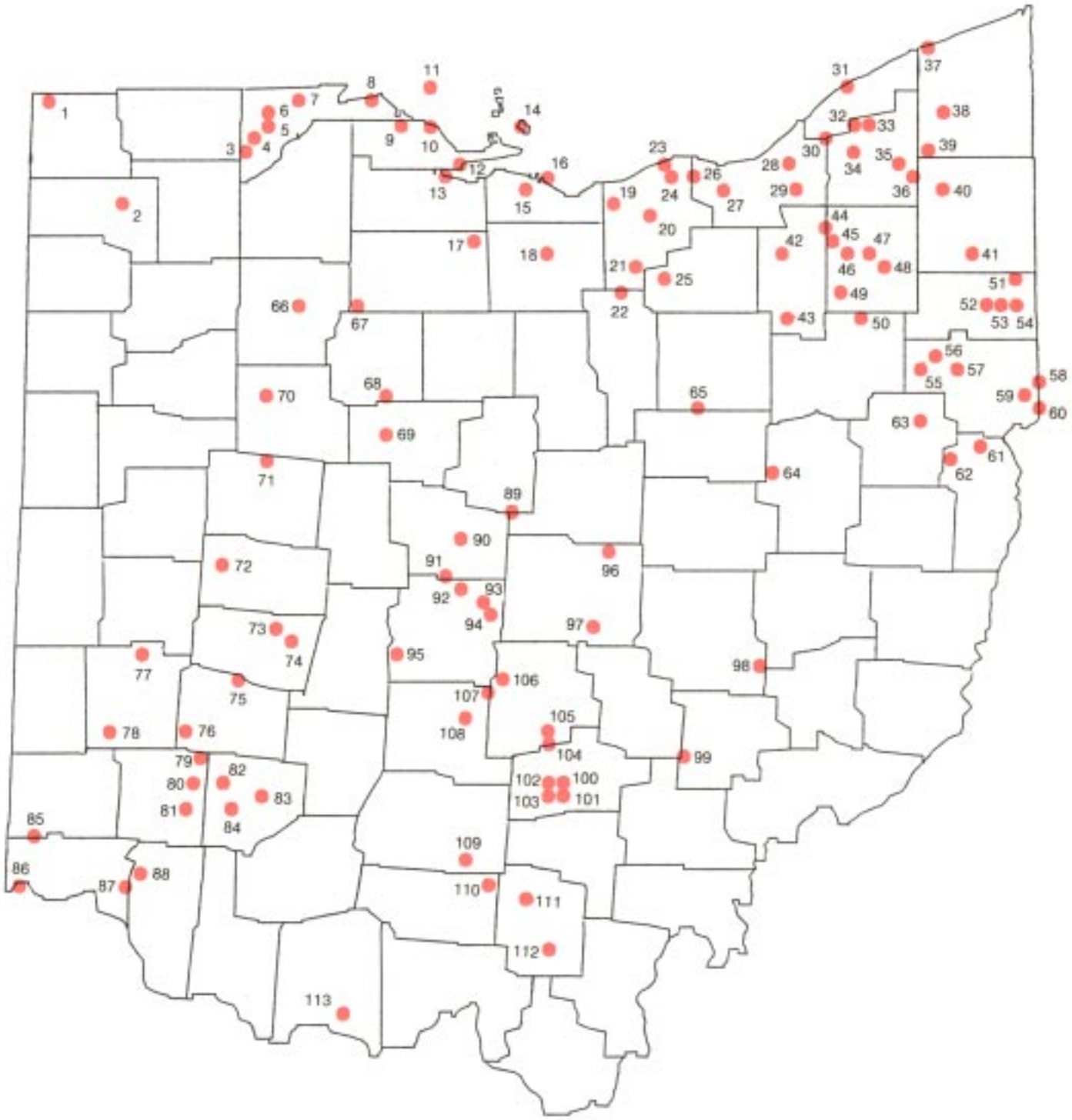


Figure 2. Location of special areas mapped for the Ohio Atlas

Table 1. Special areas mapped for the Ohio Breeding Bird Atlas

	Area Name	County
1	Lake LaSuAn Wildlife Area	Williams
2	Oxbow Lake Wildlife Area	Defiance
3	Maumee State Forest	Fulton & Lucas
4	Oak Openings Metropark	Lucas
5	Schwamberger Prairie (Kitty Todd Preserve)	Lucas
6	Wildwood Preserve Metropark	Lucas
7	Irwin Prairie State Nature Preserve	Lucas
8	Cedar Point National Wildlife Refuge	Lucas
9	Ottawa National Wildlife Refuge	Ottawa
10	Navaree Unit, Ottawa National Wildlife Refuge	Ottawa
11	West Sister Island National Wildlife Refuge	Lucas
12	Winous Point Shooting Club	Ottawa
13	Ottawa Shooting Club	Sandusky
14	Kelleys Island	Erie
15	Plumbrook (NASA)	Erie
16	Sheldons Marsh State Nature Preserve	Erie
17	Fireside Potholes	Seneca
18	Lawrence Farm	Huron
19	Chance Creek Metropark	Lorain
20	Carlisle Reservation	Lorain
21	Findley State Park	Lorain
22	Charlemont Reservation	Lorain
23	Lorain Co. Community College Grounds	Lorain
24	French Creek Reservation	Lorain
25	Spencer Wildlife Area	Medina
26	Bradley Woods Metropark	Cuyahoga
27	Lake Abrams	Cuyahoga
28	Shaker Lake Regional Nature Center	Cuyahoga
29	Bedford Reservation	Cuyahoga
30	North Chagrin Metropark	Cuyahoga
31	Mentor Marsh State Nature Preserve	Lake
32	Stebbin's Gulch	Geauga
33	Big Creek Park	Geauga
34	Heath Road Heronry (TRW Wetlands)	Geauga
35	Tare Creek Marshes	Geauga
36	Swine Creek Reservation	Geauga
37	Geneva State Park	Ashtabula
38	Morgan Swamp & Trumbull Creek	Ashtabula
39	Camp Whitewood – Phelps Creek Gorge	Ashtabula
40	Grand River Wildlife Area	Trumbull
41	Mosquito Creek (Block 5 Warren)	Trumbull
42	Peninsula (Block 2)	Summit
43	Barberton Salt Ponds	Summit
44	Tinkers Creek State Nature Preserve	Portage
45	Streetsboro Wetland (Gott & Herrick Fens)	Portage
46	Lake Rockwell & Lake Pippen	Portage
47	Mahoning River Bottoms (Block 2)	Portage
48	West Branch State Park	Portage
49	East End of Mogadore Reservoir	Portage
50	Quail Hollow State Park	Stark
51	Campbell (Block 1)	Mahoning
52	Mill Creek Park	Mahoning
53	Youngstown (Block 6)	Mahoning
54	Campbell (Block 3)	Mahoning
55	Mahoning River Wetlands (Block 5 Homeworth)	Columbiana
56	Huckleberry Swamp (Block 1 Hanoverton)	Columbiana

Table 1. Cont.

	Area Name	County
57	Guilford Lake	Columbiana
58	N. Fk. Little Beaver Creek (Block 6 E. Palestine)	Columbiana
59	Little Beaver Creek State Forest	Columbiana
60	Little Beaver Creek (Block 6 E. Liverpool N.)	Columbiana
61	Brush Creek Wildlife Area	Jefferson
62	Bergholz (Block 6)	Jefferson
63	Specht Marsh	Carroll
64	Baltic (Block 4)	Tuscarawas
65	Killbuck Marsh Wildlife Area	Holmes & Wayne
66	Findlay Clay Pits	Hancock
67	Springville Marsh State Nature Preserve	Wyandot
68	Killdeer Plains Wildlife Area	Wyandot
69	Big Island Wildlife Area	Marion
70	N.J. Moore Property	Hardin
71	Indian Lake	Logan
72	Kiser Lake State Park	Champaign
73	C.J. Brown Reservoir	Clark
74	Clark Lake Wildlife Area	Clark
75	Clifton Gorge & Glen Helen	Greene
76	Sugarcreek Reservation	Greene
77	Englewood Reserve	Montgomery
78	Germantown Reserve	Montgomery
79	Spring Valley Wildlife Area	Warren
80	Caesar Creek Dam Area	Warren
81	Fort Ancient State Memorial	Warren
82	Thobaben's Farm	Clinton
83	Wilmington Industrial Airpark	Clinton
84	Cowan Lake	Clinton
85	Feed Materials Production Center	Hamilton
86	Shawnee Lookout	Hamilton
87	Newtown Gravel Pits & Kroger Hills Park	Hamilton
88	Camp Dennison	Hamilton
89	Denny Farm	Morrow
90	Alum Creek Reservoir	Delaware
91	Highbanks Metropark	Delaware
92	Sharon Woods Metropark	Franklin
93	Blendon Woods Metropark	Franklin
94	Gahanna Woods	Franklin
95	Battelle Darby Creek Metropark	Madison & Franklin
96	Camp Ohio	Licking
97	Dawes Arboretum	Licking
98	Rich Hill Reclamation Area	Muskingum
99	Burr Oak State Park	Morgan & Athens
100	Hemlock Ravines (Block 4 S. Bloomingville)	Hocking
101	Queer Creek Gorge & the Gulf	Hocking
102	Crane Hollow	Hocking
103	Conkles Hollow State Nature Preserve	Hocking
104	Clear Creek Valley	Hocking & Fairfield
105	Wahkeena	Fairfield
106	Chestnut Ridge Metropark	Fairfield
107	Slate Run Metropark	Pickaway
108	Stages Pond State Nature Preserve	Pickaway
109	Scioto Trails State Forest	Ross
110	Hay Hollow	Pike
111	Lake Katharine State Nature Preserve	Jackson
112	Baker Swamp	Jackson
113	Abner Hollow	Adams

Ohio's "30" code was met with mixed reactions from other states and is the most controversial point of our atlas methodology. It has been adopted as a "probable" code by some states but has not been widely used, if at all, as a confirmed category outside of Ohio. Hence, the number of records attributed to this code are specifically stated in each species account in order to be able to compare the confirmation rates reported in Ohio with the rates found in other atlas projects.

Data for individual blocks or special areas were recorded on white field cards (Fig. 4). At the end of each field season, data were transcribed to identical green cards and submitted to the Division of Natural Areas and Preserves for review and computerization. Data cards also contained spaces for topographic map and block identification, names of observers, trip dates, number of hours spent on each trip, and number of new species recorded on each trip. Ohio also had a column marked "1st" on the data cards where the observer marked the trip number or date on which a species was observed in a priority block for the first time. This column was originally added as a research tool to see if there was a pattern to the way in which atlasers were covering their blocks.

POSSIBLE BREEDING (PO) –

10 – Species observed in breeding season in possible nesting habitat but no other indication of breeding noted. Note: care should be used not to include migrants or vagrants in this category.

PROBABLE BREEDING (PR) –

21 – Pair observed in suitable habitat in breeding season.

22 – Singing male(s) present (or breeding calls heard) on more than one date in the same place. This is a good indication that a bird has taken up residence if the dates are a week or more apart.

23 – Bird (or pair) apparently holding territory. In addition to territorial singing, chasing of other individuals of the same species often marks a territory.

24 – Courtship and display, copulation, agitated behavior or anxiety calls from adults suggesting probable presence nearby of a nest or young; well–developed brood patch or cloacal protuberance on trapped adult (for banders).

25 – Visiting probable nest site, or nest building by wrens and woodpeckers.

26 – Nest building or excavation of a nest hole.

CONFIRMED BREEDING (CO) –

30 – Seven or more territorial males in a block.

31 – Distraction display or injury feigning (agitated behavior and/or anxiety calls are only a '24' under Probable Breeding).

32 – Used nest found. Caution: these must be carefully identified if they are to be counted as evidence. Some nests (e.g., Northern Oriole) are persistent and characteristic, but most are very difficult to identify correctly. If in doubt, omit this as evidence.

33 – Female with egg in oviduct (for banders).

34 – Young recently out of the nest, not yet able to fly (including downy young of precocious species –waterfowl, shorebirds, etc.). This code should be used only for those birds incapable of sustained flight. Gliding and fledging flights are not considered to be sustained flight and are included in this code.

35 – Adult carrying fecal sac.

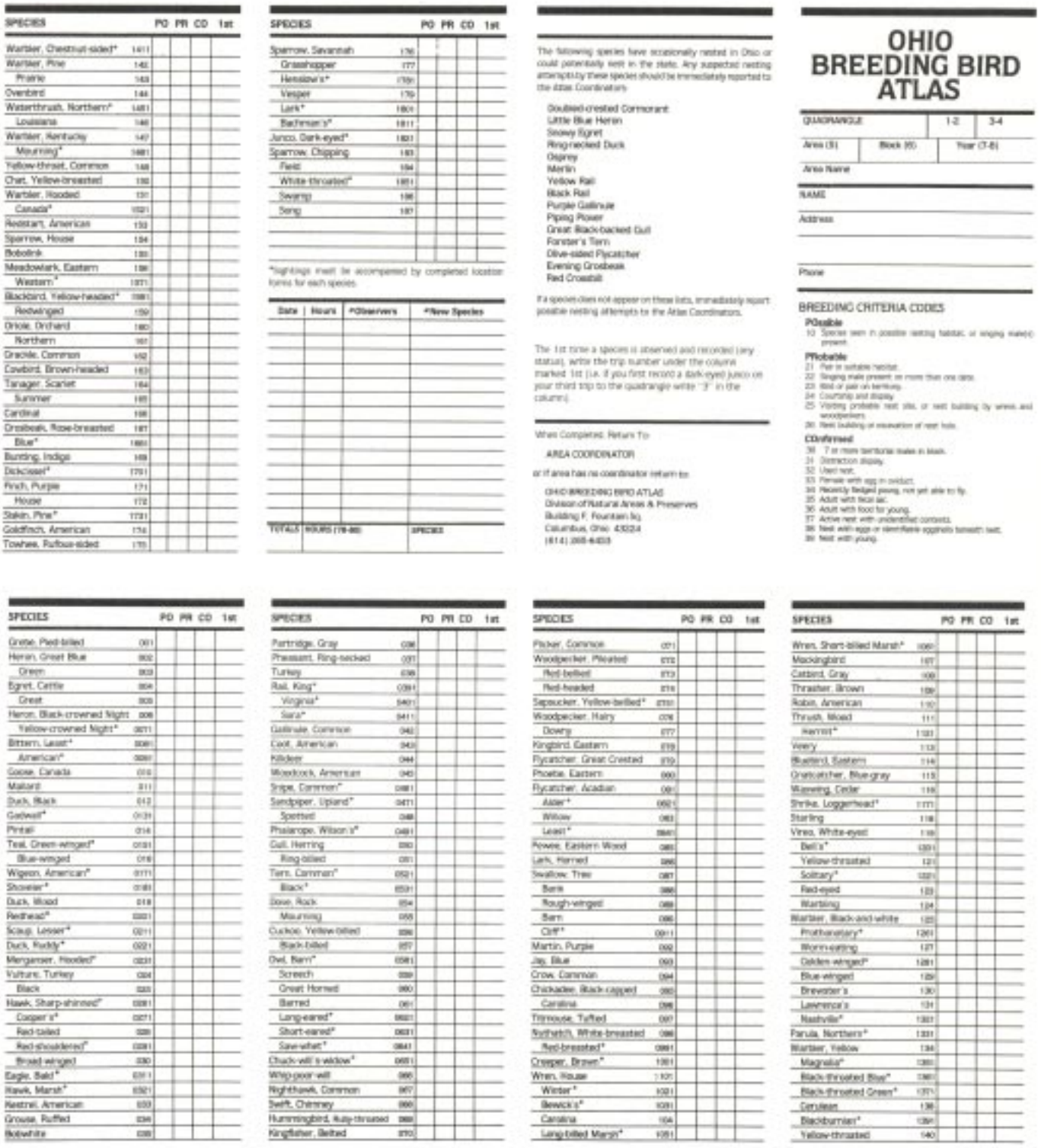
36 – Adult(s) with food for young. Some birds (gull, terns, and raptors) continue to feed their young long after they have fledged, and even after they have moved considerable distances. Also some birds (terns, herons, egrets, etc.) may carry food long distances to young in a neighboring block. Be especially careful on the edge of a block. Care should also be taken to avoid confusion with courtship feeding (a '24' under Probable).

37 – Active nest with unidentified contents. To be used when the presence of eggs or young in a nest cannot be determined due to nest location or presence of incubating adult.

38 – Identifiable nest and eggs, adult incubating eggs, or identifiable eggs shells found beneath nest. If you find a cowbird egg in a nest, it is a '38' for the cowbird, and a '38' for the identified nest' owner.

39 – Nest with young or identifiable dead nestling(s). If you find a young cowbird with other young, it is a '39' for the cowbird and a '39' for the host species.

Figure 3. Atlas codes and definitions of criteria for breeding evidence



OHIO BREEDING BIRD ATLAS

SPECIES		PO	PR	CO	1st
Warbler, Chestnut-sided*	1411				
Warbler, Pine	1401				
Prairie	1403				
Ovenbird	1440				
Waterthrush, Northern*	1481				
Louisiana	1480				
Warbler, Kentucky	1407				
Mourning*	1481				
Yellow-throat, Common	1480				
Chat, Yellow-breasted	1500				
Warbler, Hooded	1511				
Canada*	1521				
Redstart, American	1530				
Sparrow, House	1540				
Bobolink	1550				
Meadowlark, Eastern	1560				
Western*	1571				
Blackbird, Yellow-headed*	1581				
Redwinged	1590				
Oriole, Orchard	1600				
Northern	1611				
Grackle, Common	1620				
Cowbird, Brown-headed	1630				
Tanager, Scarlet	1640				
Summer	1650				
Cardinal	1660				
Grosbeak, Rose-breasted	1671				
Blue*	1680				
Bunting, Indigo	1690				
Dickcissel*	1701				
Finch, Purple	1711				
House	1720				
Siskin, Pine*	1731				
Goldfinch, American	1740				
Towhee, Rufous-sided	1750				

SPECIES		PO	PR	CO	1st
Sparrow, Savannah	1760				
Grasshopper	1770				
Henslow's*	1780				
Vesper	1790				
Lark*	1801				
Bachman's*	1811				
Junco, Dark-eyed*	1831				
Sparrow, Chipping	1830				
Field	1840				
White-throated*	1851				
Swamp	1860				
Song	1871				

*Sightings must be accompanied by completed location forms for each species.

Date	Hours	#Observers	#New Species
TOTALS	HOURS (19-80)		SPECIES

The following species have occasionally nested in Ohio or could potentially nest in the state. Any suspected nesting attempts by these species should be immediately reported to the Atlas Coordinators.

- Double-crested Cormorant
- Little Blue Heron
- Snowy Egret
- Ring-necked Duck
- Osprey
- Merlin
- Yellow Rail
- Black Rail
- Purple Gallinule
- Piping Plover
- Great Black-backed Gull
- Forster's Tern
- Olive-sided Flycatcher
- Evening Grosbeak
- Red Crossbill

If a species does not appear on these lists, immediately report possible nesting attempts to the Atlas Coordinators.

The 1st time a species is observed and recorded (any status), write the trip number under the column marked 1st (i.e. if you first record a dark-eyed junco on your third trip to the quadrangle write "3" in the column).

When Completed, Return To:

AREA COORDINATOR

or if area has no coordinator return to:

OHIO BREEDING BIRD ATLAS
Division of Natural Areas & Preserves
Building F, Fountain Sq.
Columbus, Ohio 43224
(614) 265-6453

QUADRANGLE		1-2	3-4
Area (3)	Block (6)	Year (7-8)	

Area Name

NAME

Address

Phone

BREEDING CRITERIA CODES

PObable
10 Species seen in possible nesting habitat, or singing male(s) present.

PRobable
21 Pair in suitable habitat.
22 Singing male present on more than one date.
23 Bird or pair on territory.
24 Courtship and display.
25 Visiting probable nest site, or nest building (by wrens and woodpeckers).
26 Nest building or excavation of nest hole.

COnfirmed
30 7 or more territorial males in block.
31 Distraction display.
32 Used nest.
33 Female with egg in oviduct.
34 Recently fledged young, not yet able to fly.
35 Adult with fecal sac.
36 Adult with food for young.
37 Active nest with undentified contents.
38 Nest with eggs or identifiable eggshells beneath nest.
39 Nest with young.

SPECIES		PO	PR	CO	1st
Grebe, Pied-billed	001				
Heron, Great Blue	002				
Green	003				
Egret, Cattle	004				
Great	005				
Heron, Black-crowned Night	006				
Yellow-crowned Night*	0071				
Bittern, Least*	0081				
American*	0091				
Goose, Canada	010				
Mallard	011				
Duck, Black	012				
Gadwall*	0131				
Pintail	014				
Teal, Green-winged*	0151				
Blue-winged	016				
Wigeon, American*	0171				
Shoveler*	0181				
Duck, Wood	018				
Redhead*	0201				
Scaup, Lesser*	0211				
Duck, Ruddy*	0221				
Merganser, Hooded*	0231				
Vulture, Turkey	024				
Black	025				
Hawk, Sharp-shinned*	0261				
Cooper's*	0271				
Red-tailed	028				
Red-shouldered*	0291				
Broad-winged	030				
Eagle, Bald*	0311				
Hawk, Marsh*	0321				
Kestrel, American	033				
Grouse, Ruffed	034				
Bobwhite	035				

SPECIES		PO	PR	CO	1st
Partridge, Gray	036				
Pheasant, Ring-necked	037				
Turkey	038				
Rail, King*	0391				
Virginia*	0401				
Sora*	0411				
Gallinule, Common	042				
Coot, American	043				
Killdeer	044				
Woodcock, American	045				
Snipe, Common*	0461				
Sandpiper, Upland*	0471				
Spotted	048				
Phalarope, Wilson's*	0491				
Gull, Herring	050				
Ring-billed	051				
Tern, Common*	0521				
Black*	0531				
Dove, Rock	054				
Mourning	055				
Cuckoo, Yellow-billed	056				
Black-billed	057				
Owl, Barn*	0581				
Screech	059				
Great Horned	060				
Barred	061				
Long-eared*	0621				
Short-eared*	0631				
Saw-whet*	0641				
Chuck-will's-widow*	0651				
Whip-poor-will	066				
Nighthawk, Common	067				
Swift, Chimney	068				
Hummingbird, Ruby-throated	069				
Kingfisher, Belted	070				

SPECIES		PO	PR	CO	1st
Flicker, Common	071				
Woodpecker, Pileated	072				
Red-bellied	073				
Red-headed	074				
Sapsucker, Yellow-bellied*	0751				
Woodpecker, Hairy	076				
Downy	077				
Kingbird, Eastern	078				
Flycatcher, Great Crested	079				
Phoebe, Eastern	080				
Flycatcher, Acadian	081				
Alder*	0821				
Willow	083				
Least*	0841				
Pewee, Eastern Wood	085				
Lark, Horned	086				
Swallow, Tree	087				
Bank	088				
Rough-winged	089				
Barn	090				
Cliff*	0911				
Martin, Purple	092				
Jay, Blue	093				
Crow, Common	094				
Chickadee, Black-capped	095				
Carolina	096				
Titmouse, Tufted	097				
Nuthatch, White-breasted	098				
Red-breasted*	0991				
Creeper, Brown*	1001				
Wren, House	1011				
Winter*	1021				
Bewick's*	1031				
Carolina	104				
Long-billed Marsh*	1051				

SPECIES		PO	PR	CO	1st
Wren, Short-billed Marsh*	1061				
Mockingbird	107				
Catbird, Gray	108				
Thrasher, Brown	109				
Robin, American	110				
Thrush, Wood	111				
Hermit*	1121				
Wery	113				
Bluebird, Eastern	114				
Gnatcatcher, Blue-gray	115				
Waxwing, Cedar	116				
Shrike, Loggerhead*	1171				
Starling	118				
Vireo, White-eyed	119				
Bell's*	1201				
Yellow-throated	121				
Solitary*	1221				
Red-eyed	123				
Warbling	124				
Warbler, Black-and-white	125				
Prothonotary*	1261				
Worm-eating	127				
Golden-winged*	1281				
Blue-winged	129				
Brewster's	130				
Lawrence's	131				
Nashville*	1321				
Parula, Northern*	1331				
Warbler, Yellow	134				
Magnolia*	1351				
Black-throated Blue*	136				
Black-throated Green*	1371				
Cerulean	138				
Blackburnian*	1391				
Yellow-throated	140				

Figure 4. Copy of an Ohio Atlas data card

Asterisked Species

Species that were considered by ODNR or the atlas coordinators to be rare, endangered, or of unknown status in Ohio were designated by an asterisk on the data cards. Sixty–five species received this designation (Table 2). An additional information sheet was required for each report of an asterisked species. This form was required as a means of gathering additional information on the locations of these occurrences as well as on habitat preferences, breeding evidence observed, numbers of individuals, and the specific dates of observation. Reports were requested on all sightings of asterisked species during the nesting season regardless of the location, and were not limited to priority blocks and special areas. Within the Atlas, the maps for these asterisked species reflect these data collection efforts and include all reported sightings, including those reported from areas which were submitted but not mapped as special areas. All asterisked species reports are in the files of the Division of Natural Areas and Preserves.

Table 2. Asterisked species for the Ohio Atlas Project

Yellow-crowned Night Heron	Common Tern	Golden-winged Warbler
Least Bittern	Black Tern	Nashville Warbler
American Bittern	Barn Owl	Northern Parula
Gadwall	Long-eared Owl	Magnolia Warbler
Green-winged Teal	Short-eared Owl	Black-throated Blue Warbler
American Wigeon	Northern Saw-whet Owl	Black-throated Green Warbler
Northern Shoveler	Chuck-will's-widow	Blackburnian Warbler
Redhead	Yellow-bellied Sapsucker	Chestnut-sided Warbler
Lesser Scaup	Alder Flycatcher	Northern Waterthrush
Ruddy Duck	Least Flycatcher	Mourning Warbler
Hooded Merganser	Cliff Swallow	Canada Warbler
Sharp-shinned Hawk	Red-breasted Nuthatch	Western Meadowlark
Cooper's Hawk	Brown Creeper	Yellow-headed Blackbird
Red-shouldered Hawk	Winter Wren	Blue Grosbeak
Bald Eagle	Bewick's Wren	Dickcissel
Northern Harrier	Marsh Wren	Pine Siskin
King Rail	Sedge Wren	Henslow's Sparrow
Virginia Rail	Hermit Thrush	Lark Sparrow
Sora	Loggerhead Shrike	Bachman's Sparrow
Common Snipe	Bell's Vireo	Dark-eyed Junco
Upland Sandpiper	Solitary Vireo	White-throated Sparrow
Wilson's Phalarope	Prothonotary Warbler	

Field Surveying and Coverage Standards

The primary objective of breeding bird atlas projects is to record evidence of breeding for all the species present in each priority block, confirming nesting for as many species as possible. Atlas projects usually emphasize distribution patterns based upon presence–absence data. In order for atlas project maps to show meaningful distribution patterns, a minimum standard of coverage must be achieved in each priority block to ensure that the absence, as well as the presence, of species is valid and not the result of inadequate coverage. To address this problem, most breeding bird atlas projects establish standards for determining when a priority block can be considered to have been adequately covered.

Many atlas projects have adopted a coverage standard known as the 75% rule. Under this standard, a priority block was considered to be adequately covered when at least 76 species were recorded and half of this total were confirmed as breeders. This standard was based upon the assumption that approximately 100 species were present in most priority blocks. This coverage standard was not applicable to Ohio where very few priority blocks support 100 species. Additionally, habitat availability varies markedly across the state. The wooded hills of eastern Ohio support considerably more birds than the intensively cultivated western counties where few natural habitats remain. Instead of using a fixed number of species as a coverage standard, a more flexible approach was required. Based upon previous experience, Ohio's atlas project initially used 50 species in the western counties and 70 species in the eastern counties as the minimum coverage standards. After the first two field seasons, however, these standards proved to be inadequate to judge the adequacy of block coverage since many priority blocks easily surpassed these numbers of species. During the remaining years of the Atlas Project, the data from every priority block was analyzed at the end of each field season for adequacy of coverage.

A priority block was considered to be adequately covered if all the bird groups likely to be present in the area (e.g. grassland sparrows, flycatchers, vireos, warblers, etc.) were represented in the data, and if approximately 90% of the species likely to occur within the block had been recorded. Determining adequacy of coverage in this manner took into account the physiographic region of the state where the block was located as well as established information on the bird communities in each of these regions. This process also generated a list of species that were not recorded but were likely to occur within each priority block. These lists were useful as an aid to the atlasers in their quest for achieving adequate block coverage.

Unlike other states, Ohio did not set any standards for numbers of confirmed species in priority blocks. Given the logistical problems of obtaining adequate coverage within every priority block, the project coordinators decided that the time spent trying to confirm nesting would be better used searching for additional species or covering blocks where no data had yet been collected.

Since volunteers were not uniformly distributed across Ohio, there were large portions of the state that received little coverage during the first two field seasons. While there were individual counties scattered throughout Ohio where coverage was sparse, the largest gaps were within the unglaciated Allegheny Plateau in southern and eastern Ohio and in many of the western counties from Michigan south to the Springfield–Dayton area. Blocks within these regions were covered primarily through the efforts of individuals hired by the Division of Natural Areas and Preserves between 1985 and 1987.

In addition to paid staff personnel, a limited number of blocks were covered by block–busting. This method involved a group of atlasers intensively covering a series of priority blocks during a single weekend. The Ohio Atlas sponsored weekend block–busting events in Adams, Ashtabula, and Williams counties which served as the primary means for covering the priority blocks in these counties. With the exception of Williams County which was covered in 1987, some of these priority blocks were revisited in subsequent years to look for additional species that may have been missed during the block–busting events.

Efforts were also undertaken to ensure that individual species or families were receiving adequate coverage by atlasers. A review of the atlas data after the 1985 field season indicated that early spring nesters and nocturnal species such as Ruffed Grouse, Wild Turkey, American Woodcock, owls, and Whip-poor-wills were being missed in many priority blocks. Special survey efforts were initiated for these species by volunteers and seasonal staff during the final two years of the Atlas Project and succeeded in filling many of the data gaps for them.

Data Processing and Verification

County coordinators were responsible for initially checking the atlas data cards for possible errors and to make sure all necessary information was included. Cards were then forwarded to the project coordinators for further review. Where a county had no local coordinator, data cards were sent directly to the project coordinators. The project coordinators reviewed every data card, searching for recording errors, incorrect usage of breeding criteria codes, misidentifications, and the inclusion of probable migrants. The atlas data were then computerized, and this computer data base was maintained by DNAP.

Biases and Limitations

In most priority blocks and special areas, the totals probably do not include every species that was actually present during the Atlas Project. A number of factors were responsible for the failure to record species within the blocks and special areas. Many priority blocks and special areas were intensively surveyed during only one or two years of the project, and species that only intermittently inhabited these sites were regularly missed. Since priority blocks could never be entirely surveyed, rare species or those with very local distributions could easily be overlooked. Species requiring special efforts to locate, particularly crepuscular and nocturnal birds, may have been under–recorded despite our best efforts to find them. Secretive birds such as nesting bitterns, rails, accipiters, and several species of owls are difficult to locate under the best of circumstances, and the Atlas Project records probably represent a small fraction of their total population in the state. These biases were evident whether the site was covered by volunteers, hired summer staff, or block–busting events, although sites covered during a single intensive effort (i.e. a block–busting weekend) are probably subject to the greatest amount of bias. Other factors affecting the number of species recorded in priority blocks and special areas include the amount of time spent surveying the area, difficulty of access, the observer's willingness to cover habitats away from roads, habitat type, and the observer's ability.

Results and Discussion

Over 500 volunteers spent more than 30,000 hours in the field surveying Ohio's summer birdlife during the Breeding Bird Atlas Project. These observers generated a total of 102,728 records, of which 38% were confirmed breeders and 42% were in the probable category. Of the 764 priority blocks surveyed, only one had fewer than 50 species while eight had more than 100 species (Table 3); 548 blocks (72%) ranged between 70 and 89 species.

Table 3. Distribution of blocks by species count

Number of Species	Number of Blocks
48	1
50–59	32
60–69	109
70–79	260
80–89	288
90–99	66
100+	8

During the Atlas Project breeding evidence was obtained for a total of 193 species and two hybrids (Lawrence's and Brewster's warblers). Of this total, 182 species were confirmed as breeders as were the two hybrids, 4 species were recorded as probable breeders, and 7 species were recorded as possible breeders. Snowy Egret, Little Blue Heron, and Mute Swan (feral individuals) were confirmed breeding in Ohio for the first time, while Double–crested Cormorants and Sandhill Cranes nested for the first time in over 50 years. Mourning Warblers, thought to have disappeared from Ohio as a nesting species in the 1950s , were reported from several locations in northern Ohio and were confirmed at two sites in northeastern Ohio. Species that formerly nested in Ohio, but were not confirmed as breeders during the Atlas Project include Lesser Scaup, Osprey, Short–eared Owl, Golden–winged Warbler, Black–throated Blue Warbler, Nashville Warbler, Yellow–headed Blackbird, and White–throated Sparrow. Species with no documented nesting records in Ohio that were recorded but also unconfirmed during the Atlas Project included Tricolored Heron, Peregrine Falcon, Laughing Gull, and Swainson's Warbler. Peregrine Falcons successfully nested in Toledo during 1988, a result of the captive release programs undertaken in several midwestern cities during the 1980s.

A statewide average of 78 species were recorded in the priority blocks, with a low of 48 species (Dayton N. Quad, Montgomery Co.) to a high of 115 species (Peninsula Quad, Summit Co.). Priority blocks in the eastern and southern counties tended to have higher totals than blocks in western Ohio (Fig. 5), although many western blocks equaled or exceeded species totals recorded for many of the eastern and southern blocks.

The Glaciated Plateau had the highest regional average of 84.6 species/block followed by the Unglaciated Plateau region with an average of 82.6 species/block (Table 4). Both regions are characterized by extensive woodlands, riparian corridors, successional habitats, grasslands, and, in the case of the Glaciated Plateau, wetlands. This habitat diversity results in a high diversity of nesting birds within many blocks.

The Lake Plain and Till Plain physiographic regions had the lowest regional averages of 73.4 and 73.0 species per block, respectively, but had higher total numbers of species than the Unglaciated Plateau (Table 4). The total of 161 species in the Lake Plain was the highest in the state. The large variety of waterfowl and other wetland birds occupying the Lake Erie marshes helped to account for this large total number of species and resulted in one priority block with 112 species (Oak Harbor Quad, Ottawa Co.). The lowest regional species total was 121 species in the Illinoian Till Plain. This lower total reflects the small size of this physiographic region (only 46 priority blocks), and the lower habitat diversity.

Table 4. Average no. species per block and total species count by physiographic region.

Region	No. of Blocks	Total Species	Ave. No. Species/ Block	High	Low
1. Lake Plain	95	161	73.4	112	52
2. Till Plain	271	151	73.0	97	48
3. Illinoian Till Plain	46	121	76.0	90	54
4. Glaciated Plateau	140	156	84.6	115	58
5. Unglaciated Plateau	212	146	82.6	104	57
Statewide	764	178	78.0	115	48

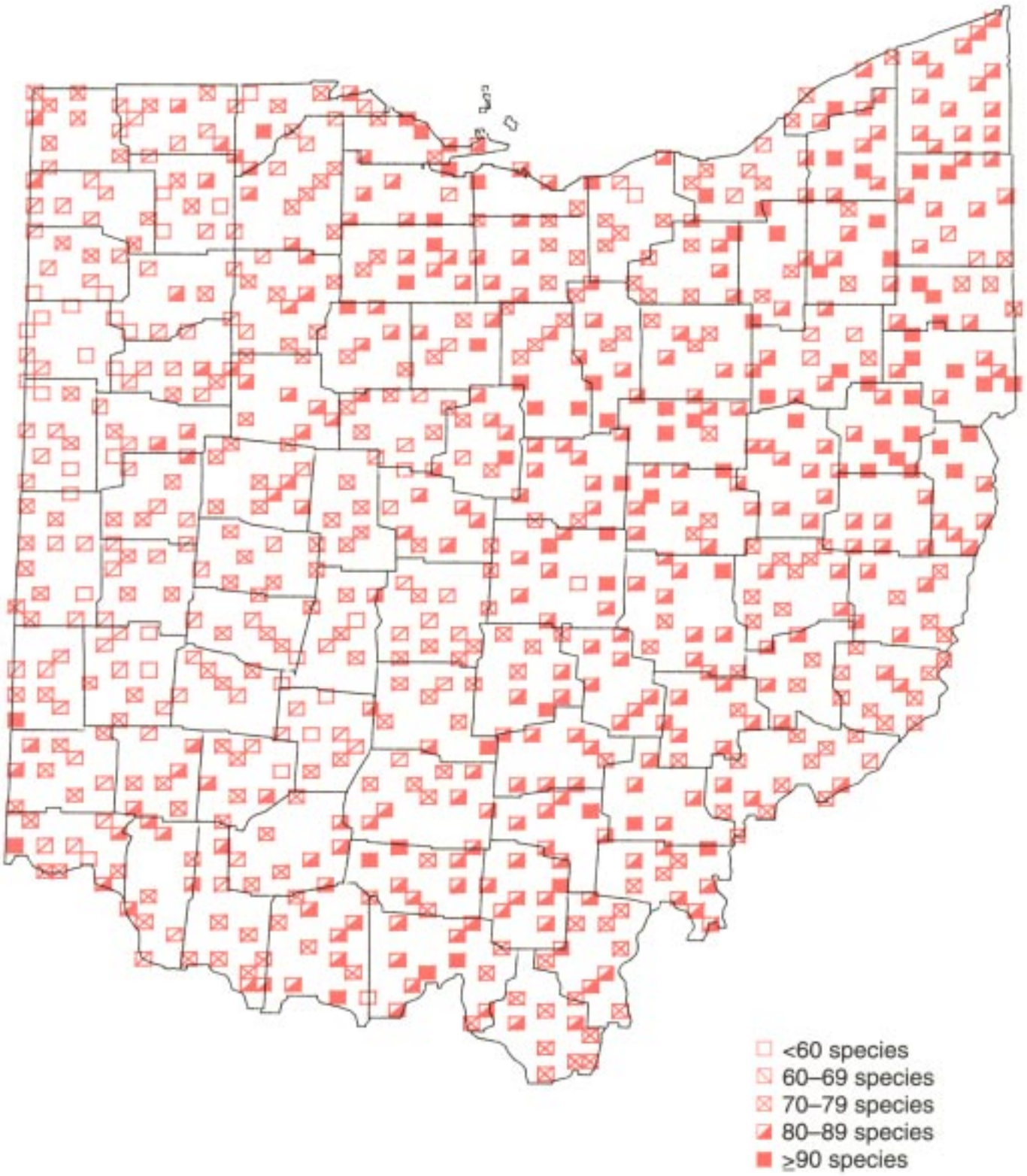


Figure 5. Block coverage achieved for the Ohio Atlas Project

Atlas data has changed our understanding about many of Ohio's breeding birds. Unexpected results included, for example, Eastern Wood-Pewees and Gray Catbirds being found in every priority block and Red-eyed Vireos being found in all but two priority blocks. Equally surprising might be the presence of Northern Orioles in all but 9 priority blocks, Wood Thrushes in all but 11 blocks, or Eastern Screech-Owls in all but 26 blocks. At the other extreme, many species which were formerly widely distributed summer residents in Ohio have almost disappeared from the state. American Bitterns, King Rails, Bewick's Wrens, Barn Owls, Loggerhead Shrikes, Golden-winged Warblers, and Lark Sparrows were all recorded in 11 or fewer blocks while Bachman's Sparrows have completely disappeared.

A number of species on the Atlas's asterisked species list proved to be more widely distributed than previously thought. Species which appeared to be increasing in numbers following earlier population declines included Cliff Swallow, Dickcissel, Cooper's Hawk, and Henslow's Sparrow. Other asterisked species which occurred more frequently than originally expected included Red–shouldered Hawk, Alder Flycatcher, Least Flycatcher, Prothonotary Warbler, Northern Parula, and Chestnut-sided Warbler (see species accounts for specifics).

A number of breeding species have also been expanding their ranges in Ohio. Species with southern affinities which have been expanding northward include Northern Mockingbird, Blue Grosbeak, Yellow-throated Warbler, White-eyed Vireo, Blue-gray Gnatcatcher, Kentucky Warbler, and Prairie Warbler. Species with northern affinities which have been spreading southward include Rose-breasted Grosbeak, Tree Swallow, Veery, Solitary Vireo, Canada Warbler, and Savannah Sparrow. As the distributional limits of many of Ohio's nesting species continue to contract and expand in the years to come, the Ohio Breeding Bird Atlas will provide a baseline against which these future changes in bird distribution can be measured.

Species Accounts

The species accounts accompanying the distributional maps focus on the following topics: historical status in Ohio, analysis of current distribution as documented by the Atlas Project, abundance information as indicated on Breeding Bird Survey routes, habitat preference, nest site selection, nesting chronology for Ohio, and a summary of the breeding confirmation codes reported during the Atlas Project. Accounts of Ohio's birdlife written by Dawson (1903), Jones (1903), Hicks (1935) and Wheaton (1882) as well as a number of regional references provide the framework against which the present distributional patterns can be compared. Abundance data was drawn primarily from the results of the U.S. Fish and Wildlife Service's Breeding Bird Survey (BBS) routes (see Robbins, C. S., et al. 1986 for additional information). The scientific names of all plants cited in the text are listed in Appendix C.

Statistical data found in the smaller of the two tables accompanying the distribution maps defines each species occurrence within priority blocks. This table summarizes the total number of records within the priority blocks and gives a breakdown of this total into the confirmed, probable, and possible breeding categories. Although occurrence data from areas outside of the priority blocks is included on the maps, this data is not included in the statistical presentation.

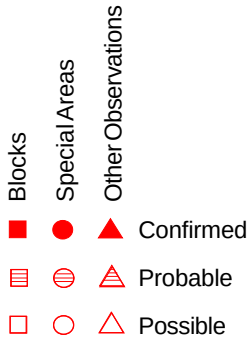
The larger table provides an analysis of priority block data with respect to Ohio's physiographic regions. As an illustration of this information, the statistical data for Whip-poor-wills in the Unglaciated Plateau region are:

	Total Blocks Surveyed	No. of Blocks with Data	Percent with Data	Regional Percent for Ohio	Average No. Individual per BBS Route
Unglaciated Plateau	212	129	60.9	69.0	0.6

Whip-poor-wills were found in 129 of the 212 priority blocks situated in this region, representing 60.9% of the region's priority blocks. The total number of occurrences in this physiographic region (129) represented 69% of the statewide total number of records (187). Hence, the regional percentage for Ohio contributed by this particular physiographic region is 69%. The abundance information given in the last column shows that an average of 0.6 individuals were observed on each BBS route run in this physiographic region between the years 1982 and 1987.

Map Interpretation

The map accompanying each species account represents the distributional data acquired during the Atlas project. Data from three areas may be exhibited on these maps; priority block data represented by squares, special areas data represented by circles, and data on asterisked species collected outside of blocks or special areas which are represented by triangles. Three different patterns are used to indicate the level of breeding confirmation achieved for a particular record. The data symbols and breeding confirmation patterns are.



Only those blocks and special areas having data are shown on the maps. County identifications for the Ohio map are found in Figure 6.

Figure 6. Location of Ohio counties

SPECIES ACCOUNTS