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TECHNIQUES FOR BANDING WOODCOCK IN  
SUMMER HABITATS IN MICHIGAN

Thesis for the Degree of M. S.  
MICHIGAN STATE UNIVERSITY

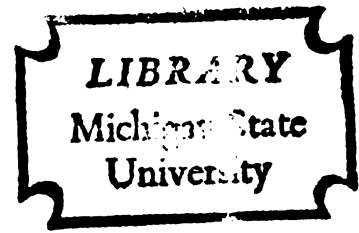
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## ABSTRACT

### TECHNIQUES FOR BANDING WOODCOCK IN SUMMER HABITATS IN MICHIGAN

By

Larry E. Gregg

Techniques for capturing American woodcock (Philohela minor) were evaluated during two summers in Michigan. A total of 457 woodcock were captured with mist nets, spotlights and ground traps. Mist nets were the most productive capture method tested, but night-lighting yielded a higher catch per unit of effort. Ground traps required a large investment in time and were productive only during dry weather. Woodcock were found to concentrate in a variety of forest openings on summer evenings, including old fields, pulp cuttings and wood roads. Openings which attracted large numbers of woodcock were usually located near diurnal cover and contained areas of moist soil where the birds could probe for earthworms. Success in capturing woodcock depends upon their local population density, the availability of suitable banding sites, proper weather conditions and the experience of the banding crew. Recommendations for the establishment of a woodcock banding program are presented.



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SUMMER HABITATS IN MICHIGAN

By

Larry E. Gregg

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## TABLE OF CONTENTS

	Page
LIST OF TABLES . . . . .	iii
LIST OF FIGURES. . . . .	iv
INTRODUCTION. . . . .	1
STUDY AREAS . . . . .	4
METHODS . . . . .	7
Mist Nets . . . . .	8
Funnel Traps . . . . .	10
Spotlights . . . . .	12
RESULTS . . . . .	14
Mist Nets . . . . .	14
Spotlighting . . . . .	14
Ground Traps . . . . .	17
Factors Influencing Capture Success. . . . .	19
DISCUSSION . . . . .	30
LITERATURE CITED . . . . .	36

# LIST OF TABLES

Table	Page
1. Summer catches of woodcock, Ishpeming and Pigeon River areas, Michigan. . . . .	15
2. Relative efficiency of woodcock summer capture techniques, Ishpeming and Pigeon River areas, Michigan, 1965-66 . . . . .	18
3. Comparison of woodcock singing-ground counts near Michigan summer study areas . . . . .	20
4. Age and sex ratios of woodcock captured by different techniques in Ishpeming and Pigeon River areas, Michigan, 1965-66 . . . . .	22
5. Monthly weather conditions and capture success in Ishpeming and Pigeon River areas, Michigan .	26

## LIST OF FIGURES

Figure	Page
1. Woodcock banding study areas in northern Michigan, 1965-66 . . . . .	5
2. Net poles held in place by slipping them over short lengths of galvanized pipe driven into the ground . . . . .	9
3. Funnel traps constructed of welded wire with cloth netting tops. . . . .	11
4. Night-lighting equipment used to capture woodcock in Michigan . . . . .	13
5. Mist nets placed between tree clumps in woodcock flight lanes generally produced good catches . . . . .	29

## INTRODUCTION

The popularity of the woodcock as a game bird is rapidly increasing, as evidenced by the change in continental woodcock kill. Goudy (1967) estimated that more than a million woodcock were harvested in North America during the 1965 hunting season. The estimated total woodcock kill has more than doubled during the past decade (Goudy and Martin, 1966). In Michigan, woodcock hunters now approximate waterfowl hunters in numbers. During the 1966 hunting season, more than 180,000 woodcock were harvested there by an estimated 85,750 hunters (Hawn, 1967).

In spite of the increasing popularity of woodcock hunting, however, relatively little research or management effort is directed at the species. Though the utilization of banding data is an important element in the analysis of avian populations, woodcock bandings have been insufficient to provide the information needed to insure proper management. A summary of woodcock bandings and recoveries provided by the Bureau of Sport Fisheries and Wildlife's Migratory Bird Populations Station revealed that less than 20,000 woodcock had been banded up to 1965 and fewer than 400 bands had been recovered.



In past years woodcock banding activities have centered on the birds' wintering grounds in Louisiana, where large numbers of birds occupy open fields at night (Glasgow, 1958). Lights and hand nets have been employed in banding more than 17,000 woodcock on the Louisiana wintering grounds from 1948 to 1968 (Martin et al., 1969). Recent work within the birds' breeding range has revealed that woodcock also fly to clearing at dusk during the summer. Sheldon (1961) first reported woodcock concentrating in fields at twilight in central Massachusetts. Similar observations were subsequently made by Martin (1962) at the Moosehorn National Wildlife Refuge in northwestern Maine and in the Upper Peninsula of Michigan (Martin and Clark, 1964).

Sites used by woodcock on summer evenings have been described by Sheldon (1960, 1961) and Clark (1966). They found that fields used by woodcock varied considerably in size and vegetation. Sheldon (1960) stated that the only feature in which the fields were similar was their location with reference to spring breeding areas, all being in or close to places where the largest number of singing males was heard in the spring.

The present two-summer study was initiated in Michigan in June, 1965, to determine the comparative value of several capture techniques and to provide an estimate of the feasibility of initiating a large-scale banding

program in the state. The project was a cooperative one between the Department of Fisheries and Wildlife, Michigan State University, and the Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior. Assistance and use of facilities were provided by the Michigan Department of Natural Resources.

I wish to acknowledge the advice and guidance provided throughout the study by W. H. Goudy, U. S. Fish and Wildlife Service. Appreciation is also expressed to Dr. G. A. Petrides, Michigan State University, and to Dr. G. A. Ammann and T. R. Prawdzik, Michigan Department of Natural Resources, for their assistance. R. A. Hunt and J. B. Hale, Wisconsin Department of Natural Resources, also reviewed the manuscript.

## STUDY AREAS

Field studies were conducted during the summers of 1965 and 1966, respectively, near Ishpeming in the central portion of the Upper Peninsula of Michigan and in the Pigeon River State Forest in northern lower Michigan (Figure 1). Both study areas were characterized by a gently rolling topography. Sandy or sandy loam soils occurred on the well-drained sites with muck and peat in the lowlands. The original forests in both areas had been modified by logging, fire and agriculture. Vegetative cover was a mosaic of hardwood timber, grassy plains, coniferous swamps and plantations, hardwood-conifer mixtures and old fields. Most of the land that was once farmed now lies fallow. Counts of singing male woodcock were made on routes followed annually through these areas. These tallies indicated that both supported sizable woodcock breeding populations (Martin, 1963, 1964b; Goudy and Martin, 1966).

Both the Pigeon River (Blankenship, 1957) and Ishpeming areas (Martin and Clark, 1964) had been studied during previous woodcock investigations. Since some of the Ishpeming area banding sites utilized in the present study had been previously discovered, field activities

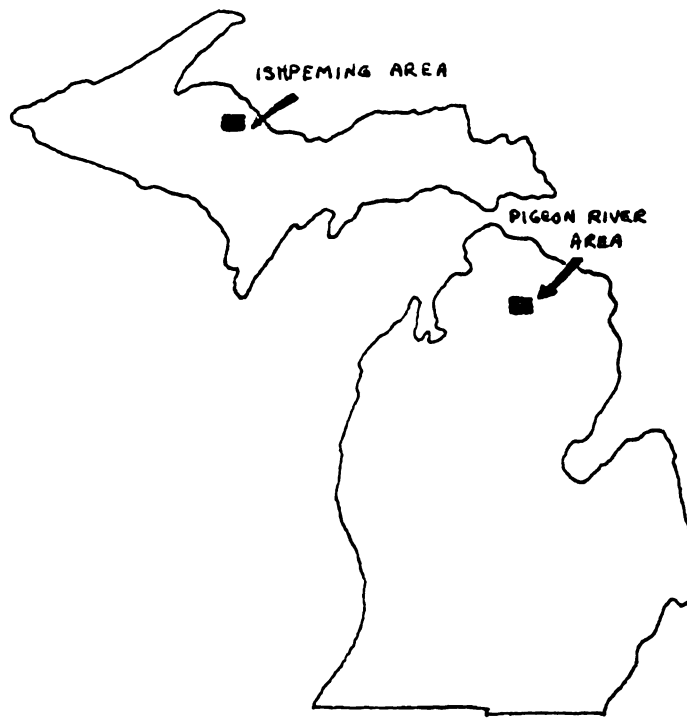


Figure 1.--Woodcock banding study areas in northern Michigan, 1965-66.

were undertaken at a new location in 1966 in order to provide additional information concerning the ability of an investigator to identify suitable banding sites.



## METHODS

Mist nets, funnel traps and spotlights were evaluated for effectiveness as capture methods. The effects of weather, season, habitat and woodcock sex and age were evaluated with respect to capture success. Recapture data were examined for information on woodcock movements and habitat preferences.

Birds were sexed and aged at the time of banding. Sex was ascertained by the combined width of the outer three primaries and by bill length (Greeley, 1953; Blankenship, 1957). Age was determined by flight feather molt and the color pattern on the tips of the secondaries (Martin, 1964a). As Sheldon (1961) suggested, sex and age ratios of captured woodcock may not be representation of those in the population. The reliability of sex and age ratio statistics derived from captured samples of woodcock were further evaluated in the present study.

Temperature, precipitation, cloud cover and wind strength were recorded in the field. In addition, weather records were obtained from the U. S. Department of Commerce weather stations in Marquette in 1965 and from the Michigan Department of Natural Resources fisheries research station near Vanderbilt in 1966.

Data on field size, vegetation, soil and distance from diurnal cover were recorded for openings used by woodcock in Michigan. Estimates of availability of woodcock food and evidences of feeding in the openings were also recorded.

### Mist Nets

The technique of using nets for capturing birds is centuries old. Dewar (1928), concerning the European woodcock (Scolopax rusticola), advises that "the poacher takes advantage of the fact that they leave their cover every evening by the same opening to set nets to catch them as they fly to their feeding ground." Sheldon (1961), upon discovering that the American woodcock also flew to open fields on summer evenings, used mist nets to capture them.

In the present study, mist nets (Type C, 12-meter, 4-tier, nylon) were suspended from 10-foot poles made of 3/4-inch metal conduit. The hollow poles were held in place by slipping them over 4-foot pieces of 3/8-inch galvanized pipe driven into the ground (Figure 2).

Nets were placed in abandoned farm fields, along logging trails and back roads, across streams and on bridges. Netting was also attempted at several muddy sites which exhibited woodcock droppings and bill probe-marks. Although up to 35 nets were operated with one assistant on some evenings, generally ten to twenty nets

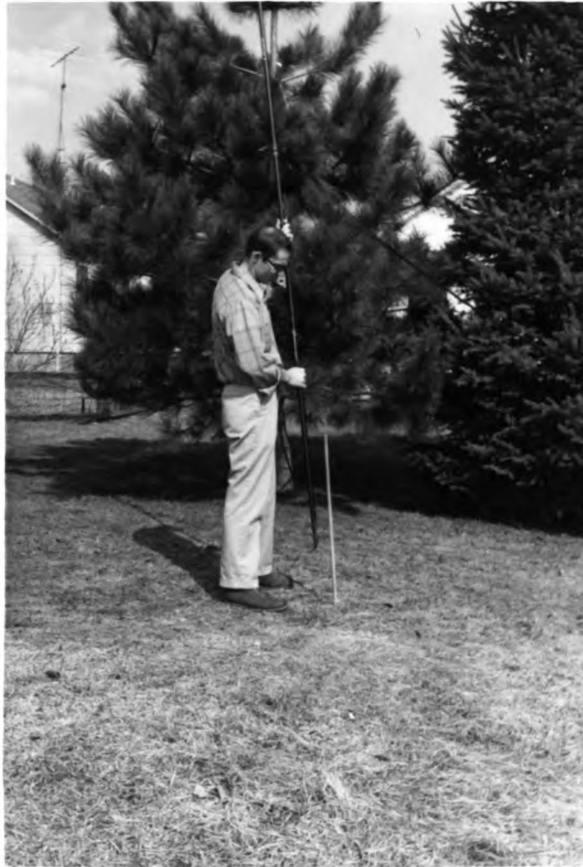


Figure 2.--Net poles held in place by slipping them over short lengths of galvanized pipe driven into the ground.



were in operation on an evening. Nets were opened shortly before sunset and furled at the cessation of woodcock activity.

In Massachusetts, a steady decline was noted (Sheldon, 1961) in the number of birds using the fields after netting activities were initiated. To avoid inhibiting woodcock use, in the present study nets were placed at more than one site and activities were rotated among sites.

#### Funnel Traps

Woodcock were captured in diurnal habitats by the use of small, wire ground traps similar to those described by Liscinsky and Bailey (1955) and modified by Martin and Clark (1964). The traps were formed of 8-foot by 1-foot pieces of 1-inch by 2-inch welded wire. Traps were usually formed into a kidney-shaped design, with a 6-inch entrance funnel of welded wire (Figure 3). Trap tops were of cloth netting held in place by bending over strands of wire from the top edge of the trap. Fences of poultry wire 1-foot high and up to 40-feet in length were used to direct walking birds into the traps. Strands of wire at the inner end of the entrance were bent toward the center to oppose the escape of trapped birds.

One to ten traps were placed at each of several sites, most being in the predominantly alder (Alnus sp.)



• JUL • 72

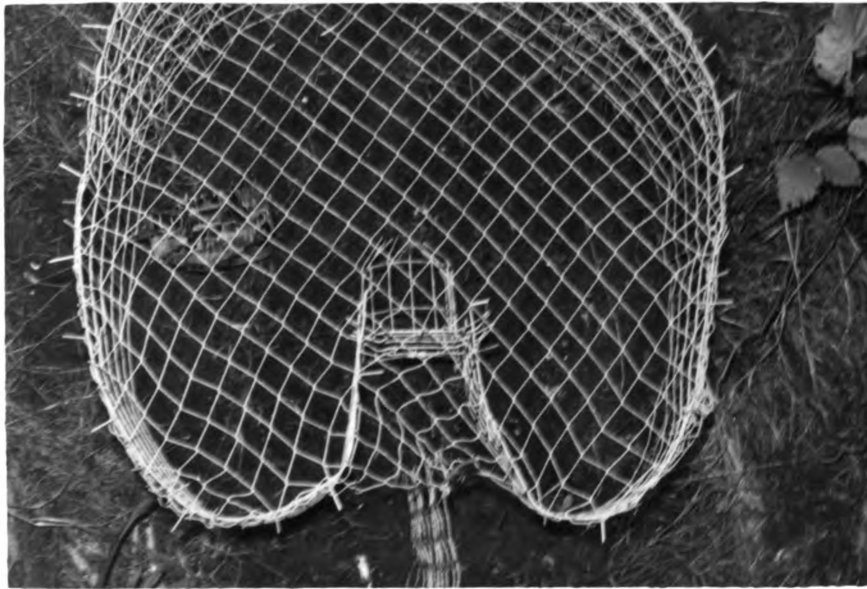
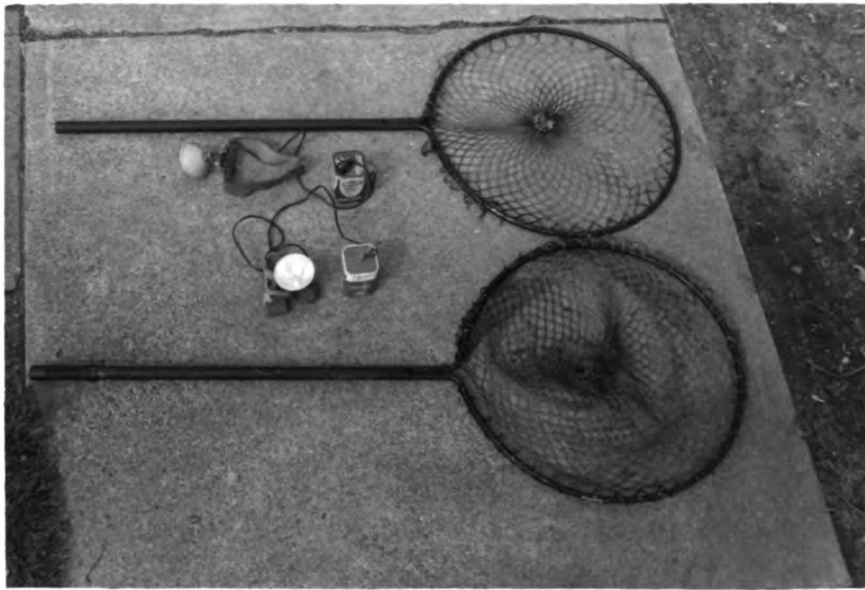


Figure 3.--Funnel traps constructed of welded wire with cloth netting tops.

cover type described by Mendall and Aldous (1943) as a favorite summer habitat for the bird.

### Spotlights

Head-mounted spotlights powered by 6-volt dry-cell batteries were used to capture birds in fields on dark evenings. Birds often could be temporarily blinded after they flushed, causing them to alight promptly or to circle the light and finally to land nearby. The birds were then captured by means of large, hand-held, landing nets. Nets with 12-foot handles were used early in the study, but were later replaced with more maneuverable nets having 3-foot handles. Netting and nets were dyed and painted black in an attempt to make them less conspicuous and to prevent re-flushing of woodcock "shined" to the ground (Figure 4).



22 • 101 •

Figure 4.--Night-lighting equipment used to capture woodcock in Michigan.



## RESULTS

A total of 457 woodcock was captured during the study. Of these, 401 were banded and released, 46 were repeat captures or recaptures of birds banded elsewhere, and 10 were casualties (Table 1).

### Mist Nets

Mist nets caught more than 70 percent of the total (Table 2). At least one capture was made on 107 of the 149 evenings that nets were opened during the two summers. Woodcock were captured with nets at a variety of sites and under various weather conditions. Nights with rain showers or high winds were the only occasions when nets were not operable. Most birds were captured during a brief period at dusk each evening, flight time normally lasting only five to fifteen minutes. The brief duration of daily netting operations resulted in few birds of other species being caught.

### Spotlighting

Although most birds were caught by mist nets, the best catch per man hour was accomplished using spotlights. Woodcock were captured with lights, however, on only 20 nights during the two summers. Use of the method was



TABLE 1.--Summer catches of woodcock, Ishpeming and Pigeon River areas, Michigan.

Capture Method	1965			1966			Total Captures
	New Birds	Recaptures	Casualties	New Birds	Recaptures	Casualties	
Mist Nets	186	16	2	114	9	4	331
Spotlights	39	4	2	5	1	0	51
Traps	13	3	0	44	13	2	75
Totals	238	23	4	163	23	6	457

limited by the need for near-total darkness. Birds were rarely seen on the ground before they flushed and many of those that flew were able to escape the light beams. Possibly, too, some birds did not flush and thus avoided capture.

Martin (1962) reported that a bird dog flushed several woodcock in the field previously checked by a night-lighting crew. He estimated that only about one-third of the birds in the fields could be captured. In the present study, the proportion of birds flushed that were captured varied considerably between evenings, depending mainly upon the weather and upon characteristics of the capture site. If the evening was clear or windy, the technique was ineffective. Night-lighting was also generally unsuccessful in recently lumbered areas because ground cover was sufficient to allow downed birds to hide. It was often possible to flush and to down a woodcock several times in such areas and yet not to succeed in capturing the bird.

A 12-volt motorcycle battery and sealed beam spotlight used on one occasion during 1966 did not appreciably improve success, but the evening was less than ideal for the test. Success in night-lighting woodcock in West Virginia improved considerably when dry-cell batteries were abandoned in favor of motorcycle batteries (Reiffenberger and Kletzly, 1967).

### Ground Traps

Funnel-type traps caught woodcock only infrequently during the study. Captures were recorded on only 38 percent of the 149 days that traps were in operation. Catch per man-hour with traps was the lowest of the three techniques used (Table 2). Trapping efficiency improved markedly during the second summer, but the catch rate still remained below that achieved with the other methods.

In 1965, traps were placed randomly in what appeared to be suitable habitat. In 1966, prospective trapping sites were examined, often with the aid of a pointing dog. Traps were then placed on or near the exact spots where birds were flushed. Captures often occurred a day or so after trap erection when traps were distributed in the latter fashion. Traps were moved more frequently in 1966, too, since traps left in the same spot for long periods during the first summer yielded few captures.

In addition to woodcock, 35 ruffed grouse (Bonasa umbellus) and four wood ducks (Aix sponsa) were captured in funnel traps. Thrushes and other ground-frequenting birds were also caught regularly. Red squirrels (Tamiasciurus hudsonicus) proved to be slight nuisances by chewing holes in the netting of trap tops. Predation on trapped birds was also a problem, with one woodcock, five grouse and several passerine casualties recorded as

TABLE 2.--Relative efficiency of woodcock summer capture techniques, Ishpeming and Pigeon River areas, Michigan, 1965-66.

Capture Method	Woodcock Captured	Capture Effort	Days of Effort	Percentage of Days Successful	Man-Hours of Effort	Woodcock Per Man-Hour
Mist Nets	331	2092 net-nights	141	76	869	0.4
Spotlights	51	79 man-hours	34	59	79	0.6
Traps	75	1704 trap-days	149	38	426	0.2
All Methods	457		174	82	1374	0.3

killed during the study. Known predators included a raccoon (Procyon lotor) and a mink (Mustela vison).

#### Factors Influencing Capture Success

Capture success for 174 days during two summers varied between zero and 15 woodcock per day. Daily capture success at a particular banding site depended upon: (1) the size and structure of the woodcock population in the area, (2) the attractiveness of the banding site to woodcock, (3) weather factors, (4) duration of capture effort at the site and (5) distribution of capture devices. Numerical values could not be assigned to some of these variables, but a subjective analysis of the relationships of these factors to capture success was attempted.

Population densities.--Woodcock population densities on the two study areas were not known. Route count indexes to population size in these areas (Martin, 1963 and 1964b), though, averaged higher in Marquette County than in Cheboygan and Otsego Counties (Table 3) and probably were representative of a higher breeding population in the Upper Peninsula location. Average numbers of captures per day in the Ishpeming and Pigeon River areas were approximately three birds and two birds, respectively. More than ten captures in one day were attained three times in the Ishpeming area but not once in the Pigeon River location.

TABLE 3.--Comparison of woodcock singing-ground counts near Michigan summer study areas.<sup>a</sup>

Study Area	Route No.	County	Mean Birds Per Stop		
			1963	1964	1965
Pigeon River	32	Otsego	0.57	0.71	0.71
	73	Otsego	1.00	1.10	1.27
	81	Cheboygan	0.57	0.71	o.c. <sup>b</sup>
	83	Cheboygan	2.22	2.78	o.c.
	98	Otsego	1.00	0.86	0.86
	103	Cheboygan	2.27	2.00	o.c.
Ishpeming	126	Marquette	2.00	2.25	1.86
	131	Marquette	-	2.57	2.14

<sup>a</sup>Sources: Martin (1964b), Goudy and Martin (1966).

<sup>b</sup>Observer change--count not comparable to previous years.

While woodcock numbers were evidently lower at Pigeon River than in the Ishpeming area, in all likelihood both areas supported populations that were better-than-average for Michigan as a whole. More than two birds per stop were heard on the singing-ground transects located near the primary banding sites (Routes 83 and 131, Table 3). This is considerably higher than the average of 1.3 birds per stop heard on all Michigan routes in the same years.

Age and sex composition.--Immature birds comprised 72 percent of the catch (Table 4). The age ratio of woodcock captured during the study was 2.5 immatures per adult or 4.3 immatures per adult female. This ratio probably did not accurately represent the age structure of the population, since a woodcock clutch normally consists of only four eggs and a single brood is produced annually (Mendall and Aldous, 1943). The age ratio of captured woodcock was much higher than the 1.6 immatures per adult female found among fall-shot Michigan woodcock (Martin et al., 1965; Goudy and Martin, 1966) during recent years.

The sex ratio of immature birds captured during the study was 1.4 males per female. More immature males than females were captured with all techniques employed (Table 4). On several evenings during the two summers, netting catches consisted exclusively of juvenile males.

TABLE 4.--Age and sex ratios of woodcock captured by different techniques in Ishpeming and Pigeon River areas, Michigan, 1965-66.

Capture Method	Adult		Immature		Age Ratio		Adult Sex Ratio		Immature Sex Ratio	
	Male	Female	Male	Female	Imm./Ad.		Male/Female		Male/Female	
Mist Nets	32	44	131	99	3.0		0.7		1.3	
Spotlights	13	10	14	11	1.1		1.3		1.3	
Traps	4	15	28	16	2.3		0.3		1.8	
Totals	49	69	173	126	2.5		0.7		1.4	



Sheldon (1961) and Martin (1962) also noted a similar imbalance. If it may be presumed that the sex ratio at hatching is even and that immature males and females are taken in equal numbers by hunters cooperating in the Bureau's wing survey (Martin et al., 1965), then either there is greater activity by young males during the summer or they show a greater preference than females for visiting forest openings at that season.

In contrast to immatures, the sex ratio among adults was 0.7 males per female. A similar adult sex ratio (0.64 males per female) has also been reported by Martin et al. (1965) from fall-shot samples. Martin et al. (1965) suggested that the preponderance of females might be due to higher losses among males as a result either of harsh weather during spring migration (when males migrate northward before females) or of predation during spring courtship displays.

Physical factors.--Evening concentration sites differed markedly in physical characteristics and in their capacity to attract woodcock. Banding sites used by large numbers of woodcock shared the following features: (1) openness, (2) Proximity to diurnal cover and (3) food availability. Birds were found in both lowland and upland forest openings and these varied in size from considerably less than one acre to more than 30 acres.

Concentration sites were located close to diurnal woodcock cover, primarily alder, and were usually associated with a stream. All of the evening fields found in this study were less than two miles distant from a stream and most were located one-half mile or less from extensive amounts of alder.

Banding sites were not sampled for woodcock foods. However, birds were occasionally seen feeding and large numbers of probe marks in the mud at some sites gave further evidence that feeding did occur. Woodcock were attracted to areas where the soil had been recently disturbed, apparently visiting these sites to obtain earthworms. More than 25 birds were caught during a six-week period at a small muddy site created by a bulldozer during replacement of a culvert. Earth-moving activities involved with the construction of an earthen dam also attracted woodcock. Many woodcock were captured along tote roads within pulpwood harvest areas and along lightly travelled forest roads, especially following a rainfall.

Woodcock were also found in dry upland sites at night, however, where it would have been nearly impossible for them to obtain earthworms. Sheldon (1961) analyzed stomach contents of woodcock captured in fields and found that a variety of fly and beetle larvae had been consumed by the birds. Sheldon reasoned that woodcock came to fields to obtain animal food other than earthworms.

Krohn (1970) collected 60 woodcock in several dry, infertile Maine summer fields, however, and found little evidence of feeding by the birds. He concluded that woodcock did not use the Maine fields primarily for feeding.

Weather conditions almost certainly influenced capture success, but it was often difficult to distinguish their effects from that of the other variables. Weather during the summer of 1965 was generally cool and rainfall was above average (Table 5). The summer of 1966 was characterized by average temperatures and well below normal precipitation. Strommen (1966) reported that "drought conditions continued to intensity over most of the State. Particularly hard hit was the northwest lower peninsula area where extreme drought, as expressed by the Palmer Index, was reached the last week of July." Rainfall was probably the most critical weather factor affecting capture success, since the presence of moist soil for probing appeared prerequisite to woodcock use in some concentration sites. Light precipitation also seemed to stimulate more birds to engage in crepuscular flights, and misty evenings generally produced good catches. Lack of rainfall during the summer of 1966 seemed to be primarily responsible for the reduced netting and night-lighting success experienced that year.

Temperatures at flight time ranged from 41° to 81°F. Although woodcock engaged in crepuscular flights

TABLE 5.--Monthly weather conditions and capture success in Ishpeming and Pigeon River areas, Michigan.

	1965				1966				Summer Totals
	June	July	Aug.	Sept.	June	July	Aug.	Sept.	
Temperatures*									
Average	60.1	63.1	62.6	53.1	61.9	68.9	63.9	54.6	
Departure from normal	0.0	-3.6	-3.2	-4.6	+1.4	+2.5	-0.9	-2.4	
Precipitation*									
Total inches	1.51	2.10	3.02	4.25	1.09	1.28	2.03	2.33	6.73
Departures from normal	-1.95	-1.10	-0.01	+0.97	-1.69	-1.31	-0.86	-1.61	-5.47
Netting Success									
Captures	11	79	84	30	19	28	22	38	107
Birds/100 net-nights	7	13	15	27	25	12	16	24	18
Nightlighting Success									
Captures	9	19	18	0	0	1	3	2	6
Birds/10 man-hours	5	7	9	0	0	3	3	5	4
Trapping Success									
Captures	0	4	9	3	1	32	21	5	59
Birds/100 trap-days	0	3	2	2	17	13	4	5	6

\*Weather data from Department of Commerce weather station in Marquette (1965) and Pigeon River fisheries research station (1966).

at both temperature extremes, catches on cold evenings were generally poor. Relatively few birds were captured on mid-summer evenings if temperatures at dusk were below 55°F.

Wind was another factor affecting capture success on some evenings. Mist nets did not function properly on windy night, often because birds hit the nets and bounced off to escape capture. Night-lighting was also less productive then, since flushed birds were soon blown out of the range of the light beams. Evening wind velocities were not measured in this study, nor were they available from a weather station near the banding sites. It was felt, however, that wind speeds exceeding ten miles per hour hindered netting and night-lighting operations.

Although capture operations were rotated among sites, woodcock use of most sites declined after netting and night-lighting activities began. In spite of declining numbers of birds, moderate capture success was maintained by shifting nets to provide better coverage of high-use areas within the banding fields. Sheldon (1960) recognized the importance of strategic net placement and, in some Massachusetts fields, attempted to channelize woodcock flight paths by cutting trees on the field edge to create an approach route. In Michigan, natural flight lanes seemed to exist over some fields. Points

where these routes passed through barriers, such as tree clumps (Figure 5), were netted effectively. One such opening produced six woodcock in a single mist net on one evening.

• JUL • 72



Figure 5.--Mist nets placed between tree clumps in woodcock flight lanes generally produced good catches.

## DISCUSSION

This study demonstrated that it is feasible to band substantial numbers of woodcock in habitats which supported good breeding populations during the previous spring. The success of the banding program depended largely upon woodcock density in the area in which trapping was conducted. Since counts of singing male woodcock provide an index to breeding population densities, it is believed that prospective evening fields should be sought near areas where large numbers of birds are heard in the spring.

Concentration sites found during this study were all relatively open areas located near shrubby diurnal woodcock cover. The sites were located mainly by searching forest trails and openings for fecal splashings and bill probe marks. Some of the drier, upland sites lacked those woodcock signs, however, and were found only by the observation of openings at dusk or after dark.

It became apparent during the study that human activities were continually making new concentration sites available. Pulpwood cuttings, pipeline construction, dam building, and other activities which opened up the forest and disturbed the soil also attracted woodcock.



Although habitat treatments designed to attract and concentrate woodcock were not attempted in this study, their use appears feasible.

Since success in a banding program depends primarily upon the number of concentration sites found and the number of birds using these areas, a bander should continually search for additional sites, or, if necessary, create new ones to insure that he is working under the best possible circumstances.

Mist nets were the most productive capture method tested and, fortunately, woodcock are easily extracted from these nets. Although they proved to be the most dependable capture technique on the Michigan study areas, however, nets should not be used alone in an operational banding program. The catch achieved by one technique is generally independent of that obtained with others. Fortunately, too, the several techniques available are useful at different times of the day, enabling the integration of all three on some days. None of the methods, however, produced a high catch per man-hour. It must be recognized that a considerable amount of effort must be expended to band woodcock in quantity, regardless of the capture techniques employed.

Night-lighting was ineffective at some woodcock concentration sites because brushy cover made locating downed birds difficult. Both night-lighting and

mist-netting were usually less productive on dry evenings, when fewer birds flew to openings and when they remained in the fields only for a short time. Declining soil moisture appeared to concentrate woodcock in the wetter portions of diurnal habitat, however, and funnel-trapping success was enhanced by dry weather. Since weather and site conditions influenced capture success, their effects should be considered in deciding which capture technique to use and on which evenings those efforts would likely be most productive.

Using the capture techniques presently available, a diligent bander should be able to capture two to three hundred woodcock or more during a summer, depending upon local population levels.

Additional research is necessary to improve our understanding of the nature of probable biases in samples of captured woodcock. Certainly one factor influencing sex and age data may be the greater activity of immature birds, especially immature males, which increases their catchability and exaggerates their relative abundance. Young male woodcock, and apparently young males of other species (Armstrong, 1965:224), perform courtship displays occasionally during the summer. An urge to participate in such activities may be more important than the desire for food in stimulating young male woodcock to engage in crepuscular flights to summer fields.

Retrap data revealed that immature males were the most mobile sub-group. Even young males, however, did not normally move far during the summer. Although Clark (1966) reported summer movements of up to five miles, the longest move among birds banded in this study was only 1 1/2 miles. Of the six woodcock captured both in diurnal cover and at an evening concentration site, only one was recaptured more than one mile from the site of banding. The only indication of long-distance moving encountered during this study was an adult female which had been banded with her brood near Carp Lake on May 11, 1966 by F. Kargal. This hen was recaptured in a mist net on July 15 of the same year in the Pigeon River area, approximately 40 miles southeast of where she had nested. The bird, although healthy, had apparently suffered a leg injury which possibly influenced this unusual movement.

Through October, 1967 a total of 22 recoveries had been achieved of the 401 birds banded in this study. Seventeen (4.2 percent) occurred during the first hunting season after banding, thirteen in Michigan, one in Indiana, one in Louisiana and two in Alabama. The low recovery rate indicates that shooting is not a major cause of total annual mortality. Since the band-reporting rate for the species is unknown and little data are available concerning crippling losses, however, much additional information will be required fully to

determine the population dynamics of the woodcock. Based on this study, an expanded banding program throughout the breeding range of the woodcock would be justified as a possibly important step toward providing essential information on the woodcock resource.

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