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## MAINE AMERICAN WOODCOCK MANAGEMENT PLAN 1985

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## AMERICAN WOODCOCK (Scolopax minor)

### NATURAL HISTORY

American woodcock (Scolopax minor) are classified as shorebirds, but they are physically and behaviorally adapted to forested habitats (Owen et al. 1981). Woodcock occur throughout the forests of eastern North America, and their northern limit is generally considered to be southern Manitoba and Ontario east to southern Newfoundland. The southern range of the woodcock extends from southern Texas east along all the Gulf states to Florida. Woodcock are migratory birds and annually migrate between northern breeding and southern wintering ranges.

Two distinct woodcock populations are recognized. These populations are referred to as eastern and central populations (Martin et al. 1970, Coon et al. 1977, Krohn and Clark 1977). In general, the two population segments are roughly separated by the Appalachian Mountains (USFWS 1985). Birds native to, or migrating through, Maine make up a portion of the eastern population. Maine woodcock generally begin their southward migration in late October (Owen and Krohn 1973). Most of the woodcock which nest or are hatched in Maine winter east of the Appalachian Mountains, primarily from southern New Jersey through Georgia (Krohn 1973). Woodcock begin their northward migration in late January and February and arrive on their singing grounds in March and April. In the northeast, woodcock begin to nest in April, often within 100 yards of a singing ground (Sepik et al. 1981).

Woodcock usage of young to middle-aged hardwoods in Maine, often associated with old fields or forest openings is well documented (Mendall and Aldous 1943, Krohn 1970, Dunford and Owen 1973, Reynolds et al. 1977, and others). Alder (Alnus spp.), aspen (Populus spp.), and birch (Betula spp.) are three important tree genera characteristic of good woodcock habitat in Maine. According to Reynolds et al. (1977) woodcock use of forest covers was related to the abundance of earthworms, the woodcock's primary food item. These researchers believed that earthworm abundance was influenced by vegetation providing earthworms with their preferred foods, namely the leaves of second growth hardwoods. The supply of earthworms available to woodcock is also affected by such soil properties as texture, moisture, and temperature (Liscinsky 1972, Reynold et al. 1977).

Recent data collected in Maine suggest that areas with a previous history of agriculture have within their soils an adequate earthworm supply (Galbraith 1984). But, suitable overhead cover and ground and soil conditions must be adequate to allow woodcock to prey upon the earthworms. According to Owen (1977) abandoned farmland in the early stages of forest succession probably provide the best (diurnal) habitat for woodcock in the northeast. In addition, woodcock also require open areas for courtship and night roosting.

Woodcock nests consist of a simple cup of leaves and grass on the ground that usually contain 4 eggs. Because of this small number of eggs, the woodcock's reproductive potential is quite low as compared to other game birds which may lay up to a dozen eggs. Fortunately, nesting success is generally high. By mid to late May, the female woodcock and her highly mobile young move to feeding cover. Common feeding cover, as mentioned previously, consists of alder swales or young hardwoods on fertile moist soils with numerous earthworms.



## HISTORY

### Habitat Trends

Woodcock are closely associated with habitats in early stages of forest succession. A review of historical records reveal that large acreages of potential woodcock habitat were created in the mid to late 1800's when small farms were numerous in Maine. Since 1880, the amount of farmland in Maine has declined from over 6.5 million acres to less than 1.5 million acres in 1980 (Benson and Frederic 1982). Between 1880 and 1925, total cropland acreages changed little. However, during this same period the amount of pasture land decreased by over one million acres. The period since 1925 has seen a steady decline in agricultural land as well.

The natural succession of abandoned farmland to young forestland produced a great deal of woodcock habitat in Maine. However, as plant succession progressed beyond optimum conditions for woodcock, population levels decreased. This appears to have occurred in recent years as well, because forest inventory data indicate a trend towards overmaturation of the aspen-birch and other important forest components in Maine (Powell and Dickson 1984).

Dwyer et al. (1983) used aerial photography to study habitat changes along singing-ground routes in 9 northeastern states, including Maine. They found that the largest single change in any habitat type along survey routes was an increase in urban/industrial development. Urban/industrial development often replaced the abandoned fields and shrublands that had been good woodcock habitat and that declines in woodcock population levels correlated with these habitat changes.

Some forest practices can have a beneficial affect on woodcock habitat. Openings for singing grounds can be created by cutting small blocks of forest (Sepik et al. 1981). Nicholson (1977) reported that commercially harvested woodlands produced openings suitable for singing grounds and nocturnal roosts, but unless these clearings occurred adjacent to adequate diurnal habitat, woodcock usage was low. Galbraith (1984) found that the agricultural history of an area was the best predictor of earthworm biomass of any characteristic examined, even though some old agricultural sites were heavily forested. In short, earthworms



occurred more often and their biomass was markedly greater at previously farmed sites than at sites that had never been farmed.

### Population Trends

Little data are available on the status of woodcock populations prior to the late 1960's. Information on woodcock numbers can be inferred from historical records and journals. This literature suggests that woodcock were abundant during the mid to late 1870's, which probably coincided with the beginning of the most active farming period in the State. Woodcock numbers reached an all-time low at the beginning of the twentieth century. Uncontrolled hunting appeared to be a factor that adversely affected woodcock numbers. According to Mendall and Aldous (1943), continuous market hunting during all seasons was an established custom over much of the birds range. Only after bag limits were reduced and seasons were drastically shortened did the general trend in woodcock numbers swing upward, even though sport hunting interest was increasing.

By the late 1930's, Mendall and Aldous (1943) observed that woodcock were an abundant summer resident in eastern Maine. In Hancock and Washington Counties, woodcock populations appeared to approach or equal the high densities of the Maritime Provinces. Woodcock were also observed to be a common breeding bird throughout other areas of the State except in the extreme northern and western portions.

Efforts to monitor trends in the breeding populations of woodcock were initiated by Gustav A. Swanson and others in Maine in 1937 (Tautin et al. 1983). Collective data from singing-ground surveys provide an annual index of breeding woodcock populations, but not actual numbers of woodcock in the population. However, refinements in the techniques of these surveys have produced a great deal of useful trend information on woodcock numbers.

Results of this survey indicate a significant long-term decline in woodcock breeding populations in Maine since 1968 (Figure 1). While a gradual loss of habitat is believed to be the primary cause for declines in eastern woodcock populations, there is some concern that hunting could be a contributing factor.

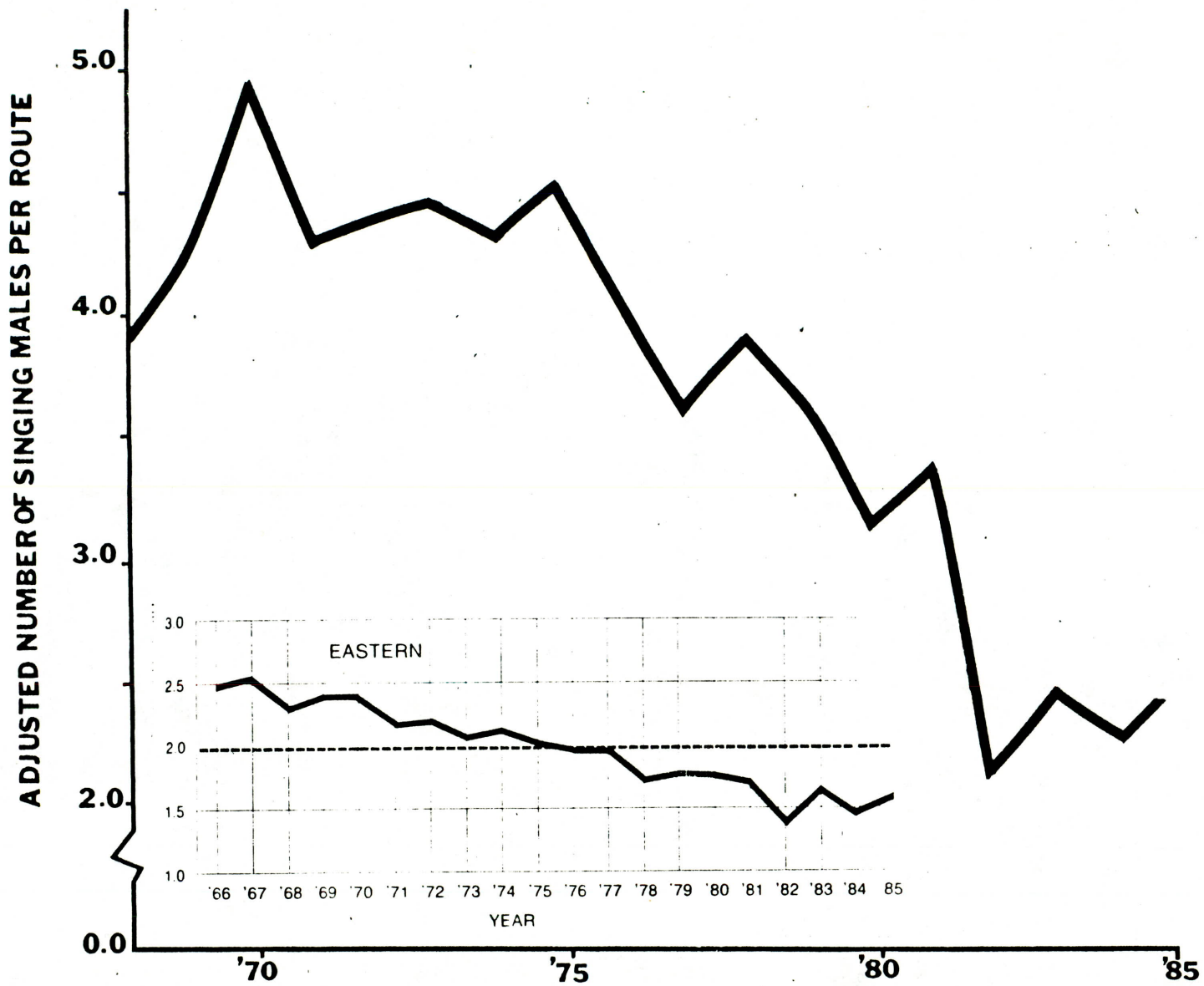


Figure 1. Adjusted indices of the Maine breeding population, 1968-85.\* \*USFWS DATA



## Use and Demand Trends

Historically, the woodcock in Maine has advanced from a species pursued by market hunters to a specialty game bird that is highly regarded by hunters with pointing dogs. Today, the woodcock fulfills an even broader-based source of recreation because of its conspicuous aerial courtship display.

## Harvest Regulations

Uncontrolled hunting in the past may have adversely influenced woodcock numbers. In the days of market hunting, tremendous numbers of woodcock were killed. Pettingill (1936) quotes a Field and Stream editorial of 1874 as follows: "Woodcock in the market, fairly plenty. Of course New York draws all of the birds of the United States into the market. From a pretty close calculation, we suppose about 1,800 single birds come into New York weekly.....price \$1.50 a pair." Prior to 1880, it was legal to shoot woodcock during July and August in addition to the fall season. It is of interest to note that; "Since Maine abolished summer shooting, other states have done likewise, and with good results" (Commissioner's Report 1880).

Early declines in woodcock numbers apparently concerned observers as early as 1880. "It is true that ten years ago (1870) one could show more birds as the result of a days shooting in Maine; but there are now ten or twenty times as many persons hunting woodcock as then, and all the best covers are hunted through almost daily during the whole season" (Commissioner's Report 1880). Reasons for this decline in woodcock numbers can only be speculative. Whether market hunting alone, or in conjunction with intensive land clearing for crops and pasture, was the cause of this decline is undetermined. Nonetheless, the continued decline in woodcock numbers resulted in a reduced bag limits which were first proposed in the Commissioner's report of 1920. "Woodcock were reported in good numbers in some of the southern counties and quite a number of sportsmen from out of the state availed themselves of the opportunity to engage in the fascinating sport of woodcock shooting. It may be well, however, to reduce the bag limit to five if we hope to see this bird increase, spreading more generally over the southern counties of the state. Five birds is the bag limit in New Hampshire and sportsmen seem well satisfied with that number."

During the late 1930's, it was not uncommon for hunters to record high seasonal harvests, even though a 4 bird daily bag limit was in effect. In 1938, a Washington County guide and his parties killed 172 birds in 21 days. Three Androscoggin County hunters had a combined total of 210 woodcock during the 1937 season (Mendall and Aldous 1943).

Prior to rangewide population surveys, regulations governing woodcock hunting were generally more restrictive than those of recent years. With refinement of these surveys came the knowledge that woodcock were more widespread and abundant than formerly assumed. In the 1960's, regulations were gradually liberalized to allow greater opportunity for harvest. During this time, and continuing through the 1970's, the woodcock became an increasingly popular game bird over its entire range. The greatest growth of interest in hunting woodcock has been in the southern states. Interest in woodcock grew and harvests increased, largely through increased participation in woodcock hunting rather than increased success. In the northeast, this increase in hunting pressure came at a time when woodcock habitat was being lost to development and successional trends of young forests on previously abandoned farmland.

Woodcock regulations became relatively stable in 1972, and remained so until 1978 when a joint woodcock and grouse opening date of 2 October was established. Continued liberal federal season frameworks and public input resulted in a reestablishment of September hunting in Maine and early woodcock seasons from 1979-1981. In 1982, the U. S. Fish and Wildlife Service (USFWS) imposed restrictions in certain northeastern states where populations were adversely affected by a severe spring blizzard and the season was delayed until 5 October. In 1983 and 1984, a 1 October opening date was established to provide additional protection to woodcock populations in the Atlantic Flyway.

In 1985, the USFWS believed further adjustments of hunting regulations were necessary in the East. For the 1985-86 hunting season, the USFWS proposed and adopted regulations shortening the season from a maximum of 65 days to no more than 45. Again, September hunting was not allowed and February hunting was prohibited as well. For the first time the bag limit was reduced from 5 to 3 birds per day.



## Harvest Trends

Mendall and Aldous (1943) reported the earliest annual estimates of harvest for Maine as 37,000 during the period 1935-1939. Through the 1950's, the average annual harvest was estimated at roughly 20,000 birds. In the 1960's, the average annual harvest was over 52,000 woodcock. Maine's woodcock harvest peaked in 1973, when an estimated 37,000 hunters killed over 210,000 birds (Table 1). The increase in woodcock harvest is believed to be largely due to increased participation in woodcock hunting and not increased success. Soon after this record kill, the first Department Woodcock Species Management Plan was completed. This plan concluded that local breeding stocks in southern Wildlife Management Units (WMU's) were sustaining maximum harvests. Krohn and Clark (1977) conservatively estimated that over 60% of the harvest of local woodcock occurred within Maine. In actuality, this percentage is likely higher still as reporting rates are generally lower near areas of extensive banding. Regulations proposed by the Department since 1975 were aimed at reducing the early season hunting pressure on these local breeding populations. Since that time, the annual woodcock harvest has declined, probably because of a decrease in woodcock numbers, hunting effort, and hunting opportunity. The average harvest from 1980 to 1983 was 138,500 birds (Table 1).

## Users

Data from the Department's Personal Hunting Report (Game Kill Questionnaire) provide yearly estimates of hunting effort for several species of wildlife. The accuracy of these estimates is questionable. However, these estimates can be used over the long-term as indicators of trends in hunting effort.

The estimated number of hunters pursuing woodcock has risen dramatically in the last 3 decades. In the 1950's, the average estimated number of woodcock hunters was 4,200 (Table 1). The 1960's saw a 3-fold increase in hunting effort and an estimated 12,500 woodcock hunters were afield. This upward trend continued into the 1970's and peaked in 1973 when an estimated 37,000 woodcock hunters hunted in Maine. This trend has since reversed and in 1983, the year that most recent data are available, an estimated 24,000

Table 1. Woodcock species management history.

Year	Estimated Harvest	Estimated Effort	Statutes and Regulations	
			Season	Bag Limit
1930's	37,000	?	≈1 Oct-31 Oct	4
1940's	?	?	≈1 Oct-30 Oct*	4
1950's	20,800	4,200	≈1 Oct-9 Nov	4
1960	33,300	9,100	1 Oct-9 Nov	4
1961	32,100	8,300	2 Oct-10 Nov	4
1962	38,100	9,200	1 Oct-9 Nov	4
1963	31,000	8,900	1 Oct-19 Nov	5
1964	43,800	10,500	28 Sept-10 Nov	5
1965	46,700	10,500	27 Sept-15 Nov	5
1966	74,900	19,100	26 Sept-15 Nov	5
1967	65,300	13,600	25 Sept-15 Nov	5
1968	91,900	15,600	24 Sept-15 Nov	5
1969	68,600	17,700	24 Sept-15 Nov	5
1970	81,500	19,300	1 Oct-30 Nov	5
1971	94,300	25,300	24 Sept-15 Nov	5
1972	174,900	28,900	25 Sept-15 Nov/2 Oct-15 Nov	5
1973	210,700	37,300	24 Sept-15 Nov/1 Oct-15 Nov	5
1974	164,000	30,300	23 Sept-15 Nov	5
1975	110,300	28,300	24 Sept-15 Nov/1 Oct-15 Nov	5
1976	151,300	28,200	24 Sept-27 Nov/1 Oct-27 Nov	5/4
1977	133,700	27,000	24 Sept-15 Nov	5
1978	99,200	23,000	2 Oct-15 Nov	5
1979	142,700	27,400	24 Sept-15 Nov	5
1980	172,800	27,000	24 Sept-28 Nov	5
1981	164,200	31,600	25 Sept-28 Nov	5
1982	109,800	25,400	5 Oct-8 Dec	5
1983	107,600	24,200	1 Oct-30 Nov	5
1984	?	?	1 Oct-30 Nov	5
1985	?	?	1 Oct-14 Nov	3

\*1940-47: 15 day seasons.



hunters pursued woodcock. Nonresident hunters consistently comprise slightly less than 20% of the estimated total number of woodcock hunters in Maine.

### Past Management Goals

Since 1975, the Department's woodcock management goal has been to maintain kills and populations at 1975-77 levels, and the management objective associated with this goal has also remained unchanged since 1975; that is to monitor the harvest of woodcock in Maine annually to ensure that a harvest of 10-12% of our estimated preseason population is not exceeded regularly (based on 5-year averages). This was projected to allow a harvest of 150,000-180,000 woodcock annually by 25,000 hunters if, 1) success per season remains constant, and 2) the composition of the birds in the harvest remains near 80% native woodcock. Harvests have averaged 20% below the midpoint objective harvest since 1975 (Table 2).

No new data on pre-hunting season population estimates are available for comparison with woodcock populations at 1975-77 levels. However, declining indices of singing males since this period suggest a general population decline from 1975 to the present (Figure 1). Whether or not a harvest of 10-12% of the estimated population occurs today is unknown. It was suggested that this would be acceptable if the success per season remained constant and that the harvest be made up of 80% Maine reared woodcock. No data are available on the later condition. Data on the seasonal kill/hunter from the Game Kill Questionnaire indicate success rates in recent years are similar to those of 1975-77. These data are somewhat contradictory to USFWS data which indicate a declining trend in the average number of birds killed per season per hunter. However, the federal data may be less biased since hunters annually submit wings and therefore may provide the most useful trend information available.

Table 2. Comparison of woodcock harvest and the midpoint of the woodcock species plan objective harvest, 1975-1983.

Year	Objective harvest	Harvest	Deviation (%)
1975	150,000-180,000	110,300	- 33
1976	165,000	151,300	- 8
1977	"	133,700	- 19
1978	"	99,200	- 40
1979	"	142,700	- 13
1980	"	172,800	+ 5
1981	"	164,200	- 1
1982	"	109,800	- 33
1983	"	107,800	- 35

- = Under-objective harvest.  
 + = Over-objective harvest.



## HABITAT ASSESSMENT

### Statewide

Status. Woodcock require the following: (1) openings (fields, etc.) used for courting and roosting, (2) fertile, generally poorly drained loamy soils containing abundant earthworm populations, and (3) the proper life forms of the vegetation giving adequate cover for protection and feeding during both diurnal and nocturnal use.

Woodcock habitat in Maine is generally associated with early stages of forest succession. Areas which receive a high degree of utilization by woodcock are dominated by shrubs or trees less than 30 years old such as alder, aspen, birch, or mixtures of the three (Owen et al. 1973). These types of areas are generally associated with abandoned farmland, recently burned and logged areas, or areas too wet to support coniferous forest growth.

Woodcock habitat, although fairly easy to identify, is relatively short-lived and is of little commercial value. Consequently, it is not well represented in standard forest inventories. Given these limitations, the amount of habitat in Maine considered suitable for woodcock was estimated at only 2,597 mi<sup>2</sup> (Table 3), based on the Department's Wetland Inventory and the Maine Forest Resurvey (1982) (Table 2, Appendix A).

The suitability of Maine's woodcock habitat was assessed by applying these inventory data to a Habitat Suitability Index (HSI) Model index values (Table 3). Variables incorporated into this model include measures of earthworm availability and accessibility as well as cover components which include shrub canopy cover and height and the stem density of trees. A detailed tabulation of the derivation of these HSI values can be found in Table 1, Appendix B.

Changes. In the 1975 woodcock management plan, 3,161 mi<sup>2</sup> of the State of Maine were believed to be suitable woodcock habitat. The amount of woodcock habitat estimated for Maine in 1985 is 2,597 mi<sup>2</sup> and represents an 18% loss in total woodcock habitat over the last 10 years.

Projections. Throughout most of the State the quantity of habitat and woodcock numbers will be declining. One exception may be in the more heavily forested areas where active forest management is the primary land use. Increased

Table 3. Present woodcock habitat suitability - 1985.

Wildlife Management Unit	Total land area (mi <sup>2</sup> )	Estimated woodcock habitat (mi <sup>2</sup> )	Woodcock habitat suitability index value	Number of woodcock habitat units
1	3,152	537	0.64	2,017
2	8,004	274	0.61	977
3	3,954	139	0.51	556
4	5,519	694	0.73	4,029
5	2,727	125	0.50	486
6	2,492	318	0.53	1,321
7	2,022	230	0.64	1,294
8	2,684	280	0.47	1,261
Statewide	30,554	2,597		11,941

\*Woodcock habitat units equal total land area times the habitat suitability index value for WMU's 1, 4, 6, 7, and 8. However, because much of WMU's 2, 3, and 5 is heavily forested and therefore less desirable to woodcock, the above relationship would grossly overestimate the number of habitat units in these regions of the State. The number of habitat units in WMU's 2, 3, and 5 were derived by establishing a ratio of habitat (mi<sup>2</sup>) and HSI values with those of the nearest WMU. The number of habitat units for WMU 2 was derived as follows:

$$\frac{\text{woodcock habitat units (WMU 2)}}{\text{woodcock habitat units (WMU 1)}} = \frac{(\text{woodcock habitat in WMU 2})}{(\text{woodcock habitat in WMU 1})} \times$$

$$\frac{(\text{HSI value for WMU 2})}{(\text{HSI value for WMU 1})}$$

$$\frac{\text{woodcock habitat units (WMU 2)}}{2,017} = \left( \frac{274}{537} \right) \left( \frac{.61}{.64} \right)$$

$$\text{woodcock habitat units (WMU 2)} = 977$$

WMU 3 compared with WMU 4  
 WMU 5 compared with WMU 6



demand for wood by both the paper and lumber industry is expected to continue, and harvest is expected to equal net growth by 1990 (Chaisson 1985). However, total forest acreages are expected to be stable through this period. Forestry practices that will result in improvements in woodcock habitat include clear-cutting, increasing demands for firewood, and increasing interest in biomass burning (Coulter and Baird 1982). While it has been shown that commercial harvests benefit woodcock populations, suitable diurnal cover is necessary in close proximity before woodcock will use cut over areas (Nicholson 1977).

Much of the once ideal woodcock habitats of central and coastal Maine have already grown into mature stands of timber no longer suitable for woodcock. Trends in abandonment of agricultural lands in recent years has undoubtedly slowed. Today, it is unlikely that significant amounts of farmland will become woodcock habitat in the future.

Overmaturation of forests out of conditions suitable for woodcock in the more residential areas of the State, coupled with development in urban areas, is expected to continue through this planning period. For these reasons, a 5% reduction in habitat suitability is assumed statewide by 1990. Habitat suitability index values (quality) and woodland acreages (quantity) for each WMU were reduced by 5% to reflect this projection (Table 4).

#### Wildlife Management Units

Status. In general, HSI values for Maine's 8 WMU's indicate that a small portion of the State is considered fair to good woodcock habitat. The highest HSI value was recorded for WMU 4, the area of the State with the greatest amount of previously abandoned farmland. WMU's 1, 2, and 7 were recorded as fair to good woodcock habitat but for different reasons. WMU 1 is the most active agricultural portion of the State with moderate amounts of woodcock habitat. Habitat conditions in WMU 2 were recorded as fair because of the more intensive clear-cutting forestry practices creating favorable habitat conditions. The quality of the habitat in WMU 2 is low compared to young forest stands on abandoned farmland. However, the area of intensive forest management is vast, and these habitats may contribute significant numbers of birds to the statewide population. WMU 7 is comprised of fair to good habitat on productive soils but timber stands are generally becoming less diverse and woodcock use may decline. WMU's 3, 5, 6, and 8

Table 4. Projected woodcock habitat suitability, 1990.

Wildlife Management Unit	Total land area <sup>1</sup>	Woodcock habitat (mi <sup>2</sup> ) <sup>1</sup>	Woodcock habitat suitability index value <sup>2</sup>	Number of woodcock habitat units <sup>3</sup>
1	2,994	510	.60	1,796
2	7,604	260	.58	868
3	3,756	132	.48	503
4	5,243	659	.69	3,618
5	2,591	119	.47	434
6	2,367	302	.50	1,184
7	1,921	219	.60	1,153
8	2,550	266	.44	1,122
Statewide	29,026	2,467		10,678

<sup>1</sup>Total land area and woodcock habitat is 95% of 1985 figures. This hypothetical adjustment reflects a loss in the quantity of woodcock habitat by 1990 and does not represent an actual loss of land.

<sup>2</sup>Woodcock habitat suitability is 95% of 1985 figures. This adjustment reflects a loss in habitat quality by 1990.

<sup>3</sup>Woodcock habitat units for WMU's 2, 3, and 5 were derived using the procedure described for Table 3, page 13.



contribute significant amounts of fair quality woodcock habitat to the statewide total.

Changes. Previous woodcock management plans did not attempt to estimate habitat suitability using an HSI model. Therefore, direct comparisons are not appropriate. However, trends in habitat conditions by WMU are similar to trends discussed in earlier management plans.

Projections. Land use practices will vary over the next 5 years by WMU, but such deviations are difficult to predict on a WMU basis. Throughout most of the State the quantity of habitat will be declining. A major exception may be in the more heavily forested WMU's 2, 3, and 5 where intensive commercial forestry practices may create additional low quality woodcock habitat. How extensive herbicide spraying will be by 1990 is unknown at this time. Its impact could outweigh any possible gains mentioned above.

The coastal WMU's 6, 7, and 8 will continue to experience a decline in habitat quality through maturation of forests beyond young successional stages and loss due to land development. This trend will also be evident in WMU 4 but should stabilize at a higher level than the coastal WMU's. The amount of habitat in WMU 1 will most likely depend upon the agricultural (mainly potato) economy.

## POPULATION ASSESSMENT - CARRYING CAPACITY

### Statewide

Status. The ability to accurately assess Maine's woodcock population is lacking. The U. S. Fish and Wildlife Service's (USFWS) census of breeding populations provide the only measure designed to estimate population trends.

For the purpose of this plan, estimates of woodcock abundance on a statewide basis in 1985 were based on the average number of singing male woodcock heard per census route in each WMU for 1985. Estimates of the number of males/mi<sup>2</sup> of habitat were derived using techniques described by Gregg (1984). This method utilizes an extrapolation of numbers of singing males, times an estimate of the number of nonsinging males, to arrive at the total number of adult males/mi<sup>2</sup>. From this, USFWS wing-collection survey data for Maine on numbers of adult females/adult males and immatures/adult female are used to estimate the total number of woodcock/mi<sup>2</sup>. The figure of 20 adult males/mi<sup>2</sup> (range = 10-25) and 29 adult females/mi<sup>2</sup> (range 14-36) of habitat during the spring was arrived at as a "best guess" maximum supportable density for woodcock in good habitat in Maine.

The number of habitat units in each WMU was obtained by multiplying the HSI value for each WMU by the total amount of land in WMU's 1, 4, 6, 7, and 8. Because of the extensiveness of the forests in WMU's 2, 3, and 5, extrapolation by total land acreages would grossly overestimate woodcock numbers in these areas. Therefore, the number of habitat units was derived by establishing a ratio of habitat (mi<sup>2</sup>) and HSI values with those of the nearest WMU. The resulting habitat unit figure was then multiplied by the density range to obtain an estimated maximum supportable population for each WMU. A statewide spring maximum supportable population of 585,800 woodcock (range = 286,600 - 728,300) was generated by this procedure (Table 5).

Changes. The maximum number of woodcock that Maine's habitat could support was not estimated for the 1980 species assessment, therefore, no comparisons with current estimates are possible.

Projections. Projections of habitat conditions (5% reduction in woodland acreages and habitat quality) were used to calculate the maximum supportable woodcock



Table 5. Current (1985) and projected (1990) maximum supportable spring woodcock population by WMU.

Wildlife Management Unit	1985 maximum supportable spring population		1990 projected maximum supportable spring population	
	Range	Best guess	Range	Best guess
1	48,400-123,000	98,800	43,100-109,600	88,000
2	23,400- 59,600	47,900	20,800- 52,900	42,500
3	13,300- 33,900	27,200	12,100- 30,700	24,600
4	96,700-245,800	197,400	86,800-220,700	177,300
5	11,700- 29,600	23,800	10,400- 26,500	21,300
6	31,700- 80,600	64,700	28,400- 72,200	58,000
7	31,100- 78,900	63,400	27,700- 70,300	56,500
8	30,300- 76,900	61,800	26,900- 68,400	55,000
Statewide	286,600-728,300	585,000	256,200-651,300	523,200

population in 1990 at 523,200 woodcock (range = 256,200 - 651,300) (Table 5).

### Wildlife Management Units

Status. The greatest maximum supportable breeding populations of woodcock can be found in WMU's 1 and 4, the WMU's with the greatest amounts of agricultural lands and productive soil conditions. The coastal WMU's 6, 7, and 8 all similarly possess good numbers of breeding woodcock. The fewest numbers of breeding woodcock come from the relatively unproductive heavily forested WMU's 3 and 5. Both the quality and quantity of woodcock habitat is lacking in these areas. The statewide carrying capacity for woodcock was obtained by summing the maximum supportable woodcock population estimates of each WMU (Table 5).

Changes. Carrying capacity for woodcock was not estimated in the last species assessment. Therefore, comparisons with earlier plans are not appropriate.

Projections. Differing land uses will result in changes in habitat conditions and woodcock numbers between WMU's, but these differences are difficult to quantify and predict over the short 5-year time period. Projections of changes in carrying capacity between WMU's is likewise difficult to predict. However, current projections assume future trends in woodcock populations will decrease statewide by 1990.

### POPULATION ASSESSMENT - ACTUAL POPULATION

#### Statewide

Status. The statewide woodcock population estimate was derived by the utilization of recent (1980) forest inventory and previous (1971) wetland inventory data to estimate the total amount of suitable woodcock habitat in Maine. These data were combined with woodcock density estimates from singing-ground and wing-collection survey information. The current (1985) spring population is estimated to range between 426,700-574,900 birds. The current (1985) fall population is estimated at between 919,600-1,250,700 (Table 6). All estimates are of resident woodcock only.



Table 6. Current (1985) and projected (1990) woodcock population estimates by WMU.

Wildlife Management Unit	1985 Estimated population		1990 Estimated population	
	Spring	Fall	Spring	Fall
1	72,500- 97,700	154,500- 211,200	65,900- 86,800	137,800- 188,600
2	42,700- 56,500	91,500- 123,600	39,200- 50,800	82,700- 111,700
3	11,400- 16,700	25,100- 36,500	10,100- 15,200	21,700- 32,600
4	104,900-132,500	226,300- 287,000	94,400-120,600	199,300- 256,900
5	13,700- 20,200	30,200- 44,000	12,200- 18,300	26,100- 39,200
6	94,700-129,600	204,300- 284,100	85,200-116,000	184,600- 253,300
7	46,500- 62,700	99,100- 135,500	42,300- 55,700	88,400- 121,000
8	40,300- 59,000	88,600- 128,800	35,700- 53,600	76,500- 114,800
Statewide	426,700-574,900	919,600-1,250,700	385,000-517,000	817,100-1,118,100

Changes. In the 1975 and 1980 woodcock assessments, Maine's pre-hunting season woodcock population was estimated to range between 1-2 million birds. A loss of perhaps as many as 500,000 resident birds is believed to have occurred since 1975.

In 1985, the amount of habitat suitable for woodcock was estimated at 82% of the 1975 figure. This alone may account for the difference in population estimates. It does seem logical that this amount of early successional forestland could have been lost over the last 10 years. The discrepancy between population estimates is primarily due to differences in woodcock density estimates (woodcock/mi<sup>2</sup>). In the 1975 assessment, the authors based their population estimate on published information, personal observations, banding data, and harvest estimates. At that time, data on woodcock populations and densities were few, and it is likely that the data used, while the only available at the time, came from studies of populations that had more woodcock/mi<sup>2</sup> than occurs on average habitats in Maine. However, it is also likely that woodcock in Maine were considerably more abundant 10 years ago.

The 1985 woodcock population is based on more conservative woodcock density estimates and recent data on sex and age structure of the harvest. The basis for the adult male woodcock density estimate came from yearly singing-ground survey data. Rangewide, these data show that there has been a significant decline in the number of singing males/route of eastern woodcock since 1968 (Tautin 1985). Adult female and immature woodcock density estimates are derived from wing-collection survey data that has been reasonably stable in the last decade.

Projections. A number of factors affect woodcock abundance and annual fluctuations are common both locally and statewide. However, Maine's 1990 spring woodcock population was projected to range between 385,000-517,000 woodcock based on current conditions and anticipated trends in habitat and populations. The estimated fall woodcock population for 1990 was projected to range between 817,100-1,118,100 birds (Table 6).

#### Wildlife Management Units

Status. Woodcock occur in varying densities and abundances in young forests in most areas of the State.



They are generally considered scarce or absent in areas of mature forests that lack suitable openings. They appear fairly tolerant of man but are rare in heavily developed urban areas.

The area of the State with the most woodcock habitat and correspondingly highest number of birds is WMU 4. WMU 6 produces good numbers of birds based on singing-ground survey data. WMU's 1, 2, 7, and 8 all produce roughly equal numbers of woodcock despite wide variation in woodcock densities and habitat acreages. WMU's 3 and 5 produce the fewest birds because of limited amounts of suitable breeding habitat.

Changes. It has already been noted in the population assessment (statewide) that the fall 1985 population estimate is considerably lower than the 1975 estimate. Therefore, comparisons by WMU will also be lower than 1975 figures.

Both past and present woodcock population estimates were derived using independent methods and direct comparisons may not be appropriate. However, when total numbers of birds by WMU are ranked in order of importance, a similar pattern exists between years. Conditions for breeding woodcock may be improving in WMU 2 as the number of singing male woodcock censused in recent years in large cut-over areas of the commercial forest has increased. As Keppie et al. (1984) point out, woodcock densities may be low, but because of the extent of the boreal forest across the northern edge of the woodcock's breeding range, significant numbers of woodcock may be produced.

Projections. Trends in woodcock numbers will most likely parallel existing ones. Intensive forest management in WMU's 2, 3, and 5 may result in increased woodcock numbers in these WMU's. However, deteriorating habitat conditions on previously abandoned agricultural land in WMU's 1, 4, 6, 7, and 8 may offset any gains realized in the other WMU's.

### Population Characteristics

Maine's woodcock population is monitored via a State harvest survey and 2 USFWS surveys (the singing-ground survey and wing-collection survey).

Breeding population. The singing-ground survey censuses approximately 50 randomly selected 3.6-mile routes in Maine each spring. Cooperators count the number of singing (courting) male woodcock heard along each route. Collective data on the average number of males heard per route provide an index of local breeding populations, but not actual numbers of woodcock in the population. Results of this survey indicate a significant statewide decline in the long-term trend of woodcock breeding populations in Maine since 1968 (Figure 1).

Sex and age structure and net production data of woodcock harvested in Maine are collected through wing-collection surveys. Results of these surveys are discussed in the Use and Demand Assessment-Harvest section of this plan.



POPULATION ASSESSMENT - RELATIONSHIP OF ACTUAL  
POPULATION TO MAXIMUM SUPPORTABLE POPULATION

Maine's spring 1985 estimated woodcock population (426,700-574,900) was 73% to 98% of the estimated maximum supportable spring population (585,000). This wide range exists because the ability of Maine's habitat to support woodcock is limited and is constantly changing. Under favorable environmental conditions, spring woodcock populations may approach or even temporarily exceed the maximum supportable population estimate. Fluctuations in woodcock numbers are common but the amount of suitable habitat is the basis for these estimates. For the purpose of this plan, it is generally assumed that woodcock numbers are directly proportional to amounts of suitable habitat. Habitat conditions will have to improve before appreciable gains in breeding woodcock numbers can be realized at the low end of this estimated population range.

## USE AND DEMAND ASSESSMENT - HARVEST

### Statewide

Status. Historically, woodcock management has emphasized controlling harvests without jeopardizing the capability of woodcock populations to maintain themselves within the limitations of their habitat (USFWS Environmental Assessment). However, in recent years, interest in woodcock hunting has grown at a time when the habitat base that supported woodcock populations in the east had diminished in both quality and quantity. Woodcock hunting seasons of recent years reflected this change.

Between 1979 and 1981, Maine woodcock hunters enjoyed liberal hunting seasons that included the last week of September through the middle or end of November (Table 1). Harvests during this 3-year period averaged over 159,000 birds. In 1982, the USFWS imposed restrictions on the season in certain northeastern states where woodcock populations were adversely affected by a severe spring blizzard. The season in Maine did not open until 5 October. From 1983 through 1985, a 1 October opening date was established to provide protection to woodcock populations in the east. From 1979-1983, an average of 139,000 birds/year were harvested by an estimated 29,000 hunters (Table 7).

Results of the federal wing-collection survey can be used as an indicator of the sex and age structure of the woodcock harvest. These data are derived from a yearly sample of roughly 1,300 wings.

The data show that more adult females than males are shot each year, because they are more abundant and/or more vulnerable to shooting. The adult male to adult female ratio typically is 0.7/1.0. The ratio of immatures to adult females in the harvest provide a retrospective index of the success of the previous nesting season. In Maine, this ratio fluctuates around 2:1 (immatures:adult females) thus indicating good production (Table 8).

Changes. Analysis of supply and demand data for any species is complicated by many interrelated factors. In the case of migratory species, such as woodcock, the task is open for much guess work due to a lack of population data for the species. The authors of past woodcock assessments felt that woodcock were abundant enough to allow additional



Table 7. Recent harvest, effort, and success rates (5-year average 1979-1983).

Wildlife Management Unit	Allowable harvest <sup>1</sup>	Harvest	Estimated number of hunters	Successful hunters	Percent successful	Hunters/mi <sup>2</sup> of grouse habitat
1	23,200- 31,700	4,100	1,100	850	76	2
2	13,700- 18,500	1,600	600	450	75	2
3	3,800- 5,600	10,900 <sup>2</sup>	2,200	1,500	69	16
4	33,900- 43,000	38,900	8,100	5,700	70	12
5	4,500- 6,600	11,800 <sup>2</sup>	2,100	1,500	70	18
6	30,600- 42,600	31,000	3,600	2,700	76	11
7	14,800- 20,300	17,400	4,700	3,000	64	20
8	13,300- 19,300	23,400	7,300	4,500	62	26
Statewide	137,800-187,600	139,100	29,700	20,200	66	11

<sup>1</sup> Allowable harvest is 15% of the estimated 1985 fall population.

<sup>2</sup> In WMU's 3 and 5, the harvest estimates are considerably larger than the estimated allowable harvest. It is not known whether an overharvest exists or whether harvests in these WMU's include a large number of birds produced in other WMU's or Canadian provinces.

Table 8. Woodcock harvest size<sup>1</sup> and composition by sex and age<sup>2</sup>, 1979-1984.

Year	Harvest <sup>1</sup>	Federal wing survey samples			
		Adult <sup>3</sup> males (%)	Adult females (%)	Immatures (%)	Immature/ adult females
1979	142,700	310 (20)	431 (28)	810 (52)	1.9
1980	172,800	293 (18)	424 (27)	863 (55)	2.0
1981	164,200	299 (24)	299 (24)	619 (52)	2.0
1982	109,800	180 (18)	257 (25)	577 (57)	2.2
1983	107,600	240 (19)	336 (27)	665 (54)	2.0
1984	----	202 (18)	343 (31)	569 (51)	1.7
Total		1,524	2,090	4,103	2.0

<sup>1</sup>Data source: game kill questionnaire (1979-83).

<sup>2</sup>Data source: federal wing-collection survey (Tautin 1979-85).

<sup>3</sup>Adult male to adult female ratio = 0.7/1.0.



harvests in certain areas of the State. However, they also felt that before this could occur, a redistribution of harvest was necessary.

Projections. The projected harvest for 1990 is 104,300 woodcock (Table 9). Based on current and projected population estimates, this harvest is believed to be near allowable harvests. Declines in hunter numbers and success rates will likely accompany a projected decline in woodcock numbers over the planning period. Season length and bag limit restrictions imposed by the USFWS will also result in slightly lower harvests. By 1990, the number of hunters and the average annual harvest is projected to stabilize at a level at, or slightly lower than, the 1983 level of use (Table 9).

#### Wildlife Management Units

Status. As would be expected, woodcock harvests varied between WMU's. In the period between 1979 and 1983, combined harvests in WMU's 6, 7, and 8 accounted for roughly half the statewide harvest (Table 7). Consistently high harvests were recorded in WMU's 4 and 6.

Based on current estimates of woodcock population levels, excessive harvests (greater than 15% of the resident birds) are being recorded in WMU's 3, 5, and 8. Only in WMU's 1 and 2 are current harvests considerably below allowable harvests. The great distance from populated areas and limited access in WMU 2 are probably responsible for the low use of woodcock in these regions. Additional rates of harvest opportunity exist in these WMU's primarily because there are less than 2 hunters/mi<sup>2</sup> of available habitat.

Harvests appear close to allowable harvests in WMU's 4, 6, and 7 (Table 7).

Changes. No harvest projections were made during past woodcock species assessments. However, the authors of these assessments predicted that harvests may become excessive in certain areas of the State.

In 1974, the author(s) of the woodcock species assessment projected that at 1971 harvest and use levels, future demand would exceed the available supply of woodcock on a sustained yield basis. Since that time, both the number of hunters and estimated harvests have fluctuated dramatically

Table 9. Projected 1990 woodcock harvest, effort, and success rates.

Wildlife Management Unit	Allowable harvest <sup>1</sup>	Harvest	Estimated number of hunters	Successful hunters	Percent successful	Hunters/mi <sup>2</sup> of woodcock habitat
1	20,700- 28,200	4,000	1,000	730	73	2
2	12,400- 16,800	1,500	400	300	82	2
3	3,300- 4,900	6,500	2,000	1,300	65	15
4	29,900- 38,500	34,700	7,500	5,100	68	11
5	3,900- 5,900	5,500	1,300	1,100	66	11
6	27,700- 38,000	20,000	3,000	2,000	68	10
7	13,200- 18,200	13,600	3,300	2,000	60	15
8	11,500- 17,200	18,500	6,200	3,700	60	23
Statewide	122,600-167,700	104,300	25,100	16,300	65	10



and are now near 1971 levels again. The reasons for these fluctuations and rapid increases in hunters and harvest levels and then subsequent declines of both are not known. Two independent surveys (State and federal) both indicate a decline in the hunter success over the last 10 years and reflect a general erosion of hunting quality over the last decade.

In the latest woodcock species assessment (1980), the authors believed that the statewide woodcock population was underutilized at 1977 levels of use. But, in the same plan, they concluded that local breeding stocks in WMU's 5 and 8 were supporting excessive harvests based on their planning data. They further indicated that a redistribution of hunter effort was necessary to prevent overharvest in other areas. Recent data support this contention as well and these data show patterns of overharvest primarily in WMU's 3 and 8.

Projections. Future harvests are expected to remain near or become lower than those experienced in recent years. Further modifications of woodcock seasons at the federal level of administration may result in reduced opportunity to harvest woodcock in the east. This occurred in 1985 and will continue for the next 2 years at least. Harvests for the period of 1985-1987 should reflect these changes.

It should be noted that Maine woodcock are migratory birds and are subsequently vulnerable to hunters over their entire migration route. Efforts to conserve this species will be best addressed on a rangewide basis.

#### USE AND DEMAND ASSESSMENT - TYPES OF USERS

##### Statewide

Status. The primary users of Maine's woodcock resource are game bird hunters. This group can generally be subdivided into 2 subgroups: hunters who use dogs and hunters who walk to flush birds. Both groups generally hunt woodcock and ruffed grouse simultaneously.

No specific data on woodcock hunter types are available. However, data on success rates and hunting effort are collected annually. The sources of these data are the State

game kill questionnaire and the federal wing-collection survey.

Success rates on the statewide level vary from year to year. Data from the 1979-1983 State game kill questionnaire indicated that of the estimated 29,700 hunters/year, 66% were successful at killing at least 1 woodcock each year. During the 1983 season, each successful woodcock hunter killed an average of 7 birds. Federal wing-collection survey data estimated a considerably higher estimate of seasonal kill in 1983 of 14 birds/hunter (Tautin 1985). The accuracy of these 2 figures is unknown. However, long-term trends of seasonal success (number of birds/hunter/season) from both surveys indicate declines over the last 10 years.

Other data from the game kill questionnaire can be analyzed with the habitat information to provide gross estimates of hunting effort. These data include the number of woodcock hunters per unit of woodcock habitat (hunters/mi<sup>2</sup>) and the number of man-days of hunting effort expended in each WMU. These estimates were derived for planning purposes only and the results should be viewed and used with caution.

Between 1979-1983, there was an estimated 11 woodcock hunters for each square mile of woodcock habitat in the State. In the northern part of the State, only 2 hunters/mi<sup>2</sup> were recorded. In central and southern Maine, figures of roughly 12 hunters/mi<sup>2</sup> and 26 hunters/mi<sup>2</sup> were recorded, respectively (Table 7).

Man-days of hunting effort were estimated annually. In 1983, each of the estimated 24,000 hunters hunted approximately 5.5 days during the season. This represents a modest decline in the amount of use over the previous 5 years when hunters hunted approximately 6.2 days/season.

Changes. No data are available for comparing changes in types of woodcock users. Data on success rates, hunters/mi<sup>2</sup>, and man-days of hunting effort all show slight declines over the last 10 years when compared to 1983 data. No significant changes were apparent in either category.

Projections. No significant change in the demand to hunt woodcock is expected during this planning period. Restricted hunting opportunity (shorter seasons and lower bag limits) and access restrictions (posted land) will likely cause a statewide decline in the number of woodcock hunters. If projected downward trends in woodcock numbers continue, additional hunters may cease hunting woodcock based on the "law of diminishing returns".



## Wildlife Management Units

Status. Because very little data are available on hunter characteristics, few meaningful comparisons can be made on a WMU basis. However, data are collected on success rates and hunting effort (man-days) by WMU.

Of the estimated 29,700 woodcock hunters between 1979-1983, 66% were successful in killing at least 1 woodcock. Hunters in WMU's 1 and 2 were generally more successful than hunters in central and southern Maine. Northern Maine hunters reported 76% success in harvesting woodcock during this period compared to success rates which were generally lower for hunters in the remainder of the State. The difference in success rate may in part be due to the difference in hunting effort by region of Maine.

Data on hunters/mi<sup>2</sup> of woodcock habitat are subject to problems inherent in the estimation of total number of hunters and the total amount of woodcock habitat in each WMU. Despite these limitations, comparison between WMU's provide an overall picture of the variability in hunter use of the woodcock resource. These data show that there are approximately 2 hunters for each square mile of woodcock habitat in WMU's 1 and 2. This hunter-density estimate ranged to a high of 26 hunters per square mile of habitat in WMU 8. Hunters/mi<sup>2</sup> in the remaining WMU's 3, 4, 5, 6, and 7 ranged between 11 hunters/mi<sup>2</sup> and 20 hunters/mi<sup>2</sup> as reported in the 1979-1983 game kill questionnaires (Table 7). Information on man-days of effort and man-days/mi<sup>2</sup> of habitat by WMU parallel this trend.

Changes. No notable change from earlier plans in user characteristics can be discussed on a WMU basis.

Projections. No significant change in demand to hunt woodcock is expected during this planning period. Hunter shifts between WMU's may occur as woodcock habitat conditions change. A shift in effort to WMU's 1 and 2 may in the future provide quality hunting opportunities.

## SUMMARY AND CONCLUSIONS

The American woodcock has long been a popular game bird in Maine. Although classified as shorebirds, woodcock have habits approaching that of upland game birds. Woodcock occur in the forests of eastern North America. In Maine, young to middle-aged hardwoods, associated with abandoned fields or forest openings on moist loamy soils provide optimum habitat conditions. Woodcock migrate between northern breeding and southern wintering grounds. Woodcock which nest or are hatched in Maine winter east of the Appalachian Mountains, primarily from southern New Jersey through Georgia. Maine's pre-hunting season population estimate for 1985 was estimated at approximately 817,000-1,118,000 birds and does not include migrant birds from Canada.

A review of historical records reveal that woodcock habitat, and presumably the number of woodcock as well, were abundant in the mid to late 1800's when small farms were numerous in Maine. Since these earlier times, millions of acres of farmland have reverted to forestland and large gains and losses in woodcock habitat have occurred in the twentieth century.

Woodcock numbers have correspondingly fluctuated over this time period. Uncontrolled hunting in the past has adversely affected woodcock numbers. Since market hunting was abolished and seasons and bag limits were imposed, woodcock numbers increased. With refinement of population surveys came the knowledge that woodcock were more widespread and abundant than formerly assumed. In the 1960's, regulations were gradually liberalized to allow greater opportunity to harvest woodcock. During this time, and continuing through the 1970's, the woodcock became an increasingly popular game bird over its entire range, with the greatest growth of hunting interest in southern states.

Interest in woodcock grew steadily and harvests increased. In the northeast, unfortunately, this increase in hunting pressure came at a time when woodcock habitat was being lost to development and forest succession beyond stages suitable for woodcock on previously abandoned farmland. Recently, woodcock numbers and harvests in Maine have decreased and regulations became restrictive in 1982.

In 1985, the USFWS believed further adjustments of hunting regulations were necessary. For the 1985-86 hunting



season, the USFWS proposed and adopted regulations for eastern states shortening the season from a maximum of 65 days to no more than 45, allowing for no September or February hunting, and cutting the bag limit from 5 to 3 birds per day.

Complete annual estimates of the number of woodcock harvested in Maine do not exist prior to the 1950's. However, one source quotes annual kills of 37,000 recorded annually in the late 1930's. Through the 1950's, the average harvest was estimated at roughly 20,000 birds. In the 1960's, the average annual harvest was over 52,000 woodcock. Maine's woodcock harvest peaked in 1973, when an estimated 37,000 hunters killed over 210,000 birds. The increase in woodcock harvest is believed to be largely due to increased participation in woodcock hunting and not increased success. Soon after this record kill, the first Department Woodcock Species Management Plan was completed. This plan concluded that local breeding stocks in southern WMU's were sustaining maximum harvests. Regulations proposed by the Department since 1975 were aimed at reducing the early season hunting pressure on these local breeding populations. Since that time, the average annual woodcock harvest has declined, probably because of a decrease in woodcock numbers and hunting effort. The average harvest from 1980 to 1983 was 138,500 birds.

The estimated number of hunters that pursued woodcock in Maine has risen dramatically in the last 3 decades. In the 1950's, the average estimated number of woodcock hunters was 4,200. The 1960's saw a 3-fold increase in hunter effort and an estimated 12,500 woodcock hunters were afield. This upward trend continued into the 1970's and peaked in 1973 when an estimated 37,000 woodcock hunters hunted in Maine. This trend has since reversed and in 1983, the year that most recent data are available, an estimated 24,000 hunters pursued woodcock (Table 10). Nonresident hunters consistently comprised approximately 20% of the estimated number of woodcock hunters in the State.

Woodcock habitat, although fairly easy to identify, is relatively short-lived and is of little commercial value. Consequently, it is not well represented in standard forest inventories. Given these limitations, the amount of habitat in Maine considered suitable for woodcock was estimated at 2,597 mi<sup>2</sup>, based on the Department's Wetland Inventory and the Maine Forest Resurvey (1982). This figure represents an 18% decline in available habitat from the 1975 woodcock assessment.

Table 10. Past, present and projected future woodcock harvests (actual, allowable and objective) and hunters (total and successful).

Year	Harvest			Hunters	
	Actual	Maximum allowable	Objective	Total	Successful
1971	94,300			25,300	17,700
1972	174,900			28,900	21,000
1973	210,700			37,300	25,700
1974	164,000			30,300	21,200
1975	110,300	225,000	165,000	28,300	19,300
1976	151,300	"	"	28,200	19,400
1977	133,700	"	"	27,000	17,800
1978	99,200	"	"	23,000	16,100
1979	142,700	"	"	27,400	18,600
1980	172,800	"	"	27,000	18,600
1981	164,200	"	"	31,600	21,500
1982	109,800	"	"	25,400	16,000
1983	107,600	"	"	24,200	15,500
1984	?	"	"	?	?
1985	?	137,800-187,600		?	?
1990	104,300	122,600-167,700		25,100	16,300



Throughout most of the State, the quantity and quality of woodcock habitat is projected to decline. The projected loss in habitat is due to a number of factors, all interrelated, but have negative affects on woodcock populations. First, much of the once ideal woodcock habitats of central and coastal Maine forests continue to overmature beyond stages suitable for woodcock. Secondly, trends in abandonment of agricultural lands in recent years has slowed and it is unlikely that significant amounts of farmland will become woodcock habitat in the future. Lastly, recently analyzed aerial photographs revealed that significant amounts of urban/industrial development has replaced the abandoned fields and shrublands that had been good woodcock habitat. The important consequence here is that land lost in this fashion is lost for a long period of time. Woodcock habitat lost to forest succession can be manipulated and returned to suitable woodcock habitat in a relatively short period of time. The only large scale habitat alteration which appears to be improving conditions for woodcock is intensive forest cutting in the form of clear-cuts. The role that biomass harvesting will play in creating woodcock habitat is not known at this time. For the reasons mentioned above, a statewide 5% reduction in habitat suitability and habitat acreages is projected for 1990.

Statewide estimates of woodcock densities were based on the average number of singing male woodcock heard per census route in each WMU. These data were then expanded to include nonsinging males, females, and immatures. Woodcock densities were then multiplied by habitat acreages in each WMU, excluding large acreages of commercial forests. The current (1985) spring population was estimated to range between 426,700-574,900. The maximum number of woodcock that Maine's habitat could support in the spring was estimated at between 286,600 and 728,300 woodcock, based on an adult male density of 10-25 birds/mi<sup>2</sup>. Maine's fall 1985 estimated woodcock population was estimated to range between 900,000 and 1,250,000 birds. For the purpose of this plan, it was assumed that woodcock numbers were directly proportional to amounts of suitable habitat. Consequently, habitat conditions will have to improve before appreciable gains in woodcock numbers can be realized.

The projected harvest for 1990 is 104,300 woodcock (Table 10). Based on current and projected statewide population estimates this harvest should be within allowable limits. Excessive harvests may occur in certain areas of the State. Declines in hunter numbers and success rates will likely accompany a projected decline in woodcock numbers over the next 5 years.

When considering management objectives for woodcock, it must be kept in mind that this species is a migratory game bird that is subjected to harvest pressure along it's entire fall migration route. In addition, the quality and quantity of rangewide woodcock habitat continues to decline.

The reliability of surveys designed to measure the status of woodcock populations and their habitats remain questionable. Because the reproductive potential of the species is low, recovery from overharvest is difficult. In light of these factors, this author feels that harvest management of this species must be conservative until better data are available.



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