

SUMMER CREPUSCULAR FLIGHTS OF AMERICAN WOODCOCKS IN CENTRAL MASSACHUSETTS*

WILLIAM G. SHELDON

THE purpose of this paper is to record observations of American Woodcock (*Philohela minor*) during nine summers (1952-60) in central Massachusetts. Active primarily in crepuscular and nocturnal hours, this elusive upland shorebird has presented a challenge to those ornithologists or wildlife biologists seeking knowledge of its life history and ecology. Intensive study of this species by personnel of the Massachusetts Cooperative Wildlife Research Unit for ten years has included exhaustive summer investigations, a season when this species is difficult to find and secretive in habits. The dearth of information on woodcock summer activities during the crucial period of molting and rearing young prompted me to develop methods of gathering critical information. The results are based on 746 woodcock captures with Japanese mist nets. A detailed description of netting techniques appears elsewhere (Sheldon, 1960). Fragmentary and preliminary reports of these summer observations also have appeared elsewhere (Sheldon, 1956*b*).

Search of the literature reveals a paucity of data on the summer behavior of woodcocks. Pettingill (1936) reported that in quest for food during the summer months, woodcocks have been known to use haunts not frequented at other times of the year, such as lawns, cornfields, and vegetable gardens. Similar observations have been made during the course of this study. Mendall and Aldous (1943) suggested that in the heat of the summer and during the critical period of the molt, woodcocks retire to dense thickets where the soil is damp and productive of earthworms. Although most food studies indicate that earthworms form a high percentage of the woodcock diet, findings in this study suggested that other invertebrates play an important part in the woodcock's summer diet.

Evening observations during the summer months revealed a high degree of activity by woodcocks during the evening crepuscular period. Birds observed "trading" across country roads and elsewhere were pursued on the subsequent evenings if their flight direction appeared consistent. These investigations led to the discovery of certain fields where the birds alight. This phenomenon is not unlike descriptions of woodcocks coming into fields to feed for earthworms in their Louisiana wintering grounds. An elder sportsman told me of accompanying a market gunner during the last century when the Massachusetts woodcock season opened in July. He described

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dusk shooting of woodcocks flying to the slope of a dry hill in Essex County. Two small spaniels were used to retrieve the birds.

Exploration revealed four fields thus frequented at widely scattered locations in Quabbin Reservation which comprises 100,000 acres of protected land and water. Three of these were used as study and netting areas. Area 3 was open to the public and unsuitable for effective netting.

DESCRIPTION OF THE AREA

The ground of the frequented fields had little in common vegetatively. Such openings were bordered by trees or shrubs 20 feet or less in height, but grass or shrub cover varied in each area. Whatever the cover might be, there were a few relatively clear patches on the ground. Woodcocks appear to favor areas where they can walk around easily whether feeding or engaged in other activities. The only other feature in which these fields were similar was location in reference to spring breeding areas. All were in or very close to regions where the largest number of singing males was heard in the spring. All were used as singing grounds in the mating season.

Area 1.—One of the two areas where birds alight in Prescott Peninsula in Quabbin Reservation was a small field about $\frac{1}{2}$ acre in size with a ground cover of low bush blueberries (*Vaccinium pennsylvanicum*), scattered sweet fern (*Myrica asplenifolia*), and a few clumps of oak (*Quercus* sp.) and chestnut (*Castanea dentata*) sprouts. There were open areas between the bushes which were the favorite alighting places. It was the site of an old burn, and numerous dead logs and stumps littered the area. These provided an ideal habitat for ants and numerous beetle larvae. The area was surrounded by a predominant growth of gray birch (*Betula populifolia*) up to 20 feet high. Oak-sprout growth was the next most abundant woody plant. Scattered white pines (*Pinus strobus*) up to 60 feet high were found at various distances from the perimeter of the field. The ground was exceedingly dry and well drained. Within 100 yards were two old gravel pits which often contained moist or wet bottoms, and these were occasionally visited by the birds. The field was used by at least one singing male each spring. One of the males was captured and banded in April 1955, but was not netted during the summer.

Area 2, South Side of Quabbin Reservoir.—The second area was almost two acres in size and situated near the top of a high hill. Part of it was an abandoned field with low-bush blueberries and scattered white pines. The favorite alighting area was a bare space of about an acre. Several years ago, machines scraped all the topsoil off the site. Vegetation was sparse and the soil rocky. Numerous ant holes were scattered in the area, but the habitat was not nearly as favorable for insect life as Area 1. The fringe of the field on one side was a red pine (*Pinus resinosa*) plantation,

and on the other, low gray birches, poplars (*Populus tremuloides*), and other scattered hardwoods. The border growth on the whole was higher than that on Area 1. There has always been a high breeding population near this area, and six singing males were heard in the vicinity in the spring. All these males were captured and banded in the springs of 1955 and 1957, but none were netted as repeats in the summers.

Area 3, South Side of Quabbin Reservoir.—This was an abandoned field of several acres in extent. It was filled with scattered clumps of high-bush blueberries (*Vaccinium corymbosum*). Being open to the public, there were well-beaten paths around all the blueberry bushes in July. These relatively bare paths at the base of the bushes were the favorite spots sought by woodcocks each evening. The birds flew from neighboring woods and were seen on occasion to come from at least 300 yards away. There was a minimum of eight "singing" males on this area in the spring of 1955. This would have been a difficult field to net, and netting was not attempted because there was little question that nets would be interfered with by the public.

Area 4.—This field was found in 1958 and netted in 1959. Situated on Mt. Pleasant on Prescott Peninsula in Quabbin Reservation, this site was on the highest point of the peninsula, approximately 1,100 feet above sea level. It was surrounded by old abandoned fields planted to Norway spruces (*Picea abies*), red pines, and larches (*Larix laricina*). Gray birch was scattered about on the periphery. Enough open places remained so that the breeding population within a radius of half a mile had not diminished appreciably for ten years. It was an old hayfield of about two acres in size with an adjoining ½-acre field grown up to sweet fern and grassy spots. Birds alighted all over the area, but avoided the heavy, long-grass hummocks.

"Singing" male woodcocks have used this field and adjoining areas for ten years.

POPULATION COMPOSITION OF NETTED SUMMER BIRDS

Composition of birds captured are depicted in Table 1.

Ages of birds captured before the molt were determined by the color on the tips of the scapular and back feathers as described by Duvall (1956). Some young birds caught early in the summer peeped in the net with the same note of newly hatched chicks. August and September birds could not be aged with certainty during night banding. Sex was determined by bill length and width of outer primaries (Greeley, 1953).

Examination of Table 1 suggests that captured birds may not be representative of the actual sex and age ratios existent in the population. The results reveal that the sex and age groups in order of number of captures were juvenile males, adult females, juvenile females, and adult males. These proportions were relatively consistent from one year to the next. Because

TABLE 1

SEX AND AGE RATIOS IN NEAREST WHOLE PERCENTAGES OF 483 WOODCOCKS
CAPTURED IN MASSACHUSETTS DURING SUMMERS 1955-1959

Year	Ad. ♂	Juv. ♂	Ad. ♀	Juv. ♀	Tot. Juv.	Tot. Ad.	Total ♂s	Total ♀s
1955	7 (7) *	41 (42)	27 (28)	25 (24)	66 (66)	34 (35)	49 (49)	51 (52)
1956	21 (28)	32 (44)	31 (42)	16 (22)	49 (66)	51 (70)	53 (72)	47 (64)
1957	20 (13)	30 (19)	36 (23)	14 (9)	44 (28)	56 (36)	50 (32)	50 (32)
1958	14 (10)	42 (30)	26 (19)	18 (13)	60 (43)	40 (29)	55 (40)	45 (32)
1959	10 (11)	35 (38)	28 (31)	27 (30)	38 (42)	62 (68)	44 (49)	56 (61)
Totals	14 (69)	34 (166)	30 (143)	20 (98)	56 (271)	44 (212)	50 (242)	50 (241)

* Figures in parentheses denote numbers of birds.

of this, I doubt that such differences are due to an inadequate sample, but reflect differences in activities of birds according to sex and age.

Reasons for these assumed behavior differences are purely speculative. Adult males may be less active in summer due to a strenuous breeding season extending from late March to early June. Juvenile males may have a greater tendency to move about, a characteristic of many juvenile male vertebrates. Adult females become more active after spending the spring on the ground incubating eggs and rearing young. It is possible evening flights may be serving to develop wing strength for the fall migration.

BEHAVIOR DURING FLIGHTS

Woodcocks were seen flying into the fields one-half hour after sunset at the same light intensity as the beginning of the courtship performance earlier in the year. Usually the flights lasted no longer than 15 minutes, but on one bright moonlight night birds continued to come into one field for 30 minutes. Observations indicate that, after alighting, birds remained in the field from 10 minutes to one-half hour unless flushed. Nets left all night yielded no additional birds.

Birds came in singly as well as in groups of two, three, and four individuals. Figure 1 depicts observations on Netting Area 2 on the evening of 20 June 1959, before netting had started. Twenty-four birds were counted. Only those visible against the evening sky were tabulated. A number of others were heard crossing the field below skyline. Although the figure depicts birds approaching from all points of the compass, the majority came from the western sector and often circled the field and made the final approach from any direction. The pattern of approach depicted was typical of the flights of incoming birds in the other netting areas.

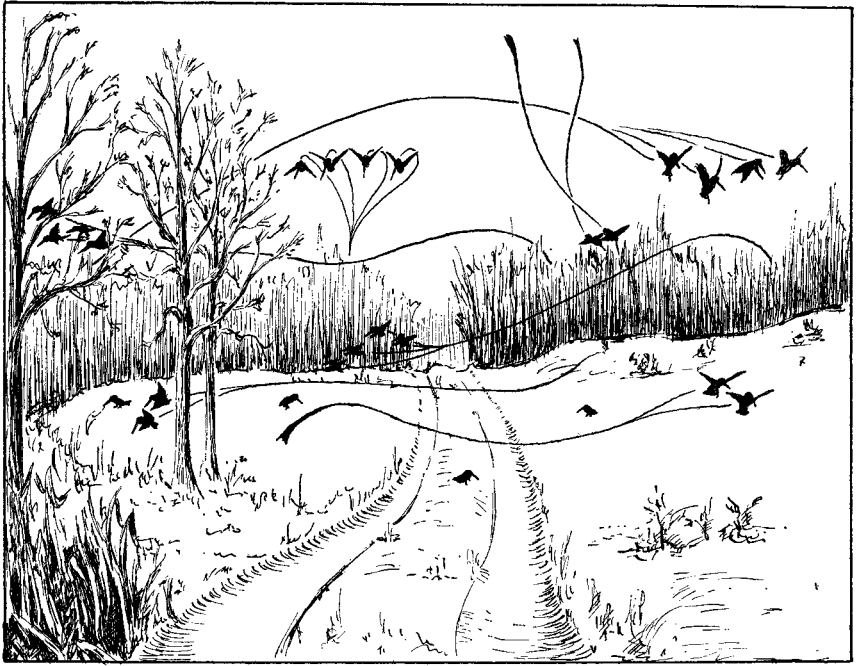


FIG. 1. Woodcock crepuscular flight into open field—Area 2.

Although there is no certain proof, there is no evidence that broods remain intact up to the time the young birds take part in these evening forays. Additional data on this are presented in a later section.

The counts of birds in evening flights when no netting is being conducted may give a rough index of annual abundance if the habitat remains static. Area 1 is in an area of deteriorating woodcock habitat due to vegetative succession. In 1951, there were 63 "singing" grounds known to be occupied in Prescott Peninsula. Censusing the same routes in 1959 indicated only 17 "singing" sites were occupied. Area 2 is on the top of a steeply drained hill which has wet seepages in normal summers. In 1957, the entire hill was dry due to a severe drought. Because of this condition, the birds apparently shifted their diurnal resting areas and used different fields for their crepuscular visits.

From 1952 to 1959 when netting usually took place every evening all summer, records were kept of birds observed and of trap success by weeks and months. It was suspected that the netting and banding operations disrupted normal evening behavior and prompted birds to seek other evening feeding grounds. In 1960, when no nets were set, evening observations of

some of the fields were conducted weekly from late June until the end of the first week in August. The evening flights with some variations continued unabated until nets had to be set to capture some live birds for insecticide studies. After six days of netting on two areas, the nets were removed. From the first night of netting the numbers of birds using the fields fell off steadily. In addition to the 1960 observations the largest number of birds observed in a netting area was on 15 August in a season before netting took place.

Variations in counts on Area 1 before netting were approximately 25–43, on Area 2, 10–27, and Area 4, 20–38. Such high counts over a period of time never were recorded while netting was taking place.

Semi-courtship Activities.—The juvenile male birds approaching the fields early in the summer often performed a “courtship” flight high over the field before landing. The performance closely paralleled the flight of adult males in the spring with the exception that the musical chirp song was not given. Occasional irregular *peent*'s were heard on the ground. Most of these males were known to be juveniles, since on some occasions they were captured in nets on their descent. Gonads of collected specimens were minute in size, showing no development. These were not sectioned to discover if there were any active spermatozoa.

On 13 July 1955, Dr. William Nutting of the University of Massachusetts Zoology Department was concealed in small bushes and observed the antics of an apparent male and female on the netting ground a few feet away. From a behavioral point of view, his following description of observations is of interest:

1. Heard *peent* NE at 8:52 and another weak one at 8:54.
2. Several birds in from NNE.

At 8:58, one bird flew in with wing whistle 6½' from me. He stood and turned SW. Then, I noticed another bird walking in from SW. First bird moved to meet the new one. Bird 1 (hereafter called a *him*) made aggressive head pass toward second (from now on called a *her*). She stopped 2' from him. He raised his wings, lowered and advanced, raised wings again, lowered and moved; then in several fluttery wing moves came up to female and passed his bill at her midback. She then moved off 3' NNW. He moved 2½' NE of her. Both stood still. I heard her give a soft cat wheeze note—followed in a few seconds by another. He turned around and squatted (faced from her). He rose, appeared to peck at ground, then turned facing her. Suddenly he flew in a low arc over her head, wings whistling, to land about 12' beyond her. She did not change position. In one minute, he flew up with wings whistling and did a semi-courtship flight, directly overhead landing about 50' to SW. She walked slowly out of sight NW.

I crept toward her and flushed her—her wings fluttered, but didn't whistle. Time, 9:14.

Nutting's description of the behavior of the bird presumed to be a male is similar to the actions of a breeding male preceding copulation. In the course of the Massachusetts studies, hundreds of male birds have been

captured on singing grounds with decoys (Sheldon, 1956a, b), and many notes were accumulated on the behavior of male birds in the presence of a decoy bird or live female. The latter are invariably approached with raised wings and the copulation act is performed with fluttering wings. Similar observations were made in 1960 on 29 June and 20 September.

The "cat wheeze" note attributed to the female was heard several times on the summer alighting fields. When this note is given, it is often loud and startling, entirely unlike other notes given by woodcocks. Birds flushed from the site of these calls appeared large and were presumably females.

Fall or late summer courtship behavior has been reported on several other bird species including several species of ducks, the Yellow Warbler, Baltimore Oriole, and others (Hochbaum, 1944).

Effects of Weather.—Although it has been pointed out that nets have a deterrent effect on birds, observations of activity in different weather conditions in netting years may well have validity.

Careful weather records kept throughout the years of netting showed slight correlation between weather conditions and bird activity. Windy nights with an air movement of more than 5 mph usually yielded poor catches. The motions of the nets were often detected by the birds and thus avoided. Under windy conditions, few birds usually visited the fields. Clear evenings with temperatures ranging from 55–75°F. often produced good catches, but just as often were unproductive. Still, hot, humid evenings following afternoon thunder showers created conditions which were most consistently productive of birds and often stimulated insect activities. Woodcock activity seemed stimulated by quiet evenings with a light drizzle or fog. On the morning of 16 July 1960 half an hour before sunrise, 64 woodcocks were seen on 3½ miles of road during a light rain. Two mornings later no birds were seen over the same route in clear weather.

Factor of Food.—The most important reason for these flights appeared to be dietary in character. Birds landing in the fields fed actively on various species of insects. Table 2 gives the results of the analysis of stomach contents of 15 birds. Some of these birds were collected as they flew into fields. Although earthworms rank second in percentage of volume, there was little more than a trace in the eight birds which were allowed to feed in the fields 10 or 15 minutes before flushing into the net. Direct observations at dusk include woodcocks actively feeding. One bird alighted on a white rock and was observed picking up food items. Examination of the surface of this rock with the aid of a light revealed numbers of a very small ant. Captive woodcocks have been observed chasing flying insects attracted by a light. Presumably, many birds left damp wooded areas where earthworms were found. Seven birds were collected as they flew into nets before alighting

TABLE 2
STOMACH CONTENTS OF 15 WOODCOCKS NETTED IN FIELDS
DURING SUMMER EVENINGS IN MASSACHUSETTS

Item	Family	No. of stomachs	Estimated per cent volume
COLEOPTERA			38.7
Ground beetle larvae	Carabidae	2	
Weevils	Curculionidae	1	
Wireworms	Elateridae	13	
Leaf chafer larvae	Scarabaeidae	1	
Short-winged beetle larvae	Staphylinidae	3	
Darkling beetle larvae	Tenebrionidae	5	
DIPTERA			15.3
March fly larvae	Bibionidae	5	
Long-legged fly larvae	Dolichopidae	4	
	Louchaeidae	1	
Snipe flies	Rhagionidae	8	
Stiletto fly larvae	Therevidae	6	
Root-feeding fly larvae	Tipulidae	1	
LEPIDOPTERA			14.7
Noctuid moth caterpillar	Noctuidae	8	
Pupa		1	
Loopers	Geometridae	1	
ANNELIDA			
Earthworms		8	30.0
CHILOPODA			
Centipede		2	.3
CHELICERAE			
Spiders		2	.3
HYMENOPTERA			
Ants		2	.3
VEGETABLE MATTER			.2

in the fields. These contained earthworm remains in their stomachs. It may well be that the high protein content of the insects consumed in the fields formed an important part of the summer diet. English workers on icterid species have observed that seeds or fruits eaten during the molting period have a high protein content.

Although the fields were dry and no probing could take place, the prehensile tip of the woodcock bill is well adapted for picking up insects from the ground or even catching a few in the air.

It will be seen from Table 2 that a large variety of fly and beetle larvae were readily consumed. Analysis of these stomachs suggests that woodcocks often consumed earthworms in their diurnal coverts but visited the fields primarily for other types of animal food.

Summer Evening Activity by Months.—The only valid observations on the activity of birds by months are those observations made when no netting or banding was taking place. Most of these observations were made in 1960. Woodcocks alight in these fields in large numbers as late as mid-August at least. Almost as many can be seen in September but fewer alight in the fields. Birds have been netted as late as 10 October and as early as 13 June. When the fields were netted, no birds were observed on several occasions on all areas during August due to the disturbance of banding.

Evidence that Flights Comprise Resident Birds.—The question is posed as to whether the flights were local movements by different groups of birds each evening. In Netting Area 2, 20 per cent of the captures in 1956 and 1958 were repeats. This was solid evidence that many of the same birds took part in the activity more than one evening. The chances of capturing repeats were small, partly since it was seldom that more than 30 per cent of the birds observed each evening were netted and perhaps, more importantly, because of the deterrent effects of the netting and banding activities referred to in an earlier paragraph. Birds in Netting Area 2 came from a relatively concentrated woodcock range. In contrast, Netting Area 1, which has yielded about 400 of all birds captured, produced few repeats. Birds from this area were surrounded by hundreds of acres of woodcock range, and several have been taken as returns several miles away. This field is small, and many other alighting areas must exist. Limited data on returns described in a later paragraph further suggest that we were dealing with resident birds.

Distance between Alighting Fields and Diurnal Cover.—The actual distance individual birds flew in the evening to reach the netting fields is somewhat conjectural. In Netting Area 1, observers posted at intervals provided evidence that many birds coming into the field were first observed coming east over a large hill half a mile from the landing field. In Area 2, observers have recorded many birds travelling toward the field from distances up to at least $\frac{1}{3}$ of a mile. There was no single observation of a bird rising from diurnal cover and flying to the field. It probably took a woodcock no longer than two minutes to fly a mile, and there was no way of knowing how far the birds had come when first observed. In one instance, two juvenile males were captured in a funnel trap on the edge of a large alder swamp two miles from the netting field and separated from it by a large hill. Ten days after the first capture, these two birds were again netted, but there was no method of ascertaining their whereabouts between the two capture dates.

TABLE 3
 RETURNS OF WOODCOCKS NETTED IN CENTRAL MASSACHUSETTS
 DURING SUMMERS 1952-1959

Band no.	Sex	Age when captured	Distance between capture sites in miles	Time lapse between capture sites to nearest year	Method of recapture
553-50260	♀	Juv.	10	2 years	Netted
563-33238	♀	Juv.	0	2 years	Netted
553-50272	♀	Juv.	0	3 years	Netted
563-33297	♀	Juv.	0	1 year	Netted
553-50220	♀	Ad.	3	4 years	Netted
563-33054	♀	Ad.	0	3 years	Netted
563-33110	♀	Ad.	2½	4 years	Netted
563-33160	♀	Ad.	0	2 years	Netted
603-44212	♀	Ad.	0	1 year	Netted
553-50286	♀	Ad.	0	2 years	Netted
523-05229	♀	Ad.	1	1 year	Netted
563-33054	♀	Ad.	0	2 years	Netted
553-50274	♀	Ad.	0	3 years	Netted
563-33295	♀	Ad.	0	1 year	Netted
563-33244	♀	Ad.	0	1 year	Netted
563-33022	♀	Ad.	0	1 year	Netted
563-33242	♂	Juv.	½	1 year	Singing-ground trap
553-50222	♂	Juv.	3	3 years	Netted
563-33213	♂	Juv.	0	3 years	Singing-ground trap
603-44205	♂	Juv.	0	1 year	Netted
603-44225	♂	Juv.	0	1 year	Netted
563-33219	♂	Ad.	⅛	3 years	Singing-ground trap
553-50211	♂	Ad.	1½	1 year	Singing-ground trap
523-07219	♂	Ad.	1	1 year	Singing-ground trap
553-50160	♂	Ad.	1	2 years	Netted
50-301755	♂	Ad.	2	5 years	Netted
563-33266	♂	Ad.	½	1 year	Singing-ground trap
563-33010	♂	Ad.	10	1 year	Singing-ground trap
563-33222	♂	Ad.	⅒	1 year	Singing-ground trap
553-50204	♂	Ad.	0	2 years	Netted
563-33773	♂	Ad.	1	3 mos.	Netted
523-50238	♂	Ad.	1	1 year	Singing-ground trap
553-50162	♂	Ad.	¾	4 mos.	Netted
553-50135	♂	Ad.	1	4 mos.	Netted
563-33243	♂	Juv.	¼	1 year	Singing-ground trap

RETURNS AND RECOVERIES

In this paper, *return* refers to a bird recaptured after a period of at least three months. *Recovery* refers to a bird shot or recovered in a location removed from the study areas. Homing and returns of adult males caught in

the spring on their singing grounds were reported earlier (Sheldon, 1956a). Table 3 presents the total data on returns of netted birds.

Returns.—Data from Table 3 offer further evidence that netted birds comprised a resident population. There are more return records on adult males than juveniles, because spring singing-ground trapping activities presented greater opportunity for collecting male return records. These data simply suggested the extent of spring and summer range of some of the netted birds. There was one case of a male and another of a female banded one year in Area 1, and captured as a return in Area 2, a distance of 10 miles.

Although the record is meager, these results suggest homing behavior on the part of all age and sex groups. These data show minimum distances from the netting fields that some individual, netted, resident birds have moved at some time in their lives during spring or summer. Not shown in the table is the instance referred to in a previous section of the netting of two juvenile males two miles from an alder swamp where they had been captured ten days previously in a funnel trap. Far more adequate data presented earlier on adult males (Sheldon, 1956a) indicate adult males return in subsequent years to the general vicinity of the breeding grounds where first captured.

This table contributes other incidental information. There is evidence that both sexes breed in their first year. Number 50-301755 was first banded as an adult male at least a year old on a singing ground in April of 1951, and subsequently netted five years later in the summer of 1956. Six years longevity appears to be the longest life span recorded for the American Woodcock in the wild.

Recoveries.—Seventeen hunter-recoveries of birds netted and banded during this study were all from southern migration lanes with the exception of two. One juvenile female banded on 16 July 1956, was shot on 1 October 1957, in Peru, Vermont, 65 miles northwest of the original banding location. This bird conceivably could have been a resident of Massachusetts and exhibited a case of vagrant migration. There seems little question that the second bird had forsaken her rearing grounds. This was another female of uncertain age banded on 1 September 1956, and shot 10 October 1957, in Belfast, Maine, 350 miles northeast of the banding location.

WEIGHTS

Weights of known juveniles and adults have varied little from year to year. Figure 2 shows the overlap in weight of the different age and sex groups. By the time juveniles were active enough to take part in evening flights, weight was an unsatisfactory criterion for separating the age groups. Table 4 represents weight changes in three adults and 12 juveniles captured twice at intervals of at least ten days. Weight changes of a few grams are of no significance.

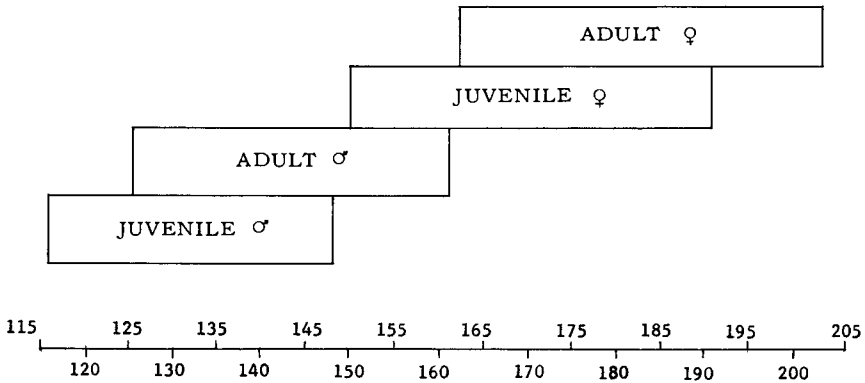


FIG. 2. Weights in grams of 112 woodcocks netted in Massachusetts in the summer of 1956.

Subsequent weighing of a large number of captive birds demonstrated weight fluctuations depending on when the birds had last consumed a meal. Each bird ate approximately 150 grams of earthworms every 24 hours. Because of rapid metabolism and digestion, weights would seldom vary more than 20 or 30 grams. Table 4 offers evidence that juveniles had attained mature growth by the time they engaged in evening flights. If growth had not ceased, much greater changes in weight would have taken place. The greatest gain took place with one adult female and two juvenile females first

TABLE 4
CHANGES IN SUMMER WEIGHT (IN GRAMS) OF 15 WOODCOCK
CAPTURED TWICE AT INTERVALS OF AT LEAST 10 DAYS

Sex	Age	Date first caught	Weight when first caught	Date of second capture	Weight on recapture	Weight change
♂	Ad.	25 June '57	127	18 July '57	132	+ 5
♂	Juv.	13 June '57	126	25 June '57	129	+ 3
♂	Juv.	25 June '57	147	12 July '57	150	+ 3
♂	Juv.	23 June '57	121	23 July '57	124	+ 3
♂	Juv.	6 July '56	139	30 July '56	142	+ 3
♂	Juv.	25 June '58	158	23 July '58	155	- 3
♂	Juv.	29 June '58	135	23 July '58	145	+ 10
♀	Ad.	3 July '56	165	28 Aug. '56	184	+ 19
♀	Ad.	30 June '58	165	20 July '58	170	+ 5
♀	Juv.	19 June '57	154	7 July '57	171	+ 17
♀	Juv.	26 June '57	173	12 July '57	187	+ 14
♀	Juv.	13 June '57	184	1 July '57	184	0

caught 3 July 1956, and recaptured the same year in late August or early September. These gains probably represented the beginning of fat accumulation preceding the fall migration. Examination of specimens taken late in the summer revealed the beginning of the growth of fat.

MOLTING

Duvall (1956) has described methods of distinguishing juveniles and adults in the summer, before the former have molted, by plumage characteristics on the back and scapulars. An important finding from summer netting has been a record of the molting sequence for adults and juveniles. This information will be published later. Suffice it to say that because juveniles do not molt their primaries in the first year, a careful study of primary feather wear revealed a method of aging fall-shot woodcocks by examination of one wing (Sheldon, Greeley, and Kupa, 1958). To further apply this technique, large fall wing-samples have been collected from hunters in the northern breeding grounds. Data gathered from this source should greatly augment our knowledge of annual population and production trends. Greeley (1953) has described a method of sexing woodcocks on the basis of outer primary width; so sex as well as age ratios can be calculated from wing collections.

SUMMARY

Seven hundred and forty-six woodcocks captured by Japanese mist nets at dusk in fields provided significant data on summer behavior of this species. The alighting areas varied in size and vegetative composition, but all were situated near the center of spring breeding grounds. The sex and age composition of birds captured showed a preponderance of juvenile males and adult females. Reasons for such age and sex discrepancy are discussed. Factors prompting these evening flights are suggested. Evidence points to food as the most important factor. Behavior of these birds has been described. The alighting grounds were dry and the food consisted primarily of fly, beetle, and moth larvae. Returns suggest homing behavior on the part of all age and sex groups. Molting studies of these summer birds provided the technique for aging and sexing wings of fall-shot birds.

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DEPARTMENT OF FORESTRY AND WILDLIFE MANAGEMENT, UNIVERSITY OF MASSACHUSETTS, AMHERST, MASSACHUSETTS, 20 MAY 1960