

# Age and sex determination of Purple Finches during the breeding season

Robert P. Yunick

## Introduction

The usual guides such as Forbush (1929), Roberts (1955), and Wood (1969) used by bird banders to determine age and sex of passerines do not address the existence of a group of Purple Finches (*Carpodacus purpureus*) which lack external sex-determining characteristics (brood patch or cloacal protuberance) during the breeding season. Through an extensive series of recaptures of a breeding/summering population of Purple Finches, I have determined the identity and apparent status of such individuals. In conjunction with this I reviewed certain aspects of the breeding of this species which are also reported here.

## Methods and results

In the past 13 years, spanning the period 11 August 1970 through 31 August 1982, I have operated a year-round feeding and banding station at a summer cottage at Jenny Lake in the Adirondack Mountains near Corinth, Saratoga Co., New York. The Purple Finch has been the most abundant species attracted to the feeders, and has represented about one-half of the birds mist netted and banded. This study is based on 10,007 captures of this species involving 5,443 bandings, 1,039 returns, and 3,525 repeats.

At the time of capture, I examined these birds for brood patch (BP) or cloacal protuberance (CP) and determined their age and sex using these characteristics in combination with plumage coloration and condition; degree of skull pneumatization; and, where applicable, molt condition. Using the information contained in Forbush, Roberts, and Wood, rose-colored birds with or without CP's were classed as after-second-year males (ASY M) prior to the completion of their prebasic (postnuptial) molt; and after-hatching-year males (AHY M) after completion of that molt. Prior to, or in the absence of, the first appearance of a BP or CP, brown-plumaged birds were classed after-hatching-year birds of unknown sex (AHY U). During the breeding season, brown-plumaged birds with brood patches were after-hatching-year females (AHY F); and those with CP's were second-year males (SY M). Also, any bird found molting flight plumage from brown to rose was called an

SY M, and from brown to brown an AHY F. Brown birds in juvenal plumage, or undergoing only the body and covert molt of the first prebasic (postjuvinal) molt, were called hatching-year birds of unknown sex (HY U). Brown-plumaged birds encountered after the completion of prebasic molt were aged by skull examination and were classed as AHY F, HY U, or U U.

In the early years of this project, I noticed that certain brown-plumaged individuals lacked any presence of a BP or CP during portions of the breeding season when other Purple Finches possessed one or the other of these characteristics. Subsequent captures of some of these individuals showed them to be males. In 1974 when the Bird Banding Laboratory was seeking additional information on sex and age determination for the Purple Finch, I supplied the data I had at the time and it became incorporated as Part 7a of the key for this species in the *Bird Banding Manual* (1976). With current data, the timing of applicability of 7a and 7b can be expanded.

From among my 5,443 bandings there were 295 AHY U birds representing 10.3% of all of the bandings of other-than-HY birds. Of these 295, 136 birds (46.1%) were subsequently recaptured at a time when their sex could be determined. These captures are summarized in Table 1.

Table 1. Sexual identity of brown-plumaged birds lacking brood patch or cloacal protuberance.

Date of capture as unknown sex	Sex <sup>1</sup>	
	Male	Female
April	4	7
1-10 May	2	9
11-20 May	7	17
21-31 May	0	5
1-10 June	0	0
11-20 June	4	1
21-30 June	8	0
1-10 July	33	0
11-20 July	18	0
21-31 July	18	1
1-10 August	2	0
Total	96	40

<sup>1</sup>Determined by previous or subsequent capture.

Through the end of May, 74.5% of these birds were females and 25.5% were SY M's. Since SY M's represented 44.9% of the male population and males outnumbered females by 1.10 : 1.00, based on my capture data, a distribution of 76.5 : 23.5 would be expected and is in close agreement with the observed 74.5 : 25.5. After May, through the remainder of the breeding season, the recaptures were 97.6% male. The two females that appeared during this time will be discussed in detail later.

All of the capture data were reviewed to determine the dates of first and last appearance of CP's among males, and BP's among females. From among 750 ASY M bandings and their additional recaptures, the date of first CP was 24 April. During the period of 14 May to 1 July every ASY M that was encountered either during banding or recapture had a CP. The date of last appearance was 11 August. From 610 SY M bandings and their additional recaptures, the first occurrence was 9 May, the period during which all captures possessed a CP was 14 May to 14 June, and the last occurrence was 4 August. For 1,272 AHY F bandings, the first BP was recorded on 9 May, all encountered females had BP's between 27 May and 7 August (with two exceptions which are discussed later), and the latest recorded BP was 20 September. These dates are represented schematically by age/sex group in Figure 1. Also represented in Figure 1 are data on arrival dates, egg dates, fledging dates, and departure dates.

The arrival dates in 9 of the 12 years for which I had data fell in the range of 27 March - 24 April (average, 13-14 April). Without the extreme date of 27 March which occurred following the winter of 1976-1977 when there had been a winter invasion of this species, the range was 7-24 April (average, 15-16 April). I discarded

dates of 5, 6, and 29 May which I believed were not representative on the basis that I had not been present in April at the appropriate time.

Egg dates ranged from 15 May to 17 July based on observations of eggs in the oviducts of 22 females. The range of first fledging dates, based on first banding or first appearance at the feeders for 12 years, was 28 June to 20 July, 5 of the 12 fell during 1-4 July, and the average was 7 July. The last fledging date was based on the last recorded appearance of wing-fluttering, begging, young being fed by an adult. This occurred on 28 August 1981 and 1982. It was corroborated by captures on 25 and 26 September 1981 of juveniles that had not yet begun their first prebasic molt. The first recorded instance of this molt, which starts usually with the lesser wing coverts, occurs about 30 days following the first recorded fledging, thereby placing the fledging of these 2 non-molting individuals back to at least as late as 26 and 27 August.

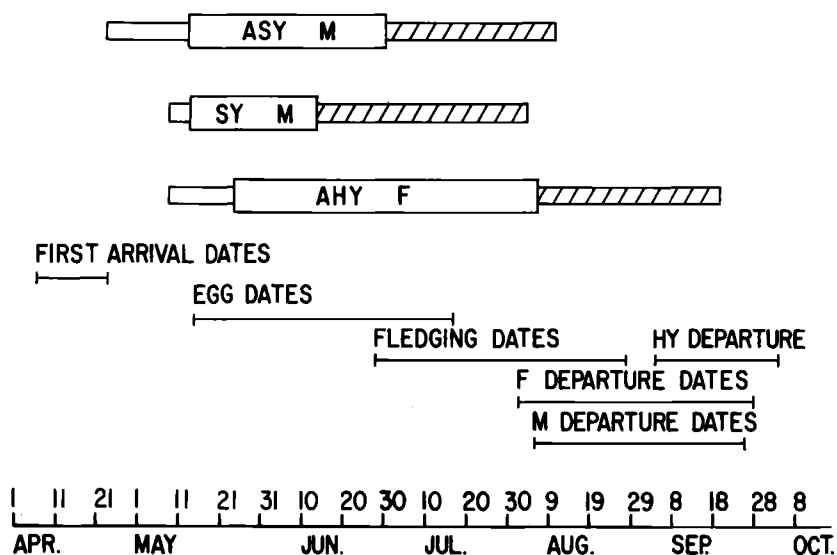
The determination of departure dates was compounded slightly by the occasional appearance of a few fall migrants. By ruling out groups of late bandings which showed no subsequent returns, the last capture dates for 12 years ranged 6 August to 26 September (28 August average) for males, with 8 of those years ranging 6-30 August. Females ranged 2 August to 28 September (31 August average) with 6 years ranging 2-28 August. Young of the year ranged 4 September - 4 October (19 September average) with 10 years ranging 7-30 September.

## Discussion

From this capture information, the following breeding schedule can be developed. Purple Finches arrive at this Adirondack breeding ground typically in mid-April

Figure 1.

Timing of breeding season events for the Purple Finch. Key: narrow bar = at left, date of first recorded BP or CP; wide bar = time period when all captured individuals possessed BP or CP; narrow bar with diagonal line = at left, date of first recorded lack of BP or CP and at right, date of last recorded BP or CP. Bracketed lines represent extreme date ranges for described events.



(± a week) led by all or nearly all males. The first ASY M with a CP was recorded on 24 April, 15 days before the first SY M. The first female with a BP was recorded on 9 May, 15 days following the first sexually prepared male; and the first egg date was recorded on 15 May, 6 days following the first recorded BP.

The ASY M's remained in breeding condition longer than the SY M's for an extreme period of 109 days vs. 87 days. The period during which all encountered ASY M's had a CP extended 17 days beyond that for SY's, 48 days vs. 31 days.

The first fledgling appeared 44 days following the first egg date. The last fledgling appeared 42 days following the last egg date. Shortly after the first young fledged, the ASY M's began losing their CP's. SY M's had previously begun losing theirs about half way through the egg-laying period. The egg-laying period lasted 63 days and the fledging period 61 days.

The egg date range of 15 May - 17 July agrees closely with the 13 May - 16 July (64 days) range of Bull (1974) for New York and extends the state record late date by one day. It differs substantially from the 15 May - 23 June range (39 days) of Bent (1968) for New York, and the 10 May - 19 June (40 days) range of Forbush for the neighboring New England states. By adding Forbush's 13-day incubation period to my 17 July egg date, one gets a hypothetical nestling date of 30 July which exceeds Bull's late date of 24 July. Adding the 14-day nestling period from the *Bird Banding Manual* (1976) gives a hypothetical fledging date of 13 August. Fledgings at mid-August are not uncommon, thereby confirming the timing of this sequence of events. My fledging date range of 28 June to 28 August exceeds the late date of Bull's range of 10 June - 1 August by a substantial margin, setting a record late New York date.

Forbush attributes one brood to this species, while Bull cites banding data that confirm double-brooding in New York. My data suggest double-brooding based on two factors. The lapse of time between first fledging (late June and early July) and later fledging, which occurred commonly to mid-August and at latest to near the end of August, is about 40 to 60 days. In this time span there is adequate time for the 42 to 44 day period observed between egg date and fledging date to allow for a second brood. Secondly, the capture record of an individual female circumstantially supports double-brooding. The female which established the late egg date of 17 July had been captured with a fully developed BP 47 days earlier on 31 May. She was presumed breeding (incubating) on 31 May and had adequate time (47 days) to fulfill that required (42 to 44 days) to fledge young before she was confirmed as a breeder on 17 July. The sequence and chronology of events do not suggest re-

breeding due to a first-brood failure. Such re-breeding attempts occur typically only in the very early stages of nesting and not 47 days later during which time a brood could have been successfully raised. Also, as pointed out above, the 17 July egg date is consistent with observed mid-August fledgings.

In some years the last adult male and female were captured as early as 6 and 2 August, respectively, 29 to 33 days prior to the same last capture of an immature on 4 September. The average last capture dates were 28 August for males, 31 August for females, 22 to 19 days before the 19 September date for immatures. Thus the departure of some adults from their breeding ground precedes the departure of the young from their natal ground by 3 to 5 weeks.

While the initiation of the loss of CP in males appears to coincide with the onset of fledging of the young, females retain their BP well past the last egg date and even beyond last fledging. This is apparently because the BP does not refeather until well into the female's prebasic molt which does not start until near the end of her family rearing responsibilities. In males, the timing of the beginning of flight feather molt coincides approximately with the time of the beginning of the loss of the CP.

I believe that a word of caution about recognizing a BP is in order. Juveniles lack substantial feathering on the abdomen and at times, at first glance, appear to be females with BP's. Also, when HY's undergo their first prebasic molt, their abdomens possess sheathing similar to that of the AHY F's undergoing refeathering of their BP's. Confusion between a juvenile and an AHY F can be avoided by keeping in mind the following criteria:

1. Before the abdomen begins to develop feathers, the bare abdomens are characterized as follows:
  - a. Juveniles have *smooth, clear, tightly-fitting* skin through which the muscle tissue beneath it stands out as a bright flesh color.
  - b. AHY F's BP's are *slightly shriveled* to *loosely wrinkled* and are usually *whitish opaque* or *translucent* through which the breast muscle may not be clearly seen.
2. While abdominal re-feathering is occurring:
  - a. Juveniles have no accompanying flight feather molt.
  - b. AHY F's undergo simultaneous flight feather molt.

Based on the schedules portrayed here and on the observed 1.10 : 1.00 ratio of males to females, it appears that these SY M's lacking CP's during part of the breeding season are individuals which attempted to breed but did not succeed. As a result, their CP's resorbed well in advance of those of the apparently more successful ASY

M's. Since 15.7% of all of the SY M's captured were these apparently unsuccessful breeders and since 44.9% of all males were SY's, these apparent non-breeders represent 7.0% of the total male population. When they are factored out of the population, the previously determined male : female ratio of 1.10 : 1.00 becomes 1.02 : 1.00.

Based on this information and on the new dates presented here, keys 7a and 7b for this species in the *Bird Banding Manual* may be revised as follows. The applicable period for calling brown-plumaged birds SY M's, when they lack a CP and BP, is 1 June to early August, as opposed to the earlier suggested 10 June - 25 July (7a). Females may be recognized by the presence of a BP from early May to late September vs. the previously stated May-August period. The criterion for identifying this group of SY M's was 97.6% reliable on a sample of 85 birds. The 2 females that appeared in this group (brown plumage with no CP or BP) represent the only cases of apparent female non-breeding from among 1,272 female bandings (0.16%).

The first of these females was captured initially as a brown-plumaged bird with a BP on 4 July 1979 and was presumed breeding. On 25 July 1980 she similarly had brown plumage, a BP and, as yet, no molt. However, in 1981 she apparently did not breed because on 18 July she had no BP and was molting from brown to brown plumage and her molt was well advanced to include new primaries 1 through 3, with 4 and 5 in molt and the lesser and greater coverts already renewed. Had she possessed a BP during this breeding season, it would still have been apparent and would have begun to show small closed sheaths at this time. Instead, she had a normally-feathered abdomen characteristic of a female prior to breeding in April. In 1982, she was recaptured again on 13 June and was in brown plumage, and lacked a BP and any evidence of molt. Whether she no longer bred after 1980, due to age or some other factor, was not apparent.

The second bird was presumed to be a female based on only one encounter. On 31 July 1982 she was captured in brown plumage, lacking a BP and molting into new brown plumage. She had renewed primaries 1 and 2, partially renewed 3 and 4, and was missing 5. The lesser and middle coverts were new, and the upper breast,

back, and rump were a mixture of open and closed sheaths. As with the first bird, she had no hint of a BP or BP refeathering.

## Summary

A 13-year study involving 10,007 captures of Purple Finches at a breeding/natal ground in New York's Adirondack Mountains allowed: 1) review of the age- and sex-determining criteria during the breeding season; and 2) construction of the species' breeding schedule from April until departure in September and October. Based on a sample of 85 brown-plumaged birds found to lack external breeding characteristics in the period June through August, 97.6% were second-year males. Previous age/sex schemes for this species have not treated this group of apparent non-breeding individuals. The male population was made up of 44.9% second-year birds, of which 15.7% appeared to be non-breeders. When these non-breeders were factored out of the population, the male/female ratio changed from 1.10 : 1.00 to 1.02 : 1.00. Only 2 cases of apparently non-breeding females out of a sample of 1,272 females (0.16%) were encountered.

## Literature Cited

- Bent, A.C. 1968. Life Histories of North American Cardinals, Grosbeaks, Buntings, Towhees, Finches, Sparrows and Allies. Bull. 237, Part 1. Smithsonian Institution Press, Washington.
- Bull, J. 1974. Birds of New York State. Doubleday/Natural History Press, Garden City, N.Y.
- Forbush, E.H. 1929. Birds of Massachusetts and other New England States. Norwood Press, Norwood, Mass.
- Robert, T.S. 1955. The Birds of Minnesota and Neighboring States. The University of Minnesota Press, Minneapolis.
- U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1976. North American Bird Banding Manual, Vol. 1. Departmental Manuals and Reports Production Division, Ottawa.
- Wood, M. 1969. A Bird-Bander's Guide to Determination of Age and Sex of Selected Species. The Pennsylvania State University, University Park, Penn.

1527 Myron St., Schenectady, NY 12309

