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Observations of the Decline Over 47 Years, 1970-2016, in an Adirondack Breeding Population of Purple Finches Attributable to Climate Change

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ABSTRACT

*Over a 47-year period, 1970-2016, a breeding population of Purple Finches (*Haemorhous purpureus*) was studied at an Adirondack mountain, New York state, location leading to the banding of 13,256 finches and 3240 return captures in subsequent years of these birds (16,494 total captures, not including thousands of same-season repeat captures). Purple Finches were abundant breeders between 1971-1990, but declined abruptly from 1991-1995 through 2011-2015 by 52.1%. This decline coincides with a shift in the National Temperature Index anomaly going from negative to positive by +2.08° F during the Apr-Sep breeding season from 1971-1975 to 2011-2015. Average spring arrival dates were earlier by eight days from 16 Apr to 8 Apr and banding dates for newly fledged immatures were also earlier by eight days from 9 Jul to 1 Jul. Adult males (3309 banded, 51.9%) outnumbered adult females (3063 banded, 48.1%) but included 814 brown-plumaged adults early in the season of unknown sex; 6017 hatching-year birds were banded. Returning adult males more greatly outnumbered adult females by 61.5% to 38.5%; while hatching-year birds that returned at a time when their sex could be determined were 58.9% male, 41.1% female. The oldest recaptured finches by their respective sexes were two males at 11 yr-01 mo and a female at 10 yr-0 mo.*

INTRODUCTION

The Purple Finch (*Haemorhous purpureus*) is a widespread breeder in New York state favoring cool, moist forested areas containing conifers preferably above 305 m (1000 ft) elevation, less so in the valleys of the Hudson, Mohawk, and St. Lawrence rivers (Bull 1974, Wootton 1996, Windsor 1998 and Young 2008). There is conflicting information on population trends depending on the geographic area surveyed and the method of

survey. Wootton (1996) reported a 50-% decline in breeding population in the wide area of northeastern United States and eastern Canada from 1966-1994 based on Breeding Bird Survey (BBS) data. He found the decline strongly associated with large increases in House Finch (*Haemorhous mexicanus*) populations, not to climatic or habitat variables. The House Finch is a species of lower elevations in New York and almost completely absent from the higher elevation Adirondack region based on Breeding Bird Atlas (BBA) data (Driscoll 2008). In New York state, Windsor (1998) cites BBS data attributed to Peterjohn (1995) of a 1.2% per year decline from 1980-1994. Young (2008) in his comparison of New York's two BBA periods from 1980-1985 and 2000-2005 refers to BBS data by Sauer et al. (2005) that do not show a significant pattern from 1980-2005 and BBS trend data for New York have been largely stable over the past 40 years. Here I report on a thriving Adirondack breeding population from 1970-1991 which, in the mid-1990s and thereafter declined in population coinciding with the National Temperature Index Average Temperature Anomaly going from negative to positive due to global warming.

METHODS

As described previously (Yunick 2014), banding was conducted starting in August 1970 at my seasonal camp in the Adirondack State Park at Jenny Lake, 7 km west of the village of Corinth, Saratoga County, New York, at 43°16'13.55" N, 73°54'36.54" W. The banding station was at an elevation of about 370 m (1270 ft) in lakeside forest dominated by white pine (*Pinus strobus*), Eastern hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*) and lesser amounts of oak (*Quercus* spp.), American beech (*Fagus grandifolia*) and spruce (*Picea* spp.).

During the “summer” season of late June through early September, I was either in residence or visiting regularly on weekends; while during May, early Jun and late Sep, I visited my study site on weekends. During the “winter” season, Oct-Apr, excluding 1970-1972, I made visits at intervals of 6-15 days to refill feeders and conduct banding sessions. Three sunflower seed feeders were employed during the summer season, 1970-2016 and once a snow-proof feeder design was developed, it was employed in the 1973-2016 winter seasons assuring an uninterrupted supply of seed through the course of the study. Each feeder had a 6-m or 12-m mist net within 1-2 m of the feeder in winter, and in the summer season an additional three 12-m nets were within 10 m of the feeders. Banding sessions, (typically a minimum of two hrs, longer if birds were abundant) were conducted every month of the year except the winter months of 1970-1971 and 1971-1972 before I had devised and employed a winter snow-proof feeder. There were 2261 sessions conducted 1970-2016 as follows: Jan, 111; Feb, 113; Mar, 124; Apr, 157; May, 212; Jun, 177; Jul, 376; Aug, 382; Sep, 254; Oct, 111; Nov, 123 and Dec, 121. Purple Finches were aged and sexed using criteria as outlined in Yunistik (1983).

Given this was a passive capture operation influenced at times by nearby human activities in the immediate area of the feeders as well as by various avian species at the feeders, i.e., the sudden disruptive arrival of a Blue Jay (*Cyanocitta cristata*) or similar species that scattered finches and other birds into the nets, conventional use of net-hours to express finch abundance did not seem appropriate. Instead, I chose to rely on a parameter I termed “Capture Index.” It was arrived at by noting as years passed and annual banding totals declined, so did annual daily maxima of birds banded declined. For instance, in the 1970s-1980s a maximum catch in one banding session could be 50-60 finches (maximum was 96) while in the 2000s-10s a maximum daily catch never exceeded 35, more typically was mid-teens to mid-20s. The “Capture Index” consisted of a total of the finches banded during the two highest banding sessions

per year collected into five-year intervals 1971-1975, 1976-1980, etc. Also included for comparison purposes are banding data, 1964-2012, on Purple Finches captured in the backyard at my residence in Schenectady, New York, at an elevation of 124 m (407 ft) at 42°49'01.92"N, 73°53'54.68" W, 11 km (31 mi) due south of Jenny Lake in a suburban residential area. Birds were captured using two platform traps (Yunistik 1971) baited with sunflower and thistle seed; as well as with one 6-m and three 12-m mist nets along the perimeter of the yard.

Climate data were accessed online from the National Temperature Index (NOAA 2018) using the Average Temperature Anomaly, ClimDiv dataset for northeastern United States, 1971-2015. NOAA's National Temperature Index consists of National Weather Service (NWS) data back to 1895 from which annual temperature norms were established. The Average Temperature Anomaly used here is the deviation in degrees Fahrenheit from the norm. A negative anomaly indicates a cooler climate and a positive one a warmer climate. Anomaly data were analyzed annually for the entire year, Jan-Dec, as well as separately for the breeding season, Apr-Sep, by averaging data by five-year intervals; 1971-1975, 1976-1980, etc. Also consulted were National Weather Service (NWS) data collected at the nearest NWS station to Jenny Lake located 26 km (16 mi) ENE from Jenny Lake at Floyd Bennet Memorial Airport, Glens Falls, Warren Co., New York at 43.34° N, 76.61° W at an elevation of 101 m (333 ft) commonly referred to as Warren County Airport.

Observations on the presence of symptoms of conjunctivitis in the finches' eyes caused by the bacterium *Mycoplasma gallisepticum* were recorded to assess its possible role in the observed population decline.

RESULTS and DISCUSSION

Data from Jenny Lake and Schenectady were summarized in a series of tables and figures as follows.

Table 1 summarizes the yearly number of birds banded as well as the number of return captures of birds banded previously for the years 1970

through 2016 at Jenny Lake. Age/Sex classes are as follows: ASY/M is After-Second-Year/Male, a rose-colored bird before completion of its prebasic molt; AHY/M is After-Hatching-Year/Male, a rose-colored bird in Aug-Dec after completion of its prebasic molt; SY/M is Second-Year/Male, a brown-plumaged bird with a cloacal protuberance (CP); AHY/F is After-Hatching-Year/Female, a brown-plumaged bird with a brood patch (BP); AHY/U is After-Hatching-Year/Unknown, a brown-plumaged bird either early or late in the season with no CP or BP, not an HY (see below); U/U is a brown-plumaged bird of unknown age and sex; and HY/U is Hatching-Year/Unknown, a brown-plumaged bird in new, unworn juvenal plumage with pointed rectrices lacking flight feather molt Jun-Dec of unknown sex.

Table 2 summarizes the monthly distribution of Purple Finches banded at Jenny Lake from 1970-2016. Blank spaces indicate no captures were made that particular month though banding sessions were conducted each month, as noted above in METHODS.

Table 3 summarizes return recapture data on birds banded as HY/U at Jenny Lake and recaptured there out to 10 years following banding. Also, it lists the annual return rates of HY birds a year later as SY birds averaging 7.9%, range 0 to 20.4%.

Table 4 summarizes the sex ratio data based on sex of birds recaptured after having been banded as HY/U at Jenny Lake, males were found to outnumber females 58.9% to 41.1%.

Table 5 summarizes monthly numbers of Purple Finches banded at Schenectady, 1964-2012, where many thousands of banding sessions were conducted except for Jun-Aug when far fewer were conducted. Years not listed and monthly blank spaces indicate years/months when no finches were banded, though banding sessions were conducted in each of those listed months for every year in the 1964-2012 period.

Table 6 summarizes re-encounters of 32 individual Purple Finches (excluding 13 others at distances of less than 10 km from the site of banding) as follows referring to these birds by their number in the left

most column of the table. Birds 1-15 originally banded at Jenny Lake re-encountered in a southerly direction outnumbered Jenny Lake birds 16-29 re-encountered to the north or east. These 20 birds represent 0.15% of the 13,256 banded at Jenny Lake. If the 13 nearby re-encounters are added to the 20 distant re-encounters, the total re-encounter rate is 0.25%. Only three finches, birds 21-23, banded elsewhere were ever retrapped at Jenny Lake. Nine finches (birds 24-32), 0.30% of the 3007 banded at Schenectady were recaptured elsewhere.

Figure 1a is a plot of the first dates of banding of Purple Finches returning to their Jenny Lake breeding area. There is no datum point for 1971-1975 because of inadequate coverage in Apr-May of some of those years. The average first date of banding was 16 Apr for the 20 years 1976-1995 and 8 Apr for the next 20 years, 1996-2015. The first date of banding ranged from 19 Apr in 1991-1995 to 5 Apr in 2006-2010.

Figure 1b represents the dates of first banding of newly fledged juveniles averaging 9 Jul for the 25 years 1971-1995 and 1 Jul for the next 20 years 1996-2015, also earlier by eight days, coinciding with the earlier arrival of breeding adults shown in Figure 1a. Average extreme dates range from 11 Jul in 1976-1980 to 30 Jun in 2006-2010.

Figure 1c illustrates a stable Capture Index for 20 years, 1971-1990, averaging 420 finches per five-year intervals followed by an abrupt change in that trend line beginning in 1991-1996 averaging 201 finches per five-year intervals for the next 25 years, a decline of 52.1%.

Figure 1d shows the change in Temperature Index over the 45-year period, 1971-2015, for both the annual 12-month Jan-Dec period as well as the Apr-Sep breeding season. Temperatures below the zero line represent a temperature anomaly cooler than average while those above zero are an anomaly warmer than average. Both the Jan-Dec and Apr-Sep trends show warming, the former going from -1.01°F to +0.75°F a change of +1.76°F, while the latter went from -1.19°F to +0.89°F, a change of +2.08°F.

Figures 2a-2c present data from Warren County Airport, Glens Falls, New York, analyzed by averaging data by five-year periods, 1971-1975 through 2011-2015, and using regression analyses to ascertain trend lines. In those analyses, the five-year intervals were converted to x values where 1971-1975 was x=1 consecutively out to 2011-2015 where x=9.

Figure 2a represents the five-year averages of the Maximum Annual Temperatures (MaxAnnTemp), 90.4° to 94.4° F. Among individual years within each five-year interval, the range in values was 88°F in 1996 to 100° F in 1988, a range of 12°F. Regression analysis produced the equation represented by the line in the graph, $\text{MaxAnnTemp} = 93.57 - 0.047x$, $r^2 = 0.01$, $P = 0.79$, no significant change over the 45-year period.

Figure 2b shows the five-year averages of the Minimum Annual Temperatures (MinAnnTemp), ranging from -27.4° to -17.0° F, with extreme values for individual years ranging from -35° F in 1994 to -4° F in 2001. Regression analysis gave $\text{MinAnnTemp} = -26.32 + 0.91x$, $r^2 = 0.59$, $P = 0.015$, a significant increase. The predicted values increased by +7.31° F from 1971-1975 to 2011-2015.

Figure 2c is a plot of the five-year averages of the Annual Average Temperatures (AnnAveTemp), ranging from 43.96° to 46.58° F, with extreme values for individual years ranging from 42.9° F in 1978 to 48.8° F in 1998. Regression analysis gave $\text{AnnAveTemp} = 44.55 + 0.18x$, $r^2 = 0.497$, $P = 0.034$, a significant increase. The predicted values increased by +1.49° F from 1971-1975 to 2011-2015.

Breeding Status/Decline

Banding data in Tables 1 and 2 show that the Purple Finch is a breeding species (95.2% of finches banded were banded May-Sep) as well as being a very rare winter visitor at Jenny Lake; while at Schenectady 11 km to the south at a lower elevation (Table 5) it was sometimes abundant in winter (1965, 1975 and 1977) and a regular spring migrant until 1990, declining thereafter. The months of March and April accounted for 68.9% of its Schenectady captures. Even during the large invasion at Vol 43 No. 2&3

Schenectady of 1372 finches banded Jan-Apr 1977, only 18 were banded during those same months at Jenny Lake. Two birds in Table 6 show a Schenectady-Jenny Lake connection. A female banded 27 Jun 1976 at Jenny Lake was retrapped at Schenectady 24 Feb 1977 (Bird No. 6) and an AHY/U (No. 23) banded at Schenectady 20 Apr 1977 was recaptured at Jenny Lake 14 May 1978 as an ASY/M.

There were unexplained declines in numbers of HYs banded in 1976 and 1984 (Table 1), followed by very severe declines to only 25 banded in 1992 and 15 in 1994 even though 126 AHY/Fs (70 banded and 56 returns) were captured in 1992 and 31 AHY/Fs in 1994 which a larger yield of HYs would have been expected. Bandings of HYs lagged 1995-2004, then improved 2005-2012, only to drop off again thereafter. Total captures of birds banded plus returns also took a sharp turn downward in 1994 to a 47-year low of 107.

The mid-1990s was also a time of drastic change in the Capture Index indicated in Fig. 1c. For the 20 years of 1971-1990, the Capture Index was stable and averaged 420 birds per five-year period. It dropped abruptly in the 1991-1995 period, averaging 201 birds for the next 25 years, a drop of 52.1%. Anecdotally, another manifestation of this decline was noted by a substantial decrease in song level. The forest was bathed with constant, abundant singing by males in May-Jun of the 1970s and 1980s. By the 2000s and 2010s, song was intermittent and less abundant than in those earlier years due to lesser numbers of males present.

This same mid-1990s period was also a time of climate transition as measured by the National Temperature Index Average Temperature Anomaly depicted in Figure 1d. The five-year averages of this anomaly were negative in 1971-1975 by as much as -1.19° F for the breeding season, Apr-Sep, and -1.01° F for the year, Jan-Dec. Starting in the late 1980s through mid-1990s, the anomaly crossed into positive territory and continued to rise through 2011-2015 resulting in a breeding season anomaly of +0.89° F or a total change of +2.08° F from 1971-1975, while the annual Jan-Dec anomaly changed +1.76° F.

The climate data in Figs. 2a-2c from the nearby National Weather Service station at Glens Falls (26 km ENE of Jenny Lake) showed there was no significant change in the Maximum Annual Temperature over this 45-year interval, while the Minimum Annual Temperature rose a significant 7.31° F. The Annual Average Temperature at Glens Falls changed +1.49° F compared to +1.76° F in the National Temperature Index. For a species described as favoring cool, moist forested areas containing conifers above 305 m elevation (Bull 1974, Wootton 1996, Windsor 1998, Young 2008), this breeding population at Jenny Lake at 370 m elevation was negatively impacted (a decline of 52.1%) by these warming trends especially by a breeding season temperature change of +2.08° F.

Wootton (1996), using Breeding Bird Survey results for northeastern United States and southern Canada, found (his Fig. 4) a decline in breeding of 50% 1966-1994 attributing it to competition from large increases in House Finches. While this explanation may apply to lower elevations in New York state, it does not appear operative at the higher elevation of Jenny Lake or the Adirondacks in general because no House Finches were seen nor captured at Jenny Lake during this study, and the New York state BBA results of 1980-1985 (Meade 1988) and 2000-2005 (Driscoll 2008) show very sparse distribution of House Finches in the Adirondacks. Sauer et al. (2017) summarizing the period 1966-2015 using New York BBS Purple Finch data reported an annual trend of -1.32% with 95% confidence limits of -2.05 to -0.59, while for the most recent era of 2005-2015 the annual trend was -0.93% with confidence limits of -2.93 to +1.66.

One other manifestation of the impact of climate change in the 1990s on the Jenny Lake Purple Finch population noted in Fig. 1d was a change to earlier annual dates of banding of newly arrived breeding adults as well as earlier banding of newly fledged juveniles. Fig. 1a shows an average arrival of 16 Apr for 1976-1995 advancing eight days to 8 Apr for 1996-2015; while first banding dates of juveniles advanced also eight days from 9 Jul to 1 Jul over the same time interval.

Conjunctivitis

No symptoms were recorded in 30 of the 47 years of this study: 1971-1998 and 2012 and 2015. First symptoms were noted in 1999; but for the five-year-period, 1999-2003, only one or two cases per year were recorded.

The first major outbreak occurred in 2004 (Yunick 2005) when 23 infected finches were recorded (22 were reported in Yunick 2005, but upon re-analysis, one additional record was found). There were two known fatalities among infected finches that year, and five of the 23 infected birds were recaptured free of symptoms at intervals of 26 days, 77 days, two birds a year later as well as one ASY/M three years, four years and six years later (see also Yunick 2002).

There were other major outbreaks of 20 infected finches in 2008, 12 in 2009 and 16 in 2011. In all other years (2005-2007, 2010, 2013 and 2014) there were one to six finches per year with symptoms. All told, 98 birds out of the 16,494 total finches banded and recaptured as returns in subsequent years 0.6% presented symptoms of conjunctivitis. Among those 98 infected birds, 41 (41.8%) were HY, 35 (35.7%) were AHY/M, and the remainder (22.4%) were AHY/F and AHY/U.

Since the first major outbreak observed in 2004 post dated the population decline noted to have begun 1991-1995 in Fig. 1c. This disease appears to have played little if any role in the species' decline.

Sex Ratio

Magee (1940) called attention to the sex ratio in Purple Finches as "not a simple matter" based on brown-plumaged birds being some combination of what we would term today as HY/M or SY/M, HY/F or SY/F, and AHY/F or ASY/F. Blake (1955) addresses this same issue. In this study, males generally outnumbered females, increasingly so with age as suggested by the following.

Among finches banded at Jenny Lake as HYs of unknown sex whose sex was determined on recapture in a following year (Table 4) the M/F ratio was 58.9/41.1. Considering sex ratio of adults at time of banding at Jenny Lake (Table 1),

the M/F ratio of birds of known sex (3309 M and 3063 F) was 51.9/48.1. However, in that same sample were 814 finches (11.3% of the total sample) of unknown sex (795 AHY/U and 19 U/U) which may compromise this ratio.

In Magee's (1940) sample of 21,715 finches banded 1922-1938 at Sault Ste. Marie, Michigan, 7.96 % were brown birds of unknown sex. Based on his remaining adults of known sex, the M/F ratio was 57.4/43.2. Groskin (1950) recaptured 95 return birds out of 4469 banded at Ardmore, Pennsylvania, over a ten-year period, 1939-1947, finding a M/F ratio of 56.7/43.2. Most numerous were birds he banded in Mar and Apr (62.4%), next most numerous in Dec and Feb (31.7%).

Based on all *return* captures of birds of known sex at Jenny Lake (Table 1), 1923 M and 1202 F, the M/F ratio is 61.5/38.5; but 110 (3.4%) of the returns were of unknown sex (AHY/U). This 61.5/38.5 ratio is higher in M than the 51.9/48.1 ratio noted above for Jenny Lake finches at time of *banding* when 11.3% were of unknown sex. The decrease in percentage of birds of unknown sex from 11.3 to 3.4% should make the latter 61.5/38.5 M/F ratio a closer approximation of the adult sex ratio.

Finally, Magee (1940) found that by comparing sex ratios of return finches five and more years old, the M/F ratio was even greater at 63.0/37.0, close to the same comparison at Jenny Lake of 65.7/34.3 as illustrated below.

Longevity

The oldest Purple Finches banded as adults in this study were two males at 11yr-01mo (hereafter 11-01) and one female at 10-0. The first male, band #840-86652, was banded as an SY/M on 3 Jul 1975 and recaptured each year thereafter, except 1976 and 1982, as an ASY/M, last on 4 Jul 1985. Annual recapture dates varied from 6 May to 11 Sep. The second male, #3111-99008, was banded as an ASY/M on 2 Jul 2007 and recaptured in 2010, 2011 and 2013 (29 Jun to 8 Aug) and last on 23 Jul 2016. The oldest finch banded as an HY, #890-82939, on 17 Aug 1979, was a male at 10-0. It was recaptured 1985-1987 (22 Jun to 13 Jul), last on 18 Jun 1989. The oldest female, #2151-95066, banded 18 Aug 1995 as an AHY was recaptured nine times in subsequent years except 1997, 1998 and 2001 over a range of dates 13 May to 19 Aug.

Bull (1974) lists a New York State record of 14 years banded by Margaret Fitzgerald near Amsterdam, Montgomery Co., New York, in Apr 1959 and found dead nearby at Mill Point, Montgomery Co., in Aug 1967. Correspondence with D. Bystrak and J. Lutmerding at the Bird Banding Laboratory (2017) indicated that the recovery report was of "band only" not qualifying the report for a valid longevity record due to the uncertain date when the bird died. Kennard (1975) lists a North American age record of 12-08 for band #53-63223 applied by C. H. Blake at Hillsboro, North Carolina, aged AHY/U on 14 Mar 1960 re-encountered as an ASY/M on 4 Feb 1972 by Blake, currently

Magee (1940)

Age, yrs	Male, n (%)	Female, n (%)
5	107 (62.7)	64 (37.4)
6	30 (63.8)	17 (36.2)
7	11 (61.1)	7 (38.9)
8	4 (66.7)	2 (33.3)
9	- -	- -
10	1 (100)	0 (0)
11	- -	- -
Total	153 (63.0)	90 (37.0)

This Study

Age, yrs	Male, n (%)	Female, n (%)
5	101 (67.8)	48 (32.7)
6	63 (64.3)	35 (35.7)
7	32 (66.7)	16 (33.3)
8	10 (50.0)	10 (50.0)
9	6 (66.7)	3 (33.3)
10	2 (66.7)	1 (33.3)
11	2 (100)	0 (0)
Total	216 (65.7)	113 (34.3)

recognized by the Bird Banding Laboratory (2018) on its web site as the oldest accepted Purple Finch record. Wootton (1996) citing the Kennard (1975) record assigns a mistaken age of 14 yr to this same bird due to an apparent misinterpretation of the BBL age codes.

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Table 1. Purple Finch banding and return capture history, 1970 to 2016, at Jenny Lake, New York. See text for explanation of age/sex abbreviations.

Year Banded Age/Sex	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
ASY/M	6	64	82	195	29	35	41	28	73	24	56	80	39	55	24	69
SY/M	0	22	25	60	43	20	24	11	40	44	79	108	49	80	38	50
AHY/M	0	0	0	5	1	0	0	0	0	0	18	18	0	6	0	32
Total M	6	86	107	260	73	55	65	39	113	68	153	206	88	141	62	151
AHY/F	12	111	113	220	46	76	60	42	91	49	142	176	93	134	44	161
AHY/U	11	30	28	27	8	40	12	25	63	9	24	19	14	50	15	5
U/U	8	1	0	6	1	0	0	0	0	0	0	0	0	2	0	0
HY/U	183	320	330	290	109	154	63	141	113	162	313	245	227	203	72	276
Total	220	548	578	803	237	325	200	247	380	288	632	646	422	530	193	593
Cum. Total	220	768	1346	2149	2386	2711	2911	3158	3538	3826	4458	5104	5526	6056	6249	6842
Returns																
ASY/M	0	2	23	83	48	53	29	22	38	42	47	51	62	74	64	29
SY/M	0	3	12	12	3	2	2	2	3	6	7	10	14	7	6	4
AHY/M	0	0	0	2	0	0	0	1	0	0	4	8	0	2	0	3
Total M	0	5	35	97	51	55	31	25	41	48	58	69	76	83	70	36
AHY/F	0	10	28	50	24	31	27	18	14	28	32	47	47	60	37	28
AHY/U	0	4	6	3	3	7	2	1	12	2	10	2	2	8	1	0
Total	0	19	69	150	78	93	60	44	67	78	100	118	125	151	108	64
Total B + Rt.	220	567	647	953	315	418	260	291	447	366	732	764	547	681	301	657
Year Banded Age/Sex																
ASY/M	45	16	31	15	37	21	26	31	7	20	10	17	16	12	7	6
SY/M	66	52	54	49	48	34	35	16	24	39	35	29	19	42	37	14
AHY/M	0	0	6	0	2	2	0	1	0	3	0	12	0	3	0	4
Total M	111	68	91	64	87	57	61	48	31	62	45	58	35	57	44	24
AHY/F	92	48	85	65	132	58	70	60	16	49	40	33	29	59	35	22
AHY/U	2	8	12	10	23	2	53	12	4	10	6	2	6	19	14	2
U/U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HY/U	202	117	339	232	280	244	25	72	15	51	20	23	26	23	44	34
Total	407	241	527	371	522	361	209	192	66	172	111	116	96	158	137	82
Cum. Total	7249	7490	8017	8388	8910	9271	9480	9672	9738	9910	10021	10137	10233	10391	10528	10610
Returns																
ASY/M	50	53	53	34	40	42	67	42	25	35	27	10	27	32	39	11
SY/M	10	8	4	13	21	8	30	0	1	2	0	1	0	3	2	1
AHY/M	0	0	5	0	3	3	0	1	0	0	0	3	0	0	0	1
Total M	60	61	62	47	64	53	97	43	26	37	27	14	27	35	41	13
AHY/F	31	37	38	32	45	37	56	32	15	23	9	5	13	18	26	16
AHY/U	0	0	4	3	1	0	7	1	0	0	1	0	0	0	0	0
Total	91	98	104	82	110	90	160	76	41	60	37	19	40	53	67	29
Total B + Rt.	498	339	631	453	632	451	369	268	107	232	148	135	136	211	204	111

Table 1 continued.

Year	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	Total
Banded																
Age/Sex																
ASY/M	19	28	19	11	12	25	16	12	26	16	17	11	6	20	17	1472
SY/M	42	25	29	21	31	38	21	18	25	26	49	18	32	7	30	1698
AHY/M	0	0	1	1	0	5	0	0	9	0	4	0	1	0	5	139
Total M	61	53	49	33	43	68	37	30	60	42	70	29	39	27	52	3309
AHY/F	42	53	49	40	31	61	43	25	56	29	71	16	32	19	33	3063
AHY/U	9	14	23	18	36	11	8	27	17	24	7	13	9	1	13	795
U/U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
HY/U	26	91	40	130	113	123	165	52	76	68	105	19	49	39	27	6071
Total	138	211	161	221	223	263	253	134	209	163	253	77	129	86	125	13256
Cum. Total	10748	10959	11120	11341	11564	11827	12080	12214	12423	12586	12839	12916	13045	13131	13256	
Returns																
ASY/M	31	41	35	21	25	30	35	19	31	22	28	14	17	10	22	1630
SY/M	0	2	3	4	6	14	2	3	2	2	5	5	0	2	2	249
AHY/M	0	0	0	1	0	3	1	1	1	0	0	0	0	0	1	44
Total M	31	43	38	26	31	47	38	23	34	24	33	19	17	12	25	1923
AHY/F	13	19	27	14	27	27	24	22	23	18	21	18	11	9	15	1202
AHY/U	0	0	2	0	5	3	1	14	0	0	2	1	1	0	1	110
Total	44	62	67	40	63	77	63	59	57	42	56	38	29	21	41	3240
Total B + Rt.	182	273	228	261	286	340	316	193	266	205	310	115	158	107	166	16496



Table 2. Monthly totals of Purple Finches banded at Jenny Lake, New York for the years 1970 to 2016.
No finches were captured during the banding sessions conducted in November and December.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Year													Total
1970								170	50				220
1971					1	7	329	184	27				548
1972				2	31	0	233	251	45	16			578
1973					73	65	310	269	82	4			803
1974					22	63	34	105	12	1			237
1975				11	6	8	189	101	10				325
1976				5	21	14	148	11	1				200
1977	5	5	6	2	29	0	51	120	29				247
1978				14	77	40	189	59	1				380
1979				2	12	66	88	116	4				288
1980				19	6	47	88	418	49	5			632
1981				14	63	117	94	255	94	9			646
1982				13	28	60	119	140	58	4			422
1983				6	46	30	136	233	72	7			530
1984				2	33	43	41	69	5				193
1985				3	11	22	76	329	147	5			593
1986				3	22	70	106	151	51	4			407
1987				10	34	43	72	77	5				241
1988				16	29	25	171	247	34	5			527
1989				15	23	36	83	172	34	8			371
1990				1	50	26	54	281	100	10			522
1991				1	40	33	51	218	18				361
1992			2	76	38	29	52	12					209
1993			19	2	16	7	8	114	20	6			192
1994					14	14	33	5					66
1995		3		9	9	33	33	70	14	1			172
1996				3	22	47	16	22	1				111
1997			1	1	11	15	17	24	38	9			116
1998				6	15	24	39	12					96
1999			1	37	36	32	38	13	1				158
2000				7	45	24	26	33	2				137
2001			3	0	0	29	18	23	8	1			82
2002				4	27	35	42	29	1				138
2003			8	15	14	29	96	41	8				211
2004				28	36	48	46	0	3				161
2005				5	37	22	66	80	9	2			221
2006				16	43	17	65	80	2				223
2007			1	5	17	49	71	80	38	2			263
2008				3	16	60	62	98	12	2			253
2009				31	18	16	12	35	22				134
2010			2	22	21	40	34	35	55				209
2011				20	13	31	37	57	5				163
2012			5	11	10	39	79	67	39	3			253
2013				4	19	34	18	2					77
2014				9	16	33	20	39	12				129
2015					9	13	42	22					86
2016			1	11	24	19	30	16	20	4			125
Total	5	8	49	464	1183	1554	3662	4985	1238	108	0	0	13,256

Table 3. Annual capture and return data on Hatching-Year Purple Finches banded at Jenny Lake, New York, 1970 to 2014. The percentage in the far right column represents the percentage of birds returning the year following their banding, year #1 below.

Year	# birds banded	Number Returned per Year, One to Ten Years After Banding										Total	1 st Yr. %
		1	2	3	4	5	6	7	8	9	10		
1970	183	13	12	8	1	2	1					37	7.1%
1971	320	22	23	6	4	3		1				59	6.9%
1972	330	22	7	4	1	4	1					39	6.7%
1973	290	4	5	4								13	14.0%
1974	109	10	5	1	1			1	1			19	9.2%
1975	154	8	7	5	2	1	1					24	5.2%
1976	63	3	4									7	4.8%
1977	141	9	6	3	2	1	1					22	6.4%
1978	113	9	3		1	2	1	1				17	8.0%
1979	162	18	11	5	9	2	1	2	1		1	50	11.1%
1980	313	25	10	6	2	1	2	2				48	8.0%
1981	245	21	12	7	1	2		1				44	8.6%
1982	227	22	8	4	2	2	1	1				40	9.7%
1983	203	7	6	3	3	1	1					21	3.4%
1984	72	6	4	2	2							14	8.3%
1985	276	11	4	1	1							17	4.0%
1986	202	9	9	2	2							22	4.5%
1987	117	9	2	2	2	4	1					20	7.7%
1988	339	19	16	9	7	5		1		1		58	5.6%
1989	232	32	9	8	4	1	3		1	1		59	13.8%
1990	280	15	10	2	3	3	1					34	5.4%
1991	244	44	26	6	11	3	1	2	1	1		95	18.0%
1992	25	1			1	1						3	4.0%
1993	72	1		1	2							4	1.4%
1994	15	3	1	1		1	1					7	20.0%
1995	51	2	1									3	3.9%
1996	20	2	1									3	10.0%
1997	23											0	0.0%
1998	26	4	4	2	1	1	1					13	15.4%
1999	23	3			1	1						5	13.0%
2000	44	2	2	1	2		1					8	4.5%
2001	34		1					1				2	0.0%
2002	26	4	2	1								7	15.4%
2003	91	10	3	3	2	3						21	11.0%
2004	40	5	3	2	1	1	1	1		1		15	12.5%
2005	130	21	9	5	3	2	2					42	16.2%
2006	113	23	7	3	1		1					35	20.4%
2007	123	5	3	2		1						11	4.1%
2008	165	19	11	4	1	1	1					37	11.5%
2009	52	4	1	1		1						7	7.7%
2010	76	5	3	1								9	6.6%
2011	68	10	2		1							13	14.7%
2012	105	7	1									8	6.7%
2013	19	2										2	10.5%
2014	49	2										2	4.1%
Totals	6005	473	254	115	77	50	24	14	4	4	1	1016	7.9%

Table 4. Sex ratio of return Purple Finches originally banded as Hatching-Year birds of Unknown sex at Jenny Lake, New York, based on sex determined on subsequent return recapture, 1970-2015.

Year	Sex upon Return		Total	%	%	Year	Sex upon Return		Total	%	%
Banded	Male	Female	M+F	Male	Female	Banded	Male	Female	M+F	Male	Female
1970	11	16	27	40.7	59.3	1993	3	0	3	100.0	0.0
1971	28	15	43	65.1	34.9	1994	2	1	3	66.7	33.3
1972	15	14	29	51.7	48.3	1995	1	1	2	50.0	50.0
1973	5	7	12	41.7	58.3	1996	2	1	3	66.7	33.3
1974	5	4	9	55.6	44.4	1997	0	0	0	0.0	0.0
1975	6	8	14	42.9	57.1	1998	5	2	7	71.4	28.6
1976	3	1	4	75.0	25.0	1999	2	2	4	50.0	50.0
1977	9	3	12	75.0	25.0	2000	2	3	5	40.0	60.0
1978	5	3	8	62.5	37.5	2001	1	1	2	50.0	50.0
1979	17	10	27	63.0	37.0	2002	2	2	4	50.0	50.0
1980	14	14	28	50.0	50.0	2003	5	6	11	45.5	54.5
1981	16	7	23	69.6	30.4	2004	5	2	7	71.4	28.6
1982	13	11	24	54.2	45.8	2005	11	15	26	42.3	57.7
1983	8	0	8	100.0	0.0	2006	17	8	25	68.0	32.0
1984	6	5	11	54.5	45.5	2007	4	4	8	50.0	50.0
1985	12	1	13	92.3	7.7	2008	12	7	19	63.2	36.8
1986	11	7	18	61.1	38.9	2009	1	2	3	33.3	66.7
1987	7	4	11	63.6	36.4	2010	3	5	8	37.5	62.5
1988	24	12	36	66.7	33.3	2011	6	5	11	54.5	45.5
1989	24	12	36	66.7	33.3	2012	3	3	6	50.0	50.0
1990	14	10	24	58.3	41.7	2013	1	2	3	33.3	66.7
1991	30	22	52	58.0	42.0	2014	3	0	3	100.0	0.0
1992	0	2	2	0.0	100.0	2015	3	3	6	50.0	50.0
Total						377	263	640	58.9	41.1	

Table 5. Monthly totals of Purple Finches banded at Schenectady, New York, for the years 1964 to 2012. Years not listed in the far left column as well as blank month and spaces in years of Finch captures represent years when banding sessions yielded no Finch captures.

Year	Jan	Feb	Mar	Apr	May	Sep	Oct	Nov	Dec	Total
1964				2						2
1965		11	204	85	3					303
1966				4	31					35
1967				7	9	2				18
1968		2	17	26	1	1	20			67
1969				22	4					26
1971			3	20	18					41
1972				11	36		2			49
1973					5			2		7
1974				3	4					7
1975		3	277	434	94					808
1976								5	1	6
1977	220	359	304	439				1		1323
1978				55	47					102
1979			1	5			1	1		8
1980				34	1					35
1981				7			1			8
1982				23	4					27
1983				8	2					10
1984					21					21
1985		1		9				6		16
1987					2					2
1988				46	8					54
1989				5	6					11
1990				8						8
1991				3						3
1992				1						1
1995						1				1
2001			5							5
2004				2						2
2008				1						1
Total	220	376	811	1260	296	4	24	15	1	3007

Table 6. Re-encounter data of Purple Finches banded at Jenny Lake, New York, 1970-2016 divided into those re-encountered to the south as well as to the north; and finches banded elsewhere re-encountered at Jenny Lake. Included are data on finches banded at Schenectady, New York, re-encountered elsewhere.

Bird No.	Date Banded	Age/ Sex	Band No.	Date Found	Location	How Found	Direction Fr Banding Site	Distance (km)
Finches Found South From Jenny Lake								
1	10-Aug-70	HY/U	76-05937	15-Feb-74	Memphis, TN	Trap/Release	SW	837
2	20-Jul-71	AHY/F	77-34568	6-Aug-72	Wilton, NY	Trap/Release	SE	22
3	21-Jul-71	HY/U	77-34586	5-Aug-72	Wilton, NY	Trap/Release	SE ¹	22
4	23-Jul-72	HY/U	78-88900	6-Aug-73	Wilton, NY	Trap/Release	SE ²	22
5	4-Aug-73	HY/U	830-24003	13-Jan-76	Reidsville, NC	Trap/Release	SSW	906
6	27-Jun-76	AHY/F	840-87232	24-Feb-77	Schenectady, NY	Trap/Release	S	31
7	26-Sep-81	AHY/M	930-85373	1-Feb-83	Drexel, NC	Found Dead	S	1060
8	7-Aug-82	HY/U	930-85898	Feb-86	Rockford, AL	Shot	SSW ³	1558
9	13-Aug-82	HY/U	930-85908	16-Mar-83	Bluffton, SC	Cat Kill	SSW	1357
10	3-Sep-82	HY/U	930-86028	28-Mar-83	Mountain Top, PA	Telescope	SW	275
11	29-Jun-86	ASY/M	2030-25347	29-Mar-87	Laurel, MD	Trap/Release	SSW ⁴	517
12	1-Sep-95	HY/U	2151-95089	Feb-97	Wittenberg, NY	Struck Object	S	137
13	29-May-00	SY/M	1561-47471	30-Jan-02	Kentucky Lake, KY	Found Dead	SW	1405
14	8-Aug-03	HY/U	3111-04391	6-May-04	Burdett, NY	Trap/Release	WSW	251
15	6-May-13	SY/U	3111-00425	26-Oct-14	High Falls, NY	Window Kill	S	168
Finches Found at Other Directions From Jenny Lake								
16	1-Aug-80	HY/U	890-83609	16-Aug-83	Glens Falls, NY	Found Dead	NE	24
17	13-Aug-83	ASY/M	970-29277	1-Jul-84	St. Jean Baptiste, NB	Car Kill	NE	746
18	15-May-88	SY/U	2040-72119	7-May-89	West Bath, ME	Cat Kill	E	355
19	1-Sep-90	HY/U	2061-47613	22-Jul-91	Stony Creek, NY	Found Dead	N	19
20	4-Aug-95	HY/U	2151-95200	21-May-97	Warrensburg, NY	Found Dead	N	30
Finches Banded Elsewhere Recaptured at Jenny Lake								
21	12-Mar-78	AHY/U	900-91321	14-May-78	Mt. Joliet, TN	Trap/Release	NE	1311
22	25-Jul-75	AHY/U	840-54359	9-Jul-77	Wilton, NY	Trap/Release	N	22
23	20-Apr-77	AHY/U	880-17148	14-May-78	Schenectady, NY	Trap/Release	N	31
Finches Banded at Schenectady Recaptured Elsewhere								
24	19-Apr-68	AHY/U	73-32762	15-Jan-70	Newport, TN	Trap/Release	SW	1095
25	12-May-71	AHY/U	77-34355	22-Dec-71	Richmond, VA	Trap/Release	SSW	647
26	10-Apr-75	AHY/U	840-86116	Apr-78	Downsville, LA	Shot	SW	1933
27	8-May-75	AHY/U	840-86577	28-May-75	Halifax Center, VT	Found Dead	E	92
28	23-Jan-77	SY/U	840-87581	25-Feb-78	East Point, GA	Trap/Release	SSW	1358
29	26-Mar-77	AHY/U	870-55654	3-Mar-79	Williamsport, TN	Trap/Release	SW	1368
30	26-Mar-77	AHY/U	870-55663	4-Apr-77	Burnt Hills, NY	Struck Object	N	11
31	6-Apr-77	AHY/U	870-55818	23-Mar-78	Yorktown, VA	Trap/Release	SSW	653
				29-Jan-81	Yorktown, VA	Trap/Release	SSW	
32	20-Apr-77	AHY/U	880-17148	14-May-78	Jenny Lake, NY	Trap/Release	N ⁵	31

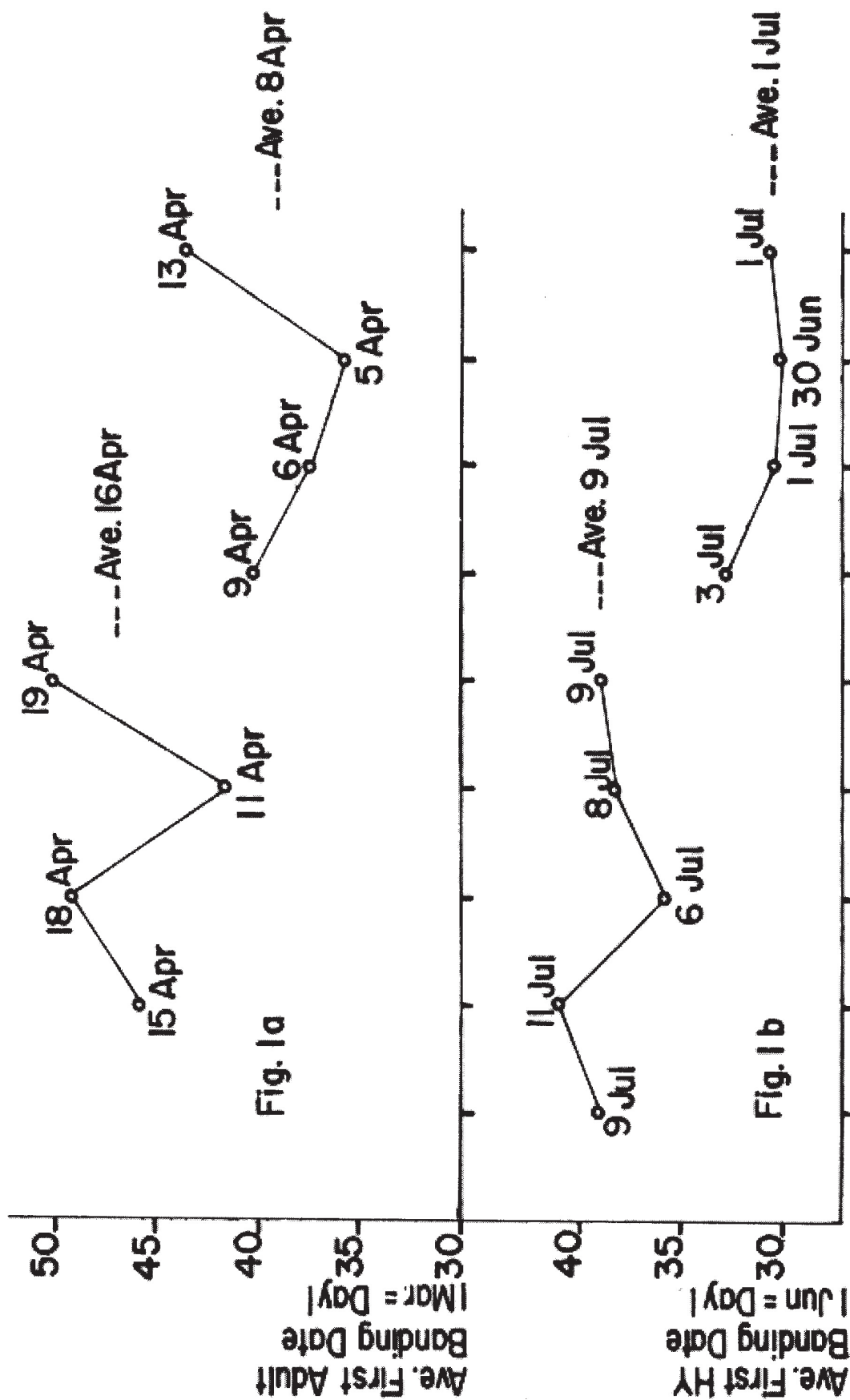
Footnotes: 1 – This bird returned to Jenny Lake 13 May 1973 and 14 Jul 1975 as an AHY/F.

2 – This bird returned to Jenny Lake 22 Jun 1974 and 3 Jul 1975 as an ASY/M.

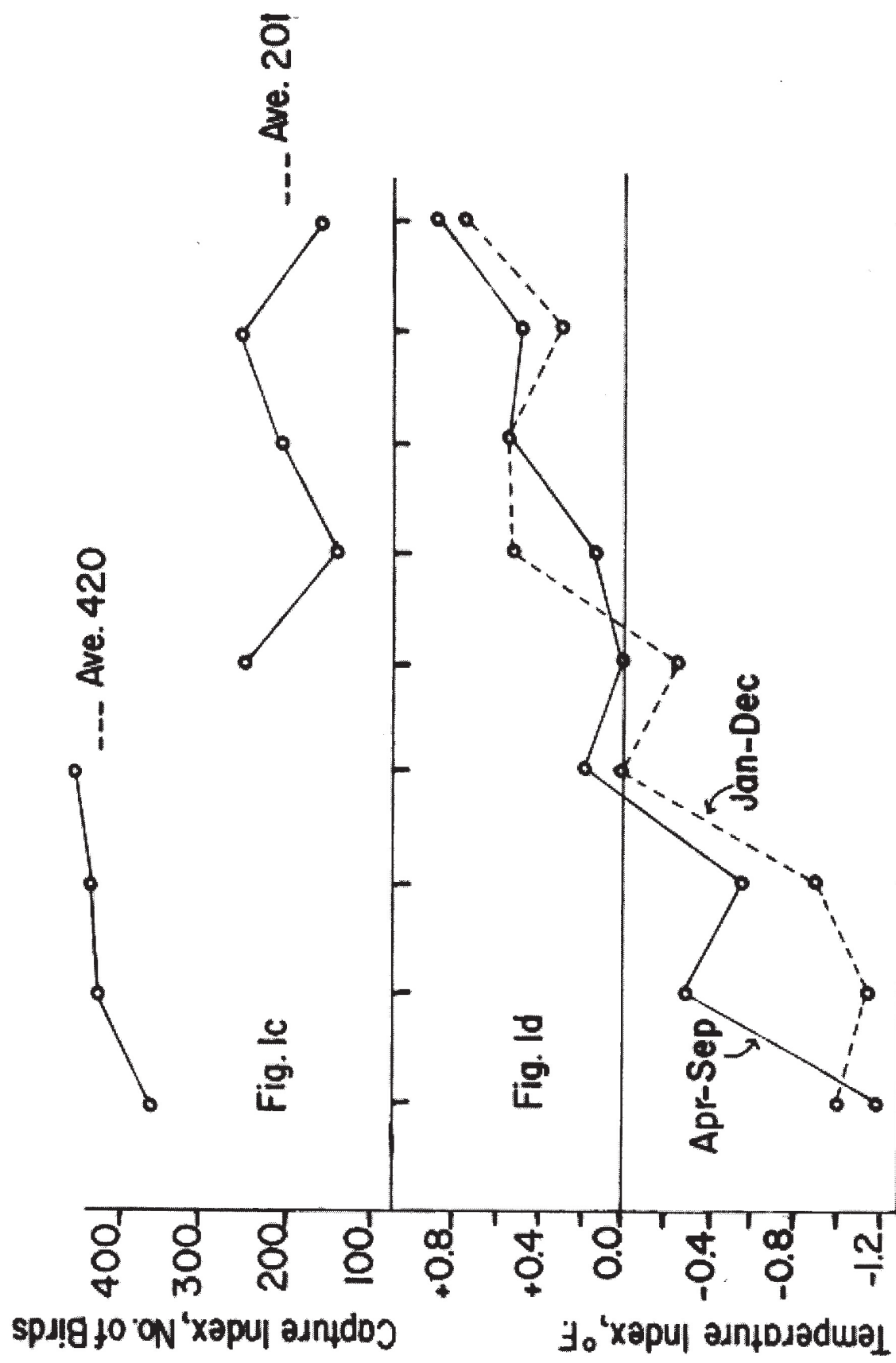
3 – This bird returned to Jenny Lake 22 May 1983 as an SY/F before being shot Feb 1986.

4 – This bird returned to Jenny Lake 20 Jun 1987 and 2 Jul 1988.

5 – This bird is the same as No. 23.



71-75 76-80 81-85 86-90 91-95 96-00 01-05 06-10 11-15
Five-year Period, 1971-75 to 2011-15



71-75 76-80 81-85 86-90 91-95 96-00 01-05 06-10 11-15
 Five-year Period, 1971-75 to 2011-15

