Observations From 24 Years, 1991-2014, of Banding an Adirondack Breeding Population of Ruby-throated Hummingbirds (*Archilochus colubris*)

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ABSTRACT

*Ruby-throated Hummingbirds (*Archilochus colubris*) were banded at an Adirondack mountain location in the state of New York over the period 1991-2014 producing 1221 birds banded and 429 returns and recaptures in the years following banding. Mist netting was used as the capture method for the first eight years, 1991-1998, yielding 232 bandings and 24 returns. A more efficient capture method using a modified Sargent trap (Russell and Russell 2001) was employed for the following 16 years, 1999-2014, resulting in 989 bandings and 405 return recaptures out as far as eight years after banding.*

During this latter 16-year period, numbers of hummingbirds banded annually ranged from 23 to 128 representing 48.9-87.9 % of the total annual captures, while returns ranged 11 to 57 annually or 12.1-51.7 % of total annual captures. Among 814 adults banded, females were 63.0% of the total, males 37.0%; but females represented 78.7% of the return captures, males 21.3%. The percentage of banded females ever recaptured at least once as a return was 38.2%, while only 22.2% of banded males were ever recaptured as a return. Among 166 banded immatures, males outnumbered females 52.4% to 47.6%, while female returns slightly outnumbered males 51.2 to 48.7%. As with adults, the percentage of banded immature females ever recaptured as a return exceeded males by 25.3% to 21.8%.

Except for the first capture period in early May when male captures exceeded females, the number of females banded as well as returned exceeded similar male captures over the entire remaining breeding season. Over the 24-year duration, the ratio of adult female bandings to adult males was 1.94:1, while among returns it averaged 3.40:1 and was as high as 4.80:1 by the fourth year after banding. No adult male was ever recaptured beyond four years after banding making it five years of age, while one adult female was recaptured every year a total of 25 times out to eight years after banding making her at least nine years old, tying the North American age record then posted on the Bird Banding Laboratory website (Bird Banding Laboratory 2015). Among banded immatures, females outnumbered males 1.08:1; while as returns, females outnumbered males 2.05:1; no male banded as an immature was recaptured beyond three years, while the oldest recaptured female banded as an immature was eight years old.

INTRODUCTION

As part of a banding operation begun in 1970 at a seasonal Adirondack camp targeting primarily seed-eating summer breeding species and wintering residents, Ruby-throated Hummingbirds were occasionally encountered in the mist nets on the property during spring and summer. A single sugar-water feeder used in 1991 indicated that greater numbers of hummers could be attracted and captured. This feeding operation was expanded to three such feeders in 1992 and maintained as such through 2014. It afforded an opportunity to define changes in abundance within the season as well as annually and assess longevity and return rates of banded hummingbirds and differences thereof between males and females, as well as other aspects about their presence on their breeding ground.

METHODS

Banding occurred at my seasonal camp in the Adirondack State Park at Jenny Lake 7 km west of the Village of Corinth, Saratoga Co., NY, at an elevation of about 370 m (1270 ft) at coordinates 431-0735. The camp is in a lakeside forest dominated by white pine (*Pinus strobus),* Eastern hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*) with lesser amounts of oak (*Quercus* spp.), American beech (*Fagus grandifolia*) and spruce (*Picea spp.*).

In 1991, the feeding strategy consisted of hanging one feeder under the north side roof overhang of the camp; and in 1992 increasing to three feeders, two of which were on the north side and one on the east side. Those three feeder locations were used annually for the duration of the study. Sugar-water was made by dissolving one part of refined cane sugar (sucrose) in four parts of non-chlorinated well water at room temperature. The feeding season began in late Apr or early May by putting one or two feeders in place, then increasing to three feeders as demand required by mid-May. Feeders were typically kept in place until late Sep or early Oct at which time a killing frost would occur. The feeders were 8-oz Perky Pet Four-Fountain brand and 32-oz Best-One brand feeders. The number and size of each feeder used among the three feeder locations was adjusted to match sugar-water demand. For instance, very early or very late in the season when demand was low, only one or two 8-oz feeders were used. When demand peaked in late May and early Jun, 32-oz feeders were at each of the three locations. Feeders were cleaned and refilled at intervals of 5-9 days as needed. Starting in 1992 and extending through 2014, each full feeder was weighed with a Pesola scale before being put in place and then reweighed when taken down prior to cleaning and refilling in order to keep track of sugar-water consumption on a daily and annual basis.

The capture strategy involved mist netting during 1991-1998 and trapping during 1999-2014. In the former case, a 6-m, 30-mm mesh polyester mist net was placed about 60 cm in front of the two north feeders to intercept birds coming to those feeders while the east feeder had been removed temporarily. During the latter years of trapping with a modified Sargent trap, this trap was constantly in place all season holding the east feeder; and during a trapping session, the two north feeders were removed temporarily while the trap was being operated. Trapping sessions of two-hour duration were the intended norm, as a means of standardizing capture effort, but occasionally might be shortened due to rain; or were intentionally discontinued if no capture was made after a lapse of 45-60 min. Starting in 2001, actual trapping times were recorded by noting on a wrist watch to the nearest quarter minute the start of operating the trap, the time of capture of a bird and the time when trapping resumed after that bird had been processed and released. These trapping-session minutes were tallied and converted to trap-hours on an annual basis to determine annual bird yields in terms of birds/trap-hr where "birds" represented the total individuals captured during a session consisting of the total of new birds banded and new returns captured (a return capture counted only once at the time of first recapture in a given year regardless if it was caught several times that year).

RESULTS

Table 1 is a compilation of first and last banding dates by age/sex class for the 16-yr period, 1999-2014, when the Sargent trap was employed as a capture method. In this table, as well as elsewhere in this paper, the ages and sexes are represented as follows: AHY signifies After-Hatching-Year (synonymous with "adult") and HY Hatching-Year (synonymous with "immature"); M signifies Male and F, Female.

Table 1. Dates of first and last banding of Ruby-throated Hummingbirds by age/sex class, 1999-2014.

	Date First Banded		Date Last Banded	
Age/Sex	Average Date	Range	Average Date	Range
AHY/M	15 May	7 May-3 Jun	17 Aug	4 Jul-29 Aug
AHY/F	18 May	10-28 May	28 Aug	19 Aug-8 Sep
HY/M	9 Aug	21 Jul-25 Aug	29 Aug	17 Aug-6 Sep
HY/F	5 Aug	20 Jul-15 Sep	28 Aug	13 Aug-15 Sep

Table 2. Annual summary of Ruby-throated Hummingbirds banded (B) and return captures (Rt.) showing distribution of returns in years following banding, 1991-2014.

Year of Banding	Number Banded	Number Returned	Total	% B	% Rt.	Number of Rt.; Years After Banding							
						1	2	3	4	5	6	7	8
1991	21	0	21	100	0								
1992	43	0	43	100	0								
1993	29	1	30	96.7	3.3		1						
1994	39	3	42	92.9	7.1	1	2						
1995	25	3	28	89.3	10.7	2	1						
1996	19	8	27	70.3	29.6	5	2	1					
1997	28	3	31	90.3	9.7	1	2						
1998	28	6	34	82.4	17.6	3		2	1				
1999	62	11	73	84.9	15.1	3	3	2	2	1			
2000	57	22	79	72.2	27.8	19	2	1					
2001	85	33	118	72.0	28.0	17	13	1	1	1			
2002	99	40	139	71.2	28.8	22	9	6	2		1		
2003	128	57	185	69.2	30.8	32	16	4	3	1	1		
2004	51	38	89	57.3	42.7	24	7	3	3	1			
2005	65	21	86	75.6	24.4	5	7	6	2		1		
2006	52	25	77	66.7	32,5	11	3	4		4	2	1	
2007	68	23	91	74.7	25.3	11	5	1	2	2	2		
2008	35	24	59	59.2	40.7	10	5	5		1	2	1	
2009	46	24	70	65.7	34.3	7	9	3	3		1		1
2010	26	13	39	66.7	33.3	6	4		2			1	
2011	73	23	96	76.0	24.0	11	6	1	3	1			1
2012	23	24	47	48.9	51.1	11	5	3	3	1	1		
2013	39	16	55	70.9	29.1	2	8	3	1	1	1		
2014	80	11	91	87.9	12.1	4		4	1	2			

Table 2 summarizes the total number of hummingbirds banded and returned per year for the entire 24-yr period, 1991-2014, as well as an annual tally of the numbers of returns by years following banding. It covers both the years of netting and trapping to represent continuity for the total period of return captures. Table 3 further defines by age/sex class the numbers of hummers banded during the trapping period 1999-2013 and returned through 2014. Table 4 compares M/F sex ratios for the hummingbirds banded over the longer 1991-2013 period returned through 2014.

Table 3. Annual summary of Ruby-throated Hummingbirds banded (B) 1999-2013 and returned (Rt.) through 2014 by age/sex class.

Year	AHY/M No.B	No. Rt.	Rt.%	AHY/F No. B	No. Rt.	Rt. %	HY/M No. B	No. Rt.	Rt. %	HY/F No. B	No. Rt.	Rt. %	Total No. B	No. Rt.	Rt. %
1999	10	5	50.0	38	17	44.7	6	1	16.7	7	4	50.0	62	27	43.5
2000	14	1	7.1	35	17	48.6	1	0	0.0	7	0	0.0	57	18	31.6
2001	24	3	12.5	38	17	44.7	10	3	30.0	13	3	23.1	85	26	30.6
2002	33	11	33.3	47	17	36,2	12	5	41.7	7	2	28.6	99	35	35.4
2003	30	8	26.7	76	17	22.4	9	1	11.1	13	6	46.2	128	32	25.0
2004	25	4	16.0	21	2	9.5	5	1	20.0	0	0	0.0	51	7	13.7
2005	20	3	15.0	31	10	32.3	7	3	42.9	7	1	14.3	65	17	26.2
2006	17	1	5.9	27	19	37.0	7	2	28.6	1	0	0.0	52	13	25.0
2007	22	2	9.1	34	9	26.5	9	2	22.2	3	1	33.3	68	14	20.6
2008	12	1	8.3	16	7	43.8	5	1	20.0	2	0	0.0	35	9	25.7
2009	16	1	6.3	27	5	18.5	2	0	0.0	1	0	0.0	46	6	13.0
2010	7	3	42.9	13	10	76.9	4	0	0.0	2	0	0.0	26	13	50.0
2011	20	1	5.0	37	9	24.3	6	0	0.0	10	3	30.0	73	13	17.8
2012	3	0	0.0	13	1	7.7	3	0	0.0	4	0	0.0	23	1	43
2013	19	1	5.3	18	3	16.7	1	0	0.0	1	0	0.0	39	4	10.3
Total	272	45	16.5	471	151	32.1	87	19	21.8	79	20	25.3	909	235	25.9

All of these tables referred to above treat data on an annual basis and some of these data are represented graphically in Fig.1. **(Figures 1, 2 & 3 are in the Appendix, pp. 9, 10 and 11).**They show annual variations in the percentage of return captures among total captures; total captures per year; total sugar-water consumption per year; as well as total captures per trap-hour, all for their respective annual intervals noted in the paragraph immediately above.

Figs. 2 and 3 address intra-seasonal variations of certain data, based on intervals of monthly halves; i.e., days 1-15 and 16-30 or 31 depending on the particular month. These monthly halves are designated May 1, May 2, Jun 1, Jun 2, etc. and cover the breeding season from May through Sep. Fig. 2 shows a seasonal profile of numbers of male and female return captures for 2000-2014 of the AHY males and females that were banded 1999-2014.

Fig. 3 shows how capture rates per trap-hr varied through the May-Sep season for the years 2001-2014 when trapping times were recorded. It also expands the data in Fig. 2 to include HY data with the AHY data showing how total captures (bandings plus returns) compared to only new bandings.

DISCUSSION

Annual Abundance – Capture data in Table 2, represented graphically in Fig. 1, show that numbers of hummingbirds caught per year were variable. The variations were modest during 1991-1998 when birds were mist netted at the north feeder. In 1999, when trapping replaced netting as the method of capture, there was an immediateince increase from 34 birds captured in 1998 to 73 in 1999 due to the improved efficiency of the Sargent trap over a mist net.

But the continued increase from 73 captures in 1999 steadily over four years to a peak of 185 captures in 2003, followed by a precipitous decline to 86 in 2004 is difficult to explain. Thereafter, total captures varied annually between 39 and 96. Throughout the 1992-2014 period changes in annual sugar-water consumption, represented in the lower portion of Fig. 1, generally agree with the annual trends in total birds captured, as do normalized capture data per trap-hour for 2002-2014 in Fig.1. Sugar-water consumption is a parameter independent of capture effort and the annual upward and downward trends of it are in agreement with the trends in the capture data.

Intra-seasonal Abundance – It is important to note that capture data shown in Table 2 and Figs. 1, 2 and 3 represent only newly encountered birds whether they be newly banded or newly returned birds banded in previous years. Recaptures of repeat birds; i.e., birds previously captured in the same year, are not included. Therefore, these capture data represent only the influx of new individuals and are not a measure of the total population present per time interval. For instance, a bird banded or returned in the May 2 period and recaptured as a repeat in the Jun 1 period would not be included in the Jun 1 period total.

Data depicted graphically in Figs. 2 and 3 show a strong preponderance of new captures in the May-Jun period, especially so for return captures suggesting most if not all of these birds are part of a local breeding population, not migrants in passage. The top panel of Fig. 3 which expresses total captures per trap-hour shows the month of May, followed by Jun, to be the time of greatest abundance per unit of capture effort, then far less productively in Jul-Sep. The return data on the far right of Table 2 show that some return birds remained faithful to this breeding ground for multiple years.

Figs. 2 and 3 show a low point in captures of new birds during the first half of Jul (Jul 1). It is at this point in the season that resident birds, which have been repeatedly captured since May and Jun, became trap shy: they would come, look and leave for alternate food sources. It is part of a seasonal progression observed each year as follows: On their arrival in May, sometimes melting snow still existed and natural food sources may not yet have bloomed fully. These birds are highly dependent on my feeders, the only ones available within 2 km at that time. Feeding was intense in anticipation of near or below-freezing nighttime air temperatures.

As the season progressed to Jun, some hummingbirds scattered to nearby nesting territories, far more natural food became available and fellow summer campers arrived to put out their feeders to attract these birds. Consequently, my feeder offerings became less attractive, reaching a low point in early Jul. As Jul progressed, adults were hard pressed to supply food to growing chicks in the nest, hence feeder usage and captures increased as noted in Figs. 2 and 3. The first newly fledged HY appeared in late Jul and early Aug (Table 1), soon to leave mostly by month's end.

As a breeding area, the yield of young birds banded is not great given the numbers of adults captured. Table 3 shows that adults banded 1999-2013 included 272 AHY/M and 471 AHY/F, but only 87 HY/M and 79 HY/F. This equates to 166 HY per 471 AHY/F or only 0.35 HY per female. One possible explanation for this low ratio is the short period of time newly fledged young have to discover and use these feeders; hence, be captured. Data in Table 1 show the average first banding dates for HY/M and HY/F are 9 and 5 Aug, respectively; while average last banding dates are 29 and 28 Aug, respectively, allowing time spans of only 20 and 23 da, respectively, for these immatures to locate and use the feeders prior to migration.

In no instance, over the 24 years of this study, has an adult been seen accompanying or feeding an immature at or near the feeders. The immatures have always appeared and fed singly and independently. On numerous occasions, they seemed inexperienced at first in using the feeders in that they would probe with their bill the red plastic cap atop a Four Fountain feeder rather than seek out the red-yellow feeder ports with sugar-water at the base of the feeder.

The seasonal capture patterns in Figs. 2 and 3 are similar in some respects to seasonal data presented in Baumgartner's Fig. 1 (1989) for the years 1987-1988 in Jay, OK. The exception was that at her

more southerly latitude of about 36° 26' N compared to Jenny Lake at 43°10' N she experienced earlier arrivals and later departures affording a lengthier breeding season. She observed first appearance by males ahead of females in mid-Apr and captures of returns by 21 Apr, two weeks ahead of Jenny Lake's captures, then peaking the week of 8 May, declining thereafter with another smaller peak the first week of Jul. Her new bandings of adults peaked in early May as opposed to late May at Jenny Lake by which time her bandings declined sharply, then peaking to a lesser extent in early Jul 1988, but in mid-Aug in 1987.

Her first captures of HY birds occurred on 8 Jul, 12 days ahead of first HY at Jenny Lake, peaked during the week of 4 Aug with another peak of greater magnitude during the week of 22 Aug; the first of these peaks most likely related to fledging of local birds, the latter peak the result of passing migrants of which there appear to be very few at Jenny Lake. Her captures ceased by 1 Oct compared to last HY captures at Jenny Lake at or before mid-Sep.

Sex Ratios – Adult males exceeded adult females at time of banding only at the very start of the season in the first half of May; otherwise, females predominated through the entire remainder of the season as shown at the bottom Fig. 2. There was a similar pattern for return captures, only even more biased toward females exceeding males in late May (top of Fig. 2). The same trend exists when data on immatures and adults are combined as in the middle and bottom of Fig. 3.

Sex ratio varied depending on age at time of banding as well as age at time of return captures in subsequent years. Adult birds at time of banding favored females over males by 1.94:1, increasing to 4.80:1 for females four years after banding, averaging over all at 3.40:1 (Table 4). Birds banded as immatures favored females by 1.08:1, rising to 2.2:1 two years after banding and 1.33:1 three years after banding, averaging 2.05:1 for all returns (Table 4).

A comparison of these sex ratio data was made, Table 5, with data from three other locations where long-term studies have been conducted: 1)Powdermill Nature Reserve (28 years) in western Pennsylvania (Mulvihill et al. 1992); (2) Hilton Pond (18 years) at York, SC (cited by Robinson et al. 1996); and (3) Jay, OK (12 years). The Powdermill banding operation employed no feeders and relied solely on mist nets for capture, while the Hilton Pond operation used traps containing feeders and Jay used a combination of traps and mist nets employing 14 feeders. In all instances, except for two, females outnumbered males; the exception being HY/M in South Carolina and Oklahoma. Table 5 shows a comparison of F/M sex ratios for these four sites.

Table 4. Sex ratios of banded and returned Ruby-throated Hummingbirds over the entire 1991-2013 period showing changes in sex ratio with age.

AHY	No. Banded		Return Captures, Year After Banding															
			1		2		3		4		5		6		7		8	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	317	616	44	132	13	21	8	37	5	24	-	15	-	7	-	1	-	1
	F/M = 1.94		3.00		1.62		4.62		4.80									
			F/M for all Returns = 3.40															
HY	101	109	14	21	5	11	3	4	-	1	-	2	-	3	-	2	-	1
	F/M = 1.08		1.50		2.20		1.33											
			F/M for all Returns = 2.05															

Table 5. Comparison of sex ratios of AHY and HY Ruby-throated Hummingbirds from four long-term studies.

Location	Years	Age	F/M Ratio
Powdermill, Pennsylvania	1963-1990	AHY (22 Apr-31 May)	1.4:1
		AHY (1 Jun-7 Aug)	3.0:1
		AHY (8 Aug-2 Oct)	4.1:1
		HY	1.1:1
York, South Carolina	1984-2001	AHY	1.5:1
		HY	0.67:1
Jay, Oklahoma	1987-1988*	AHY (Banded)	0.89:1
		AHY (Returned)	2.43:1
		HY	0.5:1
Jenny Lake, New York	1991-2014	AHY (Banded)	1.94:1
		AHY (Returned)	3.4:1
		HY (Banded)	1.08:1
		HY (Returned)	2.05:1

* Last two years of a 12-yr study, 1977-1988

Longevity – Tables 2 and 4 offer insight on the longevity of this species and an opportunity to compare results from other studies. The oldest female recaptured here had been banded Jul 2001 as an AHY and recaptured each year for the next eight years, a total of 25 times, making her at least 9yr0mo old (referred to hereafter as 9-0) when last retrapped in Jun 2009. At that time, she tied the North American age record set by Baumgartner (1989) during a 12-yr study at Jay, OK; both birds listed in the Bird Banding Laboratory (BBL) longevity website (2015). In the Sep 2015 update of this website, two other females banded as AHY exceeded this record: (1) a Michigan bird banded in Jun 2006, recaptured Jul 2014 at age 9-1; and (2) a West Virginia bird banded Aug 2006 recaptured Aug 2014 at age 9-2.

Wethington, et al. (2002) list an Ohio record female at 10-2, not included in the BBL web site. This bird was banded in Aug 1991 as an AHY and recaptured at the same location Jul 2000. Using the BBL convention of assuming Jun hatching for calculating age records (Klimkiewicz 1997), this bird recaptured in Jul should be listed as 10-1 rather than 10-2 as published. Nine Jenny Lake female birds next oldest to the 9-0 female referred to here are as follows in order of descending age:

Age	Number
7-11	1
7-2	1
7-1	1
7-0	3
6-11	3

The oldest recaptured males banded here as AHY were age 5-1: (1) one banded May 1995, recaptured seven times in the next four years, last in Jul 1999; and (2) one banded May 2002, recaptured ten times in three of the next four years, last Jul 2006. The next oldest birds were three males all 5-0, recaptured six, ten and 17 times, respectively, in the ensuing two to four years. The oldest adult male recaptured by Baumgartner (1989) was 5-0. Similarly, Hilton reported five years as the maximum male age at York, South Carolina

(Robinson et al. 1996). No male Ruby-throated Hummingbird longevity records are listed on the BBL website (2015).

The shortened longevity of males compared to females was addressed by Mulvihill et al. (1992) who attributed it to, "Low mid-summer mass in males, coupled with increased metabolic demands during the breeding season, may lead to a fatal 'energy crisis' in this sex during nocturnal fasting or periods of inclement weather." Among the 84 return captures at their site, the oldest birds banded as AHY were six years for female and three years for male. Mean annual survivorship reported by Mulvihill and Leberman (1987) in Pennsylvania was 31.2% for males and 42.3% for females, while Hilton and Miller (2003) reported resident male survival at 0.30+/- 0.05 SE and females at 0.43+/- 0.04 SE; or 30 and 43%, respectively, corroborating the findings of Mulvihill et al. (1992).

Referring to Table 3, it appears that individual survivorship from year to year can be quite variable in both sexes. Five of the 10 AHY/M banded in 1999 returned in 2000 for a high return rate of 50.0%, but none of these five return birds was ever recaptured in a subsequent year. Compare this 50% return rate with 2011, when only one (5.0%) of the 20 AHY/M banded that year returned in 2012. Also in Table 3, 10 of 13 AHY/F banded in 2010 returned in 2011 for an extraordinary return rate of 76.9%. Six of those 10 returns continued to return in subsequent years. Compare this 76.9% one-year return rate with the 9.5% return rate for the 21 AHY/F banded in 2004.

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LITERATURE CITED

Baumgartner, A. M. 1989. Ruby-throated Hummingbird populations in Northeastern Oklahoma–1997–1988. *North American Bird Bander* 14:115-117.

Bird Banding Laboratory. 2015. Longevity records of North American birds. http://www.pwrc.usgs.gov/bbl/longevity/longevity_main.cfm

Hilton Jr., B. and M.W. Miller. 2003. Annual survival and recruitment in a Ruby-throated Hummingbird population, excluding the effect of transient individuals. *Condor* 105:54-62.

Klimkiewicz, M.K. 1997. Longevity records of North American birds. Version 97.1. Patuxent Wildlife Research Center. Bird Banding Laboratory, Laurel, MD.

Mulvihill, R.S. and R.C. Leberman. 1987. Bird banding at Powdermill, 1985–with a summary of Ruby-throated Hummingbird banding data. Powdermill Nature Preserve research rep. no. 46, Carnegie Museum Nat. History, Pittsburgh, PA.

Mulvihill, R.S., R.C. Leberman and D.S. Wood. 1992. A possible relationship between reversed sexual size dimorphism and reduced male survivorship in the Ruby-throated Hummingbird. *Condor* 94:480-489.

Robinson, T.R., R.R. Sargent and M.B. Sargent. 1996. Ruby-throated Hummingbird (*Archilochus colubris*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/204.

Russell, S.M. and R.O. Russell. 2001. The NorthAmerican banders' manual for banding hummingbirds, North American Banding Council: http://www.northamericanbandingcouncil@gmail.com

Wethington, S.M., G.C. West, B.A. Carlson, N.L. Newfield and S.J. Peters. 2002. Longevity records for North American hummingbirds. *North American Bird Bander* 27:131-133.

Appendix

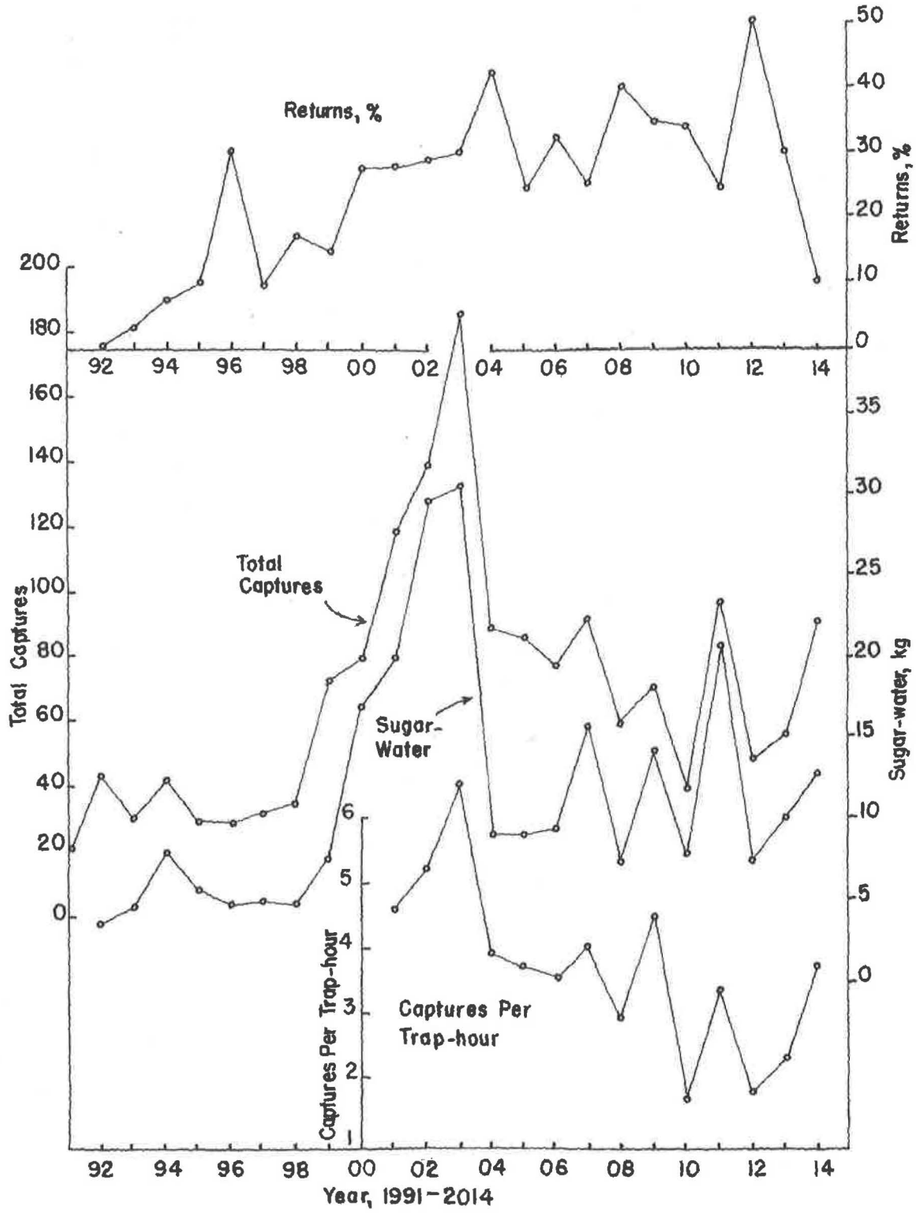

Fig. 1. ***Top Panel*****: Return captures represented as a percentage of total captures (the number of new returns divided by the sum of new bandings plus new returns) annually for 1992-2014, right axis.** ***Middle*****: Annual total captures (bandings and returns), 1991-2014, left axis; and annual sugar-water consumption in kg, 1992-2014, right axis.** ***Bottom*****: Annual capture yield, 2001-2014, represented by total new captures (bandings and returns) per trap-hour, lower left axis.**

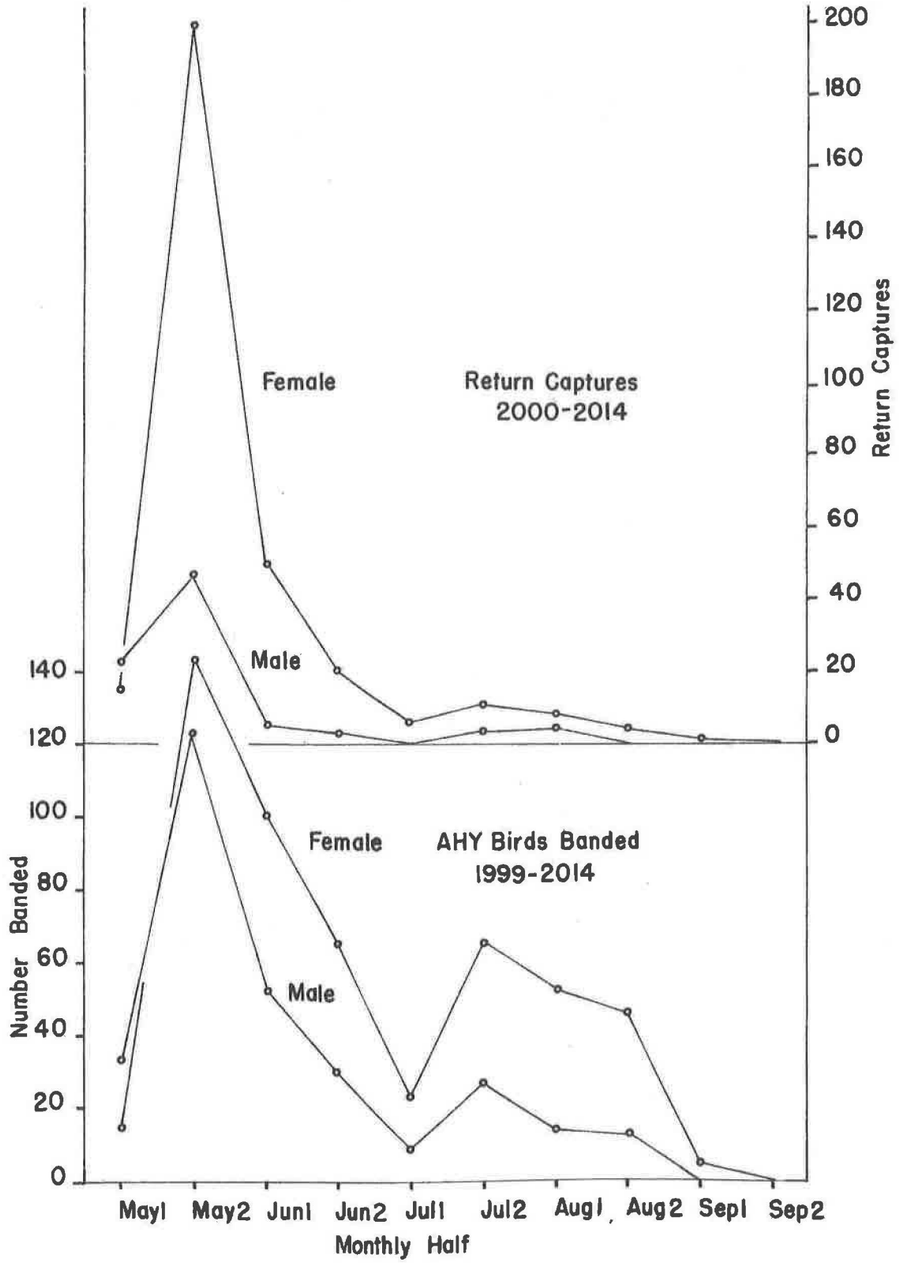

Fig. 2. *Top Panel*: **Return captures, 2000-2014, sorted by sex for monthly halves May to Sep, right axis.** *Bottom Panel*: **Bandings of AHY birds, 1999-2014, sorted by sex for monthly halves May to Sep, left axis.**

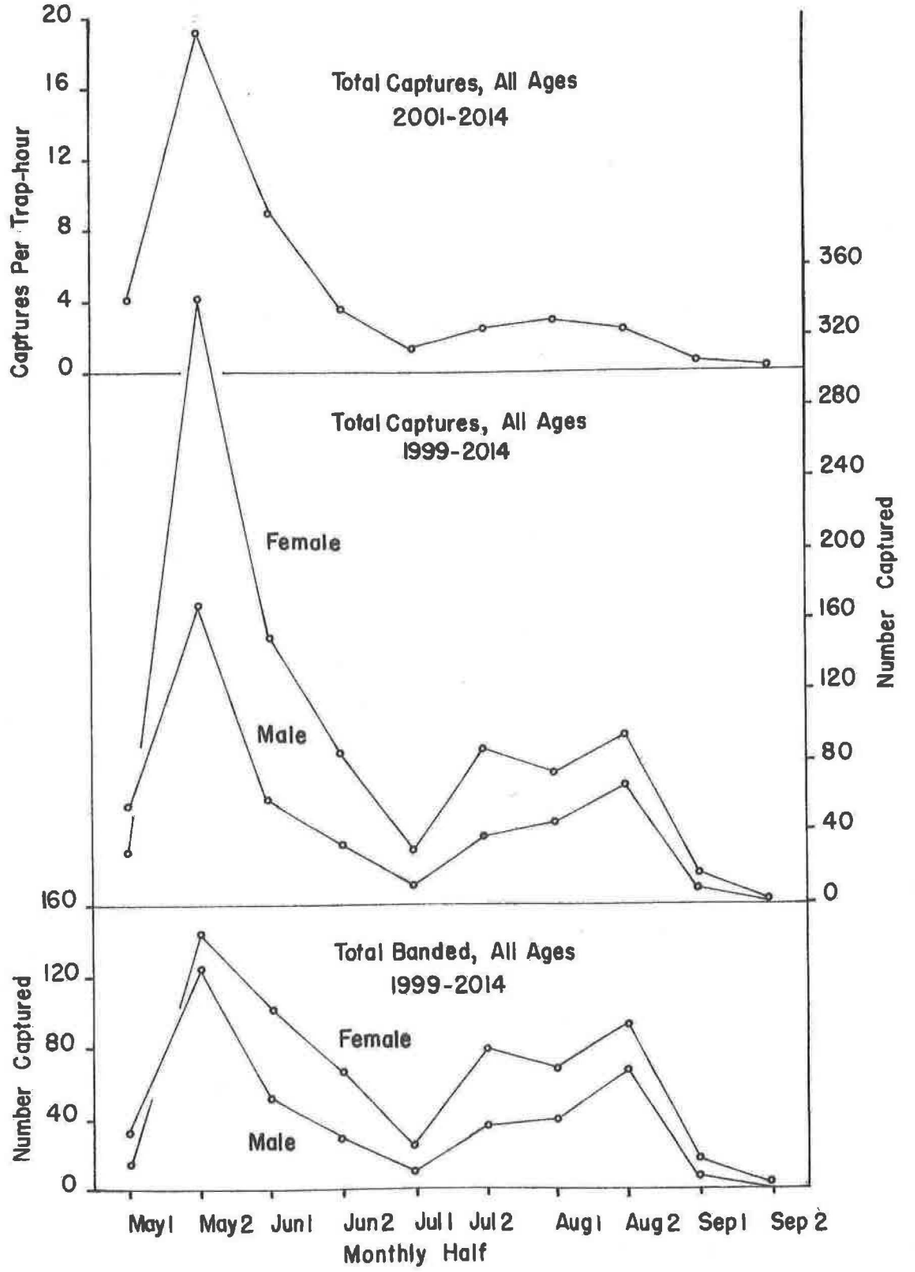

Fig. 3. *Top Panel*: **Total new captures (bandings and returns) per trap-hour by monthly halves May to Sep for birds of all ages and both sexes, 2001-2014, left axis.** *Middle Panel*: **Total new captures (bandings and returns) of birds of all ages sorted by sex for monthly halves May to Sep, 1999-2014, right axis.** *Bottom Panel*: **Total new bandings only of birds of all ages sorted by sex for monthly halves May to Sep, 1999-2014, left axis.**