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United States Fish and Wildlife Service

2015
BROWN-HEADED COWBIRD
CONTROL IN KIRTLAND'S WARBLER NESTING
AREAS, NORTHERN LOWER MICHIGAN



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INTRODUCTION

Kirtland's warbler (*Setophaga kirtlandii*) is a migratory songbird that nests in jack pine (*Pinus banksiana*) forests of Michigan, Wisconsin and Ontario. In 1967, the U.S. Fish and Wildlife Service (USFWS) listed the Kirtland's warbler as endangered. Diminished nesting habitat within the Kirtland's warbler's restricted range and nest parasitism by brown-headed cowbirds are considered primary reasons for the species' decline (Leopold 1944, Mayfield 1960).

Kirtland's warblers require specific nesting habitat consisting of large stands of early-successional jack pine ranging in size from 5 to 20 feet. Nests are built on the ground, using the understory branches of the jack pine for protection. Once trees reach approximately 20 feet in height, the low branches die off and the stand becomes unsuitable for Kirtland's warbler. Jack pine depends on fire for reproduction. Intense heat opens the seed cones, allowing seeds to germinate in the bare soil left by a forest fire. Historically, periodic forest fires created specialized breeding habitat for the Kirtland's warbler. However, modern fire suppression and landscape alterations have limited suitable nesting sites and allowed for the invasion of a brood parasite to which the Kirtland's warbler is especially vulnerable (Bocetti et al. 2012).

Brown-headed cowbirds (*Molothrus ater*) are obligate brood parasites that lay eggs in the nests of host birds. Cowbird chicks hatch before host chicks and out-compete them for resources. Brown-headed cowbirds are historically native to prairie ecosystems; however, following agricultural expansion and forest clearing in the Lower Peninsula of Michigan during the late nineteenth century, cowbirds expanded their range into Kirtland's warbler nesting areas.

Prior to brown-headed cowbird control in 1972, researchers observed parasitism rates of Kirtland's warbler nests ranging from 48% to 86% (reviewed in Shake and Mattson 1975). In addition, brown-headed cowbirds were found to exert greater pressure on Kirtland's warblers than other potential hosts within the same area. Walkinshaw (1983) reported that 93% of all the cowbird eggs he found among suitable host nests within jack pine habitat were located in Kirtland's warbler nests.

The USFWS, U.S. Forest Service (USFS), Michigan Department of Natural Resources (MDNR), Michigan Audubon Society (MAS), and others established a cooperative recovery program to restore the population and ensure the survival of Kirtland's warbler (USFWS, 1985). The program includes continuous habitat management to guarantee there are jack pine stands of the appropriate age class for Kirtland's warbler nesting, annual brown-headed cowbird control to remove cowbirds from Kirtland's warbler nesting areas, and tours to inform the public about Kirtland's warbler and provide viewing opportunities of the endangered songbird. This is a report of the 2015 brown-headed cowbird control program in the northern Lower Peninsula of Michigan.

2015 BROWN-HEADED COWBIRD TRAPPING SUMMARY

To reduce nest parasitism in Kirtland's warbler nesting areas, biologists from the USFWS East Lansing Field Office have trapped brown-headed cowbirds annually since 1972. Forty-four cowbird traps were used during the 2015 trapping season (Tables 1-2), located in eleven counties: Alcona – four, Clare – three, Crawford – twelve, Iosco – six, Kalkaska – three, Montmorency – four, Ogemaw – eleven, Oscoda – ten, Otsego – one, Roscommon – two, and Presque Isle – one (Figure 1).

During the 2015 trapping season, twelve traps were not run in order to study the effectiveness of the cowbird trapping program. The experiment is designed to answer two critical questions. One, what happens to Kirtland's warblers if cowbird trapping is stopped in an area, and two, what is the effective range of a single cowbird trap on the landscape. This experiment is scheduled to run for two additional years.

Traps are operated each year from mid-April through June, with trapping beginning approximately one month before Kirtland's warblers arrive in order to take advantage of cowbird migration chronology and behavior. Cowbirds usually begin arriving in the northern Lower Peninsula of Michigan in April. At that time, cowbirds are in flocks and tend to exhibit a higher degree of social or gregarious behavior, which seems to make them more susceptible to decoy trapping than later in the season when they disperse across the landscape to breed. Consequently, it is important to initiate trapping at approximately the time cowbirds arrive in the area for optimal trap effectiveness.

The decoy traps used require live decoys for effective operation. Weeks before they arrive in northern Michigan, the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (USDA-APHIS-WS), at Sandusky, Ohio capture and temporarily house the necessary cowbirds, which arrive in northern Ohio each spring. During March and early April 2015, USDA biologists collected 400 brown-headed cowbirds, which were transported to northern Lower Michigan by the USFWS and placed in traps to attract other cowbirds. Additional details and methods of cowbird trapping have been provided in earlier annual reports and published accounts.

In 2015, 1,245 cowbirds were captured (Figure 2). Since 1972, 159,802 cowbirds have been removed from Kirtland's warbler nesting areas, averaging 3,632 per year. The forty four traps caught an average of 28.3 cowbirds per trap over 3,106 trap days. An average of 0.4 cowbirds was caught per trap day (Figure 3, Table 1).

The number of cowbirds removed each year has increased 19 times and decreased 24 times during the 44 years of the program (Figure 2, Table 3). This is likely due to normal fluctuations in the cowbird population, and may indicate that the trapping program has had no long-term effect on the area's cowbird population.

Temporal Distribution of Catch

The temporal distribution of captured cowbirds in 2015 was similar to previous years. The highest number of cowbirds were caught in the third week, accounting for 25.3% of the seasonal catch (Figure 4, Table 4). By the fourth week, nearly 75% of all cowbirds had been captured (Figure 5, Table 5).

Table 1. Summary of individual brown-headed cowbird traps operated in Kirtland's warbler nesting areas, northern Lower Michigan, 2015.

Trap #	Location	Brown-headed Cowbirds			Total	Trap Days	CB/TD	Other Species
		Males	Females	Juveniles				
255	OG	3	7	1	11	72	0.2	5
257	CR	18	2	0	20	71	0.3	8
258	PI	16	5	0	21	69	0.3	2
259	PI	44	16	0	60	72	0.8	3
260	LE	5	2	0	7	18	0.4	0
263	OG	12	3	0	15	72	0.2	2
265	TW	15	6	0	21	71	0.3	0
266	NP	23	17	0	40	72	0.6	3
267	SE	9	2	0	11	72	0.2	2
270	CL	0	0	0	0	3	0.0	0
272	SH	11	4	0	15	67	0.2	3
273	GM	6	2	0	8	72	0.1	3
276	PI	22	8	0	30	72	0.4	3
280	CL	32	14	0	46	71	0.7	2
281	NP	17	12	0	29	72	0	3
282	MP	14	7	0	21	60	0.4	11
283	PI	44	18	0	62	72	0.9	2
284	OG	12	12	0	24	72	0.3	7
285	OG	36	21	0	57	72	0.8	8
286	LE	20	18	0	38	71	0.5	19
288	CL	21	6	0	27	71	0.4	2
289	GR	5	1	0	6	71	0.1	1
290	FR	12	1	0	13	72	0.2	15
291	JP	16	11	0	27	71	0.4	5
292	WR	9	8	0	17	83	0.2	7
294	DR	21	11	0	32	72	0.4	39
295	LR	15	5	0	20	65	0.3	13
298	KH	24	12	0	36	72	0.5	1
301	AA	25	12	0	37	72	0.5	7
302	FD	33	21	0	54	55	1.0	2
303	MA	27	9	0	36	72	0.5	0
304	WT	14	13	0	27	71	0.4	0
305	MC	13	19	0	32	72	0.4	1
307	PI	29	13	0	42	72	0.6	3
308	MC	26	10	0	26	70	0.4	1
310	HU	13	6	0	19	72	0.3	8
311	MA	9	7	0	16	72	0.2	2
312	CC	10	3	0	13	72	0.2	2
313	DE	28	9	0	37	72	0.5	0
314	LN	20	16	0	36	71	0.5	3
315	MI	8	2	0	10	68	0.1	2
316	TO	23	9	0	32	71	0.5	1
317	NB	22	4	0	26	72	0.4	15

(cont.)

Table 1 (cont.). Summary of individual brown-headed cowbird traps operated in Kirtland’s warbler nesting areas, northern Lower Michigan, 2015.

Trap #	Location	Brown-headed Cowbirds			Total	Trap Days	CB/TD	Other Species
		Males	Females	Juveniles				
318	ME	22	13	0	35	72	0.5	7
319	CL	8	5	0	13	59	0.2	2
320	LE	19	4	0	23	52	0.4	1
Total		838	406	1	1245	3106	17.8	227
Mean		18.1	8.8	0.0	26.7	67.5	0.4	4.9

Table 2. Location codes for brown-headed cowbird traps, northern Lower Michigan, 2015.

AA – AuSable Area	MA – Mack Lake NW- Bahamian
BH – Beach Road	MC – McKinley
CA – Camp Road	MI – Military
CC – Canoe Camp	MP – Mapes Road Unit
CL – Clear Lake	MU – Muskrat Lake
CR – Crapo Lake	NP – No Pablo Burn
DE – Damon East	OG – Ogemaw Mngt Unit
DR – Damon Road	OD – Ogemaw Road
EA – Eastwood Road	PE – Pere Cheney
FA – Farrington Road	PH – Preacher’s Hill
FD – Fawn Road	PI – Pine River
FR – Fletcher Road	RK – Rock Cemetery
GM – Goose Creek/ Manistee River	SE – St. Helen
GR – Guide’s Rest	SH – Sharon
HU – Hughes Lake Burn	SL – Staley Lake
JP – Jackpine Plains	TW – Tawas
KH – Kinsey Hunt Road	WR – Walsh Road
LE – Leota	WT – West Tawas
LR – Lemon Road	

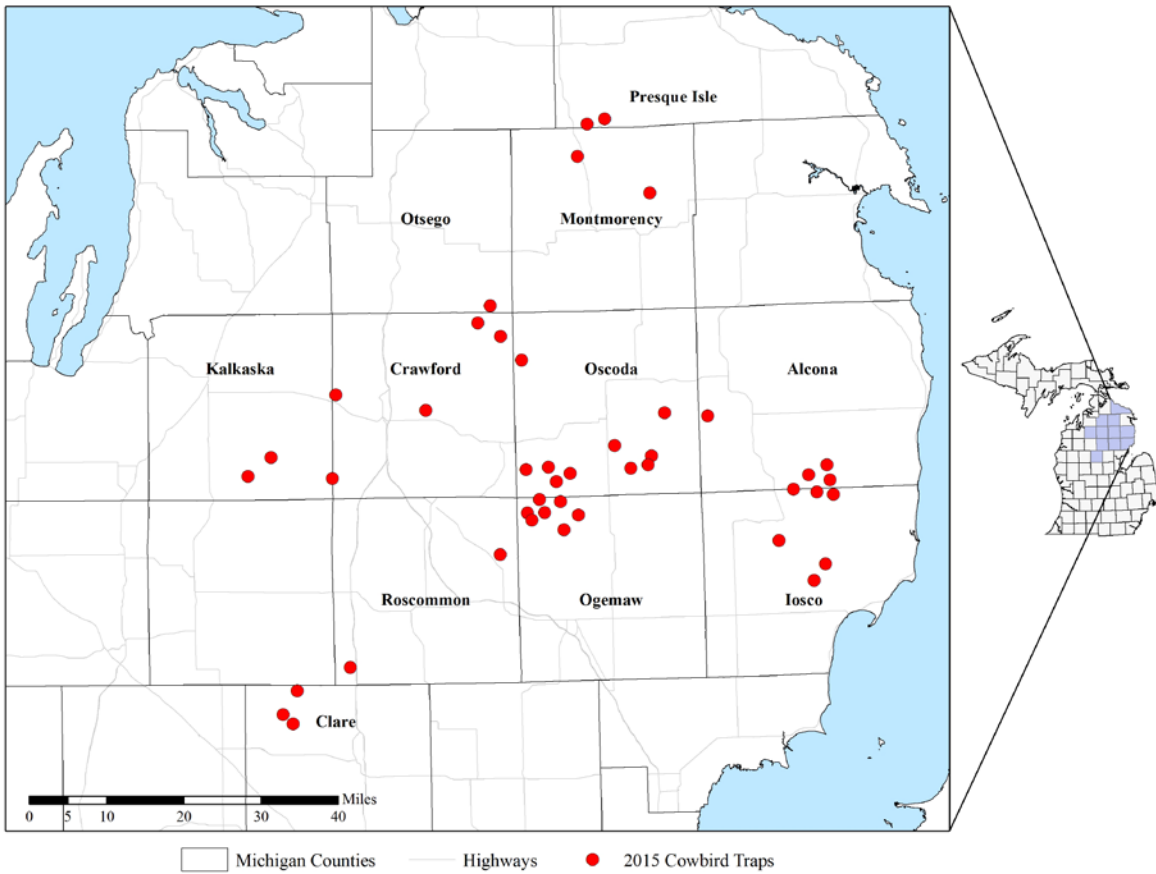


Figure 1. Brown-headed cowbird trap locations, northern Lower Michigan, 2015.

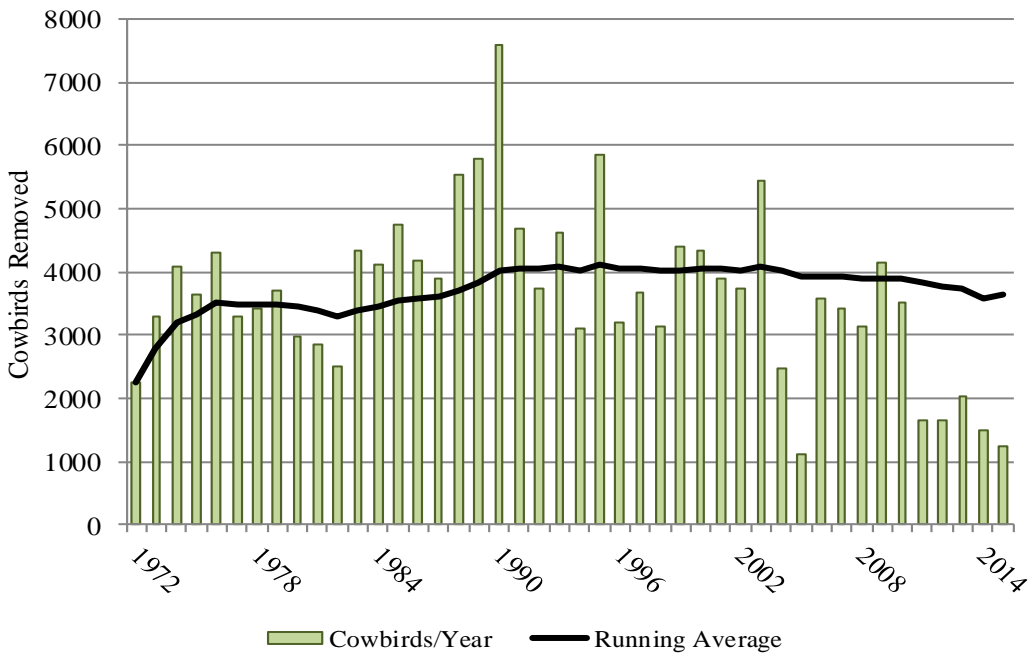


Figure 2. Total numbers of brown-headed cowbirds removed from Kirtland’s warbler nesting areas in northern Lower Michigan, 1972-2015.

Table 3. Yearly summary of cowbirds trapped in Kirtland’s warbler nesting areas, northern Lower Michigan, 1972-2015.

Year	Brown-Headed Cowbirds					M/F	Traps	Cowbirds Per Trap
	Male	Female	Adult	Juvenile	Cowbirds/Year			
1972	1621	619	2240	21	2261	2.6	15	150.7
1973	1995	1195	3190	115	3305	1.7	18	183.6
1974	2195	1717	3912	163	4075	1.3	22	185.2
1975	2026	1463	3489	161	3650	1.4	30	121.7
1976	2193	1994	4187	112	4299	1.1	38	113.1
1977	1845	1405	3250	34	3284	1.3	39	84.2
1978	1754	1639	3393	18	3411	1.1	40	85.3
1979	1954	1721	3675	16	3691	1.1	37	99.8
1980	1538	1429	2967	0	2967	1.1	37	80.2
1981	1770	1085	2855	1	2856	1.6	36	79.3
1982	1568	893	2461	38	2499	1.8	35	71.4
1983	2128	2196	4324	0	4324	1	35	123.5
1984	2183	1936	4119	0	4119	1.1	31	132.9
1985	2644	2082	4726	14	4740	1.3	30	158
1986	2328	1781	4109	75	4184	1.3	31	135
1987	2291	1549	3840	60	3900	1.5	38	102.6
1988	2932	2589	5521	19	5540	1.1	41	135.1
1989	2907	2881	5788	2	5790	1	42	137.9
1990	3818	3771	7589	6	7595	1	38	199.9
1991	2576	2088	4664	6	4670	1.2	43	108.6
1992	2003	1730	3733	4	3737	1.2	49	76.3
1993	2361	2246	4607	7	4614	1.1	51	90.5
1994	1862	1242	3104	5	3109	1.5	56	55.5
1995	3070	2782	5852	3	5855	1.1	67	87.4
1996	1844	1357	3201	0	3201	1.4	59	54.3
1997	1962	1717	3679	2	3681	1.1	64	57.5
1998	1937	1154	3091	52	3143	1.7	67	46.9
1999	2608	1745	4353	46	4399	1.5	67	65.7
2000	2801	1510	4311	34	4345	1.9	70	62.1
2001	2621	1258	3879	27	3906	2.1	68	57.4
2002	2233	1487	3720	2	3722	1.5	63	59.1
2003	2873	2568	5441	0	5441	1.1	60	90.7
2004	1533	940	2473	5	2478	1.6	59	42
2005	719	398	1117	3	1120	1.8	40	28
2006	2260	1265	3525	43	3568	1.8	54	66.1
2007	2054	1343	3397	29	3426	1.5	52	65.9
2008	1941	1167	3108	27	3135	1.7	54	58.1
2009	2460	1691	4151	9	4160	1.5	55	75.6
2010	2145	1371	3516	10	3526	1.6	60	58.8
2011	1240	396	1636	1	1637	3.1	52	31.5
2012	1144	496	1640	18	1658	2.3	52	31.9
2013	1396	637	2033	3	2036	2.2	57	35.7
2014	1149	351	1500	0	1477	3.29	55	26.9
2015	838	406	1244	1	1245	2.06	44	28.3
Total	91320	67290	158610	1192	159802	1.36	2051	77.9
Mean	2075	1529	3605	27	3632	1.55	47	87.6

Figure 3. Number of brown-headed cowbirds removed per trap and number of traps used each year in Kirtland’s warbler nesting areas, northern Lower Michigan, 1972-2015.

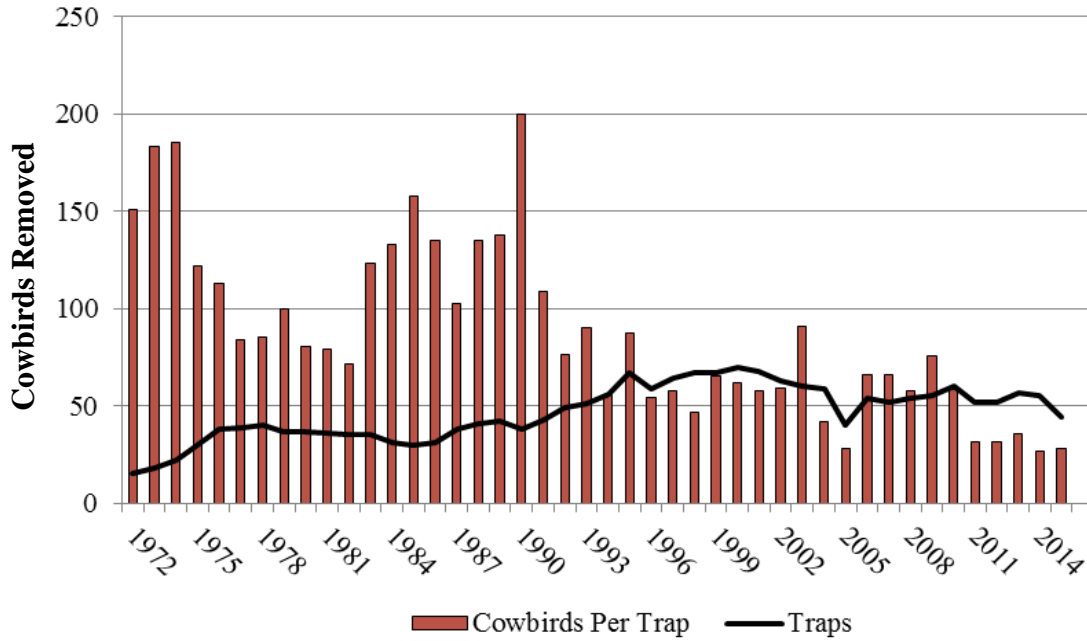


Table 4. Weekly summary of brown-headed cowbird trapping results from Kirtland’s warbler nesting sites in northern Lower Michigan, 2015.

Week	End Date	Trap Days	ASY Male	SY Male	AHY Male	Total Male	Female	Juvenile	Total	% Total
1	14-Apr	147	36	39	0	75	46	0	121	9.73
2	21-Apr	329	89	82	1	172	111	0	283	22.75
3	28-Apr	295	92	74	0	166	149	0	315	25.32
4	5-May	307	74	65	0	139	71	0	210	16.89
5	12-May	308	38	35	0	73	13	0	86	6.91
6	19-May	308	31	27	0	58	5	0	63	5.06
7	26-May	308	33	20	0	53	2	0	55	4.42
8	2-Jun	308	17	15	0	32	2	0	34	6.2
9	9-Jun	303	17	11	0	28	5	0	33	2.65
10	16-Jun	287	16	8	0	24	2	0	26	2.09
11	23-Jun	206	9	9	0	18	0	1	19	1.53
Totals		3106	452	385	1	838	406	1	1245	100

Figure 4. Weekly summary of brown-headed cowbirds removed from Kirtland’s warbler nesting areas, northern Lower Michigan, April 14 – June 23, 2015.

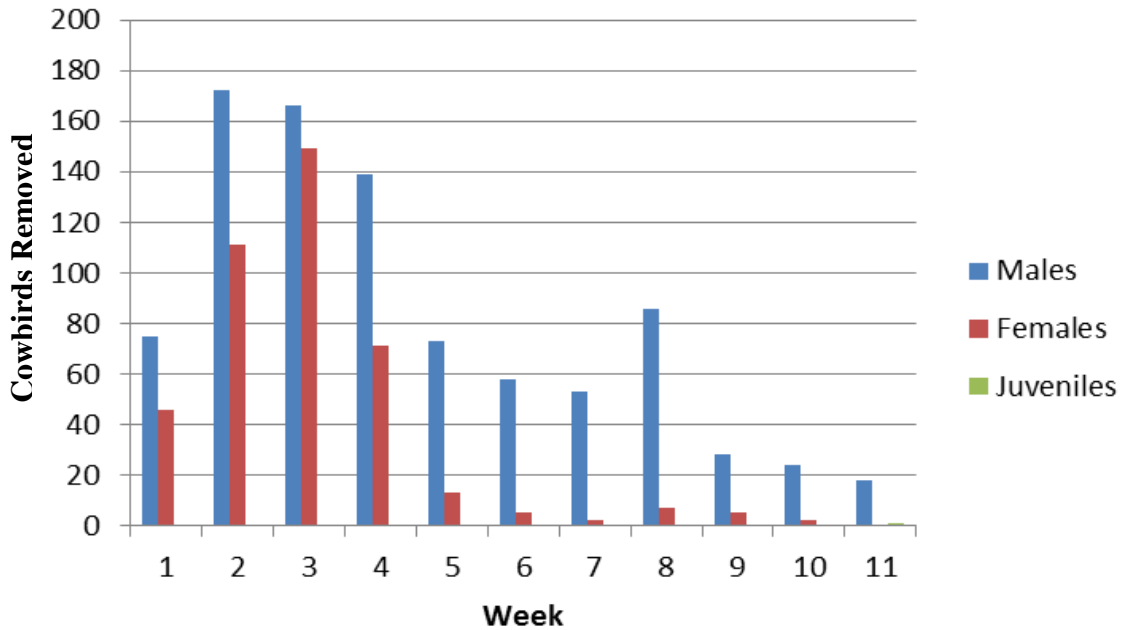


Figure 5. Cumulative summary of adult brown-headed cowbirds removed from Kirtland’s warbler nesting areas, northern Lower Michigan, April 14 – June 23, 2015.

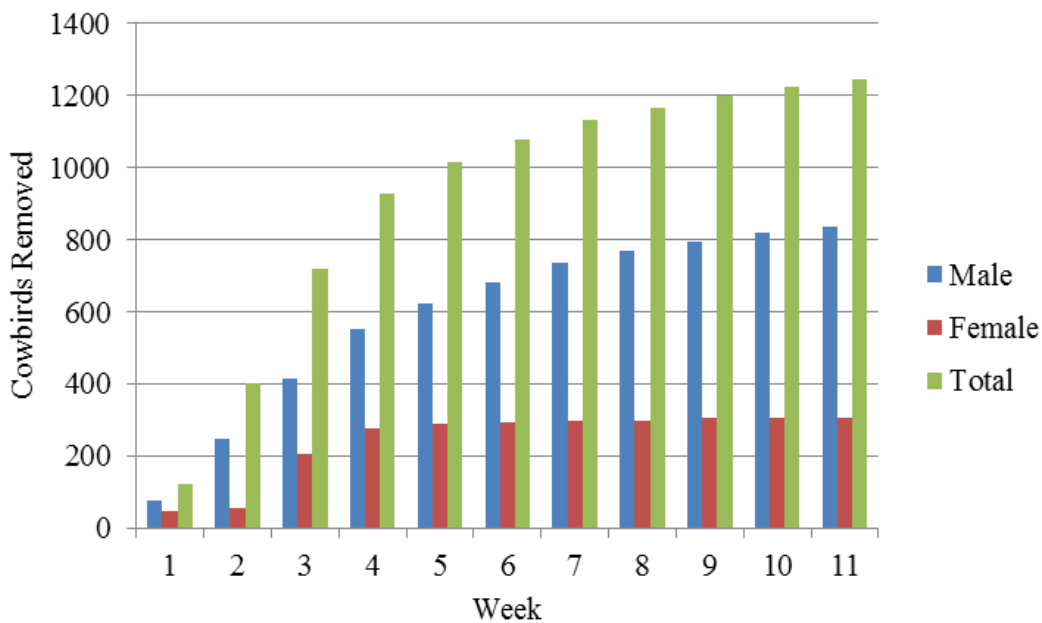


Table 5. Weekly cumulative results of brown-headed cowbird trapping on Kirtland’s warbler nesting areas, northern Lower Michigan, 2015.

Week	End Date	Trap Days	Male	% Male	Female	% Female	Juvenile	% Juvenile	Total	% Total
1	14-Apr	147	75	90.	46	11.3	0	0	121	9.7
2	21-Apr	476	247	29.5	157	38.8	0	0	404	32.5
3	28-Apr	771	413	49.3	306	75.4	0	0	719	57.8
4	5-May	1078	552	65.9	377	92.9	0	0	929	74.6
5	12-May	1386	625	74.6	390	96.1	0	0	1015	81.5
6	19-May	1694	683	81.5	395	97.3	0	0	1078	86.7
7	26-May	2002	736	87.8	397	97.8	0	0	1133	91.0
8	2-Jun	2310	768	91.7	399	98.3	0	0	1167	93.7
9	9-Jun	2613	796	95.0	404	99.5	0	0	1200	96.3
10	16-Jun	2900	820	97.9	406	100	0	0	1226	98.5
11	23-Jun	3106	838	100	406	100	1	100	1245	100

Age and Sex Data

Of the 1,245 cowbirds trapped, 838 were adult males, 436 were adult females, and 1 were juveniles (Table 4). All male cowbirds were aged by examining the underwing coverts. They were divided into three categories: after second year male (ASYM), second year male (SYM), and after hatch year male (AHYM). SYM’s underwing coverts will be black with a gray/buff tip, while ASYM’s will have black underwing coverts (Ortega et. al. 1996, Selander and Giller 1960). The AHYM category was used when it was not clear whether there were gray/buff tips on the underwing coverts; e.g., wet plumage or predation. Of the 838 adult male brown-headed cowbirds caught in 2015, 385 (45.94 %) were SYM, 452 (53.94%) were ASYM, and 1 (0.1%) were AHYM (Table 4).

Historically, male/female sex ratios throughout the trapping season suggest a trap bias favoring males (Figure 6). In 2015, the male/female ratio was 2.06, which, as in recent years, was slightly higher than the

historical sex ratio. Of the 157,366 adult cowbirds trapped during the history of the project, the male/female ratio is 1.55.

The male catch in 2015 was consistently greater than the female catch, which dropped drastically between the third and fifth weeks, whereas the male catch gradually tapered (Figure 4). Other cowbird trapping programs have observed a similar trap bias in favor of males (Dufour and Weatherhead 1991, Hahn et al. 1999, Whitfield et al 1999, Griffith and Griffith 2000, Barras et al. 2005, Benson and Lovell 2010), possibly reflecting naturally higher mortality rates for adult females (Darley 1971, Weatherhead 1989, Woolfenden et al. 2001, but see Johnson et al. 1980). It is possible that sex ratio observed among captures accurately reflects cowbird population sex ratios in northern Lower Michigan, and that all of the females that utilize Kirtland’s warbler nesting areas are captured early in the trapping season. Alternatively, females may be less susceptible to decoy trapping than males, particularly as the trapping season progresses, and the incidence of females within the local

population may be underrepresented within the trapped population.

Dufour and Weatherhead (1991) suggest that nutritional requirements and strategies to secure limiting resources differ between genders during the breeding season and can produce a trap bias in favor of males. The onset of cowbird egg-laying in early May, for example, generally corresponds with the observed decline in female capture rates observed across years. There is also some evidence that female cowbirds select home nesting ranges and become loosely territorial as the breeding season progresses (Hahn et al. 1999). Females spending considerable time

searching for nests within a somewhat confined area may encounter traps less often than vagrant males (Shake and Mattsson 1975), skewing the male/female ratio in the trapped population in favor of males.

Non-Target Species Captured

Sixteen species other than brown-headed cowbirds were captured in 2015 (Table 6). A total of 227 non-target birds were caught, of which the most common were blue jays (*Cyanocitta cristata*; 134), and red-winged blackbirds (*Agelaius phoeniceus*; 37). Twelve American kestrels (*Falco sparverius*) were also captured and released.

Figure 6. Weekly average of adult brown-headed cowbirds removed from Kirtland’s warbler nesting areas, northern Lower Michigan, 2000-2015.

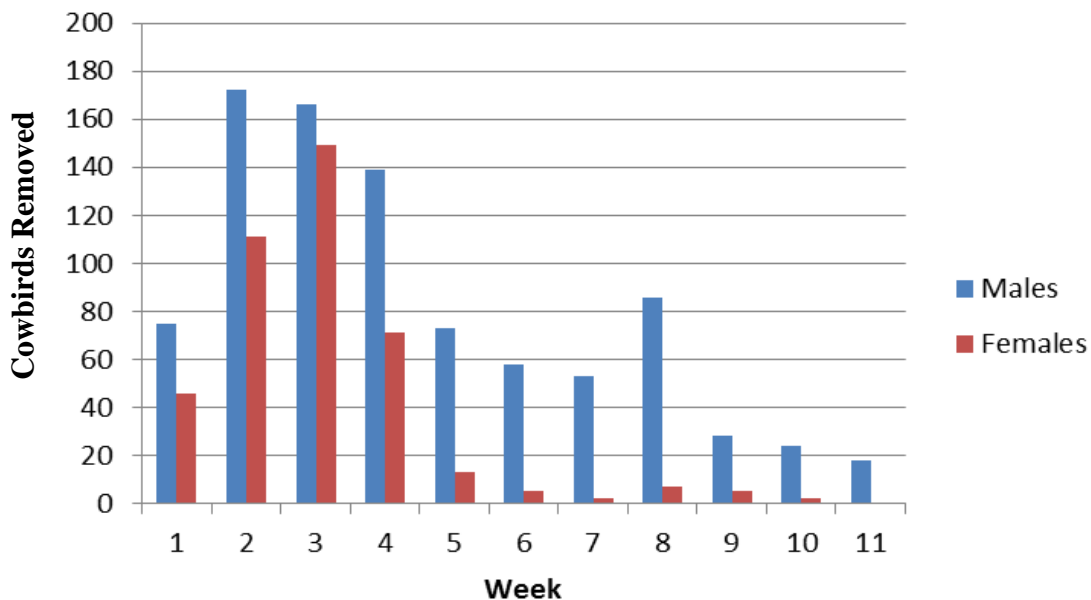


Table 6. Non-target species captured in brown-headed cowbird traps, northern Lower Michigan, 2013-2015.

Species	2015	2014	2013	Species	2015	2014	2013
American Kestrel	12	8	10	Northern Saw-whet Owl	0	0	1
American Tree Sparrow	0	0	1	Northern Cardinal	1	0	0
Baltimore Oriole	3	3	4	Northern Flicker	2	0	0
Blue Jay	134	117	101	Northern Shrike	0	0	1
Brewer's Blackbird	0	1	0	Orchard Oriole	0	1	0
Brown Thrasher	0	0	2	Red-Bellied Woodpecker	0	0	0
Chipping Sparrow	0	1	0	Red-Winged Blackbird	37	69	32
Common Grackle	5	3	6	Rose-Breasted Grosbeak	5	47	10
Dark-eyed Junco	15	2	2	Rusty Blackbird	0	0	1
Eastern Bluebird	1	2	6	Scarlet Tanager	1	0	0
Eastern Kingbird	1	2	2	Sharp-Shinned Hawk	1	2	3
European Starling	5	12	35	White-Crowned Sparrow	1	0	9
Loggerhead Shrike	0	0	1	White-throated Sparrow	3	0	0
				Vesper Sparrow	0	16	12
				Totals	227	286	247

Table 7. Escaped and recaptured brown-headed cowbird decoys from cowbird traps, northern Lower Michigan, 1998-2015.

Year	Escaped			Recaptured			Net total
	Males	Females	Sub-total	Males	Females	Sub-total	
1998	733	624	1397	302	162	464	933
1999	760	585	1345	258	101	359	986
2000	733	654	1427	213	72	285	1142
2001	765	516	1281	187	81	268	1013
2002	836	738	1574	280	153	422	1141
2003	582	674	1256	167	111	278	978
2004	573	522	1095	181	95	276	819
2005	288	269	557	88	64	152	405
2006	414	431	845	151	97	248	597
2007	529	438	967	139	86	225	742
2008	554	456	1010	164	86	250	760
2009	563	554	1117	154	109	263	854
2010	548	456	1034	87	34	121	913
2011	292	177	469	56	52	108	361
2012	310	252	562	80	66	146	416
2013	139	197	336	56	64	120	216
2014	394	318	712	176	96	272	440
2015	122	153	257	55	37	92	165

Missing and Escaped Cowbirds

Decoys were marked with colored tape to distinguish them from newly captured cowbirds. Decoys were counted daily to monitor decoy disappearance and recapture. A total of 257 cowbird decoys escaped or disappeared from traps in 2015, but 92 of the escaped cowbirds were recaptured later in the trapping season (Table 7). Many factors account for the high proportion of escaped cowbirds including vandalism, holes created by bears and raccoons, and holes resulting from trap deterioration. Not all missing cowbird decoys escaped to the wild. Predators probably completely consumed or carried off an unknown, but likely significant number of missing decoys

DISCUSSION

Results from the 2015 trapping effort were similar to recent years, with lower cowbird capture rates than historically. While the lower capture rates were initially partially attributed to weather-related variations, other population factors may be presenting themselves in a decline of local cowbird numbers within the Kirtland's warbler's breeding range. It has long been assumed that successful cowbird reproduction outside of Kirtland's warbler nesting areas likely compensates for losses created by the trapping program, but to our knowledge no formal studies have looked at recent regional population level impacts to the cowbird on either their summer or wintering range.

High male/female sex ratios in 2015 and recent years may indicate an increasing trap bias in favor of male cowbirds. If female cowbirds become increasingly trap-shy at the onset of their egg-laying period, remaining females would have many opportunities to parasitize Kirtland's warbler nests. Considering that cowbirds have the highest known fecundity of any songbird in North

America (Smith and Rothstein 2000) and may lay as many as 77 eggs in 89 days of breeding (Holford and Roby 1993), it may not take an abundance of females to have a localized effect on nesting success. In the past, it has been assumed that cowbirds captured later in the trapping season were transient birds attempting to fill the void created by the absence of removed cowbirds. The continued capture of males engaged in the pursuit of females is most likely due to the presence of female decoys within traps, but may also indicate a continued presence of free-ranging females within the vicinity of cowbird traps.

Fortunately, the Kirtland's warbler population continues to increase, as demonstrated by the 2015 singing male census (<http://www.fws.gov/midwest/endangered/birds/Kirtland/Kwpop.html>). Most likely, steadily increasing populations can be attributed to successful, intensive habitat management and brown-headed cowbird control. It is uncertain, however, that the Kirtland's warbler could remain extant without active management. The regional cowbird population probably has not been affected over the long term by 44 years of trapping, and nest parasitism of Kirtland's warblers likely would increase without continued removal of brown-headed cowbirds. Similarly, adequate habitat must always be available for the desired number of Kirtland's warblers. The survival and recovery of Kirtland's warbler depends on continued habitat management and annual cowbird control.

ACKNOWLEDGMENTS

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