BREEDING RED-WINGED BLACKBIRDS IN CAPTIVITY

CARL J. KNOS AND ALLEN R. STICKLEY, JR.

ABILITY to establish and maintain self-sustaining breeding colonies of captive Red-winged Blackbirds (*Agelaius phoeniceus*) would facilitate long-term studies designed to develop methods for alleviating blackbird depredations as well as provide basic life history data. To be most useful, the colonies should be established in pens near laboratory facilities; this frequently involves putting colonies in unnatural nesting habitat. This paper describes a 5-year effort at Gainesville, Florida, to induce captive Red-wings, most of them taken from the wild as nestlings and then hand-reared in our laboratory, to breed regularly under such conditions.

Except for an undocumented report of two young fully reared at the London Zoo in 1913 (Prestwick per. comm.), captive Red-wings have not been induced to breed successfully under avicultural conditions. In 1969, captive Red-wings, wild-trapped as adults, were induced to breed and to rear young successfully in large pens over normal marsh and hayfield nesting habitat in Ohio (Jackson pers. comm.). Earlier, a pair of Red-wings that had been caught as adults and kept together for a year hatched two young in a 40- × 20- × 6-foot cage in Massachusetts (Wetherbee 1960, Wilson Bull. 74: 90), but the nestlings died soon after hatching.

METHODS

ACQUISITION OF BREEDING STOCK

Hand-reared Red-wings taken as wild nestlings at 9–11 days of age composed most of our breeding stock. Taking birds at this age involved less effort than would have been needed to start with egg incubation as Lanyon and Lanyon (1969, Living Bird 8: 81) have done successfully with other species. Taking birds older than 9–11 days of age would have involved capturing locals that would have been less tractable. Over a 4-year period (1967–70), 84 nestlings were collected and 73 were reared successfully. This high number of hand-rearings was necessitated by mortality to breeding birds caused by accidental starvation, an outbreak of *Salmonella*, entanglement in netting, and predation by black rats (*Rattus rattus*), corn snakes (*Elaphe guttata*), and rat snakes (*Elaphe obsoleta*). Of the 73 young birds reared, 35 were males and 38 females; this approximates the 50:50 sex ratio found in the wild (Williams 1940, Wilson Bull. 52: 267). We initially fed the young birds every 20 min over a 14-h span each day but gradually reduced it to once an hour. The birds consumed vitamin-fortified turkey-starter-mash slurry consisting of 8 ounces water, 6 drops Poly-Vi-Sol vitamin solution (Mead-Johnson Laboritories, Evansville, Indiana), and enough dry mash (Turkey Startina Checkerettes) to make a doughy mixture that would adhere in lumps to the prongs of a feeding stick. We began to wean the birds when they were about 20 days old.

Shortage of hand-reared stock sometimes caused us to use wild birds as breeders. We either placed them directly in the breeding pens (wild-trapped unconditioned

birds) or kept them in cages at least 6 months prior to placement in the breeding pens (wild-trapped conditioned birds).

Facilities and Equipment

We situated our breeding compound in longleaf pine (*Pinus palustris*) saw palmetto (*Serenoa repens*) habitat. The compound contained seven 6-foot-high pens averaging 35 feet long by 10.5 feet wide (except in 1968 when nine pens averaging 26 feet long by 9.5 feet wide were used) inside an 80- × 60-foot clearing encircled by a 4-foot-high solid plywood fence. Hardware cloth (½-inch) buried a foot deep at the base of the fence and two strands of electric wire at the top prevented most predators from burrowing under or climbing over. The pens were constructed of 1-inch hexagonal poultry mesh stretched over 2- × 2-inch wood framing. In most years all pens, except one, were physically joined to an adjacent pen and were separated by one thickness of poultry mesh; the exception had an adjoining pen on each side and was separated from each by a single thickness of mesh. To prevent the possible escape of fledglings, pens were lined with 7/16-inch Zendel polyethylene netting (Union Carbide Corp., New York, New York). We removed the netting in 1969 before the breeding season because birds became entangled in it in 1968; in 1970 we replaced the poultry wire with ½-inch hardware cloth to prevent the escape of juveniles. A vestibule with a second door was placed on the entrance to each pen in 1971 to reduce the possibility of escape. Sheet aluminum on one side and on part of the adjacent top of each pen provided shelter from rain.

We provided more shelter and considerable nesting habitat per pen with cover plantings consisting primarily of wax myrtle (*Myrica cerifera*), coastal plain willow (*Salix coroliniana*), and groundselbush (*Baccharis halimifolia*). Sedges (*Carex*), Johnson grass (*Sorghum halepense*), and dog fennel (*Eupatorium capillifolium*) constituted the bulk of the lush ground vegetation.

The thickness of eggshells from captive Red-wings was measured and compared with that of local wild Red-wings. The shells were measured at the waist with a Starrett 1010M micrometer.

Selection and Care of Birds

Selection of the breeding stock each year depended on the availability of hand-reared birds, performance in previous years, plumage coloration, and age of birds. We used subadult (year-old) hand-reared birds the first year because no other hand-reared stock was available. We grouped birds in both monogamous and polygynous (two or three females) situations in the breeding pens; only one male was placed in each pen.

The birds consumed a year-round diet of unhusked rice, canary seed, white millet, and Purina Dog Meal ad libitum; and approximately six live mealworms per day. We doubled the number of mealworms during the breeding season and added 5 teaspoonfuls of fresh or freshly thawed honeybee larvae to each pen daily. When nestlings hatched, we gradually increased the honeybee larvae supply to 15 teaspoonfuls per day at fledging time, and provided both bee larvae and mealworms three times a day.

Birds generally consumed all mealworms available, but often left much of the bee larvae. We placed all food in one location in each pen, normally just inside the door on the ground or on a low platform, except in one case where we provided an additional feeding site to allow a juvenile bird to feed apart from the adults. Water ran constantly into and overflowed a 30- × 25- × 4.25-inch pan on the ground.

To encourage nest construction, every year we placed materials from old Red-wing nests on the ground in each pen. In addition, the first 2 years we tied canary cups (nest foundations formed of woven reeds) in the shrubs.

To reduce disturbances, we kept observational activities to a minimum in the pens. We usually did not have to enter a pen to determine whether a female was building a nest. After the nest was completed, we tried to monitor the contents once a day when the female was not incubating. Once eggs hatched, we did not attempt to observe the nestlings until they were due to fledge. Initially, pens containing fledglings were not disturbed; but after two were found dead, presumably from starvation, we noted daily from outside the pen whether the young birds were being fed or were feeding themselves.

We placed the birds in the breeding pens in the middle of April, when Red-wing breeding normally begins in northern Florida, and removed them at the end of July. Birds were caught in a hand net and transferred as rapidly as possible, but several died in the process or shortly afterward as a result of this handling. The birds wintered in sexually segregated, wire-floored, 14- × 8- × 6-foot cages.

RESULTS AND DISCUSSION

NEST CONSTRUCTION

The number of nests completed per female was similar the first 2 years (0.8 and 0.6) and increased greatly the last 2 years (1.3 and 3.0) (Table 1). This reflects, in part, increases in the percentage of completed nests during the last 3 years over the first year (i.e. 60% completion in 1968 vs. 88, 100, and 88% in 1969, 1970, and 1971). The low percentage of completions in 1968 may be attributable to nesting inexperience of the year-old females and excessive disturbance caused by more than one female in all except one of the pens. The high number of nests completed in 1971 reflects the high number of unsuccessful nesting attempts that year (i.e. unsuccessful females tend to build more nests than successful females) and aberrant nest-building behavior on the part of one female. This latter female, which had been the most successful parent in 1970, began seven nests in 1971 and completed five; she twice began new nests soon after completion of others, starting one even before laying an egg in the old one.

The performance of 1-year-old hand-reared females approached that of 2- and 3-year-old hand-reared females (Table 2), and if the contribution of the above-mentioned aberrant female is discounted, the record of 2-year-olds would be poorer than that of the 1-year-olds. All hand-reared stock performed nest-building functions better than did wild-trapped birds.

Females built nests primarily from materials of old nests that we had placed on the ground. Females placed most of their nests in wax myrtle and groundselbush at heights between 2 and 5.5 feet (pen tops precluded greater height) from the ground; and they built approximately half the

TABLE 1

PERFORMANCE OF PENNED BREEDING RED-WINGS OVER 4-YEAR PERIOD[1]

Year	Male	Female	Nests completed	Eggs laid	Clutches	Eggs incubated[2]	Nestlings	Fledglings	Juveniles
1968	9	14	11 (0.8)	16 (1.1)	9 (0.6)	4 (0.3)	0	0	0
1969	7	11	7 (0.6)	14 (1.3)	5 (0.5)	5 (0.5)	4 (0.4)	3 (0.3)	2 (0.2)
1970	7	7	9 (1.3)	20 (2.9)	9 (1.3)	14 (2.0)	8 (1.1)	5 (0.7)	1 (0.1)
1971	7	7	21 (3.0)	23 (3.3)	13 (1.9)	11 (1.6)	4 (0.6)	2 (0.3)	0
Totals	30	39	48	73	36	34	16	10	3
Means			(1.2)	(1.9)	(0.9)	(0.9)	(0.4)	(0.3)	(0.1)

[1] Figures in parentheses are means per female.
[2] Eggs incubated for the normal 13-day period.

nests under cover of the sheet aluminum. Canary cups were used sparingly, and only two nests started in cups were completed.

EGG PRODUCTION, INCUBATION, AND FERTILITY

Egg production per female rose each year of the study, from 1.1 in 1968 to 3.3 in 1971 (Table 1), and more than doubled between 1969 and 1970 (from 1.3 to 2.9). We attribute this sharp increase primarily to the use of all hand-reared females in 1970 vs. only 27% hand-reared

TABLE 2

AVERAGE BREEDING PERFORMANCE OF PENNED RED-WINGS BY AGE AND HISTORY

Age and history	No. birds	Completed nests	Eggs		Nestlings	Fledglings
			Laid	Incubated		
Females[1]:						
1-year; HR[2]	9	1.8	2.6	1.4	0.8	0.4
2-year; HR	5	2.2	3.6	1.6	1.2	0.8
3-year; HR	3	2.3	4.3	3.0	1.0	0.7
4-year; HR	1	0	0	0	0	0
WTC[3]	4	0.5	0.8	0	0	0
WTU[4]	3	0.3	0	0	0	0
Males[5]:						
1-year; HR	8	1.4	2.0	0.5	0	0
2-year; HR	6	2.8	3.7	1.8	1.2	0.7
3-year; HR	4	1.3	3.3	2.5	1.8	1.0
4-year; HR	2	2.0	3.0	2.5	0.5	0.5
WTC	7	1.0	1.1	0.3	0.1	0.1
WTU	1	0	0	0	0	0

[1] Females paired with apparently sterile subadult males not included.
[2] HR = hand-reared.
[3] WTC = wild-trapped; conditioned (kept 6 months or more in holding pen before being placed in breeding pen).
[4] WTU = wild-trapped; unconditioned (placed directly into breeding pen).
[5] Results (nests, eggs, nestlings, fledglings) when specified classes of males were mated with females.

females in 1969. Hand-reared females had a much better egg-laying record (mean 3.0 eggs) than did wild-trapped birds (mean 0.4 eggs) (see Table 2). Larger average pen size, use of adult males instead of subadult males after 1968, and more experienced breeders probably contributed to the increase. The high number of eggs in 1971 was due primarily to the increase in nesting failures and subsequent rise in renesting attempts.

Three-fourths of the egg production in 1968 came from one pen containing two females: 13 of 16 eggs in six of the nine clutches (Table 1).

Clutch size averaged 1.8, 2.8, 2.2, and 1.8 eggs in 1968 through 1971, respectively. These averages are less than the normal three-egg clutch reported for Red-wings in Florida (Sprunt 1954, Florida bird life, New York, Coward-McCann, Inc., p. 434). One reason for this may be that 1-year-old females laid approximately half the clutches; the clutches of 1-year-old hand-reared females averaged 1.9 eggs compared with 2.2 for older females. Seven single-egg clutches in five pens were responsible for the drop in overall clutch size to 1.8 eggs in 1971.

Eggshells taken from avicultural nests were thinner than those from nests in the wild. Three eggshells collected in 1970 and 1971 from the pens ranged from 0.07 to 0.09 mm thickness and averaged 0.08 mm. The thicknesses of 10 shells collected from the wild ranged from 0.09 to 0.12 mm and averaged 0.10 mm.

The number of eggs incubated for the full term rose steadily—4 in 1968, 5 in 1969, 14 in 1970—but then dropped to 11 in 1971 (Table 1). The total lack of hatching success in 1968 apparently was due to the infertility of the hand-reared subadult males used as breeders; we checked most of the eggs and found all that we examined to be infertile. Heavy rains probably were a factor in the failure of at least four of the 16 attempts in May and June of 1971. All eggs in the seven one-egg clutches laid in 1971 disappeared in from 1 to 10 days.

Only 36% of the 11 eggs incubated for the full term in 1971 hatched compared with 57% of the 14 incubated in 1970 and 80% of the five eggs incubated in 1969. Snakes may have taken some eggs in 1971, but we did not find conclusive evidence of this.

NESTLING AND FLEDGLING SURVIVAL

Over the 4-year nesting phase of the project, three of 10 fledglings survived to become free-flying, self-supporting birds. One, a male produced in 1969, survived until 1973; its sibling, a female, disappeared from a holding cage during its first winter. The third bird survived for 2 months before inexplicably vanishing from its rearing pen.

The remaining seven fledglings survived for 34, 34, 15, 15, 15, 13, and

13 days. The two 34-day-old fledglings may have starved to death, but only one carcass was found. As the female was laying eggs in a new nest at the time the fledglings died, she may have neglected them. One fledgling that lived to be 15 days old probably was sick or retarded because it stayed in the nest until the 14th day; nestling Red-wings normally fledge by at least the 11th day (Allen 1914, The Red-winged Blackbird: A study in the ecology of a cat-tail marsh. Abstr. Proc. Linnaean Soc. Nos. 24-25: 43–128). Another 15-day-old fledgling probably succumbed because of wet weather; a third one apparently was eaten by a rat snake. The two 13-day-old fledglings disappeared unaccountably.

The six nestlings that did not fledge disappeared at approximately 10, 10, 9, 8, 1, and 1 days of age. Other than rains that probably caused the death of at least two, we do not know why they died; these dead nestlings presumably were removed by the parents.

Performance of Breeders

Hand-reared birds, both male and female, consistently outperformed wild-trapped birds as breeders (Tables 2 and 3); this was especially true of females. Only one of the nine wild-trapped females paired with adult males produced a nest and eggs compared with 15 of 18 hand-reared females. (One wild-trapped female paired with a subadult male built up to four nests and laid up to five eggs in 1968.) Wild-trapped males performed better than did wild-trapped females. Of seven wild-trapped males used, two fathered young. One male was wild-trapped as an adult in 1967 and used in 1967, 1968, and 1969 without success as a breeder; in 1970 it fathered one of the three juveniles reared during the project. The other male was wild-trapped as a subadult in 1969 and fathered a nestling in 1970. In comparison, six of 11 hand-reared males fathered young.

One-year-old, hand-reared females performed nearly as well as 2- and 3-year-old hand-reared birds (Table 2), but subadult (year-old) males were failures. Eggs produced by pairs involving subadult males either disappeared before they could be incubated for the full term or else they proved to be infertile. Between 8 April and 1 July 1968, we examined for gonadal activity 12 wild-trapped subadult Red-wings of the same populations from which we had taken the breeding stock. Only one of the 12 birds had both testes fully developed and containing sperm. Two other males had partially developed gonads; the rest showed no gonadal activity.

Hand-reared females varied greatly in their individual breeding performance. One hand-reared female reared six fledglings, two of them to a state of self-sufficiency, in 3 years of breeding (Table 3). In contrast, three other hand-reared females, each under study for 2 years, produced a total of one self-sufficient young and no other nestlings.

TABLE 3
RED-WING PAIRS PRODUCING AT LEAST ONE NESTLING

Breeding pairs			Eggs				
Female	Male	Nests	Laid	Incubated	Nest-lings	Fledg-lings	Juve-niles
1-year HR[1]	2-year WTC[2]	1	3	2	1	0	0
1-year HR	5-year WTC	2	3	2	1	1	1
1-year HR	2-year HR	4	4	3	3	1	0
1-year HR[3]	2-year HR	1	3	3	2	2	2
2-year HR	2-year HR	1	2	2	2	1	0
2-year HR[3]	3-year HR[4]	2	6	6	5	3	0
3-year HR	3-year HR	2	6	3	1	1	0
3-year HR[3]	4-year HR[4]	4	6	5	1	1	0

[1] HR = hand-reared.
[2] WTC = wild-trapped; conditioned (kept 6 months or more in holding pen before being placed in breeding pen).
[3] Same bird, 3 different years.
[4] Same bird, 2 different years.

We were unable to determine whether pen-hatched birds will themselves breed successfully in captivity. In 1971 we paired our only surviving pen-hatched male with the hand-reared female that produced the juvenile in 1970. Breeding behavior of the male appeared normal, but as mentioned earlier, that of the female seemed aberrant, she completed five nests and partially built two others, laid two eggs, but did not incubate.

Polygynous groupings of birds in the breeding pens during 1968 and 1969 showed no apparent advantages over monogamous pairings, and because of the threat of added disturbance by probable territorial squabbles among females within the same pen, we paired birds in breeding situations thereafter. In only one of nine polygynous breeding situations did more than one female take part in breeding activities. In that one case, identified earlier as two females producing 13 of the 16 eggs in 1968, two nests were active concurrently on three occasions. On one of these, the two nests with eggs were only 1 foot apart in the same shrub; but these two clutches were incubated only part-term. Normally each female established a territory in the pen, but the year-old hand-reared female that raised the two juveniles in 1969 cowed a wild-trapped unconditioned female into a corner of the pen and kept her there for most of that breeding season. This hand-reared female produced three fledglings the following year when paired monogamously.

Breeding performance declined after the first year in every case except one where males or females were kept as breeders for more than 1 year. The lone exception was an adult wild-trapped male that improved its performance during 3 successive years (1968–1970); in 1970 it fathered a fledgling. When we paired birds for more than 1 year, breeding per-

formance was poorer the second year. For example, a pair partially reared five young in 1970 but only one in 1971. Another pair in 1970 fully incubated one egg that did not hatch; this pair in 1971 produced two eggs that disappeared within 2 days. A third pair in 1970 laid and incubated one egg that did not hatch; in 1971 this pair did not even build a nest.

Conclusions

Development of techniques to establish a self-sustaining captive colony of Red-wings now appears more difficult than it did several years ago. Problems have arisen, including egg infertility, small clutch size, and poor survival during the period in which young attain self-sufficiency. Hard rains and predation by snakes are other obstacles in the Gainesville, Florida area. The reason for the decline of individual performance after the first year of breeding is unknown. Quicker replacement with new stock of old breeders that show signs of faltering might increase the success of a Red-winged Blackbird breeding program of this nature.

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Summary

We made a 5-year effort (1967–71) at Gainesville, Florida, to establish and maintain a self-sustaining breeding colony of captive Red-winged Blackbirds. Hand-reared Red-wings taken wild as nestlings and supplemented with wild birds constituted the breeding stock.

Egg production per female increased greatly throughout the course of the study and may be attributed in part to increased use of hand-reared females. The number of eggs incubated rose steadily each year. Hatching success was zero in 1968, apparently due to infertility of the hand-reared subadult males used as breeders. Eggshells of penned birds were thinner than those collected from nests in the wild.

Over the 4-year period, three of 10 fledglings survived to become self-

sufficient birds. One, a male produced in 1969, survived until 1973; its sibling, a female, disappeared during its first winter. The third survived for 2 months before vanishing. The other seven fledglings survived for 34 days or less. Six nestlings died before fledging.

Hand-reared birds of both sexes consistently outperformed wild-trapped birds as breeders. Polygynous grouping of birds did not appear to have any advantages over monogamous pairings. Breeding performances declined after the first year in almost every case.

Successful establishment of a self-sustaining captive colony of Redwings now appears more difficult than it did several years ago. Quicker replacement of old stock with new might increase success.

U.S. Bureau of Sport Fisheries and Wildlife, Patuxent Wildlife Research Center, Gainesville, Florida, Field Station, 2820 East University Avenue, Gainesville, Florida 32601. Present addresses: 4220 S.W. 5th Avenue, Gainesville, Florida 32601, and *U.S. Bureau of Sport Fisheries and Wildlife, Patuxent Wildlife Research Center, Ohio Field Station, P.O. Box 2097, Sandusky, Ohio 44870.* Accepted 15 January 1974.