RETURNS AND SURVIVAL OF BANDED WARBLERS WINTERING IN JAMAICA

By A. W. Diamond and R. W. Smith

INTRODUCTION

The return of migrant passerine birds to the same locality in winter has been described for several parts of Africa (Moreau, 1969), Malaysia (Nisbet and Medway, 1972) and Central and South America (Schwartz, 1963; Loftin et al., 1967). The present paper, based on data from nine successive winters. describes this phenomenon in 10 species of North American warblers (Parulidae) from Jamaica. An estimate of adult survival for the combined species is presented, and longevity records for each species are given.

METHODS

The birds were caught in mist nets and banded with U. S. Fish and Wildlife Service bands. Two main netting sites were used: Mona Woods, an area of secondary riverine forest at an altitude of about 185 m adjacent to Mona Reservoir, to the northeast of Kingston; and Green Hills, the field station of the Institute of Jamaica, where nets were set both in the gardens and in the adjacent montane forest, at about 1080 m above sea level. From September 1963 to January 1970 and again from September 1971 to February 1972, R.W.S. banded on week-ends at Mona Woods and less often at Green Hills. From October 1970 to September 1971 A.W.D netted both sites regularly, although more often at Green Hills, during a study of the annual cycles of Jamaican forest birds (Diamond, in prep.). A.W.D. was concerned primarily with resident species but caught several individuals originally banded by R.W.S. and so contributed a number of longevity records. R.W.S. netted at Mona Woods mainly during the afternoon (14:00 to 18:00) and at Green Hills during the morning, But A.W.D. netted almost exclusively in the morning (06:00 to 12:00) at both sites. Between 70 m and 100 m of three- or four-panel British mist nets were in use at a time. At Mona Woods the nets were usually set along a stream or drainage culvert, and at Green Hills one half were set in the garden and one half in the forest.

RESULTS

From September 1963 to February 1972, 1,105 warblers of 21 species were banded at Mona Woods and Green Hills combined. This total includes 16 of the 18 species that occur commonly as passage migrants or winter residents (of these, only the Myrtle Warbler (*Dendroica coronata*) and Yellow-throated Warbler (*D. dominica*) were not caught), together with five other rarer species, three of which were new records for Jamaica (*Vermivora peregrina, Dendroica pinus and D. pensylvanica*). The endemic Arrow-headed Warbler (*Dentroica pharetra*) was also trapped frequently at Green Hills.

To date there have been no foreign recoveries of any warblers banded in Jamaica, and only one foreign-banded bird, a Worm-

eating Warbler (*Helmitheros vermivorus*), was trapped in Jamaica.

Table 1 lists the 10 species for which at least one individual is known to have returned to its banding site in a later winter, and gives the number of returning individuals of each species and also the longest interval between banding and recovery. To convert this latter figure to a minimum age, it should be increased by at least four months to allow for the period between hatching and migration.

TABLE 1. Warblers returning to the same wintering area in Jamaica. Figures in parentheses are the numbers of individuals returning as a percentage of the total number banded before the winter of 1971-72.

Species	Number of individuals returning		Longest interval between banding and last capture (months)
Black-and-white Warbler *Mniotilta varia*	10	(8.4%)	25
Swainson's Warbler *Limnothlypis swainsonii*	4	(17.4%)	87
Worm-eating Warbler *Helmitheros vermivorus*	14	(16.5%)	64
Parula Warbler *Parula americana*	9	(8.0%)	25
Black-throated Blue Warbler *Dendroica caerulescens*	9	(16.1%)	36
Prairie Warbler *Dendroica discolor*	3	(8.3%)	61
Ovenbird *Seiurus aurocapillus*	9	(7.6%)	48
Northern Waterthrush *Seiurus noveboracensis*	1	(1.4%)	12
Yellowthroat *Geothlypis trichas*	9	(5.7%)	33
American Redstart *Setophaga ruticilla*	15	(11.9%)	37

The data are insufficient to justify an estimate of survival for any one species, but we have calculated survival for all 10 species combined (Table 2). Only data from the first five seasons' work were used since trapping effort was much lower after the 1967/68 winter. Net-shyness is allowed for by considering only those birds retrapped in at least one winter after the one in which they were banded, but this in turn means that the calculated survival refers solely to birds known to have returned to the banding site, which could be those birds most likely to survive. To calculate survival we have used the maximum likelihood method of Roberts (1971), but have reservations about the allowance claimed to be made for trapping efficiency (t), which is the proportion of birds known to be available for retrapping which are actually retrapped. The magnitude of the mean

t should have an important effect on the standard error of s, but in Roberts' method it does not appear to do so. Using Roberts' own data, setting t to extreme values of .001 and .999 gave s values of 56.5 ± 9.4% and 49.1 ± 6.9%, respectively.

TABLE 2.   Returns of all species combined, arranged by winter of return for calculation by Roberts' (1971) method.

			K (season of return)							
Season banded	J	DJ	1	2	3	4	t	s	S.E. of s
1963/64	1	51	30	17	4	0			
1964/65	2	22	14	5	3				
1965/66	3	10	10	0					
1866/67	4	4	4						
	DK	R = 87	58	22	7	0	.333	.506	.070

Season 1 (of return) refers to the first winter following that in which the bird was banded.
R   = total number of return-years recorded.
DJ = number of return-years for birds banded in the Jth year of banding work.
DK = number of returns in the Kth year following banding.
t   = trapping efficiency (see text).
s   = calculated adult survival.
S.E. of s = calculated standard error of s.

Bearing these reservations in mind, our estimated survival value of 50.6 ± 7.0% for 10 species of parulids can be compared with Roberts' figure (based on Anderson and Maxfield's data in 1967) of 67.8 ± 4.5% for six species of parulids returning to their breeding quarters, Nisbet and Medway's (1972) figure of 66 ± 3.9% for the sylviid warbler *Acrocephalus orientalis* returning to winter in Malaysia, and Fogden's (pers. comm.) figure of 65-70% for *A. scirpaceus* wintering in Uganda. Both our data and those of Roberts refer to parulid warblers, but only five species are common to both sets of data. Thus, the two figures on survival values are not strictly comparable.

None of these estimated survival rates are significantly different statistically, but since the estimation of statistical significance involves the standard errors of the means being compared and the calculation of standard errors by Roberts' method appears to be suspect, it is worth considering the possibility that the survival of wintering parulids is in fact lower than that of summering birds. Since it is logically impossible for the actual survival to be different in the two cases, the apparent difference seems most likely to be due to the birds being less faithful to the wintering than the breeding area. This tentative conclusion is justified by our data only if the effect is age-specific, i.e., the birds become progressively less faithful to the wintering site as they grow older. The analysis uses data only from those birds that returned at least once to the banding site.

SUMMARY

The 10 species of parulids known to recur in the same winter quarters in Jamaica are listed. The survival of those adults that returned at least once is calculated as $50.6 \pm 7.0\%$. This figure is lower than published survivals of parulids returning to summer quarters, and it is suggested that this might be due to a decline in fidelity to wintering areas with advancing age of the bird.

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A.W.D.: Edward Grey Institute of Field Ornithology, Oxford, England (Present address: Intern. Council for Bird Preservation, Cousin Island via Praslin, Seychelles); R.W.S.: Ivy Lodge, The Cricket Green, Stokenchurch, Bucks., England.