quality; hence, males might tolerate foster nests as a means for attracting new females to the territory. This assumes that active nests do not offset their advertisement qualities by depleting territory resources.

Alternatively, females might desert the territory after nest failure, reducing within-breeding season gains to zero for the infanticidal males. Furthermore, males may weigh desertion probabilities against some future benefit, either a renesting later that season or a return to the same territory the next year, accompanied by a high probability of the male being able to reclaim that territory the following year. The limited data available suggest that within-season renesting is infrequent in yellow-heads (Fautin 1941; Willson 1966). Further, late season clutches may be of low value if winter survival depends on experience or some other function of fledging time (see Perrins 1970). In Great Tits (*Parus major*), both sexes normally show high year-to-year breeding site fidelity, but distances between successive annual breeding sites are higher if the first nesting attempt of the season fails (even if there is a successful renest) (Harvey et al. 1979). If female yellow-heads behave similarly, infanticide would not be profitable to male yellow-heads. There is evidence for persistent annual returns among male and female Red-winged Blackbirds (*Agelaius phoeniceus*) (Nero 1956 citing Beer and Tibbets 1950), but we are aware of no evidence of long-term pairing in yellow-heads. Equally, we are not aware that anyone has looked, so the future-mate hypothesis remains viable, if speculative.

LITERATURE CITED

ALEXANDER, R. D. 1974. The evolution of social behavior. Ann. Rev. Ecol. Syst. 5: 325–383.

BLAFFER HRDY, S. 1979. Infanticide among animals: a review, classification, and examination of the implications for the reproductive strategies of females. Ethol. Sociobiol. 1: 13–40.

FAUTIN, R. W. 1941. Incubation studies of the Yellow-headed Blackbird. Wilson Bull. 53: 107–122.

HARVEY, P. H., P. J. GREENWOOD, & C. M. PERRINS. 1979. Breeding area fidelity of Great Tits (*Parus major*). J. Anim. Ecol. 48: 305–313.

NERO, R. W. 1956. A behavior study of the Red-winged Blackbird. II. Territoriality. Wilson Bull. 68: 129–150.

PATTERSON, C. B., W. J. ERCKMANN, & G. H. ORIANS. (in press). An experimental study of parental investment and polygyny in male blackbirds. Amer. Natur.

PERRINS, C. M. 1970. The timing of birds' breeding seasons. Ibis 112: 242–255.

POWER, H. W. 1975. Mountain bluebirds: experimental evidence against altruism. Science 189: 142–143.

ROTHSTEIN, S. I. 1975. Evolutionary rates and host defenses against avian brood parasitism. Amer. Natur. 109: 161–176.

————. 1977. Cowbird parasitism and egg recognition of the Northern Oriole. Wilson Bull. 89: 21–32.

SCHALLER, G. B. 1972. The Serengeti lion. Chicago, Illinois, Univ. Chicago Press.

SMITH, N. G. 1968. The advantage of being parasitized. Nature 219: 690–694.

WILLSON, M. F. 1966. Breeding ecology of the Yellow-headed Blackbird. Ecol. Monogr. 36: 51–77.

Growth of Nestling Rufous Hummingbirds

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Although the growth of some tropical hummingbirds has been studied (Dorst 1962, Oiseau 32: 95–126; Haverschmidt 1952, Wilson Bull. 64: 69–79), there has been apparently nothing reported on the growth in body weight of temperate-area hummingbirds. This note describes changes in the mass of two young nest-mate Rufous Hummingbirds (*Selasphorus rufus*) in the northern Rocky Mountains.

I studied a nest on the grounds of the University of Montana Biological Station, Flathead Lake,
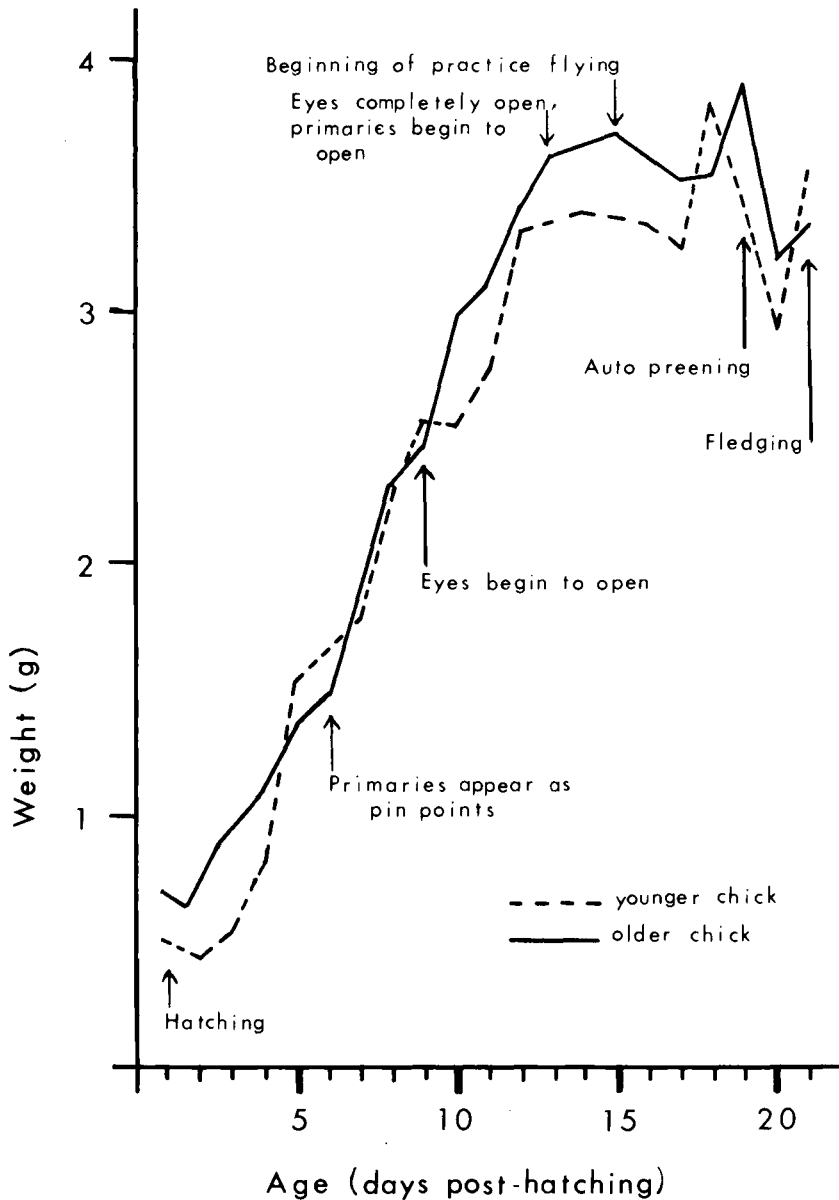
Fig. 1.   Age-specific weights of two nest-mate Rufous Hummingbird chicks. In order to express age-specific weight, the condition of asynchronous hatch necessitated shifting leftward by 1 day the weights of the younger chick.

Montana from 23 June to 15 July 1968. The nest was located 7 m above ground on a down-sweeping bough of a Douglas fir (*Pseudotsuga menziesii*), which was adjacent to a road clearing. Each chick was placed daily in an aluminum 35-mm film canister of known weight, and the container with chick was weighed to the nearest 0.01 g on a quadruple beam balance. Chick weight was calculated by subtraction. After weighing, chicks were returned to their nest.

Both hatching and fledging by the twin chicks were asynchronous by 1 day. The nestling period was

TABLE 1. Comparison of the growth of two nest-mate Rufous Hummingbirds and three tropical species (Ricklefs 1976, Ibis 118: 179–207). See text for definition of symbols.

Species	A	K	t_i	Residual mean square
Selasphorus rufus				
Older chick	3.62	0.372	6.34	0.045
Younger chick	3.45	0.388	6.55	0.054
Amazilia fimbriata (Surinam)	4.0	0.256	—	—
A. tobaci (Trinidad)	4.2	0.332	—	—
A. tzacatl (Panama)	5.0	0.362	—	—

21 days, somewhat shorter than the 26 days that Lack (1968, Ecological adaptations for breeding in birds, Methuen, London, p. 187) gives as the usual fledging period for hummingbirds.

Changes in body weight are shown in Fig. 1. After hatching from eggs of 0.70 g each (weighed 1 day prior to hatching), chicks lost weight for 1 or 2 days; one chick's weight decreased to 0.44 g. I did not record the weight of chicks immediately after hatching. Weight loss by 2 days averaged 22% of egg weight. From 3 to 12 days of age, growth was rapid (0.293 g/day) and fairly constant. This growth rate was more than twice the average over the entire nestling period of 0.133 g/day. By 12 days of age, body weight had increased to 3.5 g. From 12 to 21 days, weight of the chicks fluctuated about 3.4 g, with an asymptote of approximately 3.6 g at 18 days. Thus, the body weight at which fledging eventually occurred was attained at a point 55% of the way between hatching and fledging. The asymptotic weight of these nestlings was similar to the weight of adult female Rufous Hummingbirds ($\bar{x} = 3.68$ g, SD $= 0.27$, $n = 11$), which I captured at local feeding stations, a fact indicating that virtually all body weight is acquired during the nestling stage.

For future comparisons, the weight data were fitted to the following logistic equation (using SAS procedure NLIN):

$$w(t) = A/(1 + e^{-K(t-t_i)})$$

where $w(t)$ is weight (g) at age t (days), A is asymptote (g), K is growth rate constant (days^{-1}), and t_i is age at inflection point ($w = \frac{1}{2}A$). Although the resultant least squares fit (Table 1) suggests that the Rufous Hummingbird grows faster than three tropical species, generalizations regarding the tropical-temperate comparison await further study.

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Further Observations on Ecological Release in Mona Island Birds

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Ecological release is expected when a species occurs in a situation with reduced competition in which it may increase its density, foraging height, breadth of habitat, and so forth. Most studies of ecological release have been comparisons between islands or between islands and the mainland, and most have focused on the density aspects of this phenomenon (termed density compensation). By looking simply at numbers and not size of birds, guild membership, or resource and habitat characteristics, studies have found islands with more birds than mainland areas (Crowell 1962, Grant 1966, MacArthur et al. 1972), fewer birds than mainland areas (Diamond 1971, MacArthur et al. 1973, Yeaton 1974, Wright in press), or similar densities to mainland areas (Yeaton 1974, Yeaton and Cody 1974, Cox and Ricklefs 1977). Models of overexploitation and interference competition have been proposed to explain this variation in patterns (Case et al. 1979).