——— AND ———. 1979. Ecology and evolution of lek mating behavior in the Long-tailed Hermit hummingbird. Ornith. Monogr. 27.

WAGNER, H. O. 1946. Food and feeding habits of Mexican hummingbirds. Wilson Bull. 58:69–132.

WALSBERG, G. E. 1983. Avian ecological energetics. Pp. 161–221 *in* Avian biology, vol. 7 (D. S. Farner, J. R. King, and K. C. Parkes, eds.). Academic Press, New York, New York.

WOLF, L. L. 1970. The impact of seasonal flowering on the biology of some tropical hummingbirds. Condor 72:1–14.

——— AND F. R. HAINSWORTH. 1971. Time and energy budgets of territorial hummingbirds. Ecology 52:980–988.

——— AND ———. 1977. Temporal partitioning of feeding by hummingbirds. Anim. Behav. 25:976–989.

———, F. G. STILES, AND F. R. HAINSWORTH. 1976. Ecological organization of a tropical highland hummingbird community. J. Anim. Ecol. 45:349–379.

YOUNG, A. M. 1971. Foraging for insects by a tropical hummingbird. Condor 73:36–45.

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Behavior of polygynous and monogamous Loggerhead Shrikes and a comparison with Northern Shrikes.—Reports of polygyny in *Laniinae* are rare (Verner and Wilson 1969). To date, polygyny has been recorded only once in Loggerhead Shrikes (*Lanius ludovicianus*) (Verner and Wilson 1969) and in one study in Northern Shrikes (*L. excubitor*) (Yosef and Pinshow 1988). Additional records will allow us to understand prevailing conditions, strategies adopted, and the costs and benefits of being polygynous.

Methods.—Two polygynous and 23 monogamous Loggerhead Shrikes were studied at the MacArthur Agro-ecology Research Center, Archbold Biological Station, Lake Placid, Florida. This 4120-ha cattle ranch consists primarily of improved pasture, with scattered cabbage palm (*Sabal palmetto*) hammocks, native wetlands, and live oak (*Quercus virginianus*) uplands.

Time-budgets were constructed for all pairs included in the study. The birds' diurnal behavior was divided into (1) perching, (2) flying (to or from collecting prey, chasing conspecifics or heterospecifics, or changing lookout points), (3) handling prey (recorded from the instant the shrike landed on or near the prey and attacked it until the prey had been impaled or consumed), and (4) preening.

Males were captured with either a bal-chatri noose trap or treadle trap and color banded. Territories were mapped by plotting points of shrike activity and by observing their reaction to taped songs of other males, and to a mounted specimen. Data are presented as mean ± SD.

Results and discussion.—Monogamous males captured 7.2 prey per hour as compared to 9.3 in polygynous males. Monogamous males captured mainly insects, the rest being reptiles. Although polygynous males also captured mostly insects, they also caught amphibians and reptiles. Territories of polygynous males did not differ in area from those of 23 monogamous males ($U_{2,23} = 39$, $P < 0.1$), although the total number of nestings attempted per territory

TABLE 1

PREY CAPTURE RATES, DIETARY COMPOSITION, AND REPRODUCTIVE SUCCESS OF MONOGAMOUS AND POLYGYNOUS NORTHERN AND LOGGERHEAD SHRIKES

	Northern Shrike		Loggerhead Shrike	
N	Monogamous 5	Polygynous 2	Monogamous 23	Polygynous 2
Prey/h	0.59	1.19	7.2	9.3
Arthropods	95.4	89.4	97.3	86.3
Amphibians	—	—	—	6.7
Reptiles	4.6	7.4	2.7	7.0
Birds	—	2.7	—	—
Mammals	—	0.4	—	—
Number of nesting attempts	1.8 ± 0.5[a]	3.5 ± 0.7[b]	1.7 ± 0.6[a]	4.0 ± 0.0[b]
Total number of eggs laid	9.4 ± 2.5[c]	18.5 ± 3.5[d]	9.2 ± 2.7[c]	18.5 ± 2.1[d]
Total number of young fledged	—	—	7.0 ± 2.5	13.5 ± 2.1

Records with the same superscript are not statistically significantly different ($P > 0.05$). Capture rates and measures of reproductive success are given as mean ± SD.

($U_{2,23} = 46$, $P < 0.005$), eggs laid per territory ($U_{2,23} = 46$, $P < 0.005$), and young fledged per territory ($U_{2,23} = 45$, $P < 0.01$) were significantly larger.

Two polygynous Loggerhead Shrike males fed their young 477 times (4.3 ± 2.8 per h), while monogamous males 372 times (5.1 ± 2.3 per h). Females of polygynous males adopted different nesting strategies than females of monogamous males. I termed these 'parallel' and 'serial' strategies. In the 'parallel' strategy, females of polygynous males laid a second clutch within 10 to 12 days after the first hatched, and only the males continued to care for the first brood. Also, in this strategy females tended nests that were 'spaced out in time'. "Spaced out in time" means a situation in which the second female laid eggs only after the nestlings of the first female had hatched. The polygynous male worked at a constant rate, feeding the two females and their young. In the 'serial' strategy, females of monogamous males laid the second clutch only after the first brood fledged. In both strategies, males provided parental care up to several weeks after the young fledged.

Comparisons between contemporaneous observation periods of fixed length revealed that polygynous male Northern Shrikes spent significantly more time than monogamous males seeking and handling prey (Yosef et al. 1991). Males usually brought food to the vicinity of the nest and passed it to the female or impaled it at cache sites, and females retrieved cached food themselves. However, polygynous Loggerhead Shrike males, like their monogamous counterparts, fed and tended young. Females of both species, in monogamous and polygynous relations, relied on males to supply most, if not all, of their food requirements during the pre-nesting, incubation, and pre-fledging periods.

Assuming that apparent reproductive success equalled realized reproductive success for Northern Shrikes, polygynous males fathered nearly twice as many eggs as monogamous males. This assumption is corroborated by the data for Loggerhead Shrikes wherein polygynous males fledged almost double the number of young than monogamous males. However, the increased egg production in Northern Shrikes, and fledging of young in Loggerhead Shrikes, was not without cost: polygynous males hunted more on exposed sites and may have been exposed to greater predation risks and energetic costs.

Adaption of the 'parallel' reproductive strategy may allow males to conserve energy and maintain nutritional condition. Degen et al. (1992) demonstrated that male Northern Shrikes were able to maintain the lowest reported energy costs for adult birds feeding altricial young, and Yosef and Pinshow (1989) showed that males create large caches prior to the breeding season. The cached prey augment the fresh prey and help reduce energetic costs. In this manner, males are never in a situation wherein they feed more than one brood at a time. Although the total investment of males during various nesting stages remains unknown, this result is of importance because Loggerhead Shrikes are also capable of changing strategies, but the energetic consequences remain to be studied.

Loggerhead Shrikes display flexibility in their capability to live off the more abundant prey species during different seasons of the year. They may also enhance their fitness by choosing between alternate reproductive strategies dependent on the abundance of food resources in caches and in the territory.

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LITERATURE CITED

DEGEN, A. A., B. PINSHOW, R. YOSEF, M. KAM, AND K. A. NAGY. 1982. Energetics in Northern Shrikes: growth of nestlings and field metabolic rate of adults. Ecology (in press).

VERNER, J. AND M. F. WILSON. 1969. Mating systems, sexual dimorphism, and the role of male North American passerine birds in the nesting cycle. Ornithol. Monogr. No. 9.

YOSEF, R., W. A. MITCHELL, AND B. PINSHOW. 1991. The proximate costs and benefits of polygyny to male Northern Shrikes. Wilson Bull. 103:146–149.

——— AND B. PINSHOW. 1988. Polygyny in the Northern Shrike, *Lanius excubitor,* in Israel. Auk 105:581–582.

——— AND ———. 1989. Cache size influences female mate choice and reproductive success in the Northern Shrike, *Lanius excubitor.* Auk 106:418–421.

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The waving display and other nest site anti-predator behavior of the Black-capped Chickadee.—Adult Black-capped Chickadees (*Parus atricapillus*) and other *Parus* spp. show conspicuous postures and movements directed toward potential predators at the nest site (Odum 1941, Dixon 1949, Hinde 1952, Laskey 1957, Betts 1958, McLaren 1976, Long 1982). Descriptions of these displays, called "injury-feigning" (Pettingill 1937, Odum 1941, McLaren 1976) and "distraction" (Hinde 1952, Laskey 1957, Long 1982, Smith 1991) displays, often are incomplete and have not been defined consistently in the literature. Some descriptions are inconsistent among different authors (Long 1982), suggesting that the display is either highly variable or that more than one display is involved. Furthermore, the name "distraction" for the display implies a function for which there is currently no evidence and for