birds (Drees 1994). Ridlehuber (1982) reported fire ants destroyed three of 20 clutches in Wood Duck nest boxes. Sikes and Arnold (1986) reported that nesting success with fire ants was 40.5%, compared to 74.9% for nests without ants. Drees (1994) found no fire ant mortality of hatchling waterbirds in late February to mid May, but observed 100% mortality of nests monitored during June and July. Information on ant predation on a raptor is limited to a report by Parker (1977) on Mississippi Kite (*Ictinia mississippiensis*) nestlings. Parker (1977) found three kite nests out of 400 had nestlings preyed upon by native ants of the genus *Monomorium.*

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VANESSA M. DICKINSON, *Dept. of Wildl. and Fisheries Sci., Texas A&M Univ., College Station, Texas 77843. (Present address: Arizona Game and Fish Dept., 2221 W. Greenway Rd., Phoenix, Arizona 85023).* *Received 26 Jan. 1995, accepted 10 May 1995.*

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Food delivery and food holding during copulation in the Loggerhead Shrike.—Copulation in mated birds sometimes is accompanied by a ritual, including the delivery of food from one member of a pair to the other (e.g., Lack 1940, Calder 1967, Tasker and Mills 1981). Observed copulations in the Loggerhead Shrike (*Lanius ludovicianus*) appear to share the common element of food delivery by the male prior to his mounting the female. The retention of the food by the female during copulation has also been reported. Here, I summarize behaviors associated with six copulation events I observed by Loggerhead Shrikes during 1991 through 1993, and I suggest one possible interpretation of precopulatory food delivery and the subsequent holding of the food during copulation in this species.

I monitored nesting pairs of shrikes in southwest Idaho from the time of pair formation through fledging of young (Woods 1994), but found copulation was usually confined to a brief period prior to clutch initiation; five of the six copulations I observed occurred between two and four days before the onset of egg-laying, and three of those occurred exactly two days prior to laying of the first egg. Copulation was often preceded by foraging by the male. Generally the female, perched prominently and apparently watching the male, would begin wing-quivering and calling, the call sounding like a low "waa" rising slightly to a definite if not abrupt end (Woods 1993). It was my impression that these behaviors were initiated by the female upon seeing the male with food although, conversely, the male may have been foraging in response to the female's calls. Nonetheless, as the female called, the male appeared with food and occasionally called in a fashion similar to that of the female. At that time the female typically flew to another perch, or into a nearby shrub, while one or both birds continued to call. The male followed the female, landed, and presented the food to her in a fashion typical of noncopulatory food deliveries. Having received the food, the female held it in her beak as she lowered her upper body so as to stand horizontally. During this time the male quickly flew behind her, hovered with legs tucked under his body, then dropped his legs onto her back, bringing his cloaca to hers as she deflected her tail to one side. During copulation there was generally little movement by either bird, although the male occasionally flapped his wings briefly, apparently to keep his balance and remain mounted on the female. Several high-pitched "twitters" were also sometimes heard during copulation. Copulations lasted 1 to 3 s; in the 30 s or so following copulation, the male typically perched within 0.5 m of the female, while the female either consumed or impaled the food the male had presented to her. The male was sometimes quiet during this time, but following two of six copulations he sang and displayed emphatically to the female (see Smith 1973 for description of displays). In either case, one or both shrikes usually moved off shortly thereafter, with the female sometimes preening in the following minutes.

The Cactus Wren (*Campylorhynchus brunneicapillus*) copulates as early as 18 days prior to egg-laying (Anderson and Anderson 1973:73), but the timing of copulation in some other passerines is similar to that which I observed for the Loggerhead. Maximum copulation rate in paired Zebra Finches (*Taeniopygia guttata*), for example, also occurs two days prior to the start of egg laying (Birkhead et al. 1989). The Loggerhead Shrike, however, appears to have incorporated courtship feeding, and the holding of the food by the female during copulation, into its copulatory behaviors. Smith (1973) found male shrikes fed the female just prior to copulation in all six instances she observed in Washington, and Scott and Morrison (1990) noted one copulation preceded by the male feeding a lizard to the female, which she held during copulation, on San Clemente Island, California. In New York, Novak (1989) also reported copulation to be accompanied by courtship feeding on several occasions. At least five of the six copulations I observed were preceded by the male presenting food to the female prior to mounting her. This food was always held by the female during copulation, and eaten or impaled by her afterward.

The importance of energy supplied to female birds via courtship feeding varies with bird species (e.g., Tasker and Mills 1981, Wiggins and Morris 1986, Salzer and Larkin 1990). The apparent infrequency of copulations in the Loggerhead (pers. obs.), however, implies that food presented during the copulation event is almost certainly more important from a behavioral than an energetic standpoint (although this may be untrue for general courtship feeding in the species [cf. Carlson 1985]). Why, then, the incorporation of food delivery and, in particular, food holding into copulatory behaviors? Shrikes of the genus *Lanius* are distinct among the passerines owing to the hooked bill and tomial teeth which are used to dispatch the vertebrates upon which they prey, including small rodents, birds, and reptiles (Cade 1967). Consequently, aggression between shrikes has inherent danger, and Smith

(1973) suggested that ritualization of aggressive behaviors in the Loggerhead serves to reduce the possibility of injury to potential combatants. Copulation in several Palearctic shrike species (Great Grey Shrike [*L. excubitor*], Lesser Grey Shrike [*L. minor*], Woodchat Shrike [*L. senator*]) is also sometimes accompanied by food delivery, and aggression toward male Woodchat Shrikes has been noted when copulation attempts have not been preceded by food delivery (Cramp and Perrins 1993). Thus, prey delivery by male shrikes, and the subsequent holding of the food by the female, could result from reluctance by the male to mount the female otherwise, since she may be inclined to peck at him when she is not holding food.

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CHRISTOPHER P. WOODS, *Dept. of Biology, Boise State Univ., Boise, Idaho 83725.* *Received 21 Dec. 1994, accepted 10 May 1995.*