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**Brood adoption and apparent infanticide in a north-temperate House Wren population.**— In many bird species, a mate who dies or deserts during a breeding attempt may be replaced by another bird before the breeding attempt terminates. Replacement can also occur after physical eviction of one member of a pair by an unpaired floating bird (i.e., Freed 1986, Arcese 1989). “Replacement mates” may respond to eggs or young of the previous mate by killing them (infanticide), providing them with some form of parental care (brood adoption), or ignoring them (indifference). Rohwer (1986) reviewed the distribution of these behaviors among replacement mates in 26 species of birds. Additional cases of infanticide (among non-cooperatively breeding species) have now been reported in the Little Egret (*Egretta garzetta*), Palestine Sunbird (*Nectarinia osea*), Tristram’s Grackle (*Onychognathus tristramii*), and the Barn Swallow (*Hirundo rustica*) (Fujioka 1986, Goldstein et al. 1986, Hofshi et al. 1987, Møller 1988). Brood adoption has been reported in the Black-capped Chickadee (*Parus atricapillus*), and Black-billed Magpie (*Pica pica*) (Howitz 1986, Buitron 1988). Bowman and Bird (1987) found indifference to broods among replacement mates in American Kestrels (*Falco sparverius*). In tropical House Wrens (*Troglodytes aedon inquietus*) and Tree Swallows (*Tachycineta bicolor*), replacement mates may either kill young or show indifference to broods (Freed 1986, Robertson and Stutchbury 1988). We report here on a case of brood adoption and a case of apparent infanticide by replacement males in a north-temperate

population of House Wrens (*T. aedon*). Our observations were made on the Helen Brinton Bird Reserve at the Quarter-circle A Ranch and the Reverse E4 Ranch, both near Big Horn, Sheridan County, Wyoming.

Brood adoption occurred on the territory of a color-banded male, BG, and his unbanded mate in 1987. Normal incubation stage behavior was observed by both birds at their natural cavity nest site on 4 July. On 6 July, BG was absent, and we observed a color-banded male, VS, courting BG's female at the nest entrance. VS's prior breeding history was not known. From 7–12 July, VS continued to court BG's female. On 14 July, VS carried food to the nest four times in 34 min. We observed this pair for 20 min on each of seven days from 16 to 28 July. The male and female made 20 and 29 trips to feed young, respectively. Neither adults or young were visible at the nest site on 29 July and we presume the brood fledged. This would have been one of the latest fledgings that season, and it is extremely unlikely that VS and the female made another breeding attempt that year. We do not know if VS and that same unbanded female bred together the following year.

We suspect that infanticide occurred on the territory of color-banded male YJ and his unbanded mate in 1985. The female began egg-laying on 18 June. YJ was last observed on the territory on 1 July. His mate was incubating seven eggs this day and continued to do so after YJ disappeared. On 4 July, we observed an unbanded male singing vigorously from the perch of YJ's nest box and courting YJ's female when she left the box. The nest contained seven warm eggs. On 5 July, the unbanded male continued vigorous singing and courtship. The female left the box after unusually short periods of time. She was also panting, although it was not unusually hot, suggesting that she was stressed. Five eggs remained in her nest. On 6 July, only two eggs were present, and one egg had a hole, 2–3 mm in diameter in the shell. On 7 July, the female was present but no eggs were in the otherwise undisturbed nest. She was not present on 8 and 9 July. The male removed the lining of the nest and continued to advertise for a mate on each of these days. On 10 July, the male paired with an unbanded female, and they proceeded to nest in YJ's former nest box. We do not know if this was YJ's original female. This pair made the last of the 21 nesting attempts that we followed in 1985.

While we suspect that the unbanded male destroyed the eggs in YJ's nest, two alternative explanations are possible. First, the eggs may have been taken by a predator. We consider this unlikely because in nearly all cases of nest predation the nest lining is disturbed and/or all eggs are removed at once (unpubl. data). Second, in her agitation, the female may have damaged the eggs herself. We have observed House Wrens remove eggs that we inadvertently damaged. However, House Wrens rarely damage their own eggs (pers. obs.) and it seems unlikely that the female would have damaged all seven eggs herself.

Selection should favor replacement mates who respond to eggs or young of a previous mate in a manner which maximizes their own reproductive success. Rohwer (1986) argued that for male replacements, infanticide would be favored when: (1) unpaired females are available in the population, (2) females do not normally disperse after nest-failure, (3) mate retention between seasons is uncommon, (4) desertion of one mate by another often occurs before a brood has reached independence, and (5) time remains in the season to complete only one breeding attempt [see Rohwer (1986) for a more detailed discussion]. In our population, pair bonds are formed throughout the first 10 weeks of the breeding season which indicates that unpaired females are available long after initial breeding attempts commence in very early May. We have no data, however, on dispersal after nest failure, between-season mate retention or desertion of mates by females in our population. Other studies of temperate House Wren populations indicate that the frequency of between-season mate retention is probably low. Kendeigh (1941) reported that 13–22% of pairs represented rematings from the previous season in Ohio. Drilling and Thompson (1988) found that less

than 1% of birds remated in successive seasons among House Wrens in Illinois. Kendeigh (1941) also observed frequent desertion of mates by females during the nestling stage (also see Burns 1983). In conclusion, these data suggest that selection should favor infanticidal behavior in replacement male House Wrens. Furthermore, the two cases of mate replacement reported here occurred late in the season when time remained to complete only one breeding attempt. This would further favor infanticide unless individuals in our population normally re-form pair bonds with their last mate from the previous season, in which case adoption may be favored.

We have too few data to determine whether selection has molded the behavior of replacement male House Wrens in our population. However, there is evidence for selection in the behavior of replacement mates in one tropical population of House Wrens. Freed (1986) has studied a Panamanian population in which mate replacement occurs in 13% of all breeding attempts. Replacements apparently kill dependent young in about 70% of cases. No evidence of brood adoption was found where young were not killed. In Freed's population, apparently few unpaired birds are available after breeding begins (also see Freed 1987), between-season mate retention is high, and the breeding season is long (up to three broods may be raised per season). Although none of these conditions specifically favors infanticide, Freed (1986) did find that dispersal by females after nest failure is rare (only 9% of females deserted territories). Selection for infanticide should be strong when there is a high probability that a prospective mate will remain on the territory after a failed breeding attempt.

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**Determinacy of clutch size in Horned and Pied-billed grebes.**—Clutch size of altricial birds generally is presumed to be limited by the ability of parents to provide adequate food for nestlings (Lack 1947, Klomp 1970; but see Nur 1986). Factors determining clutch size in precocial birds are more obscure (Winkler and Walters 1983), but the ability of females to produce eggs is thought to be important for many species, especially those with self-feeding young (e.g., Anseriformes; Lack 1967, Ankney and Afton 1988; but see Rohwer 1988). Many researchers have suggested that egg-production costs might also be important for birds with parentally fed young (e.g., Houston et al. 1983, Alisauskas and Ankney 1985, Hails and Turner 1985). The egg-production hypothesis predicts that observed clutch size is smaller than the most productive brood size due to the inability of females to produce additional eggs. However, some species with parentally fed young produce larger than normal clutches when eggs are removed from their nests during laying (reviewed in Klomp 1970; see also Reid 1987, Beukeboom et al. 1988). Such examples of extended egg laying do not support the egg-production hypothesis (Klomp 1970, Rohwer 1986).

Little research has focused on the factors influencing clutch size in grebes (Podicipediformes). McAllister (1958) removed one freshly laid egg (second-, third-, or fourth-laid) from each of 32 Eared Grebe (*Podiceps nigricollis*) nests. Grebes with removal nests produced an average of 3.97 eggs, versus 3.40 for 106 control nests (*t*-test,  $P < 0.01$ ). Fugle and Rothstein (1977) removed all freshly laid eggs from two Pied-billed Grebe (*Podilymbus podiceps*) nests that they visited daily, beginning with the second- or third-laid eggs. One grebe produced a super-normal clutch of 13 eggs, and the other grebe laid a “normal” clutch of seven. In the present study, I conducted egg-removal and egg-addition experiments with Horned Grebes (*Podiceps auritus*) and a larger sample of Pied-billed Grebes.

Grebes were studied in 1987 and 1988 on small wetlands located near Minnedosa, Manitoba (50°10'N, 99°47'W). Egg-removal experiments involved the removal of eggs 3–6 (5