

digestion in seabirds, allowances must be made for unequal retention times of both hard and soft prey remains in seabird stomachs to avoid biases in diet studies.

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Infanticide by a Male Parent and by a New Female Mate in Colonial Egrets

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Infanticide by avian conspecifics is observed most often in the context of sibling competition, i.e. siblicide (see Mock 1984, 1985; Fujioka 1985a, b). In several mammals, instances of infanticide with mate takeover have been documented (Sugiyama 1965; see Hrdy 1979 for a review). Infanticide in a similar context, including egg destruction, has been reported in some group-living birds (e.g. Vehrencamp 1977, Trail et al. 1981, Mumme et al. 1983, Stacey and Edwards 1983). Recently, infanticide by a female was suggested for the polyandrous Northern Jacana (*Jacana spinosa*; Stephens 1982). Apparently, "adaptive" parental infanticide is rare among birds, excluding parental nest abandonment. Here I present observations of two unusual social interactions in monogamous colonial herons: egg destruction by a male parent of the Cattle Egret (*Bubulcus ibis*) and infanticide by a new female mate of the Little Egret (*Egretta garzetta*). Because a breeding cycle lasts about three months (pers. obs.), these egrets generally breed once in a season.

The study was done at a mixed-species heronry in Mie Prefecture, Japan (34°50'N, 135°35'E), 50 km southwest of Nagoya. Further description of the study area can be found in Fujioka and Yamagishi (1981).

One to 11 nests were observed simultaneously from a blind built on a scaffolding 5.1 m high. In 1982, 12 Little Egret nests and 10 Cattle Egret nests were observed every 1-9 days from 9 May to 6 September, for a total of 90 days or 1,056 h (>3,789 nest-hours). Five of the 12 Little Egret pairs and all 10 Cattle Egret pairs reared 2-5 chicks. Adult egrets were distinguished individually by idiosyncracies in their lores, legs, and so on. Adult gender was determined from observations of courtship displays, egg-laying, or repeated copulation positions (see Blaker 1969a, b).

Egg destruction by a male that deserted his mate.—On 20 May 1982 a Cattle Egret female (F2a) laid an egg at 0821, when I first noticed that she had a fractured bone in her left leg. Her mate (M2) attempted to copulate with her repeatedly, but she was unable to support the mounted male. At 1032 and 1448, M2 copulated with her while she was forced to lie prone on a twig. That night, M2 slept on the nest, and F2a nearby.

Early the next morning, M2 stayed on the nest while F2a left, presumably to forage. At 1654, M2 also departed, leaving the egg unprotected. Normally, parents do not leave the nest for more than 7 h even if their mate remains, and they never leave the

nest unprotected during the laying stage (pers. obs.). The male returned at 1723 and rolled the egg to the nest rim and pushed it out with his beak at 1732. Immediately thereafter he began courtship displays on the nest. The courtship was distinguishable from extrapair courtship by paired male herons when their mates leave the nest (Mock 1979) because the latter is performed only during the nest-building stage, i.e. before the laying of the first egg (pers. obs.). At 1744, F2a returned, landing 5 m north of the nest, whereupon M2 stopped courting and performed "tremble-showing," a component of nest-building behavior (see Blaker 1969a). At 1907, M2 jumped near F2a and both performed the "greeting ceremony" while raising their plumage (see Blaker 1969a). The male then returned to the nest and slept, while F2a slept about 2 m from the nest.

Between 1840 and 1920 on 22 May, M2 stayed on the nest with a new female (F2b), whose lore was nearly the maximum intensity courtship color (see Blaker 1969a) but whose yellow iris was not. M2 carried nest items to F2b and copulated with her. The new female laid her first egg in the nest on 26 May, but the eventual fate of this breeding attempt was not followed. The first female (F2a) was not seen after 21 May.

Infanticide by a new female mate.—In Little Egret nest-B, four chicks hatched between 5 and 8 June 1982. The female parent (Fb1) disappeared on 5 June. The male parent (MB) continued brooding without leaving the nest for 3 days. The first and second chicks died on 8 June, apparently of starvation. In the late afternoon, the male left the nest (presumably to forage) and returned but did not feed the two remaining chicks. He brooded the chicks during the night.

By the next morning (9 June), MB's lores began to change to bright purple-red, the courtship color (Cramp and Simmons 1977). He fed chicks only once in the day, at 1157, and was away from the nest between 1250 and 1459. After this absence he started courtship displays on and near the nest. An unmated female first approached MB at 1717 but was repulsed by the male. Such rejections are typical of the normal pair-formation process (Blaker 1969b). The third chick died this night, and only the fourth chick survived. On 10 June the male fed the sole remaining chick and displayed actively in the late afternoon. MB slept on the nest, close to a new female (Fb2).

When observation began at 0456 on 11 June, Fb2 and MB were perched on the nest. At 0500 Fb2 began to peck the remaining chick's head repeatedly, then MB chased her. She returned to the nest soon and again pecked the chick, but was chased immediately by the male. When the male walked to a perch 1 m from the nest at 0511, she quickly pecked the living chick, apparently killing it, even as MB drove her off once more.

On 12 June the new pair, MB and Fb2, obtained a used nest within 1 m of the male's previous nest,

which still contained an unhatched egg and dead chicks. Eventually, the new pair fledged three chicks from the new site.

Egg destruction in birds is a type of infanticide (Trail et al. 1981, Mock 1984). Therefore, the observation of egg dumping is a case of infanticide by its own parent ("parental infanticide"; Mock 1984), excluding the small possibility that the egg was fertilized by another male through extrapair copulations, which are frequent in the egret (Fujioka and Yamagishi 1981). Parental infanticide is generally rare, but may occur due to limited resources or reproductive opportunities. Because nests must be defended against other colony members, colonial herons cannot breed successfully without biparental care, lasting at least until the middle stage of the nestling period. Thus, after a pair bond is formed, pair members alternate on the territory until the nestlings are about 20 days old (Fujioka and Yamagishi 1981, Fujioka 1985b). This means that the Cattle Egret male (M2) that deserted his first wounded mate had no possibility of rearing the egg successfully. By parental infanticide, the male not only obtained a new mate soon, but also reused the nest. Note that even after the egg destruction, the male stopped courtship displays and performed the greeting ceremony in response to the return of his first mate. This suggests that there may be benefits associated with maintenance of the pair bond during this stage.

Among typically group-living birds, infanticide of nestlings or eggs by group members has been observed in Gray-breasted Jays (*Aphelocoma ultramarina*; Trail et al. 1981) and in Acorn Woodpeckers (*Melanerpes formicivorus*; Mumme et al. 1983, Stacey and Edwards 1983). In other types of monogamous species, mate takeover during the egg and nestling periods is infrequent (but see Crook and Shields 1985) because the benefits obtainable are generally low compared with polygynous social units (Mock 1984). Accidental loss of mates during egg-laying to nestling periods, as in the present example, may be rare in nature or easily overlooked. Male and female Mountain Bluebirds (*Sialia currucoides*) whose mates were experimentally removed during the nestling stage remated with new partners that usually discontinued parental care to the remaining nestlings but did not kill them (Power 1975). In my study, the male Little Egret (MB) attempted (unsuccessfully) to interfere when his only surviving offspring was attacked by his new mate. Strong male resistance, then, may have ruined an opportunity for renesting, as discussed for similar cases of infanticide (Hrady 1979). There is, of course, no genetic association between the second parent and the young.

Whether an offspring is killed by the parent (parental infanticide) or by its new mate ("sexually selected infanticide"; Hrady 1979) following the loss of one parent may depend on the timing in the breeding cycle. Early in the cycle the parent may gain more

from deserting the offspring and attempting to re-nest, whereas later in the cycle that parent may gain more by trying to raise the offspring. A parent that loses its mate late in the breeding cycle may raise its chicks alone, and, in fact, I observed such cases for males deserted by their mates. The timing in the breeding season is also relevant because the opportunities to remate and to rear young successfully decrease as the season progresses. Thus, the earlier a parent loses its mate, the more it should invest in remating rather than in rearing chicks alone (Mock 1984).

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