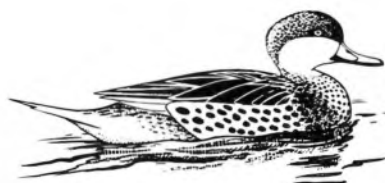


## Serial monogamy and double brooding in the White-cheeked (Bahama) Pintail *Anas bahamensis*



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*We describe the occurrence of two new phenomena in the behavioural ecology of the White-cheeked Pintail. In 1989, a probable case of serial monogamy was documented: behavioural observations of marked individuals and DNA fingerprinting showed that a male paired with two females in succession and successfully fathered two broods in one season. In 1990, double brooding was recorded: a marked female successfully fledged one brood and then laid a second clutch approximately one month later. Although occurring rarely, these phenomena provide further evidence of the increased variability in the reproductive tactics of individuals in species with variable and extended breeding seasons.*

In contrast to the restricted, synchronous breeding seasons experienced by migratory holarctic species breeding in temperate latitudes (Bellrose 1980), many dabbling ducks (Anatini) inhabiting tropical and arid environments have extended breeding seasons due to mild climates and periods of prolonged rainfall (Braithwaite 1976a,b, Halse & Jaensch 1989). Long breeding seasons may increase the reproductive options available to individuals (Emlen & Oring 1977, McKinney 1985). Females may have time to raise two broods within one season. Double brooding and asynchrony in female breeding schedules may also enable males to father two or more broods either by remaining with their mate for a second nest or by breeding sequentially with different females. Double brooding has been reported in Chestnut Teal *Anas castanea* (Frith 1982) and Australian Grey Teal *Anas gibberifrons gracilis* (Fullagar & Davey 1990), but has not been documented in northern hemisphere migratory dabbling ducks. Serial monogamy resulting from mate switches between reneesting attempts has been reported for temperate nesting Mallards *Anas platyrhynchos* (Humbert *et al.* 1978, Ohde *et al.* 1983) but detailed information on within-season pairbond relationships is lacking for most *Anas*. In this paper, we report an occur-

rence of double brooding and provide behavioural and genetic evidence for sequential mating in the White-cheeked or Bahama Pintail *Anas bahamensis bahamensis*. This tropical species is found throughout the West Indies, the Galapagos and part of northeastern South America, and in much of its range it is thought to be non-migratory (Johnsgard 1978).

The breeding ecology and mating system of a sedentary population of White-cheeked Pintails inhabiting New Providence Island, Bahamas, and surrounding cays (small islands) has been under investigation since 1985 (1985-88, L.G.S.; 1989, B.L.W. and L.M.R.; 1990, L.M.R.). A total of 229 birds has been marked individually. The nesting season (number of days from initiation of the first nest to hatching of the last nest) lasted a minimum of 62, 99, 119, 113, and 160 days in 1985-87, 1989, and 1990, respectively, indicating that breeding seasons are often extended in this population.

In 1989, a possible case of within-season serial monogamy (mate changed between broods with little or no overlap between pairbonds) was observed for the first time in our study population. When we arrived on the study area (3 April), female W was raising a brood of six ducklings, approximately two weeks old. Backdating from an

approximate hatch date of 21 March and assuming 25 days of incubation, this clutch would have been initiated on or about 18 February (assuming a clutch of eight eggs). Female W and her brood were frequently attended by male G but she rejected him with the repulsion display and never gave any indication that he was her mate (e.g. inciting or head-pumping displays). Females tending broods are sometimes escorted by their mates, but they may also be attended and courted by one or more males that are not the female's mate (Sorenson 1992).

Female B initiated a nest on about 25 March. She was attended by her mate, male Y, throughout her incubation period and hatched eight ducklings on 25 April. On 30 April, male Y was observed associating with female W (still raising ducklings) for 1.75 hours. During this period, the pair was approached by two different males. Female W responded to each of these approaches by inciting beside male Y and against the other male. Male Y and Female W were again observed together on 5 May but no additional inciting displays were observed.

DNA fingerprinting showed that two of female W's ducklings (the only two from which blood samples were obtained) were fathered by male Y and could not have been fathered by male G. DNA samples were not available for female B's ducklings. The combined evidence from our behavioural observations and the fingerprinting analysis support the conclusion that male Y was paired with female W prior to our arrival on the breeding site and that he fathered her brood in addition to female B's brood. Females only perform the inciting display beside the male to which they are paired. Male Y and female W were also paired in 1988 and 1990. (Interestingly, female W was female B's daughter.) Although we did not begin observations until early in female B's incubation stage, it is highly unlikely that she was paired to a male other than Y during her laying stage: in five years of observations, no female ever switched mates between egg laying and incubation. The possibility, however, that male Y fathered the two ducklings sampled from female W's brood via forced extra-pair copulation cannot be completely ruled out.

Although the two females bred asynchronously (a five week difference in nest initia-

tion dates) and male Y was observed only twice with female W during our observations, it is possible that he simultaneously maintained pairbonds with both females prior to our arrival on the study area. During 1985 to 1987, a low but regular rate of polygyny (one male simultaneously paired to two females) was documented in this population (a more detailed account of polygynous relationships is provided in Sorenson, 1992). The relatively late nest that we observed for female B in 1989 may have been a re-nest following an earlier failed attempt also with male Y: Female B was at least four years old in 1989 and was one of the earliest breeding females in 1986 and 1987. Thus, it is not clear if our observations represent a case of serial monogamy or polygyny. Asynchrony in female breeding schedules combined with female-only parental care apparently provides males with opportunities to breed sequentially with more than one mate.

Extended breeding seasons may also allow female White-cheeked Pintails to successfully produce two broods in one season. Although re-nesting following predation was recorded for two females in 1987 (Sorenson 1990), no instances of double brooding were recorded from 1985 to 1989. In 1990, however, the first case of a second nesting after successful brood-rearing was documented. When observations began on 2 April, female W (the same female as above) was sighted with a brood of ten newly hatched ducklings. Backdating from an approximate hatch date of 31 March, female W initiated her first nest on about 26 February. She successfully fledged ten young (~ 20 May) and then initiated a second clutch of nine eggs on about 20 June. Female W was still incubating this clutch when observations ended on 13 July (projected hatch date was 22 July). Female W and her brood were searched for but not found during a visit to the study area from 23 to 26 August. Because brood-tending females are quite mobile and prefer ponds with dense shoreline cover, however, it is possible that female W and her brood were missed during this short visit.

Female W was paired to male Y for the second nesting attempt. Since these birds were also paired in 1988 and probably 1989 (see above), it is likely that he was also the father of her first clutch. Female W, four years old in 1990, and male Y, at least five years of age, are two of the oldest

marked birds in our study. Furthermore, the 1990 nesting season was the most extended season recorded to date: 160 days as compared to 119 days for the next longest season. It appears that double brooding is a rare phenomenon in this population, perhaps because breeding seasons tend to be too short. Pair compatibility as well as age and experience may also be important factors enabling a female to take advantage of favourable conditions and produce two broods in a single season.

Double brooding has not been recorded in any holarctic dabbling duck, but it occurs commonly in southern populations of North American Wood Ducks *Aix sponsa*. Annual variation in the frequency of double brooding in Wood Ducks was related to the length of the nesting season, which lasted 157 days on average over five years (Kennamer & Hepp 1987). Very long

nesting seasons have also been documented in two different populations of the Pacific Black Duck *Anas superciliosa* (means = 177 and 192 days over four and five years, respectively) and the Grey Teal (means = 177 and 130 days over four and five years respectively; Crome 1986, Fullager *et al.* 1988) in Australia. Double brooding is reported to occur commonly in several Australian species (e.g. Grey Teal, Pacific Black Duck, Chestnut Teal, Fullager & Davey 1990), but detailed data for individually marked birds have not been reported. We emphasize the need to document breeding season length in future studies of *Anas* breeding strategies. Also, because it is usually very difficult to obtain complete records of the breeding activities of individual birds, the detailed evidence available should be reported in each case where double brooding is suspected.

*Financial support for this research has been provided by grants from the National Science Foundation (BNS-8317187) (1984-88), Ducks Unlimited (Bahamas) (1989-90), the Wilkie Fund for Natural History and the Dayton Natural History Fund of the James Ford Bell Museum of Natural History, the University of Minnesota (Doctoral Dissertation Fellowship), The Frank M. Chapman Memorial Fund of the American Museum of Natural History, the Explorer's Club, and the Sigma Xi Society. We are grateful to the Bahamas Ministry of Agriculture and Fisheries for permission to conduct this study and the Bahamas National Trust for logistical support. Blood processing and DNA fingerprinting were performed gratis by the staff of Therion Corporation while in the employment of the Animal Identity division of Lifecodes Corporation. M. Sorenson and two anonymous reviewers provided valuable comments on the manuscript. We are deeply indebted to the Maillis family, M. Lightbourne, B. Brown, and many fine field assistants.*

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