

# Nesting patterns of captive Mandarin Ducks

RICHARD L. BRUGGERS

This paper reports the results of investigations into the reproductive behaviour and biology of Mandarin Ducks *Aix galericulata*. Studies of the relationships of age of first breeding to behavior, to plumage, and to nesting and reproductive success are lacking for many waterfowl species (Korschgen & Frederickson 1976), including the Mandarin, despite its popularity to aviculturists and its presence in many zoological gardens and private estates.

Mandarins were introduced into Europe from Asia near the end of the 18th century and added to the London Zoo in 1830, where they first bred in 1834 (Savage 1952). Although exceptions exist they generally have been difficult to breed in captivity, with success at such English estates as Walcott and Leckford (Stevens and Jones, pers. com.) being quite variable. Sporadic breeding also has occurred in the U.S. (Funk, Webster, Macy, pers. com.) and at the Schedel Estate in Ohio where this study was conducted.

Korschgen and Frederickson (1976) have shown that the precopulatory displays of yearling, male Wood Ducks *Aix sponsa*, the only other member of the genus *Aix*, tribe Carinini, were more poorly oriented and less distinctive than those of adults. Grice and Rodgers (1965) previously had found lower female productivity in the same species. A general consensus among many aviculturists is that yearling Mandarins, which like Wood Ducks acquire an alternate (nuptial) plumage in the first autumn prior to courtship, often are less productive than experienced birds. Research by Bruggers and Jackson (1977a) has shown age-related differences in productivity and behavioural differences in the copulatory display patterns of Mandarins similar to those found by Wood ducks. Time budgets of the Mandarin have been determined by Bruggers and Jackson (1977b).

## Methods

From 1971–1974 over 400 hours of continuous and intermittent observations were made on 30 pinioned birds of both sexes at a 10 ha estate in northcentral Ohio (coord. 83°31'W and 41°18'N) (Bruggers 1974). Birds ranged in age up to nine years. Artificial nest boxes, like those often used for

Wood Duck studies (30 × 15 × 46 cm), were positioned (with ascent ramps) on 0.3–1.3 m poles or on the ground around the two estate lakes of 0.6 and 1.0 ha (Figure 1). Four to six pairs were released annually in early March from over-wintering pens on to the lakes over which they ranged freely. Another four or five pairs were maintained in lake-edge pens. All ducks were individually identified by patagial markers or coloured and numbered, polyurethane nasal saddles.

Laying dates and intervals were noted by regularly checking the nest boxes and numbering most eggs of all clutches using a rapidograph pen. The onset and duration of incubation and the time and length of daily incubation periods and of breaks in incubation (break periods) by each female were determined. A Rustrak recorder, attached to a nest box ramp and started after the female had returned to the nest for the night, was triggered by a switch activated by the duck's weight as she entered or left the box. Time of day was calibrated to chart speed. Kymograph paper was also attached to the ramps such that directional movements across the paper would leave tracks (Justice 1961).

Temperatures in the middle of the nest, taken during and after incubation periods, were recorded on four females in 1972 and five in 1973 using a portable USI manual temperature recorder. A thermister lead was taped to an egg and the temperature read remotely at 30-minute intervals. The presence or absence of down over the eggs during the female's break period was noted.

## Results and discussion

### *Copulation frequency and success*

Copulations were first observed 17 and 3 days after release from the over-wintering pens to the lake in 1971 and 1973, respectively. (Intensive, post-release observations were not made in 1972 and 1974.) Copulations occurred in quiet, undisturbed areas of the lakes, most frequently during the morning (Figure 2), as observed by Collias and Jahn (1959) for semi-wild Canada Geese *Branta canadensis* but unlike the random pattern observed by McKinney (1967) for Shoveler *Anas clypeata*.

Copulations were more frequent during pre-laying than laying periods: 65% in 1971 and 52% in 1973 (Table 1). McKinney (1967) noted a similar pattern for Shovelers, relating it to the increased time spent by females at the nest during laying and hence their unavailability. This is an even more probable explanation for Mandarins, since laying also was more prevalent during the morning.

The pattern of copulations during 1973, when 41% of the observed copulations occurred during the laying period, appeared similar to that reported for feral Mandarins in a natural nesting situation (Savage 1952). Only three copulation sequences were observed after 21 May in 1973, and one stopped through male disinterest. Multiple copulations were observed for seven females, with 48% and 33%

of the copulations of these females occurring during their pre-laying and laying periods, respectively. Four females copulated (19% of the copulations) following removal or destruction of their first clutches; two of these females later renested.

Frequent copulations by a pair (and the associated displays) during the pre-laying and laying periods are undoubtedly more important to synchronizing reproductive physiology and strengthening pair bonds than insuring fertilization, since Elder and Weller (1954) reported sperm viability in Mallard *Anas platyrhynchos* of 12–15 days. There was no apparent relationship between frequency of copulation and age of males.

Sixty-six percent of the observed copulation sequences were apparently successful

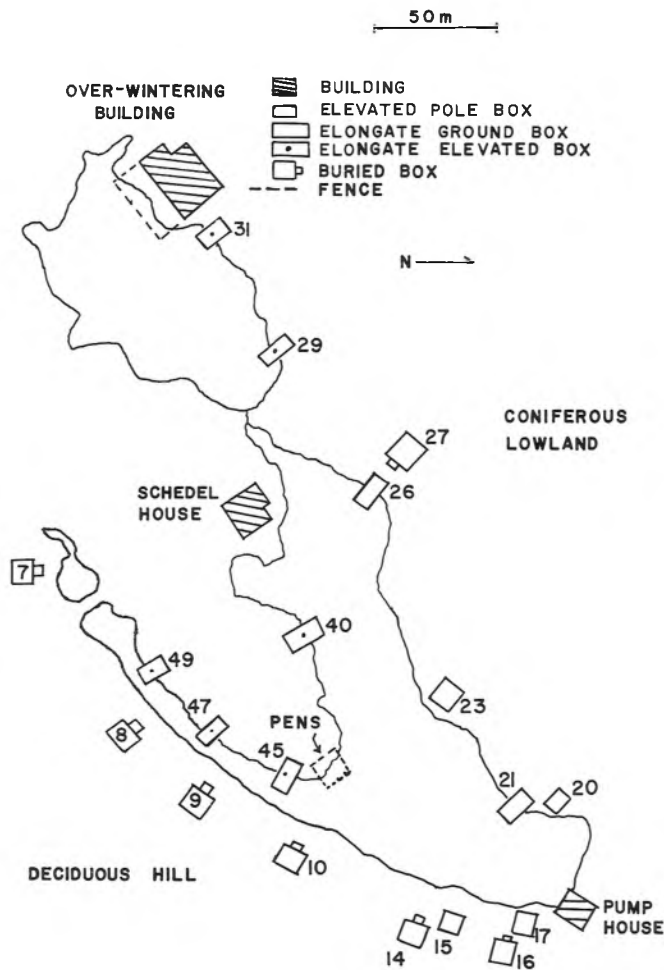


Figure 1. Map of study area showing 0.6 and 1.0 ha ponds, locations of out-door breeding pens, nest boxes, and over-wintering building.

(Table 2). Better success (75–77%) was achieved when both sexes were the same rather than different ages (55%). This lack of success in mixed pairs probably resulted both from the time of year in which these unsuccessful copulations were observed (late May) and the age of the male involved. One male at least six years old showed little interest in pre-copulatory behaviour and usually swam away after the female went prone.

Five copulation sequences were interrupted by other birds (four among

penned birds), and nine stopped because of low-intensity male behaviour. Low-intensity female behaviour was observed only once (24 October 1973) when a female that had successfully copulated at 0830 failed to maintain the copulatory position again at 1000.

As with Shovelers (McKinney 1967), promiscuousness was rare and rape infrequently observed, characteristics undoubtedly indicative of strong pair bonds. This situation is unlike that known for Pintail *Anas acuta* (McKinney 1973), Muscovy

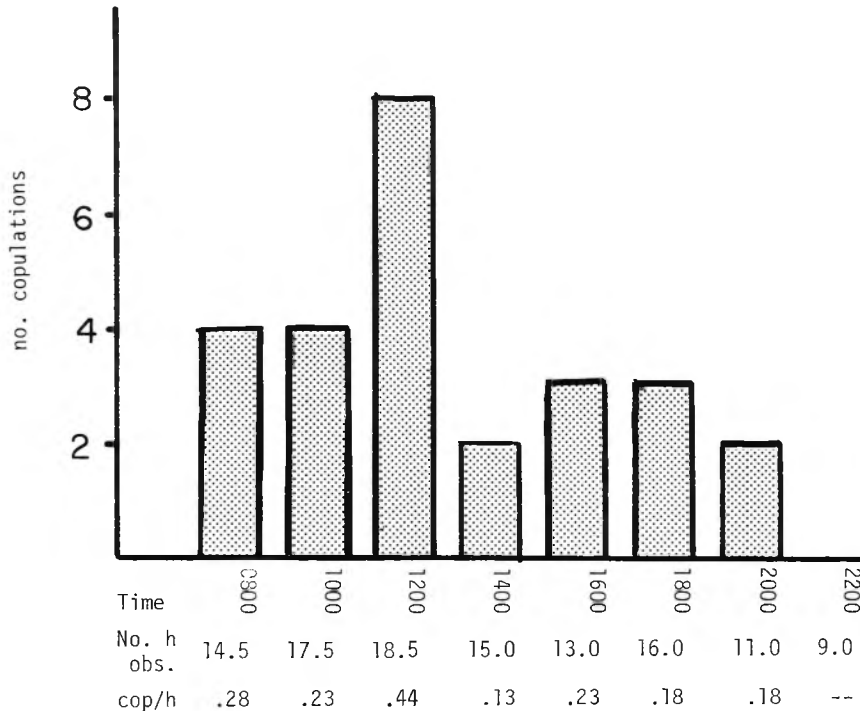


Figure 2. Frequency of copulatory behaviour ( $n = 26$  sequences) relative to time of day between 3 April–31 May 1973, the date of the last observed sequence.

Table 1. Proportion of Mandarin copulations during the pre-laying, laying, and reneating periods in 1971 and 1973.

Year	Total	Pre-laying			Laying			Reneating*		
		no.	%	obs. h	no.	%	obs. h	no.	%	obs. h
1971	20	13	65	37**	7	35	15	0	0	0
1973	27	14	52	32	11	41	45	2	7	20
Totals	47	27	58	69	18	38	60	2	4	20

\* No reneating occurred in 1971.

\*\* In 1971 a total of 53 h of observation were made during the pre-laying period, but only 37 h encompassed the period of copulatory activity (17 Apr–19 May); in 1973 copulations were observed within 3 days of release to the lakes.

**Table 2. Outcome of 47 copulatory sequences of yearling and adult Mandarins recorded during 1971 and 1973.**

	Yearling birds	Mixed* birds	Adult birds	Totals
Copulation occurred	12	12	7	31
Copulation did not occur	4	10	2	16
reasons for failure				
a) pair interrupted or disturbed by other birds	2	2	1	5
b) low intensity female precopulatory behavior		1		1
c) low intensity male precopulatory behavior	2	6	1	9
d) mount without successful** copulation		1		1
Totals	16	22	9	
Rape		2	1	

\* mixed—in all cases, an adult male and yearling female.

\*\* Successful copulation—a sequence consisting of pre-copulation movements, mounting and apparent cloacal contact.

Unsuccessful copulation—a sequence consisting of some precopulatory movements which may or may not lead to mounting. If mounting occurred there was apparent lack of cloacal contact.

Ducks *Cairina moschata*, Comb Ducks *Sarkidornis melanotos* (Weller 1964), and other species which have few displays or vocalizations and weak or no pair bonds (Johnsgard 1965).

Copulation by one pair sometimes stimulated other birds in the area, particularly under penned conditions. Contagious copulatory behaviour by free-ranging birds was observed only on 31 May 1973, when the pairs had begun to reassociate following incubation.

#### Laying patterns

During the four years, first clutches were begun as early as 3 April 1972 and as late as 30 May 1971, with 75% of the eggs laid between 15 April and 15 May. The initial laying dates were like those of birds in North Dakota, New York, and England (Strutz, Webster, Olney, pers. com.), but slightly later than those known for Mandarins in Japan and Russia (Savage 1952).

The average time from release to the first egg each year was 15 days (Figure 3), and for 40% of the 18 females between 17–21 days. Only five females failed to lay during the study; two died early in the spring, two were full-winged and escaped, and one just did not initiate a clutch.

Although the time of laying of individual females varied daily, as with most waterfowl (Weller 1963), it usually occurred during the morning (Figure 4) with the male in attendance outside the nest. Most (68%) of the 26 layings actually observed were prior to 1100. Twelve additional eggs were found when the boxes were inspected before noon. The actual duration of laying, based on the time spent in the box by three females, averaged 23 minutes (range: 15–31 minutes). This time is considerably less than the two to six hours spent on the nests daily during laying periods by Shovelers (McKinney 1967) and Gadwall *Anas strepera* (Oring 1969).

On 17 of 21 occasions females laid in their first year (when 10–11 months of age), but with reduced fertility (78%,  $n = 12$  females) compared to adults (90%,  $n = 4$  females). Yearling clutch size ( $9.75 \pm \text{SD } 2.01$  eggs) was not significantly different from adult clutch size ( $8.75 \pm \text{SD } 1.71$  eggs) ( $P > 0.05$ ). Yearling females (10 of 11 during 1973 and 1974) laid earlier in the spring than adults.

There is little specific information on laying periods relative to age in any waterfowl and none for wild Mandarins. However, yearlings laying before adults is contrary to that known for some of the Anatini which breed in their first year, such as Pintail (Sowls 1955) and Wood Ducks (Korschgen & Frederickson 1976).

Females sometimes renested following destruction of the first clutch by predators or its removal for incubation under bantams. In this situation five of six yearling females laid second clutches, all significantly smaller ( $P < 0.001$ ,  $6.60$  av.) in size but higher in fertility (94%) than their first clutch. Adult females did not renest, presumably because of their later initial laying date. No females renested that had incubated initial clutches through to pipping.

Sowls (1955) stated that the delay in

renesting was directly proportional to the time spent incubating the first nest, averaging 3 days plus 0.62 days for each day of the initial incubation period. This renesting interval was close to that actually observed for four of the five renesting Mandarin females but in marked contrast to the fifth female, who laid six eggs, did not incubate, and renested 22 days later. While only one of the five renested in the same box, four nested in the same type of box.

Most Anatids, including Wood Ducks

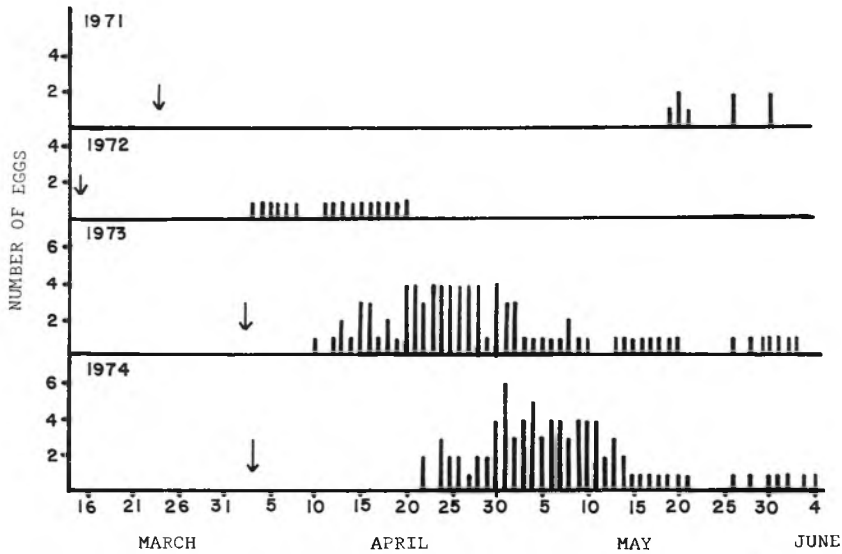


Figure 3. Egg-laying patterns of Mandarins each spring, 1971-1974. Release date to out-door areas indicated by arrows. Number of females laying eggs: 1971-3; 1972-5; 1973-10; 1974-9.

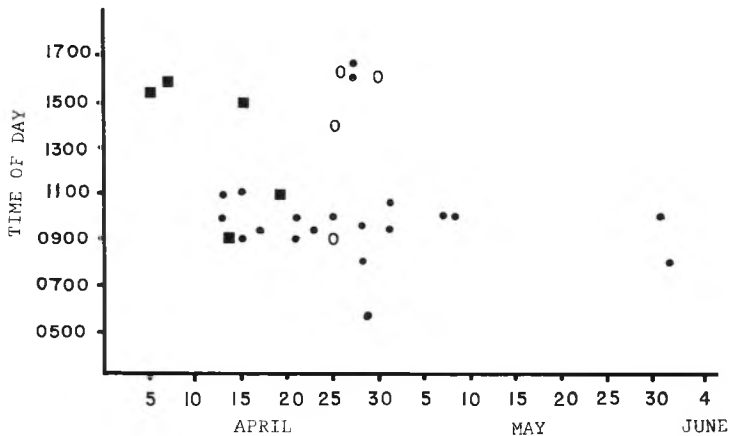


Figure 4. Time of day at which females were observed laying eggs, 1972-1974. 1972-5 eggs ( $\square$ ); 1973-20 eggs ( $\bullet$ ); 1974-4 eggs ( $\circ$ ).

(Breckenridge 1956) usually lay one egg per day, with skips being relatively rare. This was the case for five of 14 Mandarin clutches. The average completion time for these 14 clutches (9.3 eggs) was 12–14 days, with an average interval of 2–15 days between the first two eggs. Failure to lay an egg a day probably resulted from human disturbance or an overcrowded nesting population.

#### *Nesting and incubation*

Nest box inspection occurred primarily during the morning and late afternoon. The male in full-sail posture accompanied the female. The choice of boxes appeared to be by the female, who entered the boxes 72% of the time. Although the male occasionally approached a box and stood on the ramp prior to the female's entering, he usually (74%) swam alertly at the base of the ramp. Jones (1972) also reported seeing a male enter a box during inspection, but this seems to be atypical behaviour. Inspection time inside the box by the female averaged two minutes (range: 1–7 min; 10 < 3 min; 5 < one min).

During the pre-laying periods females inspected different nest boxes (average 3.3, range 1–5 different boxes) and frequently reinspected previously visited boxes. Five of seven laid in the box they were last observed inspecting. Savage (1952) stated that feral Mandarins also visit many potential nest sites. As with copulatory behaviour, frequent nest box inspection by a pair probably is important in pair bond maintenance and synchronization of physiological condition.

Mandarin females preferred elevated boxes mounted either on poles or against trees, despite the increased difficulty in ascending the ramps. Sixty-six per cent of all clutches were started in such boxes with only

4% destroyed by predators. In comparison, 58% of the nests begun in surface or subsurface boxes were destroyed. Nest box choices appeared related to habitat preference, with 60% of the boxes used by free-ranging females being along the water on the wooded, hilly, and mostly undisturbed east side of the large lake. During 1973 and 1974, the years with the greatest nesting pressure, 75% of the nests were started in seven boxes in this area.

#### *Incubation patterns*

Mandarin females began lining the nest with down during laying of the last couple of eggs and usually completed it within the first two days of incubation (Table 3). The 28–30 day incubation period began during the afternoon of the final day of laying. Most females took three break periods during early incubation with the time on the nest during the first day shorter in the morning than afternoon (Figure 5). Later, break periods occurred only prior to dawn and at dusk. Evening break periods (av: 97 min, range: 55–180 min; n = 9) were longer than morning periods (av: 80 min, range: 65–120 min; n = 4). However, since females usually had left the nest prior to sunrise and as early as 0530, complete morning periods generally were not seen. The average duration for 11 such "incomplete" break periods was 63 minutes.

The daily incubation session for five females on six occasions averaged 10.25 h (range: 9.5–12 h). Females usually had returned to the nest by sunset and did not leave during the night.

The onset of break periods seemed closely tied to sunrise and sunset. Evening breaks began later as spring progressed. The five

**Table 3.** Nesting biology of seven Mandarin females observed during 1973 and 1974.

Year	♀ no.	Clutch size	Egg at which: down pulled	inc. start	Dur. of inc. (days)	Pipping start (hours)	Elapsed time to hatching* (hours)
1973	F 0A27	8	8	8	28	0700	24–30
	F 0A32	8	6	6	29–30	1900	22–24
	F 0A36	10	10	10			
	F 0A31	10	9	10	29	0700	24–30
	F 0A19	9	9	9	33**		
1974	F 0A48	13	11	12	30–31	0900	30
	F 0A49	12	11	11–12	29–30	1300	35–40

\* Hatching time—duration between pipping (when first egg cracked) and when duckling is out of shell.

\*\* Female killed in first week of incubation—eggs incubated under bantam.

break periods (3, 4, 15, 16, 18 June) of F 0A35 were very similar in duration (60–75 min) and generally began later each evening. In the morning the bird left and returned to the nest earlier in late May. It also was my impression that females incubating in west-facing boxes began break periods later in the evening than females in east-facing boxes.

Incubation temperatures in the nests of six females varied between 34.4 and 36.6°C (Table 4). Temperatures in down-covered nests generally dropped less than 0.5°C in

the first 30 min of an incubation break and even during a 2.5 hr long period dropped only 2.3°C. While female waterfowl usually cover the nest during these break periods (Weller 1964), Mandarin females generally left the nest uncovered on breaks during the first few days and thereafter showed no consistent pattern.

On one occasion a male was observed incubating. After approaching the box with the female, he quickly entered while the female moved away and stood concealed under a

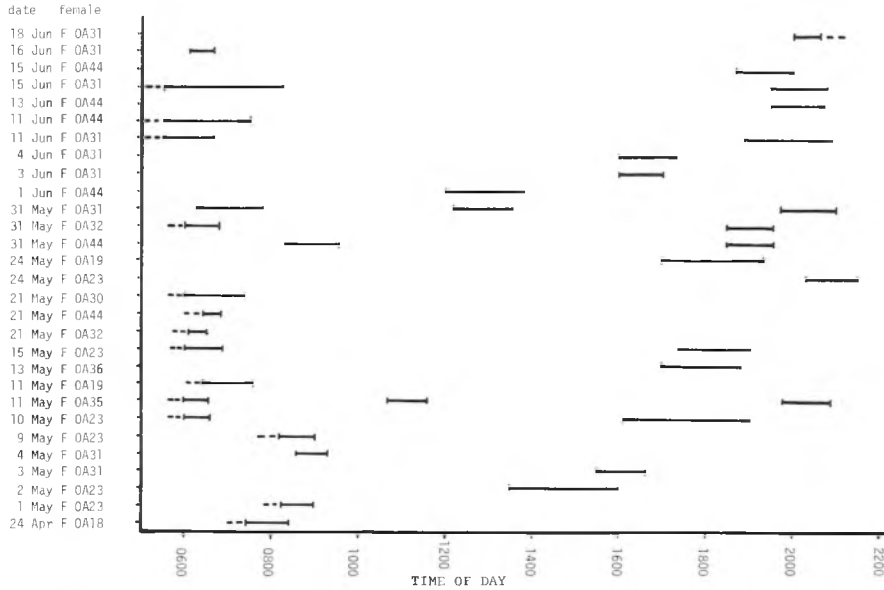


Figure 5. Mandarin female break periods recorded during 1972 and 1973. For mornings when onset of break period was not observed, solid line indicates actual periods of observations.

Table 4. Temperatures in middle of nests during incubation and at intervals during rest periods. Sensing accomplished with YSI portable thermister unit.

Date	Time	Female	Ambient	Box	When incubation	Temperature(°)					Notes
						Nest at break intervals (min.)					
						30	60	90	150	180	
1972											
16 May	1500	0A18	19.0	28.9	36.1	35.7					c
17 May	1715	0A18	26.6		36.7						
17 May	1715	0A19	26.6	28.3	34.4	33.9					c
17 May	1715	0A23	26.6		34.0						
1973											
11 Jun	1850	0A32	31.1		35.6	33.3	32.8	31.9*	35.5		u
11 Jun	2025	0A31	31.1		35.8	35.3*	36.1				c
15 Jun	1853	0A34	31.1	32.2	35.8	35.6					up
15 Jun	1845	0A32	31.1	32.2	35.6	35.6	35.0	33.9	33.3*	35.6	cp
16 Jun	0645	0A32	22.8		35.6	35.1*	38.1				c

\* Indicates resumption of incubation. c = eggs covered, u = uncovered, p = pipping.

pine tree. Both were feeding at 0600 the following morning. Although Rollin (1957) observed a male Wood Duck in basic (eclipse) plumage incubating a clutch in July, male incubation is considered aberrant behaviour in waterfowl.

During the four years three cracked eggs, exhibiting bill punctures (presumably by the female), were found in the water or vegetation outside of nest boxes. One apparently was cracked during laying and a replacement laid, while the other two were cracked during incubation. Removal of damaged eggs or eggshells is reported for many waterfowl species (reviewed by Johnsgard & Kear 1968), including Wood Ducks, but has not previously been observed in Mandarins.

#### *Spacing behaviour: male sociability*

Mandarins were very social during the first days following release on to the lakes, a time period presumably comparable to arrival on breeding grounds by feral birds. Initially 75% of the free-ranging birds loafed next to penned birds, but this sociability decreased with the onset of pre-laying and laying activity (Figure 6). With the flock break-up, males began to defend only the area occupied at any particular time by the female. This area was dynamic, with encounters between birds often at close range, e.g. at a nest box during inspection or laying.

Savage (1952) found nests of feral Mandarins widely dispersed and observed pairs feeding in fields as far as one mile from their nests. His brief description suggests the operation of spacing mechanism and territoriality in Mandarins, concepts reviewed for waterfowl in general by McKinney (1965). The nest positions observed on 3 May 1973 indicate that the agonistic encounters during the pre-nesting period were effective in spacing Mandarins, even in a limited habitat. Dominance was established within the flock based on pair bond formation and a female's subsequent aggressiveness as indicated by inciting behaviour. Most agonistic encounters and all fights occurred among penned birds.

The onset of incubation and the use by males of territorial posts reduced the number of social and agonistic encounters. From these positions, males usually threatened intruders by assuming full-sail posture and performed either head-shakes or bill-pointing. One male routinely patrolled the entire end of the lake in which the female nested and pursued intruders. These pursuits often were followed by displays directed toward his female. Aerial chases, common spacing behaviours among most waterfowl (McKinney 1965), could not occur because of pinioning.

During early incubation the male waited for the female at a loafing or waiting spot close to and in view of the nest. From here he

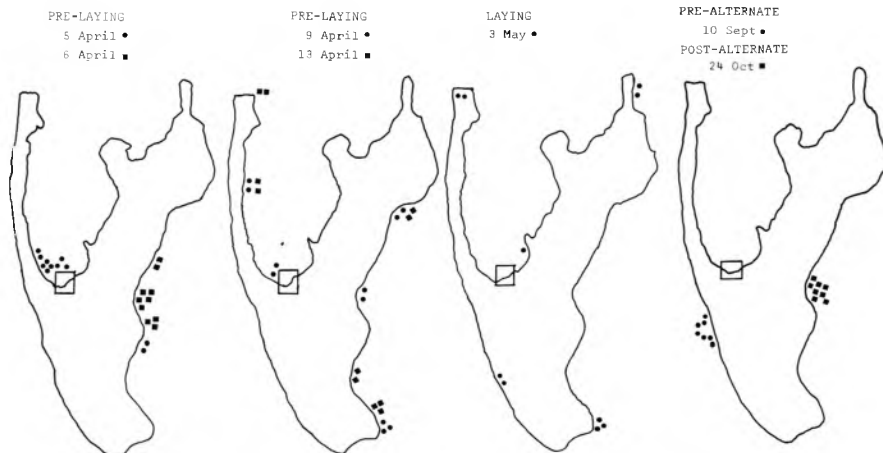


Figure 6. Locations of free-ranging Mandarins during the first two weeks following release to the lakes on 2 April 1973, during laying period, and during autumn (pre-alternate moult, and alternate plumage periods). Points are based on birds' locations between 1200 and 1300. Out-door breeding pens are indicated by box and contain 8 birds.



threatened or chased conspecifics of either sex entering the area. He attended the female during her break periods, not feeding but remaining alert while she fed, bathed, and preened. Such male behaviour would be advantageous in that fertilization for any second replacement clutches was by the original pair drake. He discouraged harassment of the female by other males during her feeding periods, and he might vocally warn her of approaching danger while she was incubating.

Waiting males throughout the spring were more tolerant of unpaired males than they were of either solitary females, paired males, or other pairs. This also was observed for Gadwalls by Dwyer (1974), and Erskine (1972) reported conflicts between male Buffleheads *Bucephala albeola* only in the presence of a female. As incubation progressed, tolerance to paired males increased, except in the presence of the female.

Savage (1952) indicated that males sometimes attended females into the brooding period. This could not be determined in the present study, since clutches were removed at pipping. Pair bonds, however, usually remained strong through most of the first incubation period, but males left with the onset of any second clutches, beginning in late May. If by this time incubation was complete or the clutch destroyed, the pair remained together and began reassociating with other pairs by mid-June.

#### Acknowledgements

I am greatly appreciative to Mr and Mrs J. J. Schedel on whose beautiful private estate this research was conducted and to the Schedel Foundation for funding many of the activities. I also wish to thank my wife Jackie for assisting with some of the observations and in the preparation of the manuscript and R. Greenwood, NPWRC, for providing nasal saddles. Valuable discussions were held or correspondence exchanged with many zoo curators or private aviculturists in the

United States (M. Block, W. K. Macey, C. Strutz, C. Webster, W. Guest) and England (P. R. Butler, T. Jones, P. J. Olney, E. Savill, N. Stevens). The manuscript reviews of S. Vessey and W. B. Jackson were particularly helpful.

#### Summary

Copulation behaviour of captive Mandarin Ducks *Aix galericulata* occurred primarily in the morning throughout the spring, except during the incubation period. Most incomplete sequences resulted from low intensity male behaviour. Rape and promiscuousness were infrequent.

Nest box inspection averaged two minutes, occurred primarily during the morning, and nearly always was by the female with the male in attendance. Several potential nesting sites were inspected with females usually laying in the last one observed inspecting.

Mandarin females nested as yearlings (10–11 months of age) but with less fertility (78%) than adults (90%). Initiation of first clutches was between 3 April and 30 May, with most begun between late April and middle May. Yearlings began laying earlier than adults each year and were prone to initiate second clutches if the first were removed or destroyed. Ninety-four per cent of the eggs of these second clutches were fertile. The average clutch sizes were 9.8 and 6.6 eggs for the first and second clutches of yearling females, respectively, and 8.8 eggs for adults.

Incubation (lasting 28–30 days) usually began in the afternoon of the day the last egg was laid. Females generally took three break periods during the first few days of incubation but only two (pre-dawn and dusk) thereafter. They did not leave the nest boxes at night. The nest temperature during incubation was 34.4–36.6°C and dropped only 1–2°C during the female's break periods. Incubation period of second clutches was between 30 and 35 days.

Mandarins formed strong seasonal pair bonds, which reformed in successive years if both individuals lived. The strength of the bond may be a result of frequent copulations. Males attend and defend (usually) the female throughout the spring, often waiting for her in view of the nest site during incubation.

#### References

- Breckenridge, W. J. 1956. Nesting study of Wood Ducks. *J. Wildl. Mgmt.* 20: 16–21.
- Bruggers, R. L. 1974. Nesting biology, social patterns and displays of the Mandarin Duck, *Aix galericulata*. Ph.D. Thesis. Bowling Green State University, Bowling Green, Ohio. 188pp.
- Collias, N. E. & Jahn, L. R. 1959. Social behaviour and breeding success in Canada geese (*Branta canadensis*) confined under semi-natural conditions. *Auk* 76: 478–509.
- Dwyer, T. J. 1974. Social behaviour of Gadwalls in North Dakota. *Auk* 91: 375–86.
- Elder, W. H. & Weller, N. W. 1954. Duration of fertility in the domestic Mallard hen after isolation from the drake. *J. Wildl. Mgmt.* 18: 495–502.

- Erskine, A. J. 1972. *Buffleheads*. Canadian Wildl. Serv. Mono. Series No. 4. Information Canada. 240pp.
- Grice, D. & Rodgers, J. P. 1965. The Wood Duck in Massachusetts. *Massachusetts Div. Fish and Game. Final Rep.*, Fed. Aid Project W-19-R.
- Johngard, P. A. 1965. *Handbook of Waterfowl Behavior*. Ithaca, New York: Cornell Univ. Press. 378pp.
- Johngard, P. A. & Kear, J. 1968. A review of parental carrying of young by waterfowl. *Living Bird* 7: 89-102.
- Jones, T. 1972. Bird Farm-1971 Breeding season at Leckford. *Avic. Mag.* 78: 22-25.
- Justice, K. E. 1961. A new method for measuring home range of small mammals. *J. Mammal.* 42: 462-70.
- Korschgen, C. E. & Fredrickson, L. H. 1976. Comparative displays of yearling and adult male Wood Ducks. *Auk* 93: 793-807.
- McKinney, F. 1965. Spacing and chasing in breeding ducks. *Wildfowl Trust Ann. Rep.* 16: 92-106.
- McKinney, F. 1967. Breeding behaviour of captive Shovelers. *Wildfowl Trust Ann. Rep.* 18: 108-21.
- McKinney, F. 1973. Ecoethological aspects of reproduction. pp. 6-21 in D. S. Farner (Ed.) *Breeding Biology of Birds*. Washington, D. C.: Nat. Acad. Sci.
- Oring, L. W. 1969. Summer biology of the Gadwall at Delta, Manitoba. *Wilson Bull.* 81: 44-54.
- Rollin, N. 1957. Incubation by drake Wood duck in eclipse plumage. *Condor* 59: 263-5.
- Savage, C. 1952. *The Mandarin Duck*. London: Adam and Charles Black. 78pp.
- Sowls, L. K. 1955. *Prairie Ducks*. Washington, D.C.: Wildl. Mgmt. Inst. 193pp.
- Weller, M. W. 1964. The reproductive cycle. pp. 35-79 in J. Delacour (Ed.) *The Waterfowl of the World*. Vol 4. London: Country Life Ltd.

**Dr R. L. Bruggers**, Environmental Studies Center, Bowling Green State University, Bowling Green, Ohio 43403

A pair of Mandarins *Aix galericulata*. (B. A. Crosby)

